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# 1.0 METHODOLOGY

## 1.1 Overview

This report has been prepared in response to NUREG-0737 item 1.D.1 and details the means by which a Detailed Control Room Design Review was conducted for the Turkey Point Units 3 & 4 Nuclear Power Plants owned and operated by the Florida Power & Light Company. The review was conducted using NUREGs-0700 and -0801, and spanned the period from July 1981 to July 1983.

The review was conducted in four phases, as follows:

Phase 1 - Project Planning.

- o Preparation of a review planning document which discusses
  - Review methodologies
  - Review documentation
  - Status, personnel qualifications, and project organization
  - Assessment and prioritization of discrepancies
  - Reporting (findings, assessment, and schedules).

Phase 2 - Control Room Review. This represents the period in which data collection, reduction, and analysis was conducted, resulting in Human Engineering Discrepancy reports and draft reports.

Phase 3 - Enhancement & Design Solutions. Human Engineering Discrepancies were collated, alternate enhancements and design solutions were generated, and the results were considered in trade-offs.

Phase 4 - Reporting. Backfit schedules and Detailed Control Room Design Review results will be provided to the Nuclear Regulatory Commission.

Figure 1-1 shows, in general, the phases and task flow for the Detailed Control Room Design Review. A brief discussion of the activities conducted in each phase of the review follows this figure. The Detailed Control Room Design Review was conducted using the NUREG-0700 guidelines. Planning, staffing, technical approach, and prioritization were conducted in accordance with the guidelines as stated in NUREG-0700.

The present Detailed Control Room Design Review report closely follows the outline recommended in Section 5.2 of NUREG-0700. Specifically, this final report discusses:

- o The Detailed Control Room Design Review phases
- o The technical activities
  - review of operating experience
  - assembly of control room documentation
  - system/function/task analysis
  - conduct of control room surveys
  - verification of task performance capability
  - validation of control room functions

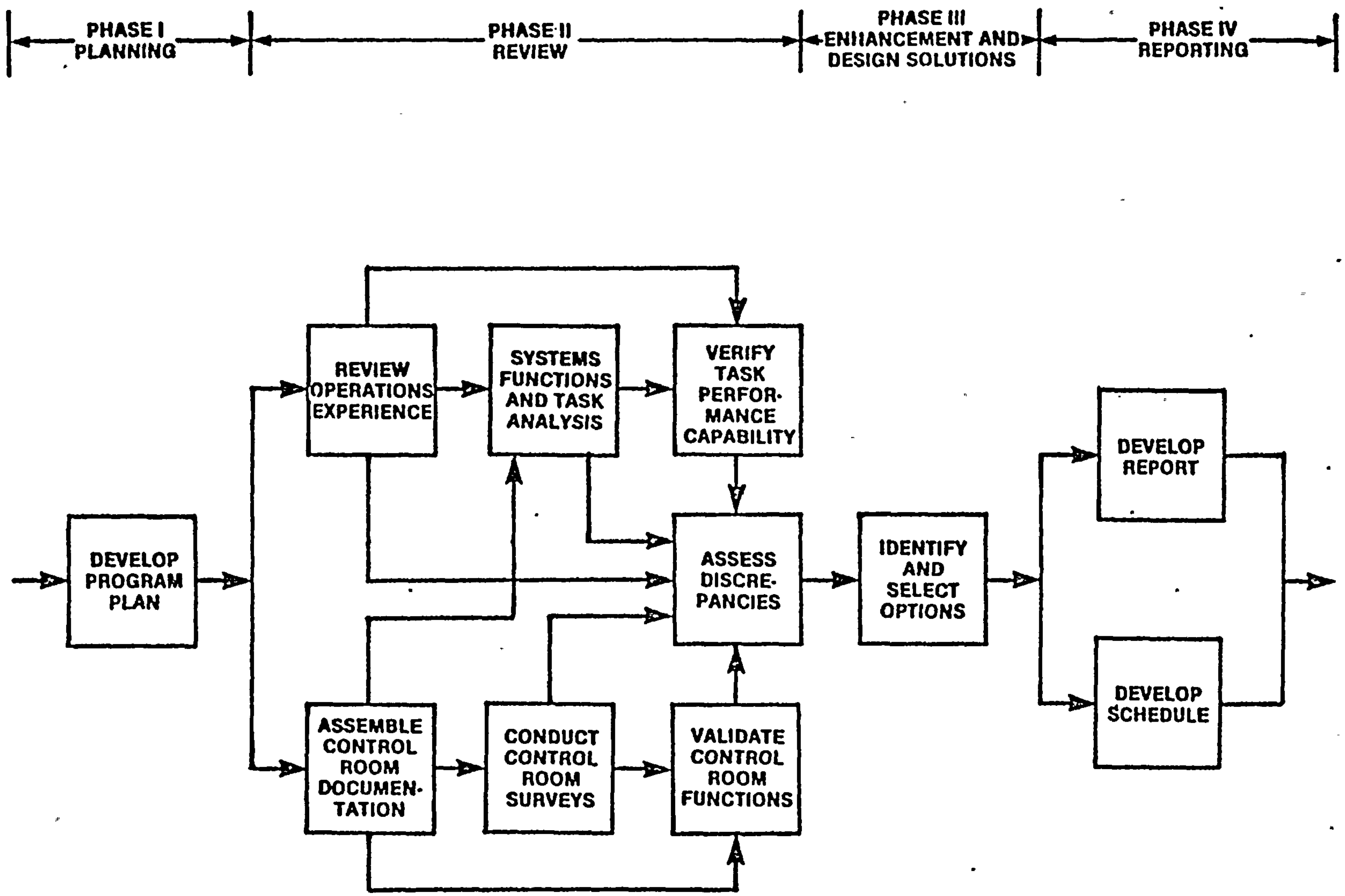



**FIGURE 1-1**

**THE FOUR PHASES AND THE TASK FLOW RELATIONSHIP OF THE CR REVIEW**

[illegible]

[illegible]

- Method of assessment of discrepancies
- Method of identification and selection of enhancement and design solutions
- Review results of Human Engineering Discrepancies, Human Engineering Discrepancy Assessment, and the selected enhancement and design solutions will be organized into the following groups:
  - survey findings (annunciator, communications, etc.)
  - task analysis findings (panel/workspace)
  - human factors engineering suitability and validation of functions findings (control room traffic, workload distribution, and man/machine functional allocations)
- Improvements to be made
  - enhancements/justification/extent of correction
  - design alternative/justification/extent of correction
- Schedule of implementation.

## 1.2 Review Procedures

This section presents, in general terms, the review procedures employed. In Section 2.0, Findings, detailed descriptions of the procedures employed, and results of each, are presented.

### 1.2.1 Phase 2 — Control Room Review

The Control Room Review phase was subdivided into six subtasks as follows:

- o Review of Operating Experience
- o Assemble Control Room Documentation
- o Review of System Functions and Task Analysis
- o Control Room Surveys
- o Verify Task Performance Capability
- o Validate Control Room Functions.

1.2.1.1 Review of Operating Experience — This task was composed of two subtasks: 1) conduct of operator interviews, and 2) review of plant operational experience through Licensee Event Reports, technical specification modifications, etc. This review task was conducted in accordance with the guidelines of NUREG-0700 published September 1981.

1.2.1.2 Assemble Control Room Documentation — In this task, a control room data base was established to support subsequent evaluation. A library was established with control room related documentation (technical specifications, drawings, etc.), control room components were photo-documented, and a 1/3 scale photomosaic was constructed. The library and photo-documentation were centrally located to support the effort. In addition to the library and photographic documentation; a control room inventory of components was developed, identifying for each component, its location, system relationships, functions, and characteristics. Inventory data has been filed for subsequent use.

1.2.1.3 Conduct Control Room Surveys — Much of the detailed assessment of the control room was conducted via surveys. Surveys required the collection of data using preconstructed checklists and interview forms, and the taking of direct measurements of control room parameters such as noise levels, light levels, etc. The survey criteria are presented in Appendix A. For each survey, a draft report (summarizing Human Engineering Discrepancies) was prepared for subsequent inclusion into the present final report. The surveys conducted were:

- o Noise — direct measurements of noise levels were taken and compared to individual checklists items.

- o Lighting — measurements were taken under various conditions (e.g., normal and emergency lighting) and compared to individual NUREG-0700 items.

- o Control Room Environment — assessments were made by direct measurement of the parameters listed below and by comparison to the data in the NUREG-0700 guidelines.
  - temperature
  - humidity
  - ventilation
  - workspace arrangement
  - document organization, use, and storage
  - control room access

- o Design Conventions — evaluations by survey for the conventions listed below. The data was subsequently compared to NUREG-0700 guidelines.
  - coding methods (color, shape, pattern, etc.)
  - standardization of abbreviations and acronyms
  - consistency of control use
  - consistency of display movement or indication

- o Controls — checklist evaluation of controls.

- o Displays — checklist evaluation of displays.

- o Computers — checklist evaluation of computer systems.

- o Emergency Garments — data were collected by walk-throughs, use of emergency garments, speech intelligibility analysis, and checklist application.

- o Labeling — checklist evaluation of labels.

- o Annunciators — checklist evaluation of annunciator systems;, direct measurement of annunciator fonts, signal intensities, etc.

- o Anthropometrics — analysis of reach and visual access to control room components given physical configuration of boards, panels, layout, etc. The data was subsequently compared to checklist item requirements.

- o Force/Torque — where indicated by operator observation, force/torque information for control types were collected for comparison to checklist items.

- o Communications — checklist evaluation of communications systems; speech intelligibility analysis of communications modes

- o Maintainability — checklist and questionnaire data concerning operator-maintained components (trend recorders, bulbs, etc.).

1.2.1.4 Review of System Functions and Task Analysis (SFTA) — System functions and tasks were identified and evaluated in this task. A 4-step procedure was employed:

- o Identification of systems and subsystems by review of plant documentation

- o Identification of event sequences to undergo Task Analysis. These were identified using:
  - NUREGs-0737, -0660, and -0700
  - results of Operating Experience Review
- o Identification of system/subsystem functions through document review and operator interviews
- o Identification and analysis of control room operational tasks.

Task Analysis data served as an input to the verification of task performance capability and to the validation of control room functions (see paragraphs 1.2.1.5 and 1.2.1.6). The results/products of this task were:

- o Response Selection Diagrams
- o Task analysis of functional sequences
- o Task analysis of event sequences
- o Spatial-Operational Sequence Diagrams of task sequences
- o Traffic Pattern Diagrams.

1.2.1.5 Verify Task Performance Capability — This evaluation task involved two subtasks: 1) verification of instrument/control availability, and 2) verification of human engineering suitability. The first, verification of availability, was conducted using the Task Analysis and Control Room Inventory. In general, tasks associated with control room functions were examined in terms of appropriate instrumentation in the control room (i.e., task equipment demands vs. actual equipment present in the control room). Estimates of the frequency-of-use for all instrumentation were then generated based on the set of procedures examined.

Estimations of nonprocedurally-bound operations (e.g., boration, etc.) were generated via operator interviews. Also task sequences required in selected event sequences were estimated as to frequency of occurrence in the event sequences. Comparing both frequency and requirements data to the inventory, identification was made of: 1) the absence (in the control room) of task-required information or control, 2) the estimated frequency with which the information or control is required, and 3) the conditions (events, procedures, etc.) under which the information or control is required.

The second subtask, verification of human engineering suitability, involved using Spatial-Operational Sequence Diagrams, Traffic Pattern Diagrams, identified functional groups, and checklists to evaluate human engineering suitability in terms of sequence of component use, control/display proximity, and so forth. NUREG-0700 guidelines served as the principal source document for evaluation criteria.

1.2.1.6 Validate Control Room Functions — This task involved analysis of workload and distribution of workload for operators performing specific task and event sequences. Also overall control room traffic ,was analyzed. The means of the analysis were task timelines and traffic analysis.

### 1.3 Documentation and Document Control

Three types of documentation were addressed: 1) reference documentation, 2) process and Human Engineering Discrepancy documentation, and 3) Detailed Control Room Design Review output findings and reports.

#### 1.3.1 Reference Documentation

A program library was established with reference documents to support the Detailed Control Room Design Review tasks. It contains:

- o Licensee Event Reports
- o Outage Analysis Reports
- o Final Safety Analysis Reports
- o Technical specifications and system descriptions
- o Piping and Instrumentation Diagrams
- o Floor plans
- o Panel drawings and photographs
- o Software descriptions
- o Procedures
- o Samples of computer printouts
- o Various Nuclear Regulatory Commission and industry documents bearing on control room design (i.e., NUREGs-0700 and -0660, IEEE specifications and standards, human factors engineering texts, etc.).

As required, this documentation was referenced to support specific tasks within the control room evaluations.

#### 1.3.2 Process Documentation

Data collection and reduction methods were documented for reporting purposes. The general flow of information management is presented in Figure 1-2. Task plans served as the basic process documentation.

#### 1.3.3 Guideline Human Engineering Discrepancy Documentation

Data files for each Human Engineering Discrepancy were generated. For each task requiring a report, file space was reserved for that report. Human Engineering Discrepancy information was stored in a computer file which contained the following information:

- o Guideline number

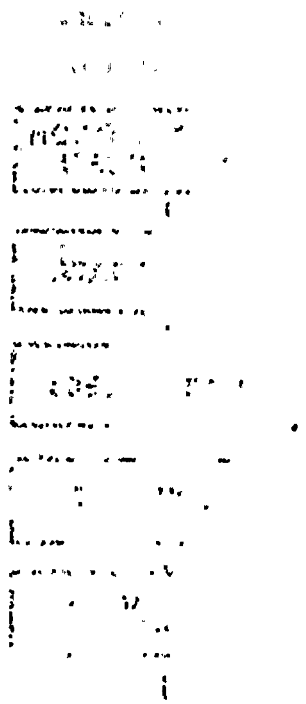
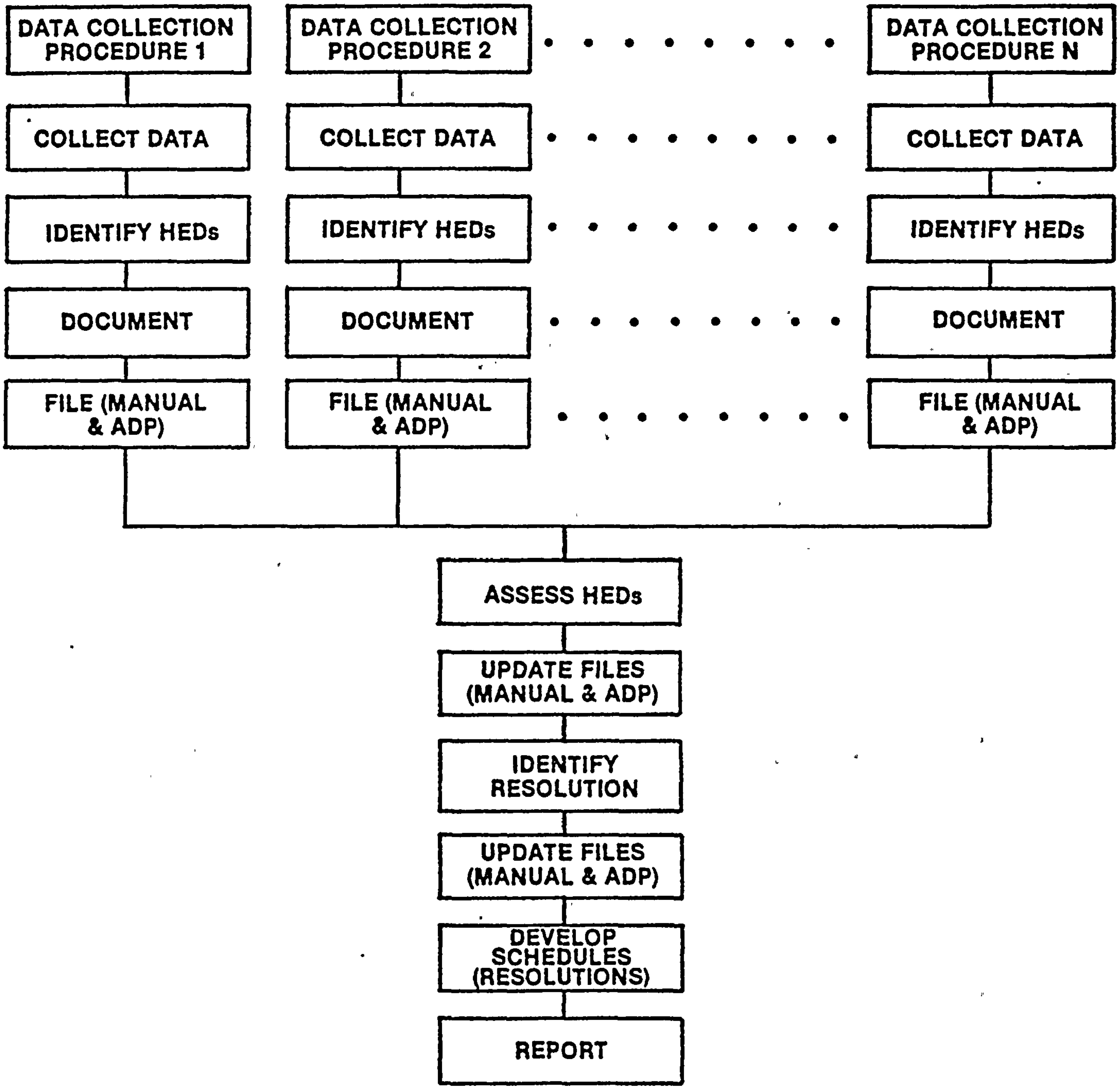


FIGURE 1-2

INFORMATION MANAGEMENT



- o Human Engineering Discrepancy description
- o Human Engineering Discrepancy assessment
- o Human Engineering Discrepancy locations (components which are discrepant from the NUREG-0700 guidelines)
- o Action to be taken on the Human Engineering Discrepancy.

Figure 1-3 presents the Human Engineering Discrepancy form used to document and report findings.

### 1.3.4 Component Human Engineering Discrepancy Reports

A manually maintained file was established which documented, for each component, Human Engineering Discrepancies cited against that component (generic Human Engineering Discrepancies, such as label font, were not recorded on component sheet). In addition, the header for each Component Level Human Engineering Discrepancy contains the following Control Room Inventory information:

- o Panel/workstation
- o Unique location code
- o System relationship
- o Component function and use
- o Component type and characteristics.

The Human Engineering Discrepancies noted against a component are, where appropriate, listed on the bottom of the form by Human Engineering Discrepancy number (which corresponds to a NUREG-0700 guideline number). The Component Level Human Engineering Discrepancy form used is presented in Figure 1-4.

### 1.3.5 Task Reports

For each survey, a separate report section has been generated detailing:

- o Objectives of the survey
- o Actual data collection and analysis methods employed
- o Criteria used as a baseline or guideline for evaluation
- o Summary of findings.

[illegible]

[illegible]

[illegible]

[illegible]

# FIGURE 1-3
# HUMAN ENGINEERING DISCREPANCY REPORT

NO:________________ PLANT-UNIT:____________________________ DATE:__________

REVIEWER NAME:______________________________

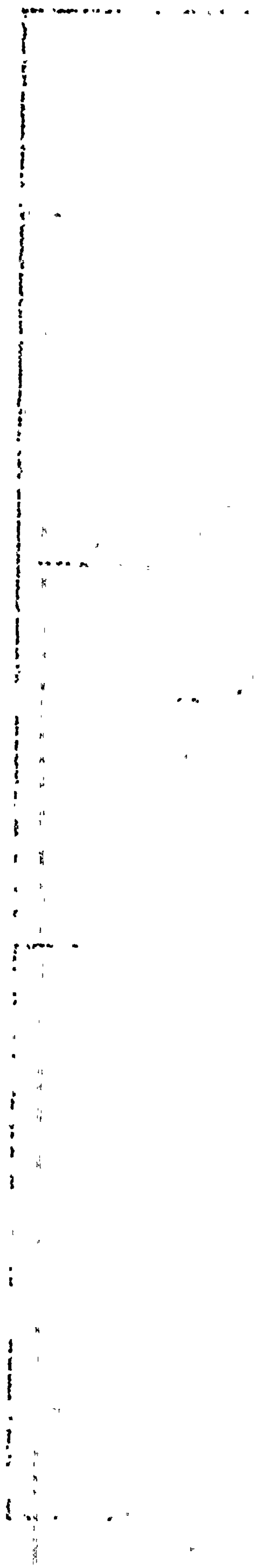
a) HED TITLE:______________________________________________________________________

b) ITEMS INVOLVED:

| ITEM TYPE | NOMENCLATURE | LOCATION | PHOTO NO. |
|---|---|---|---|
| | | | |

c) PROBLEM DESCRIPTION (GUIDELINES VIOLATED):

d) SPECIFIC OPERATOR ERROR(S) THAT COULD RESULT FROM HED:



## FIGURE 1-3 (continued)

**e) SUGGESTIONS FOR POTENTIAL BACKFITS**

**f) ESSEX REVIEW**

DATA COLLECTOR ______________________ DATE __________

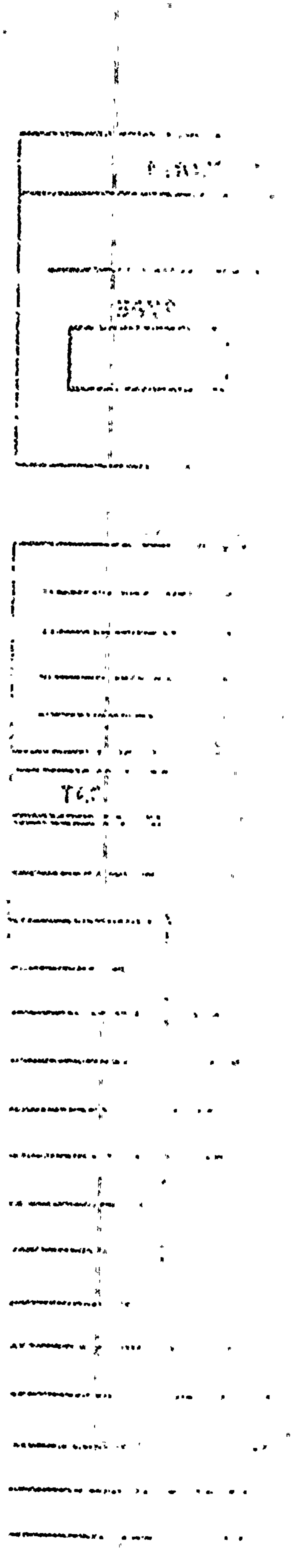
DATA COLLECTION MGR ______________________ DATE __________

PROGRAM MGR ______________________ DATE __________

**g) DISPOSITION**

- ☐ FURTHER REVIEW BY ______________________ DATE __________
- ☐ TO BE CORRECTED BY ______________________ DATE __________
- ☐ REFER TO OPERATIONS
- ☐ NO ACTION
- ☐ OTHER ______________________

EVALUATION COMPLETED
FPL PROJECT DIRECTOR ______________________ DATE __________



# FIGURE 1-4
# COMPONENT LEVEL
# HUMAN ENGINEERING DISCREPANCY REPORT

| COMPONENT(S) LABEL | ASSOCIATED EQUIPMENT | DESIGNATION # |
|---|---|---|
| LINE 1 ______ | ______ | PANEL ______ |
| LINE 2 ______ | ______ | LOC CODE / TYPE |
| LINE 3 ______ | ______ | |

SUBSYSTEM: ______ CONTROL MODES/DISPLAY RANGE: ______

USE: ______

| HED NUMBER | CAT | HED NUMBER | CAT |
|---|---|---|---|
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## 1.4 Technical Approach

The technical approach (review procedure) employed is briefly introduced in this section. Detailed discussions of review methodologies are presented in Section 2.0, Findings, where text is provided which describes the activities for the following tasks:

- Review of operating experience
- Assembly of control room documentation
- Review of system functions and task analysis
- Surveys
  - noise
  - lighting
  - control room environment
  - design conventions
  - controls and displays
  - computers
  - emergency garments
  - labeling
  - annunciators
  - anthropometrics
  - force/torque
  - communications
  - maintainability
- Verification of task performance capability
- Validation of control room functions
- Assessment of discrepancies.

Each survey report addresses:

- Task Objectives — The type of data to be collected or human performance variables under analysis.
- Review Team — The personnel required to conduct the task.
- Criteria — Generally, the review guidelines appropriate to the evaluation being conducted.
- Task Definition — Steps or procedures followed in the conduct of the task.
- Outputs and Results — Task results. These are Human Engineering Discrepancies which may be drawn upon by subsequent tasks (e.g., Task Analysis).

## 1.5 Assessment and Implementation

Once a Human Engineering Discrepancy was identified, its disposition had to be determined. This section of the summary report: 1) describes the means whereby Human Engineering Discrepancies were assessed for error-inducing potential and system consequences of induced errors, and 2) details the means by which Human Engineering Discrepancies will be disposed of (redesign, additional Job Performance Aids, etc.) The assessment portion, in essence, determines the scheduling of backfits as a function of the potential consequences of the Human Engineering Discrepancy. The disposition portion determines the means by which a Human Engineering Discrepancy will be ameliorated. Assessment is initially divorced from disposition in terms of selection of backfits; however, Human Engineering Discrepancy disposition may, in some instances, drive scheduling of backfits due to availability of materials, extent of engineering redesign, and so forth. Also candidate backfits undergo assessment to ensure that human engineering discrepancies have been adequately addressed.

### 1.5.1 Assessment

The basic assessment process is divided into four steps, as follows:

- o Assess extent of deviation from NUREG-0700 guidelines
- o Assess Human Engineering Discrepancy impact on error occurrence
- o Assess potential consequences of error occurrence
- o Assign Human Engineering Discrepancy scheduling priority.

A Human Engineering Discrepancy Assessment Form and a Logic Diagram are presented in Figure 1-5.

1.5.1.1 Assess Extent of Deviation from NUREG-0700 Guidelines —This step required that a subjective assessment of the extent of discrepancy from NUREG-0700 guidelines be made with regard to the control room. For example, symbol/background contrast might be 40 percent rather than 50 percent, or only small amounts of parallax may exist in a display. A judgement was made based on the content of the guideline being applied and the control room component under assessment. Extent of deviation was subjectively scaled from "1" (some deviation) to "5" (complete deviation). There was also a catagory N/A (not applicable) for Human Engineering Discrepancies which are not described in NUREG-0700 (discrepancies from other documents such as military standards, human factors engineering texts, etc). Extent of deviation judgements are <u>not</u> used directly to assess priority or scheduling of backfits, but relate to assessment of

operational error potentials. It is possible to have little deviation from the guidelines and high error assessments, and vise versa.

1.5.1.2 Assess Human Engineering Discrepancy Impact on Error Occurrence — Given that no control system can be designed to be operationally error-free, the assessment here was to estimate Human Engineering Discrepancy impact on hypothetical (unknown) baseline error rates of control room components; e.g., will additional errors be induced by discrepancies from the guidelines? Estimates of Human Engineering Discrepancy impact on error occurrence were qualitatively arrived at by consideration of the following:

- Body physiology
  - fatigue/physical stress
  - discomfort
  - injury
  - anthropometry
- Sensory/perceptual performance
  - vision
  - audition
  - proprioception
  - touch
- Information processing
  - overload
  - confusion
  - recall
  - pattern matching/recognition
  - data manipulation (comparing, extrapolating, etc.)
- Learning
  - inhibition
  - habituation
  - response predominance
  - transfer
  - response competition
  - response latency
- Task demands
  - frequency
  - duration
  - competition
  - sequence
  - speed
  - communication
  - precision
  - information.

1.5.1.3 Assess Potential Consequences of Error Occurrence — Review team, technical staff, and operations representatives evaluated system consequences of hypothesized operational errors. Four determinations are required:

- o Does the Human Engineering Discrepancy relate to plant safety functions?
- o Does the Human Engineering Discrepancy relate to plant functions required to mitigate the consequences of an accident?
- o Could an error lead to unsafe operations or plant conditions?
- o Could an error lead to violations of technical specifications?

Each of these requires a yes/no type response. The Logic Diagram on Figure 1-5 (Human Engineering Discrepancy Priority) shows how these data are integrated to assign categories and priorities to Human Engineering Discrepancies.

Category I Human Engineering Discrepancies are those which have been noted from documented operational errors. All Category I Human Engineering Discrepancies are deemed to increase error potential, but consequences must still be assigned to determine ultimate scheduling priority. Category II Human Engineering Discrepancies are those discrepancies noted during field surveys and/or operator interviews which have been determined to be of valid concern and require corrective action, but for which no documented cases of operator error were found during the Review of Operating Experience. Category III Human Engineering Discrepancies are those discrepancies noted by field surveys and/or operator interviews which have been determined to have little or no impact on operator performance, and for which no documented cases of operator error were found during the Review of Operating Experience.

Assessment of error occurrence was estimated for the following:

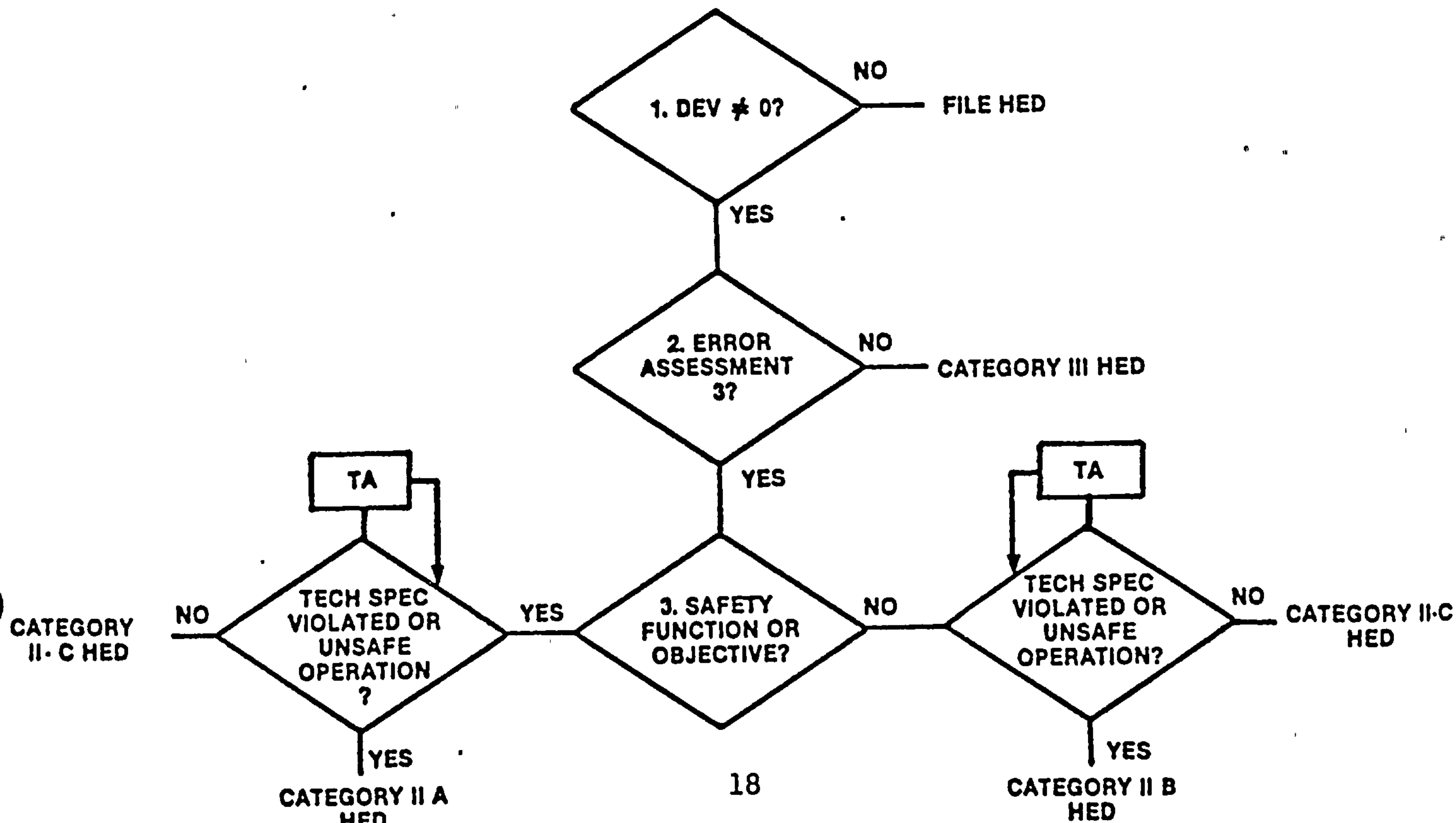
- o Overall operator performance is/is not degraded by the Human Engineering Discrepancy impact on body physiology?
- o The Human Engineering Discrepancy does/does not degrade sensory performance?
- o Information processing capability is/is not exceeded via the Human Engineering Discrepancy?
- o The Human Engineering Discrepancy does/does not induce direct error due to principles of learning?
- o Task difficulty and reliability is/is not affected by the Human Engineering Discrepancy?

