Opening Remarks and Introductory Presentation

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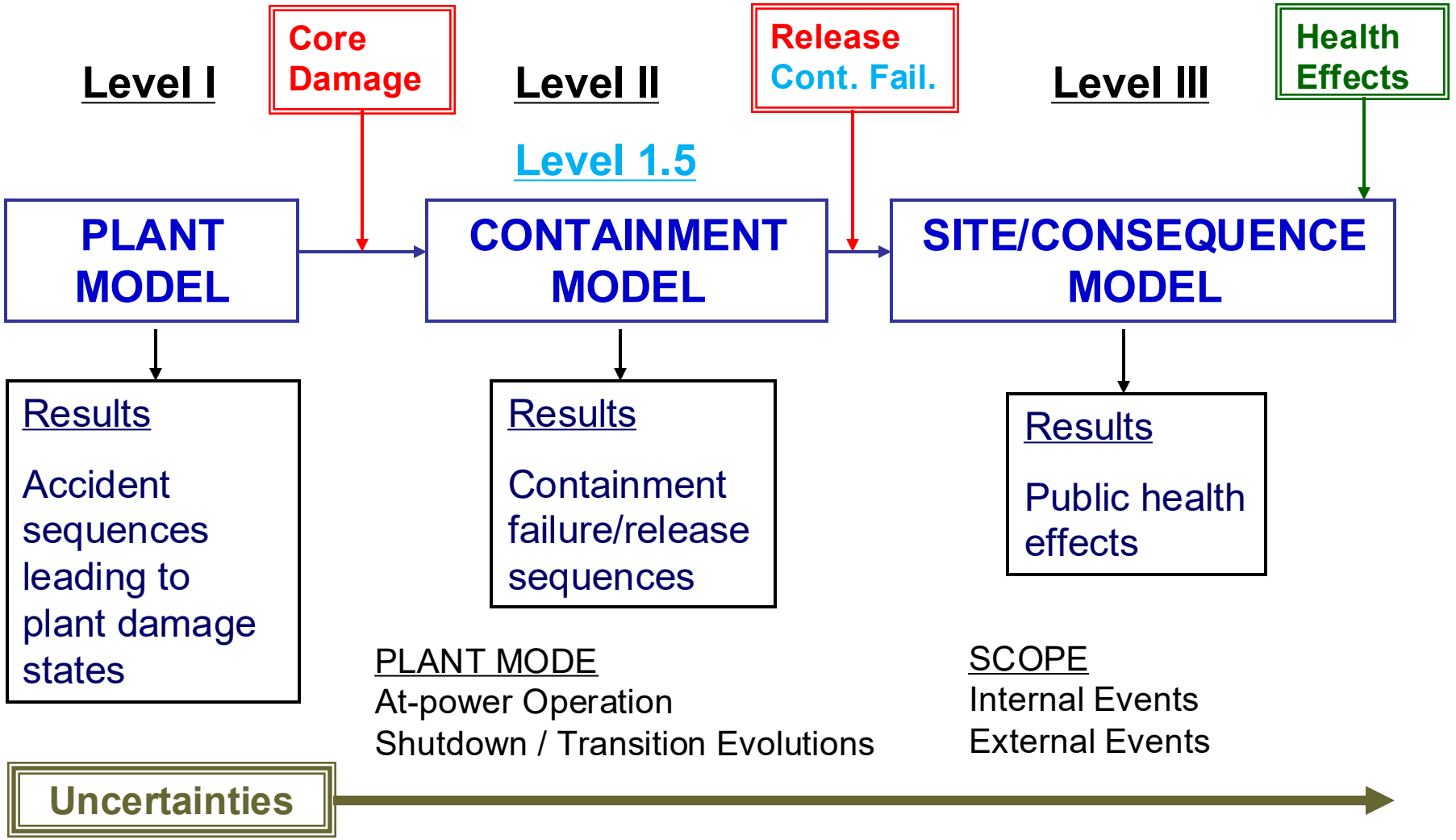
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The Triplet Definition of Risk (Kaplan & Garrick, 1981)

- What can go wrong? (thousands of accident sequences or scenarios are developed)
- How likely are these scenarios?
- What are their consequences (core damage, containment failure, release of radionuclides, health effects)?

