

Risk-Informed Decision Making

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Commissioner S. Yamanaka**
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Overview

- **Risk-informed decision making**
- **PRA quality**
- **Safety goals**

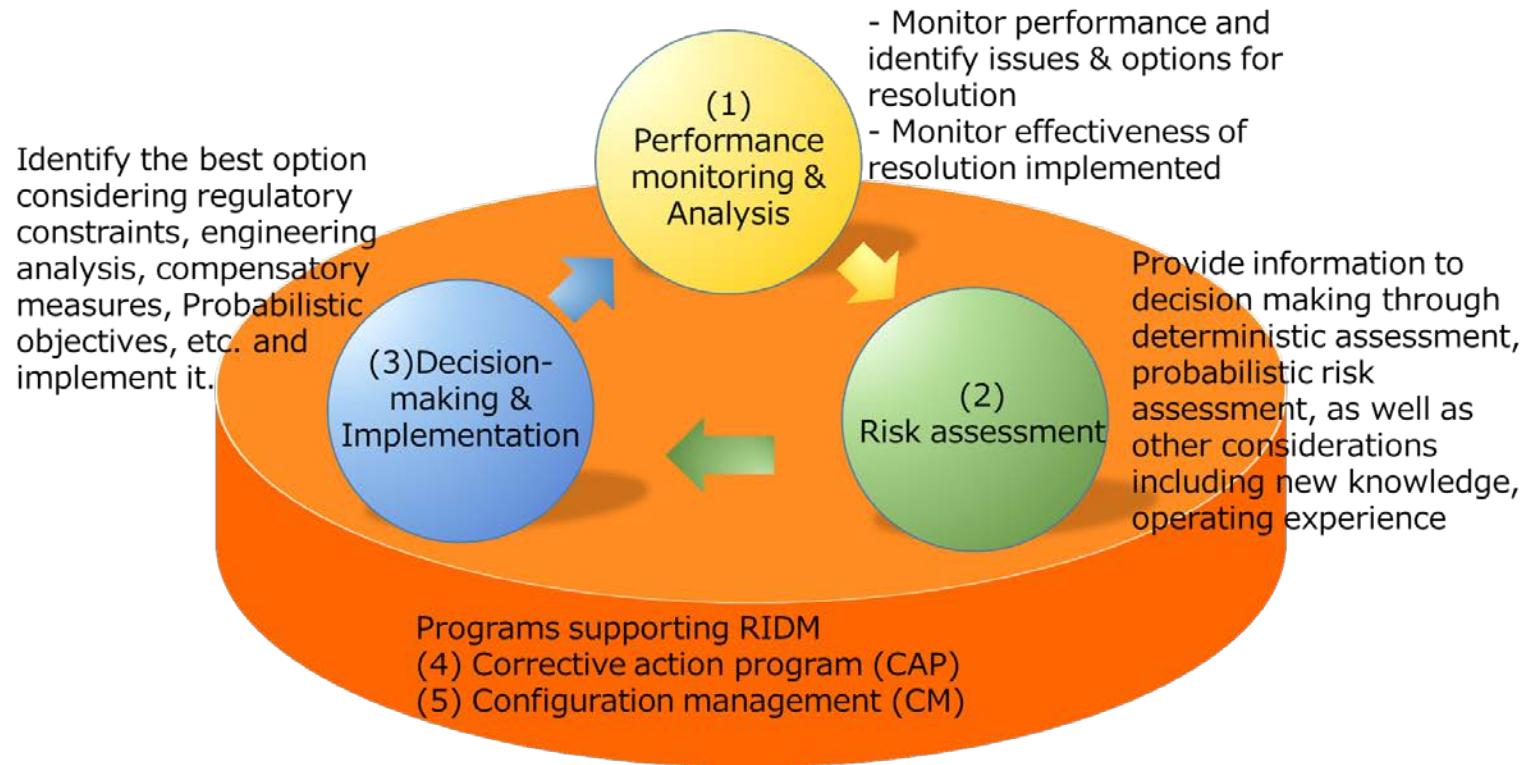
Our Main Thesis

- Neither the traditional process that focuses on “deterministic” requirements nor a risk-based decision-making process is sufficient for rational decision making.
 - The U.S. NRC-sponsored WASH-1400 identified the risk significance of human actions and support systems
 - The U.S. industry-sponsored Zion/Indian Point PRAs pointed out the significance of external events
- We must use the best attributes of both processes, i.e., a risk-informed decision-making process (RIDM).
- Risk is plant-specific. Only PRA can provide useful insights about unique plant features.
- Large variability of CDFs in the U.S., even though all plants were licensed under the same system.

