Task III.A.3: Improving NRC Emergency Preparedness

The objective of this task is to enable NRC, in the event of a nuclear accident at a licensed reactor facility, to: (1) monitor and evaluate the situation and potential hazards, (2) advise the licensee's operating staff as needed, and (3) in an extreme case, be able to issue orders governing such operations.

Item III.A.3.1: NRC Role in Responding to Nuclear Emergencies

The five parts of this item have been combined and evaluated together.

Description

This TMI Action Plan[1] item was to define the NRC role in emergency situations involving NRC licensees. The definition of the NRC emergency response role will be used by OIE in revising and upgrading plans and procedures for the NRC emergency operations center. OIE, with input from other NRC offices, will revise NRC Manual Chapter 0502 and NUREG-0610[2] to describe and implement the NRC emergency response program.

NUREG-0610[3] was revised as Appendix I to NUREG-0654[4] in November 1980. NUREG-0728,[5] published in September of 1980, provided the basis for continued upgrading of the NRC Incident Response Program and information to be included in the revised NRC Manual Chapter 0502. In the interim, until NRC Manual Chapter 0502 was approved by the Commission, NUREG-0845[6] written for trial use in March 1982, provided detailed procedures for the NRC Incident Response Plan. When the Commission approves the proposed revisions to NRC Manual Chapter 0502, NUREG-0845[7] will be issued for final publication.

The proposed revision to NRC Manual Chapter 0502 was approved by the Commission on January 5, 1983. Resolution of Item III.A.3.1 also resolved Item B-71, "Incident Response," which was essentially superseded by Item III.A.3.1. All required action on this item has been completed.[8,9]

Conclusion

This item has been RESOLVED.

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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-0610, "Draft Emergency Action Level Guidelines for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, September 1979.
[3] NUREG-0610, "Draft Emergency Action Level Guidelines for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, September 1979.
[4] NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, February 1980, (Rev. 1) November 1980.
[5] NUREG-0728, "Report to Congress—NRC Incident Response Plan," U.S. Nuclear Regulatory Commission, September 1980.
[6] NUREG-0845, "Agency Procedure for the NRC Incident Response Plan," U.S. Nuclear Regulatory Commission, March 1982.
[7] NUREG-0845, "Agency Procedure for the NRC Incident Response Plan," U.S. Nuclear Regulatory Commission, March 1982.
[8] NUREG-1509, "Radiation Effects on Reactor Pressure Vessel Supports," U.S. Nuclear Regulatory Commission, May 1996.
[9] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan Completed Items," January 26, 1983. [8303090323]

Item III.A.3.1(1): Define NRC Role in Emergency Situations

This item was evaluated in Item III.A.3.1 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.1(2): Revise and Upgrade Plans and Procedures for the NRC Emergency Operations Center

This item was evaluated in Item III.A.3.1 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.1(3): Revise Manual Chapter 0502, Other Agency Procedures, and NUREG-0610

This item was evaluated in Item III.A.3.1 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.1(4): Prepare Commission Paper

This item was evaluated in Item III.A.3.1 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.1(5): Revise Implementing Procedures and Instructions for Regional Offices

This item was evaluated in Item III.A.3.1 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.2: Improve Operations Centers

Description

This TMI Action Plan[10] item called for the NRC Operations Center (OC) in Bethesda, Maryland to be upgraded to support activities in response to a major accident.

Near-term improvements[11] made to the OC during 1979-1981 included improved physical space, rearrangement, better facilities (such as status systems and weather information), and improved telecommunications equipment including the possible use of HF radios. A study has recently been completed on long-term improvements in the OC. This study addressed a complete redesign of the OC taking into account specifically human factors considerations and improved communications.

OIE considers implementation of this item important and is working toward its completion. Taking into account the problems in logistics of construction relocation, equipment purchase, and budget constraints, implementation should be completed by December 1983.[12,13]

Conclusion

This item was RESOLVED and no new requirements were established.

Item III.A.3.3: Communications

Both parts of this item have been combined and evaluated together.

