Commentary on Basic Policy on Nuclear Energy

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Items to be addressed

- **Unremitting effort to improve safety on the basis of no zero - risk**
- **Rebuilding public trust**

Safety Improvement

- A major step forward: Establishing the independent Nuclear Regulation Authority

- “The new regulatory standards include unparalleled safety requirements for existing reactors and are thus regarded as the world’s highest standards.”

- “On the other hand, some are concerned that such a high level of strictness may easily lead to a new safety myth in which people may complacently think that as long as a station satisfies the standards, it is perfectly safe.”

“White Paper on Nuclear Energy 2020,” page 13, JAEC, 2021.

Are we creating another Myth?

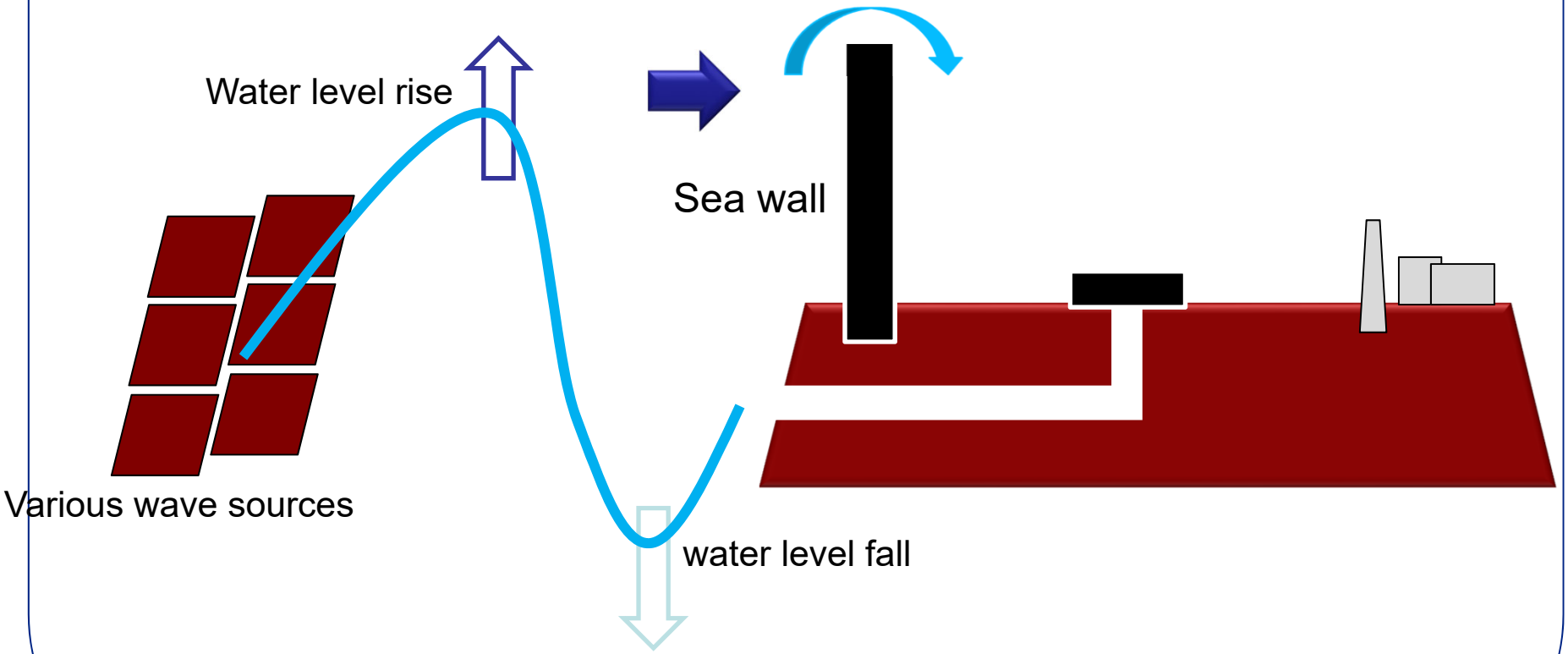
- **There is room for safety improvement even if the regulatory requirements are "the world's highest standards," because these regulatory requirements are based on judgments that are largely unquantified and presumed to be conservative.**

