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DCS-NRC Discussion on NRC's Request for Additional Information on the DCS Construction Authorization Request

26 July 2001

Attachment 2

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Topics of Discussion

- Introduction
- Design versus Design Basis
- Likelihood and Reliability
- Fire Protection
- Non Principal SSCs

Design Versus Design Basis

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Design Versus Design Basis

- 10 CFR 50.2 definition
- Regulatory Guide 1.186 (Appendix B of NEI Guidance 97-04)
- Distinction between:
  - Licensing Basis
  - Regulatory Design Basis
  - Engineering Design Basis
- Examples of RAIs

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Design Basis Definition

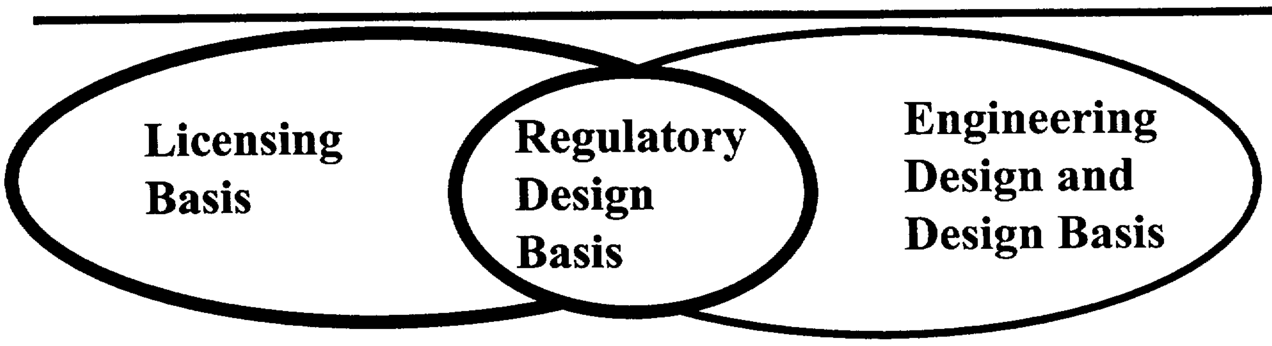
- 10 CFR 50.2 -
  - Design basis means that information which identifies the specific functions to be performed by a SSC of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be:
    - (1) restraints derived from generally accepted "state of the art" practices for achieving functional goals, or
    - (2) requirements derived from analysis (based on calculations and/or experiments) of the effects of a postulated accident for which a SSC must meet its functional goals.

Appendix B of NEI 97-04

- 10 CFR 50.2 design basis consist of the following:
  - Design bases functions: Functions performed by SSCs that are
    - (1) required by, or otherwise necessary to comply with, regulations, license conditions, orders or technical specifications, or
    - (2) credited in licensee safety analyses to meet NRC requirements

Appendix B of NEI 97-04

- 10 CFR 50.2 design basis consist of the following (continued) :
  - Design bases values: Values or ranges of values of controlling parameters established as reference bounds for design to meet design bases functional requirements. These values may be
    - (1) established by NRC requirement,
    - (2) derived from or confirmed by safety analyses, or
    - (3) chosen by the licensee from an applicable code, standard, or guidance document.



