MEMORANDUM FOR: William J. Dircks
Executive Director for Operations

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

SUBJECT: CRGR MEETING NUMBER 19 MINUTES

The Committee to Review Generic Requirements met on Wednesday, September 15, 1982 from 1-4p.m. A list of attendees is enclosed.

R. Mattson (NRR) presented for Committee consideration the Cost/Benefit Study of Design Requirements for Inadequate Core Cooling/Instrumentation as well as several open technical issues resulting from the CRGR meeting #11 on March 24, 1982.

The need for additional instrumentation to detect inadequate core cooling was derived from studies of the TMI accident. One of the most important lessons from that accident was that the operators required more information on the status of core cooling during an accident than was available in the control room at the time. This realization led to early actions by NRC to require the installation of Subcooling Monitors (SM) in PWR control rooms and to upgrade the number and quality of core-exit thermocouples (TC) in PWRs. Even with this added instrumentation, however, there remained, during a small LOCA, a period of time after the system reaches saturated conditions (indicated by SM) but before the core has boiled dry (indicated by TC) when the operators have insufficient information to track the inventory of coolant in the vessel and primary system. To address the insufficient information issue, NRR has required extensive further studies by the industry to determine whether additional instrumentation could be provided to monitor the status of core cooling.

The minutes of CRGR Meeting #11 contain the Committee's conclusion that additional instrumentation to detect inadequate core cooling would be highly desirable to complement the current package of Subcooling Monitors and Thermocouples. At this meeting NRR requested that the CRGR endorse the following recommendations which supercede previous NRR recommendations:

(1) The inadequate core cooling instrumentation systems proposed by Combustion Engineering and Westinghouse constitute acceptable generic designs when properly implemented and operated in accordance with operating procedure guidelines acceptable to the staff.

(2) In principle, differential pressure (d/p) measurement techniques for reactor coolant system inventory tracking are acceptable provided that

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they meet NUREG-0737 design requirements and monitor the coolant inventory over the range from the vessel upper head to the bottom of the hot leg. For B&W reactors, a d/p measurement from the top of the candy cane to the low point in the hot leg is also required. A d/p measurement extending from the bottom of the reactor vessel will not be required if equivalent instrumentation (e.g., pump current monitor) is provided to trend the RCS void content when pumps are running.

(3) Inadequate core cooling instrumentation sub-systems which were incomplete with respect to procurement and installation on January 1, 1982 must conform to the design requirements specified for Item II.F.2 of NUREG-0737.

(4) Instrumentation systems which were complete with respect to procurement and installation prior to January 1, 1982 and which are being used as an inadequate core cooling instrumentation sub-system (e.g., in-core thermocouples) must be upgraded in design consistent with NUREG-0737 Item II.F.2. However, NUREG-0737 design specifications may be considered as design guidelines for this purpose. The staff should maintain review flexibility and provide relief from seismic and environmental design qualification requirements on an individual plant when plant unique problems impose an abnormal cost penalty to meet these requirements. Any relief granted will be done with full consideration of the new Environmental Qualification Rule and other applicable regulations. It is expected that very few licensees will request exceptions or be able to justify them.

(5) Licensees not yet committed to a specific inventory tracking system design should be ordered to conclude their conceptual design review and submit detailed engineering, procurement, and installation schedules for an acceptable reactor coolant system inventory tracking monitor not later than January 1, 1983.

(6) The staff should renegotiate a practical schedule for implementation of additional instrumentation and upgrading of existing instrumentation for each operating reactor. This negotiation can occur at the same time as the similar discussions with licensees regarding the SECY 82-111 requirements. Installation and instrument upgrading should be required during the earliest refueling shutdown consistent with the existing status of the plant and practical design and procurement considerations. This is likely to result in installation dates for several plants which will be later than that proposed in the February 19, 1982 memorandum from D. Eisenhut to Distribution, "Operating License Rule for NUREG-0737 Requirements."

(7) After installation, the operating utilities should be given ample time to allow the operators to familiarize themselves with the performance charcteristics of the additional instrumentation. The utilities should assure operator confidence in the new systems prior to extensive integration of the coolant inventory signals into emergency operating procedures.

NRR presented several ICC instrumentation design options to the Committee. The options, including option 1 recommended by NRR, are as follows:

1. Reference Design - meets NUREG-0737 design requirements.

2. Delete all seismic design requirements from reference design.

3. Delete environmental qualification requirements, except seismic, from reference design.

4. Delete single failure design requirements (redundancy) from reference design.

5. Delete Class 1E power source requirement from reference design.

The NRR estimate of costs associated with each design option is shown below in Table I.

