

원자력 사건 조사분석에서 위반 오류의 비난성에 대한 기초연구

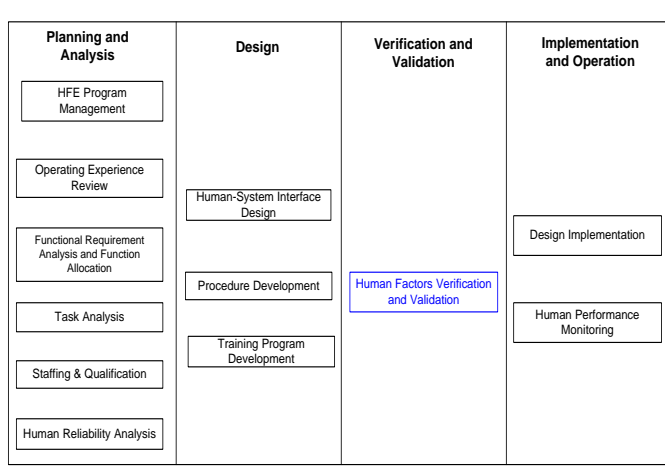
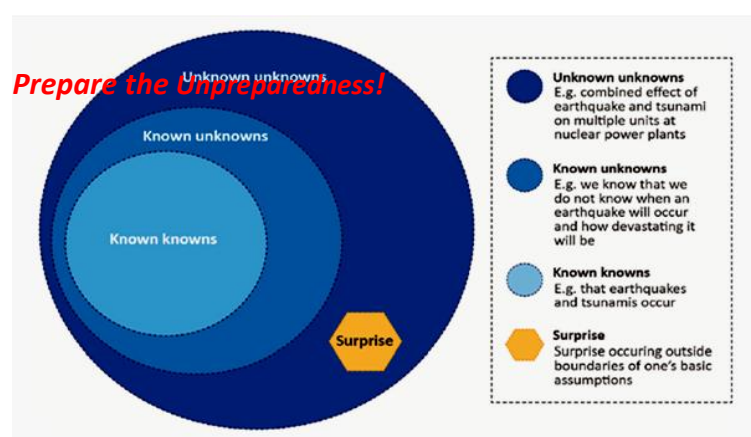
A Preliminary Study on the Culpability of Violation Errors in Nuclear Events and their Investigations