Licensing Basis

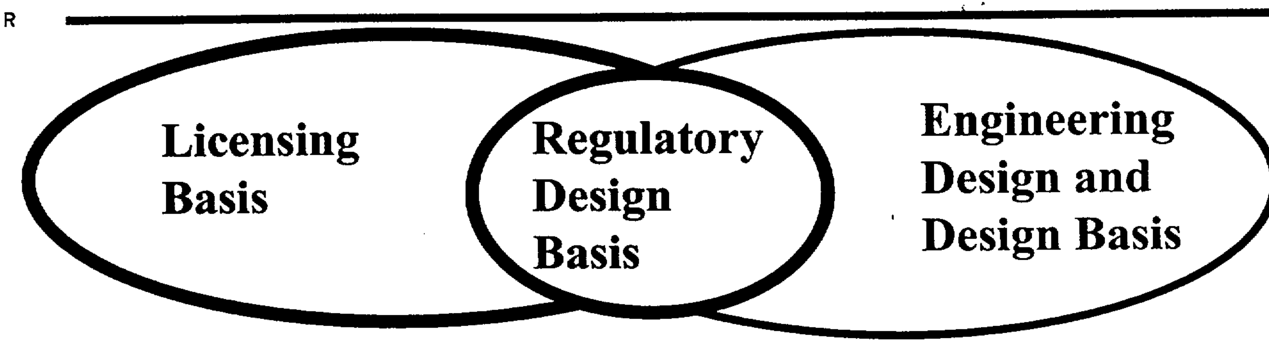
Information that identifies NRC requirements applicable, and DCS's written commitments for assuring compliance with and operation within these requirements

Regulatory Design Basis

Design restraints that form the basis for the NRC staff's safety evaluation

Engineering Design Basis

Information that identifies the specific functions to be performed by structure, system, or components and the values chosen controlling parameters as reference bounds for design.



Licensing Requirements Outside of Design:

QA Program
Emergency Plan
Security Plan
Training
Radiation Safety
Personnel Safety
Shift staffing
Environmental
Protection Agency
Limits Post Closure Plan

Regulatory Design Basis Requirements:

Safety functions, specific values and ranges of values as described in the CAR

General Design Requirements:

Operational requirements specified in design system/components that are not required for accident mitigation or otherwise required by NRC as a basis for its safety judgement.

Example - App. B NEI Guidance 97-04

Example - BWR Containment System

10 CFR 50.2 Design Bases Functional Requirements	Examples of Design Bases Controlling Parameters Chosen as Reference Bounds for Design	Examples of supporting design information for the BWR containment system
The Containment System (including the containment structure and isolation system) shall: • provide an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and • ensure that the containment design conditions important to safety are not exceeded for as long as postulated accidents require. Basis: • GDC 16, *Containment design* • GDC 38, *Containment heat removal* • GDC 50, *Containment design basis* • GDC 51, *Fracture prevention of containment pressure boundary* • GDC 54, *Piping systems penetrating containment*	• The Containment System shall provide a barrier which, in the event of a loss-of-coolant accident (LOCA), controls the release of fission products to the secondary containment and the environment to ensure that any radiological dose is less than the values prescribed in 10 CFR Part 100. • The Containment System shall be capable of maintaining its leakage rate performance for at least 30 days following the accident. • The Atmospheric Control system shall establish and maintain the containment atmosphere to less than X.X% by volume oxygen during normal operating conditions. • The containment shall be designed to withstand the design basis pressure of XX psig.	• The containment is designed to permit and facilitate initial demonstrations of structural capabilities at test pressures up to and including 1.15 times the design pressure. • The containment isolation valves are designed and fabricated in accordance with ASME, Section III. • The containment is designed to meet the leakage testing requirements of 10 CFR Part 50, Appendix J. • The containment is designed, fabricated, constructed, and tested as a Class MC vessel in accordance with Subsection NE of the ASME Code. • The drywell is a steel pressure vessel with a spherical lower portion XX feet in diameter, a cylindrical upper portion XX feet in diameter, and an elliptical top head XX feet in diameter. • The pressure suppression chamber is a steel torus-shaped pressure vessel located below and encircling the drywell with a major diameter of XXX feet and a cross-sectional inside diameter of XX feet. • A total of 8 vent pipes having an internal diameter of X feet connect the drywell and the pressure suppression chamber.

Design Versus Design Basis

- DESIGN BASIS

[redacted]

- DESIGN IMPLEMENTATION
  - Available, will provide as requested
  - Not easily provided
  - Not Available
- Design implementation information is provided for basic system understanding and is subject to change as part of the design process
  - Implementation information is not the design basis and should not be relied upon for safety determination or to establish conditions to limit operation.

