

Layer 1: National Safety Culture

Are there Cultural Factors contributing?

- Rigid, non permeable hierarchies?
- „Mavericks „ excluded from review process?
- No bottom-up- questioning attitude?
- Too strong obedience to authorities?
- Fear of losing face due to „mistakes“?
- Selection of review committees biased?
- Individual accountability obscured/absent?

Economic-governmental entanglement?

- „Amakudari“ (re-employment of ex-govt officials in industry)
- TV and journalism uncritically in line with governmental decisions and attitudes

Layer 2: Basic Problems in Nuclear Field:

- No independence of NISA from METI.
- Emphasis on cost-cutting over safety in TEPCO
- Nuclear safety a non issue in Japanese TV
- Politician-bureaucrat-industry collusion
- Lopsided publicity („NPPs absolutely safe“) prevented open discussion of NPP safety
- NSC is purely administrative and has no independent effective supervision of NISA
- Regulation on tsunamis since 2006, but no real requirements concerning big tsunamis (Joghan) by NSC
- Perpetual Resistance of NISA and TEPCO against serious warnings concerning high risk of big tsunamis in the Tohoku region by seismic specialists

Layer 2: Basic Problems in Seismological Field:

- Dogmatic National seismic risk map did not predict megaquakes $M > 8.3$ in Tohoku region → undue risk focus on South East → underestimation of risk in Tohoku region → underestimation of Megatsunami risk in this region from nearby Japan Trench subduction zone
- Historic tsunami data verified since 1990 Joghan-Megatsunami and even older Megatsunamis with a frequency of $1E-3$ 1/y. This higher risk was not officially acknowledged for years
- No historic tsunami hazard map exists for Japan

Layer 3: Main Safety Deficiencies of Fukushima:

- No high efficiency filtered venting system
- Wrongly directed venting into secondary containment
- No passive autocatalytic hydrogen recombiners in secondary containment
- Insufficient tsunami and flooding resistant design (e.g. alignment of emergency power supply)
- Wrongly located switchgear building (beneath flooding level)
- No redundant earthquake and flood resistant, bunkered core & containment heat removal system
- No diversified cooling water intakes from different sources
- Deficits in severe accident management after accident initiation

→ No backfitting since years!

Disaster of 11-03-11:

Result: Not a residual risk issue!
Simply gross negligence!

Contributing Layers of Failure Leading to the Fukushima Accident