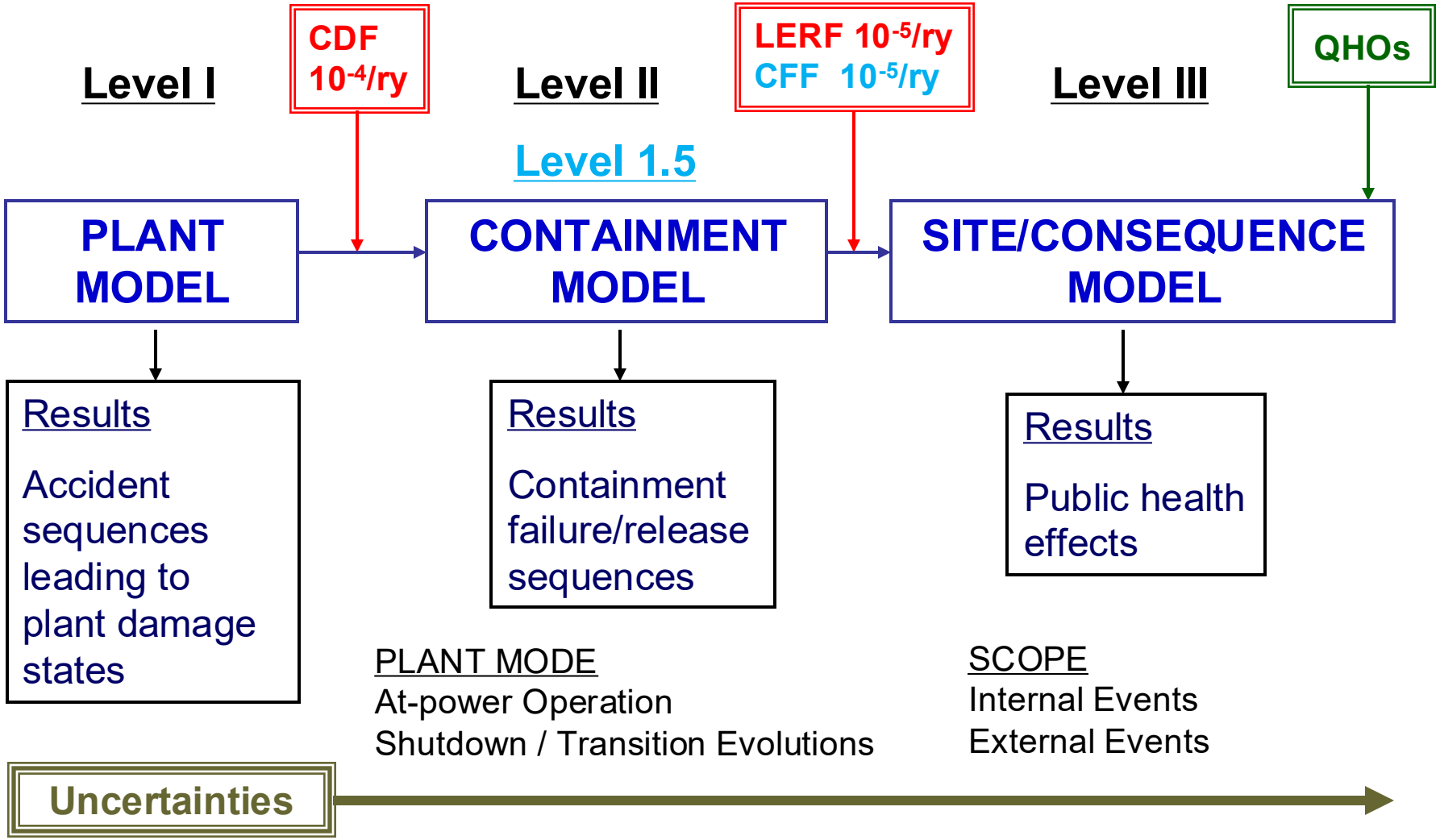
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PRA Model Overview



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PRA Model Overview and Safety Goals for One Reactor



