GPU Service

GPU Service Corporation
100 Interpace Parkway
Parsippany, New Jersey 07054
201 263-6500
TELEX 136-482
Writer's Direct Dial Number:
File: 1201.16

October 13, 1980
E&L-2882

Mr. R. W. Froelich
Division of Human Factors Safety
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Froelich:

Enclosed herewith are the comments regarding NUREG-1580, Human Engineering Guide to Control Room Evaluation, submitted on behalf of the Pennslyvania Electric Company ("PENELEC") and Metropolitan Edison Company ("MET-ED"), both of Pennsylvania; Jersey Central Power & Light Company ("JCP&L") of New Jersey and GPU Service Corporation. The four companies are subsidiaries of General Public Utilities Corporation ("GPU"), a holding company which is registered under the Public Utilities Holding Company Act of 1935. GPU appreciates the NRC's allowance for accepting comments submitted beyond the commenting date.

The Human Engineering Guide to Control Room Evaluation is a well written and researched evaluation aid. The draft has many strengths and some weaknesses that may prevent optimal use in control room evaluation. Therefore, GPU submits general and specific comments to assist in the further development of the Human Engineering Guide.

If you have any questions or comments on the issues we have raised, please feel free to contact us.

Very truly yours,

T. E. Tipton
Manager, Licensing and
Regulatory Affairs

TET:bjo
Enclosure

X150
S.1

8010200414

General Comments:

1. NUREG/CR-1580 does not emphasize the importance of assessment of operator needs. It is important in any human factors evaluation that the needs of the operator, control room or otherwise, be known if proper study and evaluation are to be done. In particular, operator needs for stressful situations must be carefully assessed. In the final analysis, those items determined essential to optimum performance must be present in the control room, while those of no benefit to the operator should be eliminated.

   One extremely useful tool in the assessment of operator needs is task analysis. Task analysis should be used to determine the needs and actions of the operator for stressful and complex situations. Task analysis should not be used for those situations where it would extract little relevant information. Other tools, such as link analysis, scanning time determination and sampling frequency determination, should be considered for situations where task analysis is not practical and/or beneficial. The use of other analytical tools to augment task analysis for those situations where task analysis applies should be considered.

2. The stability of a system is dependent upon the amount of feedback the system receives from its component parts. In the example of functions in planning process (Figure 2-2, Page 9), no means for feedback is provided from any of the systems components. The example shows no feedback from any of its components, a violation of a basic human factors principle.

   Feedback in control room evaluations should come in the form of reevaluation of any proposed changes or backfits. Only by going through the same evaluation process with the proposed change, that was done with the original, can the impact of the change and its acceptance be determined. The evaluation of the proposed change should occur throughout the development of the backfit or alternative backfits. Evaluation or alternative changes on a mock-up can lead to the production and selection of the backfit that is of optimum aid to the operator.

   Feedback is essential in determining whether the implementation of a design change or modification on one system drastically effects the operator's use of another system. Very few systems or system components in a control room are independent of all other systems and their components in the control room. Most systems or components interact with other systems and components, making the implementation of all backfits difficult. A change that might appear to be beneficial for a particular component or system might actually be detrimental to the overall system or control room. Feedback must be obtained before any backfit is implemented to insure that the backfit does not cause more problems in terms of conflicts with other systems and components that it solves.

3. Human factors evaluations of the control room should not be a one-time program. Ongoing control room reviews are essential if future modifications to the control room are going to be of optimal use to the operator. Every change made to a control room in its lifetime should be evaluated to insure

that it contains good human factors principles. Integration of the control room review process with the design process would help prevent implementation of design modifications detrimental to operator performance. NUREG/CR-1580 needs to address the organization and process by which ongoing evaluations are conducted.

4. The appendices, and in particular the Human Engineering Guidelines, are neither clear nor concise. The Guide's attempt at being comprehensive and covering all aspects of control room design is commendable; however, the inclusion of superfluous information in the name of completeness makes use of the appendices difficult. Such items as desk and chair dimensions are unnecessary and should be removed. While all the material in the Human Engineering Guidelines is important, much of it is not needed for the purpose and scope of NUREG/CR-1580, and all of it has been documented elsewhere. It might be beneficial to test the Guidelines for their usability and restructure them if they are found to be difficult to use.

5. The use of walk-throughs as structured according to NUREG/CR-1580 may not be of optimum benefit in control room evaluations. Structured, videotaped walk-throughs in a simulator may result in data that is expensive, narrow in scope, and lacking in operator feedback.

   The best time for finding out about operator difficulties with a system is when he is using the system. It is important that the operator can give feedback about a systems problem at the time he encounters the problem. It is for that reason that talk-throughs, as opposed to walk-throughs, appear to be more desirable. In a talk-through, the system and procedure of interest is "talked through" with the operator, using full-scale mock-up of the control room. Problems with the instrumentation and procedures are discovered immediately. Poor designs and/or procedures which the operator has taken for granted as being good are quickly isolated by the examiner. The interactive nature of the talk-through allows for immediate feedback from the operator on any problem he is having with the system.

