



Lessons Learned in Defining the Role of Safety Basis in the Conceptual Design of New DOE Nuclear Facilities

**Scott Rogers, P.E.
Terry Foppe, P.E., CSP
Craig Sprain**





Presentation Overview

- Introduction
- Background on Standards
- Safety Basis Development & Expectations
- From PHA to PDSA
- Paradox in Development Process
- Conclusion





Introduction

- Several Major Design Projects:
 - NNSA's PDCF, MOX Facility, & CMRR (LANL)
 - Environmental Management's WTP & K Basins Sludge Treatment Process at Hanford
 - Office of Science's Physical Sciences Facility (PNNL)
 - Nuclear Energy's AFCF
- Acquisition regulations governing capital projects
- Safety Basis (SB) Development:
 - Complies with 10CFR830
 - Approved by DOE prior to major procurement
 - Follows Order 420.1 and implementation guides





Introduction (cont'd)

- Varying expectations for SB development during early design phases:
 - PHA and PDSA development
 - DOE guidance and interpretations
 - Some common, some uncommon
- Canvassing individuals at various DOE sites and projects





Background

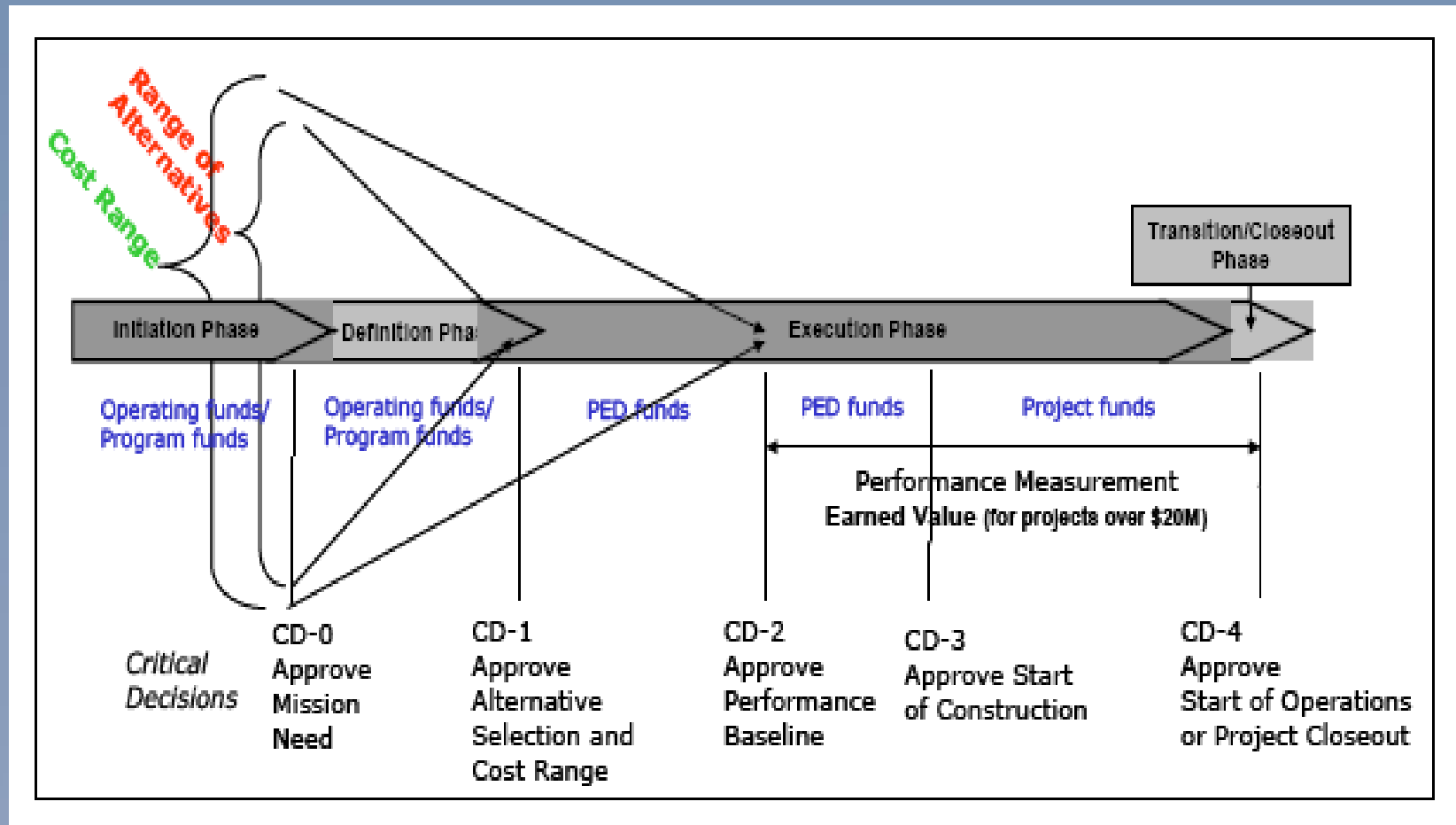
- 10CFR830 Subpart B regulatory requirements for safety basis documents
- DOE Order O 413.3, *Program and Project Management for the Acquisition of Capital Assets and Manual M 413.3-1*