AND

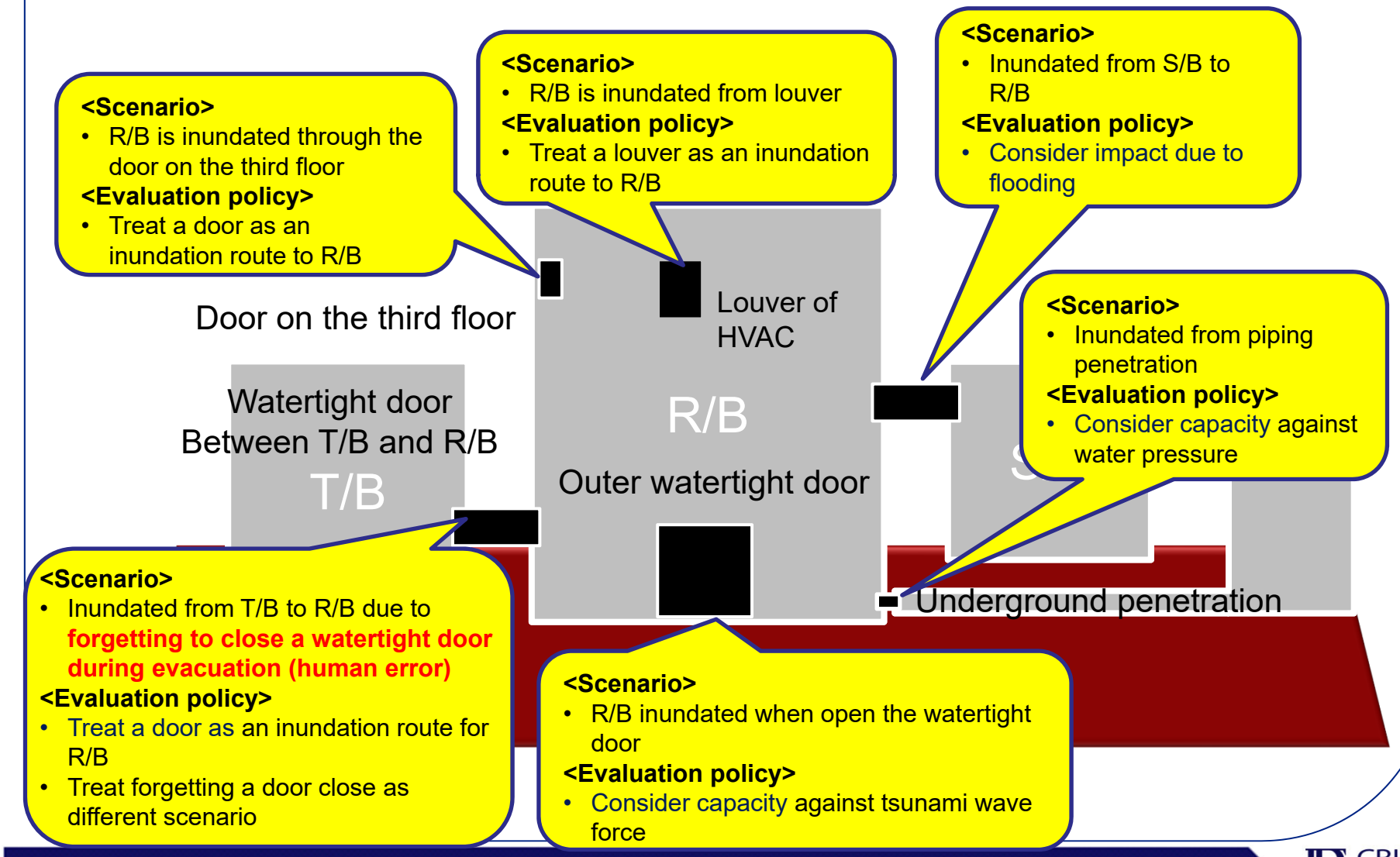
- **The system's approach (including hardware and humans) of Probabilistic Risk Assessment (PRA) is not utilized.**
  - **What can go wrong? (accident scenarios)**
  - **How likely is it? (probabilities and frequencies)**
  - **What are the consequences, if it goes wrong?**