이용희(Lee Yong Hee yhlee@kaeri.re.kr) , 한국원자력연구원(KAERI)/사고감시대처연구실



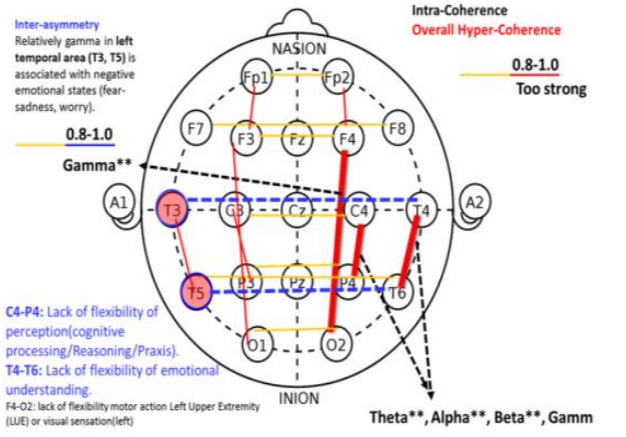
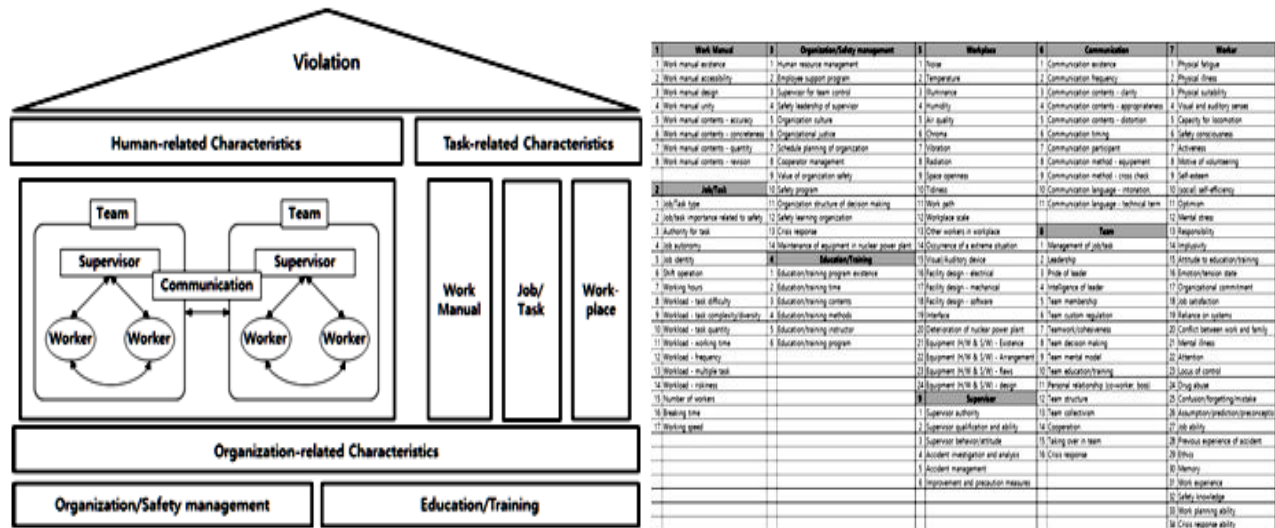
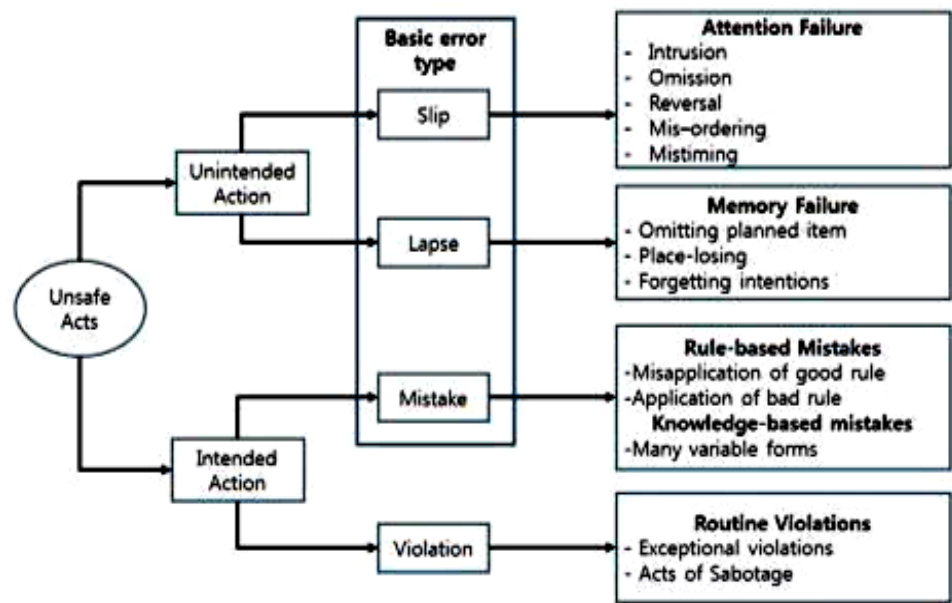
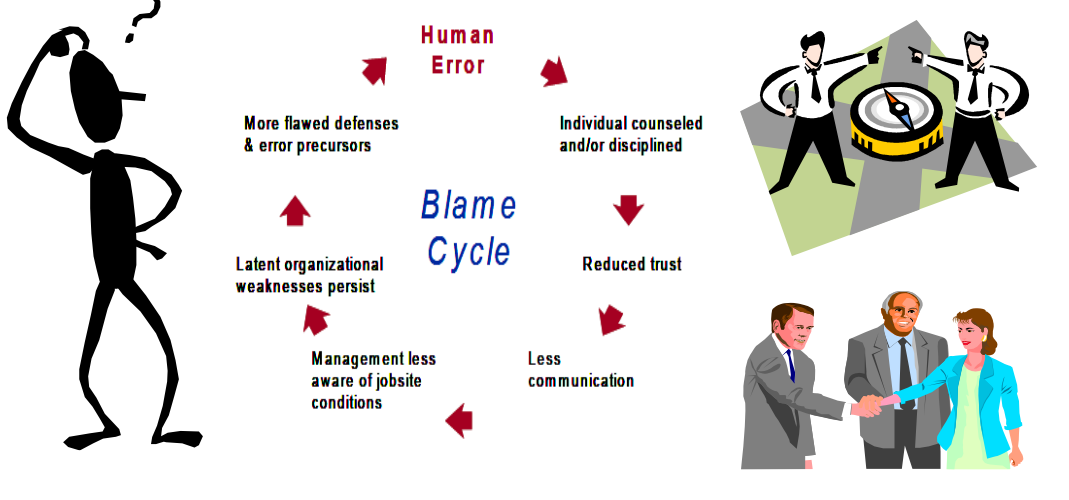
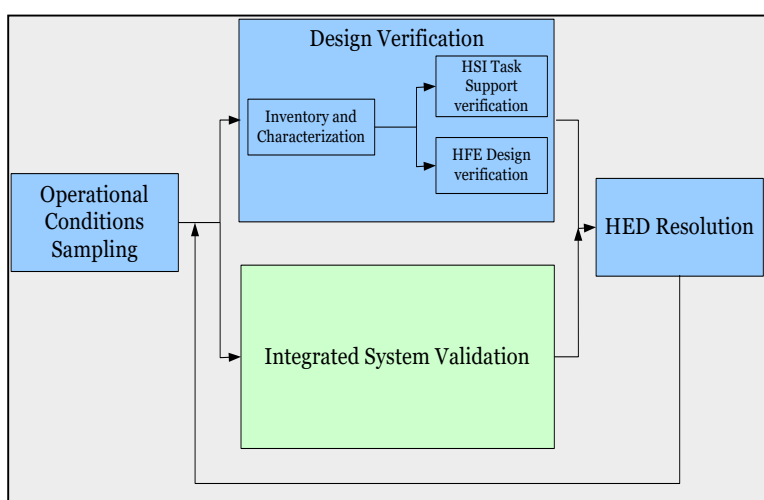
1. Background and Introduction