Based on the above, a subjective error assessment was generated on a 5-point scale; "1" indicating a low probability of induced errors is expected as a result of the Human Engineering Discrepancy, and "5" indicating a high probability of additional errors being induced.

## FIGURE 1-5

## HED ASSESSMENT FORM

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. | EXTENT OF DEVIATION FROM 0700 GUIDELINES | N/A | SOME | | | | COMPLETE | |
| | | | 1 | 2 | 3 | 4 | 5 | |
| 2. | ERROR ASSESSMENT | N/A | LOW | | | | HIGH | |
| | | | 1 | 2 | 3 | 4 | 5 | |
| 3. | SAFETY FUNCTION ? | YES | | | | NO | | |
| 4. | NON SAFETY RELATED, REQUIRED TO MITIGATE CONSEQUENCES OF AN ACCIDENT | YES | | | | NO | | |
| 5. | CONSEQUENCES OF ERROR OCCURENCE | | | | | | | |
| | A. UNSAFE OPERATION | YES | | | | NO | | |
| | B. VIOLATION OF TECH. SPECS. | YES | | | | NO | | |



1.5.1.4 Assign Human Engineering Discrepancy Priority Scheduling — Priority for scheduling of backfit was assigned per the following:

- o Priority A — Prompt - first outage, given availability of materials and engineering lead time.
- o Priority B — Near Term - second refueling outage given availability of parts and engineering lead time.
- o Priority C — Long Term - at any time.

# 2.0 FINDINGS

This section presents results and findings of the Detailed Control Room Design Review. Section 2.1 discusses the Equipment Inventory. Section 2.2 presents findings for the Operating Experience Review. Section 2.3 presents findings and results of the Control Room Surveys. Finally, Section 2.4 discusses the System Functions and Task Analysis findings. Where applicable, all Human Engineering Discrepancies identified via the evaluation processes are presented.

## 2.1 Equipment Inventory

### 2.1.1 Objective

The objective of the Equipment Inventory was to identify and reference all instrumentation controls and equipment within the control room for: 1) assessment of task equipment demands, 2) Component Level Human Engineering Discrepancy documentation, and 3) priority assessment. The inventory included all components and major assemblies with which operators interface in the control rooms.

### 2.1.2 Review Team Responsibilities

A human factors specialist with control room operating experience assembled the Equipment Inventory using the form presented in Figure 1-4. (One form was completed for each component or major assembly).

### 2.1.3 Criteria

Criteria for this task included:

- The inventory should include all controls, displays and other components on the control boards, peripheral consoles, back panels, etc. - that is, the components with which operators interface at all work stations. (NUREG-0700, p. 3-19).
- Each component should have a unique identifier (NUREG-0700, p. 3-20).
- The inventory should identify the system, subsystem, function/subfunction, purpose, and characteristics (range for scaled displays, colors for indicator lights, and position labels for controls) for each component (NUREG-0700, p. 3-19).

### 2.1.4 Task Definition

A photomosaic of the control room was used as the basis for most of the inventory work. Because the panels are long, they were divided into sections for the purpose of assigning alphanumeric identifiers. The console consisted of the following sections (from left to right facing the console): Coolant Volume Control System, Reactor Control, Steam Flow/Feed Flow, and Electrical. The back panel was divided into the Reactor Coolant System; Reactor, Steam Generator and Reactor Trip; Condensate, Feedwater and Turbine-Generator; and Electrical. The Safeguard Panel was divided into four sections and numbered 1 through 4, from left to right. Each component was assigned a unique alphanumeric code. All components sharing a single label were given the same code.

One Component Level Human Engineering Discrepancy Report (component sheet) was completed for each unique alphanumeric code. Information not available from the photomosaic was collected on-site. Components were divided into subsystems within each panel by a human factors specialist with control room operating experience, and this information was included on the component sheet.

The bottom half of the component sheet includes a list of Human Engineering Discrepancies noted for each component. The Human Engineering Discrepancy number shown refers to the NUREG-0700 guideline which was violated by the component.

Although the control room Equipment Inventory was intended for use in Task Analysis, the references to Human Engineering Discrepancy numbers on the component sheets also provide Florida Power & Light with a list of Human Engineering Discrepancies associated with each component. The component sheets are filed by unit, by panel, by component type within each panel, and finally by location code within component type.

The control room Equipment Inventory was completed July 1983 after the majoarity of data collection was completed.

### 2.1.5 Outputs and Results

The output of this task is a filing system containing a data form for each component in the control room. The form contains information describing the component and a list of associated Human Engineering Discrepancies. The Human Engineering Discrepancy number references NUREG-0700 guidelines and the appropriate Human Engineering Discrepancy.

## 2.2 Operator Interviews/Operating Experience Reviews

### 2.2.1 Objective

Interviews were conducted with operating personnel in order to obtain information on control room design and operability from users of the system. Questions were intended to gather information on workspace design and panel layout, environmental features, alarm and warning systems, computer systems, communications, procedures, maintenance, and staffing and training. Potential discrepanices as well as positive human factors engineering features were identified.

### 2.2.2 Review Team Responsibilities

Interviews were conducted by a human factors analyst experienced in interview techniques. The human factors analyst was responsible for briefing each interviewee regarding the purpose and general content of the questionnaire, and for recording responses appropriately on the interview forms. Briefings and interviews both were conducted individually.

Operations personnel participating in the interviews included a majority of the reactor operators, senior reactor operators, watch engineers (shift technical advisors), and shift supervisors.

### 2.2.3 Criteria

The specific items presented during the interviews are presented in Appendix A.

### 2.2.4 Task Definition/Methodology

An operations representative was designated to arrange times and places for individual interviews. It was decided that since Unit 3 was off-line it would be most convenient to brief and interview individual operators (one at a time) in an alcove off the control room. The close proximity to the primary operating zone allowed the interviewee rapid return to control room duties if required, allowed demonstrations of incidents or problems on the control board, and provided sufficient privacy to achieve a confidential interview.

Each operator was briefed on the purpose of the inteview and its contribution to the overall control room evaluation, as well as about the role of human factors engineering in the design of power plant control systems and interfaces. The interviewees were also assured as to the anonymity of their responses.

Each question was read aloud and then paraphrased to ensure that the intent was clear. The interviewer listened carefully to each response, asking questions when statements were unclear, recorded responses on the questionnaire (Appendix A), and read each recorded response aloud to the interviewee to ensure accuracy.

Prior to each subsequent data collection task, the relevant section of each questionnaire was reviewed to ensure that all of the interviewees' concerns were evaluated and verified.

Questionnaires are retained in comprehensive project files to provide supporting data for this and other aspects of the evaluation.

2.2.5 Output and Results

Responses to individual questions were tallied and any clustering of answers noted. A listing of the most frequently noted (clustered) responses is contained in Table 2.2.5-1.

Many insights were identified only once (by one interviewee); yet when verified in the control room (with the three control room operators on shift), the insight was found to be shared. Therefore, all potential human factors engineering problems were reviewed and verified; not simply those problems most frequently identified. An area where this was particularly evident was in panel layout where a variety of potential grouping and arrangement problems were identified.

Each negative observation (noted during interviews) was documented on Human Engineering Discrepancy forms and verified or discredited via subsequent surveys and/or Task Analysis. A number of negative observations were deleted where previously scheduled control room modifications ameliorated the potential discrepancies.

TABLE 2.2.5-1

SAMPLE OF MOST FREQUENT INTERVIEW RESPONSES

| Positive Responses | % Response Occurrence | Negative Responses | % Response Occurrence |
|---|---|---|---|
| **Workspace Layout & Environment** | | | |
| o Control Room Layout - compact, accessible | 57 | o Noise/Traffic Excessive (6113c,d) | 64 |
| o Panel Layout - system grouping | 57 | | |
| **Annunciator Warning System** | | | |
| o System/Function Grouping | 71 | o Nuisance alarms present (6313a1) | 50 |
| | | o Size too small (6335a) | 43 |
| | | o No dark board/some normal "ON" (6332e) | 43 |
| | | o New annunciators not grouped (6331a) | 43 |
| **Communications** | | | |
| o Availability of various alternative or backup systems | 50 | o Page system overcrowded (62183c) | 78.5. |
| | | o Bell phone lines overloaded (night shift especially when no switchboard operator available) (6211c) | 50 |
| | | o PAX phones unreliable | 78.5 |
| **Process Computers** | | | |
| o Present functions helpful and easy to use | 86 | o More functions needed no trends/graphics (6733a,c,d) | 43 |

TABLE 2.2.5-1

SAMPLE OF MOST FREQUENT INTERVIEW RESPONSES (CONT'D)

| Positive Responses | % Response Occurrence | Negative Responses | % Response Occurrence |
|---|---|---|---|
| Corrective and Preventive Maintenance | | | |
| o Vital instruments well maintained | 57 | o Operators not allowed to set the priorities (no HED generated) | 50 |
| PMS on recorders weekly | 71 | | |
| Procedures | | | |
| | | o Changed/updated too often to allow memorization | 36 |
| | | o Emergency procedures too long | 36 |
| | | o No operational input to the writing (no HEDs generated) | 36 |
| Staffing and Job Design | | | |
| | | o Control room understaffed (3 CROs per shift for 2 units inadequate) (6112a) | 78.5 |
| | | o Paperwork and communication duties overload and distract from operational duties (6112b) | 64 |
| Training | | | |
| o Simulator training helpful | 78.5 | o Simulator not plant-specifc | 78.5 |
| | | o Classroom and requalification training not long enough | 57 |
| | | o Instructor undermanned (no HEDs generated) | 57 |

## 2.3 Surveys

This section presents the objectives, review team, evaluation criteria, task definition/methodology, and results/finding of each control room survey. These include:

- o Noise
- o Light
- o Environment/Workspace
- o Controls and Displays
- o Conventions
- o Process Computer
- o Emergency Garments
- o Labels and Location Aids
- o Annunciators
- o Anthropometry
- o Force/Torque
- o Communications
- o Maintainability.

### 2.3.1 Noise Survey

2.3.1.1 Objective — The purpose of the Noise Survey was to ensure that noise levels within the control room do not interfere with aided and unaided voice communications and signal audibility. Noise, signal, and communication levels were measured to determine whether or not they met NUREG-0700 guidelines.

2.3.1.2 Review Team Selection and Responsibilities — The survey was performed by a human factors analyst familiar with the operation of the sound level meter used and fundamental properties of sound.

2.3.1.3 Criteria — The following guidelines were used for data collection, analysis, and discrepancy documentation:

- Ambient noise levels, under normal operating conditions, do not exceed 65 dB(A) (NUREG-0700, 6.1.5.5.b)
- To ensure the audibility of signals and alarms, each is at least 10 dB(A) above the ambient noise level (NUREG-0700, 6.3.2.1.a)
- Acceptable levels for voice communication are as indicated in Figure 2.3.1-1.

2.3.1.4 Task Definitions

Basal Level Reading and Contributing Noise Sources — Noise measurements were taken at a basal level, without contributing conversation, communication, or noise from signals and other oscillating sources. Contributing sources were measured first as individually as possible, then simultaneously. Potential noise sources include:

- Audible Alarms
- Printers
- Communications equipment (ringing telephones, radios, loudspeakers)
- Emergency or typical environmental control systems (air conditioning, exhaust fans) (since this noise could not be eliminated, it as well as backroom relay clatter was included in all basal measurements)
- Loud conversation
- Adjacent control room alarms
- Open doors leading out of control room (noise from outside sources).

Measurements at Operating Positions and Desks — Measurements were taken at each operator position that requires verbal communication and /or auditory discrimination of a signal or communication. These positions included at a minimum all control room operators' desks and work stations (each panel). A diagram of the control room layout was prepared, and each measurement position was identified by number or code.

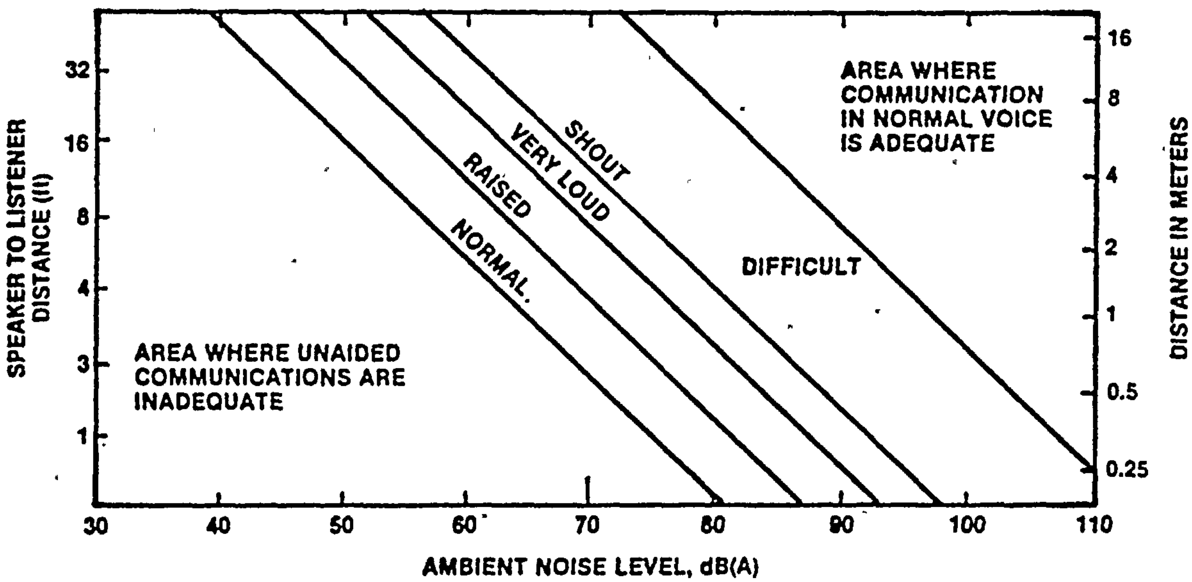



**FIGURE 2.3.1-1**
**VOICE LEVEL AS A FUNCTION OF DISTANCE BETWEEN SPEAKER AND LISTENER AND AMBIENT NOISE LEVEL (FROM NUREG 0700)**

Microphone Positions at Control Panels — Microphone positions for measurements at control panels were:

- o Toward panel
- o Toward nearest operator desk or station
- o Toward source
- o Straight up without obstruction, for omnipositional measurement.

Microphone Positions at Operators' Desks — Microphone positions for measurements at operators' desks were:

- o Straight up
- o Toward nearest operator
- o Toward source of noise.

Weightings for Measurement — Readings were taken in dB(flat), dB(A) and dB(C) weightings. Special attention was given to dB(A) readings since these simulate subjective responses to noise. The flat (dB) response is an indiscriminate mode, attributing the sound level to no specific frequency range. To be able to make single figure measurements that take the frequency response of the ear into account, three frequency weighting curves, A, B, and C, based upon the response of the ear, have been devised. The C-weighted mode has, essentially, a uniform response from 30 Hz to 8 kHz. The dB(A) mode is the most commonly used mode for industrial standards, and is the mode upon which the Essex survey recommendations were based. This mode favors the frequencies between 1 and 4 kHz, peaking at 2.5 kHz. Steady-state noise measurement is best made in this mode because it discriminates most sounds which are audible to the average ear over a period of time.

Noise that was difficult to attribute to a specific source, when measured by using general weightings, was measured by using the octave band selector on the sound level meter. All readings were appropriately recorded.

Ambient Noise Corrections — Accuracy requires that the background noise be at least 10 dB below the noise level being measured, in each octave band. Even with this 10 dB difference, the background noise will add about 0.4 dB to the measured SPL. The ambient noise corrections given in the table may be used to compensate for the effect of background noise.

## AMBIENT NOISE CORRECTIONS (DB)

| Difference Between Total Measured Sound Pressure Level and Measured Sound Pressure Level of Ambient Noise Only | Correction to be Subtracted from Total Measured Sound Pressure Level to Obtain Sound Pressure Level of Noise Source Only |
|---|---|
| 4 | 2.2 |
| 5 | 1.7 |
| 6 | 1.3 |
| 7 | 1.0 |
| 8 | .8 |
| 9 | .6 |
| 10 | .4 |
| 11 | .3 |
| 12 | .3 |
| 13 | .2 |
| 14 | .2 |
| 15 | .1 |

(From SNI S1.13)

Data Analysis — After data collection the measured noise levels were compared to the evaluation criteria.

Equipment/Facility Requirements — A certified industrial sound level meter was necessary for executing the noise survey. This meter was capable of measuring in dB, dB(A), and dB(C) weightings as well as in a variable octave band range from 30 to 16,000 Hz. The survey was conducted using a Genrad Model 1982 sound level meter and attachments. The unit was calibrated, per the instructions in the operations manual, prior to the collection of the data.

Inputs and Data Forms — All readings were recorded on a floor plan of the Turkey Point Control Rooms. Remarks regarding any acoustical considerations and recommendations were also recorded. Measurement positions were numbered or coded according to the first diagram.

Outputs — Data were extracted from the Noise Survey form and diagrams and were analyzed for any anomalies. Readings that proved discrepant, resulting from excessive or inadequate levels, were reported on Human Engineering Discrepancy Report forms.

Recommendations were made for the solution of problems that were found in the course of the survey. Typical recommendations were acoustical absorption backfits and signal attenuation.

2.3.1.5 Findings/Results — Figures 2.3.1-2 through 2.3.1-8 present the noise level data taken in the Turkey Point Control Rooms.

Summarizing these data, Figure 2.3.1-2, basic ambient noise levels are in the acceptable range of 59 to 66 dB(A). Noise sources which were identified and considered as significant contributors to ambient noise were: 1) the instrumentation power transformers located behind the operators panels, 2) the ventilation system, and 3) the overall control room vibration from (apparently) the turbine deck and major machinery. Sources which momentarily contributed to ambient noise (other than audible signals) included:

- o Opening and closing of accesses
- o Normal conversation
- o Habitation noises (paper shuffling, etc.).

Figure 2.3.1-3 presents ambient noise levels for ten audible frequencies. The data indicate high levels of noise in the lower frequencies (63 to 80 dB in the 31 to 63 Hz frequency range) and moderate levels of noise (51 to 41 dB) in the middle to high frequency ranges, which represent the primary speech frequencies and most audible signal frequencies.

Figures 2.3.1-4 to 2.3.1-8 present sound level data for ambient plus noise contributed from audible alarms. Note that significant auditory masking occurs: 1) when the frequencies of the target and the masking stimuli are about the same, and 2) when the masking stimulus is of a <u>slightly</u> lower frequency than the target stimulus. The point of the above is that audible signal detection is a function of: 1) masker frequency, 2) masker intensity, 3) target frequency, and 4) target intensity.

For all measured audible alarms, exept the Unit 3 annunciator audible, the alarm signal intensity (for the signal frequence) was greater than potential ambient masking frequencies for the same and adjacent lower ambient frequencies (see table below).

**FIGURE 2.3.1-2**
**AMBIENT NOISE LEVELS (dB(A))**

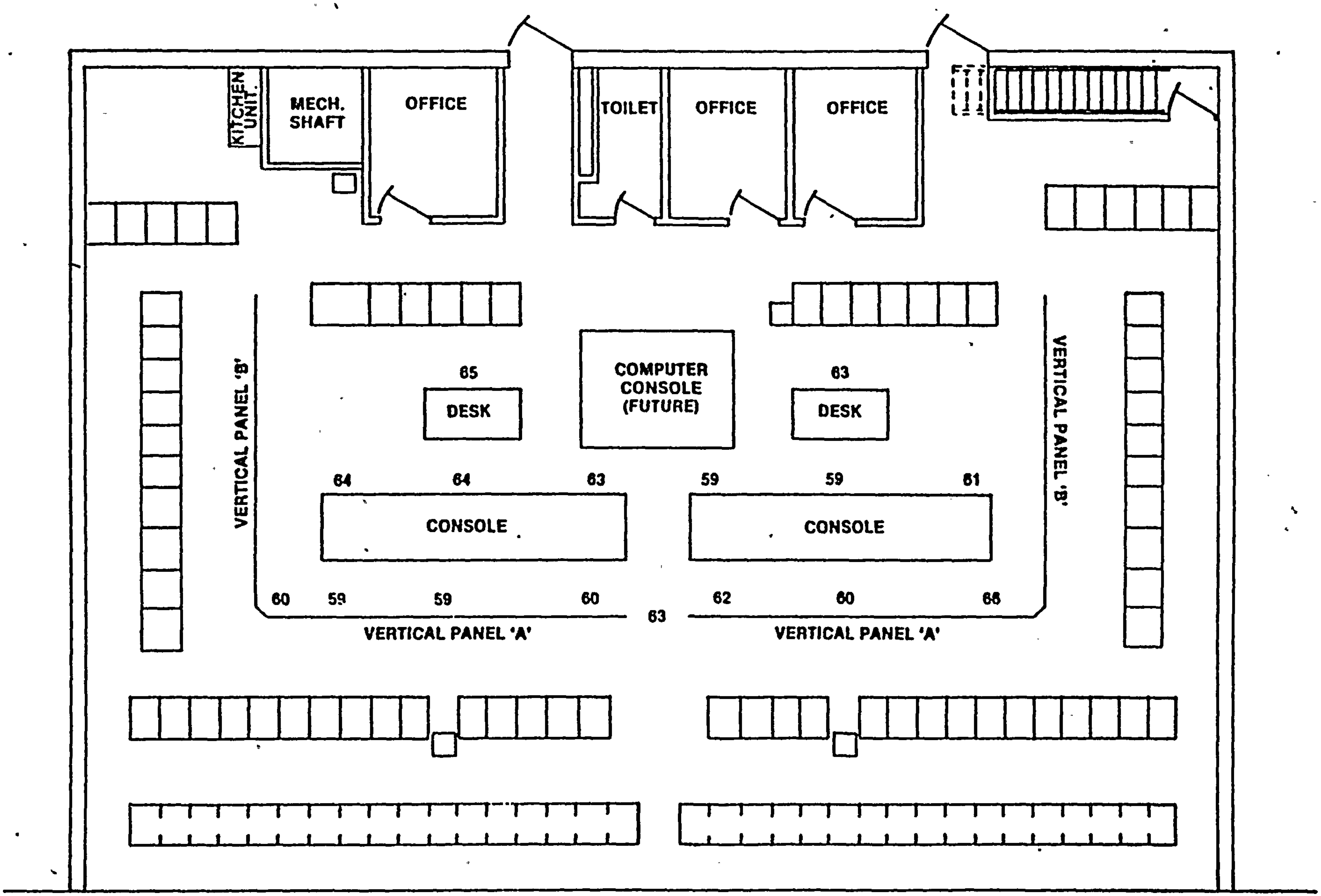
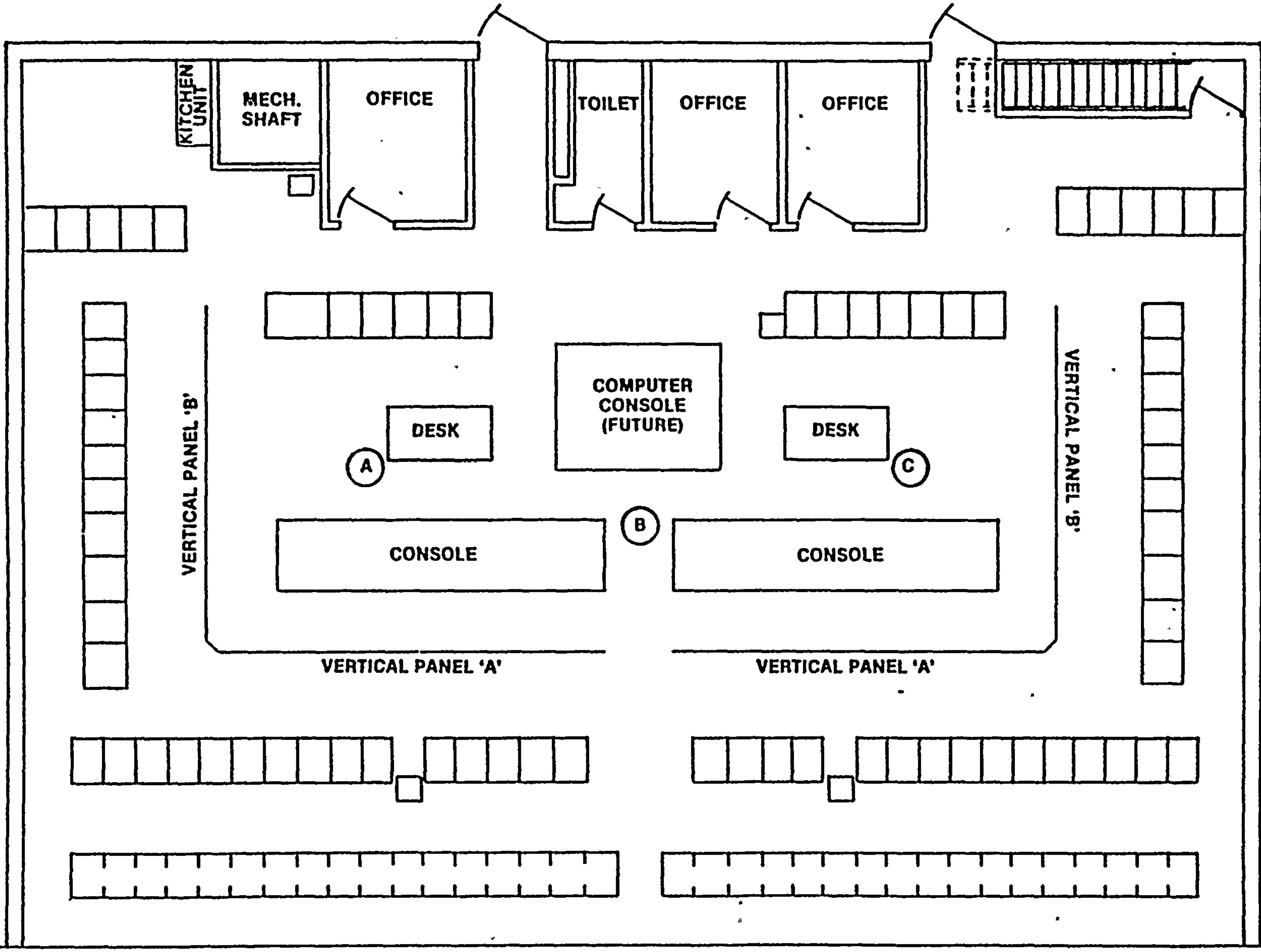


**FIGURE 2.[illegible]-3**
**SOUND LEVELS (dB) AT THREE PRIMARY OPERATING LOCATIONS FOR 10 FREQUENCIES (Hz)**

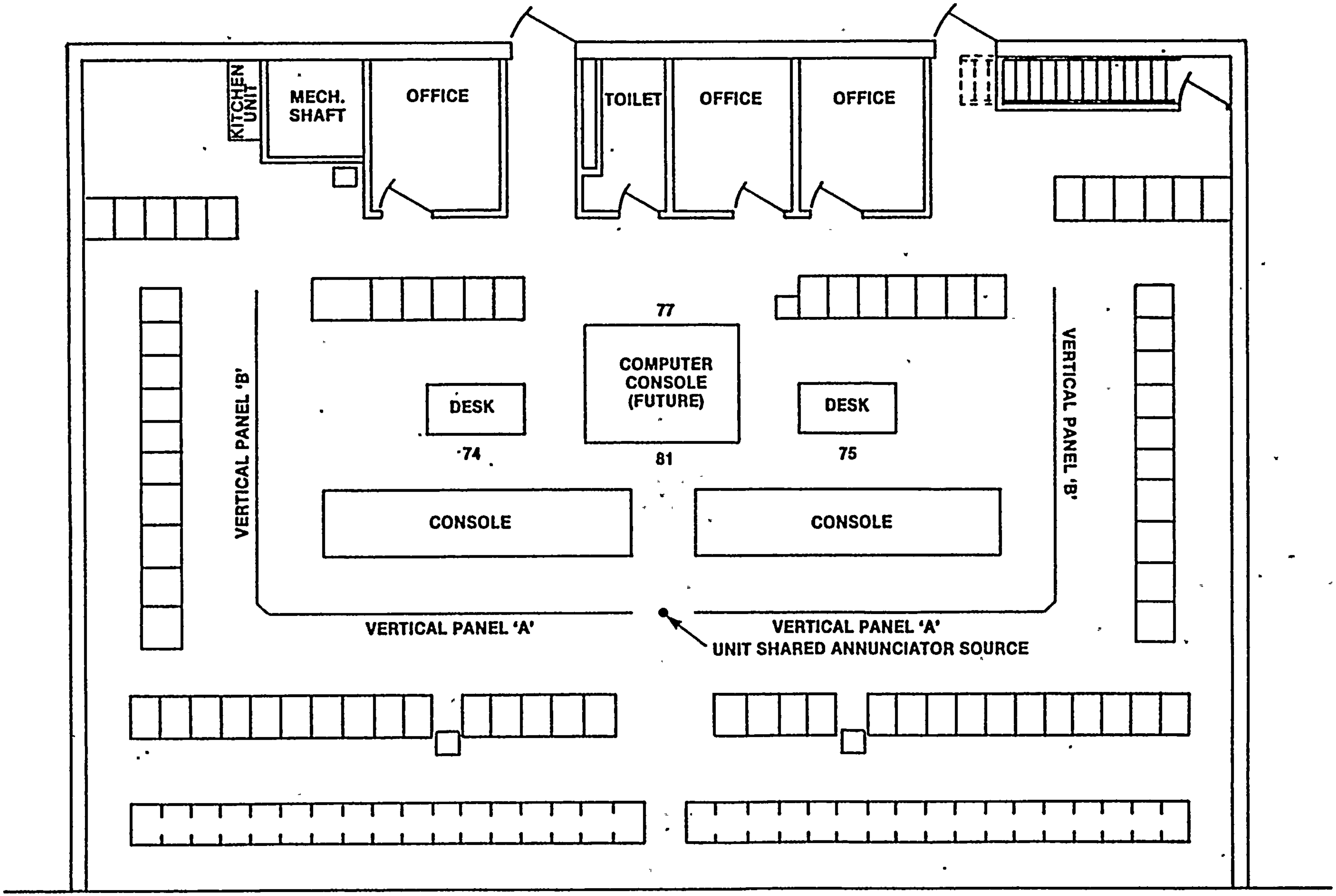



dB LEVELS

| f | A | B | C |
|---|---|---|---|
| 31.5 | 78 | 78 | 80 |
| 63 | 63 | 67 | 66 |
| 125 | 57 | 56 | 56 |
| 250 | 53 | 56 | 50 |
| 500 | 50 | 57 | 53 |
| 1K | 49 | 51 | 46 |
| 2K | 50 | 50 | 46 |
| 4K | 49 | 49 | 44 |
| 8K | 44 | 46 | 43 |
| 16K | 44 | 43 | 41 |

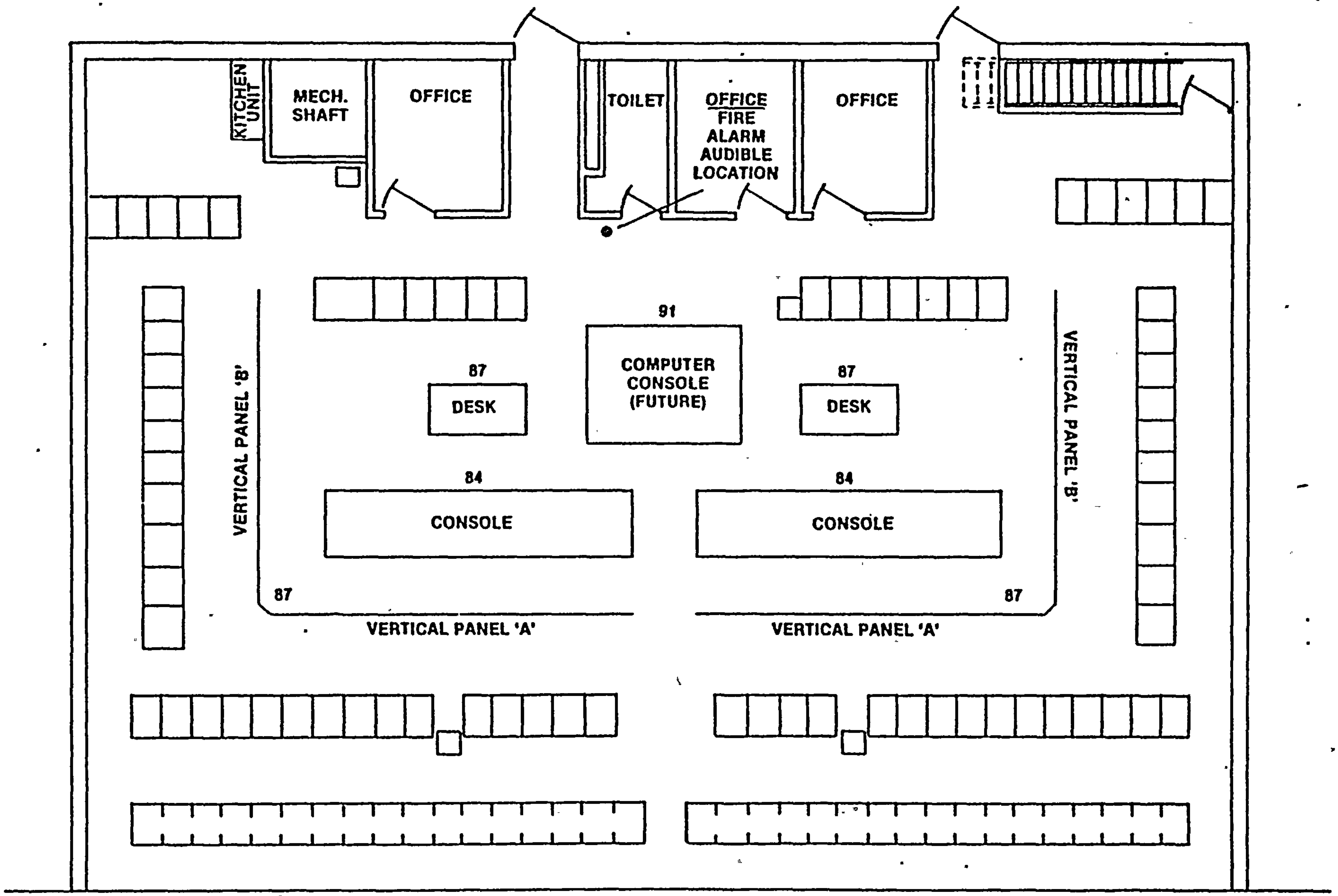
MAXIMUM MEASURED NOISE LEVEL WAS 80 dB(A) @ 8000 Hz

