April 30, 2001

MEMORANDUM TO: Ashok C. Thadani, Director
Office of Nuclear Regulatory Research

THRU: Farouk Eltawila, Acting Director **/RA/**
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

FROM: Jack E. Rosenthal, Panel Chairperson and Chief **/RA/**
Safety Margins and Systems Analysis Branch
Division of Systems Analysis and Regulatory Effectiveness

SUBJECT: INITIAL SCREENING OF CANDIDATE GENERIC ISSUE 187, "THE POTENTIAL IMPACT OF POSTULATED CESIUM CONCENTRATION ON EQUIPMENT QUALIFICATION IN THE CONTAINMENT SUMP"

In accordance with Draft Management Directive (MD) 6.4, "Generic Issue Program," a Generic Issue Review Panel Meeting was held to discuss the merits of candidate Generic Issue 187, "The Potential Impact of Postulated Cesium Concentration on Equipment Qualification in the Containment Sump." The panel has completed the "Initial Screening Stage" (Stage 2) of the Generic Issue Program (GIP) as outlined in the draft MD. The panel met initially on September 6, 2000, with follow-up meetings on September 28, 2000, and October 26, 2000, and continued discussion via e-mail.

The panel has decided that the candidate generic issue should be dropped, as having no significant chance of meeting the incremental risk thresholds for backfit as described in the MD 6.4 Handbook. The rationale for this recommendation, as endorsed by the panel, is attached.

However, because of the potential for licensee confusion regarding regulatory requirements, the panel also recommended that the Office of Nuclear Reactor Regulation be requested to consider issuing a Regulatory Issue Summary (RIS) for this issue.

Attachment: As stated

cc w/att.:
Jason Schaperow, RES
Arthur Buslik, RES
Stephen LaVie, NRR
Harold Walker, NRR
Robert Palla, NRR

April 30, 2001

MEMORANDUM TO: Ashok C. Thadani, Director
Office of Nuclear Regulatory Research

THRU: Farouk Eltawila, Acting Director **/RA/**
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

FROM: Jack E. Rosenthal, Panel Chairperson and Chief **/RA/**
Safety Margins and Systems Analysis Branch
Division of Systems Analysis and Regulatory Effectiveness

SUBJECT: INITIAL SCREENING OF CANDIDATE GENERIC ISSUE 187, "THE POTENTIAL IMPACT OF POSTULATED CESIUM CONCENTRATION ON EQUIPMENT QUALIFICATION IN THE CONTAINMENT SUMP"

In accordance with Draft Management Directive (MD) 6.4, "Generic Issue Program," a Generic Issue Review Panel Meeting was held to discuss the merits of candidate Generic Issue 187, "The Potential Impact of Postulated Cesium Concentration on Equipment Qualification in the Containment Sump." The panel has completed the "Initial Screening Stage" (Stage 2) of the Generic Issue Program (GIP) as outlined in the draft MD. The panel met initially on September 6, 2000, with follow-up meetings on September 28, 2000, and October 26, 2000, and continued discussion via e-mail.

The panel has decided that the candidate generic issue should be dropped, as having no significant chance of meeting the incremental risk thresholds for backfit as described in the MD 6.4 Handbook. The rationale for this recommendation, as endorsed by the panel, is attached.

However, because of the potential for licensee confusion regarding regulatory requirements, the panel also recommended that the Office of Nuclear Reactor Regulation be requested to consider issuing a Regulatory Issue Summary (RIS) for this issue.

Attachment: As stated

cc w/att.:
Jason Schaperow, RES
Arthur Buslik, RES
Stephen LaVie, NRR
Harold Walker, NRR
Robert Palla, NRR

Distribution w/att.:

REAHFB R/F	SRubin, RES
SMSAB R/F	PNorian, RES
DSARE R/F	DPowers, ACRS
REmrit, RES	

C:\GI187scrn3.wpd

***See previous concurrence** **RES File Code** ~~RES-2D-3~~

OAR in ADAMS? (Y or N) Y ADAMS ACCESSION NO.: ~~ML011210348~~ TEMPLATE NO. ~~RES-006~~

Publicly Available? (Y or N) Y DATE OF RELEASE TO PUBLIC ~~05/08/01~~ SENSITIVE? ~~No~~

