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Important Human Actions for Advanced Reactors:

Implications for Human Factors

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What is an Important Human Action (IHA)?

- NUREG-0711 - IHAs are typically known as any human action which relates to a safety-significant structure, system, or component (SSC) that is credited in the plant's analysis.
- Ties to CDF and LERF historically
- Advanced reactors may use different methods or parameters
  - Like Quantitative Health Outcomes (QHOs)
- Focus of Part 53 regulatory and guidance development for advanced reactors
- NUREG-1764 handles changes to existing human actions for existing reactors, e.g., changes for maintenance, but very out of date ~20 yrs

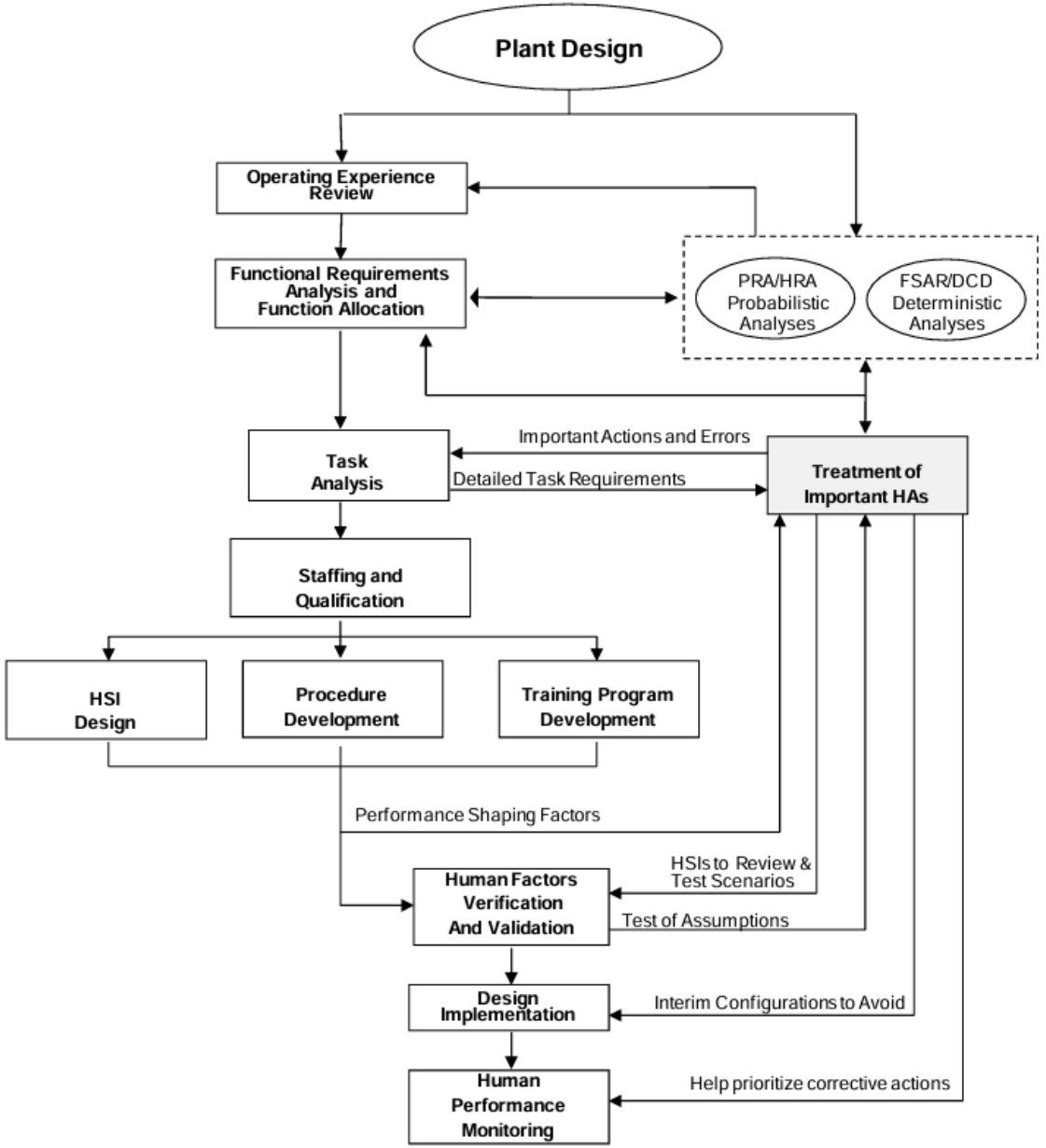
Advanced reactor review process

- NEIMA Act (2019) defined the characteristics of an advanced reactor review process
  - Technology inclusive
  - Risk-informed
  - Performance-based
- ADVANCE Act (2024) changes to advanced reactor regulatory frameworks
  - Guidance for microreactors
  - Regulatory framework for fusion
  - Streamlining application review process

The question

- Using historic **assumptions** around IHAs, some advanced reactors have posited many different risk analysis systems
  - Some advanced reactor platforms don't use traditional risk analysis methods
    - Some may not have a PRA, CDF, or LERF
    - Some may not have traditional human failure events
  - Some advanced reactors propose more automation and less human control