   Using a full scale mock-up of the control room instead of a simulator or the actual control room has many advantages when using talk-throughs in control room evaluation. The mock-up is always available, tests and evaluations are not restricted by access schedules to the control room or simulator. Proposed backfits can be installed in a mock-up, allowing for the evaluation of the backfit and the eliciting of operator comments before the backfit is implemented. The cost of a mock-up is small compared to that of a simulator, and yet, transference and acceptance appear to be high using a mock-up. While a mock-up lacks the realism of a simulator or the actual control room, it seems to be a useful tool in control room evaluations. We feel that NUREG/CR-1580 needs to address the use of a mock-up in control room evaluations, including where and when it is appropriate to use a mock-up and where and when it is not appropriate to use a mock-up.

   We feel the use of videotape in control room evaluations should be reserved for real transients. The use of videotape for walk-throughs may not result in obtaining relevant information, but only documentation of the walk-through.

The placement of a videotape camera in the control room, to be activated at the start of a transient, may be a better use for videotaping than using it for walk-throughs. If talk-throughs are used in place of walk-throughs, videotaping would provide little additional information.

6. The order of data collection as proposed by NUREG/CR-1580 may result in a lack of adequate operator feedback or insufficient operator feedback. The review of generic problems is the obvious place to start collecting data, allowing the examiners to become familiar with control room human factors deficiencies. The use of operator interviews and surveys, which are basically ways of obtaining operator feedback, may result in more relevant information if done later in the evaluation process. The operator may not be properly sensitized to what the control room evaluation is attempting to do to give adequate and sufficient feedback. It would seem better to follow the review of generic problems with a checklist technique, to further familiarize the examining team with the specifics of the plant and to help pinpoint some of the obvious human factors trouble spots. Following the checklists with procedural talk-throughs, which are basically a combination of an interview and a walk-through, would allow for meaningful examiner-operator interaction and could make the operator aware and sensitive to the goals and purpose of the evaluation. The use of a survey after the talk-through might elicit information that, had the operator not recently performed a given procedure, might have been difficult for the operator to remember and/or convey to the examiner.

7. The preparation and use of the HED's may result in an amount of clerical work uncalled for in a control room evaluation. Proper documentation is important, as is determination of human engineering discrepancies; however, the vast majority of human engineering discrepancies in a control room probably would not require the amount of documentation suggested in NUREG/CR-1580.

   The important result of a control room review is to identify and correct human factors deficiencies in the control room. The extent to which documentation (HED reports) aids in determination and correction of human engineering discrepancies is the extent to which the documentation should be used.

   The important items to be documented are what was the discrepancy, where was it located, what were the alternative backfits, why was a particular backfit chosen, when will the backfit be implemented, and why will it be implemented at that time.

Specific Comments:

1. The availability of a human factor data base is essential for control room evaluations, but it should be compiled on an industry-wide basis and not by each company (Page 7, 2.2).

2. The format of Appendix IC should be changed. The use of reference numbers is overdone, making use of the appendix difficult.

3. The discussion in NUREG/CR-1580 on how to photograph the control room (Page 20, 2.5.7) is far too detailed and specific.

4. The criteria for audible alarms (AD-25), which states that alarms be 20dB over background, may be inaccurate. The figure of 20dB over background is for environments with high background noise. The background noise of a particular control room may not be high enough to warrant an alarm 20dB higher than background. The ability to detect the alarm, besides being a function of the amplitude and background noise, is also a function of the signal frequency of the alarm. The signal frequency must be accounted for when determining the amplitude of the alarm signal.

5. The human engineering guideline dealing with keyboard arrangement (CON-79) uses inaccurate information. The study by Conrad and Hill, which was referenced in McCormick (1976), dealt with telephone keyboards that are the same as today's calculator keyboards. The Conrad and Hill study did not use modern telephone keyboard arrangement and also used housewives as the subjects. It is premature to say that the best keyboard arrangement is the one starting with #1 in the top left and ending with #9 in the bottom right. The conclusion that might be drawn from the Conrad and Hill study, and the conclusion McCormick does draw, is that the numerical entry keyboard digits should increase from left to right. The starting point of top left or bottom left needs to be studied further.

6. NUREG/CR-1580 recommends the use of the military standard for color coding, red for abnormal and green for normal (VD-106). This is in direct contradiction of current color conventions in the nuclear power industry. A "green board" would be almost impossible to attain without extremely sophisticated logic added to the system. We feel that it would be better to continue with the current color convention, red for active and green for inactive, since a "green board" would be difficult to obtain and the operators are comfortable with the current convention.