To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	REAHFB	E	SMSAB	E	AC:SMSAB	E	AD:DSARE	E
NAME	HVanderMolen:mtb		CTinkler		JRosenthal		FEltawila	
DATE	04/24/01*		04/24/01*		04/30/01*		04/30/01*	

Generic Issue 187, "The Potential Impact of Postulated Cesium Concentration on Equipment Qualification"

Panel Decision Basis

Background

NRC regulatory requirements include the estimation of individual offsite dose from the design-basis loss of coolant accident. The fission product source term in Technical Information Document (TID)-14844, *Calculation of Distance Factors for Power and Test Reactor Sites*, March 1962, which is referenced by the regulations, has historically been used for this application. As an update to the source term in TID-14844, the NRC developed NUREG-1465, *Accident Source Terms for Light Water Nuclear Power Plants*, February 1995. NUREG-1465 provides a more realistic source term based two decades of severe accident research; its use in offsite dose analysis provides safety and cost benefits. Accordingly, the NRC issued a new regulation, 10 CFR 50.67, allowing licensees to implement an alternative source term. Together with the issuance of 10 CFR 50.67, the NRC issued a regulatory guide which states that one acceptable alternative source term (AST) is the gap and in-vessel releases described in NUREG-1465.

NRC regulatory requirements also include the environmental qualification of equipment for the duration that it is needed to perform its safety function. This includes qualification for radiation, temperature, pressure, and humidity. Regulatory Guide 1.89, *Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants*, Rev. 1, June 1984, states that it is acceptable to use the TID-14844 source term for this application. Regulatory Guide 1.89 also states that, for equipment that must be qualified for more than thirty days, a source term that incorporates considerable quantities of cesium as suggested by the accident at Three Mile Island Unit 2 may produce doses greater than those estimated by TID-14844. The TID-14844 source term includes a 1% release of cesium. The gap and in-vessel releases described in NUREG-1465 include a 30% release of cesium.

Sandia National Laboratories' letter report *Evaluation of Radiological Consequences of Design Basis Accidents at Operating Reactors Using the Revised Source Term*, September 28, 1998, showed that, for equipment exposed to the containment atmosphere, the TID-14844 source term and the gap and in-vessel releases in the AST produced similar integrated doses. This letter report also showed that, for equipment exposed to sump water, the integrated doses calculated with the AST exceeded those calculated with TID-14844 after 42 days for a pressurized-water reactor (PWR) and 145 days for a boiling-water reactor (BWR) because of the 30% vs. 1% release of cesium. In the implementation of NUREG-1465 for estimating offsite dose, the issue arose as to whether any additional requirements were needed with respect to estimating doses for equipment exposed to sump water.

Panel Evaluation of Issue

In accordance with the Generic Safety Issue (GSI) panel's procedures, the panel was requested to provide a clear statement of the issue and categorize the issue. The statement of the issue is the following:

> The integrated sump doses from the gap and in-vessel releases of the more realistic AST are higher than the TID source term after 42 days for a PWR and

145 days for a BWR. Should licensees be required to backfit use of AST in evaluating the design basis for equipment qualification?

In evaluating the basis, if any, for a backfit, the panel focused, in accordance with 10 CFR 50.109, on whether there was a substantial safety benefit from the backfit requirement to reevaluate the adequacy of the equipment qualification for an extended time interval post accident (greater than 30 days).

In addition to the issue of safety significance for extended times for equipment operability, the panel also considered the relationship of the equipment qualification source term to the various classes of accidents. In that regard, it was recognized that for design basis accidents for the containment temperature and pressure and the reactor core and ECCS systems, the source term of either the TID or the AST is bounding since for these accidents there is minimal fuel damage and only relatively modest fission product releases. It is only for accidents involving severe fuel damage (for which most/much equipment is not operable anyway for at least several hours) that the fission product source term for an extended time interval becomes a question.

