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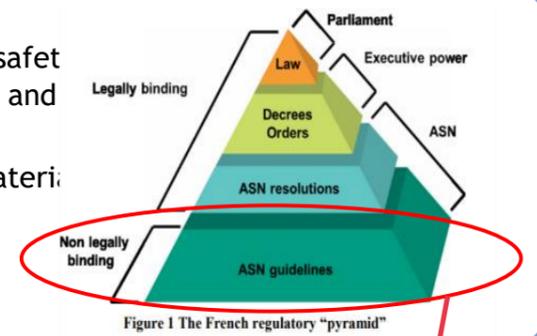
UPDATES OF THE FRENCH CRITICALITY SAFETY ANALYSIS GUIDE AND EVENT DATABASE (LOGIC)

Fabien Duret, Matthieu Duluc, Aurélie Bardelay (IRSN, France)

French regulations for Nuclear Criticality Safety

The Fundamental Safety Rule RFS I.3.c (1984) had been used to set out the principles for nuclear criticality safety assessment of French nuclear facilities. It has been replaced by a **ASN resolution in 2014 for civil facilities** and the **ASND instruction n°34 in 2020 for defense-related facilities**. These new resolution and instruction:

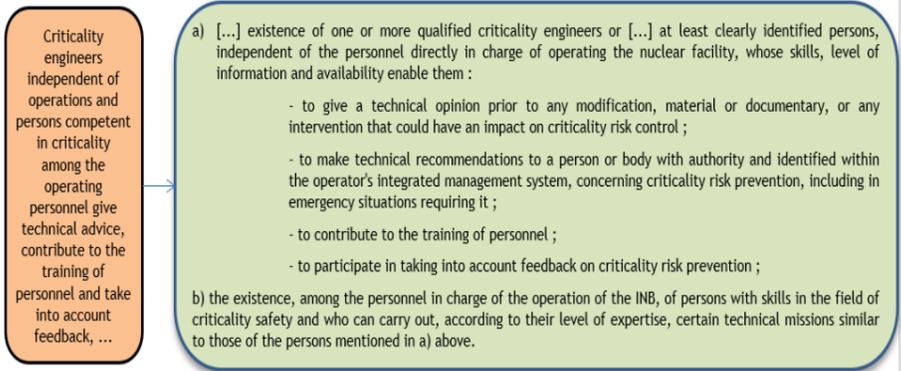
- clarify the scope for reactors loading and unloading operations and transport packages of fissile materi
- address the application of the defense in depth principle (prevention, detection and limitation of consequences) to criticality safety
- state the "double contingency" principle



A guide for practitioners

To follow regulatory evolutions, the IRSN criticality safety analysis guide, created in 2010, has been updated in 2022. IRSN guide appendix, the first diagrams present principles related to the general approach to criticality risk in France. It is a general overview of the French approach. These diagrams cover the following topics:

- civil or defense nuclear facilities **design**
- **reactors design** for safe loading or unloading operation
- **safety measures** in plants and reactors belonging to civil and defense
- **human organization** in some defense plants or reactors



Example of a diagram about French regulations

New topics in 2022

The 2022 new guide completes the original guide with new diagrams about:

- definition of the bounding **fissile medium** for reactor loading and unloading (nature of the fissile material and moderation, isotopic composition and density)
- application of "**criticality control modes**" for reactor loading and unloading (moderation, geometry, poison)
- impact of **environment** affecting neutron reflections and interactions conditions (concrete walls, distances between fissile units, etc.)
- **measurement** of fissile mass
- **criticality accidents** (alarm, protection, emergency management and means to stop an accident)

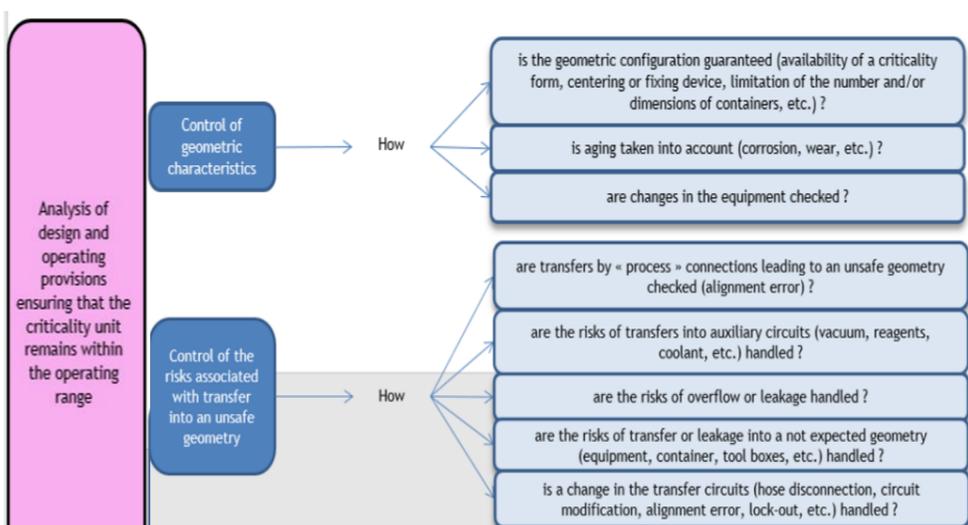
Lessons From Experience

The 2022 new guide integrates the lessons learned from NCS events occurred in French facilities. IRSN used "LOGIC", a criticality safety event database created in 2015. LOGIC gathers information on the events (nuclear operator reports, follow-up, etc.) and IRSN assessments.

There is a "virtuous circle" : new assessed events lead to complete the scenarios/questions, thus enhancing criticality safety.



Example : Near miss in Dampierre PWR core, 2001



e.g. of diagram

LOGIC	Accueil	Ma page	Incidents	Rapports	
2006-009	1	1	NFS INC : Fuite de 35 litres d'uranium enrichi aux États-Unis	2006-03-06	Validé
2017-023	1	1	USA, Y-12 NSC - Concurrent uranium overmass and hydraulic fluid leak	2017-05-01	Validé
2011-041	2	1	Nuclear catastrophe narrowly avoided at Los Alamos National Laboratory	2011-08-11	Validé
1991-008	1	1	WILMINGTON : Accident potentiel de criticité	1991-05-28	Validé
2020-012	0	1	Dépassements de quatre grammes et d'un gramme de la masse de plutonium dans l'unité de criticité n° 2 "chaîne d'incinération de déchets alpha".	2020-12-11	Validé
2021-005	0	1	Déclenchement de l'alarme "unité de sécurité - détection chaîne gamma"	2021-02-15	Validé

Main LOGIC screen