**FIGURE 2.3.1-4**
**SOUND LEVELS (dB(A)) WITH CONTRIBUTED NOISE FROM UNIT SHARED ANNUNCIATOR**



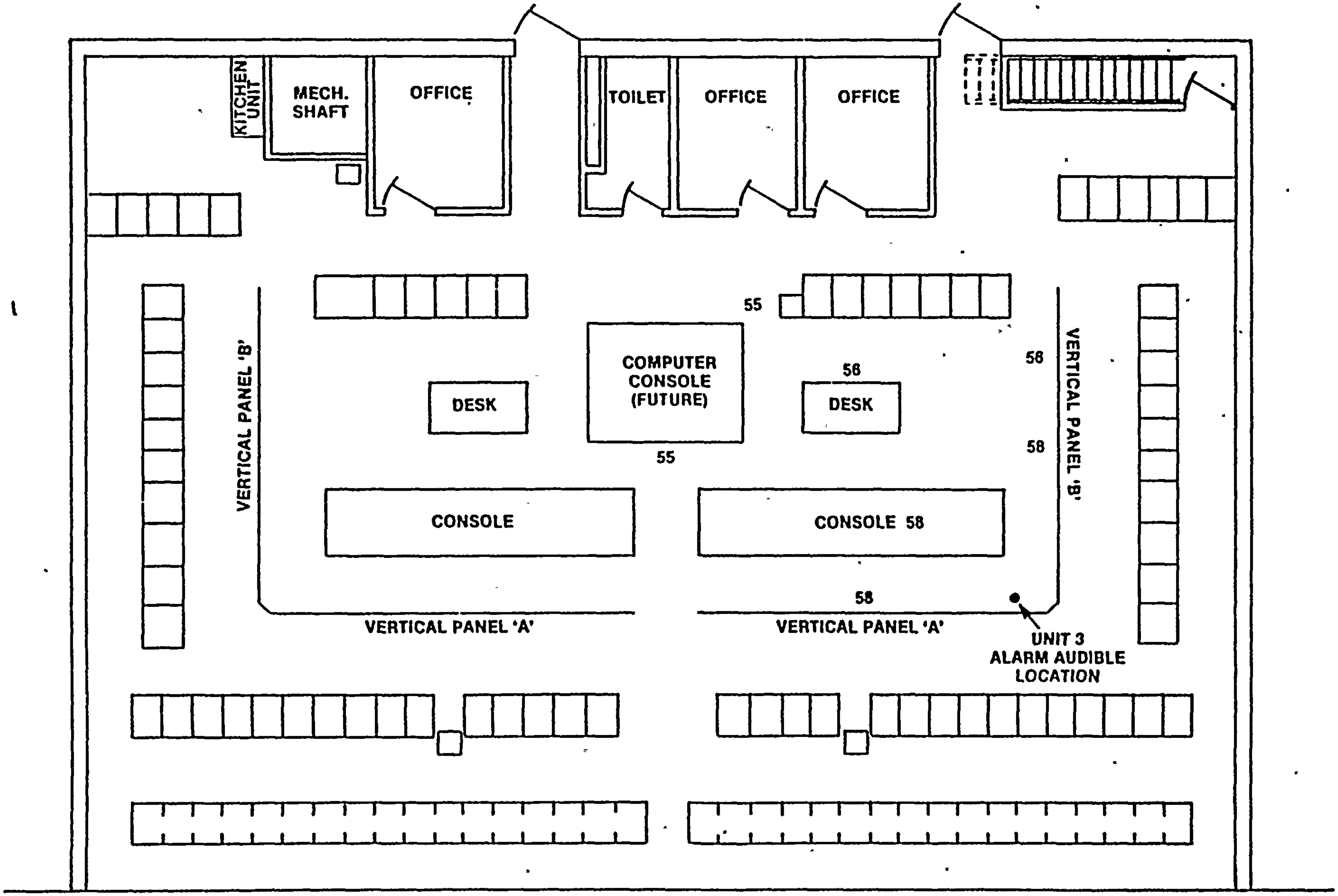

MAXIMUM MEASURED NOISE LEVEL WAS 80 dB(A) @ 8000 Hz

**FIGURE 2.3.1-5**
**SOUND LEVELS (dB) WITH CONTRIBUTED NOISE FROM SITE FIRE ALARM**




**MAXIMUM MEASURED AUDIBLE dB LEVEL WAS 87 @ 8000 Hz**

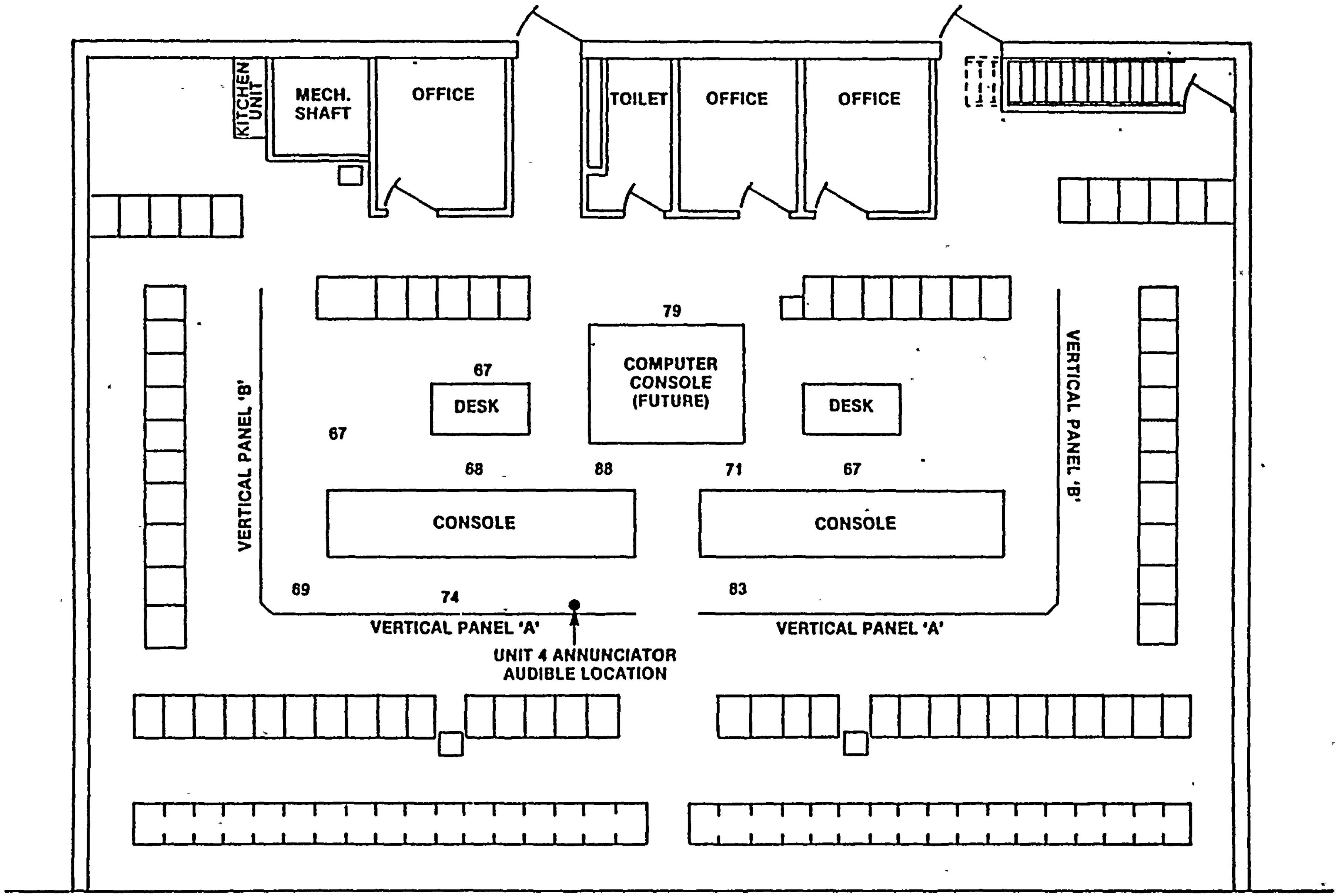
**FIGURE 2.3.1-6**
**SOUND LEVELS (dB) WITH CONTRIBUTED NOISE FROM UNIT 3 ANNUNCIATOR AUDIBLE**




**MAXIMUM MEASURED AUDIBLE dB LEVEL WAS 62 @ 63 Hz**

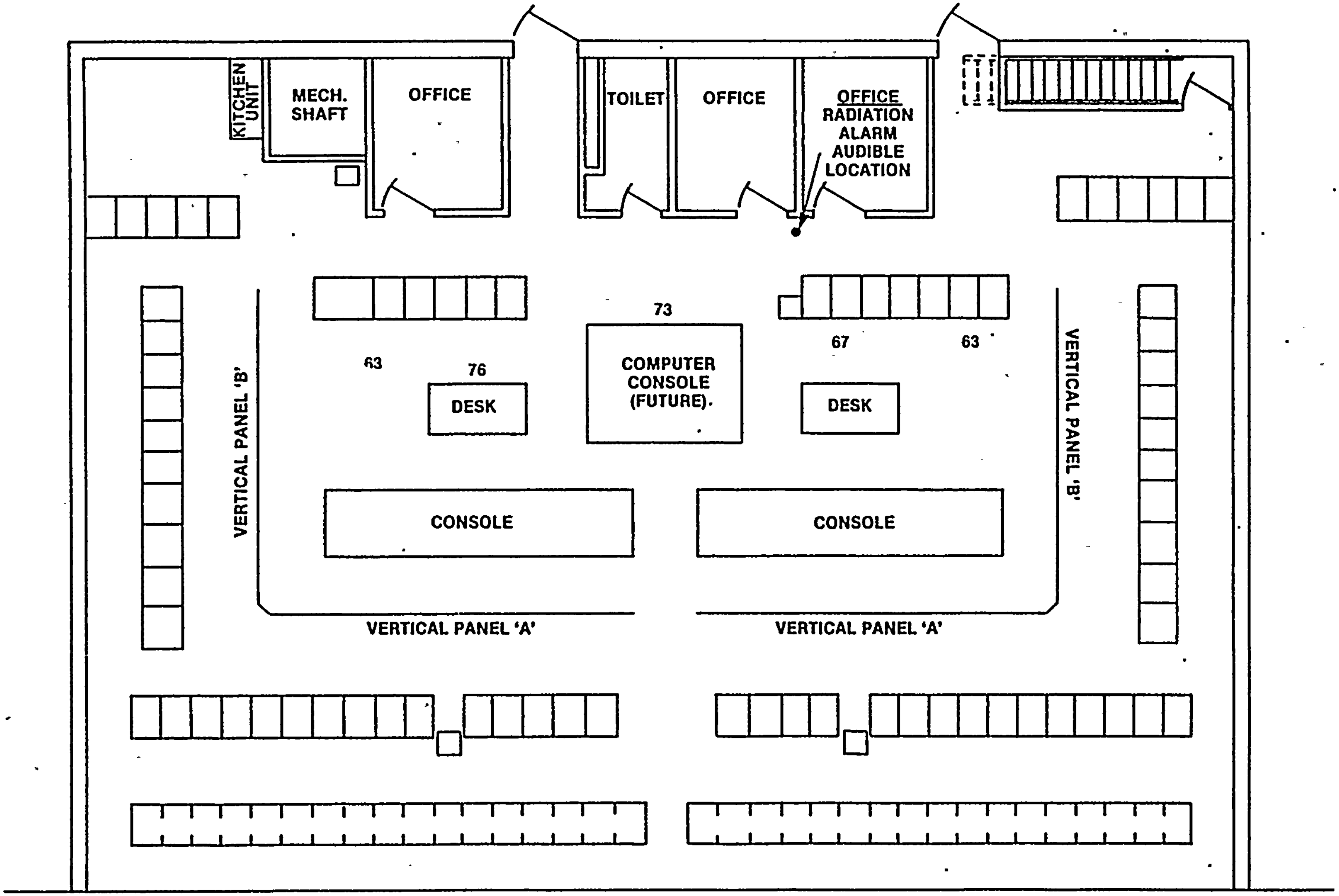
MAXIMUM MEASURED AUDIBLE dB LEVEL WAS 71 @ 2000 Hz

## FIGURE 2.3.1-7
## SOUND LEVELS (dB) WITH CONTRIBUTED NOISE FROM UNIT 4 ANNUNCIATOR AUDIBLE




MAXIMUM MEASURED AUDIBLE dB LEVEL WAS 71 @ 8000 Hz

FIGURE 2.3.1-8
SOUND LEVELS (dB) WITH CONTRIBUTED NOISE FROM SITE RADIATION AUDIBLE




MAXIMUM MEASURED AUDIBLE dB LEVEL WAS 65 @ 8000 Hz

| Signal | dB Level | at Hz | Unit 3 Ambient | Unit 4 Ambient |
|---|---|---|---|---|
| Unit shared annunciator | 80 | 8000 | 46 (8000 Hz) | 49 (4000 Hz) |
| Fire Alarm | 87 | 8000 | 46 (8000 Hz) | 49 (4000 Hz) |
| Unit 3 Annunciator | 62 | 63 | 67 (63 Hz) | 80 (31.5 Hz) |
| Unit 4 Annunciator | 71 | 8000 | 46 (8000 Hz) | 49 (4000 Hz) |
| Radiation Alarm | 65 | 8000 | 46 (8000 Hz) | 49 (4000 Hz) |

In summary, overall control room noise at the times of data collection was found to be within the NUREG-0700 guidelines of 65 dB(A) with the exception of a reading at 67 dB(A) which is not considered excessively over the limit. All audible signals measured (except Unit 3 annunciator) are considered to have a high probability of signal detection, e.g., ample volume which is not highly subject to auditory masking. The Unit 3 annunciator alarm is, however, subject to masking due to: 1) low signal intensity and 2) high ambient noise in the same octave band as the signal.

The following recommendations are made:

- o Increase both the signal integrity and frequency of the Unit 3 annunciator alarm
- o Provide, if feasible, sound attenuators such as carpeting to reduce ambient control room noise
- o Isolate and attunuate, if possible, the sources of low frequency noise in the control room.

2.3.2 Lighting Survey

2.3.2.1 Objective — The objective of the Lighting Survey was to ensure that control room lighting is sufficient to permit the operator to effectively perform all tasks. The lighting test included ambient illumination; display luminance; and reflectance off panel, wall, desk, and floor surfaces. The survey was conducted under both full lighting conditions and emergency lighting conditions.

2.3.2.2 Review Team Responsibilities — A human factors specialist conducted this survey. Responsibilities included developing the test procedure, conducting the test, and recording and reducing the data.

2.3.2.3 Criteria — Criteria for the survey are from NUREG-0700, Section 6.1.5.3 "Illumination" and 6.1.5.4 "Emergency Lighting." The tables and charts on Figure 2.3.2-1 summarize the criteria used for the evaluation (source is NUREG-0700). Additional criteria included assessment of:

- o Glare (6.1.5.3.f)
- o Color recognizability (6.1.5.3.h)
- o Illuminance uniformity (6.1.5.3.b)
- o Shadowing (6.1.5.3.e).

2.3.2.4 Task Definition/Methodology

Ambient Illumination — Using the photometer and illuminance probe, measurements (in footcandles) were taken at all operator work stations. Work benches, tables, consoles, panels, floors and walls were measured using an omnidirectional probe and placed directly on horizontal surfaces or at the average male (50 percentile) eye height for vertical panels.

Readings were taken under both normal and emergency lighting conditions. The data were recorded on control room drawings showing the location of each reading. The measurements were then compared with the human factors guidelines in order to identify discrepancies.

Display Brightness — Display brightness was subjectively assessed by walk-throughs of the control room by the human factors engineering analyst. The major backlit component types were sampled and elsewhere where display brightness was deemed a possible discrepancy.

Reflectance — Using the photometer with a spot probe, measurements (in-foot-Lamberts) were taken at all operator work stations. Surfaces were measured in approximately six sections of the board, depending on the surface (for floor and wall

| |
|---|
| [illegible] |
| [illegible] |
| [illegible] |
| 90 |
| 100 |
| [illegible] |
| [illegible] |
| [illegible] |
| [illegible] |
| [illegible] |
| [illegible] |

| Areas | Luminance Ratio |
|---|---|
| Task area versus adjacent darker surroundings | 3:1 |
| Task area versus adjacent lighter surroundings | 1:3 |
| Task area versus more remote darker surfaces | 10:1 |
| Task area versus more remote ligher areas | 1:10 |
| Luminaries versus surfaces adjacent to them | 20:1 |
| Anywhere within normal field of view | 40:1 |

Maximum task area luminance ratios.

| Work Area or Type of Task | Task Illuminance, footcandles | | |
|---|---|---|---|
| | Minimum | Recommended | Maximum |
| Panels, primary operating area | 20 | 30 | 50 |
| Auxiliary panels | 20 | 30 | 50 |
| Scale indicator reading | 20 | 30 | 50 |
| Seated operator stations | 50 | 75 | 100 |
| Reading: | | | |
| • Handwritten (pencil) | 50 | 75 | 100 |
| • Printed or typed | 20 | 30 | 50 |
| Writing and data recording | 50 | 75 | 100 |
| Maintenance and wiring areas | 20 | 30 | 50 |
| Emergency operating lighting | 10 | As above for area/task | |

(Source: Illuminating Engineering Society of North America, *IES Lighting Handbook*, 1981 Application Volume.).

Illumination levels

| Surface | Reflectances | |
|---|---|---|
| | Preferred | Permissible |
| [a]Ceiling | 80% | 60-95% |
| Upper Wall | 50% | 40-60% |
| Lower Wall | 15-20% | |
| Instruments/Displays | 80-100% | |
| Cabinet/Consoles | 20-40% | |
| Floor | 30% | 15-30% |
| Furniture | 35% | 25-45% |

[a]Recommended reflectances are for finish only. Over-all average reflectance of acoustic materials may be somewhat lower. The upper walls (one to two feet below the ceiling) may be painted with the same paint as is used on the ceiling.

Recommended workplace reflectance levels

## FIGURE 2.3.2-1

## Summary of Lighting Evaluation Criteria

measurements a smaller sample was used). It was not necessary to measure the ceiling as the surface was covered exclusively with light diffusing fixtures. Several measurements were taken and compared to identify areas of nonuniform luminance. The distance of the probe from the surface being measured was standardized at one foot from the surface and was oriented at right angles to each sampled surface.

Contrast — Contrast was subjectively assessed by a walk-through of the control room with the human factors engineering analyst visually examining the boards.

2.3.2.5 Results/Findings

Raw data in the form of a control room floor plan drawing and tables of measurements are presented below. Discrepancies were reported on Human Engineering Discrepancy report forms. In general, the lighting system in the Turkey Point Control Rooms meet the NUREG-0700 guidelines. Table 2.3.2-1 summaries the Human Engineering Discrepancies generated from the Lighting Survey. These were: 1) excessive ambient illumination, 2) glare on the vertical panels, 3) low levels of control room reflectance, and 4) excessively low levels of emergency illumination. Findings for each subtest are presented below.

Illuminance — The normal ambient illumination exceeded the levels recommended in the NUREG-0700 guidelines at most work stations (see Figure 2.3.2-2 and Table 2.3.2-2). The emergency illumination was below the minimum guideline values of NUREG-0700 at all operator work stations (see Figure 2.3.2-2 and Table 2.3.2-2).

In response to a preliminary finding regarding illuminance and glare on the vertical boards, Florida Power & Light Company installed blue florescent lights over these panels to reduce both incident lighting levels and glare. The blue florescent lighting was evaluated (the data are summarized on Figure 2.3.2-3) and was found to successfully reduce lighting levels and glare over the vertical panels; however, the blue color had an adverse effect on color coding especially on blue indicator lights (washed out color).

Display Brightness — Luminance ratios for display brightness are considered adequate for all back and transilluminated displays and controls.

Reflectance — Reflectances of the vertical panels and upper walls was generally found to be below the guideline values, while the percentages were above guideline recommendations off the floor, lower wall, and the blotters on the CRDs' desks. These values, however, were not sufficiently out of tolerance to have a significant effect on human performance. Therefore, a low error assessment was assigned and no backfits recommended in the area of reflectance.

TABLE 2.3.2-1

LIGHTING SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 30 | 6153A | IIC | IIC | High levels of ambient control room light |
| 33 | 6153F | III | III | Moderate – high levels of glare |
| 34 | 6153H | III | III | Low levels of control room reflectance |

TABLE 2.3.2-2

LIGHTING MEASUREMENTS BY LOCATION

| Location as Cited On CR Floorplan | Normal Illumination | Emergency Illumination | Average Luminance | Average Reflectance |
|---|---|---|---|---|
| | fc | fc | F+L | % |
| 1. TP3 CRO's Desk | 86 | 7.60 | 44.0 on blotter | 51 |
| 2. TP3 Console | 91 | 9.60 | 17.7 | 21 |
| 3. TP3 VPA | 40 | 1.95 | 6.9 | 17 |
| 4. TP3 VPB | 40 | 0.99 | 6.5 | 9 |
| 5. TP3 $VPB_2$ | 51 | 0.99 | -- | 9 |
| 6. TP3 NIS pane | 69 | Min. 3.0 Max 8.0 | 9.4 | 14 |
| 7. Computer Desk | 91 | 2.71 | 6.9 (37.1 on paper) | 8% (41% off paper) |
| 8. TP4 NIS | 71 | 0.99 | 8.0 | 11 |
| 9. TP4 CRO's Desk | 88 | 6.30 | 48.0 on blotter | 55 |
| 10. TP4 $VPB_1$ | 53.5 | 0.80 | -- | 4 |
| 11. TP4 $VPB_2$ | 42.4 | 0.90 | 5.9 | 12 |
| 12. TP4 VPA | 45.55 | 3.40 | 10.0 | 22 |
| 13. TP4 Console | 81.5 | 4.50 | 20.6 | 25 |
| 14. Lower Wall | 42<br>40 | --<br>-- | 15<br>9.5 | 36<br>24 |
| 15. Floor | 68 | -- | 23.3 | 34 |

## FIGURE 2.3.2-2
## LIGHTING SURVEY MEASUREMENT POINTS

**(SEE TABLE 2.3.2-2 FOR MEASURED/COMPUTED VALUES)**

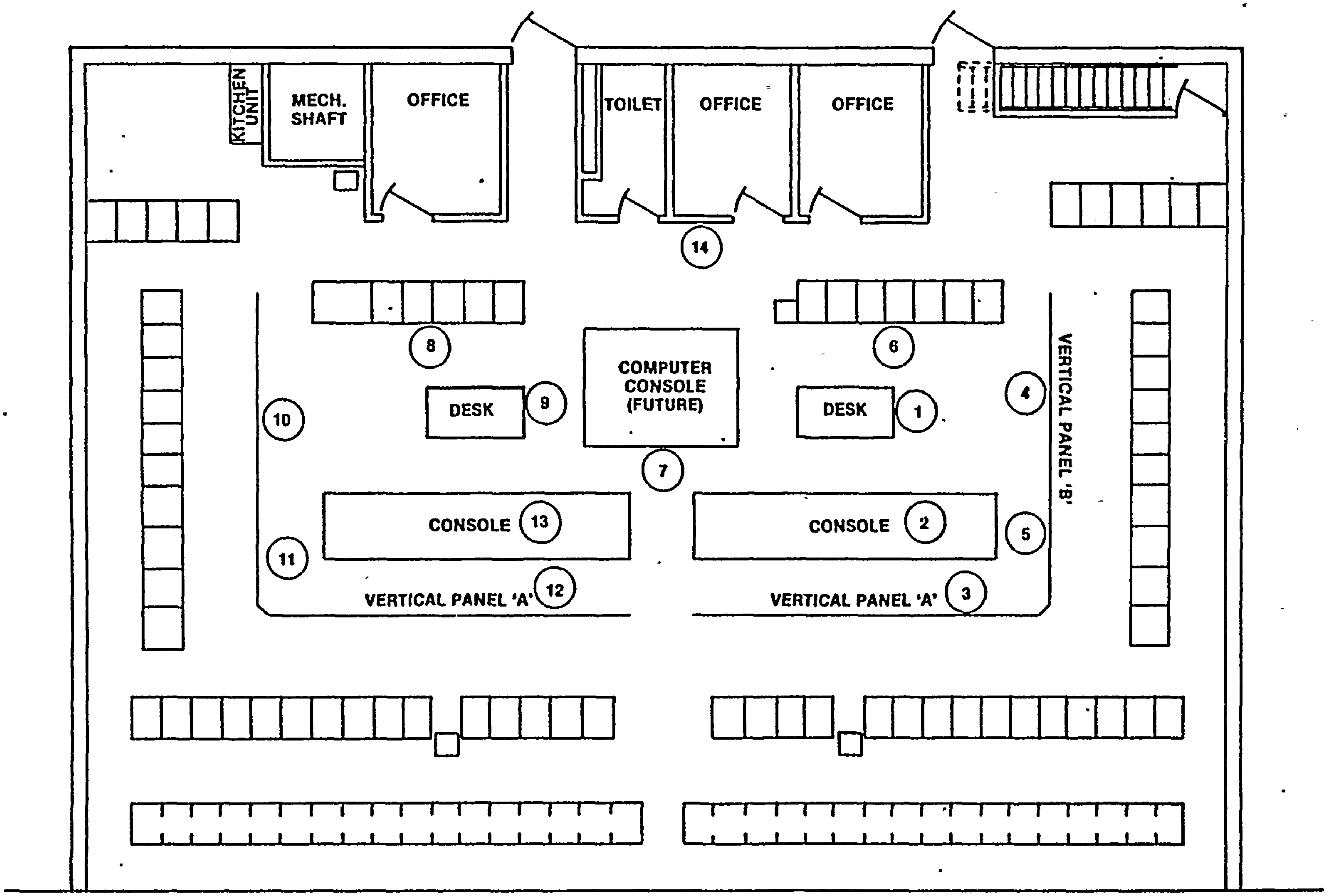
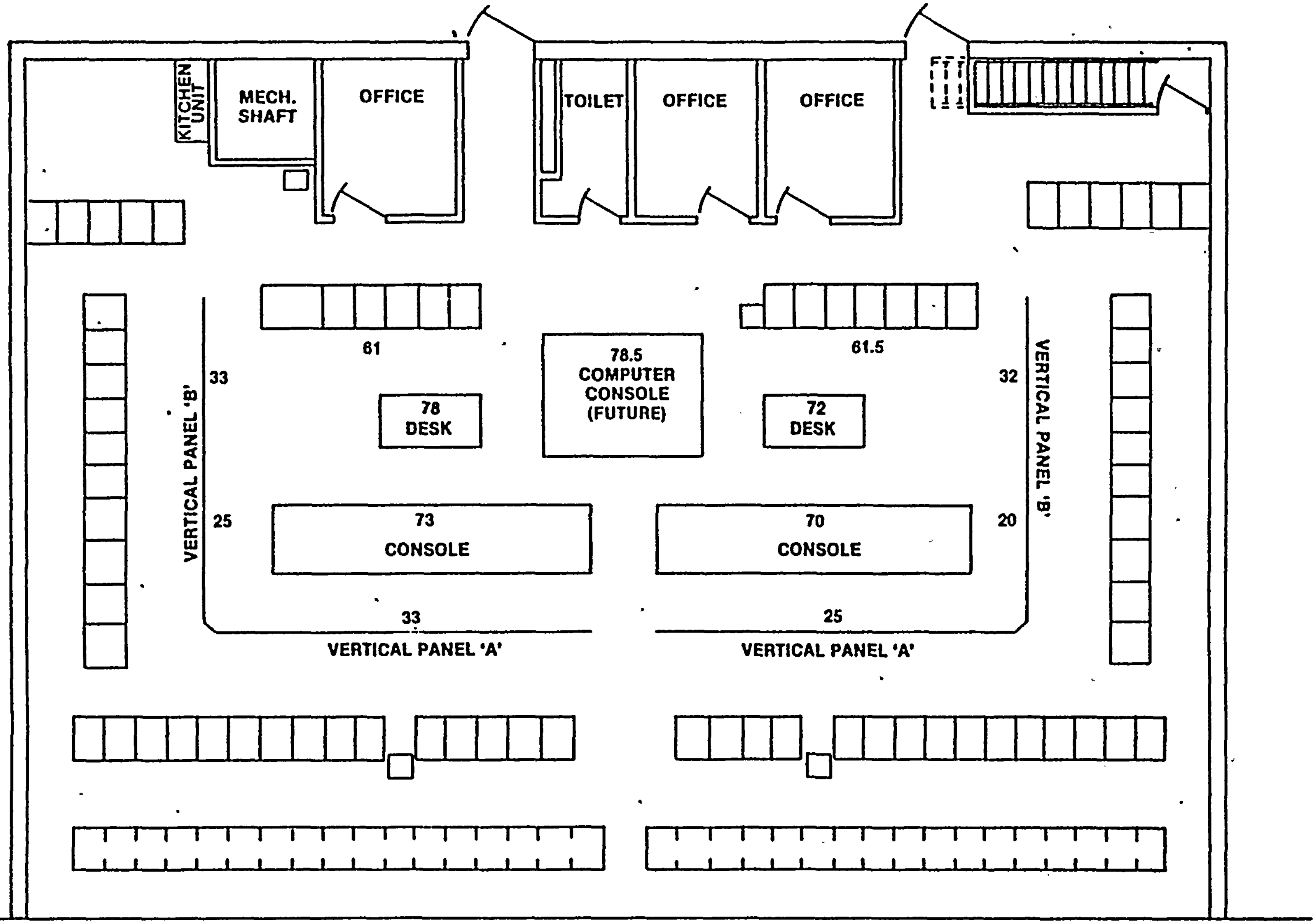


**FIGURE 2.3.2-3**
**ILLUMINATION LEVELS USING BLUE FLORESCENT LIGHTS OVER VERTICAL PANELS**
**(FOOT-CANDLES)**



Contrast — Contrast reduced by grime on miscellaneous labels, pushbutton legends and mechanical flags were found discrepant as well as the low contrast of printed numerals on impact recorder chart paper.

### 2.3.3 Control Room Environment Workspace Survey

2.3.3.1 Objective — The objective of the Control Room Environment Survey was to evaluate the control room environment to ensure safe, comfortable, and efficient operation. The assessment included furniture and equipment layout; document organization, use, and storage; supervisor access to control room; ambiance and comfort; and temperature, humidity, and ventilation.

2.3.3.2 Review Team Selection — The personnel required to conduct this survey and their responsibilities included:

- A Human Factors Engineer was responsible for data collection, data analysis, and final report preparation.
- Various Control Room Operators, familiar with the control room operations and problems, to assist in the assessment of the control room environment. Their input was contributed through informal and formal interview processes.
- A Technical Assistant to aid in the collection of measurements and data.

2.3.3.3 Criteria — The following are the summarized guidelines from NUREG-0700 used to evaluate the control room environment. Detailed criteria are contained in the attached checklist.

Furniture and Equipment Layout — Work stations, including desks, consoles, and panels, will be placed and spaced to facilitate unobstructed viewing, movement and communications.

- L-shape, U-shape, concentric, or wing configurations facilitate sight, movement, and communications.
- Enough space is allowed to enable a single operator to perform required tasks.
  - A minimum of 50 inches is suggested between a single row of equipment/panel and a wall or other opposing surface.
  - A minimum of 50 inches is recommended between two rows of facing equipment.
- A minimum of 8 feet of space is recommended between opposing rows of equipment where more than one operator must work simultaneously or where kneeling or bending is necessary.

