UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

July 11, 1979

MEMORANDUM FOR: Bill Johnson, Group #2
Bill Parler, Group #1

FROM: C. O. Miller

SUBJECT: HUMAN FACTORS QUESTIONS FOR NRC PERSONNEL

When preparing suggested interview questions for Group #1 (reference my memo to Mr. Parler dtd 11 July 79), several human factors questions came to mind which can best be addressed to NRC personnel. Since I have little feeling as to whom such questions should be addressed, nor am I certain which would fall within the purview of Group 1 rather than Group 2, I submit the attached list for your joint consideration.

I would be pleased to explain them further and, of course, would welcome the opportunity to participate in the interviews when appropriate.

C. O. Miller

Enclosure:
As stated

cc: E. K. Cornell
R. DeYoung
R. Haynes

Human Factors Questions for NRC Personnel

1. Is it true that no one among the technical staff of NRC is a trained or experienced human factors specialist? If so, why so? If not, in what organizational segments can they be found and what are examples of their outputs?

2. Several documents indicated shortcomings in NRC's attention to human error in commercial nuclear power reactors. They include:

WASH 1400	Oct. 75
EPRI Study, NP-309	Nov. 76
Aerospace Corp. Study for NRC	Feb. 77
Lewis Report, NUREG CR/0400	Sept. 78

   What was the full scope of NRC's attention to these criticisms?

3. A few examples have been encountered where some relatively recent effort towards human error elimination has been undertaken:

   1. As noted in the NRC 1978 Annual Report, p. 198:

      "Human Factors

      Research on human factors is directed toward assessing the role of human errors in reactor safety and to the study of means by which they can be reduced. In 1978, training programs for use by NRC's Office of Inspection and Enforcement were initiated. A study also was initiated to assist in setting safety-related criteria for operator actions in nuclear power plants."

   2. As noted in the EPRI Report (supra) at p. 2-4, an NRC Standardized Review Plan provided human factors guidance, as did NRC Regulatory Guide 1.114 dated Feb. 1976.

   3. Again as noted in the EPRI report at p. 2-4 and 2-5, a "Guide for the Design of Display and Control Facilities for Central Control Rooms of Nuclear Generating Stations" was underway presumably under EPRI committee sponsorship.

The question is how far had these efforts progressed at the time of the TMI accident and to what extent have they been coordinated?

(Note: The EPRI report provides a summary of efforts going back to 1960 which describe the continuing deficient nature of power plant control centers from a human factors engineering point of view. See pp. 2-1 thru 2-5.)

4. In November 1974, the ACRS requested the NRC staff give attention to the evaluation of safety systems from a multi-disciplinary point of view since "designers did not assure that redundancy and independence of safety systems were provided..." This was identified as an Unresolved Safety Issue (A-17) in NUREG-0510 and reported also in the 1978 Annual Report (p. 31). A contract was let to SANDIA Labs "to identify areas where interactions are possible between and among systems and have the potential of negating or seriously degrading the performance of the safety functions." It had a Phase I target date of completion of Sept. 1979.

   The question arises has this effort recognized that human operators are, in fact, one of the safety systems and their performance -- their interactions -- are precisely what TMI was all about?

   A corollary question is why, in view of past reported human factors/ human engineering difficulties, the "Unresolved Safety Issues" are totally hardware oriented? Issue A-17 read literally as presented in NRC documents does not include human involvement.

5. Part of the NRR Lessons Learned Task Force inquiry involved Man-Machine factors being studied by Leo Beltracchi. What were his findings and to what extent is action contemplated resulting therefrom?

6. Regarding the training issue, where in NRC can be found personnel with training program development background or experience sufficient to delineate requirements and/or evaluate the utility's response to such a requirement? To what extent do NRC personnel personally observe and critique the training as conducted by the utilities?

From Memo of 7/11/79 "Questions for Met Ed ..."

CONTROL ROOM DESIGN

1. Regarding the original requirements that led to the TMI-2 control room configuration including the design of the controls and displays:

   a. What were they and how were they documented?

   b. Which person or organizational segment had responsibility to respond to those requirements?

   c. At that time, were any members of your staff qualified in the so-called "human factors" or "human engineering" field? If so, please identify them and their background or experience.

   d. To what extent was the TMI-2 instrumentation and displays merely a derivative of TMI-1 or prior plants?

2. Regarding the design procedures followed for the control room for TMI-2:

   a. During what calendar time period was this accomplished?

   b. Were any task analyses performed? If so,

   c. Were they ever plotted on a time line basis?

   d. Were they ever subsequently evaluated in mockups, simulators or in an actual plant?

   e. What human engineering references were used to establish the physical layout of controls and displays.

3. Regarding maintenance of plant/reactor equipment and systems:

   a. Was a maintenance task analysis ever performed? If so,

   b. To what extent was the design of the control room, including displays and controls, integrated with required system or equipment maintenance tasks?

   c. Which organizational segment had the responsibility to integrate the procedures relating maintenance and control room operation?

   d. Did simulations, shakedown procedures or training exercises ever include equipment failures or system abnormalities caused by maintenance error? If so, please describe.

4. After the incident in which a PORV stuck open, who decided the position of the valve should be portrayed on the panel based upon power to the solenoid? Furthermore:

   a. What was his position and background?

   b. What rationale did he use for such an engineering change?

5. Was any system available to the control room operators to report deficiencies in displays or controls? If so,

   a. How was that system to function?

   b. Was it ever used? Examples?

SELECTION/TRAINING

1. Regarding requirements for control room operators:

   a. When were such requirements first documented in the design process?

   b. Who made the decision on the number and required qualification of operators?

   c. What was the basis for that decision?

   d. What was the role of the operator to be vis-a-vis automatic operation of the reactor and plant systems?

2. Regarding selection of operators:

   a. What was their job description?

   b. What procedures were followed in the selection process? (Including testing?).

   c. What were minimum requirements for consideration as an operator?... Documented?

   d. What difficulties were encountered in acquiring operator candidates?

3. Regarding the training program:

   a. To what extent were specific behavioral objectives applicable to control operators determined and documented during the design process?

   b. Same as (a) except as applicable to maintenance personnel.

   c. Was a specific training specialist or department assigned to develop and implement the training program? If so,

   d. What were the backgroundsof these training personnel?

   e. What training curriculum was followed for control room operators?

   f. What training curriculum was followed for maintenance personnel?

   g. What emergency training was effected? (e.g., unannounced quizzes, simulations).

h. To what extent were personnel encouraged to expand their knowledge of nuclear reactor safety beyond company training programs?

i. To what extent was safety awareness a specific part of the training effort?

j. What safety engineering or safety management courses were given by the company or otherwise authorized by them for attendance by their personnel?