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MULTI-UNIT RISK AND CONTEXT INFORMED MONITORING AND DECISION-MAKING

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Single-unit PSA of a given NPP is a necessary, but not sufficient, condition for risk assessment and monitoring, comprehensive safety characterization, and decision-making for performing various operations in normal and emergency conditions. This is due to some shortcomings of the PSA, which necessitates its mandatory complementation with DSA. They are the following:

1. Risk has an integral character, and many deterministic analyzes a priori do not have an integral character, but a particular character for establishing facts, subjectively determining and reducing a limited number of representative sequences and boundary cases, with a similar accident progression. And besides, the exchange of information between DSA and PSA is incomplete, and their interaction is suboptimal.
2. Risk is uncertain, which is due to ignorance (epistemic) and the impossibility to clearly separate and distribute in time and space the random from the regular (stochastic).
3. Site risk must be based on multi-unit PSA, which requires a compatible, dependent, examination of all units, fuel storages and radioactive materials for the most complete possible spectrum of combined initiating events, internal and external hazards at the site.
4. Risk is not only static but also dynamic, which gives rise to the need for operationality in monitoring, distribution (globally & locally) and reckoning in time for decision-making, considering regulatory requirements and quantitative rules (if any) for research, planning and evaluation of safety measures and implementation of technical solutions.
5. Risk includes not only the calculated part but also the residual risk too, which is due to the omission or non-correlation in the PSA model of the multiple factors and conditions in the PSA model due to its extensively increasing models, leading to difficulties for calculation, organization, uncertainty and sensitivity assessments, and conversion into more operational tools for risk monitoring, which to support conscious and intuitive decision-making.
6. Risk is influenced by the processes of cognition, communication, decision and action of the person or crew (or trained AI, if natural intelligence is replaced), which implies a comprehensive study of the dependencies, context of the situation in which the installation operates and the person or crew finds themselves and makes decision.

The research and overcoming of these shortcomings can be done separately, but it can also be done by searching for a common means for their joint identification, qualification, quantification and elimination through a procedure for monitoring of risk and context in a given situation.

The paper presents the possibilities for such joint overcoming by means of a risk monitoring tool based on the PSA, supplemented with the procedure for context quantification of the "Performance Evaluation of Teamwork" as a human reliability (HRA) method for multi-unit risk- and context-informed monitoring, decision-making and management.

Keywords: Risk, PSA, DSA, site risk, context, monitoring, cognition, decision-making, HRA method.