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VICE PRESIDENT
STEAM PRODUCTION

September 29, 1980



Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Director, Division of Human Factors Safety

Subject: U.S. Nuclear Regulatory Commission
"Availability of Draft Human Engineering
Guide to Control Room Evaluation"
Duke Power Company Comments

Reference: (1) Federal Register, August 20, 1980, Vol. 45, No. 163 pg. 5551
(2) NRC Letter of August 5, 1980, extending comment date.

Mr. Secretary:

Duke Power Company offers the following general comments concerning NUREG-CR-1580.

We concur with the intent of Volume 1 of CR-1580 in that a systematic and organized methodology should be incorporated into the control room reviews. However, we call attention to the fact that the organization and procedures of CR-1580 are only one of many possible approaches to the control room review process. There are probably many other very effective review teams and approaches depending upon the individual utilities expertise and needs. In the interest of more effective control room reviews, we urge that such diversity be encouraged.

Significant portions of the experienced industry manpower is now being utilized in response to many of the new regulatory requirements following Three Mile Island. Consequently, there is not sufficient experienced manpower in the industry to perform human factors reviews on both operating and near term plants. We feel that the industry human factors response should proceed as expeditiously as possible, but our concern is that there is insufficient manpower to attack the human factors improvements on all fronts. We suggest that the more fertile ground for significant human factors improvements be directed toward the implementation of the Emergency Facility (SPDS, EOF, TSC) as outlined in draft NUREG-0696 and a detailed identification of parameters to be monitored in these facilities as enumerated in Reg. Guide 1.97 and the AIF/Industry work. We are concerned that the efforts toward the emergency facilities have not sufficiently addressed human factors considerations and would welcome a cooperative effort to insure these facilities are implemented in accordance with sound human factors principles.

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We concur with most of the human factors guidelines enumerated in Volume 2 of CR-1580. These guidelines appear to be selected excerpts from some well established human factors standards and texts. There appear to be some errors in the guidelines, however, and some of these are enumerated in the enclosed specific comments.

share the opinion expressed in the foreword to CR-1580 in that "... hardware or procedures that fail to meet one or more of the guidelines are not necessarily in violation of NRC criteria or regulation." It is our position, however, that Volume 2 provides insufficient guidance such that industry can establish acceptable criteria that may be applied to:

- a. validate the improvement and validity of changes, and
- b. provide a common basis of understanding by which industry and the NRC can agree on the adequacy and sufficiency of control room improvements.

Thus, Volume 2 gives very detailed guidance with regard to some selected human factors considerations, but fails to provide any guidance and acceptance criteria by which the total impact of potential and actual modifications may be judged. It would be most difficult to arrive at a specific set of acceptance criteria; however, we do feel that each utility should put together an independent review team for assessing the improvements in human factors changes to each control room.

It is noted that the individual checklists are not included in CR-1580 and we would encourage their early issuance by the NRC prior to the industry reviews. These checklists could potentially be of great value in expediting the planning, organization, and review by each utility.

In summary, we feel that CR-1580 does not adequately provide the guidance needed by the individual utilities for the human factors review of existing control rooms. We feel the document fails to address the most important area of acceptance criteria and further is less than complete in the selection of specific human factors guidelines. If CR-1580 is applied in its current form, we do not feel that sufficient experienced industry manpower is available to simultaneously address the human factors review of operating stations and facilities under design in addition to the incorporation of emergency facilities in all stations. The most fertile ground for industry and NRC focus appears to be in the implementation of the emergency facility.

Attached are more specific comments we offer for your consideration.

Very truly yours,

William O. Parker, Jr.
William O. Parker, Jr. *by WAH*

RFJ/sch
Attachments

Secretary of the Commission
September 29, 1980
Page Three

bcc: H. B. Tucker
W. A. Coley
K. S. Canady
N. A. Rutherford
M. J. Gavioli
L. E. Schmid
Master File GS-811.10

C. J. Wylie (DE)
T. C. McMeekin (DE)
R. S. Darke (DE)
Section File GS-801.01
Section File GS-811.10
Master File GS-801.01

Comments on NUREG/CR-1580
Human Engineering Guide to Control Room Evaluation

PREFACE:

The preface states that additional changes and modifications and revisions are planned and that the format will be revised to simplify application (page iv). Additional opportunity for public comment should be made available following such changes and prior to publication.

