Chapter 3

Survey on Reasonable Regulation, Communication, and Continuous Improvement

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Chapter 3

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The literature survey in chapter 2 found in some cases that measures of operators against initial failures and application of risk-informed led to improved capacity factors. However, in more cases, regulatory measures taken that were associated with troubles affected the capacity factors thereafter. Capacity factors stagnated after the introduction of the SALP programme after the TMI accident in the US, new regulatory requirements after the Fukushima Daiichi accident in Japan, and regulations on quality assurance after the TEPCO issue in Japan. Meanwhile, application of risk-informed after the TMI accident and the introduction of regulations on reactor oversight process after the Millstone issue resulted in improved capacity factors.

Based on the results of the literature survey primarily focusing on the impact of regulations on the capacity factor, the IEEJ conducted interview surveys in the US and Europe targeting persons who have worked for a regulator or operator as well as nuclear energy–related international organisations and consultants. The major topics the IEEJ put forward are: the scale and the magnitude of risks, constructing risk-based regulations, the flexibility and responsibility of the regulations, voluntary (self) effort by operators, the relationship between backfitting and the operation, OLM, limitation of operation period, and communication among stakeholders.

1. Experiences and Cases in the United States

The US Congress monitors regulatory activities. It is a legislative organ and has a role to provide the NRC, an administrative organ, with proposals on establishing requirements that form the basis of administrative activities. Congress monitors to see whether regulations are effective, and the members will share opinions on behalf of taxpayers if any ineffective and/or unreasonable regulations are found to be in place. The NRC now has an established reputation of setting reasonable regulations. However, it was harshly criticised and told by Congress to make improvements up until the 1990s. During that period, the industry brought issues about unreasonableness of regulations to Congress and, as taxpayers, demanded effective use of taxes. After that, the NRC promised to examine each case submitted by operators during a specified period.

The basis of NRC's regulatory activities is reasonable assurance of adequate protection, and regulations must be reasonable and appropriate. That is, the NRC must maintain a questioning attitude, always asking how much cost is required to realise a regulation, and whether safety improvement effects that justify the cost can be achieved. When revising

regulations, the NRC does not determine these only at its discretion. It would discuss with stakeholders, including experts, whether to revise the regulations according to new knowledge. At that stage, information like how regulations will be changed and until when backfitting shall be (can be) done is shared with the operators. As regulation making and backfitting proceed following appropriate procedures, it does not mean that the operators must obey one-sidedly. A good example is the application of FLEX (diverse and flexible coping strategies) against SBO accidents that last for a long time. Initially, the NRC was thinking of applying conservative measures, but it listened to voices from the industry, conducted cost–benefit analysis, and decided to flexibly apply FLEX according to individual circumstances.

What enables reasonable activities at the regulator side is that industry has not desired to attain zero risks but instead checked whether risks are within certain limits.

2. Experiences and Cases in Europe

1) France

In response to the TMI accident, in France, the regulator enforced the installation of hydrogen recombiners in all NPPs existing then to prevent hydrogen explosion. The operators initially resisted, stating that the integrity of the containment vessel of a plant with the latest design was adequately secured. Eventually, they accepted the enforcement by the regulator.

Meanwhile, for France, as discussed in chapter 2, the literature survey did not find any case where a trouble that occurred at a specific plant led to the suspension of other plants and affected the country's overall capacity factor. France has a history of thinking that one can judge whether the plants are safe only by operating them. This idea of checking safety whilst the NPPs are operating is shared by all European states. Europe has an organisation called the European Nuclear Safety Regulators Group (ENSREG), a group of regulators that acts as a European Union–wide advisory body for regulators. ENSREG is extremely transparent for participated regulators, and acts as a silent pressure on individual regulators in European countries to prevent unreasonable regulatory activities.

2) United Kingdom

In the UK, the regulator unprecedentedly put unreasonable enforcement on nuclear facilities just once after the Fukushima Daiichi accident. However, the situation soon improved after the operators investigated the unreasonable enforcement by the regulator, shared the results with the regulator, and conducted discussions.