Document Organization, Use, and Storage — A good system for organizing and storing documents is required to enhance their location and use. All documents are easily accessible. Documents are clearly labeled.

Supervisor Access to Control Room — The shift supervisor's office is readily accessible to the control room.

Temperature, Humidity, and Ventilation

- o Air temperature at floor level and at head level should not differ by more than 10° F.
- o The ventilation system should introduce outdoor air into the control room at a rate of at least 15 cubic feet per minute per occupant.

Ambiance and Comfort — Features to consider in creating a pleasant and comfortable atmosphere in the control room are:

- o Color combination
- o Color and lighting
- o Visual relief from instrumentation
- o Comfortable seating
- o Carpeting.

2.3.3.4 Task Definition/Methodology

The below procedures were performed for each of the control room envirnoment subcategories.

Furniture and Equipment Layout

- o The control room work stations were determined to include the Control Room Operator's desk, the entire bench console, vertical panels A, B, and NIS, and the computer printer table. Also examined were entrance/exists from the primary area, and walkspace/passageway dimensions surrounding work stations.
- o Maintenance and operational requirements were reviewed (to eliminate those criteria not applicable to this control room).
- o Sample components were evaluated using the checklist.

Document Organization, Use, and Storage

- o The plant procedures documents were selected for evaluation as these were the only documents stored within the primary area of the control room.
- o The procedures were evaluated on a sample basis, according to the NUREG-0700 guidelines, using the checklist.

Supervisor Access to Control Room — Access for the Nuclear Plant Supervisor and Nuclear Watch Engineer were evaluated, using to the NUREG-0700 guidelines and the prepared checklist. Meetings were attended regarding the possible relocation of these offices, to assess operational requirements and possible alternatives to the present design.

Temperature, Humidity, and Ventilation

- o Temperature and Humidity were measured 24 hours each at head and floor level using a 7-day continuous circular trend recorder.
- o Ventilation was measured using a Davis Ball Bearing Anemometer hand-held six feet above the floor at three equally spaced locations of vertical panel A (A-F on attached drawing) for each unit. Other workspace locations sampled (e.g., G-J) produced no significant readings on the scale. Five 1-minute readings within a 2-foot square matrix (approximate space occupied by one standing operator) were taken at each location, averaged, and the correction factor applied to derive actual air velocity in feet per minute (FPM). A multiplication factor of 2 cubic feet (size of measured matrix) was used to convert feet per minute to cubic feet per minute (CFM) yielding air quantity in each location.
- o Temperature, Humidity and Ventilation measurements were evaluated using NUREG-0700 guidelines and the prepared checklist.

Control Room Decor — Operator interviews were reviewed, and each feature of control room decor was evaluated, according to NUREG-0700 guidelines.

2.3.3.5 Results/Findings — The output for this survey includes the completed checklist for each subcategory of the control room environment, Human Engineering Discrepancy Reports for each parameter conflicting with NUREG-0700 guidelines, and a tabular listing of ventilation measurements. Table 2.3.3-1 summarizes Human Engineering Discrepancies identified during this survey.

In general, the Turkey Point control rooms met the NUREG-0700 guidelines. Two Human Engineering Discrepancies of particular interest were: 1) supervisor visual access to the control room and 2) mirror imaging in the control rooms. Each is discussed below.

Supervisor Visual Access — Figures 2.3.3-1 and 2.3.3.2 show control room visibility from the shift formen's and watch engineer's offices, respectively. Note that a good deal of each control room is obscured by the nuclear instrumentation system (7-foot vertical) panels. A variety of means to ameliorate these discrepancies have been considered, from "bulging" the offices out into the control room between the nuclear instrumentation system panels to elevating the office floors to a point when visibility <u>over</u> the nuclear instrumentation system panels would be afforded. Florida Power & Light elected to extend the Nuclear Plant Supervisor's office into the control room area, which allows complete control room visibility.

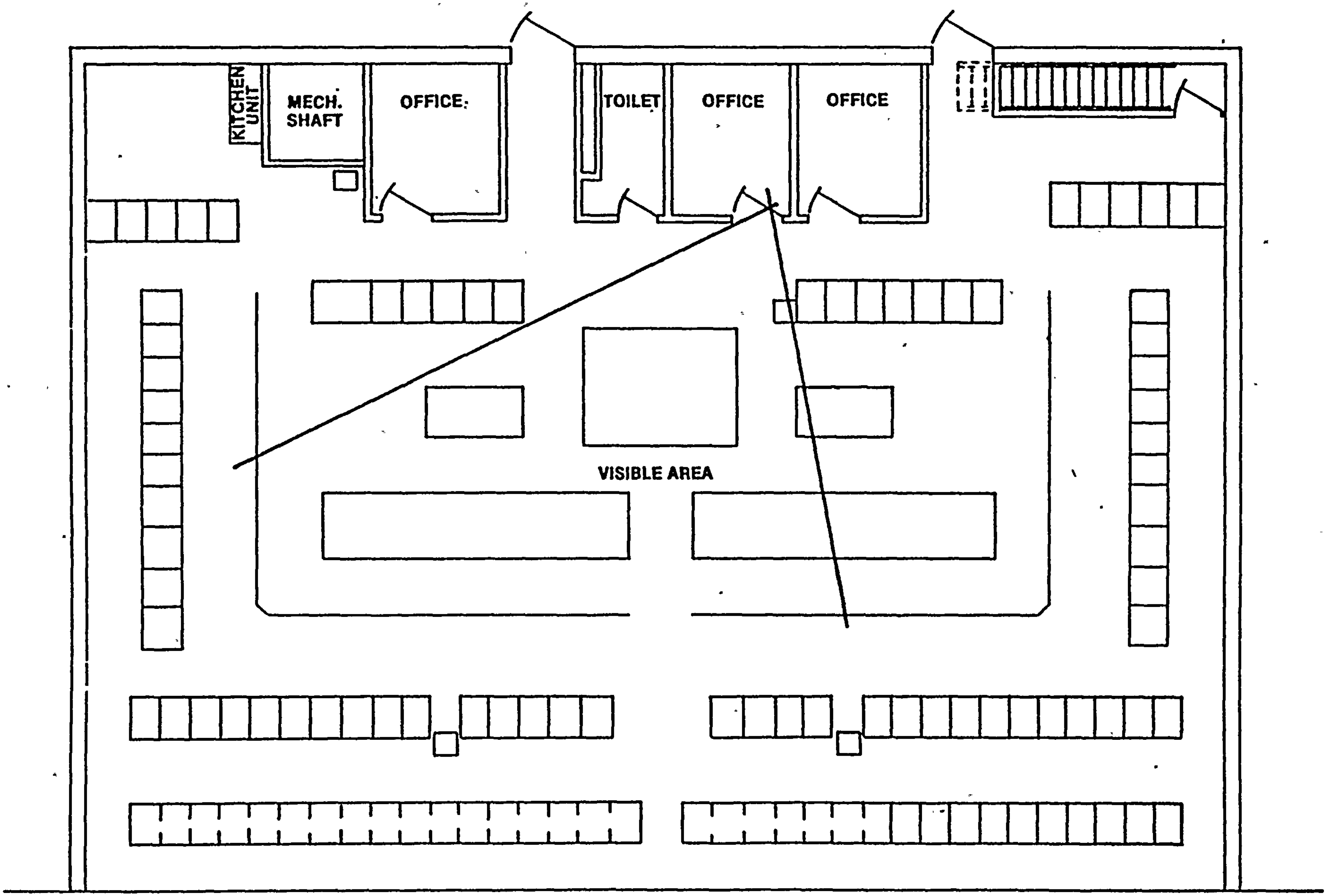
Unit Mirror Imaging — Mirror-imaging in design is considered to potentially present a problem in terms of its impact on human performance in systems operation. The potential impact of this design is represented in plant staffing: if each unit had separate

TABLE 2.3.3-1

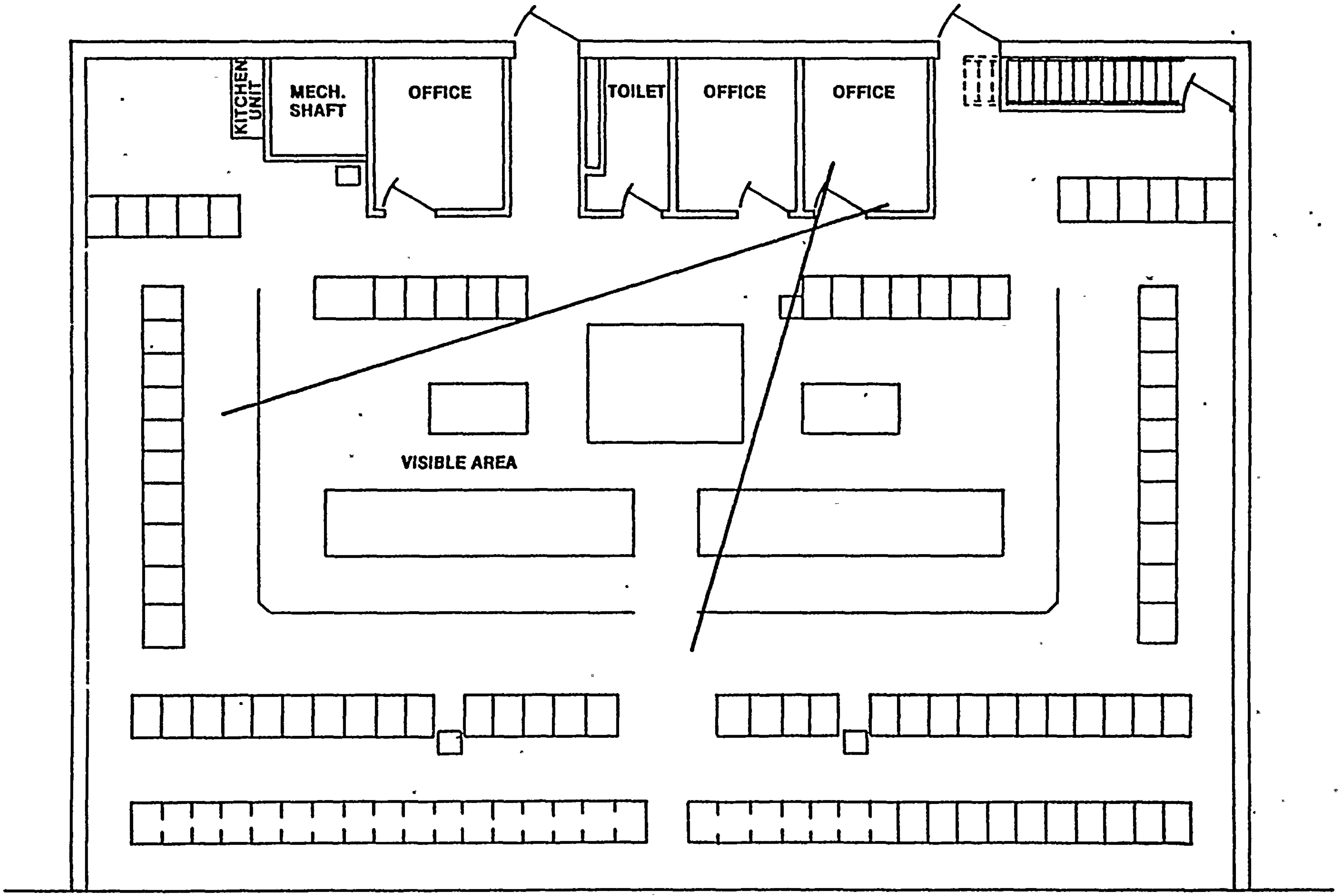
ENVIRONMENT/WORKSPACE SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 2 | 6112A | III | III | Staffing paperwork |
| 1 | 6112B | IIC | IIC | Utilization of additional personnel |
| 3 | 6113A | III | III | Component visibility |
| 9 | 6113G | III | III | Unguarded openings |
| 35 | 6114A | IIC | IIC | Storage space in control room |
| | 6114B1-3 | IIA | IIA | Document organization and storage |
| 10, 27, 38 | 6115,C,D | III | III | No provision for storage |
| | 6116A | IIB | IIB | Supervisor office location |
| 39 | 6123F | III | III | NPS phone layout |
| 40 | 6131E | IIC | IIC | Unit 4 information in Unit 3 |
| 20 | 6131E2 | IIC | IIC | Equipment integration and interference |
| | 6131E2 | IIA | IIA | Unit dedicated phones |
| 24 | 6132 | III | III | Mirror imaging |
| 28 | 6151A | IIC | IIC | Air conditioning reliability |
| 28 | 6151A | III | III | control room temperature too low |
| 29 | 6152B | III | III | Excessive ventilation flow |

**FIGURE 2.3.3-1**
**CONTROL ROOM VISIBILITY FROM SHIFT FOREMANS OFFICE**



## FIGURE 2.3.3-2
## CONTROL ROOM VISIBILITY FROM SHIFT WATCH ENGINEERS OFFICE



staff the problem would not exist. At the Turkey Point Nuclear Power Plant there are two units each with their central control areas and respective control room operator. Both unit control areas are housed in the same room. In addition, there is a control room operator who is available to work either unit. The inherent issue lies in the monitoring and controlling of the nuclear instrumentation for both units on an alternating basis.

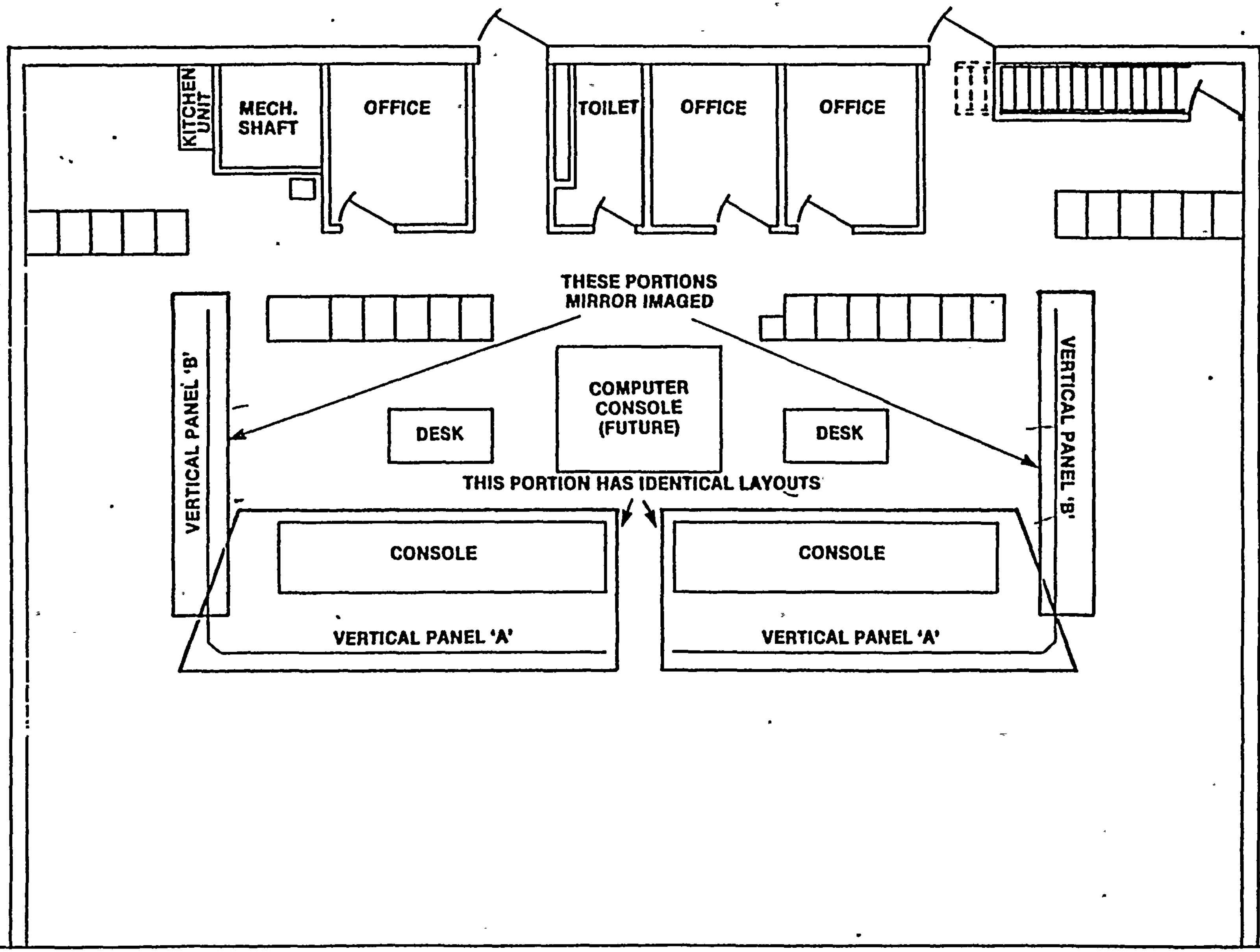
Mirror-imaging of Turkey Point control panels is limited to the Safeguard Panels which are partial mirror images of each other. Mirror-imaging is called "partial" for the purposes of explanation in this study. It is partial because mirror-imaging occurs only on the vertical "B" panels. Figure 2.3.3-3 should help clarify this. In other words, a major group of components located on the right side of a panel for one unit will appear on the left side of the panel for the other unit. For the most part, component sequence and arrangement within the group remains intact and identical between units. The potential impact with this design lies in the change in movement and orientation patterns for the operator who conducts tasks on both Units 3 and 4 Safeguard Panels.

The following describes a study that was conducted to pinpoint some of the task sequences and control room locations where any deleterious effects of mirror-imaging are most likely to occur. The study was based on the findings and data of the Turkey Point system, functions, and task analysis.

Operator orienting, timing, and search pattern requirements were compared between units for task analyzed sequences. This was conducted using Task Analysis and Spatial-Operational Sequence Diagams to depict interrelationships between temporal and sequential aspects of the task sequences. In addition, traffic patterns were used to evaluate movement between panels and the effects of mirror-imaging. The results indicate a divergent operational sequence for personnel who operate both units. Figures 2.3.3-4 and 2.3.3-5 show, for the same task sequence (reactor startup from hot standby), the traffic requirements for Units 3 and 4, respectively. Note that circulating patterns are similar, but 1) links differ in length, and 2) directions are revised. Figures 2.3.3-6 and 2.3.3-7 make this point move dramatically. In micro, task sequences conducted on the vertical ("B") panels are mirrored. Figures 2.3.3-8 and 2.3.3-9 show a task sequence for Units 3 and 4, respectively. Note that this is the same task sequence for each unit. The major concern in this example is the visual similarity of the panel layouts, particularly in the area of the recirculation and sectioning values (Task 2). Here a definite possibility of control substitution exists.

From the above, two distinct concerns are apparent: 1) divergent traffic patterns between the two control rooms, and 2) once vertical "B" panel has seen accessed, mirrored left/right sequences. Each of these is discussed below.

