



Nuclear Safety Goals in Japan: History, Context and Challenges

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RICOMET 2017



Introduction

◆ “How safe is safe enough?”

- Acceptability/Tolerability of risk
- Reference level for risk-informed decision making
- Key issue for justification process of nuclear energy use

◆ Research question

- *Why the safety goals (SGs) have not taken root in Japanese nuclear community despite much effort to establish them?*
- History of SGs in Japan, its societal context, and challenges
- Qualitative research: bibliographic survey and in-depth interviews with key persons

History

◆ The end of 1980s

- Start of studying PRA (Probabilistic Risk Assessment) and SGs in the academic societies/industry

◆ 2000s

- Start of examining SGs in the government
- The Nuclear Safety Commission (NSC) set up the Special Committee on SGs on Feb, 2001.
- “**The Interim Report**”; Dec, 2003.
- “Performance Goals Report”; Mar, 2006.

◆ Post-Fukushima

- “Decision” of SGs by the Nuclear Regulatory Authority (NRA) on Apr, 2013.

2003 Draft Safety Goals in Japan

◆ Qualitative goals

- The possibility of public health hazards due to radiation emission of radioactive substances associated with the utilization of nuclear energy ought **to be controlled to such levels at which the health risks entailed in the everyday life of the people do not increase significantly.**

◆ Quantitative goals

- The mean value of acute fatality risk by radiation exposure, resulting from a nuclear accident, to individuals who live in the vicinity of the nuclear facility **should not exceed the probability of about 1×10^{-6} per year.**
- For those who live near a nuclear facility, the mean value of fatality risk by latent cancer caused by radiation exposure, resulting from a nuclear accident, **should not exceed the probability of approximately 1×10^{-6} per year.**

◆ Performance goals

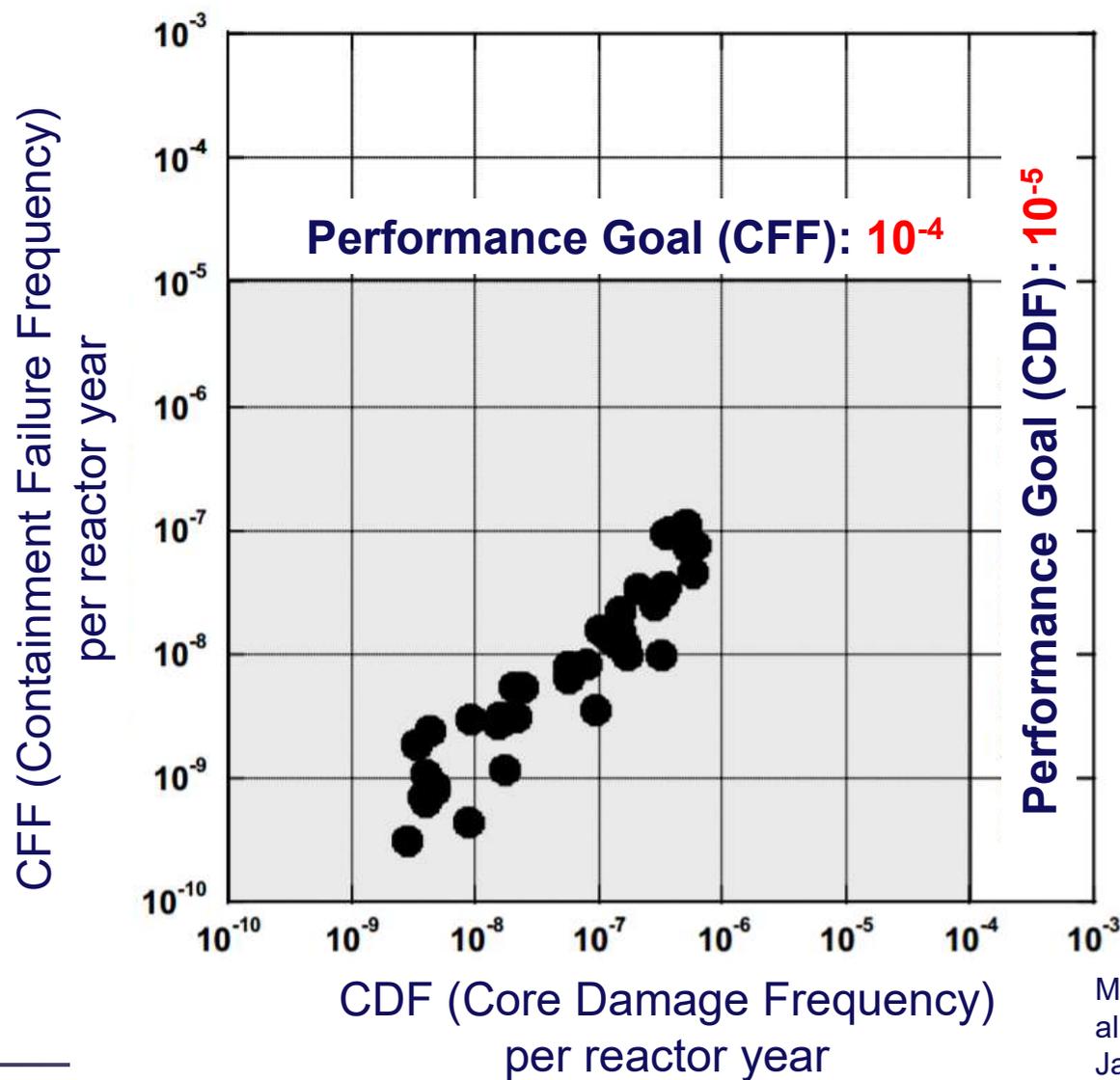
- Frequency of core damage (CDF): roughly $<10^{-4}$ /year
- Frequency of containment vessel failures (CFF): roughly $<10^{-5}$ /year