- 인적오류의 재부각 : 후쿠시마 => 중대사고 => **HOF**
- 인적오류 범위의 확대 : **인적오류 검증의 한계= 위반 능력**
 - ◆ 설계 검증 v&v에서 인적오류 범위
 - ◆ PSA/ HRA에서 고려되는 인적오류의 범위
 - ◆ PSR, stress Test에서 인적오류의 범위
 - ◆ 사고고장 사건의 조사분석에서 빈번한 논란
- 원자력 시스템의 특성 관련 (**NPP 기준**) unique and hard-to-overcome . (2015, 2016 Lee)
 - large and complex system into a social disaster
 - non-injury system loss with low self-motives
 - latent hazards by multiple barriers and DID
 - rare data for learning from errors
 - tightly-coupled but delayed risk
 - out-of-loop by the partial automation/integration
- 위반(violation)의 중요성 (2015/2019 이용희) => **more vulnerable & quarrelsome issue**
 - 예외성(exceptionality) : 설계/예상된 범위 밖의 조치
 - 책임성(responsibility) : 관련자/이해관계자 **cf. Sharp-End/Organized Irresponsibility Issue**
 - 파급성(propagatory) : 안전 기능의 무력화 파급 + 사후 논란의 파급성 **cf. 등급평가 문제**