**FIGURE 2.3.3-3**
**TURKEY POINT UNIT 3&4 MIRROR IMAGING**



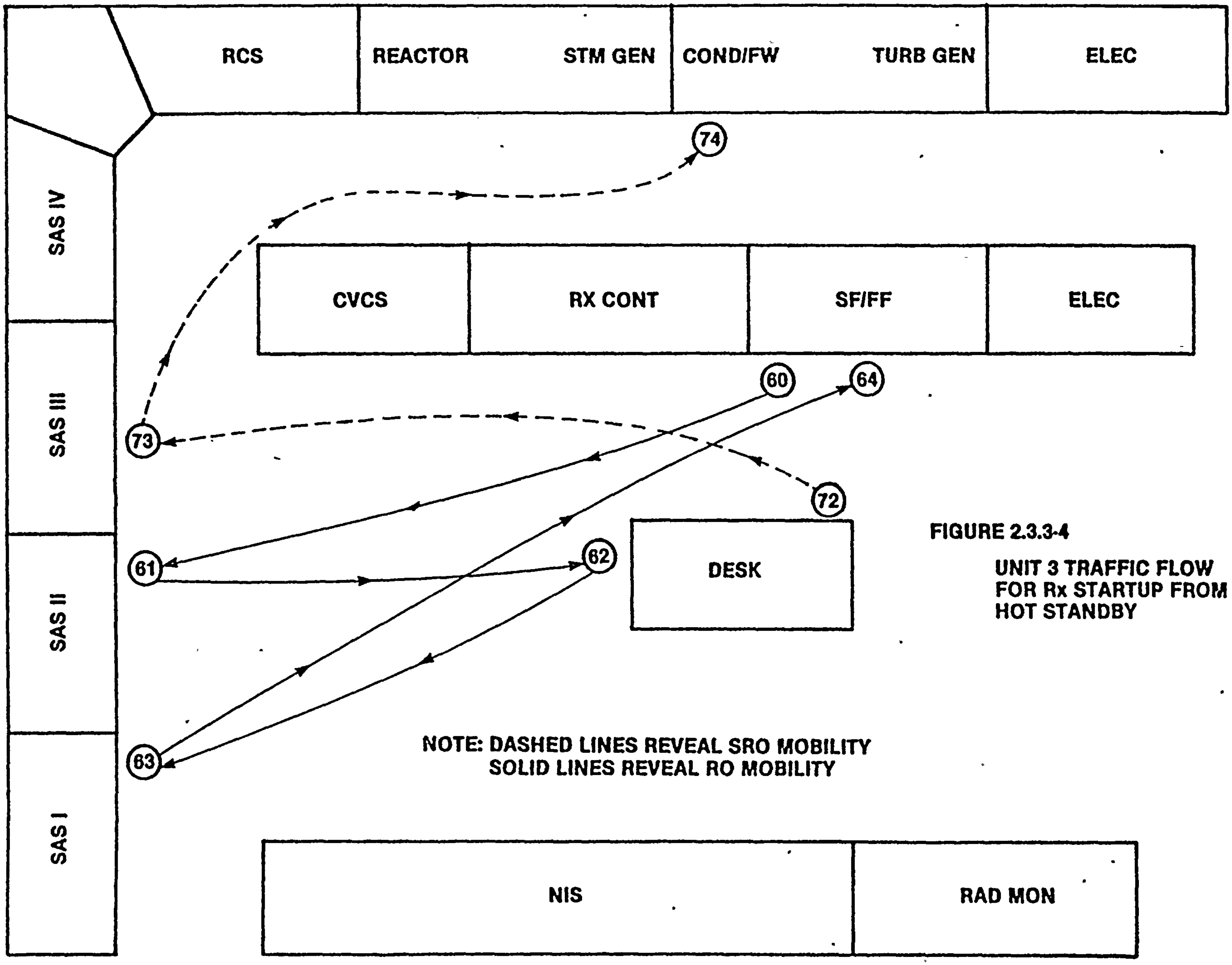



FIGURE 2.3.3-4

UNIT 3 TRAFFIC FLOW FOR Rx STARTUP FROM HOT STANDBY

NOTE: DASHED LINES REVEAL SRO MOBILITY
SOLID LINES REVEAL RO MOBILITY

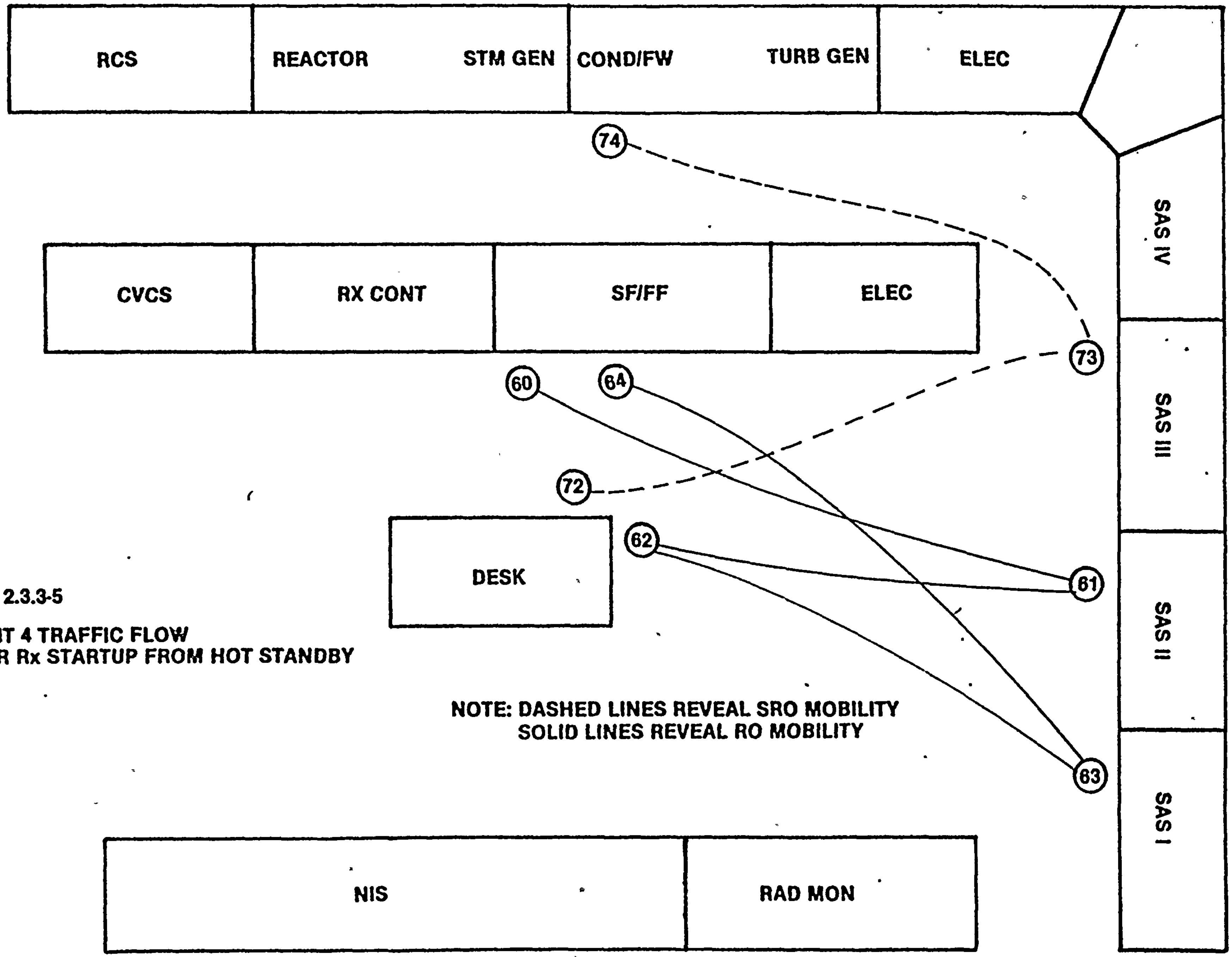



FIGURE 2.3.3-5

UNIT 4 TRAFFIC FLOW
FOR Rx STARTUP FROM HOT STANDBY

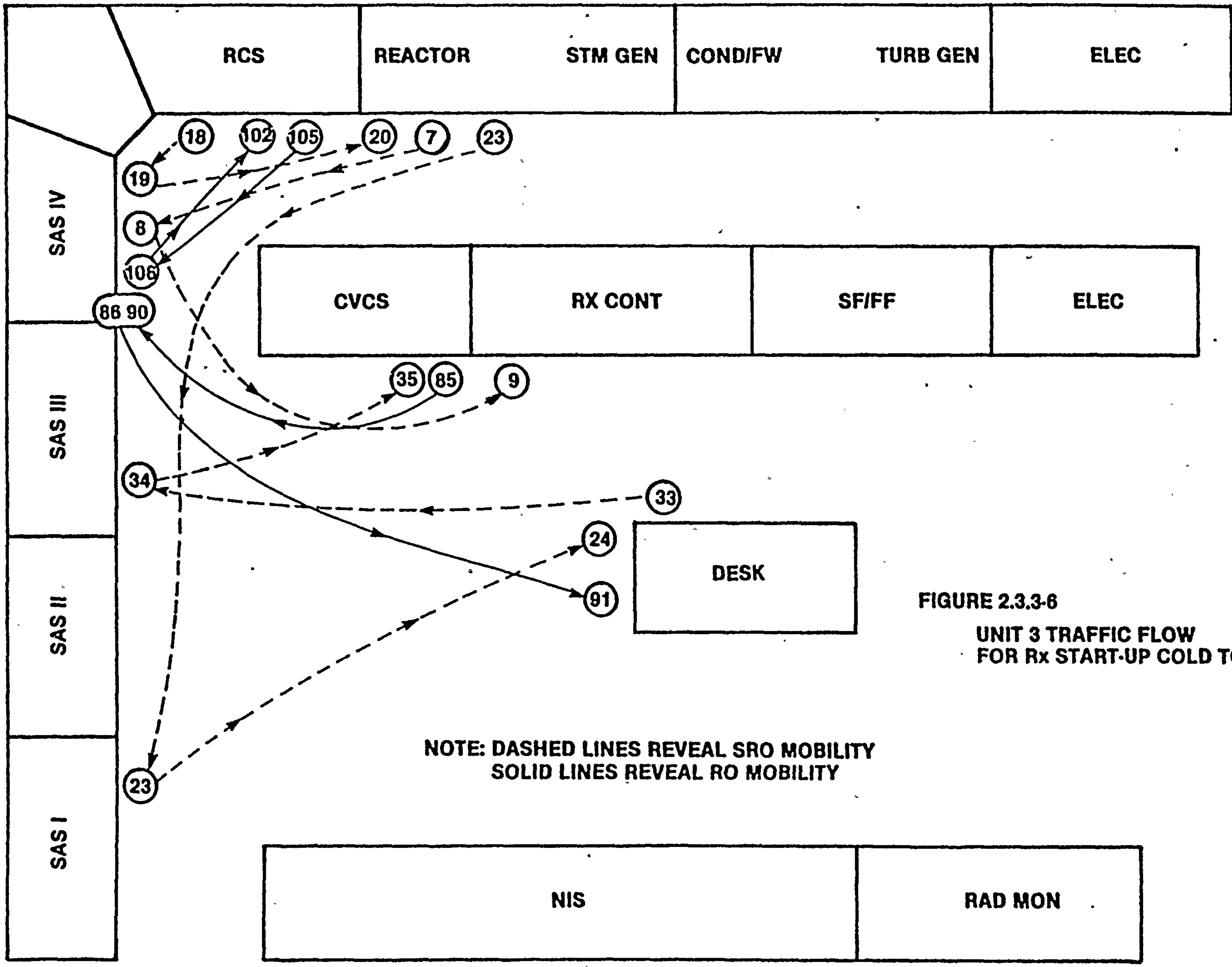



FIGURE 2.3.3-6

UNIT 3 TRAFFIC FLOW
FOR Rx START-UP COLD TO HOT

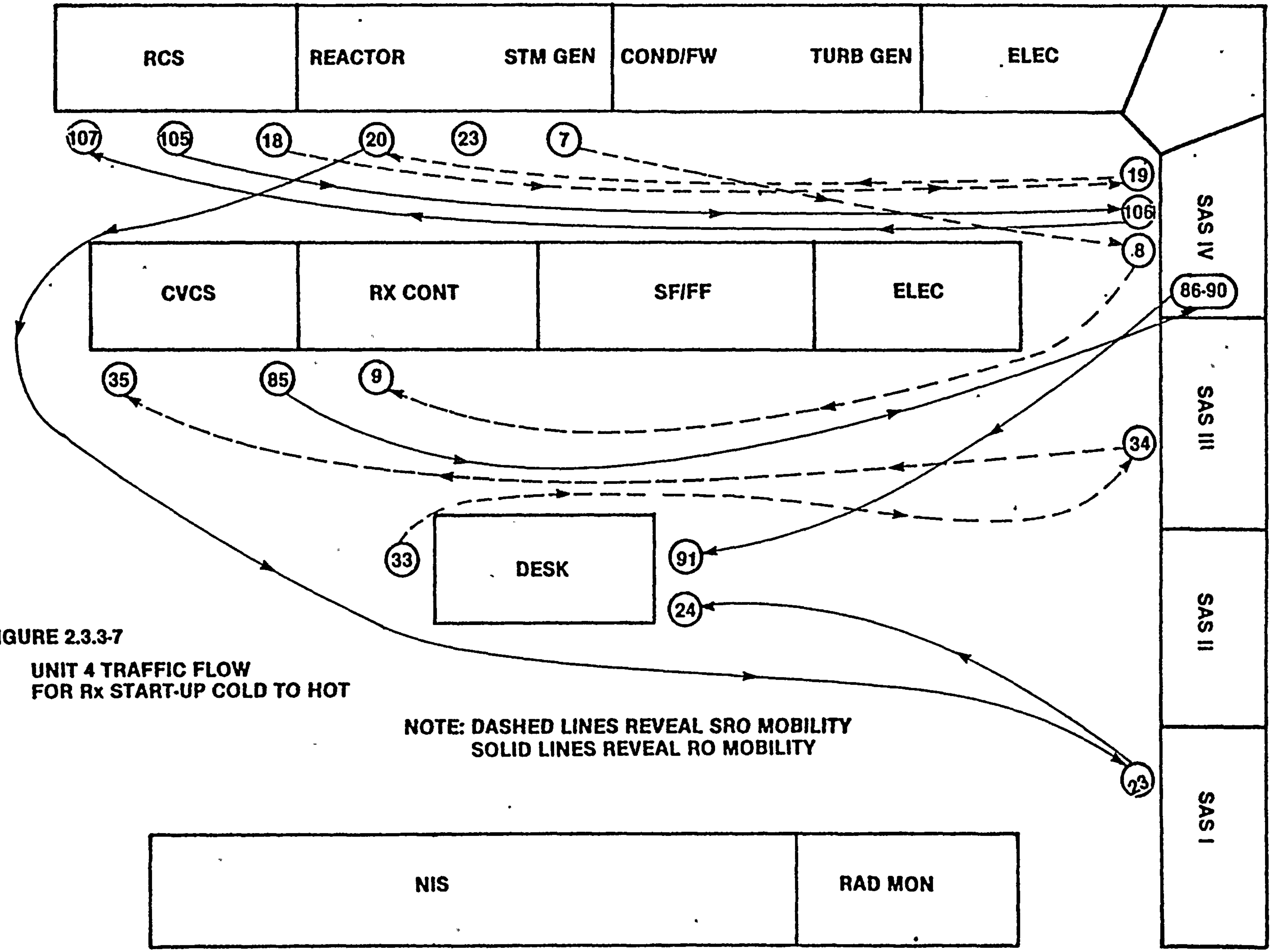
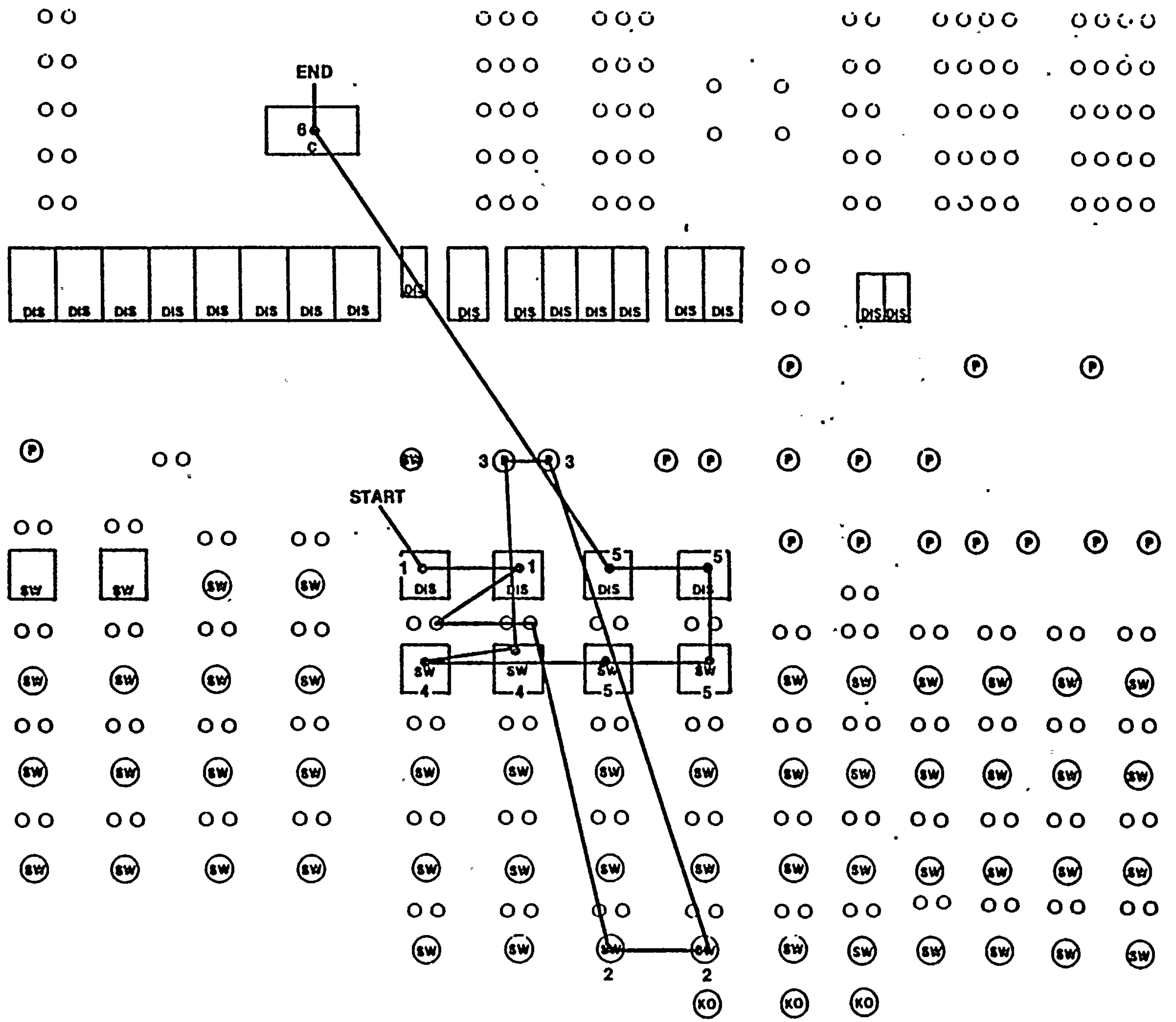



FIGURE 2.3.3-7

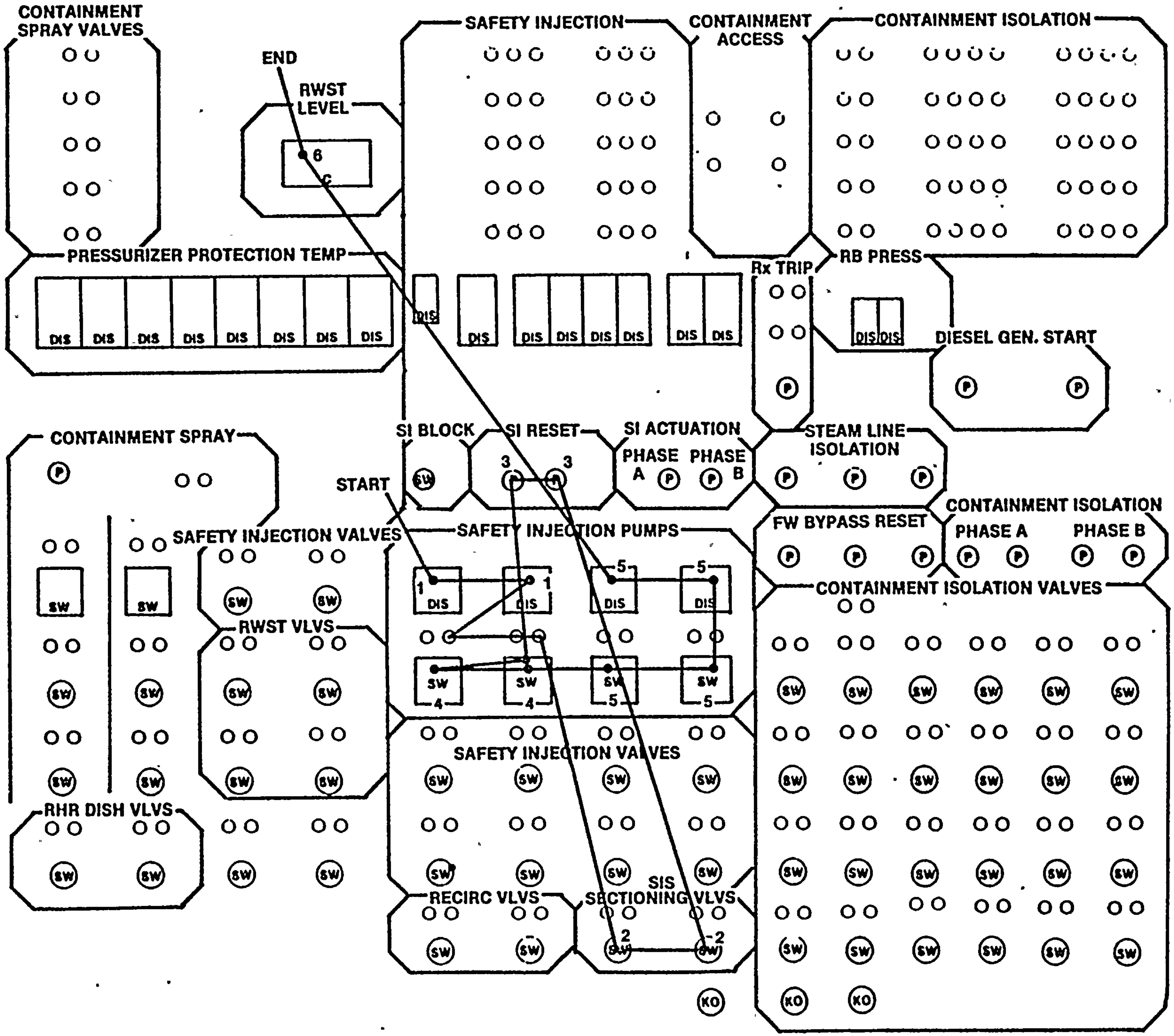
UNIT 4 TRAFFIC FLOW
FOR Rx START-UP COLD TO HOT

NOTE: DASHED LINES REVEAL SRO MOBILITY
SOLID LINES REVEAL RO MOBILITY

FIGUR[illegible].3.3-8
SIX STEP TASK SEQUENCE FOR TP UNIT 3



FIGU[illegible].3.3-9
TP UNIT 3 TASK SEQUENCE WITH DEMARCATION

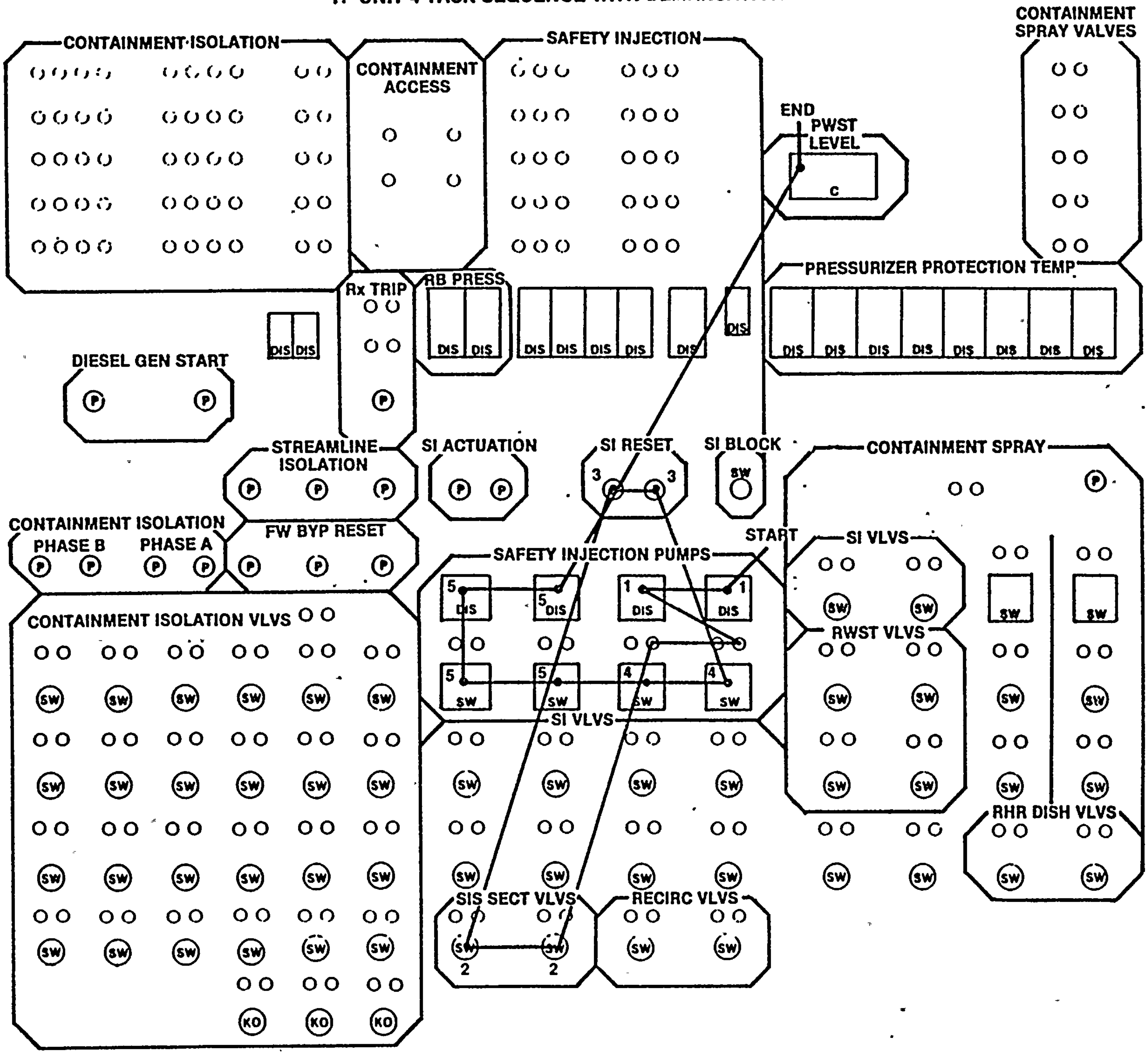


Trafficability —In this case, orienting responses to the "B" vertical patterns may be disrupted. In other words, an operator may initially orient himself to the right, rather than the left, to begin access to the panel. However, there are numerous noncognitive cues to panel location, probably the most significant being the periphery of vision and the acoustical environment. Additionally, the only error type anticipated are those concerning temporal access to controls and displays. Here if a misorientation occurs, it would be readily identified and reorientation would take place. In this case, temporal errors would probably be measured in milliseconds. Given this, essentially no severe adverse operational effects from mirror-imaging of control room overall layout are expected or predicted.

Mirrored Left/Right Sequences — Of greater interest to the issues of operability is the mirroring of the designs of the vertical "B" (Safeguards) panels. As mentioned earlier with regard to the example task sequences of Figures 2.3.3-8 and 2.3.3-9, the principal errors that could be involved are control and display substitution errors. Again, however, the stimuli for orienting to, and accessing, controls and displays are not entirely homogeneous. That is, the visual periphery and acoustic cues are not identical and therefore may not greatly facilitate substitution errors. Indeed many cues exist which may faciltate correct responding. For example, as both units, the safety injection controls/displays are located between the vertical "A" panel and containment isolation on the vertical "B" panels. Panel orientation will probably be towards (or away from) significant stimuli, e.g., vertical panel "A". In humans, left-right discriminations based on interoceptive (or internal, or cognitive) stimuli are at best unreliable. Far more reliable discriminations are exteroceptive cues, e.g., vision and sound. However, different response patterns to similar stimuli do exist, and some cues may be added to help mitigate any deleterious effects of left-right stimulus transfer. That is, additional stimuli can be added to the panels to facilitate correct responding; in this case, demarcation and summary labels. Figures 2.3.3-9 and 2.3.3-10 show the same task sequence for Turkey Point Units 3 and 4 on the vertical "B" panels. The demarcations in these figures clearly break up the panels and provide many additional component localization cues. It is considered to drastically reduce component localization time and increase the probability of correct responding. With demarcations and summary labels as indicated in these figures, minimal negative transfer is anticipated.

Mirror-imaged panels (Safeguard Panels) were compared on a component basis to identify those components which appear out of sequence within a functional group between units. The potential for operator substitution error exists since the mirror-image

FIGURE 2.3.3-10
TP UNIT 4 TASK SEQUENCE WITH DEMARCATION

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design disturbs the left-to-right or top-to-bottom sequence an operator would expect to find on both units.

Specific controls and displays which violate expectancies and conventions are listed below.

- Several controls in the grouping for S.G. BLOWDOWN, S.G. SAMPLE and BORON INJECTION are in different arrangements between units.
- Sequence of displays for HOT LEG and COLD LEG FLOW differs between units.
- Arrangements of controls for the SAFETY INJECTION group located in the center of the panel are identical betweeh units with the exception of the bottom four controls which are in reversed arrangement between units. Control substitution is highly likely.
- Sequence of indicator lights for RECIRCULATION SUMPS are reversed on Unit 4 with SUMP B NORTH to the left of SUMP A SOUTH.
- Arrangement of the display group for RHR INTERLOCK, RHR OUTFLOW, COMPONENT COOLING TEMPERATURES differs in the left-to-right sequence between units.
- Arrangement of the COMPONENT COOLING WATER controls differs between units. The top-to-bottom sequence of PUMPS A, B, C and adjacent related controls are not identical between units.
- Group sequence of AUX BUILDING VENTILATION controls differ between units. Arrangement on Unit 3 is as follows (left-to-right): SUPPLY FAN A, B, EXHAUST FAN A, B. Arrangement on Unit 4 is as follows (left-to-right): EXHAUST FAN A, B, SUPPLY FAN A, B. This is potentially confusing because an operator uses adjacent or surrounding components for cues in locating a needed component.
- Sequence of controls differ between units for PRZR STEAM SAMPLE ISOL, LOOP A&B SAMPLE ISOL, ACCUMULATOR SAMPLE ISOL, RC DRAIN TK GAS ANAL ISOL.
- Component appearance for RHR LTDN TO CVCS controller differs between units. Unit 3 controller has a black face plate, Unit 4 controller has a silver face plate.
- Label terminology differs between units for identical components.
  - A and B CONTR ROD DR COOLER DAMPER (controls and displays)
  - RECIRC SUMP A and B (indicator lights)
  - CONTAINMENT SPRAY PUMP DISCHARGE (controls)
  - SI PUMP DISCH HRD ISOL OPEN (controls).

### 2.3.4 Controls and Displays Survey

2.3.4.1 Objective — The purpose of the Controls and Displays Survey was to identify and document Human Engineering Discrepancies associated with the detailed design of controls and displays. Details of design include for example: color coding, sizes/shapes (e.g., of switch handles), control/display orientations, and so forth.

2.3.4.2 Review Team Responsibilities — The review team consisted of two human factors specialists who collected data and documented the discrepancies. Operations personnel available in the control room at the time of data collection answered plant-specific questions regarding the operator-control board interface. In addition, many guideline items required access to engineering, maintenance, and instrumentation and control personnel for resolution and identification of Human Engineering Discrepancies. These personnel were contacted on an as-needed basis.

2.3.4.3 Criteria — Criteria for controls and displays are presented in the control and display checklists which consist of NUREG-0700 recommended guidelines that are applicable to assessment of detailed control and display design. The specific checklists used by the review team are presented in Appendix A.

2.3.4.4 Task Definition/Methodology — The Controls and Displays Survey was divided into a number of component-specific checklists (e.g., meters, rotary controls), each of which was designed to be used independent of all other checklists. All checklist items for a particular control or display type were applied to each component in that class. Each component that did not meet a criterion was listed in a Human Engineering Discrepancy discussing the guideline violated. All Human Engineering Discrepancies resulting from this survey are listed on the appropriate control room inventory forms, providing Florida Power & Light with a list of control and display detailed design discrepancies associated with each component.

2.3.4.5 Results/Findings — Table 2.3.4-1 lists each Human Engineering Discrepancy identified as a result of the Controls and Displays Survey. The table contains the finding number, category, description, and related comments.

Control Board Maintenance — Obsolete components have not been removed, meter scale face coding has not been updated to match expected scale values, and dynatape is used to change scale ranges and position labels rather than modifying or replacing the control or display with an appropriate component.

Other problems with component use are also a product of plant age. Tape used to code operating zones on meter scale faces is peeling off and paint from position labels has chipped, rendering a subset of the labels unreadable.

TABLE 2.3.4-1

CONTROLS & DISPLAYS SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 1 | 6411b1 | III | III | Unguarded/unnecessary control |
| 3 | 6411c1 | IIC | IIC | Selection of controls |
| 4 | 6411c2 | IIC | IIC | Human suitability - inching valves not marked |
| 5 | 6411e1 | IIC | IIC | Durability/control selection |
| 6 | 6412 | IIC | IIC | Prevention of accidental activation |
| 8 | 6412b2 | IIC | IIC | Movable covers |
| 9, 10, 11 | 6421 | III | III | Direction of movement |
| 12-15 | 6422f3 | III | III | Contrast with panel (low contrast) |
| 16 | 6431b | III | III | pushbutton-indication of activation (feedback) |
| 17 | 6431c | III | III | Surface not frictionalized |
| 32 | 6432d | III | III | Guarded pushbutton-ease activation |
| 18 | 6433a | III | | Distinguishability legend pushbuttons |
| 30 | 6433b3.4 | IIC | IIC | Legend contrast |
| 19 | 6433c3 | IIC | IIC | Provision for lamp failure & shock hazard |
| 23 | 6442a | III | III | High torque designs |
| 26 | 6444e1 | III | III | Knob skirt dimensions |

TABLE 2.3.4-1

CONTROLS & DISPLAYS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 27 | 6444e5 | III | III | Knob dimensions |
| 28 | 6445b2 | III | III | Control positioning |
| 29 | 6445d1 | III | III | Lack of pointer/visibility |
| 33 | 6445e4 | III | III | Control dimensions - thumbwheels |
| 34 | 6445f | III | III | Spring momentary controls-torque |
| 25, 26, 27, 28 | 6511b | IIC | IIC | Completeness of information |
| 24 | 6511c | IIC | IIC | Unnecessary components |
| 1 | 6511e | IIC | IIC | Demand information vs. status information |
| 28, 79 | 6511f | IIC | IIC | Display failure |
| 3 (6 HEDs) | 6511f | III | III | Failure indications |
| 29 | 6512a | III | III | Scale is larger than necessary or unnessary |
| 30 | 6512b | IIC | IIC | Usability of display values |
| 31 | 6512e | III | III | Scale size marking and transformations |
| 32 | 6513a | III | III | Display character height - label |
| 4 | 6513b1,2 | | III | Inconsistent font style |
| 5 | 6513b3 | III | III | Label not in all caps |
| 6 | 6513d | IIC | IIC | Character dimensions |
| 34 | 6514a | III | III | Measurement units missing |

TABLE 2.3.4-1

CONTROLS & DISPLAYS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 8, 39, 40 | 6515a1 | III | III | More than nine marks between numbered scale points |
| 43-45 | 6515b | III | III | Scale format |
| 9, 10 | 6515c | III | III | Scale increments |
| 46 | 6515d | III | III | Scale markings inconsistent |
| 11 | 6515f | III | III | Multiple indications |
| 50, 51 | 6522a2 | III | III | Pointer tip form |
| 52, 53 | 6522b1 | III | III | Pointers not close enough to index |
| 16 | 6522b2 | III | III | Pointer parallax |
| 54 | 6522b2 | | III | Parallax |
| 55 | 6522c | IIC | IIC | Pointer visibility |
| 57 | 6531a1 | IIC | IIC | Lamp test/master light test |
| * | 6531a2 | IIC | IIC | Failure of display not apparent |
| 18 | 6531a3 | IIC | IIC | Ease of bulb replacement tools for bulb replacement |
| 58 | 6531c1 | III | III | Precautions to avoid misinterpretation |
| 61 | 6531d | | | Use as alerting indicators |
| 64 | 6533 | IIC | IIC | Design of legend light indicators |
| 64 | 6533 | III | III | Legend design |
| | 6533a2 | IIC | IIC | Readability/contrast |

TABLE 2.3.4-1

CONTROLS & DISPLAYS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 81 | 6541 | IIC | IIC | Recorder maintenance |
| 66 | 6541a | III | IIC | Quality of materials |
| 67 | 6541b | III | III | Paper/scale mismatch |
| | 6541d | IIC | IIC | Recorder paper takeup |
| | 6541f | III | III | Recorder paper maintenance |
| 68 | 6541i | IIC | IIC | Paper speed adjustability |
| 69 | 6541k | | IIC | Visibility |
| 84, 72 | 6542b2 | IIC | IIC | Channel identification on instrument |
| 73 | 6542b3 | IIC | IIC | Recorder readability |
| 74 | 6542b4 | IIC | IIC | Channel selection capability |
| 20 | 6551a2 | III | III | Numeral width:height ratio |
| 75 | 6551a3 | III | III | Grouping of numerals |
| 76 | 6551c | III | III | Counter drum movement |
| 21 | 6552a2 | III | III | Slanted characters |
| 32 | 6552a3 | III | III | Counter numeral height |
| 22, 23 | 6552a5 | III | III | Separation between numerals |

Population Stereotypes — A number of controls and one display in each unit do not operate in conformance with control room conventions. Some controllers have conventional 0-100 scales for valve position, but the "100" indicates that the valve is 100 percent closed. A clockwise rotation of the associated knob, therefore, closes rather than opens the valve. Some rotary controls have "off" or "stop" to the right of the "on" or "start" positions.

Control Panel Contrast — No controls are presently color coded. Silver thumb rotaries, keyswitches, and toggle switches on the main control panels and black discrete rotaries on the nuclear instrumentation system channels should not be coded by their present colors, however, because they do not contrast sufficiently with the panel color. All other controls may be coded by their present color.

Inadvertent Actuation — Rotaries on the Safeguard Panels are guarded by placing magnetized metal covers over them. The covers have either red or green construction paper taped to them, indicating whether the valve is normally open or closed, and the valve number is written on the construction paper. The guards are inadequate because they may be moved easily and do not always cover the control. They are not desirable from a human factors standpoint because they sometimes obscure the control labels or indicator lights, may be placed somewhere on a panel other than over the intended control, and must be moved when the guarded control is used, possibly interfering with the operation or observation of adjacent controls or displays.

Rotaries on process controllers which should not be manipulated by control room operators are coded with a red dot. These controllers are, however, interspersed in a row of identical controllers and all are guarded in the same away. Similarly, fuses which, when pulled, will result in a reactor trip are not guarded or marked to distinguish them from less important fuses.

Pushbuttons — The following discrepancies with pushbuttons were noted:

- Nonlegend pushbuttons provide no form of positive feedback when activated.
- Some illuminated pushbuttons on the area radiation monitor are not concave or frictionalized.
- Legend pushbuttons on the area radiation monitor look like the legend lights on the process radiation monitor. One of the two should be coded in some way so that they are distinguishable.

Key-Operated Switches — At the time of the evaluation, key-operated switches were only installed in Unit 3. Analogous controls had not yet been installed in Unit 4. If,

once installed, they are identical to those in Unit 3, the Human Engineering Discrepancies discussed will apply to both units. The following discrepancies with keyswitches were noted:

- o Keys are not inserted with teeth pointing up.
- o Locks are not oriented so that the switch is "off" when the key is in the vertical position.

Rotary Controls — The following problems with rotary controls were noted:

- o J-Handle controls are too small and provide more than the recommended clearance when in the "pull-to-lock" position.
- o Both the continuous rotary knobs and the knob skirts on process controllers are too small.
- o Black discrete rotaries on nuclear instrumentation system channels may be positioned between detented points.
- o Rotaries on nuclear instrumentation system channels are not provided with a visible indication of position.

Information Displayed — Necessary information is not always displayed to the required degree of specificity, or is not available when necessary. The following are the noted instances:

- o All three condensate storage tank indications are powered by the same supply. If that supply were to fail, none would be available.
- o The RCP VIBRATION RECORDER, the only indication of pump vibration, takes two minutes to provide a trend.
- o CCW Header A and B level meters normally read between 0 and 10 but the scale is 0-140.
- o Some scales must be multiplied by a factor other than ten, making interpretations of these displays more difficult. In addition, scale multipliers are not well labeled.
- o SECONDARY WATER CONDUCTIVITY is displayed in Micromhos/cm rather than ppm, the units of measurement used by operators.

Scaled Displays — Discrepancies associated with the design of the instrument generally resulted from poor scale or pointer design. Discrepancies with scale design include the following:

- o Some graduations are missing or too small.
- o Major, intermediate, and minor marks are sometimes used inappropriately.
- o Adjacent meters measuring the same parameter do not always have compatible markings.

- o Meters with curved faces have parallax problems at all but the middle part of the scale.

Discrepancies with pointer design include the following:

- o Pointers on vertical meters are more than 1/16 inch from graduation marks.
- o A single pointer is used with multiple scales.
- o Pointer tips on impact recorders, horizontal meters on process controllers, and semicircular meters associated with rotary controls obscure graduation marks and/or scale numerals.
- o Pointer/background contrast on RWST level meters is insufficient because a temporary black label has been added behind the black pointer.

Light Indicators — Discrepancies with indicator lights are of two types: use of lights in inappropriate situations, and misinterpretation of light meaning because of component design. Indicator lights are (but should not be) used to alert operators to unfavorable conditions and to imply equipment status. The OMS legend light has a split window which illuminates completely when either side lights up.

Trend Recorders — Trend recorders are of two types: continuous (strip charts) and discrete (impact recorders). The following trend recorder discrepancies were noted during the evaluation:

- o The Tracor Westronics strip charts installed in Unit 4 have pen vibration.
- o Recorder paper scale does not always correspond with the integral recorder scale.
- o No recorders (other than the Tracor Westronic) have variable paper speeds.
- o Impact recorders do not identify the channel being displayed.
- o Impact recorders are often loaded beyond their channel capacity, making it difficult to identify any one trend.
- o It is not possible to select a single impact recorder channel for display before awaiting completion of the sampling cycle.

### 2.3.5 Conventions Survey

2.3.5.1 Objectives — The objectives of the Conventions Survey were to identify plant conventions and to determine if these were in compliance with the field survey document. Where discrepancies were identified an assessment was made to determine if there were deviations from acceptable in-place control room conventions, and to determine if a lack of convention was detrimental to efficient plant operation.

2.3.5.2 Review Team Responsibilities — Human factors representatives interviewed operators, applied checklists, and identified discrepancies. Operators were requested to identify conventions, sequences, and violations of conventions.

2.3.5.3 Criteria — Detailed criteria are contained in the checklists in Appendix A.

2.3.5.4 Task Definitions/Methodology

Interview — Control room operations personnel were interviewed to determine what conventions exist in the control room related to arrangement of systems and components, coding, abbreviations and acronyms, and control operation. Questions were presented to determine whether or not confusion existed due to certain conventions, deviations, or lack of conventions.

Sample — A sampling of components, systems, labels, and other performance aids were used to verify interview findings. If 50 percent or more of each group were similar in arrangement, coding, and operation, then a convention was assumed to be established. Deviations were reported, as well as lack of convention.

Checklist — A checklisting procedure was employed to determine if existing conventions are acceptable by human factors standards. Some items required operator assistance.

2.3.5.5 Results/Findings — The data collected is contained on the raw checklist along with interview questions and comments. The identified discrepancies were documented on Human Engineering Discrepancy Report forms. Table 2.3.5-1 summarizes findings (Human Engineering Discrepancies) of the Conventions Survey.

Suggestions or recommendations for the resolution of each discrepancy are documented on the Human Engineering Discrepancy Report forms and were discussed at joint Essex/Florida Power & Light Human Engineering Discrepancy review meetings. In general, very few conventions have been established in the two control rooms; therefore, there are not many discrepancies regarding inconsistent use of conventions. In a complex control room it is recommended that conventions be established (and be adhered to consistently) to reduce operator reliance on memory and reading errors. Definition and implementation of a standard set of control room conventions will aid in overall operations and reduce potential confusion.

TABLE 2.3.5-1

CONVENTIONS SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 3 | 6212b7 | III | III | Color coding of communication equipment |
| 10 | 6221b | IIC | IIC | Communication audible signal coding |
| 14 | 6222a | III | III | Telephone bell coding |
| 23 | 6342b4,6 | IIA | IIA | Annunciator control coding |
| 10, 11 | 6421 | IIB | IIB | Direction control movement |
| 31 | 6422d | III | III | Control shape coding |
| 20 | 6441 | IIC | IIC | Direction of control activation |
| 24 | 6443b | III | N/A | Key orientation |
| 25 | 6443d | III | N/A | Key orientation |
| 28 | 6445b2 | III | III | Control positioning |
| 28 | 6511b | III | III | Lack of color coding |
| 14 | 6516d | IIC | IIC | Color coding consistency - pushbuttons |
| 80, 15 | 6516d1 | IIC | IIC | Color coding consistancy - indicator lights |
| 49 | 6521a | IIC | IIC | Directability of movement |
| 56 | 6523a | IIC | IIC | Scale face coding |
| 17 | 6523b | III | III | Zone marking interference |
| 19 | 6542a1 | IIC | IIC | Color identification |
| 84 | 6542a2 | IIC | IIC | Recorded channel color coding |

### 2.3.6 Process Computer Survey

2.3.6.1 Objective — The objective of the Process Computer Survey was to evaluate the design characteristics (system hardware and operational characteristics) of the existing process computer man-machine interface. Those characteristics were observed at the process computer terminal, or were identified through interviews with a plant Digital Data Processing System cognizant engineer and reviews of system design documentation. The system characteristics gathered from the above sources were then compared to human factors engineering design guidelines, and deviations from these guidelines were recorded as Human Engineering Discrepancies.

