Task II.E.3: Decay Heat Removal (Rev. 2)

The objective of this task was to improve the reliability and capability of nuclear power plant systems for removing decay heat and achieving safe shutdown conditions following transients and under post-accident conditions.

ITEM II.E.3.1: RELIABILITY OF POWER SUPPLIES FOR NATURAL CIRCULATION

DESCRIPTION

This TMI Action Plan[1] item resulted in the issuance of requirements for: (1) upgrading the pressurizer heater power supply and associated motive and control power interfaces sufficient to establish and maintain natural circulation in hot standby conditions; and (2) establishing new procedures and training for maintaining the RCS at hot standby conditions with only onsite power available.

CONCLUSION

This item was clarified in NUREG-0737[2] and requirements were issued.

ITEM II.E.3.2: SYSTEMS RELIABILITY

DESCRIPTION

One of the basic tenets of reactor safety is that there must always be a means of removing decay heat. The shutdown heat removal systems are designed to removed this heat at a rate that will enable the reactor to be brought to, and maintained in, a state of cold shutdown. This TMI Action Plan[3] item was intended to focus on shutdown heat removal system reliability.

Shutdown heat removal systems generally consist of two independent trains, each of which is quite reliable. Moreover, other systems can be used to prevent a core-melt under many circumstances. Nevertheless, given the importance of decay heat removal, the reliability of the shutdown heat removal systems remained in question.

The issue called for NRR to conduct a generic study to assess the capability and reliability of shutdown heat removal systems under various transients and degraded plant conditions, including complete loss of all feedwater. Deterministic and probabilistic methods were to be used to identify design weaknesses and possible system modifications that could be made to improve the capability and reliability of these systems under all shutdown conditions (i.e., startup, hot standby, shutdown, etc.).

CONCLUSION

This item was integrated[4] into the resolution of Issue A-45.

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[1] NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, (Rev. 1) August 1980.
[2] NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980, (Supplement 1) January 1983.
[3] NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, (Rev. 1) August 1980.
[4] Memorandum for R. Fraley from K. Kniel, "Draft Task Action Plan for TASK A-45, Shutdown Decay Heat Removal Requirements," May 22, 1981. [8106010652]

ITEM II.E.3.3: COORDINATED STUDY OF SHUTDOWN HEAT REMOVAL REQUIREMENTS

DESCRIPTION

A shutdown heat removal system is necessary in a nuclear reactor to establish and maintain a safe shutdown condition during normal and accident conditions. If the normal shutdown heat removal system does not perform its intended safety function, then an alternate method must be used. Therefore, this TMI Action Plan[5] item called for a coordinated effort to evaluate shutdown heat removal requirements in a comprehensive manner, thereby permitting a judgment of adequacy in terms of overall system requirements. As part of this effort, a study was to be conducted to assess the desirability of, and possible requirements for, a diverse heat removal path, such as feed-and-bleed, particularly if all secondary side cooling were unavailable. The need for alternate shutdown heat removal systems for PWRs and BWRs was to be evaluated based on value/impact or cost/ benefit analyses. If such systems appeared to provide a significant safety benefit, alternative concepts were to be studied and recommendations made.

CONCLUSION

This item was reviewed and considered in the resolution of Issue A-45.

ITEM II.E.3.4: ALTERNATE CONCEPTS RESEARCH

DESCRIPTION

This TMI Action Plan[6] item involved a specific study related to the usefulness of installing an add-on decay heat removal system in existing nuclear power plants to improve the overall operational reliability of decay heat removal. The study entailed a review of the detailed design of a decay heat removal system (to be designed under DOE auspices) and was expected to result in suggested systems performance and safety design criteria as well as a value/impact analysis. In addition, scoping studies were to be performed to develop further information regarding the usefulness of other alternate concepts proposed for decay heat removal systems.

CONCLUSION

This item was RESOLVED with the publication of NUREG/CR-2883,[7] the results of which were considered in the resolution of Issue A-45.

ITEM II.E.3.5: REGULATORY GUIDE

DESCRIPTION

This TMI Action Plan item[8] called for the issuance of Revision 1 of Regulatory Guide 1.139[9] which includes requirements for reaching cold shutdown using safety-grade equipment.

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[5] NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, (Rev. 1) August 1980.
[6] NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, (Rev. 1) August 1980.
[7] NUREG/CR-2883, "Study of the Value and Impact of Alternative Decay Heat Removal topics for Light Water Reactors," U.S. Nuclear Regulatory Commission, (Vol. 1) June 1983, (Vol. 2) June 1983, (Vol. 3) June 1983.
[8] NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, (Rev. 1) August 1980.
[9] Regulatory Guide 1.139, "Guidance for Residual Heat Removal," U.S. Nuclear Regulatory Commission, May 1978.

CONCLUSION

In accordance with NUREG/CR-2883,[10] this issue was integrated into the resolution of Issue A-45.

[10] NUREG/CR-2883, "Study of the Value and Impact of Alternative Decay Heat Removal topics for Light Water Reactors," U.S. Nuclear Regulatory Commission, (Vol. 1) June 1983, (Vol. 2) June 1983, (Vol. 3) June 1983.