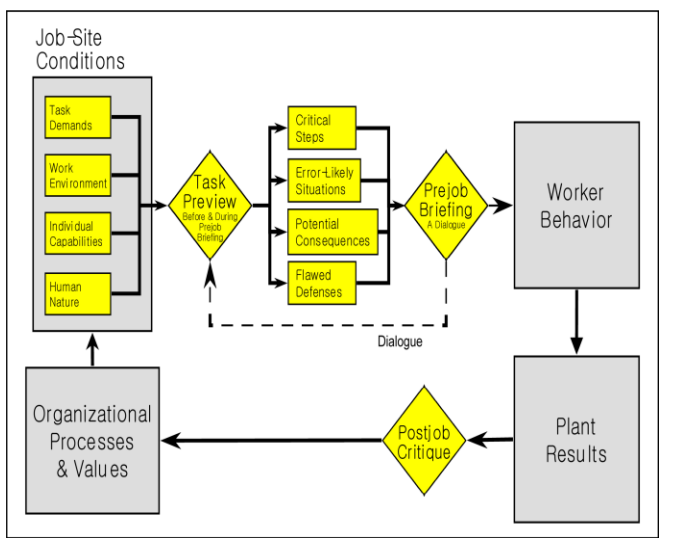
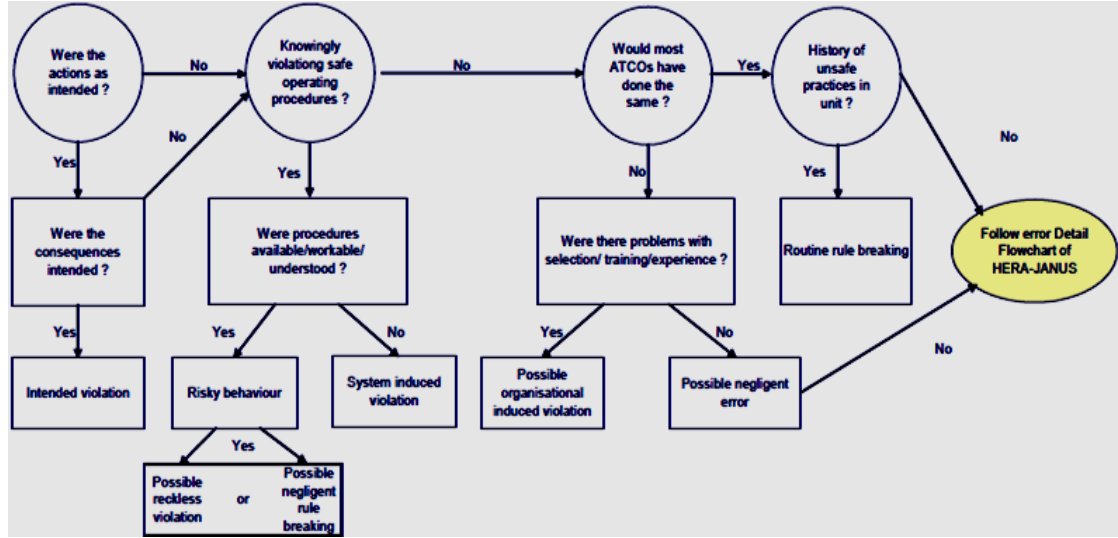
2. Violation as a Safety Culture or HF?

- Human Error including Violations?
- **Safety Culture Issue => Attribution Error!!! 답정너 현상**
 - 당연성 Triviality ; self-evident factor to all Events negative or positive
 - 종결조건 : Convenient Termination Criteria to Event Investigations
 - 임의성 : Artificiality to Countermeasures
- **Prior Studies**
 - Violations in Safety Culture Management (2015 이용희, 2015 박기찬)
 - Types of Violations (2016/2019 이용희)
 - routine/permitted violation,
 - mannerism, negligence, avoidance, by-standing...
 - Optimized and convenience violation...
 - temporal and exceptional violation...
 - test violation, curiosity violation, learning violation, asked/induced violations...
 - after-event violation...
 - Influencing & causal factors to characterize violations. :
 - House Model of Violations :10 keys/152 factors (2015/2016 한성호 외)
 - Just Culture (2019 NSSC, 2020 Jung) -> **Validity of Responsibility**
 - EOC(error of commission) and EOO(error of omission) (2019 Kim)
 - Security Error & Fitness-For-Duty (2018 서영아 외, 2019 임만성 외, 2020김정환 외)