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Multiunit Sites

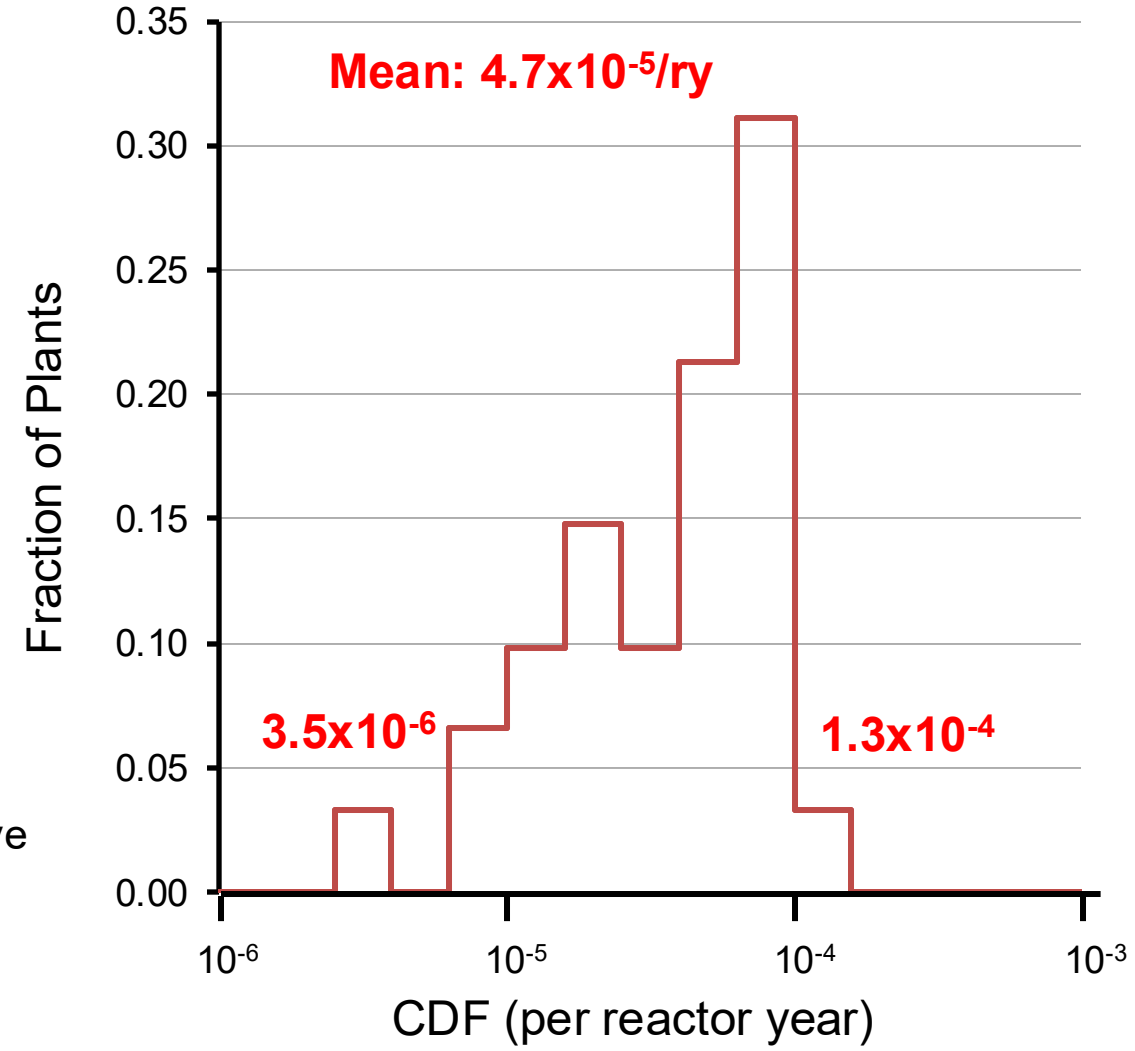
- In the U.S., PRA is applied to one reactor, even when there are other reactors on the site (at most three more).
- In Japan, there are sites with as many as seven reactors. Calculating a CDF or CFF is prohibitively expensive.
- There is a need for guidance from the NRA on what to do with multiunit sites. Should the PRA be applied to a single reactor as in the U.S.?

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CDF Estimates for U.S. Plants

- Current point estimates including internal and external events (61 units)
  - Post 2000 (90% after 2005)
  - Plant-to-plant variability reflects differences in designs and modeling

From License Amendment Requests (LAR) and Severe Accident Management Alternative (SAMA) analyses



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CRIEPI Central Research Institute of Electric Power Industry

The 10^{-6} culture

- Japanese PRAs in the past reported CDFs below 10^{-6} per reactor year. This led to loss of credibility.
- A recent NRRC study showed that the contribution from fires led to a CDF greater than 10^{-5} .
- Unexpectedly, some utility engineers were concerned that this number was “too high” and might create a regulatory issue.
- Such a number is not too high and is consistent with international practice.