2.3.6.2 Review Team Responsibilities — The review team included a human factors analyst, a computer-cognizant engineer (Florida Power & Light employee) responsible for the Digital Data Processing System modifications, maintenance, etc., and the plant control room operators who utilize the Digital Data Processing System. The computer-cognizant engineer provided information that was not easily accessible to the evaluator from documentation sources, and the control room operators provided system operations information as required.

2.3.6.3 Criteria — The guidelines used for evaluating the man-machine interface characteristics of the process computer were the following:

Detailed Design — The guidelines checklist in sections 6.7.1, 6.7.2, and 6.7.3 of NUREG-0700 provided the criteria for the survey. The characteristics evaluated by means of these checklists typically address harwdare design characteristics. Of equal importance are the operational characteristics of the Digital Data Processying System. For example, while the design guidelines specify the appropriate delay period for system response to keyboard requests for information, no guideline was suggested for evaluating the efficiency of the information access strategy required to reach the necessary level of information detail. Many of the above system operational characteristics were addressed in checklist fashion.

Task Requirements — Additionally, the outputs of the function and task analyses (NUREG-0700 recommended studies) where they address the operation of the plant process computers were reviewed by the personnel conducting this survey. The survey evaluators are the evaluation team personnel most familiar with computer operation (from the hardware standpoint) and are the logical candidates to perform an evaluation of system operational characteristics; i.e., be involved in the conduct of an analysis of process computer operational tasks. Issues addressed by the analysis include the following:

- o Have the operational information display functions (e.g., operations monitoring, operations analysis, etc.) been provided for in the display system design?
- o Has the information access structure been organized to facilitate the most frequently used functions and subfunctions, i.e., display system mode and submode organizational efficiency?
- o Does the allocation of functions to either man or machine capitalize on their respective functional capabilities?
- o Are the display formats appropriate to the displayed information type?
- o Does the display system design provide display page formatting flexibility which accommodates individual operator decisionmaking styles? Has too much flexibility been provided resulting in degraded decision-aiding support?

2.3.6.4 Task Definition/Methodology — The two CRTs with corresponding keyboards and the printer that comprise the control room Digital Data Processing System were evaluated according to NUREG-0700 guidelines using the checklist contained in Appendix A.

The checklisting was conducted by an Essex Research Scientist using the avenues of observation, measurement, document review, hands-on demonstration, and interview as data sources. Additional data and confirmation of survey findings were contributed by the review of operator interviews and the Task Analysis. Identified discrepancies were documented on Human Engineering Discrepancy forms.

2.3.6.5 Results/Findings — The results of the Process Computer Survey include the completed checklist and Human Engineering Discrepancy Reports for each parameter not in agreement with guidelines. Table 2.3.61 summarizes all Human Engineering Discrepancies identified during the survey.

In general, the discrepancies found related to the limitations of the equipment and programming. For example,

- o The computer printer did not print rapidly enough
- o There is no scroll function or page designation for data contained on multiple pages
- o The dialogue does not contain delay feedback messages

TABLE 2.3.6-1

PROCESS COMPUTER SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 3 | 6713A,B | IIC | IIC | Prompting/Structuring |
| 4 | 6713C | III | III | Mode File Designations |
| 5 | 6714 | III | III | Unused Keys |
| 6 | 6714D,G | III | III | CRT Keyboard Design |
| 7 | 6716B,C | IIC | IIC | Printer Speed |
| 8 | 6716B | III | III | Computer Updates |
| 9 | 6718A2,4 | IIC | IIC | Computer Procedures |
| 10 | 6718B | IIC | IIC | Computer Index |
| 11 | 6721C | III | III | CRT Letter Contrast |
| 12 | 6721F | IIC | IIC | CRT Resolution |
| 13 | 6721G | IIC | IIC | CRT Screen Fluctuation |
| 14 | 6723F | III | III | Keyboard and CRT Location |
| 15 | 6724A,C | III | III | Complex Number Printout |
| 17 | 6725F | III | III | CRT Screen Layout |
| 16 | 6725H,I | IIC | IIC | No Page Designation |
| 18 | 6725M | III | III | CRT Screen Loading |
| 19 | 6726B | IIC | IIC | Computer Set Points |
| 20 | 6726I | IIC | IIC | No System Feedback Messages |
| 21 | 6726K | IIC | IIC | No Delay Feedback Messages |

TABLE 2.3.6-1

PROCESS COMPUTER SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 22 | 6727A,E,J | IIC | IIC | Highlighting |
| 23 | 6731E3 | III | III | Printer Maintenance |
| 24 | 6732 | IIC | IIC | Alarm Messages |
| 25 | 6733A,B,D, | IIC | IIC | Computer Graphic Capability |

- o Prompts and feedback messages cannot be requested by the operator
- o Alarm messages cannot be requested by the operator
- o No coding or priorization of alarm messages exists
- o Graphic capabilities of the system are inadequate.

Other discrepancies involve computer procedures, keyboard dimensions and location, CRT legend readability, and the presence of unused function keys on the keyboard.

### 2.3.7 Emergency Garments Survey

2.3.7.1 Objective — The objective of the Emergency Garments Survey was to identify Human Engineering Discrepancies associated with the use of emergency garments and breathing apparatus. Using checklists drawn from NUREG-0700 and a standard rhyme test, the emergency garments and breathing apparatus were evaluated.

The evaluation consisted of anthropometrics, communications while wearing breathing apparatus, storage and placement of emergency gear in the control room, the ease of access to and donning of emergency gear, and operation of the control boards while wearing emergency clothing.

2.3.7.2 Review Team Responsibilities — The evaluation team was composed of two Essex Corporation staff members, one utility staff member from the Health Physics Department, and one control room operator. The Essex staff, composed of research scientists and associates, served as human factors specialists. Utility Health Physics personnel functioned as operations specialists and evaluation process expediters. The experience of the control room operator aided in identification of plant-specific discrepancies relevant to the survey.

2.3.7.3 Criteria — The control room emergency garments should comply with the guidelines contained in NUREG-0700.

Operator Protective Equipment

- o Types of Equipment — Protective equipment includes protective clothing and breathing apparatus.
- o Anthropometry — Protective clothing and breathing equipment are compatible with operator body size and tasks to provide adequate tactile sensitivity and ability to see, reach, move, communicate, and hear.
- o Periodic Checks — Operator protective equipment is periodically checked to determine if it is in good condition.
- o Quantity — Protective equipment is available in sufficient quantities and sizes for the required number of operators.
- o Marking — Protective clothing sizes are clearly identifiable.
- o Expendables — There is an adequate supply of personal protection equipment expendables, such as filters.
- o Accessibility — All protective equipment is easily and readily accessible.
- o Training — Operators are well practiced in donning protective equipment.
- o Procedures — Instructions for donning, doffing, and controlling personal protective equipment are provided.

Emergency Communications - Voice communications with masks survey guidelines:

- o Emergency face masks are equipped with diaphragms that are specially designed to transmit speech.
- o The diaphragms separate voice from exhaust valve action.
- o If not equipped with diaphragms, masks are equipped with electronic speech systems which pick up the voice with an internal microphone and transmit it to a loudspeaker attached outside the mask.

2.3.7.4 Task Definitions/Methodology — A human factors specialist with Health Physics training observed and timed Health Physics personnel dressing out in anti-contamination clothing. Overall time and task times, along with pertinent human factors observations, were recorded.

A touch-and-feel test for the identification of an assortment of hand-held objects was conducted with a subject wearing anti-contamination gloves.

A subject was observed donning the breathing apparatus. Overall time and task times along with pertinent human factors observations were recorded.

A modified rhyme test requires a subject (listener) to identify a set of spoken words from a list of phonetically similar (rhyming) words. A modified rhyme test was conducted with the talker wearing the breathing apparatus mask to test the intelligibility of speech when attenuated by the mask faceplate. The test was then repeated using a mask equipped with an electronic speech system. The talker's instructions used during the test were:

1. Each list was presented by the following statement: "This is test ________", where the blank was replaced with the list identification letter found at the bottom left corner of the Talker's List.
2. Each word was embedded in the carrier sentence "Please circle __________ in group __________", where the first blank was the target word from the Talker's List and the second blank was the word group number from the corresponding Listener's Sheet containing the target word.
3. The presentation rate was approximately 4 seconds between target words.

2.3.7.5 Results/Findings — Several HEDs were identified in the course of this survey. These are presented in Table 2.3.7-1, and address 1) the availability of procedures for donning/controlling inventory of protective equipment and clothing, 2) the storing and packaging of protective clothing, 3) accessibility and labeling of protective clothing, and 4) labeling of fire fighting equipment. Results of the survey subtasks are presented below.

TABLE 2.3.7-1

EMERGENCY GARMENT SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 25 | 6141a,h | IIA | IIA | Protective equipment storage/donning. Procedures for donning/accessing/ controlling |
| 26 | 6142 | IIC | IIC | Fire equipment |
| 27 | 6143b | III | III | Labeling of storage locker |

Emergency Garment Dress-Out — Observed task times and observations are recorded on Table 2.3.7-2. As noted, it took approximately six minutes to dress out (without breathing apparatus), including exiting the control room, accessing the equipment, dressing out, and returning to the control room. An additional 25 seconds were required to don and adjust breathing apparatus (Scott air packs), making total dress out time 390 seconds. This amount of time is considered reasonable, and, therefore, no Human Engineering Discrepancies were generated.

Glove Sensitivity — Common pocket items and/or tools were used to test tactile identification and glove sensitivity. Subjects (human factors analysts) attempt to identify items by feel picking up while wearing the provided anticontamination gloves, the objects identified below:

| Item | Correctly Identified | Remarks |
|---|---|---|
| Key | Yes | |
| Pencil | Yes | |
| Pen | Yes | |
| Coins: | | |
| 25¢ coin | Yes | |
| 10¢ coin | Yes/No | Potentially confused for penny |
| Paperclips (Large) | Yes | |
| Paperclips (Small) | No | |
| Small clamp | Yes | |
| Eraser | Yes | |

No Human Engineering Discrepancies were identified during this subtask. It was, however, noted that when using prophylactic gloves with cotton undergloves, freedom of hand movement was somewhat restricted and the muscles controlling hand motion were fatigued rather rapidly. This seems due to the muscles having to overcome the elasticity of the glove materials.

TABLE 2.3.7-2

ANTI-CONTAMINATION DRESS OUT TIME

| No. | Task Description | Task Time (Sec) | Cumulative Task Time (Sec) | Remarks |
|---|---|---|---|---|
| 1 | Start from main control board area and go to dress-out area. | 40 | 40 | 1. Get key from NWE<br>2. Go to locker (over 2 rope barriers)<br>3. Open 2 padlocks and a latch<br>4. (Task 8) approx. 15 sec. more to return to CR (inadequate space in front of locker to dress out). |
| 2 | Locate and open garment storage, layout garments. | | | |
| 3 | Don overalls. | 19 | 59 | Overalls were a little large so extra time was required to tape the waist (take up slack) (see step 5). |
| 4 | Don boots and hat. | 33 | 92 | No hat was provided. |
| 5 | Tape seams, prepare tape for gloves. | 25 | 217 | Tape was hard to handle as the roll was large and unwieldy. Perhaps a tape dispenser would be of assistance. |
| 6 | Bag and tape badges, TLD, dosimeter. | 37 | 254 | |
| 7 | Don and tape gloves. | 96 | 350 | |
| 8 | Return to control board. | 15 | 365 | |

Total time 365 sec. = 6.1 minutes

Speech Intelligibility With Breathing Mask — This test (a modified rhyme test) was run under free-air, low (minimum) ambient noise level conditions. During the initial conduct of the test a distance of approximately six feet was maintained between the listener and speaker. In this test, the speaker, while wearing a Scott air pack and mask, presented 55 words (see Table 2.3.7-3) to the listener (see Table 2.3.7-4), of which 34 words or 62 percent were correctly identified. The test was repeated twice (at 6 and 10 ft.) using a mask equipped with a "Speak Ezee" electronic voice amplification device and new subjects. Intelligibility was significantly improved with use of the "Speak Ezee" advice. With this device attached, 55 words presented to two additonal listeners. Listener 1 correctly identified 50 of 55, or 91 percent, of the speaker words. Listener 2 correctly identified 47 of the 55 words, or 85 percent correct identification. Total correct responses were then 97 correct out of 110 words, or 88 percent accuracy, a significant improvement from the unaided speech intelligibity. Given contextual cues to enhance speech intelligibility, use of the "Speak Ezee" device with breathing apparatus should provide good communications.

TABLE 2.3.7-3

MODIFIED RHYME TEST TALKER'S LIST

| | | | | | |
|---|---|---|---|---|---|
| WELL | 1 | PAGE | 25 | SIN | 49 |
| BENT | 2 | CAPE | 26 | PALE | 50 |
| HOLD | 3 | SHOP | 27 | PICK | 51 |
| PACK | 4 | COIL | 28 | PEAS | 52 |
| DIME | 5 | TAB | 29 | BUFF | 53 |
| LAME | 6 | FIN | 30 | SAD | 54 |
| BIT | 7 | TAME | 31 | BUN | 55 |
| RUST | 8 | KEEL | 32 | | |
| ROPE | 9 | BARK | 33 | | |
| TEAM | 10 | HEAT | 34 | | |
| DIG | 11 | CUP | 35 | | |
| BED | 12 | LAW | 36 | | |
| TOLD | 13 | HEN | 37 | | |
| JAR | 14 | PUP | 38 | | |
| SIN | 15 | BEAM | 39 | | |
| DUD | 16 | SEAT | 40 | | |
| SUN | 17 | HIP | 41 | | |
| SEEM | 18 | KID | 42 | | |
| NOT | 19 | SANG | 43 | | |
| VEST | 20 | HOOK | 44 | | |
| PICK | 21 | MAD | 45 | | |
| BASS | 22 | RAY | 46 | | |
| WAY | 23 | SANE | 47 | | |
| BIG | 24 | WILL | 48 | | |

TABLE 2.3.7-4

MODIFIED RHYME TEST LISTENER'S SHEET

LISTENER ______________________________

DATE ______________________ TIME ______________________

CONDITION ______________________

| | | | |
|---|---|---|---|
| 1 | HELL | JELL | SELL |
| | BELL | WELL | TELL |
| 2 | WENT | SENT | BENT |
| | DENT | TENT | RENT |
| 3 | HOLD | COLD | TOLD |
| | FOLD | SOLD | GOLD |
| 4 | PAT | PAD | PAN |
| | PATH | PACK | PASS |
| 5 | DIVE | DIME | DIRE |
| | DICE | DINE | DIKE |
| 6 | LAND | LAY | LATE |
| | LAKE | LACE | LAME |
| 7 | KIT | BIT | FIT |
| | HIT | WIT | SIT |
| 8 | MUST | BUST | GUST |
| | RUST | DUST | JUST |
| 9 | LOPE | POPE | HOPE |
| | COPE | DOPE | ROPE |
| 10 | TEAK | TEAM | TEAL |
| | TEACH | TEAR | TEASE |
| 11 | DIN | DILL | DIM |
| | DIG | DIP | DID |
| 12 | BED | LED | FED |
| | RED | WED | SHED |
| 13 | TOAD | TOME | TOLD |
| | TONE | TOE | TOLL |
| 14 | FAR | MAR | BAR |
| | CAR | JAR | TAR |
| 15 | PIN | TIN | SIN |
| | FIN | DIN | WIN |
| 16 | DUG | DUNG | DUCK |
| | DUD | SUB | DUN |
| 17 | SUM | SUN | SUNG |
| | SUP | SUB | SUD |
| 18 | SEEP | SEEN | SEETHE |
| | SEEK | SEEM | SEED |
| 19 | NOT | TOT | GOT |
| | POT | HOT | LOT |
| 20 | VEST | TEST | REST |
| | BEST | WEST | NEST |
| 21 | PIG | PILL | PIN |
| | PIP | PIT | PICK |
| 22 | BACK | BATH | BAD |
| | BASS | BAT | BAN |
| 23 | WAY | MAY | SAY |
| | PAY | DAY | GAY |
| 24 | PIG | BIG | DIG |
| | WIG | RIG | FIG |
| 25 | PALE | PACE | PAGE |
| | PANE | PAY | PAVE |
| 26 | CANE | CASE | CAPE |
| | CAKE | CAME | CAVE |
| 27 | SHOP | MOP | COP |
| | TOP | HOP | POP |
| 28 | COIL | OIL | SOIL |
| | TOIL | BOIL | FOIL |
| 29 | TAN | TANG | TAP |
| | TACK | TAM | TAB |
| 30 | FIT | FIB | FIZZ |
| | FILL | FIG | FIN |
| 31 | SAME | NAME | GAME |
| | TAME | CAME | FAME |
| 32 | PEEL | REEL | FEEL |
| | EEL | KEEL | HEEL |
| 33 | HARK | DARK | MARK |
| | BARK | PARK | LARK |
| 34 | HEAVE | HEAR | HEAT |
| | HEAL | HEAP | HEATH |
| 35 | CUP | CUT | CUD |
| | CUFF | CUSS | CUB |
| 36 | THAW | LAW | RAW |
| | PAW | JAW | SAW |
| 37 | PEN | HEN | MEN |
| | THEN | DEN | TEN |
| 38 | PUFF | PUCK | PUB |
| | PUS | PUP | PUN |
| 39 | BEAN | BEACH | BEAT |
| | BEAK | BEAD | BEAM |
| 40 | HEAT | NEAT | FEAT |
| | SEAT | MEAT | BEAT |
| 41 | DIP | SIP | HIP |
| | TIP | LIP | RIP |
| 42 | KILL | KIN | KIT |
| | KICK | KING | KID |
| 43 | HANG | SANG | BANG |
| | RANG | FANG | GANG |
| 44 | TOOK | COOK | LOOK |
| | HOOK | SHOOK | BOOK |
| 45 | MASS | MATH | MAP |
| | MAT | MAN | MAD |
| 46 | RAY | RAZE | RATE |
| | RAVE | RAKE | RACE |
| 47 | SAVE | SAME | SALE |
| | SANE | SAKE | SAFE |
| 48 | FILL | KILL | WILL |
| | HILL | TILL | BILL |
| 49 | SILL | SICK | SIP |
| | SING | SIT | SIN |
| 50 | BALE | GALE | SALE |
| | TALE | PALE | MALE |
| 51 | WICK | SICK | KICK |
| | LICK | PICK | TICK |
| 52 | PEACE | PEAS | PEAK |
| | PEACH | PEAT | PEAL |
| 53 | BUN | BUS | BUT |
| | BUG | BUCK | BUFF |
| 54 | SAG | SAT | SASS |
| | SACK | SAD | SAP |
| 55 | FUN | SUN | BUN |
| | GUN | RUN | NUN |

SCORE ______________

2.3.8 Labels Survey

2.3.8.1 Objective — The objective of the Labels Survey was to determine the appropriateness and clarity of labeling in the control room to enhance operator performance.

2.3.8.2 Review Team Responsibilities — A human factors specialist was responsible for data collection, analysis, and report preparation. A control room operator was required to assist in collecting the necessary information and to advise the human factors specialist of problems that have been encountered.

2.3.8.3 Criteria — The criteria used for the labeling survey are contained in the labels checklist and are presented in Appendix A of this report.

2.3.8.4 Task Description — All components, panels, and systems requiring identification and manipulation were examined to ensure that they were labeled, as were the positions of all discrete controls. In addition, the location and orientation of each label were evaluated for readability and consistency. Panels without hierarchical labeling were identified. Label content was reviewed for clarity, brevity, and spelling. Label readability was evaluated. Measurements included character height, width, width-to-height ratios, and visual angle subtended at the eye; stroke width-to-character height ratios; space between characters, words and lines; and character-to-background contrast. Type style was assessed for consistency, simplicity, and use of all capital letters.

Components with unique labeling requirements (e.g., contrast on electronic counters) were evaluated. Temporary labels, including equipment "tag-outs", were assessed to ensure that they conform with human engineering criteria applied to permanent labels. The procedure for adding a temporary label to the board was evaluated.

2.3.8.5 Results/Findings — A list of all Human Engineering Discrepancies identified during this survey are presented in Table 2.3.8-1. A summary of these findings regarding labels is presented below.

Need for Labeling — Many components lack sufficient descriptive labeling, and some have only temporary dynatape labels. In particular, the Area Radiation Monitor panel and the Hydrogen Recombination panel have inadequate labeling. Labeling criteria requires each component to have a permanent label horizontally oriented above the element. Descriptive labeling for vertical meters is vertically oriented on the display face with the engineering nomenclature on a horizontal label above the component. Many recorders are lacking legend cards to identify pens or channels as well as a descriptive functional label. Most panels lack a hierarchical labeling scheme with letter gradations to

## TABLE 2.3.8-1

## LABELS SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 30 | 6433b3 | IIC | IIC | Legend contrast is inadequate due to collected dirt and wear |
| 31 | 6433b4/ 6533b4 | IIC | IIC | Legend content is highly ambiguous |
| 30 | 6512b | IIC | IIC | Display information not provided |
| 32 | 6513a | III | III | Character height is insufficient for viewing angle and distance |
| 4 | 6513b1, 2 | III | III | Type style is used inconsistently |
| 5 | 6513b3 | III | III | Use of lowercase letters |
| 33 | 6513d (6642d) | IIC | IIC | Character dimensions and spacing are inadequate |
| 64 | 6533 | III | III | Legend has more than three lines of lettering - legend lights |
| 65 | 6533a 2, 3 | IIC | IIC | Legend readability is degraded by low contrast and letter size |
| 70 | 6542a1 | IIC | IIC | Recorder pens and parameters are not clearly identified |
| 20 | 6551a2 | III | III | Numeral width-to-height ratio is inadequate |
| 75 | 6551a3 | III | III | Grouping of digits are not separated by commas, decimals, space |
| 21 | 6552a2 | III | III | Character font is slanted |

TABLE 2.3.8-1

LABELS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 32 | 6552a3 | III | III | Character font is too small for viewing angle |
| 22, 23 | 6552a5 | III | III | Horizontal spacing between numerals is inadequate |
| 1, 36 | 6611 | IIC | IIC | Need for control position and component labeling |
| 3, 35 | 6611 | III | III | Labeling is inaccurate |
| 19 | 6612 | IIC | IIC | Group labeling |
| 38 | 6612a3 | IIC | IIC | Lack of component level labeling in hierarchical scheme |
| 5 | 6612b3 | IIC | IIC | Lack of hierarchical scheme with letter gradations |
| 39 | 6621a | IIC | IIC | Labels not located above |
| 40 | 6621a | IIC | IIC | Label mounted insecurely |
| 41, 42 | 6621d | IIC | IIC | Label not located in close proximity to component |
| 6, 7 | 6621f | III | III | Adjacent labels are too close together |
| 26 | 6622a | IIC | IIC | Meter zone marking labels are not securely mounted |
| 43, 44 | 6623a | III | III | Labels are diagonally or horizontally oriented |

TABLE 2.3.8-1

LABELS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 45, 46 | 6624a | IIC | IIC | Label obscures display information, recorded matter, figures or scales |
| 8 | 6624b | III | III | Labels obscured by component |
| 47 | 6624d | III | III | Engraved labels have low contrast |
| 9, 49, 68 | 6631a | IIC | IIC | Labels unnecessary, unclear or missing |
| 11, 12, 13 | 6632a,b | IIC,III | IIC, III | Label content is either excessive inadequate or inconsistent |
| 14 | 6632f | III | III | Incorrect spelling in label content |
| 15, 65 | 6633b | III | III | Inconsistency in label content, numbering, abbreviations |
| 16, 17 | 6634e | III | III | Labels use Roman numerals |
| 18 | 6636 | IIC | IIC | Labels are highly similar |
| 50, 51 | 6637b | IIC | IIC | Inconsistent in label placement |
| 20, 27, 28 | 6638a | IIC | IIC | Control position labeling missing |
| 22 | 6638b | IIA | IIA | Control direction of motion not identified |
| 23-26 | 6638c | IIC, III | IIC, III | Position label not visible |
| 29 | 6639A,B | III | III | Panel access openings not labeled |
| 30, 54-56 | 6641 (6641a1) | IIC | IIC | Character height is insufficient for maximum viewing distance for labels and display printing |

TABLE 2.3.8-1

LABELS SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 57 | 6641(6513b1,2) | IIC | IIC | Font size and style is inconsistent |
| 58, 59 | 6641a2 | III | III | Character heights vary from one label to another |
| 60 | 6641b | IIC | IIC | Labels have low contrast |
| 62, 63 | 6651a,b | III | III | Temporary labels;<br>o Not used only for high necessity<br>o Not temporarily used<br>o Not administratively controlled<br>o Don't comply with good Human Engineering principles |
| 61 | 6651d-h | IIC | IIC | Tag-out labels:<br>o Not secured to components<br>o Obscure labels<br>o Don't prevent control actuation |
| 64 | 6652 | III | III | Lack of procedures and administrative control of temporary labels |

represent systems, subsystems, components and their parts. The lack of this type of design has resulted in highly simiiliar and redundant wording of component labels.

Label Location — It was found that many functional component labels are not located in accordance with NUREG-0700 guidelines. In general, labels are positioned inconsistently throughout the boards with placement beside, below, and above the described component. For example, display units of measurement appear at the bottom or at the top. Meter labels are vertically oriented on the display face. It is recommended that one arrangement be adopted — placement above the component — and be consistently followed. In many instances component identification may be confusing because labels are not located in close proximity to the associated component and because adjacent labels appear to be continuous. The mounting of some labeling is precarious. Although most labels are screwed onto the panel, some have broken off and have been loosely taped back on. The visibility of portions of recorded matter, figures, or scales is degraded by labels and legend cards located on the display face. A specific rotary control was identified which conceals part of the position label. Control position labels on the Radiation Monitor Panel are partially concealed by the knob skirts.

Label Content — It was found that there are instances of labeling in which content was either excessive or inadequate. The primary function of a component should be described in a concise and explicit manner. Some labels are ambiguous, unclear or inaccurate due to improper word selection. In one case a pushbutton which uses an arrow to indicate flow status is reversed showing an inaccurate condition. Clarity of label content is often degraded by the usage of inconsistent abbreviations, acronyms or alphanumeric codes. For instance, some identifiers consist of a three-character alpha code which may be confused with an abbreviated word or acronym. Some control position labels are inconsistently labeled. Breaker control positions are inappropriately labeled as "ON" and "OFF", while pump control positions are labeled as "TRIP" and "CLOSE". Cases of misspelling and the use of Roman numerals were identified.

Maintenance — Various function and position labels and legends on pushbuttons have become dirty from the collection of grime and dust thereby reducing letter-to-background contrast and readability. It should also be noted that the use of white letters on a dark background is not recommended due in part to the greater likelihood of loss of readability from dirt. Dark characters on a light background would generally prevent this from occurring. There is widespread use of temporary labels on all panels. Such usage is not limited to conditions of high necessity for a temporary period, and appplication is not administratively or procedurally controlled to comply with good human engineering

principles. Some "tag-out" labels were in the form of red and white slips hung over the switch handle. They were not secured to the component to prevent control actuation, and often obscure associated and adjacent labels.

Label Format and Readability — Label readability was found to be degraded by the following lettering characteristics.

- Inconsistent character dimensions
- Insufficient character height for viewing angle and maximum distance
- Inadequate width-to-height ratio of counter numerals
- Use of lowercase letters
- Letter width-to-height ratios and stroke widths for component and position labels are less than the recommended dimensions
- Spacing between characters, words and lines is less than the required minimum for legend lights and Electronic displays (LEDs)
- Legend letter size is too small and has low contrast with background
- Use of a slanted font and a font with serifs
- Legends have more than three lines of lettering
- Counter numerals are not separated by commas, decimals or spaces where appropriate.

### 2.3.9 Annunciator Survey

2.3.9.1 Objective — The objective of the Annunciator Survey was to assess the operability and usability of the system using the guidelines outlined in NUREG-0700, and to document and assess all resulting discrepancies.

2.3.9.2 Review Team Responsibilities — The members of the review team included a human factors specialist to conduct the annunciator survey; a nuclear operations specialist to supply plant systems information (i.e., interrelationship of various components, the impact of loss of a pump on plant operations); and a plant instrumentation and control engineer to answer questions, provide information, and obtain any necessary documentation for completion of this task.

2.3.9.3 Criteria — The criteria used to evaluate the annunciator system are described in the Annunciator Checklist. The specific criteria for each subtask are contained in Appendix A.

2.3.9.4 Task Definition/Methodology — This survey was conducted by: 1) application of checklists, and 2) by verification of operator concerns identified during operator interviews. The checklists were separated into two major parts: visual displays and auditory warnings. These checklists addressed maintainability, identification, coding, operation, and arrangements of the annunciator system. The checklisting was designed to be conducted on-site. Operations personnel were interviewed about the system, and were asked to demonstrate the alarm systems operability. Observations and notations were recorded on the checklist sheets. For those items found to be in conflict with checklist criteria, Human Engineering Discrepancy reports were written.

2.3.9.5 Results/Findings — Table 2.3.9-1 lists all Human Engineering Discrepancies identified in the course of this survey. Following are the general findings of this survey.

Annunciator Controls — Only one set of annunciator controls exists in each control room, and no test or reset functions/controls are provided. Figure 2.3.9-1 shows the location of annunciator controls for each unit. Certain advantages exist for the Turkey Point control rooms having one annunciator control station for each plant. The orienting responses to alarm control stations will be stronger (since only one response station exists), which should tend to reduce response latency. Also given the size and arrangement of the control rooms and the central location of the annunciator response stations, operator responses to anomalies could be facilitated. Several disadvantages also exist, including potential for increased control room traffic, for increased visual distances to annunciator tiles, and for possible crowding of the annunciator control locations during periods of high activity. The distance from the annunciator control location to the

TABLE 2.3.9-1

ANNUNCIATOR SURVEY SUMMARY OF FINDINGS

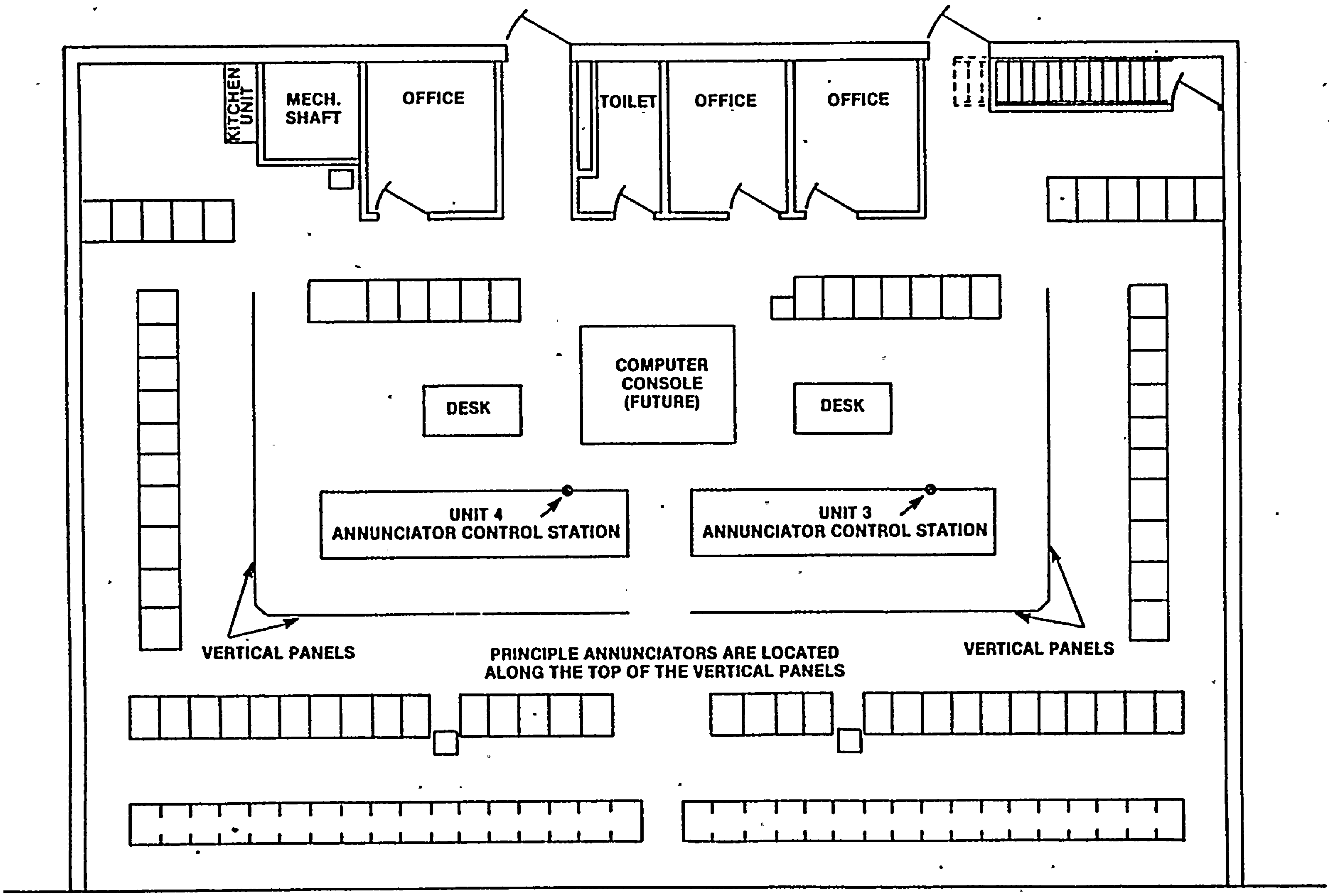
| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 2 | 6312al | IIA | IIA | Nuisance alarms/fire false alarms |
| 1 | 6312al | IIC | IIC | Set points/nuisance alarms |
| 3 | 6312al | | IIC | Alarm parameter selection |
| 4 | 6312bl,cl | III | III | Annunciator location |
| 5 | 6312cl,3 | IIC | IIC | Lack of reflash |
| 6 | 6313al | IIC | IIC | Reactor first out |
| 7 | 6314 | IIC | IIC | Prioritization nonvital annunciators |
| 8 | 6315a,b | IIC | IIC | No alarm clear signal |
| 10 | 6321a | IIA | IIA | Annunciator audible alarm |
| 9 | 6321f | IIA | IIA | Audible alarm location code |
| 12 | 6331a | IIC | IIC | Annunciator location/group |
| 11 | 6331cl | IIA | IIA | Annunciator tile interchange |
| 13 | 6332b | III | III | Flash rate |
| 14 | 6332e | IIA | IIA | 'Dark' annunciator panels |
| 15 | 6332e | IIC | IIC | Normally on annunciators |
| 16 | 6333cl | IIC | IIC | Cover interchangeability |
| 16 | 6333cl,2 | IIC | IIC | Annun window matrix |
| 17 | 6334a | III | III | Wordy/unclear legend |
| 18 | 6334b | III | III | Local indication summary annunciators |

TABLE 2.3.9-1

ANNUNCIATOR SURVEY SUMMARY OF FINDINGS (CONT'D)

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 19 | 6335a1,a2 | IIA | IIA | Font size/style; readability |
| 20 | 6335c | IIC | IIC | Impermanent labels |
| 21 | 6341b | III | III | Annunciator control location |
| 22 | 6341d | IIA | IIA | Brightness/lamp test |
| 23 | 6342b4,6 | IIA | IIA | Annunciator control coding |

## FIGURE 2.3.9-1
## LOCATION OF ANNUNCIATOR CONTROL STATIONS



individual windows, and therefore window readability, is of the most concern. Additional control stations would relieve this discrepancy, as would larger, more legible tiles.