    - Potentially few human actions and many not related to control or safety actions
- So, we can eliminate IHAs with less human actions, more automation, etc?
  - **False**

IHAs in the HFE Program



Reality of IHAs in advanced reactors

- Part 53 takes an approach to IHAs that is best described as “important human actions wherever they occur.”
  - Different from focus on safety critical control actions in historic assumptions
- So what *is* an IHA?
  - NUREG-0711 has a definition
  - NUREG-0800, Ch. 18 has one too
  - Our definition is:

    - ***Any human action such that, the performance of that action directly affects, deterministically or probabilistically, the performance of any system, process, or component that is credited in the plant’s safety, design, or risk analyses.***

IHA and related terms

- Some key modifications since the days of NUREG-1764
  - RIPE Review processes
  - NEI 18-04 – New PRA standard for advanced reactors
  - No longer binary, risk-significant or non risk-significant, now includes: “contains PRA information or significant risk discussion” but not a full PRA mod (LIC-206)
  - Safety-related (SR) – meet safety criteria § 53.210
  - Non-safety-related but safety-significant (NSRSS) – do not perform safety function but warrant special treatment.

Special treatment

- Special treatment is defined as:
  - Requirements, such as quality assurance and programmatic controls for every design feature to ensure that safety criteria are satisfied.
  - So, still kind of § 53.210 but more what do the features you credit in § 53.210 require to work? **Those become IHAs**

