

OSART Good Practices

USE OF PSA FOR PLANT OPERATIONAL SAFETY IMPROVEMENTS

Use of PSR and OEF to support PSA applications

Borssele, Netherlands

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The plant has developed a unique risk-informed application that categorizes the proposed areas of improvement identified in the Periodic Safety Review (PSR), according to deterministic and probabilistic risk benefits in order to concentrate efforts in areas most beneficial to safety.

Purpose

The goal of this application is to improve the review of PSR results in a risk-informed way that enhances plant safety.

Description

The use of the Probabilistic Safety Assessment (PSA) as part of the PSR follows the next structured multi-stage process:

- Definition of 'State of the Art' in PSA.
- Updating of the model to the 'State of the Art' standard.
- Use of the updated model to identify potential improvements of the plant based on the PSA metrics for both level 1 and level 3.
- In the next step, the complete set of results from the PSR are ranked based on probabilistic and deterministic considerations. These ranking forms part of the decision on what measures to implement at the plant.

POTENTIAL SAFETY IMPROVEMENT				
Core Damage Frequency	Individual Risk	Instantaneous CDF		
Delta CDF (average /yr.)	Delta IR (average /yr.)	CDF above internal limit: CDF > 1E-4 /yr.		
Very big impact (>250%)	Very big impact (>250%)	Multiple times per year at EPZ	Very big	
Big impact (25-250%)	Big impact (25-250%)	1 or 2 times per year at EPZ	Big	
Significant impact (5-25%)	Significant impact (5-25%)	Did happen at EPZ (0,1 / year)	Moderate	
Limited impact (1-5%)	Limited impact (1-5%)	Did happen in the nuclear industry (1E-3 / year)	Small	
Negligible impact (0,2-1%)	Negligible impact (0,2-1%)	Never happened in the nuclear industry (1E-5 / year)	Very small	

Probabilistic thresholds for ranking of PSR measures

- The measures identified are incorporated in the PSA at an early stage as part of the license application following the PSR.

This approach was partially implemented during the PSR conducted in 1993 and was fully implemented during the PSR in 2003.

GA/SF -No.	Description of area	Safety Importance		PM-No.	Description of potential measure	Cost	Follow-up
		Det.	Prob.				
GA 01 Extension of autarky and autonomous safety							
SF 01.14	Capacity 24V- batteries GRID1 and GRID2			PM 01.07a	Increase capacity of 24V- batteries of Emergency GRID1 and Emergency GRID2 for monitoring of the plant. Consider 12 hours capacity based on EPR-benchmark.		None
				PM 01.07b	Provide mobile means to supply power to Emergency GRID 2 for monitoring and charging 24V-batteries.		CSA
SF 01.15	Capacity 220V- batteries GRID1			PM 01.08	Install UPS on bus bars CY/CZ for secondary bleed & feed and primary bleed.		10EVA
SF 01.16	PSRV's control from bunkered buildings			PM 01.09	<ul style="list-style-type: none">Control PSRV's from reserve control room or from cabinetsProvide power to the PSRV's from 380V batteries.		10EVA
GA 02 Improvements on spent fuel pool cooling system (TG)							
SF 01.05	Grading of TG-system			PM 02.01a	Adjust safety classification of the TG-system from class 3 to class 2.		None
				PM 02.01b	Apply surveillance and maintenance on the TG-system according to a class 2 system.		10EVA
SF 01.49	Independence of TG080 from TG020/030			PM 02.02	Connect the TG080-heat exchanger directly to the TG025-pump (separation of TG020/TG080).		10EVA
SF 01.51	Avoid potential failure of TG-pumps after containment isolation (YZ33)			PM 02.03	Additional flow measurements in the TG020 and TG030 trains to protect the TG-pumps.		10EVA

Combined deterministic and probabilistic evaluations of PSR measures

Benefits

The use of PSA to supplement the deterministic considerations ensures a complete and balanced approach of the PSR. The PSA specifically helps in identifying improvements for complex dependencies regarding nuclear safety at the plant. When using PSA for the ranking of improvements, it helps in the allocation of resources to areas most beneficial to safety.

By using the level 3 results of the PSA, the safety and protection of people and the environment local to the plant is taken into account alongside nuclear safety.