

NOV 12 1982

MEMORANDUM FOR: P. S. Shewmon, Chairman
 Advisory Committee on Reactor Safeguards

FROM: William J. Dircks
 Executive Director for Operations

SUBJECT: ACRS COMMENTS ON DRAFT NRC EVALUATION OF PRESSURIZED
 THERMAL SHOCK

Your letter of October 14, 1982, to Chairman Palladino provided the comments of the ACRS regarding the draft NRC Staff Evaluation of Pressurized Thermal Shock, dated September 13, 1982. The Committee indicated that the RT screening criteria proposed in the draft staff evaluation "are reasonable^{NDT} on the basis of current knowledge and provide adequate time for licensees to demonstrate plant-specific capability or planned actions in order to avoid unacceptable public safety consequences from PTS." As you know, the draft staff evaluation is currently under management review prior to the submittal of recommendations to the Commission. The ACRS comments will be addressed by the staff in that Commission paper.

You requested that the Committee be kept informed about PTS control actions under consideration for reactor vessels that are expected to be the earliest to exceed the screening criteria. At the ACRS meeting on November 5, 1982, the staff informed the Committee that further consideration is being given to the need for actions to assure the early implementation of flux reduction programs for those plants that are currently projected to exceed the screening criteria before the end of design life. The staff will continue to keep the ACRS informed of the progress of these deliberations.

The Committee indicated that there is adequate time to conduct an orderly, comprehensive research program concerning measures needed to protect against pressurized thermal shock and recommended some elements of such a program. The staff agrees and is developing a better defined program. We will arrange a subcommittee briefing on the research program early next year.

The Committee recommended that the staff's program on FTS give special attention to improvements in PTS-related operator training and procedures; better characterization of initiating events and subsequent operator actions; the value of heating the ECCS water; and plant-specific evaluations of the value and costs of fast neutron fluence reduction programs. The staff agrees and consideration of these items is part of the planned program.

The Committee also recommended an additional careful assessment of uncertainties in the irradiation test data used to develop correlations for

OFFICE				
ORNAME	82 11190015			
DATE	XA			XA Copy Has Been Sent to PDR

P. S. Shewmon

prediction of RT_{HDT} increases with fluence for various materials compositions. The staff will include additional studies of RT_{HDT} shift correlations in the research program under development.

The staff is also considering the additional comments of ACRS member David Okrent in its preparation of the Commission paper on PTS.

(Signed) William J. Dircks

William J. Dircks
Executive Director for Operations

Note: See previous concurrences.*

*Revised to reflect 11/5/82
ACRS meeting.*

PPAS*
10/28/82

OFFICE	GR	DST	RES	NRR	NRR	EDO
NAME	FSchroeder	jmShanauer*	GArlotto*	ECase*	HDenton*	WDircks
DATE	10/27/82	10/27/82	10/26/82	10/28/82	10/29/82	



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE F

OCT 20 1982

MEMORANDUM FOR: William J. Dircks
Executive Director for Operations

FROM: Victor Stello, Jr., Chairman
Committee to Review Generic Requirements

SUBJECT: MINUTES OF CRGR MEETING NUMBER 21

The Committee to Review Generic Requirements met on Wednesday, October 6, 1982, from 1-6 p.m. A list of attendees is enclosed.

S. Hanauer (NRR) presented the technical background and the recommendations proposed by NRR to address the issue of Pressurized Thermal Shock (PTS). These recommendations were included in a draft report that is intended by NRR to form the basis for a Commission paper. The Committee noted that the staff did a thorough job in examining the various technical aspects of this complicated issue. The draft report reflects a good balance between deterministic engineering analyses and probabilistic risk assessment (PRA) techniques. While acknowledging the large uncertainties involved (the staff estimated as much as two orders of magnitude uncertainty in the vessel failure probability estimate) the Committee believes the PRA analysis is a valuable supplement to the deterministic analysis in arriving at a balanced engineering judgment on this issue.

NRR proposed screening criteria for the vessel reference temperature RT_{NDT} , a parameter that characterizes the state of embrittlement of reactor vessels. The Committee agreed that the proposed screening criteria (270°F for longitudinal welds and 300°F for circumferential welds) seem appropriate. NRR proposes that, whenever the value of RT_{NDT} for a given vessel is projected to exceed either of the screening criteria within the next 3 calendar years, the licensee would be required to submit a plant specific analysis, the scope of which has yet to be specified. NRR also proposes that a number of long term actions be required to ameliorate the PTS problem.