Major Challenges

- Both the regulators and the industry have been focusing on regulatory-compliance for a long time.
- Moving to a risk-informed culture is not easy and takes time.
- An important first step is the ROP that will be implemented in Japan in 2020.
- Another important step is the issuance of the Strategic and Action plans by the industry.

Risk-Informed Decision-Making



From: Strategic and Action Plans for the Implementation of Risk Information Utilization at Nuclear Power Plants, February 8, 2018.

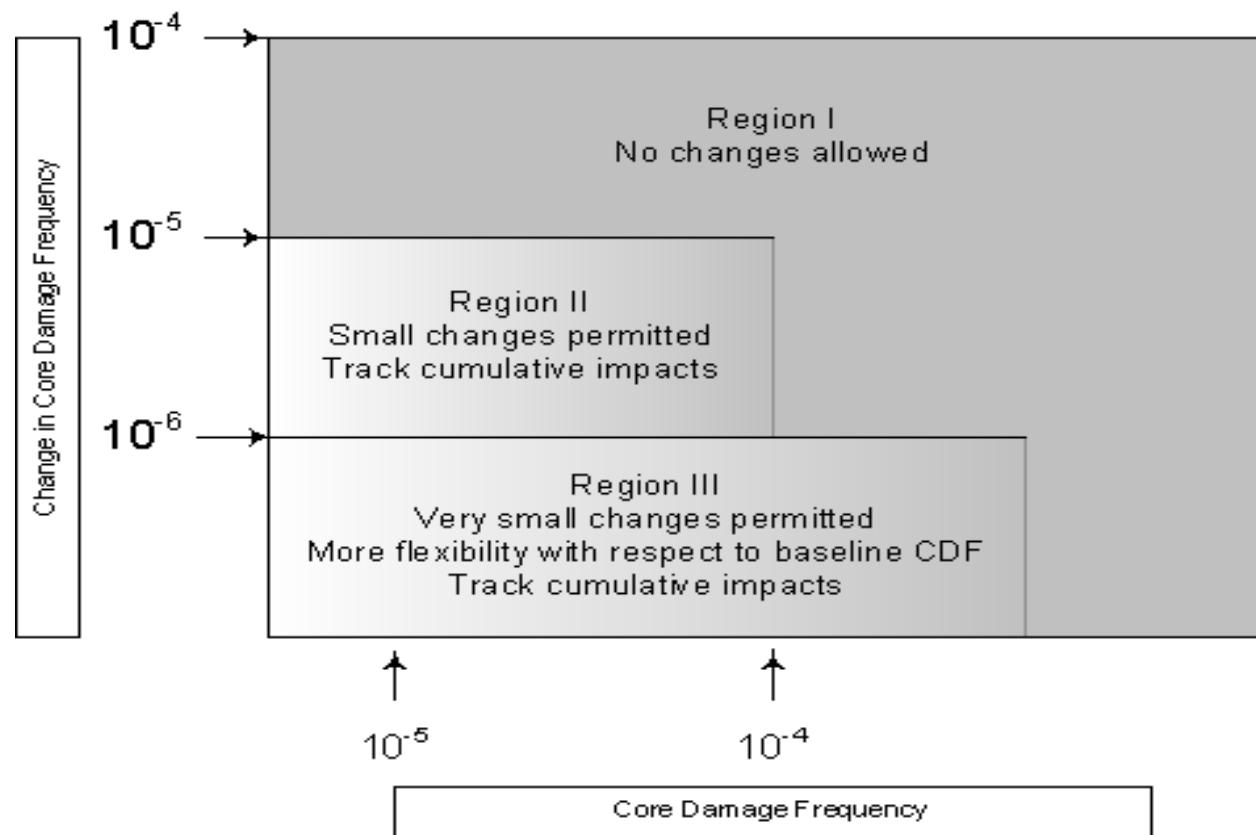
PRA Quality

- A plant-specific PRA is the essential element for RIDM and the ROP.
- Such a PRA is a complex combination of logic models, experimental and statistical evidence, and judgment.
- The uncertainties for some initiators may be very large (however, they are not quantified in the “deterministic” system).
- An exhaustive review was performed for the industry-sponsored Zion/Indian Point PRAs by Sandia National Laboratories on behalf of the NRC.
- This review was unique and very resource intensive.
- A practical solution was needed.

Assuring PRA Quality in the U.S.

- **U.S. scientific societies (ASME and ANS) issued standards.**
- **The NRC issued reports and regulatory guides endorsing the standards (with exceptions, as appropriate).**
- **NEI issued guidance on peer reviews.**
- **NRC and ACRS staff observed several peer reviews.**
- **NRC approved the NEI peer review process.**
- **Compliance with these documents has eased the NRC's burden regarding PRA reviews.**
