

Strengthening the implementation of Defence in Depth

Highlights from the Work of NEA/CNRA on the Activities, Priorities and Challenges Related to DiD

*Dr Jean-Christophe Niel
NEA/CNRA Chair
Director General, ASN, France*

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Activities, Priorities and Challenges related to DiD

1. Background

- Concept and Context
- Impact of the Fukushima Daiichi Accident
- CNRA and others recent work

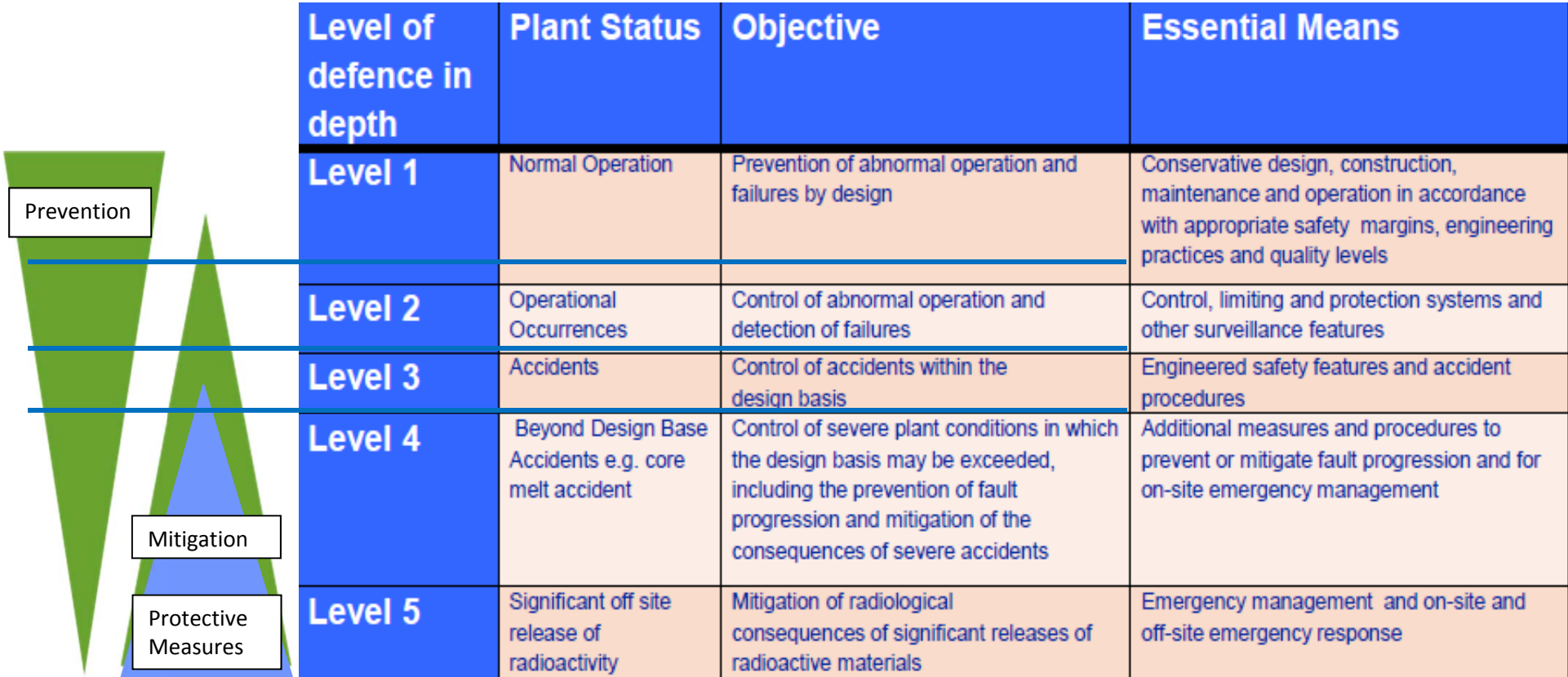
2. The role of the regulator in all levels of DID (concept definition, implementation...)

3. NEA/CNRA dedicated task group (on-going activity)

- Objectives & scope
- Deliverables & programme of work
- Cooperation / interaction

Activities, Priorities and Challenges related to DiD

1. Background: **concept** used for many years to secure high levels of safety - 5 independent barriers



Level of defence in depth	Plant Status	Objective	Essential Means
Level 1	Normal Operation	Prevention of abnormal operation and failures by design	Conservative design, construction, maintenance and operation in accordance with appropriate safety margins, engineering practices and quality levels
Level 2	Operational Occurrences	Control of abnormal operation and detection of failures	Control, limiting and protection systems and other surveillance features
Level 3	Accidents	Control of accidents within the design basis	Engineered safety features and accident procedures
Level 4	Beyond Design Base Accidents e.g. core melt accident	Control of severe plant conditions in which the design basis may be exceeded, including the prevention of fault progression and mitigation of the consequences of severe accidents	Additional measures and procedures to prevent or mitigate fault progression and for on-site emergency management
Level 5	Significant off site release of radioactivity	Mitigation of radiological consequences of significant releases of radioactive materials	Emergency management and on-site and off-site emergency response