Like *Reducing Risks, Protecting People* published by the Health and Safety Executive (2001) in the UK, regulations in Western countries carry the concept of 'reasonably practicable'. The comparison between cost and benefit is made for any regulation, not only for nuclear power.

If the regulator's review is slow and inefficient, it instantly affects the benefits of the operator. In the UK, if that happens, the operator will not remain silent about it; it will request discussions with the regulator. As such, reviews in the UK do not drag on.

3) Sweden

In Sweden, introducing a specific equipment, such as an independent core-cooling facility and filtered venting system, was forcibly added to regulatory requirements as government-led initiatives after 2000.

Meanwhile, the regulatory code describes the regulator's duties where the term 'reasonable' is frequently used, such as to employ reasonable means for resistance against abnormalities. A high-level agreement was reached so that supervision by the regulator shall be done under trust and must be reasonable above all else. Regarding severe accidents, though a certain level of measure has been taken, it was decided to establish accident management assuming accidents do occur. That is fine if its effectiveness can be confirmed to a certain degree, with the understanding that no measure can reduce the probability to zero.

As to whether regulatory activities are performed correctly or not, the Riksrevisionen (Swedish National Audit Office) takes the role of supervision. When an operator has a question about a decision or activity of a regulator, it may appeal to the National Audit Office or a court. An example of a court case is when an operator filed a suit against the government setting a limit on the operating period whilst no limit had been placed until then. As a result, the court supported the claim of the operator, and no upper limit has been placed on the operation period since then. In another case, an operator demanded to compensate for the forced shutdown of its plant because of political reasons, and the government paid.

At the nuclear industry of Sweden, the Kärnkraftssäkerhetskoordineringsgrupp (Nuclear Safety Coordination Group of the Swedish licensees) was established in 2013 to clarify the industry's attitude towards safety issues and to thoroughly communicate with the regulator. The coordination group also disseminates the industry's coordinated opinions.

The following section lists the findings from the interview survey that are commonly applicable to all relevant countries:

- The management of regulations needs to be flexible to individual circumstances whilst having clear logic about safety, instead of pursuing a rigid ideal about it. On the operators' side, interested parties broadly share the view that enough communication with the regulator is needed. Meanwhile, regulations should not be inappropriately flexible regardless of the time or circumstances, such as those favouring the industry without safety considerations.
- As for regulations having to be flexible, considering that the scale of hazards that may occur varies from plant to plant even if the frequency is the same, a PRA may be useful in identifying which equipment plays an important role for a given situation.

- The role of the regulator is to decide, and no one person can have all information necessary for making the decision. Therefore, operators must provide information, such as proposing an alternative method for backfitting. When making a proposal, the operator shall conduct a cost–benefit analysis and decide not to invest into it if the expected improvement in safety does not justify the cost. If the operator decides to invest, then the operator needs to talk with the regulator to agree on when the proposal can be put into practice; in other words, by when the proposal shall be included in the regulations. If the regulator fails to observe the agreement, the operator, believing in its reasonableness, may have to appeal to the court.
- Generally speaking, the regulator forcing something onto the operators by prescriptive regulations in a negative sense does not produce a good outcome. It impairs the incentive for the operators to improve through their efforts. Desirably the regulator takes a goal-setting approach, leaves how to attain goals to operators, and lets them employ safety assurance means that are more suited to individual events.
- Only by operating a plant does it become possible to discern good outcomes and problems of the plant. Stopping all plants at once as an action against certain trouble needs to be avoided as much as possible, and the regulator and the operators need to think together about safety whilst always keeping plants in operation.
- One method to prevent the regulator from inappropriately operating regulations is to use the functions of the parliament, the legislative organ of the country, such as clearly stating the discretion of regulatory activities in a law. Government needs to show it is not committed to unreasonable regulations.
- One means of encouraging a regulator to effectively manage is to build trust and consensus to operators amongst the stakeholders, including the public.
- It is more realistic to think that severe accidents are fine when risks are reduced to acceptable levels by alleviating these accidents than overly pursuing complete prevention.
- Rigorous verification needs to be made on the credibility of new findings before officially legislating them.
- Extending an operation period related to long-term facility use is possible as long as safety is periodically ensured by, for example, conducting a safety review once every 10 years. Long-term operation is possible regardless of the number of years after the construction if the safety of the facility, its staff, and organisation is ensured. However, it might become difficult for old plants to catch up with new technologies as time goes on. Also, though safety is to be confirmed periodically, the attitude about it shall not be like those towards a single special event in a certain period. Such confirmation of compliance requirements by operators and regulators shall be regularly performed as part of daily routine.

