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MATRIX-METHOD FOR SEARCHING FOR POSSIBLE INCIDENTS (REACTOR STATUS)

INCIDENT REACTOR STATUS	NO EJECTION	POD GROUP	POD THERMAL	...
LOADING	-	-	✓	✓
START UP COLD	✓	✓	✓	✓
START UP HOT	✓	-?	-?	✓
PARTIAL POWER	✓	-?	-?	✓
FULL POWER	✓	-?	-?	✓
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?: Power Distrib. - Influent
: Detectable?

(Gerhard Vogel, TUV Hannover)

MATRIX-METHOD FOR SEARCHING FOR POSSIBLE SYSTEMATIC ERRORS (FHS)

FUNCTION	STATE	LEVEL-TRANSFORM	GRAPT LEVEL	GRAPT IN FHS	SPRT OR MISTAKE	AD-UNBIS
LOADING	Δ	Δ	-	-	-	✓
UNLOADING	✓	-	-	-	-	✓
NORMAL OPERATION	✓	✓	✓	✓	✓	✓
START UP CORE	✓	✓	✓	✓	✓	✓
BURN-IN-CORE	✓	✓	✓	✓	✓	✓
END.-CORE	✓	-	-	-	-	✓

• Δ: How?

• ? : Different Enrichment!

Filter for and Additional Aspects of HTR-Design (Shutdown Safety)

Event, Effect	PWR	HTR
Rod ejection	yes	no
Uncontrolled rod withdraw	yes	yes
Boron dilution	yes	no
Water ingress	yes	(no) <i>600 kg/m³</i>
Uncontrolled fuel addition	no	yes
Collapsing of holes in the core	no	yes
Loss of Collant Accident	yes	yes
Loss of Flow Event	yes	(no)
Rod drop with reactivity gain	no	yes
Core densification	(no)	yes
Boron-loss by earthquake	yes	no
Burn out of poison in structural materials	no	yes
Uncontrolled cooling of the core	yes	yes
Temperature increase of the reflector	no	(yes)
Error in excess reactivity	(no)	yes
ATWS	yes	yes
Changes of reflector geometry	no	yes
Burn out of reactivity control devices	yes	yes
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Modular HTR-2 NPP, Reactor Physics

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TÜV NORD GRUPPE