Activities, Priorities and Challenges related to DiD

1. Background: **context**

- Well established tool to assist designers, operators, regulators, etc. in their functions
- Complementary to other tools such as:
 - Deterministic evaluation
 - Probabilistic risk evaluation
- Used in combination provide a diverse synergistic approach to securing high levels of safety

Activities, Priorities and Challenges related to DiD

1. Background: **impact of the Fukushima Daiichi accident**

- Raised questions about DiD and its implementation
 - Implementation to be done more consistently
 - Importance of independence when implementing DiD at different levels
 - Rare external site specific hazards should be addressed at all DiD levels
- Concept remains valid, although there are some discussions on the end safety goals
 - Initiatives are being considered to look at the overall end safety goals considering social impacts

Activities, Priorities and Challenges related to DiD

1. Background: **CNRA and others recent work**

- NEA Steering Committee Policy Debate on DiD, Oct. 2012
- NEA's CNRA/CSNI Workshop on DiD, June 2013
- IAEA International Conference on Topical Issues in Nuclear Installation Safety – DiD, Oct. 2013
- NEA/CNRA: on-going drafting of a **Green Booklet on DiD in the light of Fukushima Daiichi accident**
(initial STG meeting on April 2014)

Activities, Priorities and Challenges related to DiD

2. The role of the regulator in all levels of DiD (concept definition, implementation...) (1/2)
 - Prime responsibility is on the licensee
 - The regulator ensures that:
 - At levels 1, 2 & 3, the licensee / operator discharges its role of designing, constructing and operating plant safely
 - At levels 4 & 5, that design and operational means contribute to limit risks of massive off-site radiological releases
 - Importance of prevention AND mitigation (including rare events)

Activities, Priorities and Challenges related to DiD

2. The role of the regulator in all levels of DiD (concept definition, implementation...) (2/2)
 - End safety goal to be extended to include prevention of **severe accidents**, of **significant releases** of radioactive materials and of **social disruption**
 - Need for Regulators to **maintain** their **Technical Capability, Independence** and **Credibility** in these different roles

Activities, Priorities and Challenges related to DiD

3. NEA/CNRA dedicated task group

- **Objective & scope – to:**
 - Explain the background, concept and context of DiD
 - Provide a consensus on those selected topics in scope
 - Enhance guidance on these topics
 - Make recommendations to enhance the implementation & use
- **Cooperation / interaction**
 - IAEA
 - WENRA
 - NEA Committees
 - various regulatory bodies
 - INSAG
- **Deliverable: final draft Green Booklet – May 2015**

Scope / outline of the Green Booklet (1/2)

1. Introduction to the topic and Green Booklet
2. Description of Basic DiD concept, its principles and definitions and relationship to PSA, etc as safety decision-making tools
3. Considerations about DiD arising from Fukushima Daiichi Nuclear Accident, e.g.:
 - a. Practical Elimination concept and relationship with other safety goals
 - b. Structure and Independence of levels, relationship of levels to plant and failure states, design basis and design extension conditions, use of margins/confidence levels/reasonableness, acceptance criteria
 - c. Impact of common mode failures
 - d. Optimisation of prevention and mitigation
 - e. Minimisation of social disruption
4. Challenges to its use such as:
 - a. New and emerging technology
 - b. External Hazards and uncertainty
 - c. Role of PSA
 - d. Relationship to safety categorisation
 - e. Consistent use in a regulatory body
 - f. Harmonised use and understanding by nuclear regulators across the world
 - g. Public confidence – use of terms such as practical eliminate and independence
 - h. Determining when to stop enhancing DiD

Scope / outline of the Green Booklet (2/2)

5. Importance and considerations for robust emergency arrangements and post-accident management off-site
6. Guidance on its application for:
 - a. Operating reactors
 - b. Multi-unit sites
 - c. New reactors
 - d. Advanced reactors
 - e. Ponds and other storage facilities for spent fuel
 - f. Other nuclear facilities
7. Wider uses of DID concepts to secure nuclear facilities such as:
 - a. Nuclear Institutional systems
 - b. Operations and operational constraints
8. Regulatory use in:
 - a. Assessing its implementation in a design
 - b. In delivering regulatory functions such as inspections
9. Conclusions and Recommendations

Activities, Priorities and Challenges related to DiD

Way forward

- On-going drafting of the Green Booklet
- Main interest on policy issues
 - DiD concept and end safety goals
 - Balance between prevention and mitigation
 - Adequate attention to site aspects
 - Convergence on DiD implementation
 - Closer harmonisation of the application and implementation of DiD
- Ensure a consistent approach with others initiatives (IAEA, INSAG...)