3. International Conference on Effective Nuclear System in the IAEA

As information related to this survey, which was obtained through interviews, an international conference on effective nuclear system was held multiple times so far in the IAEA.[2] The objective of the conference includes reviewing and assessing ways of further improving the effectiveness of regulatory systems for facilities and activities, as well as proposing specific actions. It was pointed out in the first conference that the delivery of effective nuclear safety regulations is vital for the safe use of nuclear energy. This recognition is consistent with the aim of this project – improving both nuclear safety and effective use – and discussions in the conferences are likely to provide useful information.

To date, five conferences were held as follows:

- February to March 2006: Moscow (Russia)
- December 2009: Cape Town (South Africa)
- April 2013: Ottawa (Canada)
- April 2016: Vienna (Austria)
- December 2019: The Hague (The Netherlands)

These conferences mainly targeted regulators to be more informed of requests from the industry. The main topics on nuclear safety at each conference are shown in Table 0.1: Main Topics on Nuclear Safety at the IAEA Conference.

Table 0.1: Main Topics on Nuclear Safety at the IAEA Conference

1st (2006)	2nd (2009)	3rd (2013)	4th (2016)	5th (2019)
		Regulatory lessons learned and actions taken (from the Fukushima Daiichi accident)	Regulatory lessons learned and actions taken (following the Fukushima Daiichi accident)	
Independence and regulatory effectiveness	Regulatory independence and effectiveness			
Regulatory safety challenges	Emerging regulatory challenges	Emerging programmes	Challenges in regulating nuclear installations	Regulating nuclear installations
		Emergency management		Emergency preparedness and response

[2] https://www.iaea.org/events/conference-on-effective-regulatory-systems-2019

Regulatory effectiveness from operators' viewpoint		Human and organisational factors, safety culture	Strengthening regulatory competence	Leadership and management for safety

Sources: International Atomic Energy Agency (2006, 2009, 2013, 2016, 2019).

Special focus was placed on the independence of regulations in the conferences before the Fukushima Daiichi accident, and on emergency responses after the accident. Matters related to countries introducing nuclear power were brought up at the second conference in South Africa, received special attention at the third conference, and have since been actively discussed. Active discussions about lessons learned from the accident and relevant activities were held particularly at the third and fourth conferences.

From the third conference onwards, special attention has been paid on methods to resolve issues. The main contents of discussions held in the conferences to date are as follows:

- Balance between expectations and regulatory requirements in relation to safety culture
- Balance to human, organisational, and technical factors
- Balance between the structure of the management system and the culture of the organisation,
- Self-assessment and improvement and reform; internal and external communications
- Transparent and open communications with regulator and stakeholders
- Leadership of regulator to realise smooth communications

At each conference, future tasks are identified, as summarised:

1) Government
   - Maintaining the framework of regulations and continuing its development
   - Establishing regulators independent of supporters and opponents of nuclear power
   - Securing resources required by regulators
2) Regulations
   - Maintaining and improving regulatory systems (reduction of uncertainty, harmonisation of regulatory requirements, consideration to the culture)
   - Assessing and monitoring the effectiveness of regulations, and providing feedback on the experience
   - Promoting, implementing, and improving safety culture, and reporting the progress (important elements: safety goals, graded approach, risk-based culture)
   - Transparent and open communication, and leadership to realise these

3) Stakeholders

- Paying attention not only to the introduction of new nuclear power generation but also to the state of existing facilities (e.g. management of old facilities)
- Acting from lessons learned to improvement
- Sharing feedback of experience.

The IAEA conference concluded that sharing experience and lessons learned is key, and what is important is to understand the future and configure ourselves to deal with problems we will face in the next decade(s).

Through the interview survey, the major opinions gained are reasonable regulations, communication, and continuous improvement towards reasonable regulation.