3. Analysis of Culpability in Violations

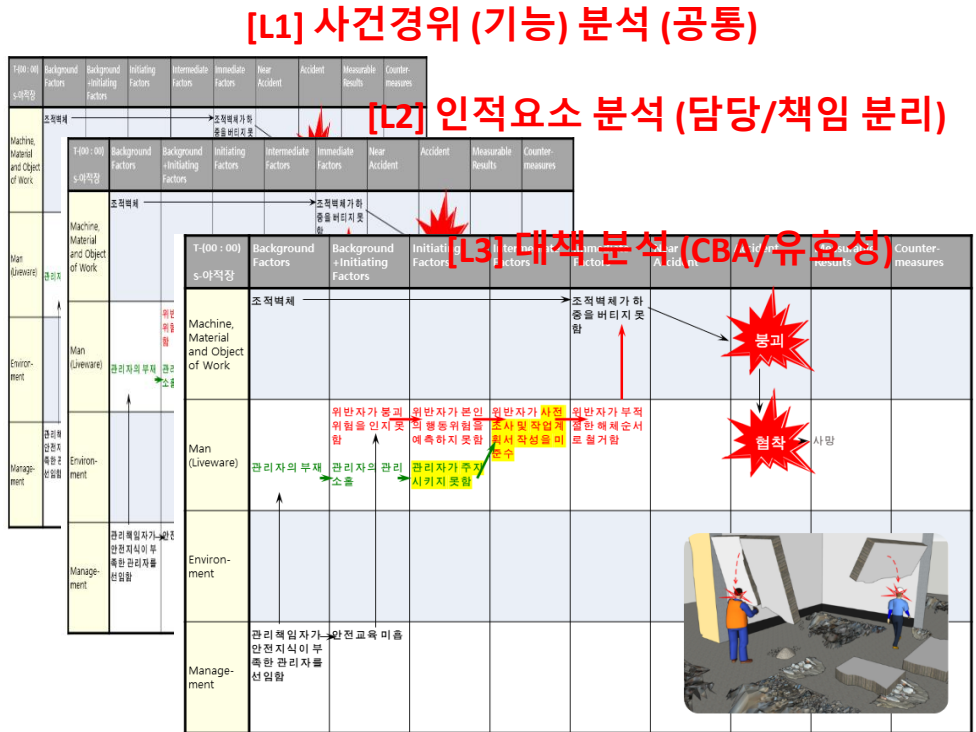
- Culpability of Human Error
 - Validity with Objectivity
 - Responsibility Allocation => **Sharp-End/Organized Irresponsibility Issue** (2016/2019 이용희)
- Technical Approach : Human Error 1.0~3.0
 - separated/layered analysis - new type of human errors during event investigations
- Multi-layered Analysis with three additive layers of analysis on events.
 - L1 : functional level of events (event sequence)
 - L2 : behavioral level of human assignments : R&R
 - L3 : culpability level
- Two Separated Dimensions of Culpability
 - Validity to Blame the (Personal/Org.) Responsibility
 - Worthiness to ask (Personal/Org.) Responsibility for Remedial Countermeasures