Demetrios Basdekas attended the CRGR meeting and summarized the comments in his memorandum of September 24, 1982 to Carl Johnson in RES. In his memo, Mr. Basdekas noted the short time available for him to offer comments on the NRR draft staff report and the fact that he "had not participated in PTS related activities...for quite some time..." Mr. Basdekas agreed with the thrust of CRGR discussions on the need for prompt decisions on plant modifications, such as low leakage fuel loadings. Mr. Basdekas expressed dissatisfaction with the screening criterion recommended by NRR but was unable to make specific recommendations for its alteration. Mr. Basdekas reiterated what he called his long standing concern that there is insufficient information available to him or to the NRC generally to properly address the safety implications of reactor

82 1028051

William J. Dircks

- 2 -

control systems (unresolved safety issue A-47 which Mr. Basdekas has responsibility to support through his research tasks). He urged more attention to obtaining better control system data from representative licensees. It is his belief that the findings of A-47 may eventually have an important influence on the decisions on the PTS issue. He did not offer any specific examples of this influence nor did he hold out any hope that the A-47 input would be available in any reasonable time frame to support the short term PTS decisions. He also did not have any specific criticism concerning the proposition that the draft staff report takes into account the control system contributions to PTS event sequences that have occurred or were covered by the PRA.

The Committee finds Mr. Basdekas' arguments that PTS decisions should depend on the resolution of USI A-47 to be generally lacking in substance; i.e., we see no reason that A-47 cannot follow A-49. Furthermore, it would appear that requiring resolution of A-47 before deciding on PTS would be contrary to the desire for reaching an early resolution of PTS.

Mr. Basdekas brought to the Committee no new technical information or unique insight on PTS not otherwise available to the staff and already utilized in the development of the draft report on PTS. This is not to fault Mr. Basdekas - he was asked to comment on the staff report in a very short time period and he is not normally assigned to work in that area. The Committee feels it is counterproductive to efficient and effective staff work for NRC management to seek his reactions to staff proposals on PTS in this manner.

Mr. Sanford Israel also cautioned the CRGR that there could be more severe overcooling transients than considered in the PRA analysis. The Committee agreed with his observation and suggested that NRR continue to evaluate the probabilities and consequences of the full range of potential overcooling transients in their ongoing PTS work.

Based on the briefing by NRR and review of the extensive background material, the following recommendations are made:

1. The draft report should be modified to make clear that a rule change will be required to finally resolve the PTS issue.
2. It was noted that, because the pressure vessel embrittlement increases with irradiation exposure, the risk from PTS increases with time. In the absence of remedial actions, some PWR vessels are estimated to have RT_{NPT} well in excess of 300°F at the end of their service life. Since this indicates that some remedial action will be required for those vessels, the Committee requested that NRR develop further information on the costs and benefits of requiring near term flux reduction measures such as replacing outer row fuel assemblies with dummy assemblies. The CRGR stressed that this action, if implemented, was needed not because the PTS risk is unacceptably high at this time, but because the passage of time forecloses the flux reduction option as an effective remedy.

3. The Committee agreed that improved operator training and emergency operating procedures are needed. However, it was emphasized that these improvements must be done in an integrated manner and must not deemphasize the importance of maintaining adequate core cooling in the event of a loss-of-coolant accident by an over emphasis of the PTS issue.
4. The Committee suggested that NRR add a short term task to investigate whether the frequency of overcooling transients for B&W plants may be higher than the average, based on operating experience to date.

The CRGR will continue its review of the PTS issue on October 28, 1982, at which time NRR will present information on the costs and benefits of requiring near term flux reduction measures.


Victor Stello, Jr., Chairman
Committee to Review Generic Requirements

Enclosure: List of Attendees

cc: CRGR Members
Commission (5)
Office Directors
Regional Administrators
G. Cunningham
S. Hanauer

CRGR MEETING #21

LIST OF ATTENDEES

October 6, 1982

CRGR MEMBERS

Vic Stello
R. Bernero
Roger Mattson (for D. Eisenhut)
Ed Jordan
Joe Scinto

OTHERS

Tom Murley
Walt Schwink
Steve Hanauer
Roy Woods
Mat Taylor
L. F. Litton
Karl Kniel
Carl Johnson
Frank Schroeder
Harry Boulden
Richard Donovan
James Popelarski
Demetris Basdekas
E. D. Throm
Alan Rubin
Bill Shields
Jack Strosnider
Larry Shao
Jesse Funches
Steve Stern
Sanford Israel
Norm Lauber
Neil Randall
Ray Klecker
Hugh Thompson
Lambros Lois
Jim Clifford
Ed Abbutt
Tom Dorian
John Austin
Milt Vagins



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 26, 1982

MEMORANDUM FOR: Victor Stello, Jr.
FROM: Joseph F. Scinto
SUBJECT: COMMENTS ON MINUTES OF CRGR MEETING NUMBER 21

On page 1 of the Minutes, dated October 20, 1982, I would note that the way in which RTNDT for the screening criterion is to be computed (by including a 2 sigma value to the mean values, p.5-5 of the draft) makes the 270°F screening criterion more protective than figure 8.3 in the draft report might suggest. That figure provides longitudinal crack extension frequencies for mean surface RTNDT, rather than for RTNDT computed as mean plus 2 sigma.

