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MEMORANDUM FOR: Z.R. Rosztoczy, Chief, Analysis Branch, DSS

FROM: R.F. Audette, Systems Analysis Section, Analysis Branch, DSS

THRU: for P.E. Norian, Section Leader, Systems Analysis Section, Analysis Branch, DSS

SUBJECT: ANALYTICAL SUPPORT TO NRC MANAGEMENT FOR OPERATING PLANT INCIDENTS

Of the many lessons to be learned from the recent Three Mile Island Unit 2 (TMI-2) accident, one of the more important ones was that only limited information was available for NRC management concerning the plant status. The information that was initially available was largely inadequate, confusing, and often contradictory from all accounts, as would be expected in any first-of-a-kind accident. This accident has, as indicated by Commissioner Ahearne, served to spot-light many procedural weaknesses which are correctible to various degrees, and the following are some suggestions for correcting one of the weaknesses that I believe falls within our branch charter responsibilities.

Information as to the sequence of events that occurred at TMI-2 was quite slow (~3 days) in reaching the AB staff, and what information was furnished was incomplete in terms of being able to clearly define what had occurred, and what the status of the plant was at the time when management decisions were needed. As a result, our support and contributions to the decision process was hampered, when critical decisions had to be made compared to what I believe would be possible with some upgrading of our Branch capabilities. To rectify this inadequacy, I believe that the following suggestions for upgrading of our capabilities and functions should be implemented over the short and long term;

A. Short Term Upgrading

1. Incident Information Transmittal to NRC Headquarters

To obtain prompt and as complete information as is available on recent events or events in progress at any operating plant, it is suggested that a plant incident data acquisition (PIDA) system be implemented at NRC headquarters. This system would

consist of digital computer tapes and tape drives designed to receive and store data transmitted from any selected plant site over telephone lines. As each plant site now contains some form of digitized logging of plant measurements when events occur in addition to automated logging of events, such information could be readily transmitted electronically to NRC headquarters for staff review and analysis.

2. Data Conversion for Review and Analysis

From the PIDA tapes, charts of events and plots of selected parameter transients for the incident could be generated on existing NRC headquarters equipment within minutes of transmittal from the site. This would require prompt, or immediate, access to computer services to convert the tape data to graphics equipment commands. Information converted to such a format would serve as a basis for prompt and timely incidence assessments by the staff and management.

3. Incident Analysis

From the incidence sequence of events and parameter transients data, input data modifications to an existing plant model approximating the plant in question could be implemented, and attempts to approximate the incidence transient could be made for the purpose of assessing un-measured or un-measurable plant parameters, and to pre-predict suggested courses of action for an on-going incident. From these pre-predictions, a recommended course of action for an on-going incident could be made.

This phase of the AB contribution to the TMI-2 accident evaluation was not initiated on a timely basis due to the lack of accurate and complete information on the accident chronology as was indicated earlier. Implementation of the first step in the proposed upgrading process would obviate this problem, and would place the AB in a position to respond within a few hours, or in one day to accidents such as occurred at TMI-2.

This phase of our support to management in such incidences would necessarily be the most time consuming, and would be limited by computer availability, problem run times, and the number of pre-predictions of possible courses of action.

4. Information Feedback to NRC Site Representatives

Information feedback to NRC site representatives following incidents, or during on-going incidents to assist their assessments and selection of options to follow could be transmitted verbally, and charts and graphics generated by Headquarters facilities could be transmitted by telecopy to equip them with all information available to the staff upon which staff recommendations are made.

B. Long Term Upgrading

The short term upgrading proposed above is considered feasible for implementation in 4 to 6 months as only the information acquisition portion of this phase of upgrading will involve some computer programming and utility information access arrangements.

For a truly adequate information and analytical base for assessing incidents in operating plants, and for recommending courses of action for on-going incidents, a more fully computer based and automated system resembling space-age telecommunications and control systems to a minor extent is required. The principles involved are quite simple as has been outlined in the short term upgrading phase. The principal difference for the long term upgrading will be in the degree of automated data transfer between the site and NRC headquarters, and the use of plant specific models for the analytical portion of the branch support.

The central feature of the proposed system will be the use of a design data base containing all pertinent design data required to rapidly assemble a LOCA or systems transient analysis model. Current plans to develop such a data base in connection with the WRAP system in development at SRL are being formulated for implementation in FY'80, and will be described separately, elsewhere. The basic plan for use of such a data base is to provide the design data source, data handling, and programming to permit a fully automated and balanced plant specific model for analysis of any operating plant or plant in licensing review. Storage of such design data, much of which is common to several plant designs, in a readily retrievable data base such as provided by the JOSHUA system at SRL will permit prompt access for manipulation and development of an analytical model. The self-initialization feature of the WRAP system for PWRs and BWRs will provide the pre-transient steady-state balanced conditions required for transient analyses from any specified initial operating condition.

With a fully automated model assembly procedure, such as planned for WRAP using the JOSHUA system data base, the addition of a sequence of input events from an incident chronology obtained from a plant computer events log would be straight forward, and could be transmitted directly as an input perturbation sequence to WRAP once the plant in question has been identified, initial conditions specified, and the steady-state balance computed. Verification that the automatically assembled model was appropriate and adequate could be evaluated by running a comparison of computed output from the model for the prescribed input events with the measured parameter outputs from the plant which have been transmitted from the site and plotted as in step 2 of the short term upgrade. The comparison should be run in parallel with the model calculations and be displayed on terminal output graphics to provide a running assessment of the automated model adequacy. The comparison will indicate any need for user intervention in changing model parameters to obtain an acceptable comparison, or to fine tuning as it is otherwise known. From such a model and comparison calculations, the basis for assessing possible actions to be taken in on-going incidents such as occurred at TMI-2 could be developed on a timely basis to assist management decisions.

Information transmittal to the NRC representatives at the site could be direct from the computer comparison over to terminal graphics equipment at the site comparable to that at the NRC computer so that simultaneous assessments could be made by staff and site representatives.

The long term concept for providing an upgrading of our support capabilities to NRC management in the event of accidents such as occurred at TMI-2, or for less severe incidents that may be of interest to NRC staff and management is based on existing equipment capabilities much of which is already in place or planned for the near future.

One significant feature of the short and long term proposals described above is the staff dependence on DOE Laboratory computers which is considered to be the primary weak link in the entire process. This weakness stems from difficulties in computer access on a high priority basis when needed for NRC work on DOE machines, the need for two staffs, NRC and DOE Labs, to be involved when output results are needed on an expeditious basis, and the need for output data transmission to two terminals, NRC headquarters and the plant site from a DOE location when management decisions are needed promptly. For a viable rapid response capability such as is needed when plant accidents or incidents occur, the availability of an in-house computer main-frame capable of performing all our analytical studies under staff guidance

and control is almost mandatory, and is strongly recommended for proper implementation of this entire support capability.

Many more details of the support schemes, short and long term, are needed to completely describe each plan, but the general outlines are presented in the foregoing discussion, and will be described more fully if this proposed plan is of further interest.

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