PRA Example: Tsunami Scenarios; Big Picture

- **Tsunami water level rise / water level fall / site inundation route**



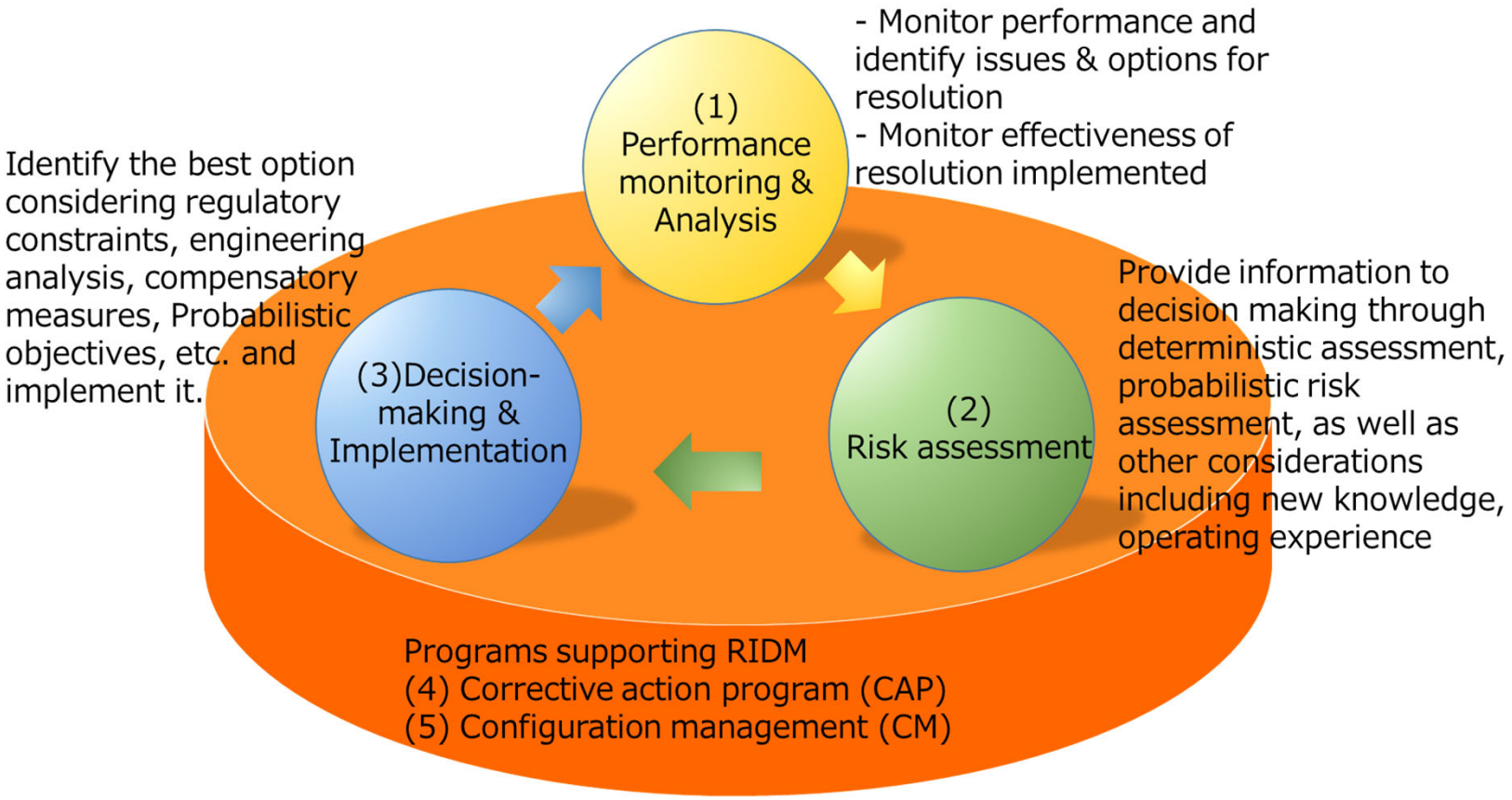
Tsunami Scenarios: Plant Configuration and Human Actions are important



PRA Evolution in Japan

- PRA was not taken seriously prior to Fukushima.
- Industry established the NRRC in 2014.
- "To assist nuclear operators and the nuclear industry in their continuous effort to improve the safety of nuclear facilities, that is, to manage the relevant risks, by developing and employing modern methods of Probabilistic Risk Assessment (PRA), risk-informed decision making and risk communication."
- International expert committees review the PRAs for Ikata 3 (PWR) and Kashiwazaki-Kariwa 7 (BWR).
- NRA establishes a Reactor Oversight Process similar to the risk-informed U.S. process (2020).

Utilities' Strategic Plan (2018)



NRRC, with the help of electric utilities, is currently examining the technical basis for risk-informing on-line maintenance.

Considerations on Performing Integrated Risk Informed Decision Making (IAEA-TECDOC-1909, 2020)