1. GENERAL

- (1) The evaluation process outlined in Part I is normal Project Management textbook material modified to some specifics of nuclear control room review. However, it is not particularly applicable or practical in today's utility environment. As structured, and if followed literally, it places a great need on resources and personnel that just are not available. The character of the resources unique to each utility should structure the review organization and procedure.
- (2) The guide is a collection of existing references with no direct or suggested assistance explicitly for nuclear generating stations. No apparent effort is made to recognize the complexity of a nuclear plant as it relates to the volume of instrumentation and control devices or the interactions between fluid systems in normal or emergency procedures. This fact significantly affects the validity of many of the references used.

- (3) This guide can only be considered as one approach to a review process that is dedicated to minimizing human error and improving safety - there are other acceptable techniques. But this guide does not address the ultimate requirements of acceptance and/or performance criteria nor the interaction of semantic details with such things as operator training and maintenance operations. In other words the problem of human error should not be restricted to specific control room design details in isolation.
- (4) Acceptance criteria cannot be practically derived from such subjective guides. The only reasonable approach is to establish performance requirements based on experience in the appropriate environment, and resulting from joint industry - NRC effort.
- (5) The specified review process implies that a collection of "HED's" can be individually processed and corrected. Because of interactions as mentioned above, this is not the case. Review of related factors must be carried out in order to optimize the design. This is implied in Part I, Section 6.0 "Implementation" but the details of the guidelines and the lack of performance criteria do not support this claim.
- (6) Subparagraph C of Section 6.0 implies that the review report and evaluation of the entire control room is subject to this guide. This should be modified to be compatible with the third paragraph of the Forward which states that only where operator performance of a safety-related task could be jeopardized should the hardware or procedure problem be considered serious.

- (7) While the detailed guidelines are in most cases very specific, the absence of performance criteria makes it exceedingly difficult to substantiate the proposed "Human Errors" on the basis of the safety significance of such errors or the appropriateness of a proposed backfit.
- (8) Backfits and implementation thereof must be justified and properly completed to realize any benefits from this overall program. Yet there appears to be no "verification" or validation procedures to insure that the changes that are made do indeed accomplish what they are supposed to do.
- (9) Lastly, there is no apparent recognition that the specified guides are established for the review of existing control room designs rather than standards for new designs. Therein lies the importance and significance of acceptance and performance criteria.

II. SPECIFIC

Examples of comments on specific guideline items contributing to the above general comments, are listed below.

- (1) Workspace Arrangement, WA-8 "Shelf Dimensions"; and WA-16, "Desks"; are examples of guidelines that do not seem germane to this document. Not all dimensional requirements are clear - witness paragraph No. 3 and 4 under W-28 "Wrap-around consoles", (WA33) "Storage Space"; is an example of a guideline that by itself; is not applicable: - Maintenance personnel material storage should not be provided on Nuclear Power plant consoles or even in the immediate work space area of the control room.
- (2) Control Room Environment, CRE-1 "Comfort Zone"; For consistency in use of guidelines the term "head level" should be changed to a specific value - e.g. "60 inches from the floor". CRE-15 "Ventilation"; should specify that "outside air for ventilation purposes shall be introduced into the control room at a minimum rate of 20 cubic feet per minute per man" and "Air velocity past the man, measured 30" to 60" above the floor". CRE-3 "Glare"; some qualification should be included in the guidelines such as item 2. "When positioned less than 60° from the viewers line of sight, light sources shall be adequately shielded. For item 6 of CRE-3, the use of non-glare instrument covers should be included. CRE-10, "Illumination"; the footnote to the table should allow an exception where back lighted scales or self-illuminated indicating lights would require less light for proper contrast.

- (3) Visual Displays. Topics defined in groups (e.g. 1-General guidelines, 2- Design of A/N displays, 3- Meters, 4- Warning and caution displays, 5- CRT's, etc.) would help minimize error of usage of these guidelines, be easier to use, and help maintain consistency - all human factors in themselves. Similarly, figures should be adequately labeled and referred to in the text, to avoid confusion. Explanations of normal operator positions and the changeability of these positions must be adequately explained in order to qualify the requirements for the "normal line of sight". Some guidelines imply that the operator is in a fixed position - as a pilot in a cockpit-, but this is not the case in a nuclear plant control room. In VD-2, the avoidance of redundancy is contradictory to certain Nuclear Power regulatory requirements. Reading Distances in VD-32 are inconsistent. Zone marking (VD-74,75) on indicator window rather than the scale should recognize dangers of parallax. The different flash rate ranges in VD-95 can be confusing when established as guidelines.
- (4) Auditory Displays. Correlation of function and purpose of auditory signals with visual displays/controls does not appear to be discussed and confusion between the various individual guidelines for auditory displays can exist without further qualification. Multiplicity of usages plus

the high number of alarm "points" in a nuclear plant requires some guideline for codifying audible displays if the specific singular guidelines are to be useful. Required levels of audible alarms (AD-23) are excessively high and should relate better to experience as well as frequency discrimination.

