GENERAL ELECTRIC

NUCLEAR POWER SYSTEMS DIVISION
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August 20, 1984 MFN-122-84

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

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

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

DRAFT AMENDMENT TO GESSAR II SECTIONS 1G.12 AND 1G.21

Attached please find a draft amendment to GESSAR II Sections 1G.12 and 1G.21. Section 1G.12 responds to 10CFR50.34 (f) Item (1)(xii) pertaining to the evaluation of alternate Hydrogen Control Systems. Section 1G.21 responds to 10CFR50.34 (f) Item (2)(ix) pertaining to Hydrogen Control System preliminary design.

The utility Applicant is required to provide an igniter Hydrogen Control System capable of handling hydrogen generated as required by the proposed Interim Requirements Related to Hydrogen Control (December 23, 1981 46FRG2281). This Hydrogen Control System will be based on the NRC approved results of the BWR Hydrogen Control Owners Group (HCOG) tests and analyses. Although the hydrogen generation required by 10CFR50.34 (f) Item (2)(ix) is higher than required by the proposed Interim Requirements Related to Hydrogen Control, utilization of the HCOG results are acceptable because the GESSAR II design, utilizing the Ultimate Plant Protection System (UPPS), reduces the overall risk of core damage of an order of magnitude.

If there are any questions on the information provided herein, please contact me or J.F. Quirk (408) 925-2606.

Very truly yours,

J F Quirk for

Glenn G. Sherwood, Manager
Nuclear Safety & Licensing Operation

Attachment

cc: D.M. Crutchfield (NRC) L.S. Gifford (GE-Bethesda)
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ATTACHMENT

DRAFT AMENDMENT
TO
GESSAR II SECTIONS 1G.12 AND 1G.21

Table 1.9-1

CHAPTER 1

GESSAR II/FSAR INTERFACES (CONTINUED)

ITEM NO.	SUBJECT	DESCRIPTION	PAGE	SUBSECTION	INTERFACE CATEGORY
1.127	Hydrogen Control System Evaluation	Provide design descriptions of equipment, function and layout of ignition Hydrogen Control System based on the results of the BWR HCOG sponsored tests and analyses.	1G.12-1	1G.12	3
1.128	Long-Term Training Upgrade	Establish a training program which addresses the concerns related to Item I.A.4.2 of NUREG 0718.	1G.13-1	1G.13	3
1.129	Long-Term Program of Upgrading of Procedures	Establish a program for integrating and expanding current efforts to improve plant procedures.	1G.14-1	1G.14	3
1.130	Hydrogen Control System	Provide an igniter Hydrogen Control System capable of handling hydrogen generated as required by the proposed Interim Requirements Related to Hydrogen Control(December 23,1981, 46 F.R. 62281)	1G.21-2	1G.21	3
1.131	Purging	Provide performance information of purge valves	1G27.1	1G.27	3

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) 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. The costs and benefits of these two alternatives are summarized in Table 1G.12-1.

Neither igniters or post-accident inerting exhibit overriding benefits. However, from a cost standpoint, igniters should be an order of magnitude less expensive than post-accident inerting provided the first GESSAR II Applicant is not required to incur the cost of an equipment ~~qual~~ qualification program. Assuming that the first Applicant referencing GESSAR II can fully utilize the results of the BWR Hydrogen Control Owners Group(HCOG) sponsored tests, igniters are clearly more cost-effective than post-accident inerting. Hence, the Applicant shall commit to a igniter Hydrogen Control System.

(B) The results of the BWR HCOG tests and analyses will be ~~The Applicant will provide the analyses and test data used to satisfy 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, based on the results of the BWR HCOG sponsored tests and analyses.

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/BWR HCOG**	None planned]
Pros	• Minor impact of inadvertent 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 • Sensitize to hydrogen generation rate and containment entry point • Requires active heat removal	• Inadvertent actuation has potential adverse impact on plant operation • High containment pressure • High cost • Some redesign of containment piping to accommodate • 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.

** Igniter Hydrogen Control System testing by the BWR Hydrogen Control Owners Group (HCOG).]

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 an igniter Hydrogen Control System capable of handling hydrogen generated as required by the proposed Interim Requirements Related to Hydrogen Control(December 23,1981, 46 F.R. 62281). This Hydrogen Control System will be based on NRC approved results of the BWR Hydrogen Control Owners Group(HCOG) tests and analyses. Although the hydrogen generation required by Item (2)(ix) is higher than required by the proposed Interim Requirement Related to Hydrogen Control, utilization of the HCOG results are acceptable because the GESSAR II design, utilizing the Ultimate Plant Protection System(UPPS), reduces the overall risk of core damage an order of magnitude.

The Applicant shall demonstrate that the BWR HCOG results are applicable to his igniter Hydrogen Control System. This will constitute reasonable assurance that:

(1) Uniformly distributed hydrogen concentrations in the containment do not exceed 10% during and following an accident that releases hydrogen as required by the proposed Interim Requirements Related to Hydrogen Control.

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

Response (Continued)

(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~~ as required by the proposed Interim Requirements Related to Hydrogen Control.

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.]

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