A handwritten signature in black ink, appearing to be "Joseph F. Scinto", written over a printed name.

Joseph F. Scinto

cc: R. Bernero
Ed Jordan
R. Cunningham
C. Heltemes
D. Eisenhut

8/408280348

CRGR MEETING #23
LIST OF ATTENDEES
October 28, 1982

CRGR MEMBERS

Vic Stello
Ed Jordan
Joe Scinto
Jack Heltemes
Bob Bernero
Bob Purple (For Darrell Eisenhut)

OTHERS

Tom Murley
Steve Hanauer
Walt Schwink
Lambros Lofts
Guy Vissing
Norm Lauben
Les Rubenstein
Ed Case
Steve Stern
Bill Shields
Ed Throm
Ray Klecker
Neil Randall
Rainer Rantala
Jack Strosnider
Frank Schroeder
Roy Woods
Jim Milhoan
Tom Cox
Mat Taylor
Ed Abbott
Felix Litton

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 12 1982



MEMORANDUM FOR: William J. Dircks
Executive Director for Operations

FROM: Victor Stello, Jr., Chairman
Committee to Review Generic Requirements

SUBJECT: MINUTES OF CRGR MEETING NUMBER 23

The Committee to Review Generic Requirements met on Thursday, October 28, 1982, from 1-4 p.m. A list of attendees is enclosed.

S. Hanauer (NRR) presented further technical information on the issue of Pressurized Thermal Shock (PTS) in response to questions raised at CRGR Meeting No. 21.

Material was presented which disaggregated the overall PWR operating experience according to reactor manufacturer. This analysis of operating experience suggested that the frequency of overcooling transients for B&W plants may be higher than that for Westinghouse and Combustion Engineering plants. However, because the sparcity of data leads to large uncertainty bands, the Committee felt that there was not a sound basis for establishing a different value of the RT_{NDT} screening criterion for B&W plants. The Committee agreed with NRR that more detailed analysis of B&W plants will be required.

NRR presented further analyses of small break loss-of-coolant accidents (SBLOCA), which the staff's PRA results had shown to be the dominant risk sequence for Westinghouse plants. If, for example, the small break LOCA were to occur in a location where the break were isolatable by operator action to close a valve, then the threat to the vessel would be greater due to (a) repressurization to full system pressure and (b) no credit could be taken for the ameliorating effect of warm prestress. On the other hand, recent data from ECC mixing tests show that there is a better mixing of cold ECC water with hot water in the cold leg pipes and vessel downcomer and, as a result, the vessel would not cool down as fast during a SBLOCA than previous analyses had indicated. The net result of all these factors is that the conditional vessel failure probability for an isolatable SBLOCA would be increased by a factor of 10 over earlier estimates for a nonisolatable SBLOCA. NRR did not have an estimate for the relative probabilities of isolatable vs. nonisolatable SBLOCAs, but in light of the large uncertainties in the overall risk analyses (the staff estimated at least a factor of 100 uncertainty) the Committee did not believe this new information would significantly alter the engineering judgments on this issue. The Committee recommended that NRR continue to evaluate probabilities and consequences of the full range of potential overcooling transients for each reactor manufacturer in their ongoing PTS work.

8211240064

At Meeting No. 21, the CRGR had noted that, because the pressure vessel embrittlement increases with irradiation exposure, the risk from PTS increases with time. In the absence of remedial actions, some PWR vessels were estimated to have RT_{NDT} well in excess of 300°F at the end of their service life. Since this indicates that some remedial action will be required for those vessels, and since the passage of time reduces the effectiveness of flux reduction as a remedy, the Committee had asked NRR to develop further information on the costs and benefits of near term flux reduction measures.

NRR presented information which showed that there are some plants which will need no remedial actions for their vessel RT_{NDT} to remain below the screening criteria throughout their service life, based on current information. The remaining plants can generally be grouped into three categories.