Figure 1 - DOE Acquisition

Management System (from DOE M 413.3-1)





Background (cont'd)

- Expectations for existing facility safety basis fairly well understood
 - 1994 issuance of DOE-STD-3009
 - 2001 issuance of 10CFR830
- Expectations for new facility safety basis not well established
 - Especially problematic during early design
 - Similar situation with major modifications
- New DOE-STD-1189 expected to fill gap





From PHA to PDSA

- Facility hazard categorization (HC)
 - Impacts the SB process
 - Preliminary HC typically included in PHA
 - Revisit HC as design matures
- For HC 3, SB development can be greatly simplified
- Conversely, the possibility of changing to HC 2 can greatly complicate SB development





PHA to PDSA (cont'd)

- DOE M 413.3-1 invokes Integrated Safety Management (ISM) to design in safety
 - Accidents are preventable through early and close attention to safety, design, and operation
 - More than just meeting the specified safety requirements in the design
 - Project team should take specific proactive measures including making design changes
 - Does not always require that SSCs be added to prevent or mitigate releases
- Project team collaborates and exchanges information throughout the design process





PHA to PDSA (cont'd)

- DOE Guide G 421.1-2 recognizes design maturity during Safety Evaluation Report preparation of PDSA
 1. design is completely reviewed & acceptable
 2. based on commitments to fully meet specific safety criteria in the final design
 3. based on the requirement to complete specific research before the DSA is finalized
- Approach could also be applied to DOE acceptance of PHA





Paradox in Development Process

- Initial/preliminary safety basis assumptions and boundaries are later confirmed or revised
- Certain information relevant to final confirmation is not available early in design process, yet often needed
- Inherent paradox exists between need for early, conclusive analysis and lack of specific project design information





Detailed Hazard Profile

- Hazard profile is needed to support PHA development
 - MAR by form and location as well as energy sources
 - Critical to preliminary hazard categorizations
- Without PED begun, facility layout often not yet established





Facility and Site Boundary

- Decisions on public access and control are critical to SB development
- While alternatives being considered
 - Consequences cannot be analyzed in a precise manner
 - Conservative approach can translate into the apparent need for safety class SSCs
- Problematic even for HC 3 facilities when potential for “challenging” the 25 rem offsite EG





Codes & Standards

- Applicable industry codes and standards are often not identified at conceptual phase
- Detailed listings can predetermine final design
 - Certain Codes & Standards can become expectations
 - Risk of codes and standards driving PED process
 - Project team does not seek reduction or elimination of hazards as the design progresses.





NPH Performance Category

- Desire for NPH performance categorization (PC) as early as possible
- PC determination during the “Definition Phase” is tentative
 - Facility layout
 - Distribution of operational hazards
- Safety SSCs likewise affected
- Significant impact on cost wedge @ CD-1





Methodology – Old vs. New

- 10CFR830 safety basis program established
 - Sites have mature programs
 - Largely based on experience with facilities existing prior to 2000
- For a new facility design
 - Existing program SB development methods may not be adequate
 - Design basis accidents (DBAs) evaluated for precluding (by design) significant consequences
 - Safety SSCs that prevent single-point failures, provide redundancy/reliability, and establish separation distance





Other Examples

- Design detail @ CD-3 vs. need for complete safety SSC system evaluations
- For major modifications:
 - Interface with Existing Activities
 - Exemptions to Orders, codes and standards





Conclusion

- Integration of safety basis development into the facility design process represents a number of challenges
- Lack of consensus on how to effectively integrate SB development in a consistent and effective manner
- DOE-STD-1189 development important to clarifying expectations