- (5) Controls. The anomalies of Primary control location, control location and arrangement, control functional grouping and sequence grouping are not addressed together on a system or operating mode basis. Nor are they addressed with respect to whether or not the controls are the proper ones to have in order to perform specified tasks. These items are all greatly interactive. Specific details of controls, knobs, levers, etc. are many times out of the realm of the control room designer (equipment design) and direction of movement convention is sometimes open to logical and human-factor-related disagreement - depending on the equipment being controlled, and the equipment-related terminology (e.g. - circuit breakers, Open/Close versus Valve-Open/Close).
- (6) Control/Display Integration. (CDI-4) "Different Planes"; The figures do not appear to be consistent with other conventions, depending on how the devices may be mounted. (CDI-9) "Principles of Control/Display Arrangement" does not address the conflict between "Sequence-of-use" and "Frequency of Use" principles nor the conflict between "Functional" and "Importance" principle. - These conflicts are frequently present in the complexity of nuclear plants.

- Also, no guidelines appear to provide any guidance on acceptable variations in principle - e.g. mirror-image.
- (7) Operator/Computer Interface (OCI-1) "Data Presentation" guidelines are unnecessarily detailed and restrictive - and in some cases inconsistent with some overall System display concepts or needs - e.g. on Item 12, abbreviations, contractions or shortened forms cannot be avoided and on Item 15, the requirement may easily cause confusion and requires unnecessary duplication. Graphics requirements, OCI-7, are not clear. (OCI-10) "Feedback" is unnecessarily restrictive on Item 2, initial acknowledgement should suffice, periodic feedback may not be necessary or possible. "Typical Backfits" on all items include "Rewrite Software", which is an enormous oversimplification and does not, for instance, provide the means for correcting a terminal output speed (OCI-14, Item 5). (OCI-19) "Error Messages", cannot always, and in some cases should not contain instructions to the operator - depending on the situation. - Computer system errors vs plant operating errors". (OCI-22) "Command Language", again unnecessarily restricts the use of abbreviations. In general, a great deal of generalities exist on Command Language, etc. but no serious effort is made to qualify the use of the computer system as a tool for the Plant operator - computer details should be as "transparent" as possible to the plant operator.

- (8) Performance Aids. This section appears to be restricted to labeling - why not call it that.
- (9) Communications. The technical requirements on system characteristics, reception, dynamic range microphones, receiver characteristics, etc. - appear to be unnecessarily restrictive as far as commercially - available, and currently used and proven equipment is concerned.

III. CONCLUSION

The "Evaluation Process" portion of the guidelines contains some academically useful examples of procedures, formats, suggestions, which if they were followed to conclusion, might be helpful, but the actual Human Engineering Guidelines seem to be a group of separate rules that preclude the use of judgment and applicability to the complexities of a nuclear plant. Lack of acceptance or performance criteria is a serious omission. Human error statements in many cases appear to be contrived justification for the guideline and backfit methods are in most cases simple minded statements with no thought as to time, cost, availability or impact on the net result - on retaining, reliability, etc., or as to optional considerations.

No thought has apparently been given to anything except a one-on-one evaluation of potential error, and no consideration of secondary sources of information as back-up or confirmation of primary sources, has been included. The total problem of human error goes far beyond consideration of the original design. Reevaluation of it cannot safely be left to singular point-by-point design deficiency corrections.

Duke Power Comments
NUREG CR-1580
Attachment 2

The following inconsistencies are presented for your consideration.

Section

Visual Displays - Recommended Flash Rate is given as:

<u>Page</u>	<u>Flash Rate</u>
VD 95	1-10 per sec
VD 99	3-10 per sec
VD 109	1-5 per sec

Which is correct (VD 109 1-5 per sec is preferred).

Auditory Signals - Recommended volume above threshold is given as:

<u>Page</u>	
AD 4	50 db above threshold
AD 14	30 db above threshold
AD 23	20 db above threshold

Which is correct (we had to adjust our volume at McGuire to 7-9 db above threshold).