- **The NRC receives a PRA summary but staff may review as much of the industry's PRA as they wish.**

Uncertainties in RIDM (RG 1.174)



- The analysis is subject to increased technical review and management attention; ...the numerical values associated with defining the regions in the figure are to be interpreted as indicative values only.
- The decision-making process combines risk insights and defense in depth; it is inherently subjective.

Japanese Industry's Efforts on PRA Quality

- **Improving the infrastructure**
 - NRRC Guides on HRA, Fire PRA, Data Collection
 - Models for external events, including the SSHAC process
 - Multi-unit PRA
- **NRRC's Technical Advisory Committee (TAC) high-level review of Ikata 3 PRA**
 - Expanding the list of Initiating Events, e.g., adding loss of instrument air system
 - Improving plant-specific data collection
- **International expert reviews following the ASME/ANS standards and the NEI process**
 - Ikata 3: Torri, Lin, Fleming (U.S.), Boneham (U.K.)
 - KK 7: Chapman, Wachowiak (U.S.), Nusbaumer (Switzerland)
- **NRA staff are welcome to observe these meetings, the resulting actions, and relevant documents**

NRRC Training Courses

1. PRA and risk information utilization course

- For beginners
- Preparing for implementation in FY2018

2. Risk professional course (supported by EPRI)

- Mainly L1 internal events PRA
- For utility's PRA practitioners and regulatory staff
- Started in FY2018

3. Risk information utilization course

- For decision makers (NPP managers)
- Preparing for a trial offering in FY2018.