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Example - RAI 165
Electrical Independence - Digital Controls

Electrical Independence, Digital Controls (RAI 165)

MFFF Principal SSC Safety Function	Design Basis Parameters	Examples of supporting design information
Digital controls used which are IROFS must be · Independent of normal and emergency control systems such that any failure of a normal or emergency system components will not prevent the safety control system from performing its safety function. · 10CFR70.64 · BDC 4 Environmental and dynamic effects, · BDC 6 Emergency capability. · BDC 7 Utility services, · BDC 9 Criticality control · BDC 10 Instrumentation and controls, and · SRP 11.4.3.2B Instrumentation and Control Systems Regulatory Acceptance Criteria.	Electrical independence of safety control system is provided by use of physical separation and approved electrical isolation techniques. · Physical separation is provided between safety control system and both the normal and the emergency control system. · The basis for electrical separation distances, barriers, and isolation devices are provided in IEEE 384-92. · Additionally, digital communications between safety and non-safety digital control equipment shall not inhibit performance of the safety function. Bases: These criteria ensure that the safety control system is electrical independent of the normal and the emergency control systems. · The emergency control system is hardwired and does not use digital controllers therefore requirements for digital communications is not applicable. · The emergency control system also has independence criteria applied to it. · IEEE 384 and IEEE 7_4.3.2 provide standard design criteria for meeting independence criteria for commercial nuclear power plants (10CFR50) and are adopted for the design of the MFFF.	· The safety control system is designed to fail safe with loss of power and uses standby power (UPS backed by diesel generator) but is not independent of the normal control system with respect to power. · The emergency control system independently shutdown all of the AP and MP processes in the event of an earthquake with out regard to the status of the safety control system during and after the seismic event. Therefore the safety control system is not seismically qualified except for seismic class II/I interactions. · The safety control system is comprised of a number of programmable logic controllers and discrete hard wired devices that operate autonomously from each other and from the facility control communications networks. · A one-way serial communications is provided between safety programmable logic controls and normal controllers to alarm on a criticality limit violation. · A independent output of the safety controller will terminate the process independent of the normal system. · The serial communications between the safety controllers and the normal controllers will be optical fiber to provide the requisite electrical isolation. Any shared inputs between the safety control system and the normal control system will be electrically isolated.

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Example - RAI 170 Software Programming

Software Programming for IROFS (RAI 170)

MFFF Principal SSC Safety Function	Design Basis Parameters	Examples of supporting design information for the MFFF HVAC system

Instrumentation and controls design must provide for inclusion of instrumentation and control systems to monitor and control the behavior of items relied on for safety.
• 10CFR70.64
  • BDC 10 *Instrumentation and controls,* and
• SRP 11.4.3.2 *Instrumentation and Control Systems Regulatory Acceptance Criteria.*)
	To ensure the appropriate level of quality assurance for digital computers used for IROFS, DCS commits to
	• IEEE 7-4.3.2-1993 *IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Generating Stations.*
	  • IEEE 7-4.3.2 provides criteria for the procurement of hardware and the development of software and the entire software life cycle.
	  • IEEE 7-4.3.2 invokes a number of other industry standards as criteria documents and DCS is committed to these as well.
	• IEEE 7-4.3.2 provide standard design criteria for digital computers used in safety systems of commercial nuclear power plants (10CFR50) and are adopted for the design of the MFFF.
		• The emergency control system is hardwired and does not use digital controllers therefore requirements for digital computers are not applicable.
		• For the safety control system programmable logic controllers, the following plans will be developed as part of the detailed design:
		  • Software QA Plan
		  • Software V&V Plan
		  • Software Configuration Management Plan
		• Software language(s) will be specified in the Software QA Plan.
		  • Benefiting from the fact that the MFFF is based on the MELOX design, the software language used for the safety programmable controllers and all other programmable controller is "Functional Sequence Chart" language, reference IEC 60113-3 (1993-03) *Programmable controllers-Part 3:Programming Languages*

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Example - RAI 208 Instrument Air