Table I

ICC Instrumentation	Fit Status	OPTION 1(c)	2(s)	3(s)	4(s)	5(s)	Range(c)
		NRR ESTIMATES					INDUSTRY ESTIMATES
Core Exit Thermocouple	BF	2,148	14	35	21	3	648-6,280
	FF	948	15	12	22	5	551-1,250
Subcooling Margin Monitor	BF	325	19	30	30	2	70-500
	FF	658	16	15	30	10	100-1,750
Inventory Trending W/RCS Pumps Off	BF	3,176	9	16	30	2	1,530-5,280
	FF	1,826	4	15	16	2	195-3,694
Inventory Trending W/ RCS Pumps On	BF	240	1	1	8	0	200-280
	FF	200	10	20	50	0	200
Overall ICC Instrumentation	BF	5,889	11	23	26	2	2,488-12,340
	FF	3,632	9	14	22	4	1,046-6,894

NOTE: C- Cost ($1,000/Plant); S- Savings in % (Compared with Option 1); BF- Backfit; FF- Forward Fit.

In addition to the monetary costs associated with the ICC instrumentation, NRR indicated that there would be a 30 to 50 man rem per plant occupational exposure associated with installation of the instrumentation at operating plants. NRR cautioned the Committee concerning the certainty of the cost data in that the cost sampling is small, not completely defined, not necessarily representative and difficult to interpret.

Although NRR provided to the Committee a cost assessment of various design options for the ICC instrumentation package, no cost-safety benefit assessment was available. Therefore, the Committee could only make judgments about an implied net safety benefit for the ICC instrumentation proposed by NRR. The Committee judged that the principal safety benefit is expected to be an improvement in the reliability of plant operators to correctly diagnose the approach of inadequate core cooling and to assess the adequacy of responses taken to restore adequate core cooling.

Thus, the principal safety benefits from the ICC instrumentation would be preventive in nature, in that the instrumentation would assist the operator in avoidance of a degraded or melted core when coolant voids and saturation conditions result from transients and small loss of coolant events. The incremental gains in operator performance may be larger for the more frequent overcooling and depressurization transients than for the more rapid, but less probable, small to intermediate size LOCA events where some heatup of the core can be expected to occur independent of the human response. The ICC instrumentation package could therefore be of greater safety benefit for events such as steam generator tube ruptures, loss of instrument bus or control system upsets, pump seal failures, or overcooling events originating from disturbances in the secondary coolant side of the plant. For these more frequent events, the ICC instrumentation package could significantly reduce the likelihood of human misdiagnoses and errors in actions taken to control such events. For less frequent events, involving coincidental multiple faults or more rapidly developing small LOCA conditions, the ICC instrumentation package would appear to have a lesser safety benefit -- perhaps factors of 2 to 3 improvement in the probability of human misdiagnosis and subsequent errors leading to a degraded core.

The majority of PWRs have containment designs that are relatively insensitive to (that is, decoupled from) degraded core conditions, in that most of the degraded core accidents in PWRs would be predicted to result in very small to negligible off site radiological consequences. Small reductions in the probability of a degraded core would thus not be expected to have a very large benefit in terms of overall risk reduction to the public. Therefore,

the Committee found it difficult to justify the projected costs of the ICC instrumentation on the basis of averted radiological consequences.

Nonetheless, after considering the estimated costs and the benefits to improved operator performance, the Committee reaffirmed its previous conclusion that additional instrumentation to detect inadequate core cooling would be highly desirable to complement the current package of Subcooling Monitors and Thermocouples. It was noted that there have been instances since TMI where ICC instrumentation would have been helpful for the operators (e.g., the Ginna steam generator tube rupture accident.) The Committee's recommendations are as follows:

(1) The ICC instrumentation proposed by NRR should be required to complement the instrumentation (subcooling monitors and thermocouples) currently required by NRC, provided that (a) the ICC instrumentation is viewed as a whole, not individually, and clear guidance and training are provided to operators, and (b) the cost associated with the ICC instrumentation does not significantly exceed projected costs and occupational exposures for each plant,

(2) Although NRR recommends the Option 1 ICC instrumentation design (redundancy, equipment qualification and seismic qualification comparable to an engineered safety system) less redundant and qualified design might be adequate. The Committee recognizes, however, that it may be necessary to require design and installation of these instrument systems as engineered safety features to assure that operators will rely on these instruments as they do for other safety instruments. The NRR staff should be flexible relative to approving deviations consistent with design Options 2 through 5 for individual plants when justified by the utility. Specifically, the need to qualify these instruments to high radiation levels should be re-evaluated.

(3) Plant operators should be trained and guided to have high confidence in the ICC instrumentation relative to inadequate core cooling. Nothing should be done to diminish that confidence.

(4) The NRR report should be revised to include consideration of other factors (such as benefits of redundancy, seismic design, environmental qualification and operator confidence) in evaluating the various options noted in Table I.

(5) NRR should assure that plant specific schedules are established (in accordance with the procedures in SECY 82-111) to account for design, procurement and installation.

Original Signed By
V. Stello

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

Enclosure:
List of Attendees

cc: Commission (5)
Office Directors
Regional Administrators
G. Cunningham, ELD

Distribution
VStello
TMurley
DEDROGR cf
DEDROGR staff
Central File
PDR (NRG/CRGR)
EPodolak
SStern
WBrach

OFFICE	DEDROGR	DEDROGR	DEDROGR				
SURNAME	Schwink	Murley	Stello				
DATE	9/21/82	9/24/82	9/27/82				