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SYSTEMS DIVISION

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JNF 048-83

June 28, 1983

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555

Attention: Mr. D.G. Eisenhut
Division of Licensing

Gentlemen:

SUBJECT: IN THE MATTER OF 238 NUCLEAR ISLAND
GENERAL ELECTRIC STANDARD SAFETY ANALYSIS REPORT
(GESSAR II) DOCKET NO. STN 50-447

PROPOSED REVISION TO RESPONSE TO CP/ML RULE

Attached please find our proposed revision to our response to the CP/ML Rule (10CFR50.34(f)) items (1) (xii) and (2) (ix) pertaining to hydrogen control.

We plan to formally file an amendment of this revision in early July 1983.

If there are any questions on the information provided herein, please contact J.N. Fox of my staff at (408) 925-5039.

Sincerely,

Glenn G. Sherwood, Manager
Nuclear Safety & Licensing Operation

Attachments

cc: F.J. Miraglia (w/o attachments)
D.C. Scaletti
C.O. Thomas (w/o attachments)
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PROPOSED REVISION TO
RESPONSE TO 10CFR50.34 (f)
ITEMS (1) (xii) and (2) (ix)

1G.12 EVALUATION OF ALTERNATIVE HYDROGEN CONTROL SYSTEMS [Item (1) (xii)]

NRC Position

Perform an evaluation of alternative hydrogen control systems that would satisfy the requirements of paragraph (f) (2) (ix) of 10CFR50.34(f). As a minimum include consideration of a hydrogen ignition and post-accident inerting system. The evaluation shall include:

(A) A comparison of costs and benefits of the alternative systems considered.

(B) For the selected system, analyses and test data to verify compliance with the requirements of (f) (2) (ix) of 10CFR50.34.

(C) For the selected system, preliminary design descriptions of equipment, function, and layout.

Response

(A) Comparison of costs and benefits of the alternative systems considered will be provided by the Applicant.

(B) The Applicant will provide the analyses and test data to verify compliance with the requirements of 10CFR50.34(f)(2)(ix).

(C) The Applicant will provide the design descriptions of equipment, function, and layout.

(A) GE has conducted evaluations of the various hydrogen control concepts for the GESSAR II design. These concepts included distributed ignition, catalytic burners and post-accident inerting with carbon-dioxide or halon. Of the concepts considered, only distributed ignition (igniters) and carbon-dioxide post accident inerting appear to be viable alternatives. Table 1G.12-1 summarizes the costs and benefits of these two alternatives.

Table 1G.12-1

Comparison of Hydrogen Control Alternatives

Item	Igniters	Post Accident Inerting
Description	Distributed Ignition Systems Controlled Burn at Low H_2 Concentration	Liquid CO_2 discharged into Containment Airspace (Prevents Combustion)
Cost (Order of Magnitude)	$1 Million*	$10 Million*
R&D Concerns	Flammability, Mixing, pressure response	Possible partial inerting flammability characteristics. Mixing, effects on electronic equipment
R&D Programs	Underway EPRI/NRC	None Planned
Pros	• Minor Impact of Inadvertant Operation • Low Cost • Minimum Design Impact • Lower containment pressures	• No Heat Loads • No dependence on H_2 Generation Rate • Minor impact on existing equipment • AC power not required for inerting
Cons	• Potential for large equipment qualification program • Assurance of combustion at low concentrations • Sensitive to hydrogen generation rate and containment entry point • Requires active heat removal	• Inadvertant actuation has potential adverse impact on plant operation • High containment pressure • High Cost • Some redesign of containment piping to accomodate • Potential adverse effects from low temperatures during injection

* These costs do not include the cost of corresponding equipment qualification programs. Inclusion of equipment qualification costs could result in nearly equal total costs for the first Applicant referencing GESSAR II.

1G.21 HYDROGEN CONTROL SYSTEM PRELIMINARY DESIGN [Item (2) (ix)]

NRC Position

Provide a system for hydrogen control that can safely accommodate hydrogen generated by the equivalent of a 100% fuel-clad metal water reaction. Preliminary design information on the tentatively preferred system option of those being evaluated in paragraph (1) (xii) of 10CFR50.34(f) is sufficient at the construction permit stage. The hydrogen control system and associated systems shall provide, with reasonable assurance, that: (II.B.8)

(A) Uniformly distributed hydrogen concentrations in the containment do not exceed 10% during and following an accident that releases an equivalent amount of hydrogen as would be generated from a 100% fuel clad metal-water reaction, or that the post-accident atmosphere will not support hydrogen combustion.

(B) Combustible concentrations of hydrogen will not collect in areas where unintended combustion or detonation could cause loss of containment integrity or loss of appropriate mitigating features.

(C) Equipment necessary for achieving and maintaining safe shutdown of the plant and maintaining containment integrity will perform its safety function during and after being exposed to the environmental conditions attendant with the release of hydrogen generated by the equivalent of a 100% fuel-clad metal water reaction including the environmental conditions created by activation of the hydrogen control system.

1G.21 HYDROGEN CONTROL SYSTEM PRELIMINARY DESIGN [Item (2) (ix)] (Continued)

(D) If the method chosen for hydrogen control is a post-accident inerting system, inadvertent actuation of the system can be safely accommodated during plant operation.

Response

The Applicant will provide a Hydrogen Control System capable of handling hydrogen generated by the equivalent of a 100% active fuel-clad metal water reaction. Detailed descriptions of the selection of the hydrogen generation event, the progression of the event, and the methodology used in evaluating the hydrogen generation rate during the hydrogen generation event are contained in Reference 1.*

FI The Hydrogen Control System shall provide with reasonable assurance that:

(1) Uniformly distributed hydrogen concentrations in the containment do not exceed 10% during and following an accident that releases an equivalent amount of hydrogen as would be generated from a 100% fuel-clad metal water reaction, or that the post-accident atmosphere will not support hydrogen combustion.

(2) Combustible concentrations of hydrogen will not collect in areas where unintended combustion or detonation could cause loss of containment integrity or loss of appropriate mitigating features.

(3) Equipment necessary for achieving and maintaining safe shutdown of the plant and maintaining containment integrity will perform its safety function during and after being exposed to the environmental conditions attendant with the release of hydrogen generated by the equivalent

* 1. S. S. Dua, et al, "BWR/6 Mark III Hydrogen Control Owners' Group Report on Hydrogen Control: Accident Scenarios, Hydrogen Generation Rates and Equipment Requirements," General Electric Company Report, April 1982.

1G.21 HYDROGEN CONTROL SYSTEM PRELIMINARY DESIGN [Item (2) (ix)] (Continued)

of a 100% fuel-clad metal water reaction, including the environmental conditions created by activation of the hydrogen control system.

The following criteria will be used to design the Hydrogen Control System:

(1) The system will be single active failure proof.

(2) Operation of the Hydrogen Control System will not adversely affect the safe shutdown of the plant.

(3) The system will be protected from tornado and external missile hazards.

(4) The system will not compromise the containment design.

(5) If the method chosen for hydrogen control is a post-accident inerting system, inadvertent actuation of the system must be safely accommodated during plant operation.