4. A FRAMEWORK PROPOSED FOR VIOLATION INVESTIGATIONS

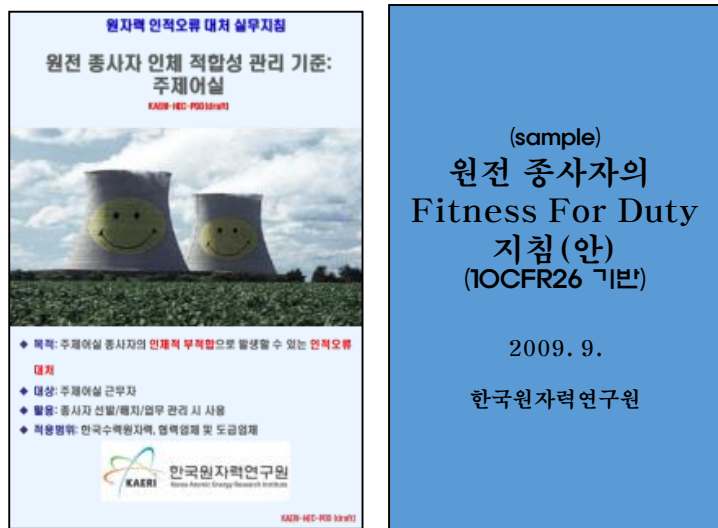
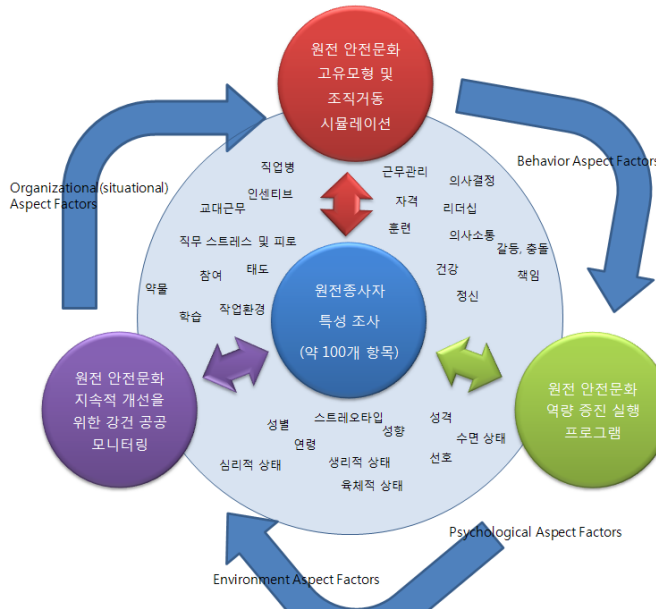
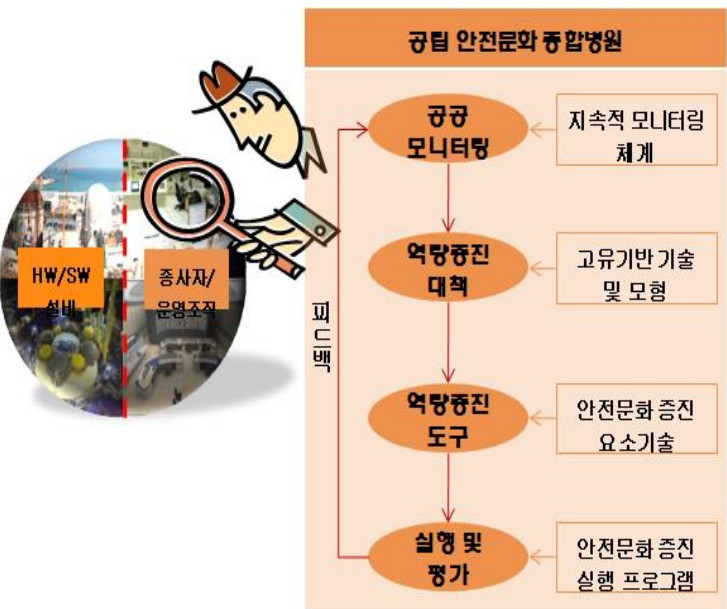
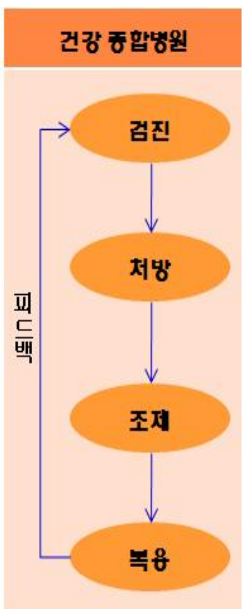
- **Human Error 3.0** changes the main focus of investigations from the factual causes to the practical countermeasures (2016, 2018, 2019 Lee).
 - Multi-layered Analysis with three additive layers of culpability.
- **Simplified Haddon-Matrix** 다계층/다관점 분석 : L3에서 책임성과 별도 분석
 - 기본 3 원칙 : three basic principles proposed
 - (1) 규칙(수준) 비례 원칙
 - (2) 책임(respo.) < 권한/능력 (capability)
 - (3) 원인(cause) < 대책 (countermeasure)

	keys	sub-factors
intention	consequence (negatives)	loss/damage punishment
	value gain (positives)	gain interest, fun etc. personal value convenience others
	mis-captured	(selected in domain tasks)
perception	rule	rule itself/details rule purpose intended rule-breaking meaning of rule-breaking
	availability	physical informational
	intervention	self peer supervisory education-class, case, mt'l training - OJT and etc. PJB etc.
management	E&T	
	experiences	job-related personal others
	organization others	(selected in domain org.) (selected on purpose)



5. Conclusion and Discussion

- How to Treat Violations in Nuclear Events?
 - Safety Culture?
 - (Personal/Org.) Responsibility?
 - Remedial Countermeasures to Enhance Safety
- INVALUABLE LESSONS LEARNED for Nuclear Safety
 - Retrospective to Proactive
 - Subjective Importance of Events
- People Analytics with Big-Data



6. References

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