

MUPSA and Risk Management

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Risk-Informed Framework



Traditional “Deterministic” Approach

- **Unquantified probabilities**
- **Design-basis accidents**
- **Defense in depth and safety margins**
 - **Can impose unnecessary regulatory burden**
- **Incomplete**

Risk- Informed Approach

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

Risk-Based Approach

- **Quantified probabilities**
- **Thousands of accident sequences**
 - **Realistic**
- **Incomplete**

Safety Goals (USNRC) 1

- **Qualitative and quantitative goals on health effects.**
- **Subsidiary goals for CDF (10^{-4} per reactor-year) and LERF (10^{-5} per ry) .**
- **These are goals, not regulatory requirements.**
- **There is agreement that the LERF goal applies to the site.**

Safety Goals (USNRC) 2

- **There is disagreement as to whether the CDF goal applies to individual reactors or to the site as a whole.**
 - **My personal view: It should apply to individual units (it is a design objective)**
 - **Remember that $MUCDF \leq SUCDF$**
- **If MUCDF is close to the goal, then SUCDF is already there.**
- **The purpose of the goal is to alert the owner and the regulator that an investigation of possible actions to reduce the CDF and/or the MUCDF is warranted.**

IAEA Case Study Results

		Initiating event				
		SLBO	Fire in the turbine hall	LOOP (SFT approach)	LOOP (MET approach)	Seismic events
CDF for Units 1&2 (“old” units)	Unit 1	2.56E-08	7.65E-07	1.13E-06	1.13E-06	1.58E-04
	Unit 2	9.84E-08	2.98E-06	1.13E-06	1.13E-06	1.58E-04
	Units 1&2	1.87E-10	6.46E-09	1.68E-08	1.68E-08	1.32E-04
	R ₂ (“old”)	7.30E-03	8.44E-03	1.49E-02	1.49E-02	8.35E-01

IE	Base case	Sensitivity case
CD12 for seismic events	1.32E-4	9.65E-5

From: IAEA, “MUPSA for New and Existing Reactor Facilities,” Vienna, 2019.

- **The plant-specific numbers for seismic failure are high and exceed the safety goal for CDF.**
- **They should prompt plant management to investigate further these results and, possibly, take action.**

Final Thoughts

- **The IAEA methodology for MUPSA is a significant step forward.**
- **As expected at this stage of development, further improvements and refinements will occur.**