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Countering the 10^{-6} culture

- **Industry Response:**
  - **NRRC's Technical Advisory Committee (TAC) high-level review of Ikata 3 PRA**
  - **International PRA review teams reviewed and made recommendations for improvement to the Ikata 3 (PWR) and Kashiwazaki-Kariwa (BWR) PRAs.**
  - **The ASME/ANS Level 1 PRA Standard and the ASME/ANS Level 2 PRA Standard were used.**
  - **"Although there are opportunities for improvement, the PRA has been developed in a manner generally consistent with good international practices"** *KK7 Review Team*
  - **Other plants will upgrade their PRAs consistent with the findings for the reviewed PRAs.**
- **Encouraging sign: Takahama recently reported a CDF of 1.9×10^{-5} per reactor year for internal floods.**

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The U.S. 1995 Policy Statement

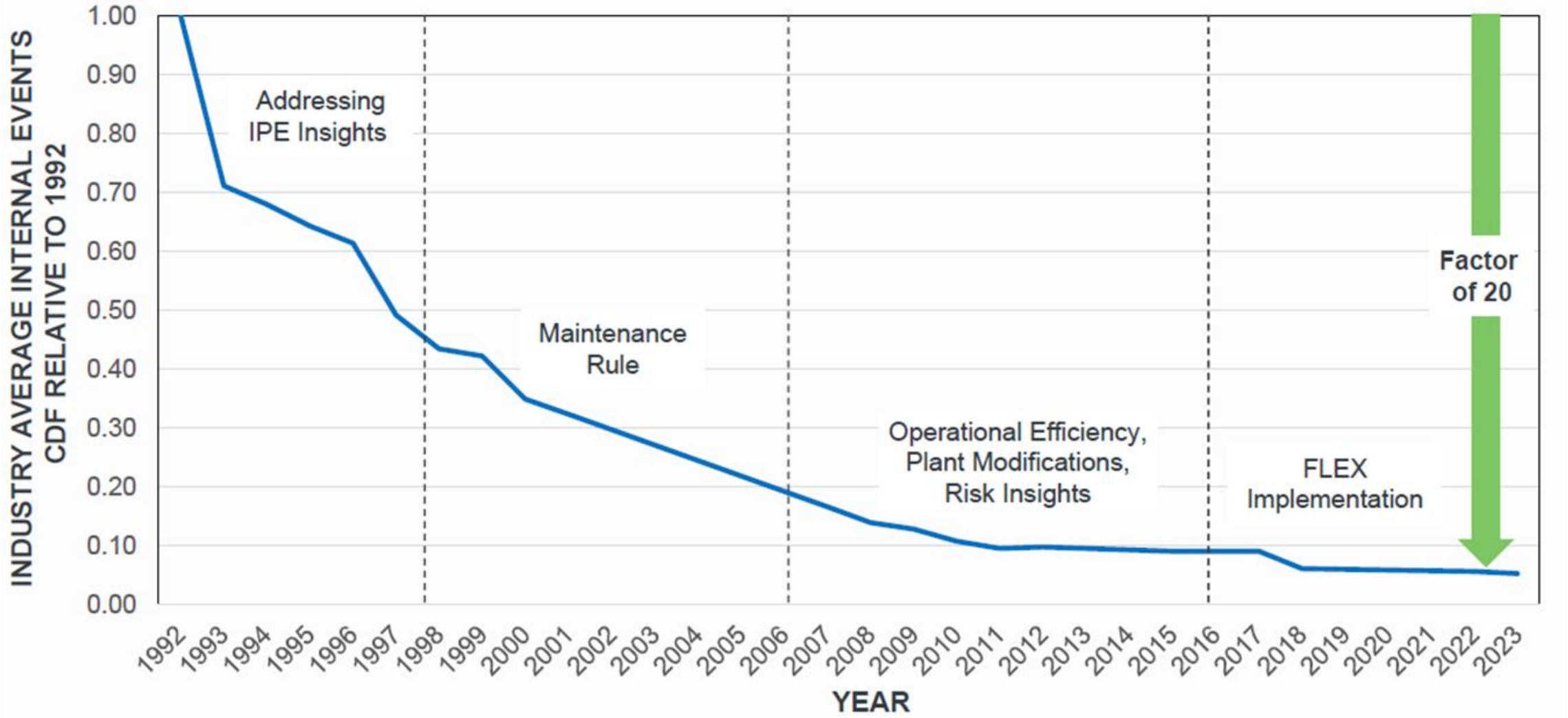
- *The use of PRA should be increased to the extent supported by the state of the art and data and in a manner that complements the defense-in-depth philosophy.*

- *PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the-art, to reduce unnecessary conservatisms associated with current regulatory requirements, regulatory guides, license commitments, and staff practices.*

- *PRA evaluations in support of regulatory decisions should be as realistic as practicable.*

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U.S. Industry Internal Events CDF Trend



From D. True, 2024 NRRC Workshop on Risk-Informed Decision-Making: Benefits and Obstacles.

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