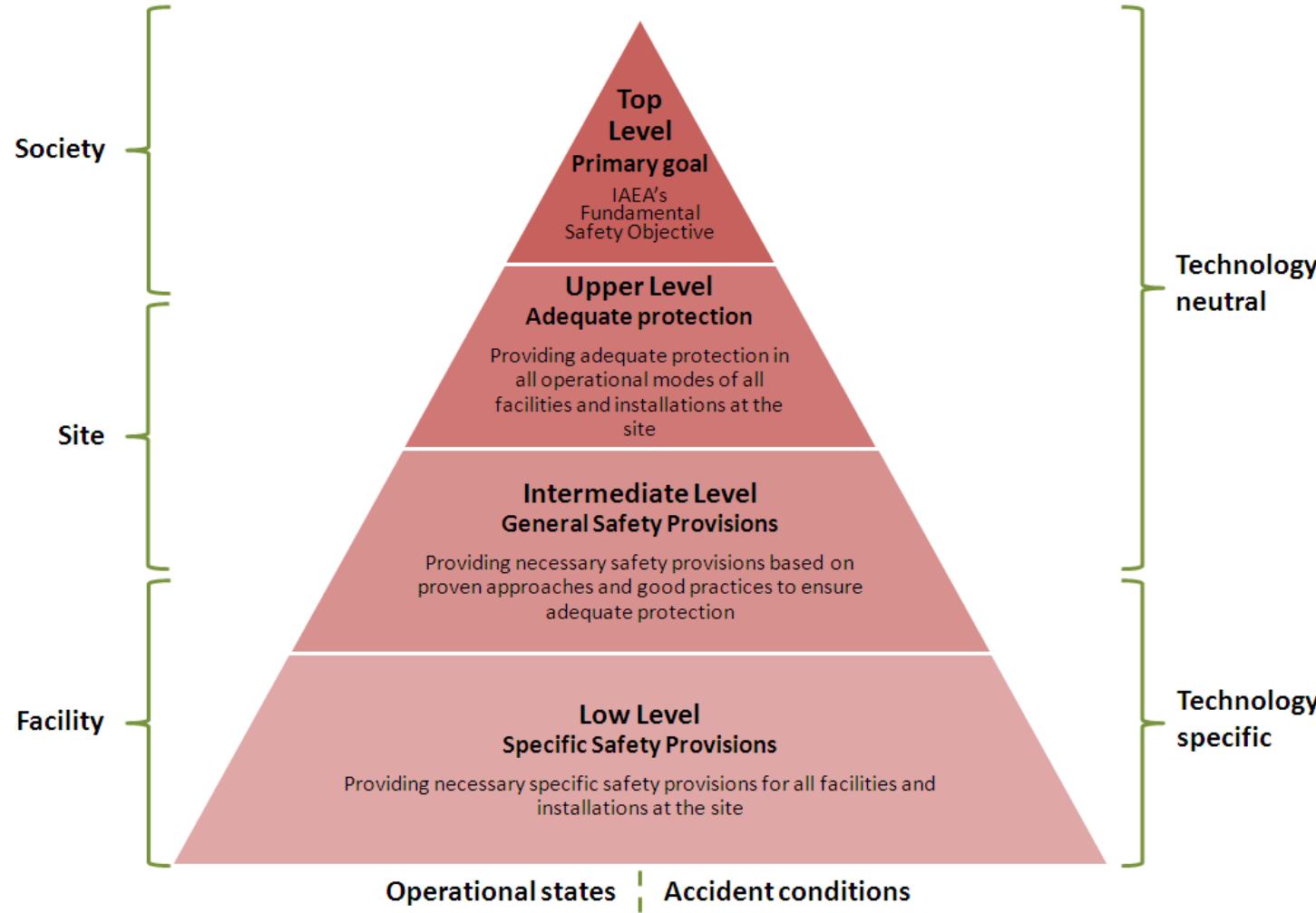
Safety Goals

- SGs contribute to answering the question: How safe is safe enough?
 - “Continuous risk management” versus “continuous safety improvement”
- Easier to communicate the level of safety to all stakeholders
 - They replace the obscure statement “the plants will be safe if they meet the regulations”
- They are an essential part of RIDM
- The SGs are indicative values.
- “Informal” Goals in Japan
 - CDF < 10^{-4} per reactor year
 - CFF < 10^{-5} per reactor year
 - Frequency of release of more than 100 TBq of Cs 137 < 10^{-6} per reactor year

Establishing Safety Goals

- Because of their significance, formal SGs should be the result of deliberation among the regulators, industry, scientific societies, and the public
- Safety Goals can be in different forms
 - U.S.: Point values for CDF and LERF
 - ✓ Proposed safety improvements are evaluated using the Backfit Rule (adequate protection vs. safety improvement).
 - U.K.: Two values for individual risk of death
 - ✓ Basic Safety Level (10^{-4}), not allowed to be exceeded
 - ✓ Basic Safety Objective (10^{-6}), “the BSO doses/risks have been set at a level where ONR considers it not to be a good use of its resources or taxpayers’ money, nor consistent with a targeted and proportionate regulatory approach, to pursue further improvements in safety.”
 - ✓ Between BSL and BSO, cost-benefit analysis evaluates improvements

A Broader Proposal from the IAEA



Final Remarks

- RIDM is the rational way to proceed both for the industry and regulators
- PRAs should be plant-specific
- We need to move from a regulatory-compliance culture to a risk-informed culture
- The ROP and the industry's strategic and action plans are significant steps forward
- PRA quality is improved by issuing standards, regulatory guidance, and implementing peer reviews
- RIDM is an inherently subjective process requiring substantial training
- The deliberative process for establishing safety goals should start soon