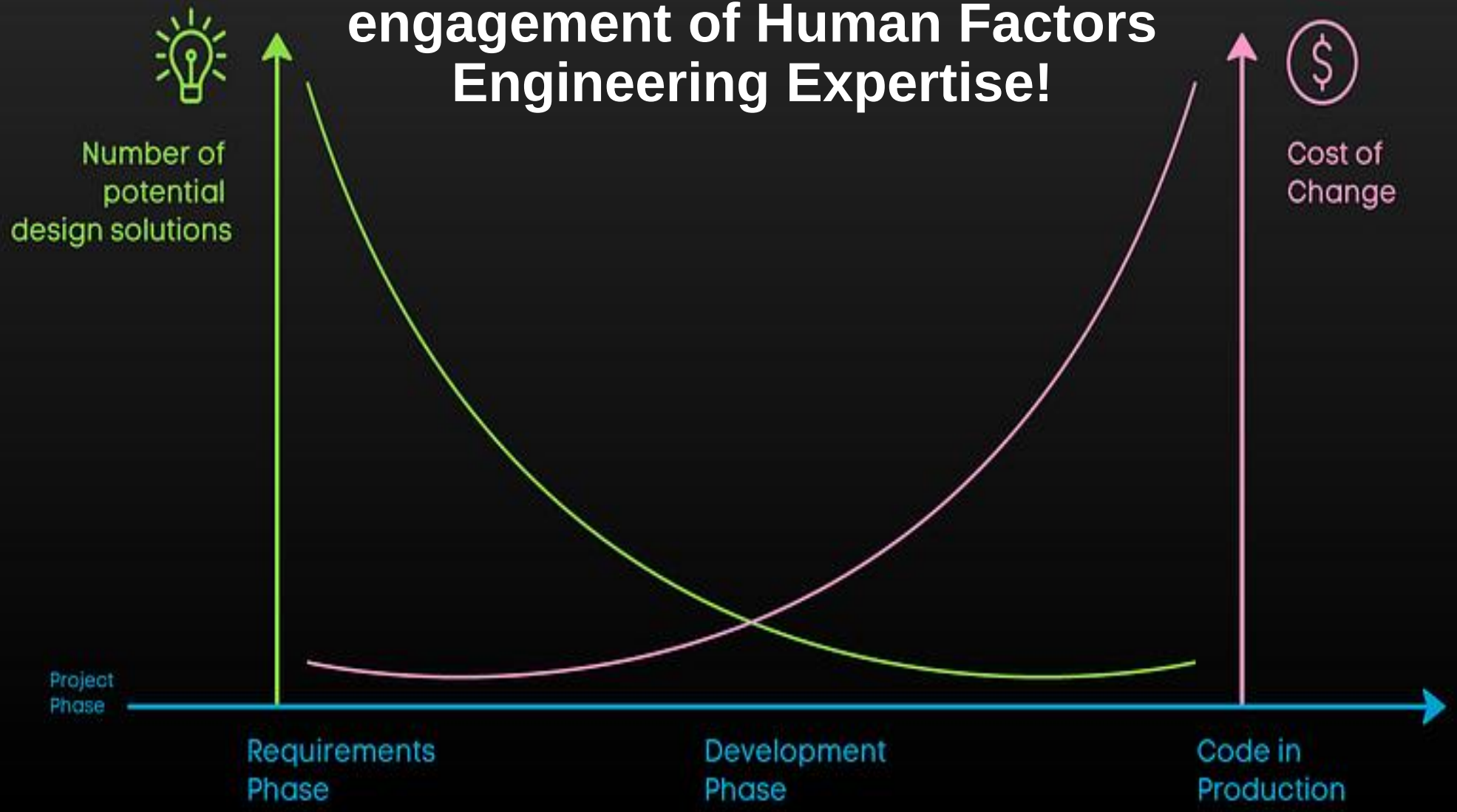
Draft Part 53

- Scalable HF Interim Staff Guidance (DRO-ISG-2023-03) defines IHAs as “in addition to credited operator actions, such actions may include, for example, actions by maintenance personnel […] and emergency response personnel.”
- § 53.410(b): Any human actions or programmatic controls necessary to achieve and maintain the reliability of any SSC credited under § 53.210.
- § 53.460(c): Human actions needed to prevent or mitigate LBEs must be captured and the requirements or programs performed as assumed in § 53.450 safety analysis and credited in § 53.210, 220, 450(e), or 470.
- So, in some ways, anything can be an IHA now

What is HFE's role?

- HFE must rise to the challenge of being able to competently assess the efficacy of human performance across many different programs, tasks, and responsibilities!
  - Quality assurance programs
  - Training
  - Maintenance
  - Manufacturing or assembly
  - Automated system maintenance
- Anything that is credited in § 53.200 sections must be evaluated for human supportive actions

For Advanced Reactor Companies there is a solution—early and frequent engagement of Human Factors Engineering Expertise!



12: https://medium.com/@andrerolla/understanding-the-value-of-design-how-to-measure-return-on-investment-roi-in-user-experience-d80ec54a03af

Questions?

- Thank you for your time!