Annunciator Readability — Annunciator font-size was determined to be too small from the central operating station (at the console) to any annunciator window location. The window size is also very small which prevents a significant increase in legend font size without replacing the entire annunciator system. It is recommended that enhancement (coding) techniques and inceasing font size be used to improve readability.

Coding — During the survey, no coding (other than first out panel location coding) was being used. A means to prioritize is currently being developed and will be implemented.

Nuisance Alarms —Operator interviews identified several nuisance and general alarms as follows:

"Normally in" alarms were identified by operators as being:

- o RCP bypass flow low (2 observations)
- o Source range loss of detection voltage (1 observation)
- o RHR heat exchange to flow (3 observations)
- o CR local-normal control (1 observation)
- o FW HTR levels (1 observation)

Nusiance alarms were identified by operators as being:

- o SG level (2 observations)
- o Steam flow (1 observation
- o Feed flow (1 observation)
- o FW HTR hi/lo level (1 observation)
- o PRZR cubicle hi/low temp (1 observation)
- o Condensate recovery tank hi level (2 observations)
- o Waste boron panel trouble (3 observations)
- o Ht tracing trouble (2 observations)
- o WTR plant trouble (1 observation)
- o Radwaste (1 observation)

It is recommended that a review of set points on (or the necessity for) the identified nuisance annunciators be conducted; and, an alarm for Reactor Coolant Pump vibration be added to Unit 4.

Functional Groups — In general, annunciator tiles are well grouped. Seven tiles were identified by operators as being poorly located as follows:

- SI pump low suction pressure
- CCW surge TK level
- RCP standpipe hi/low level
- Bypass low flow
- Breathing air system trouble
- SG blowdown TK hi pressure
- SG blowdown TK hi/low level

2.3.10 Anthropometry Survey

2.3.10.1 Objective — The objective of the Anthropometry Survey was to determine whether controls and displays are located in a manner which makes them highly visible, within reach, and precludes inadvertent actuation.

2.3.10.2 Review Team Responsibilities — Two human factors engineers took the measurements necessary for performance of the Anthropometry Survey. With those measurements, a human factors specialist analyzed reach envelopes and visual angles, applied all checklist items, and identified and documented all discrepanices.

2.3.10.3 Criteria — The criteria used are from the NUREG-0700 guidelines. These are detailed specifically in Appendix A and generally below:

a. All controls are within reach of the 5th percentile female (i.e., the person who is smaller than 95 percent of the female population) (6.1.2.2.b.1).

b. The 95th percentile male can reach all controls without stooping (6.1.2.2.b.2).

c. All displays are visible from any point at which they must be monitored, based on eye height of both the 5th percentile female and the 95th percentile male. This includes viewing of annunciators from their associated acknowledge controls (6.1.2.2.e).

d. Controls are placed far enough back on the board to avoid inadvertent actuation (6.1.2.2.d.1).

e. All controls and displays involved in a single task sequence are located to minimize the requirement for operator movement (6.1.2.2.f).

f. Consoles are designed to allow sufficient leg and foot room and, if necessary, space for writing (6.1.2.2.g).

g. Controls and displays which are frequently used or important are located in the most favorable position with regard to viewing or reaching (6.1.2.5.a & 6.1.2.5.b.2).

h. CRTs are easy to view with a minimal amount of head movement (6.7.2.3).

2.3.10.4 Task Definition/Methodology — There were two subtasks in this survey: 1) evaluation of reach envelopes and visual angles, and 2) measurement of distance criteria.

Reach Envelopes and Visual Angles — A silhouette drawing of the board was obtained from Florida Power & Light and verified by taking measurements on-site. The required measurements were the distance from floor to benchboard, the distance from benchboard to panel top, and benchboard angle and depth. Using a scale drawing made

from board dimensions, angles from eye height (displays) and functional reach from shoulder height (controls) were drawn in for both 5th percentile female and 95th percentile male. The points at which reach envelop lines cross the board and the points at which the angle from line of sight to display face is less than $45^{o}$ were marked, measured, and converted to full scale dimensions. These points were measured on the board on-site, and then lines were marked on board drawings to indicate the pass/fail area for each checklist item.

Horizontal visual angles were assessed by listing controls and displays used together (identified through the task analysis). For each display to be monitored while activating a control, the viewing angle was measured to ensure that it is less than $45^{o}$ from line of sight.

Distance Criteria — In addition to the measurements involved with reach envelopes, a number of board measurements were taken. The distance between controls used in a single task sequence, the distance of controls from the front of the benchboard, control and display height on vertical boards, height of emergency or frequently used controls and displays, and height of consoles which the operator must be able to see over were measured as part of this survey.

Workspace and furniture applications were assessed through measurement of floor-space between furniture, consoles, and walls on-site to ensure that sufficient space has been allocated for the smooth flow of pedestrain traffic.

2.3.10.5 Results/Findings — Table 2.3.10-1 summarizes all Human Engineering Discrepancies identified in this survey. In general, no discrepancies deemed significantly debilitating to operations were observed. Most of the Human Engineering Discrepancies deal with the height on the vertical boards for control display mounting, and of these many deal with: 1) low frequency of use components, and/or 2) components deemed insignificant (by operations personnel) to safety issues.

Figures 2.3.10-1 and 2.3.10-2 show, for the 5th percentile female and the 95th percentile male population, functional reach and extended functional reach envelopes on the main operating consoles. Figure 2.3.10-3 shows the vertical reach envelope for the vertical panels "A" and "B" in the control rooms.

TABLE 2.3.10-1

ANTHROPOMETRIC SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| | 6113f1 | III | III | Available walkspace |
| 11 | 6122b,c,e | III | III | Reach to console controls |
| 12 | 6122e1 | IIA | IIA | Components mounted too high or low on vertical boards |
| 14 | 6123g | III | III | Console dimensions |
| 15, 16 | 6125a1,2 | IIC/III | IIC/III | Control height for precise operation |
| 17, 18 | 6125b1,2 | IIA<br>III | IIA<br>III | Display mounting height for accurate reading |

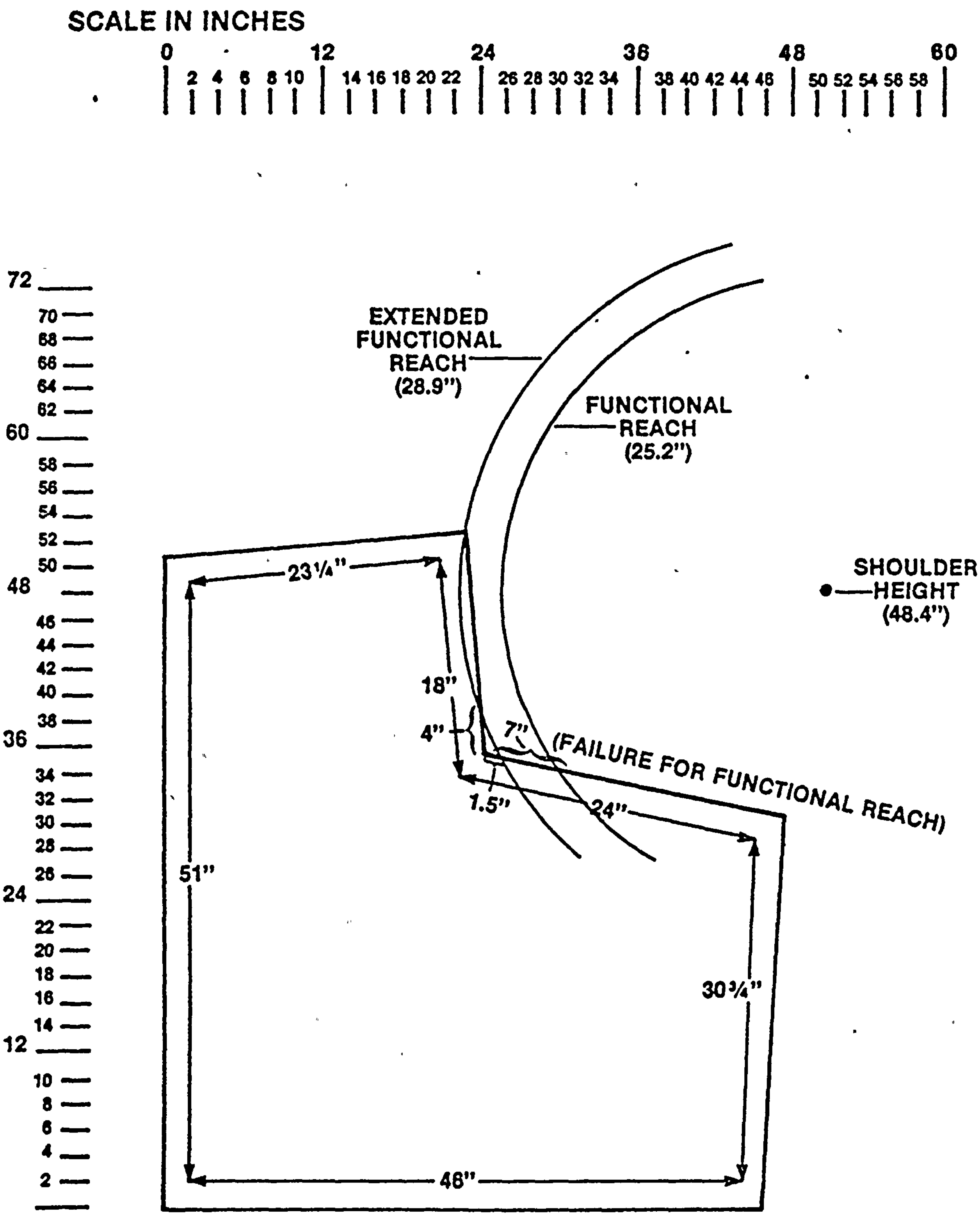



**FIGURE 2.3.10-1**
**REACH ENVELOPE FOR 5th PERCENTILE FEMALE — OPERATOR'S CONSOLE**

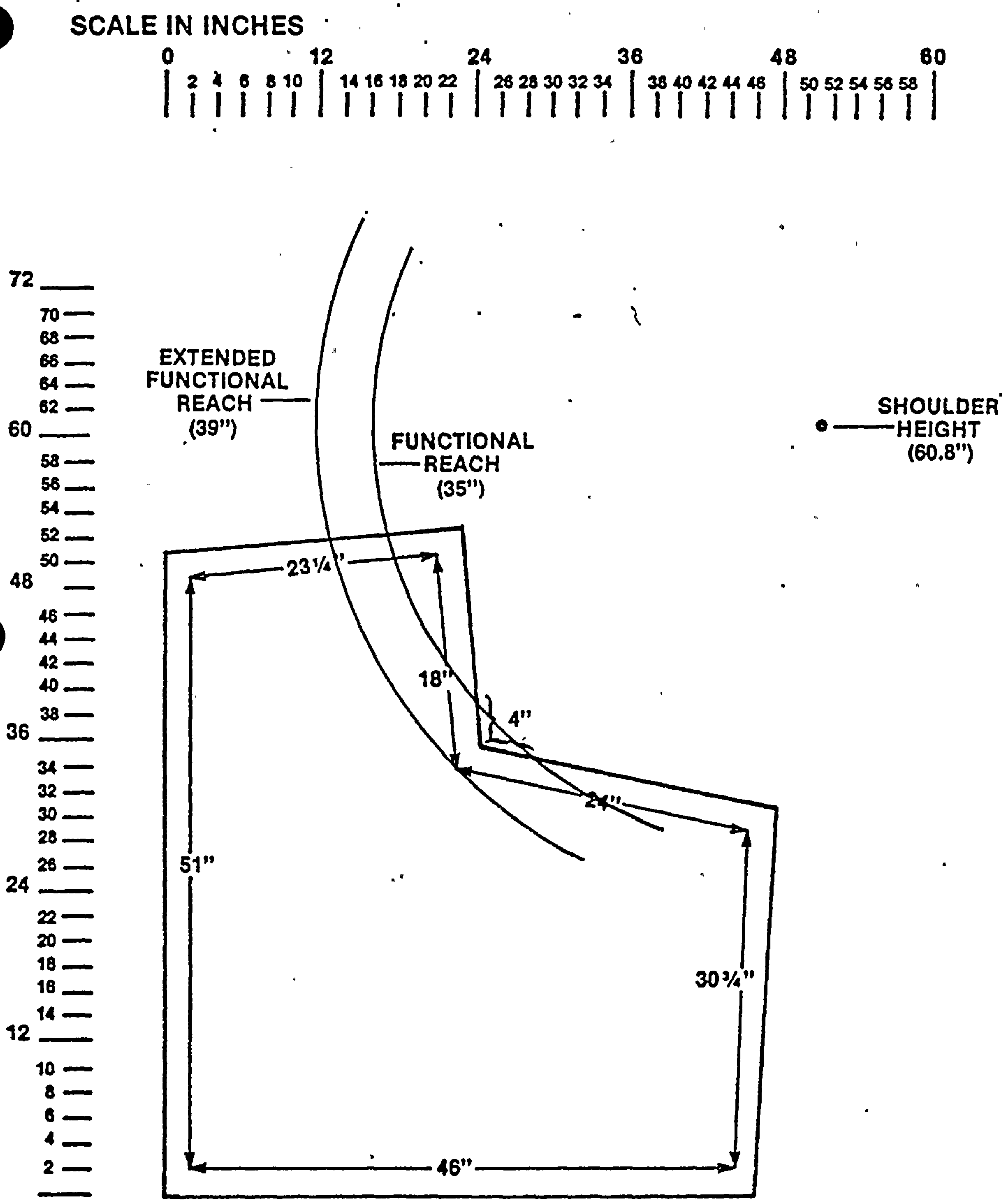
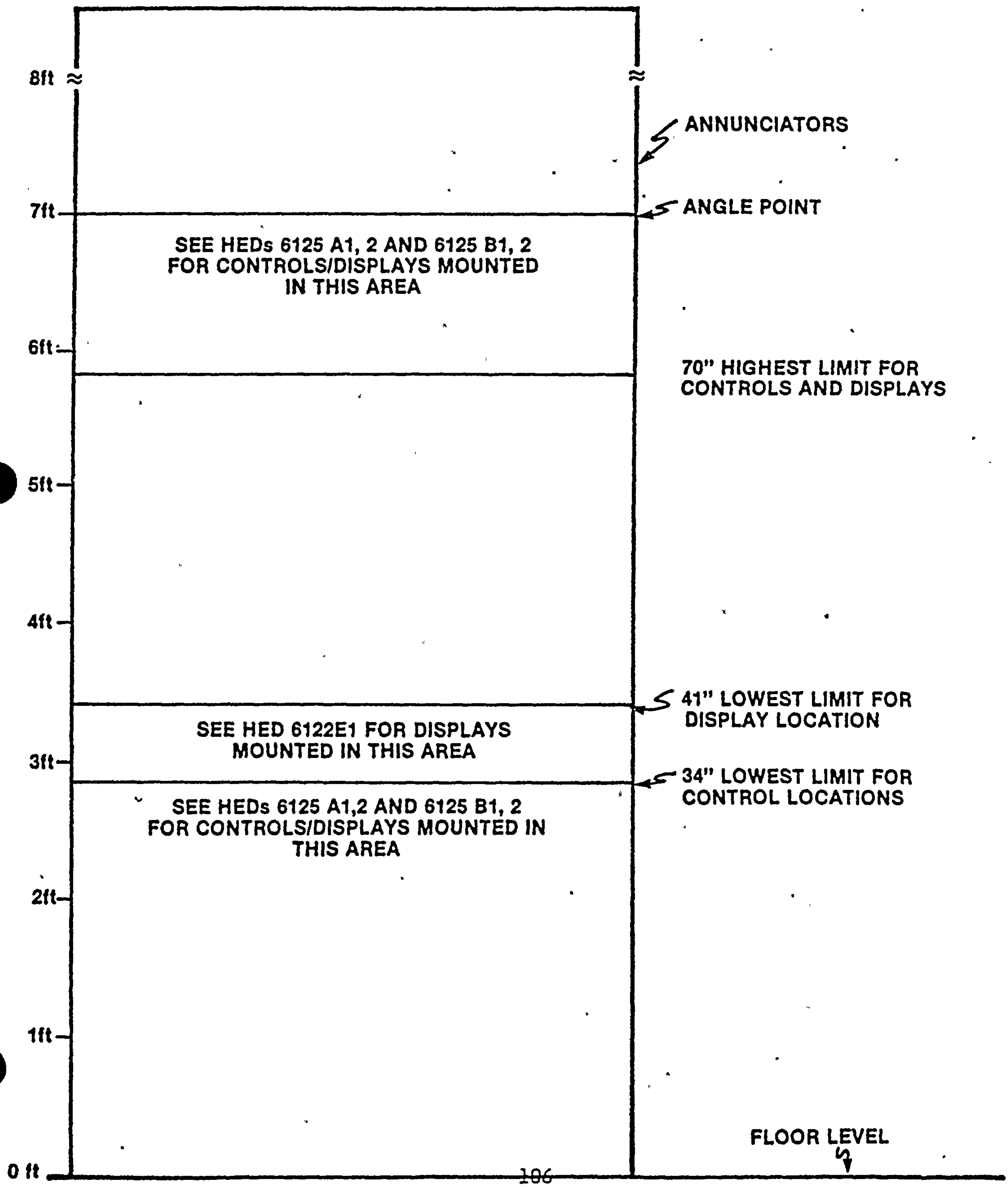



FIGURE 2.3.10-2
REACH ENVELOPE FOR 95th PERCENTILE MALE—OPERATOR'S CONSOLE

## FIGURE 2.3.10-3
## REACH AND VISUAL ENVELOPES FOR VERTICAL PANELS



### 2.3.11 Force/Torque Survey

2.3.11.1 Objective — The objective of the Force Torque Survey was to identify control room equipment, via operator interview, which require too little or too excessive force for their operation, and to evaluate conformance of any potentially discrepant equipment to applicable human engineering criteria.

2.3.11.2 Review Team Responsibilities — The evaluation team consisted of a human factors engineer qualified to take force/torque measurements and a control room operator. Where control actuation was necessary to subjectively assess the force/resistance of a control, operations personnel directed the activity.

2.3.11.3 Criteria — The force criteria for operation of switch types are contained in the checklists in Appendix A. The source document for the checklist was NUREG-0700.

2.3.11.4 Task Definitions/Methodology — Several control room operators were interviewed using a preconstructed force/torque questionnaire (see Table 2.3.11-1). Individual component types were activated by a control room operator to test conformance with criteria, and were evaluated using the checklist.

2.3.11.5 Results/Findings — Table 2.3.11-2 presents the Human Engineering Discrepancies identified by this survey. As indicated in the table, only two Human Engineering Discrepancies were identified. No additional control resistance problems exist in the control rooms.

TABLE 2.3.11-1

FORCE/TORQUE QUESTIONNAIRE

1. Do you recall any inadvertent switch actuations as a result of coming in contact with the switch mechanism? If so, do these switches appear to be too easily actuated?

GO TO FIRST PANEL, THEN REPEAT QUESTIONS AT EACH PANEL

2. Are there any controls, pushbuttons, or legend pushbuttons which appear to be too easily actuated or difficult to actuate?

3. Do toggle switches have an elastic resistance that increases as the control is moved and drops as the switch maps into position?

4. Are knobs for spring loaded momentary contact rotary selector controls large enough to be easily held against the spring torque for as long as necessary?

5. Does rocker switch resistance gradually increase then drop to zero when the control snaps into position?

6. Does the resistance for the rocker switch preclude the switch from being placed between positions?

7. Do any control knobs or handles rotate or move loosely on their shafts?

8. Do any controls give the "feeling" that internal wear has occurred or that breakage might occur, or have the "feel" that sensory feedback has altered over the life of the control?

TABLE 2.3.11-2

FORCE/TORQUE SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 32 | 6432d | III | III | Guarded pushbutton ease of use |
| 23 | 6442a | III | III | High torque design on several rotary selector switches |

### 2.3.12 Communications Survey

2.3.12.1 Objective — The objective of the Communications Survey was to assess the degree to which various modes of communication transmission and reception used in the control room conform to the human factors guidelines outlined in NUREG-0700. Through the evaluation process generic discrepancies and discrepancies specific to individual communication devices were identified.

2.3.12.2 Review Team Responsibilities — The members of the review team and their responsibilities included:

- o A human factors specialist to conduct the checklisting, identify discrepancies, and report the survey findings.
- o A senior human factors scientist to observe the system operation during an emergency drill and identify discrepancies, and to assist in conducting rhyme tests.
- o Communications system operators (Control Room Operator, Nuclear Plant Supervisor, and Nuclear Watch Engineers) to supply operational information and demonstrate system operations.
- o Plant technicians (Instrumentation and Control and Electric Department personnel) to provide and to obtain necessary documentation for completion of this task.

2.3.12.3 Criteria — The criteria used to evaluate the various communication systems are based on NUREG-0700 guidelines. Other source books included NUREG/CR-1580 and MIL-STD-1472C. The specific criteria used are contained in Appendix A.

2.3.12.4 Task Definition/Methodology — The four procedures used to conduct this survey were: 1) conduct of operator interviews, 2) application of human engineering checklists, 3) observation of emergency drill communications, and 4) conduct of a modified rhyme test. Each is discussed briefly below.

Interview — The operator interviews collected in the "Review of Operating Experience" task were reviewed for identification of potential communications discrepancies. The discrepancies were then targeted for verification in the control room and evaluated according the survey criteria.

Human Engineering Checklist — The checklist, applied on-site, was concerned with the following issues: maintainability, identification, coding, operation, audibility, usability, and accessibility.

Operations personnel were asked specific questions about the different communications systems or were asked to demonstrate the system operation and capabilities. Instrumentation and control engineers and plant technicians were consulted concerning specific system capabilities (e.g., frequency ranges, power supplies, and maintenance).

Emergency Drill — A human factors specialist and a senior human factors scientist observed most of the communications systems in real-time operation during two of the emergency drills conducted for the Nuclear Regulatory Commission on March 15th and 16th, 1982. Discrepancies, not apparent during normal operations and operator demonstrations of system operations, were noted and Human Engineering Discrepancy reports were written.

Page System Rhyme Test — A modified rhyme test of the plant page system was conducted spontaneously, based on operator interivew findings. In this subtask, 15 words were spoken over the page system while the plants were in normal operating conditions. The procedure used was, except for talker's list length, the same as described in Section 2.3.7 of this report.

2.3.12.5 Results and Recommendations — Table 2.3.12-1 summarizes the Human Engineering Discrepancy findings for this survey. In general, the communications system was found to be discrepant in several areas including emergency use, reliability/maintenance, identification/coding, location, and design.

Interviews suggested intelligibility problems with the page system. Tables 2.3.12-2 and 2.3.12-3 present the target and test words used in a modified rhyme test. The test was presented and 87 percent correct recognition was made of target words. These findings are considered to demonstrate acceptable intellegibility for the page system.

TABLE 2.3.12-1

COMMUNICATIONS SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category | | Description |
|---|---|---|---|---|
| | | TP-3 | TP-4 | |
| 11 | 6211a | IIC | IIC | Emergency communications |
| 10, 12 | 6211b | IIA | IIA | Phone intelligibility |
| | 6211c | III | III | Communications procedures |
| 2, 3 | 6212b6 | III | III | Location of handset cradle |
| 5 | 6213b1,2,4 | IIA | IIA | Sound powered phone set |
| 4 | 6213c2 | III | III | Switch from sound powered to page communications |
| 13 | 6216a | III | III | Security page |
| 6 | 6216a2,f | IIC | IIC | Page communications system |
| 7 | 6216e1 | IIC | IIC | Page speaker location |
| 8 | 6217b | IIC | IIC | Volume controls on communications equipment |
| 9 | 6218b,c | IIC | IIC | Emergency equipment and communications |
| 10 | 6221b | IIC | IIC | Communications audible signal coding |
| 14 | 6222a | III | III | Phone bell coding |

TABLE 2.3.12-2

MODIFIED TALKER'S LIST
FOR PAGE SYSTEM RHYME TEST

| | | |
|---|---|---|
| Group | 11 | DIM |
| | 12 | SHED |
| | 13 | TOE |
| | 14 | JAR |
| | 15 | SIN |
| | 16 | DUG |
| | 17 | SWOG |
| | 18 | SEEN |
| | 19 | NOT |
| | 20 | WEST |
| | 21 | PIT |
| | 22 | BAT |
| | 23 | SAY |
| | 24 | DIG |
| | 25 | PAGE |

2.3.13 Maintainability Survey

2.3.13.1 Objective — The objective of the Maintainability Survey was to evaluate the adequacy of the control room design to support maintenance activities performed by operations personnel. The survey was organized into three parts:

- o Maintenance of Components with Integral Lighting
- o Recognition of Visual Display Failure
- o Spare Parts, Operating Expendables, and Tools.

2.3.13.2 Review Team Responsibilities — The following personnel were required to conduct this survey: a human factors engineer, responsible for data collection and analysis and for report preparation; a control room operator, responsible for providing assistance during data collection and analysis; and an instrumentation and control technician, who was responsible for providing information and assistance during data collection and analysis.

2.3.13.3 Criteria — Criteria used in this survey are summarized below.

- o Lamps should be replaceable from the front of the panel (i.e., components should not have to be removed to replace lamp.
- o Components are not susceptible to shorting out or, in the case of switches, to inadvertent activation during the process of lamp removal or replacement.
- o Lamp replacement does not subject the operator to a shock hazard .
- o Covers having legends, color coding, or other component-specific information are physically keyed, or some form of procedural safeguard is provided to prevent interchanging of covers.
- o If lamp replacement requires tile removal, there is a way to ensure that the tile is replaced in the correct location.
- o Dual-bulb or dual-filament light assemblies are used, or bulb-test capability is provided where lamp status cannot be verified.
- o Component design encourages immediate replacement of burned-out bulbs by providing for rapid and convenient bulb replacement with power on and without hazard to personnel or equipment.
- o Operator aids are provided if needed for lamp replacement.
- o When panel instruments such as meters fail or become inoperative, the failure is apparent to the operator (i.e., a failed meter displays an off-scale indication).
- o Spare parts, such as indicator lamps, and any tools required by operating personnel are stored in suitable designated space(s) within the control room.
- o An adequate supply of expendables and spare parts (e.g., fuses, bulbs, ink, recorder charts, printer paper, etc.) are provided.

- o Expendables and spare parts are readily accessible.
- o All tools required to replenish expendables and install spare parts are available.
- o There should be adequate storage space for expendables and spare parts.
- o When different types, sizes, or styles of expendables and spare parts are required, they should be clearly and distinctively marked to avoid confusion or misapplication.
- o Records should be maintained concerning the status of expendables and spare parts.
- o The paper, ink, and other expendables required to maintain graphic recorders should be provided and accessible in the control room.
- o The design of graphic recorders permit quick and easy replenishment of paper and ink.
- o Fresh replacement batteries for walkie-talkies are accessible and well marked.
- o The stock of batteries is sufficient to support continuous emergency operation of walkie-talkies.

2.3.13.4 Task Definition/Methodology — The following procedures were followed to conduct this survey.

Maintenance of Components with Integral Lighting — All components having integral lighting were identified. Components were organized into generic classes (e.g., legend switches, annunciators, etc.). Next, representative components were selected from each class for evaluation.

Maintenance procedures for lamp replacement for each sample component were reviewed and assessed. Finally, each sample component was evaluated according to the above criteria by using the checklist contained in Appendix A. Whenever necessary, the control room operator or the instrumentation and control technician demonstrated required maintenance activities.

Recognition of Visual Display Failure — All visual displays were identified. Visual displays were organized into generic classes (e.g., vertical meters, strip charts etc.). Next, representative displays from each class were selected for evaluation; and display failure modes, indications, etc., were identified by interviewing the control room operators and/or instrumentation and control technician using the interview form contained in Appendix A.

Each sample display was evaluated according to the above criteria using the checklist contained in Appendix A. Whenever necessary, the operator or instrumentation

and control technician simulated display failure either by disrupting the electrical signal to the display, or some other means, as appropriate. Where it was impractical to simulate display failure, display specifications were reviewed to determine display failure response.

Spare Parts, Operating Expendables, and Tools — All control room components requiring maintenance by operations personnel in the form of replacing parts or replenishing expendables were identified. The components were organized into generic classes (e.g., transilluminated displays, graphic recorders, printers, etc.). Next, for each class of components the associated spare parts and/or operating expendables required for maintenance by operations personnel were identified and described. Information entered on the data form included:

- o Component — component name or designation (e.g., graphic recorder)
- o Type — type of spare part or operating expendable (e.g., paper)
- o Size — cubic dimensions of spare part or expendable, as stored (approximate)
- o Markings — provisions for labeling or otherwise designating similar items to avoid confusion
- o Replacement frequency — how often the item must be replaced (e.g., once per week)
- o Tools — tools required to replace spare part or replenish expendable
- o Storage location — where in the control room the item is stored.

Storage closets, lockers, etc., were also identified and described. Information entered on this form included:

- o Designation — name assigned to locker, closet, etc. (e.g., Storage Locker #1)
- o Location — where in the control room the container is located
- o Size — internal dimensions of the container
- o Stored items — items stored in the container
- o Labeling — bins, compartments, etc.
- o Frequency of stocking — schedule for restocking container.

The control room design was evaluated with respect to spare parts, operating expendables, and tools by using the checklist contained in Appendix A. In conducting this evaluation it was important to consider the following:

- o Adequacy of supply — to determine if the supply of expendables and spare parts is adequate, one must determine the frequency with

which the spare part or expendable is replaced, as well as the periodicity of stock replacement (i.e., the likelihood that an item will run out before the shelves are restocked).

- Adequacy of space — to determine the adequacy of storage space, one must compute the volume of all items contained in the storage space when the shelves are fully stocked.

2.3.13.5 Results/Findings — Table 2.3.13-1 presents the findings of this survey. A summary of the discrepancies noted on Human Engineering Discrepancy forms follows:

- Display failure is not apparent and no lamp test is provided for simple indicator lights, annunciators, and bright is right
- Some meters and strip charts fail on-scale (failure is not apparent)
- Illuminated displays
- Most digital displays have no indication of failure
- Storage and labeling is inadequate (absent or inaccurate)
- Stored item accessibility is reduced by location and by locked cabinets
- Inadequate storage space is provided in, or accessible to, the primary area
- No inventory is kept for replenishment of spare parts and expendables
- Tools, when provided, do not fit/work.