Description

The TMI Action Plan[14] included communications in the required improvements for NRC emergency preparedness. Included in communications are two items: (1) direct and dedicated telephone lines (OPX)

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[10] 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.
[11] Memorandum for H. Denton from R. DeYoung, "TMI Action Plan Items Still Pending," June 10, 1982. [8401170101]
[12] Memorandum for H. Denton from R. DeYoung, "TMI Action Plan Items Still Pending," June 10, 1982. [8401170101]
[13] Memorandum for H. Denton from R. DeYoung, "Draft Report on the Prioritization of Non-NRR TMI Action Plan Items," January 24, 1983. [8401160474]
[14] 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.

between the licensee facilities and NRC; and (2) the use of the dedicated short-range radio communication system (FIRS).

OPX and HPN telephone systems were installed at all operating reactors by August 1980 and are being installed at newer plants prior to operation. FIRS has been obtained for use by NRC field personnel during emergencies. All required action on this item has been completed (see References [15, 16,17, 18]).

Conclusion

This item has been RESOLVED.

Item III.A.3.3(1): Install Direct Dedicated Telephone Lines

This item was evaluated in Item III.A.3.3 above and was determined to be RESOLVED. New requirements were established.

Item III.A.3.3(2): Obtain Dedicated, Short-Range Radio Communication Systems

This item was evaluated in Item III.A.3.3 above and was determined to be RESOLVED. New requirements were established.

Item III.A.3.4: Nuclear Data Link

Description

Historical Background

After the TMI event, the NRC concluded that the NRC Operations Center (Incident Response Center) should be upgraded to allow NRC personnel to analyze and evaluate plant conditions based on directly transmitted information, as opposed to a voice link. The term "Nuclear Data Link" (NDL) was given to a conceptual system that would access plant data and directly transmit the information to the OC.

Safety Significance

It was believed that, with more current and reliable plant data available to the NRC, the staff could help develop and evaluate accident mitigating actions.

Possible Solution

It was determined that a phased approach would be utilized. The first phase was to have Sandia study the available options and to report their findings. Sandia completed their report which will not be published. The Sandia options were evaluated and it was determined that an elaborate NDL configuration which was interactive with the licensees' system was inappropriate to the NRC's role. The second phase is to be implementation of a prototype which will be evaluated to help the Commission decide whether an NDL is needed and, if so, what it should look like.[19]

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[15] Memorandum for H. Denton from R. DeYoung, "TMI Action Plan Items Still Pending," June 10, 1982. [8401170101]
[16] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan—Completed Items," December 28, 1981. [8205260197]
[17] Memorandum for H. Denton from R. DeYoung, "Draft Report on the Prioritization of Non-NRR TMI Action Plan Items," January 24, 1983. [8401160474]
[18] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan—Status Report," March 4, 1982. [8204290601]
[19] SECY-81-153, "Nuclear Data Link," U.S. Nuclear Regulatory Commission, March 11, 1981. [8103240155]

Priority Determination

Assumptions

PNL did an assessment of this issue.[20] To assess the impact of this issue, we needed to consider all the other related issues which are involved with the OC. (See Items III.A.3.1, III.A.3.2, III.A.3.3, III.A.3.5, and III.A.3.6.) Many of these issues have been completed or almost completed. In addition, we considered the utilities' emergency response facilities (ERFs). The ERFs are planned to be completed [along with the Safety Parameter Display System (SPDS) and the Data Acquisition System (DAS)] according to requirements outlined in SECY-82-111[21] and a letter[22] issued to all licensees of operating reactors.

Frequency/Consequence Estimate

We constructed an event tree which assumed a base case core-melt based on the Oconee and Grand Gulf risk studies. We then analyzed certain event tree branches based on a risk reduction with results from the possibility that NRC personnel at the OC could: (1) detect and correct an error by the plant operators during accident recovery; or (2) provide optimum approaches to the operators for the mitigation of particular evolving sequences.

It was first assumed that the base case core-melt frequencies are 8.15×10^{-5}/RY for PWRs and 3.67×10^{-5}/ RY for BWRs. We assumed that 90% of the core-melt scenarios would proceed slowly enough to allow input from observers at the OC or ERFs. Next, it was assumed that the operator's judgment was not optimum in about 50% of the cases. This includes consideration of the fact that he is not able to take a step back and completely evaluate the accident sequence or evaluate and/or anticipate ahead in the scenario. We then assumed that, given the above, the utilities' ERFs would be manned and available in 90% of the cases and that the utilities' ERF personnel could provide successful input in 75% of the cases.