MFFF Principal SSC Safety Function	Design Basis Parameters	Examples of supporting design information
The Instrument Air System IROFS shall: Emergency scavenging air for plutonium vessels to prevent radiolysis-related hydrogen buildup following an earthquake, loss of normal instrument air, or loss of power. Provide features to maintain building confinement With stand natural phenomena events • Withstand Environmental and dynamic effects • must be based on defense-in-depth practices Basis 10CFR70.61 (b) & (c) performance requirements 10CFR70.64 (a) (2), (3), (4) & (5), &(b)	• Dilution air must be provide during normal operation to maintain the hydrogen concentration at 2% (50% of the LEL) • The system shall prove a source of emergency scavenging air to those tanks and vessels that could reach 4% hydrogen concentration within 7 days if no scavenging air is provide • Redundant monitoring for scavenging air flow. • Redundant scavenging air supplies • IROFS System Components shall be seismically designed • Isolate upon seismic event to maintain building confinement	• *schematic flow diagram* • Analysis of hydrogen production due to radiolysis • *List of tanks requiring emergency scavenging air* • P&ID's • Operating flows and pressures • Control loops • *Flow rates* • Valve Specification Data • Control Element Specification Data • Set point and ranges

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Example - RAIs 122 & 200
Argon/Hydrogen System

MFFF Principal SSC Safety Function	Design Basis Parameters	Examples of supporting design information
The Argon/Hydrogen System IROFS shall: · Prevent the supply of explosive and combustible mixtures of argon/hydrogen to the MFF building and the sintering furnaces · Provide features to maintain building confinement · With stand natural phenomena events · Withstand Environmental and dynamic effects · must be based on defense-in-depth practices Basis 10CFR70.61 (b) & (c) performance requirements 10CFR70.64 (a) (2), (3), (4) & (5), &(b)	· The system shall supply a argon hydrogen mixture containing up to 5% hydrogen · Isolate if hydrogen concentration exceeds 5% · Redundant monitoring and isolation devices. · IROFS System Components shall be seismically designed · Isolate upon seismic event to maintain building confinement	· schematic flow diagram · P&ID's · Operating flows and pressures · Control loops · Flow rates · Valve Specification Data · Control Element Specification Data · Set point and ranges

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Example - HVAC

MFFF Principal SSC Safety Function	Design Basis Parameters	Examples of supporting design information
The MFFF HVAC systems (including the C2, C3 and C4 Exhaust systems) shall: · Provide filtration to mitigate dispersions to the public · Limit the dispersion of radioactive material for worker protection · With stand natural phenomena events · Withstand Environmental and dynamic effects (including Remain operable during design basis fire and effectively filter any release) · Maintain suitable Environmental for principal SSC's · must be based on defense-in-depth practices Basis 10CFR70.61 (b) & (c) performance requirements 10CFR70.64 (a) (2), (3) & (4), & (b)	· Final filters shall be designed to include two stages of HEPA filtration with each stage having a rated efficiency of at least 99.95% · The design shall provide effective cooling of the air entering the final filters by mixing air from rooms not involved in a fire with the high temperature air stream of a room involved in a fire to maintain the temperature of the air interring the filters below the rated filter temperature. · The ventilation systems shall be designed to continue to provide the required safety function assuming a single failure of an active component. · The Glovebox Exhaust System shall be designed to maintain a 125-ft/min (38.1-m/min) face velocity across a design basis glovebox breach. · The ventilation system shall maintain a suitable environment for IROFS and emergency operations during postulated natural phenomena events · The ventilation system shall maintain a differential pressure between areas contain nuclear materials and the environment · HVAC system Components shall be seismically designed	· The design basis breach is equal to the larger area of either two 8-in (20.3-cm) glove ports or one bag-out port up to 24 in (61 cm) in diameter · Air flow schematic diagram · List of DP's between confinement zones · P&ID's · Confinement Zones maps · Flow rates · Fan Specification Data (type, head and flow) · Filter size and quantity · Filter Specification Data · Heat loads · Filter Analysis