◆ Not yet endorsed officially

Gaps between ideal and reality

Original Intention	In Reality
<p><u>Ameliorating safety regulation</u></p> <ul style="list-style-type: none"> Establishing RIR (Risk-informed regulation) 	<p><u>Ambiguous position of SGs in regulatory framework</u></p> <ul style="list-style-type: none"> The 2003 SGs was NOT a “Decision”, but remained a “Draft”.
<p><u>Accumulating experience of risk assessment and management</u></p> <ul style="list-style-type: none"> Accelerating PRA practices Revising safety regulation, design and operation management 	<p><u>Halfway measures against risk assessment of external events</u></p> <ul style="list-style-type: none"> Seismic “back-check” after revising seismic regulatory guide; analyzing “residual risks” PSR (Periodic Safety Review)
<p><u>Promoting related research</u></p> <ul style="list-style-type: none"> Developing PRA, assessment of socio-economical impact, terrorist attacks, ... 	<p><u>Slow progress of risk research</u></p> <ul style="list-style-type: none"> Except seismic risks
<p><u>Communicating risks with general public</u></p> <ul style="list-style-type: none"> The importance of interaction with the society had been emphasized in the Committee. 	<p><u>“Communicating risks” ended up as a mere slogan.</u></p> <ul style="list-style-type: none"> SGs had functioned as a explanation tool for emphasizing an assertion that “NPPs had already been safe enough”.

PRA outputs in Japan before 2011



Modified from Kajimoto et al., Science Council of Japan Symposium, 2009

Why the gaps occur?

- ◆ Pitfall of “Public acceptance-oriented” management
 - Using PRA and safety goals for explaining “our NPPs are safe” could narrow the scope of risk assessment and management.
 - As PRA was performed only for the domains of **internal events**, **nuclear community was satisfied with the results which seemed to fulfill SGs.**
 - Little effort was made to deal with the domains of **external events.**
 - Reluctance to assess risks and to disclose it **for fear of societal “overreactions”**
 - Main reason why the Draft safety goals had not been endorsed
 - Tendency to avoid doing something “difficult to explain”
 - PRA’s uncertainties and the difficulty of explaining its meaning had “legitimized” reluctant views on proactive use of PRA by relevant actors.

- ◆ Organizational Culture: “Tunnel-visioned incrementalism”
 - Power companies are attracted their foci too much on what they have been told to do by regulators or local governments.
 - While responding to these requests, the important goal of improving risk management by utilizing SGs was receded into background.

2013 NRA Safety Goals

i. **The discussions were based on the results of the deliberation by the Special Committee on SGs.**

➤ CDF: 10^{-4} /reactor-year, CFF: 10^{-5} /reactor-year

ii. Incorporating the impact of environmental contamination by radioactive materials, **the frequency of an accident that causes discharging Cs-137 over 100TBq should be reduced to not exceed one in a million reactor years** (excluding accidents by terrorist attacks, etc.).

...

◆ Lack of transparency in decision processes

- Expanding SGs' endpoints into environment is a significant change, but...
- No stakeholder engagement, no public discussion, no clear evidence, ...

◆ Backlash to “science”

- NRA's view: “SGs have nothing to do with social acceptance.”
- Break away from PA-oriented management, but lack of views on social values

Conclusion and challenges

◆ Key findings

- Before 2011: **Public acceptance-oriented management**
 - ✓ SGs had been originally expected to be used for improving risk management.
 - ✓ In reality, SGs had been utilized as a tool to convince people of the “completeness” of safety, and as an excuse for stopping further effort to gain deep risk insight.
 - ✓ Fear of societal “overreaction” could distort the ways of risk management.
- Since 2011: **Backlash to “science”**
 - ✓ Unclear decision-making process, Lack of view on social values, ...

◆ Challenges

- How to harmonize scientific rationality and democratic legitimacy
 - ✓ How to design public discussion process on SGs
- How to utilize SGs for ensuring “Questioning attitude”
 - ✓ How to keep motivation for continuously improving risk assessment and management instead of being satisfied with the present condition
 - ✓ How to ensure such attitude not only by safety culture of individual organization but also by societal/institutional framework
 - ✓ Risk governance (IRGC), Institutional strength in depth (INSAG) ?