Of the remaining 25% of the cases, we assumed that the OC would be available 90% of the time and that the NRC personnel could provide the successful input about 50% of the time. This number was assumed smaller than the utility's ERF success rate because of the data available at the OC, i.e., it is not complete and available only by voice communications. This would somewhat hinder the NRC staff's performance.

For this calculation, we ignored the smaller contribution of the event tree branch which is due to the 10% unavailability of the utility's ERF and the success of the OC staff.

Therefore, with the assumption that Items III.A.3.1, III.A.3.2, III.A.3.3, III.A.3.5, and III.A.3.6 are completed and the ERFs are in place, we estimated a potential core-melt frequency reduction for the present OC of about 4.5%.

This was then considered the base-case value for the overall OC as it is completed to date. We then estimated that the incorporation of an NDL could improve the success of the OC staff by about 50% due to the availability of more complete, more accurate, and more timely information. This would then equal an additional core-melt frequency reduction of about 2%.

From the reduction in core-melt frequency, the per plant reduction in public risk was then calculated (based on a population density of 340 people per square mile) to be 4.5 man-rem/RY for PWRs and 5.5 man-rem/RY for BWRs. With 95 PWRs, 49 BWRs, and an average remaining life of 28.5 years for PWRs and 22 years for BWRs, the total public risk reduction is then 18,000 man-rem.

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[20] NUREG/CR-2800, "Guidelines for Nuclear Power Plant Safety Issue Prioritization Information Development," U.S. Nuclear Regulatory Commission, February 1983, (Supplement 1) May 1983, (Supplement 2) December 1983, (Supplement 3) September 1985, (Supplement 4) July 1986, (Supplement 5) July 1996.

[21] SECY-82-111, "Requirements for Emergency Response Capability," U.S. Nuclear Regulatory Commission, March 11, 1982. [8203180409]

[22] Letter to All Licensees of Operating Reactors, Applicants for Operating Licenses, and Holders of Construction Permits from U.S. Nuclear Regulatory Commission, "Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982. [ML031080548]

Cost Estimate

Industry Cost: Licensees are not implementing standard data sets, formats, or equipment and the NRC will have to electronically process each of the data outputs that it receives from licensees. Relatively simple equipment at each site, costing perhaps $20,000 for hardware and $15,000 for labor to install, will transmit data in the licensee format to the NRC. There are 50 sites with operating reactors (counting Indian Point as two sites because of the mixed ownership) and 35 additional sites with reactors under construction. New reactors at six existing sites might also be built with new (separate) DAS. Rounding off to be conservative, an estimated 100 sites will require data-transmitting equipment at a total initial cost of $3.5M.

NRC Cost: It would be expected that the NRC would incur the majority of the cost of the overall data link. It was assumed that the OC will have been im-proved (Item III.A.3.2) before the NDL is implemented. With respect to NRC equipment costs, it was assumed that the ERF at individual utilities would be completed. Based on this, the DAS necessary for support of the facility will already be implemented.

At the OC, the NRC will need a unit for receiving and processing the data. The unit may cost up to $500,000 and software as much as $30,000 for each site, since processing instructions will be different for each different licensee output. Therefore, the estimated initial cost at the OC is $3.5M. System maintenance is estimated at 2% of equipment costs per year for 30 years, or $1.5M.

The total estimated NDL system cost, regardless of who pays it, is $8.5M for concepts currently envisioned. The planned Prototype Program will develop more refined evaluations and cost estimates to permit the Commission to decide what is really needed.

Value/Impact Assessment

Based on the estimated public risk reduction of 18,000 man-rem, the value/impact score is given by:

$$S = \frac{18{,}000 \text{ man-rem}}{\$8.5\text{M}}$$

$$= 2{,}100 \ \frac{\text{man-rem}}{\$\text{M}}$$

Other Considerations:

(1)	Present plans are to implement a prototype system.[23] [24]
(2)	More accurate cost estimates are difficult without clearer system definition which is to be provided by evaluation of the prototypes.
(3)	The estimate of the potential reduction in core-melt frequency is subject to large uncertainty because of the sequences of assumptions which went into the event tree.
(4)	OIE believes that this issue should receive high priority.