Do the questions ... design to design bases

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Design - Design Basis RAIs

- Examples of the RAIs requesting Design/Design Basis information are:

RAI #	Section	Summary Description
39	Section 5.4.3, pp. 5.4-8 & 5.4-9; Section 5.5.2.4.6, pp. 5.5-27 thru 5.5-31	quantify likelihood & reliability of I&C
49	Section 5.5.1.2, p. 5.5-3	calculate passive removal of decay heat
115	Chapter 8, General	chemical storage & handling
118	Section 8.7, pp. 8.22 & 8.23	8.7 - controls & reliability
127	Section 8.7, pp. 8-22 & 8-23	offgas treatment unit design basis
128	Section 8.7, pp. 8-22 & 8-23	controls for asphyxiants (N2, argon)
139	Section 11.3.2, General	11.3.2 - chemical safety operating ranges & limits
141	Section 11.3.2, pp. 11.3-1 thru 11.3-25	11.3.2 - corrosion allowance
165	Section 11.6.7, pp. 11.6-12 thru 11.6-14	data communications independence
170	Section 11.6.7, pp. 11.6-12 thru 11.6-14	software programming language
190	Section 11.8, pp. 11.8-1 thru 11.8-10	11.8 - fluid transport systems pressures / temperatures
196	Section 11.9, General	11.9 - fluid systems chemical double isolation / backflow - values
200	Section 11.9, pp. 11.9-1 thru 11.9-116	11.9 - Instrument Air - 7 day, 10 minute, 1 hour bases
207	Section 11.9.2.1, pp. 11.9-23 thru 11.9-25	11.9.2 - N2 design bases / values
208	Section 11.9.2.2, pp. 11.9-25 thru 11.9-27	11.9.2.2 - Argon/ H2 design bases / values
213	Section 11.9.3.10.1, p. 11.9-44	11.9.3.10 - mixing hydrazine & nitric
214	Section 11.9.4, pp. 11.9-49 thru 11.9-51	11.9.4 - non-PSSCs vs PSSCs

Conclusion

- DESIGN BASIS

[redacted]

- DESIGN IMPLEMENTATION
  - Available, will provide as requested
  - Not easily provided
  - Not Available
- Design implementation information is provided for basic system understanding and is subject to change as part of the design process
  - Implementation information is not the design basis and should not be relied upon for safety determination or to establish conditions to limit operation.

Likelihood & Reliability

Fire Protection

Fire Protection Issues - RAI 109

RAI 109 (reference Section 7.4, pp. 7-16 through 7-20):

- Analyze the potential for fire spread between two fire areas. Appendix D4 of the SRP identifies "potential for fire spread between two fire areas" as information needed to comprehensively assess fire safety. The fire hazard analysis confines the fire event to the area of fire origin. The analysis does not consider spread through interconnected glove boxes which could occur due to the heating of metal fire doors between glove boxes, an explosion, or room fire doors that are propped open.

- **DCS Response**
  - The information requested by this RAI will be provided by the Fire Hazards Analysis, which will available in November, 2001.

Fire Protection Issues - RAI 109

In support of the analysis of the potential for fire spread, the combustible load in each of 340 fire areas is determined:

- Fire loads are conservatively estimated.
- Fire barrier ratings are checked against a fire that consumes 100% of the combustibles, including an allowance for transient loads.
- Each fire area is surrounded by fire walls, all penetrations are sealed, doors entering each fire area are fire rated and transfer gloveboxes have fire doors.

Fire Protection Issues - RAI 109

Preliminary Fire Hazards Analysis (PFHA) reached three basic conclusions that are summarized in Section 7.4.2 of the CAR:

- In most of the 340 fire areas, potential fires are typically small and non-propagating,
- Where a fire could involve an entire fire area, the barriers surrounding the fire area contain the effects of the fire to the fire area itself, and
- To provide defense-in-depth to the fire barriers protecting areas containing dispersible radioactive materials, the fire detection and fire suppression systems in these areas will be designated principal SSCs.