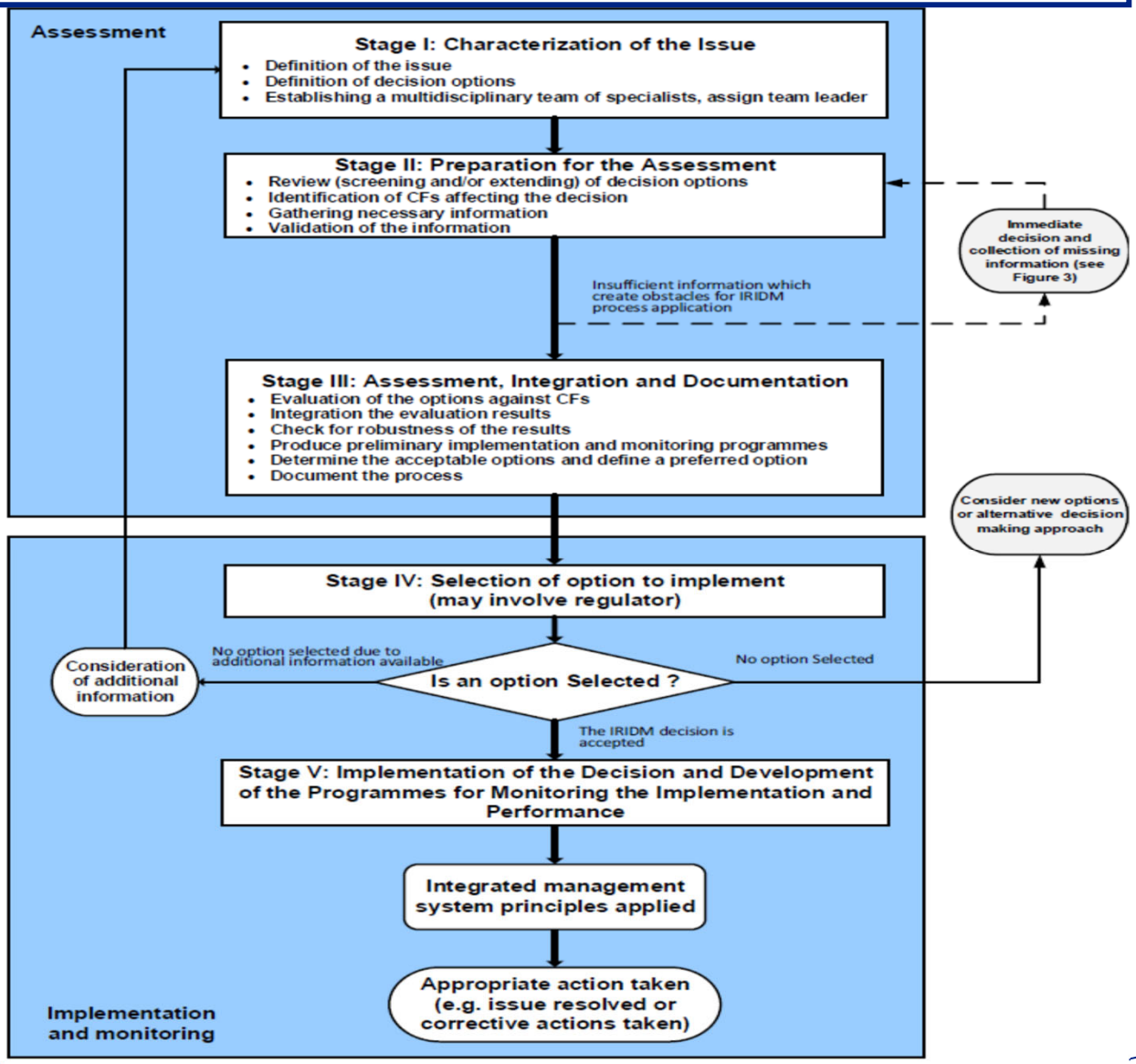


FIG. 3. IRIDM workflow.

Risk-Informed Framework

Traditional "Deterministic" Approach

- Unquantified probabilities
- Design-basis accidents
- Defense in depth
- Can impose unnecessary regulatory burden

Risk-Informed Approach

- Combination of traditional and risk-based approaches through a deliberative process

Risk-Based Approach

- Quantified probabilities
- Thousands of accident sequences
- Realistic

Safety Goals

- They underlie risk-informed decision making.
- The NRA has not declared formally any SGs.
- Informally:
  - Core damage frequency: 10^{-4} per reactor year
  - Containment failure frequency: 10^{-5} per reactor year
  - The frequency of the release of Cs137 larger than 100 TBq during nuclear emergency should be less than once in one million years (excluding those due to security events)
- Consistent with the JAEC statement: “Unremitting effort to improve safety on the basis of no zero - risk.”
- An implicit admission that accidents may happen, albeit with very low probability.

Rebuilding Public Trust

- An essential requirement: No incidents or rule violations should occur.
- Openness is also essential (example: the NRRC publishes the (sometimes critical) reports of its Technical Advisory Committee on its website).
- Building trust requires telling the truth.
- The language of truth in nuclear safety is risk (accident consequences and probabilities).
- The metrics core damage frequency (CDF) and large early release frequency (LERF) are used routinely in the U.S. by the industry, regulators, and public-interest groups.
- It's unclear what the Japanese public reaction to the risk language will be (probably negative in the beginning).
- But, it is the truth.