Conclusion

Based on the value/impact score and the total risk reduction potential, this issue was given a medium

[23] Letter to N. Palladino (U.S. Nuclear Regulatory Commission) from M. Udall (Chairman, Committee on Interior and Insular Affairs, U.S. House of Representatives), June 4, 1982. [8207120246]
[24] Letter to M. Udall (Chairman, Committee on Interior and Insular Affairs, U.S. House of Representatives) from N. Palladino (U.S. Nuclear Regulatory Commission), June 30, 1982. [8206130067]

priority ranking. However, in June 1985, it was determined by the staff that the design that met NRC requirements was one that utilized electronic data transmission systems that were already being developed by licensees for their own ERFs. This concept, Emergency Response Data System (ERDS), was approved by the Commission in March 1985.[25] Licensees will not be required to backfit their systems to include additional parameters to provide data on NRC's parameter list. Data that is not available from the electronic data stream can be provided by voice over existing phone lines. Thus, this item was RESOLVED and no new requirements were established.

Item III.A.3.5: Training, Drills, and Tests

Description

The TMI Action Plan[26] identified a need to improve the capability to respond to emergencies by continuing the headquarters and regional drills and exercises. The scope is envisioned to be slowly expanded to include joint exercises with State and local agencies and other Federal response capabilities. A schedule involving various levels of participation by the various parties is to be prepared.

Exercises, scheduling, and training are being conducted with gradually increasing scope and continuing programs related to this item have been incorporated into routine ongoing NRC operations. (See References [27, 28, 29, 30])

Conclusion

This item was RESOLVED and no new requirements were established.

Item III.A.3.6: Interaction of NRC and Other Agencies

The three parts of this item have been combined and evaluated together.

Description

The TMI Action Plan[31] identified the requirement to establish interaction agreements between NRC and other agencies for cooperation, communication, and assistance during emergency situations. Agencies involved include other international governments, i.e., Mexico and Canada, other Federal agencies, and State and local governmental bodies.

In September 1980, the NRC published NUREG-0728[32] which described in general the NRC's responsibilities and plans for responding to emergencies at nuclear power reactors. This report further described the coordination/liaison with other agencies and organizations. In March 1982, the NRC published NUREG-0845,[33] which contains detailed agency procedures for the NRC incident response

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[25] Memorandum for W. Dircks from J. Taylor, "TMI Action Plan—Completed Item," June 26, 1985. [8507080034]
[26] 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.
[27] Memorandum for H. Denton from R. DeYoung, "TMI Action Plan Items Still Pending," June 10, 1982. [8401170101]
[28] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan—Completed Items," December 28, 1981. [8205260197]
[29] Memorandum for H. Denton from R. DeYoung, "Draft Report on the Prioritization of Non-NRR TMI Action Plan Items," January 24, 1983. [8401160474]
[30] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan—Status Report," March 4, 1982. [8204290601]
[31] 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.
[32] NUREG-0728, "Report to Congress—NRC Incident Response Plan," U.S. Nuclear Regulatory Commission, September 1980.
[33] NUREG-0845, "Agency Procedure for the NRC Incident Response Plan," U.S. Nuclear Regulatory Commission, March 1982.

plan. It also includes the details for providing the interaction between NRC and other involved Federal agencies and other organizations.

All work required by this item has been completed and the NRC Incident Response Plan is being implemented.[34,35,36]

[34] Memorandum for H. Denton from R. DeYoung, "TMI Action Plan Items Still Pending," June 10, 1982. [8401170101]
[35] Memorandum for W. Dircks from R. DeYoung, "TMI Action Plan—Completed Items," June 2, 1982. [8401170114]
[36] Memorandum for H. Denton from R. DeYoung, "Draft Report on the Prioritization of Non-NRR TMI Action Plan Items," January 24, 1983. [8401160474]

Conclusion

This item has been RESOLVED with changes in the NRC procedures that address the interaction with other agencies during emergency situations.

Item III.A.3.6(1): International

This item was evaluated in Item III.A.3.6 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.6(2): Federal

This item was evaluated in Item III.A.3.6 above and was determined to be RESOLVED. No new requirements were established.

Item III.A.3.6(3): State And Local

This item was evaluated in Item III.A.3.6 above and was determined to be RESOLVED. No new requirements were established.