Fire Protection Issues - RAI 109

Potential fires are typically small and non-propagating :

- The duration of a typical fire is short relative to the rating of the fire barriers of the fire area,
- The fire themselves have a low heat release rate and/or heat flux,
- The fire barriers surrounding these fire areas have a minimum fire rating of two hours,
- The fire barrier penetrations will be routinely inspected, and
- Any fire doors in the fire barriers will be self-closing.
- Transfer Glovebox fire doors will duplicate the MELOX design which has been tested by the French Fire Testing Laboratory

Fire Protection Issues - RAI 109

In Fire Areas where a potential fire could involve an entire fire area, the fire will not propagate :

- The barriers surrounding the fire area contain the effects of the fire to the fire area
- The fire barriers surrounding these fire areas typically have a fire rating of three hours,
- The fire barrier penetrations will be routinely inspected, and
- Any fire doors in the fire barriers will be self-closing

NOTE: Fire areas where a fire could involve the entire fire area do not include any fire areas containing dispersible radioactive materials.

Fire Protection Issues - RAI 109

To provide defense-in-depth to the fire barriers containing dispersible radioactive materials, the fire detection and fire suppression systems in these areas will be designated principal SSCs

Non Principal SSCs (IROFS)

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Non Principal SSCs

- Chapter 11 of the CAR provided SSC information
  - Basic structure of Chapter 11 is:
    - Function
    - Description
    - Major Components
    - Control Concepts
    - System Interfaces
    - Design Basis for Non Principal SSCs
    - Design Basis for Principal SSCs

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Non Principal SSCs

- CAR should have made the distinction between Principal or Non-principal SSCs clear, however:
  - In some instances the isolation function is the only portion of a System that is important to safety yet the CAR description may not have been clear
    - We will clarify the information in our responses to the RAIs
- Once the distinction is clear the level of detail information being requested is not commensurate with the safety significance
  - In addition the information is not available due to our work focusing on safety significant systems

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Non Principal SSCs RAIs

- Examples of the RAIs asking for design information on non principal SSCs are:

per Ken Ashe 7/26/01

RAI #	Section	Summary Description
115	Chapter 8, General	chemical storage & handling
128	Section 8.7, pp. 8-22 & 8-23	controls for asphyxiants (N2, argon)
148	Section 11.4.9.2, pp. 11.4-25 thru 11.4.26	soot loading analysis / ventilation explosion
~~150~~	~~Section 11.5.2.3.1, p. 11.5-4~~	~~EDG 7-day fuel tank IEEE Std 308-1991~~
151	Section 11.5.2.4, p. 11.5-6	communication systems
202	Section 11.9, pp. 11.9-1 thru 11.9-116	11.9 - Rad Monitor Vacuum System failure detect
203	Section 11.9, pp. 11.9-1 thru 11.9-116	11.9 Nitric Acid System - overfill/release
205	Section 11.9, pp. 11.9-1 thru 11.9-115	11.9 - Fluid Systems - design bases
207	Section 11.9.2.1, pp. 11.9-23 thru 11.9-25	11.9.2 - N2 design bases / values
208	Section 11.9.2.2, pp. 11.9-25 thru 11.9-27	11.9.2.2 - Argon/ H2 design bases / values
209	Section 11.9.2.3, pp. 11.9-27 & 11.9-28	11.9.2.3 - He design bases / values
210	Section 11.9.2.4, pp. 11.9-28 & 11.9-29	11.9.2.4 - O2 design bases / values
211	Section 11.9.3.1, pp. 11.9-29 thru 11.9-32	11.9.3.1 - Nitric Acid design bases / values
212	Section 11.9.3.1.2, 11.9-30	11.9.3.1.2 - 6N nitric acid tank safety - air pressurized
213	Section 11.9.3.10.1, p. 11.9-44	11.9.3.10 - mixing hydrazine & nitric