- (1) There are several plants for which near term action to reduce the flux at critical welds by a factor of 2 or less will ensure that they do not exceed the screening criteria throughout their service life. Information available to NRC from reactor manufacturers indicates that a flux reduction factor of 2 can be attained through installation of a low leakage core, which is simply the installation of partially burned fuel assemblies in the periphery of the core in place of fresh fuel assemblies. This fuel management option is already being implemented by some licensees at reportedly little or no additional cost.
- (2) There is a group of about nine plants for which near term action to reduce the flux at critical welds by factors of 2 to 4.5 will ensure that they do not exceed the screening criteria throughout their service life. NRR presented analyses which showed that these flux reduction factors can be attained through the installation of a low leakage core and the replacement of some peripheral fuel assemblies (estimated 4-12) by dummy assemblies. There would be an estimated engineering cost of \$20 million per plant, but no substantial increase in fuel cycle costs or operating costs.
- (3) There is one plant, H. B. Robinson 2, which is close to reaching one of the screening criteria and for which the fuel management options described above could not reduce the flux at the critical welds enough to prevent reaching the screening criteria. It was suggested at the meeting that there were no practical fuel management schemes or operating modes that would prevent Robinson 2 from reaching the screening criteria within the next few years, and this was confirmed by NRR. It is possible, however, to reduce the flux at the critical weld by a factor of about 9 by replacing the entire outer row fuel assemblies with dummy assemblies. This option would entail an engineering cost of \$20 million and probably additional operating costs due to the need to derate the power level of the plant.

The Committee discussed the technical options open to NRC to resolve the pressurized thermal shock issue.

- (a) NRC could continue to refine the analyses, including plant specific risk analyses, in the expectation that they would show that the plants could meet their service life without remedial actions. The Committee felt that this option would be costly and not likely to produce convincing arguments for no remedial actions.
- (b) NRC could require near term actions to reduce the flux levels for those plants where such actions would ensure that the vessel RT_{NDT} would remain below the screening criteria throughout the service life.
- (c) NRC could establish a regulatory limit on vessel embrittlement and permit plant operation until that limit is reached, at which time the vessel would have to be thermally annealed or the plant shut down. The Committee noted that vessel annealing appears to be technically feasible, although unproven on a large scale, and costly in terms of engineering, plant down time and occupational exposure.

The initial NRR proposal would establish screening criteria for the vessel reference temperature, RT_{NDT} , for critical welds. Whenever the value of RT_{NDT} for a given vessel would be projected to exceed the screening criteria within the following 3 calendar years, the licensee would be required to submit a plant specific analysis. The staff would develop acceptance criteria for determining whether plant modifications would be required after the staff review of the plant specific analyses. The initial NRR proposal also included a number of long term actions intended to ameliorate the PTS problem.

Discussions with the Committee made clear that for those plants that the staff estimates are currently near the screening criteria, the two-step process above would result in delays which could foreclose options that currently appear to be feasible at little additional cost, particularly flux reduction options. Such delays could mean that, at the point of decision, there may be few if any alternatives to annealing the vessel.

For those reasons, NRR proposed and the Committee agreed that the staff should take steps to initiate flux reductions for those plants in categories (1) and (2) above to ensure that RT_{NDT} for critical welds does not reach the screening criteria before the end of service life. The Committee believes that the PTS risk is not unacceptably high at this time, but by taking these relatively low cost actions in the near term, the PTS risk can be maintained at acceptable levels for these plants and the need for requiring costly and unproven actions in the future would thereby be obviated for these plants. NRR staff indicated agreement with this course of action at the meeting.

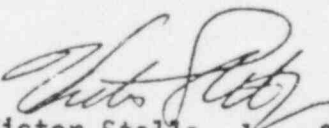
NOV 12 1982

Although various methods for initiating flux reduction requirements were discussed, including rulemaking, generic letters and orders, the Committee concluded that selection of the appropriate procedural method should be left to the staff.

For the case of H. B. Robinson 2, the Committee recommends that the staff promptly have the licensee submit a plan showing what actions they intend to take to resolve the PTS issue for their plant. It is expected that this plan could include consideration of heating ECC water, safety systems to prevent repressurization, flux reduction methods, annealing, or some combination thereof, but the Committee judges that some remedial actions will be needed in the next few years to ensure that the PTS risk for Robinson 2 remains within acceptable levels throughout its service life.

The CRGR reemphasized that staff actions to improve operator training and emergency operating procedures must be done in an integrated manner and must not deemphasize the importance of maintaining adequate core cooling in the event of a loss-of-coolant accident by an over emphasis of the PTS issue in the training and emergency procedures.

In summary, the Committee recommends that NRR develop a program to inform licensees of the need to modify plant operations through flux reduction programs to ensure that RT_{NDT} values do not reach unacceptable levels. For plants in categories (1) and (2) above, flux reduction appears adequate. In one plant, H. B. Robinson 2, a more comprehensive plan is needed.


Victor Stello, Jr., Chairman
Committee to Review Generic Requirements

Enclosure: List of
Attendees

cc: Commission (5)
Office Directors
Regional Administrators
CRGR Members
G. Cunningham