Other technical considerations relate to the extent to which the AST sump dose estimate exceeds that of the TID source term late in time. The increase of the sump dose estimate also includes analytical assumptions which would tend, on an absolute basis, to increase the calculated sump dose, namely assumptions related to complete washdown of atmospheric fission products to the sump and the assumptions that fission products are completely soluble and spread throughout the sump. It can reasonably be expected that some fraction of the fission products assumed to be washed to the sump will in fact be retained on the myriad of containment surfaces that are not directly exposed to rinsing by sprays (for certain severe accident sequences sprays may not have been available). Additionally, experimental evidence from ongoing research suggests that some portion of the fission product inventory may be in an insoluble form and conducive to settling. Although not quantifiable at this point, it is nonetheless useful to note that there is likely conservatism in current estimates of sump dose.

In examining the safety significance of equipment qualification for extended intervals, the panel reflected on the risk significant time intervals identified in NUREG/CR-5313, Equipment Qualification (EQ) - Risk Scoping Study. This study was performed to provide insights regarding the risk significance of equipment qualification and equipment survivability issues by the use of probabilistic risk assessment insights and methods. The authors of that study concluded that the risk significant period is limited to the first days of an accident and that equipment qualification issues associated with long term accident equipment operability are not risk significant. This is also consistent with the positions taken by the NRC on risk informing the regulations (and advanced reactors) where large early release frequency and containment performance are concerned with the interval roughly 24 hours following the onset of significant fuel damage.

The panel used the categories in Draft Management Directive 6.4, “Generic Issue Program,” to categorize the issue as a compliance issue, a subset of another issue, a burden reduction issue, or a safety issue. The basis for the panel’s categorization is given below.

Compliance Issue: 10 CFR 50.49, *Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants*, does not explicitly state the source term to use for equipment qualification but refers to a radiation environment associated with the most severe design basis accident. Regulatory Guide 1.89 specifies use of the TID-14844 source term. Regulatory Guide 1.89 also states that "for equipment that must be qualified for more than thirty days, a source term that incorporates considerable quantities of cesium as suggested by the accident at Three Mile Island Unit 2 may produce doses greater than those estimated by the present [TID-14844] source term." The regulations do not strictly require licensees to use the AST. In fact, licensees have used the TID-14844 source term to define the design basis for the radiation environment for equipment qualification. Therefore, this issue is not a compliance issue.

Subset of Another Generic Issue: Based on a review of the list of unresolved generic issues, the only related generic issue is GSI-168, "Environmental Qualification of Electrical Equipment (Rev. 2)." The purpose of GSI-168 is to assess the need to upgrade equipment qualification requirements for older plants. However, the purpose of GSI-187 is to assess the need to require licensees to use the AST instead of the TID-14844 source term for equipment qualification. Therefore, GSI-187 is not a subset of GSI-168.

Burden Reduction Issue: The regulations allow use of either the TID-14844 source term or the AST. Therefore, requiring licensees to use the releases of the AST would not reduce regulatory burden.

Safety Significance (for the adequate protection and substantial safety enhancement classifications): As discussed above, for equipment exposed to sump water, the integrated doses calculated with the AST exceeded those calculated with TID-14844 after 42 days for a PWR and 145 days for a BWR because of the 30% release of cesium. It can be argued that certain systems, (e.g., residual heat removal) must remain operable for periods of time greater than 42 days. However, equipment qualified for a given period may, in practice, remain available for a much longer period. In addition, the decay heat rate will be lower for this later time interval, allowing for more time for operator actions and more opportunity for alternative strategies. Thus, it is unlikely that a more explicit treatment of long-term accident recovery would reveal any new risk-significant considerations.

Conclusion: As a result of the above considerations, the panel concludes that there is no clear basis for backfitting the requirement to modify the design basis for equipment qualification to adopt the AST. There would be no discernible risk reduction associated with such a requirement. Licensees should be aware, however, that a more realistic source term would potentially involve a larger dose for equipment exposed to sump water for long periods of time. Longer term equipment operability issues associated with severe fuel damage accidents, (with which the AST is associated) could also be addressed under accident management or plant recovery actions as necessary.