TABLE 2.3.13-1

MAINTAINABILITY SURVEY SUMMARY OF FINDINGS

| File No. | HED# | Category TP-3 | Category TP-4 | Description |
|---|---|---|---|---|
| 35 | 6114a | IIC | IIC | Storage space in control room |
| 36 | 6115 | III | III | No provisions for storage |
| 37, 38 | 6115e | IIC | IIC | Spare bulb storage and maintenance |
| 10 | 6115f | IIC | IIC | Spare parts inventory |
| 19 | 6433c3 | IIC | IIC | Computer failure and shock hazard |
| 3, 79 | 6511f<br>III | IIC<br>III | IIC | Display failure indication |
| 57 | 6531a1,2 | IIC | IIC | Lamp test/display failure not apparent |
| 18 | 6531a3 | II | IIC | Tools for/ease of bulb replacement |
| 81 | 6541 | IIC | IIC | Recorder maintenance |
| 66 | 6541a | IIC/III | IIC/III | Quality of materials. Recorder stamping/ marking/reading |
| 67 | 6541b | III | III | Recorder scaled paper supply |
| 83 | 6541f | III | III | Recorder paper maintenance |
| 23 | 6731e3 | III | III | Recorder paper maintenance |

## 2.4 System Function and Task Analysis

System Function and Task Analysis was conducted in four basic steps, as follows:

- o Identify/review systems, functions, and tasks
  - identify system functions
  - develop task lists and Response Selection Diagrams
  - identify event sequences to be analyzed
- o Analyze tasks
  - analyze tasks for each function
  - develop Spatial-Operational Sequence Diagrams
- o Verify task performance capability/human engineering suitability
- o Validate control room functions.

Each of these steps is discussed in the following sections.

### 2.4.1 Identify/Review Systems, Functions, and Tasks

The overall objectives of the System Function and Task Analysis were to identify and organize plant systems, functions, and operator tasks to support subsequent analysis. Subtasks are presented below.

2.4.1.1 Identify Systems/Subsystems and System Functions — The objectives of this subtask were to identify and document the plant systems and subsystems which function to operate the reactor plant and generate and distribute power. This included the systems which are represented in the control room. Once the system and subsystem boundaries were identified, the functions which are performed within a subsystem division were identified and documented.

The review team consisted of several senior operations personnel, four human factors specialists, and plant instrumentation and control engineers.

The team members reviewed the Final Safety Analysis Reports, technical specifications, system descriptions, and other available documentation which describe the reactor plant, power generation, and power distribution systems. A preliminary systems and subsystems list was developed. The team interviewed the operations personnel using the control room photomosaic to verify/revise the system and subsystem divisions which were identified by operations personnel as governing:

- o Reactor control and instrumentation systems
- o Safety systems
- o Feedwater systems
- o Radwaste systems
- o Power generation systems
- o Power distribution systems.

The system and subsystem boundaries were identified and verified to reflect the as-built operational status and operating practices. The operations personnel were requested to provide, for each subsystem, the functions (or operations) of (and any operational variations associated with it) the subsystem and its components. Operational variations and the conditions under which they are employed were documented as function alternatives.

This subtask identified the major plant systems, the functions which they govern, and the subsystems of each major system. The list of system functions underwent task Analysis.

2.4.1.2 Develop Task Lists and Response Selection Diagrams — The objectives of this subtask were: 1) to identify and describe motor, perceptual, and information processing tasks associated with performance of system and subsystem functions, 2) to identify task sequences and dependencies, and 3) to graphically depict task sequences in Response Selection Diagrams.

Through review of standard, abnormal, and emergency operating procedures and interviews with operations personnel; conditions which initiate operator tasks in relation to performing functions (initiators include alarms, routine monitoring, administrative procedures, etc.) were identified.

Also identified were the prerequisite conditions for the conduct of functions and the possible variations in the conduct of functions based on presence or absence of prerequisite conditions.

By reviewing system operating procedures and interviewing training instructors and operators, individual tasks and decision points involved in function performance were identified. Detailed descriptions of task actions were recorded in the form of Response Selection Diagrams which graphically represent task sequences (see Figure 2.4-1) and identify actions and decisions on the part of the operator.

This subtask provided Response Selection Diagrams for each control room function, depicting:

- Tasks
- Task sequences
- Decision points
- Task dependencies
- Detailed task descriptions.

See Figure 2.4.1.-1 for an example of a completed Response Selection Diagram. These Response Selection Diagrams were used as initializing information for detailed analysis of tasks.

2.4.1.3 Identify Event Sequences — The objective of this subtask was to identify event sequences (postulated and experienced transients) to be evaluated in the task analysis. The specific list of event sequences selected for analysis were:

- o Plant Startup/Shutdown/Change in Power
- o Loss of Coolant Accident
- o Inadequate Core Cooling
- o Multiple Steam Generator Tube Ruptures
- o Failure of Auxiliary and Main Feedwater
- o Failure of High Pressure Reactor Coolant Make Up
- o Anticipated Transients Without Scrams
  - Loss of offsite power
  - Stuck Power-Operated Relief Valve.

## 2.4.2 Analyze Tasks

The basic objective of this System Function and Task Analysis activity was to use the data previously generated to analyze, in detail, operator-allocated tasks for each of the functional sequences selected for analysis. Subtasks are discussed below.

2.4.2.1 Analyze Tasks for Each Function — The objectives of this subtask were to analyze task requirements to determine information requirements, control requirements, communication requirements, constraints (time, etc.) on task performance, and decisions and skills/knowledge requirements; and to document task requirements in an accessible, usable format for each task and task sequence.

The Response Selection Diagrams were used as a basis to determine detailed task requirements. Detailed task descriptions were analyzed, and for each task the following information was assembled on the Task Analysis/Response Selection Diagram form (See Figure 2.4-1):

- o The required control action, if applicable (i.e., binary, multi-discrete, or continuous)
- o The control panel and the display or control code associated with the task
- o The display requirement, if applicable (i.e., binary, multi-discrete, or continuous scale)
- o Parameter ranges and control features necessary for safe plant operation

- Skills/knowledge demanded of the operator for task performance
- Workload assessment.

2.4.2.2 Develop Spatial-Operational Sequence Diagrams — The objective of this subtask was to present sequential task accomplishment graphically on line drawings of the board layouts.

Using Task Analysis/Response Selection Diagram data as input, human factors engineering analysts graphically represented task sequences on panel line drawings (i.e, Spatial-Operational Sequence Diagrams). The procedure for generating Spatial-Operational Sequence Diagrams is as follows:

- Assemble line drawings of control board
- Code components compatibly with locator codes on Task Analysis/Response Selection Diagram forms
- Sequentially link control board instrumentation and displays based on Task Analysis/Response Selection Diagram data
- Numerically identify links with task code numbers from Task Analysis/Response Selection Diagrams
- Assemble and file Spatial-Operational Sequence Diagrams for subsequent analysis.

The outputs and results of this subtask were Spatial-Operational Sequence Diagrams for each system and subsystem function that identify:

- Sequence of control/display use for each function
- Frequency of control/display use for each function
- Decision and task sequence output failure points.

With the knowledge of the original design considerations and the design and human factors trade-offs that were conducted during the plant design phase, the Operations Department performed an integral role in the determination of task requirements.

The outputs and results of this subtask were verification or identification of: instrumentation and design requirements for performance of tasks, operator skills and knowledge required for task performance, and workload assessment.

### 2.4.3 Verify Task Performance Capability/Human Engineering Suitability

This task required further analysis and evaluation of operator-allocated tasks. Subtasks for this task are discussed below.

2.4.3.1 Develop Functional Sequence Diagrams — The objective of this subtask was to develop event-based Functional Sequence Diagrams for each event sequence listed in Section 2.4.1.3, above.

For each event sequence which underwent evaluation, event evolutions (courses) were identified.

Functional Sequence Diagrams generated from procedures represent the evolving plant and operational status ensuing after an initiating event.

The procedure for developing Functional Sequence Diagrams was as follows:

- o Identify the previously defined functions and tasks as operationally sequenced in the event
- o Identify branch points (e.g., diagnostic decisions, etc.)
- o Timeline operations and tasks to identify event progressions.

As Functional Sequence Diagrams were completed, sequential functions were overlaid on control room floor plans and sequentially numbered to identify and analyze control room traffic patterns. The traffic pattern analysis was conducted as follows:

- o Assemble Functional Sequence Diagrams for each event
- o Obtain control room floor plan drawings
- o Sketch the traffic paths for all operators as required by the event sequence
- o Identify functional (operational) dependencies, as required.

Figure 2.4.3-1 shows a typical Functional Sequence diagram. Figure 2.4.3-2 shows an example of a traffic analysis for the same sequence as presented in Figure 2.4.3-1. Outputs of this subtask are Functional Sequence Diagrams and Traffic Diagram checklists.

2.4.3.2 Verify Human Engineering Suitability — The objective of this subtask was to identify man-machine interface problems that may affect task performance, but that may not be evident in component surveys.

There are four major design issues that this subtask addressed: 1) the grouping of components with respect to function, sequence, importance, and frequency-of-use criteria; 2) control and display integration to ensure that associated controls and displays are not dispersed and that their designs are compatible; 3) component discrimination through enhancements such as demarcation and coding techniques; and 4) panel layouts for consistency of conventions across all panels/units. Specific checklist items regarding the above issues were used as compliance standards.

The functional groups were identified in the system and subsystem definition of Task 1. The extent to which functional groups/systems/subsystems define an appropriate functional group with respect to operational requirements was then assessed using the Spatial-Operational Sequence Diagrams. These diagrams identify: 1) the components

which are involved in carrying out the subsystem functions, 2) the sequence of component use, and 3) the associated controls and displays for a particular action. In addition, by identifying corresponding functions between control panels and units, where applicable, location and sequence aspects of the layout consistency were assessed. The checklist criteria items (Appendix A) were applied to each Spatial-Operational Sequence Diagram sheet, and discrepancies were noted. All the Spatial-Operational Sequence Diagrams involving a discrepant component were analyzed with respect to the component's frequency-of-use and importance as determined in Subtask 2.4.4.

### 2.4.4 Validate Control Room Functions

The objective of this task was to: 1) estimate the importance and frequency-of-use for equipment, and 2) verify the availability of required instrumention and controls in the control room.

2.4.4.1 Develop Frequency and Importance Data — The objective of this subtask was to determine both importance and frequency-of-use data for equipment used in task sequences and selected plant events.

Based on: 1) event sequences, 2) normal operating procedures (e.g., startup), and 3) frequency estimates of nonprocedurally-bound operations (e.g., Boron control, annunciator responses, etc.), frequency data for equipment use is estimated. The procedure for estimating task frequency was as follows:

- o Determine an estimate of the frequency of implementation of normal operating procedures (e.g., start-up, shutdown, change in power) by interviewing senior operations personnel.
- o Similarily, determine estimates of the frequency of nonprocedurally-bound operations (e.g., boration, volume control, etc.) for each function.
- o Assemble data on form.
- o Develop a frequency table for function call-up.
- o Develop frequency estimation for each instrument/control/communication requirement based upon estimated frequency-of-function execution.
- o Sort and store frequency data (see Table 2.4.4.-1).

Using a similar technique, indication of equipment importance was identified by weighting the importance of the events shown on frequency data form and then summing the weighted frequencies of equipment uses in function callups.

The outputs and results of the subtask were estimated frequency-of-use and importance data for control room equipment by event/operation.

## TABLE 2.4.4-1

## ESTIMATED FREQUENCY OF FUNCTION CALLUP

| Procedures | Frequency Per Week or Frequency Per Month | Total Frequency Per Year | Rated Importance |
|---|---|---|---|
| 1. Startup | | | |
| 2. Shutdown | | | |
| 3. Change in Power | | | |
| • | | | |
| • | | | |
| • | | | |
| n. etc. | | | |
| Nonprocedurally Bound operations (function callups) | | | |
| 1. Boration | | | |
| 2. Dilution | | | |
| 3. Cooling Water flow | | | |
| 4. Maintain SI Tk level | | | |
| • | | | |
| • | | | |
| • | | | |
| n. PRZR Temp Maintenance | | | |

2.4.4.2 Verification of Equipment Availability — The objectives of this subtask were to identify availability (presence) of required instrumentation and controls in the control room to support performance of system functions, and to identify potentially extraneous control room equipment.

The basic criteria for the subtask were: 1) the control and display designs should match the task needs and operators' capabilities, 2) frequently required or important instrumentation or controls should be located in the control room, and 3) infrequently used or unimportant instrumentation should be excluded from the control room inventory.

The Task Analysis/Response Selection Diagrams were compared with the Functional Sequence Diagrams to identify the equipment requirements. To identify any deficient areas, the results were then compared to the control room inventory list representing the present equipment capabilities and characteristics. All equipment was evaluated for its appropriateness to operating requirements using the checklist (see Appendix A).

The calculated frequency-of-use data was examined to identify equipment with very high or very low frequency of use. Lists were prepared for infrequently used equipment located in the control room and frequently used equipment located outside of the control room. These lists were also annotated with the assessment of the component's importance to operations as previously developed.

The outputs and results of this subtask include: 1) a list of required control room equipment located external to the control room, 2) a list of infrequently used equipment located in the control room, and 3) a list of discrepancies based on Task Analysis of the equipment requirements and the present control room inventory.

## 3.0 IMPLEMENTATION

The objectives of this phase are: 1) preparation of schedules for implementation of selected backfits, and 2) preparation and submittal of the final report.

### 3.1 Develop Backfit Schedules

Backfit implementation programs were prepared when Human Engineering Discrepancies had been identified, documented, and assessed. Scheduling of Human Engineering Discrepancy backfits will be a function of:

- o Human engineering discrepancy priority
- o Engineering and procurement lead time requirements and constraints
- o Overall plant outage schedules.

Schedules will be reviewed and updated as part of the implementation program.

#### 3.1.1 Phase 3 — Enhancement and Design Solutions

The basic procedure to be employed in identifying and selecting enhancements and design solutions is based on Figure 3-1.

- o Analysis of correction by enhancement
- o Analysis of correction by design alternatives
- o Assess extent of correction.

#### 3.1.2 Analysis of Correction by Enhancement

Discrepancies selected for correction are first examined for possible correction by enhancement (labeling, demarcation, procedure aids, etc.). Each Human Engineering Discrepancy is considered, and, where such correction is possible, the discrepancy is reassessed for its effect on operator performance. Human Engineering Discrepancies are, as appropriate, re-evaluated via checklisting and Task Analysis until human factors engineering suitability is verified. Where it is determined that correction by enhancement is not possible, the Human Engineering Discrepancy is analyzed for correction-by-design alternatives (see Figure 3-2).

#### 3.1.3 Analysis of Correction by Design Alternative

Identification of design alternatives was achieved by the examination of the Human Engineering Discrepancy, reference to task analysis data, and identification of potential

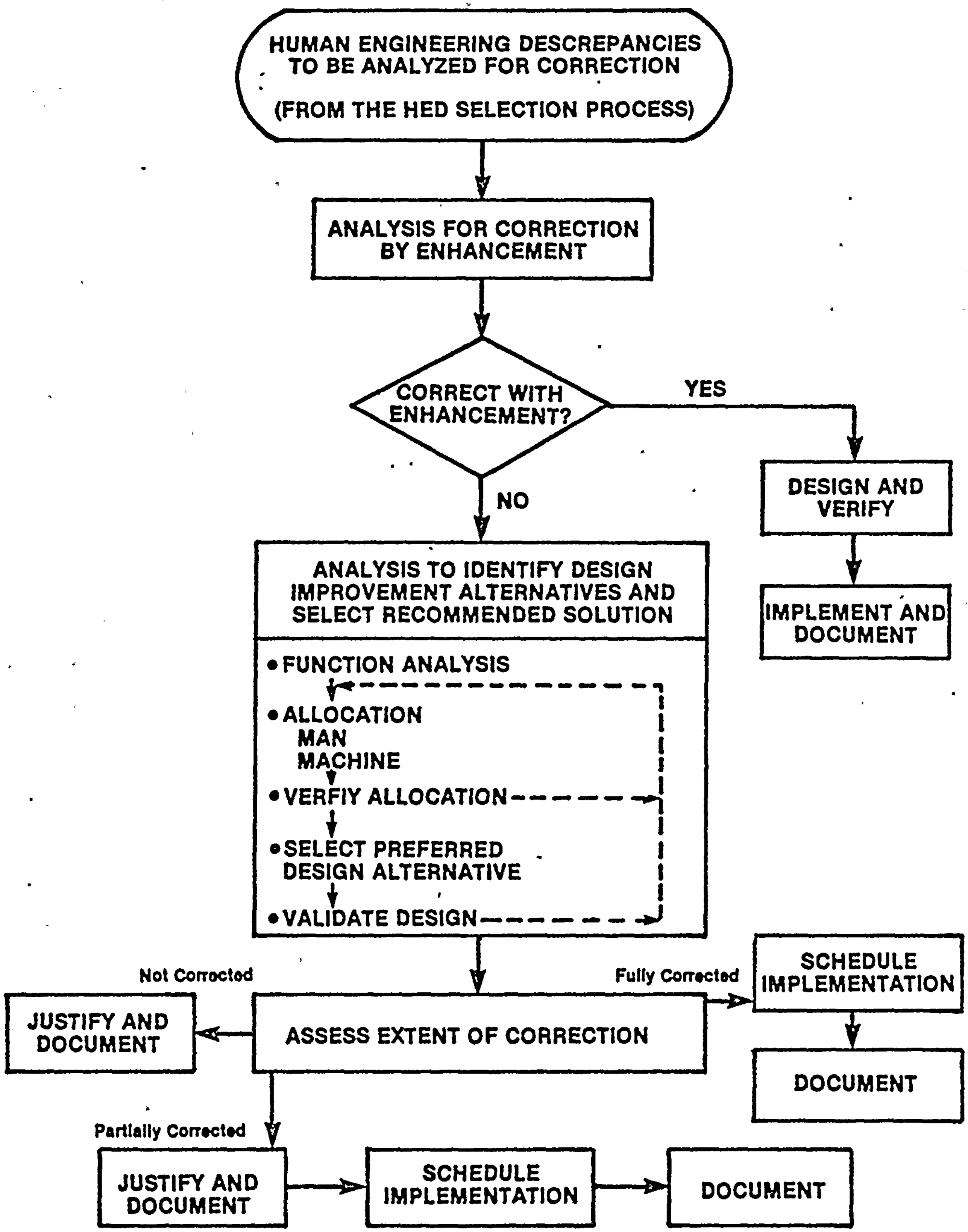
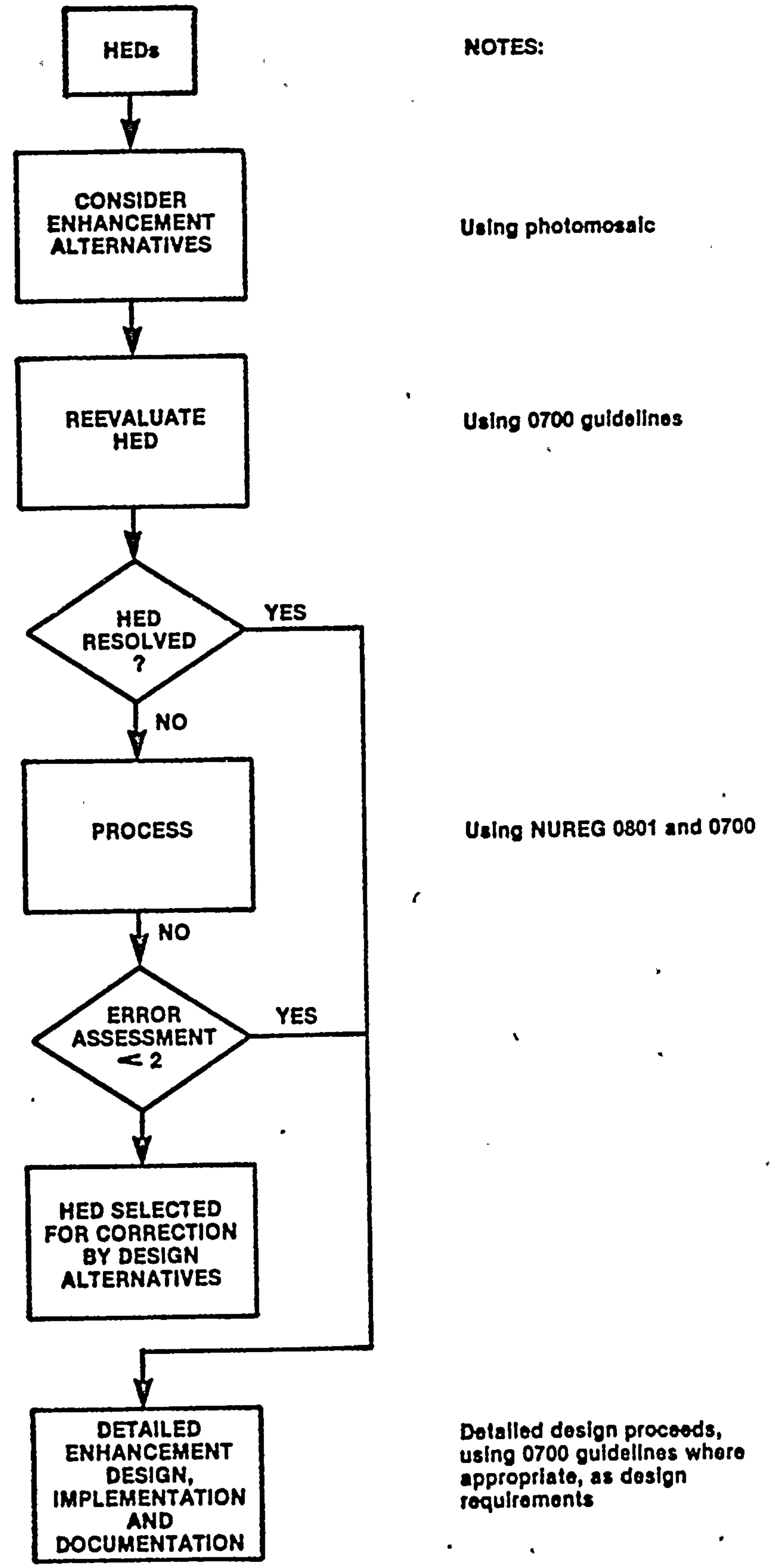



**FIGURE 3-1**
**ASSESSMENT: SELECTION OF DESIGN IMPROVEMENT**
**(FROM NUREG-0700)**

## FIGURE 3-2

## FLOW FOR CORRECTION OF HEDs BY ENHANCMENT



constraints (e.g., availability of equipment, Reg. Guide 1.75, etc.) and was dispositioned by taking into account plant safety, design restrictions, operator performance, and cost effectiveness. The acceptability of design alternatives will be verified by further evaluation using the following:

- o Functional analysis
- o Task analysis
- o Reapplication of appropriate checklists.

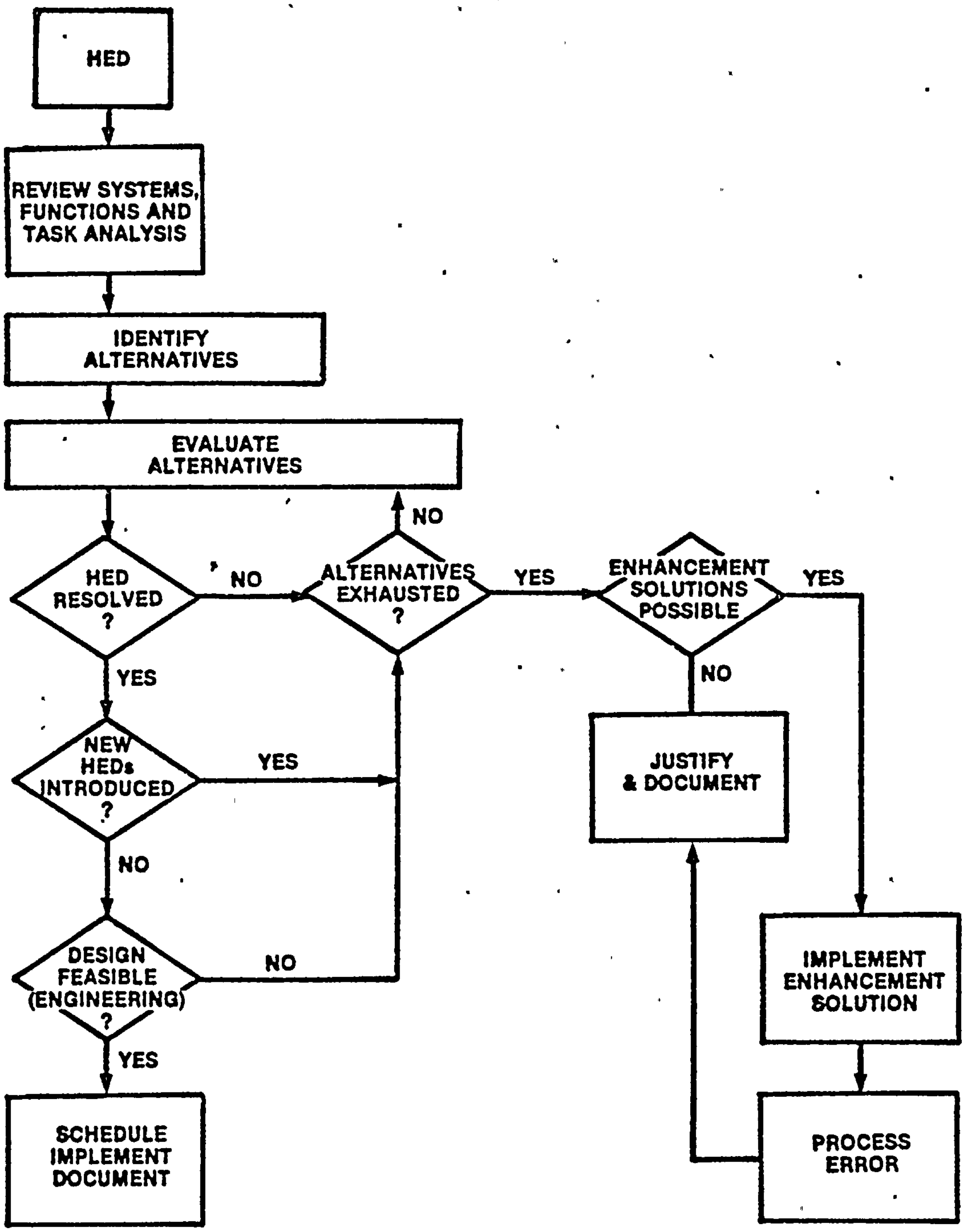
Figure 3-3 presents the general activity involved in the analysis of correction-by-design alternative.

### 3.1.4 Extent of Correction

For all human engineering programs implemented or Human Engineering Discrepancies selected for correction-by-design alternatives, the extent of correction (by enhancement or redesign) will undergo evaluation. To achieve the assessment, a simple reapplication of program guidelines and verification of human factors engineering suitability will be performed. Figure 3-4 is the form used to document extent of correction assessments. In cases where a generic program is consistently implemented (i.e., labeling, color coding, etc.), only a sample of enhancements will be re-evaluated for extent of correction since the results will be the same in all cases. Correction assessments will occur as part of the implementation program since the full extent of enhancements cannot be evaluated until a sample survey of filed implementation is made.

## FIGURE 3-3

## PROCESS FOR ANALYZING HED DESIGN ALTERNATIVES



# FIGURE 3-4

## HED BACKFIT ASSESSMENT

HED NO. ______________________

| | PROPOSED BACKFIT | IMPLEMENTED BACKFIT |
|---|---|---|
| **I ENHANCEMENT** | | |
| a) LABELING | a) ______ | ______ |
| b) DEMARCATION | b) ______ | ______ |
| c) CODING | c) ______ | ______ |
| d) PROCEDURES | d) ______ | ______ |
| e) TRAINING | e) ______ | ______ |
| **II DESIGN ALTERNATIVES** | | |
| a) RELOCATION | a) ______ | ______ |
| b) REPLACEMENT | b) ______ | ______ |
| c) CONFORMANCE TO PROCESS CONVENTION | c) ______ | ______ |
| d) RELOCATION OF FUNCTION | d) ______ | ______ |

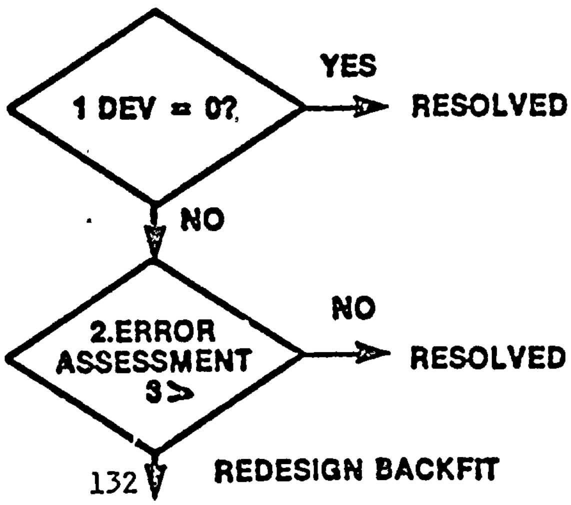
### REASSESSMENT OF PROBABLE ERROR AND DEVIATION

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. EXTENT OF DEVIATION FROM 0700 GUIDELINES | N/A | SOME | | | | COMPLETE |
| | | 1 | 2 | 3 | 4 | 5 |
| 2. ERROR ASSESSMENT | | LOW | | | | HIGH |
| | | 1 | 2 | 3 | 4 | 5 |

SIGNOFF: HEPM

______________________

DATE: ______________________



## 3.2 HUMAN ENGINEERING BACKFIT PROGRAM

### 3.2.1 LABELING

As a result of the Detailed Control Room Design Review performed on Turkey Point Unit 3 and 4, 44 of the findings (summarized in Table 3.2-1) identified, remain to be implemented as part of an ongoing labeling effort at the Turkey Point Site.

The labeling effort developed at the Turkey Point Site follows NUREG-0700 as a guideline while taking into account the compact control room design, although compact, Turkey Point 3 and 4 common control room is functionally designed with a consistant pattern of controls and displays. The labeling guideline will standardize the different sections of the control board.

The subject guideline was developed using NUREG-0700 to establish criteria for:

- o Light height
- o Label configuration, i.e., number of lines of print per label
- o Label borders and space between lines
- o Font characteristics

The developed guidelines provides:

- o Guidelines for the preparing, revising, and fabrication of labels for use in the control room and related areas.
- o A dictionary of standard abbreviations and acronyms to be used as a reference in control room labels and procedures.

The following is a list of the remaining findings to be corrected by the ongoing labeling effort. The findings are listed by section number as they relate ot NUREG-0700 and file number as they relate to FP&L tracking system. A more detailed listing along with descriptions of each line item presented in Section 3.5 of this report.

| SECTION NO. | FILE NO. |
|---|---|
| 6.4 | 5,7,10,29,35 |
| 6.5 | 6,19,30,70,86 |

Continued on next page.

| | |
|---|---|
| 6.6 | 2,3,4,5,7,8,11,12,16,17,18,19,22, 30,36,37,38,39,40,41,42,44,45,46, 48,49,50,51,53,60,62,63,66 |
| 6.9 | 3 |

### 3.2.2 DEMARCATION

As a result of the Detailed Control Room Design Review performed on Turkey Point 3 and 4 only 3 findings identified, remain to be implemented. (Summarized in Table 3.2-1). Turkey Point 3 and 4 common control room is compact but functionally layed out enjoying vertical grouping of associated controls and displays at this time.

Appendix 2 was developed to provide general guidence for designing and intergrating demarcation along with summary labels and mimic coding. The demarcation guidelines ensure that the final product maintains:

- o Simplicity of design
- o Intergration of summary labels
- o Use of mimics where beneficial to the operators and current panel space permits.

Demarcation will be used to improve functional grouping and/or provide operators with visual keys to improve response time and overall task performance.

Appendix 2 contains: A guidence document which discusses the philosophy of hierarchical labeling and example demarcation scheme. The final demarcation disign selected will be developed using task requirements, system/functional relationship, and operating experience on the Turkey Point control rooms to identify those areas needing enhancement, the demarcation will be coordinated with the relabeling program and completed as part of the units overall control room upgrade effort.

The following is list of the remaining findings to be corrected by the ongoing demarcation/labeling effort. The findings are listed by section number as they relate to FP&L's tracking system. A more detailed listing along with descriptions of each line item are presented in Section 3.5 of this report.

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 18,24 |
| 6.8 | 7 |

### 3.2.3 ANNUNCIATOR REVIEW

As a result of the Detailed Control Room Design Review performed on Turkey Point Units 3 and 4, 13 of findings (summarized in Table 3.2-1) identified, remain to be corrected as part of the ongoing Annunciator Review Program.

The Annunciator Review Program address the following points to resolve the subject findins:

- o Re-engraving of alarm windows to alleviate:
  - Congested tiles
  - Incomplete messages
  - Confusing messages
  - Addition of new tiles
  - Standarization of abbreviations
- o Prioritization of alarms by color coding
- o Reveiw of alarm windows to identify those with multiple inputs requiring reflash capability
- o Review of alarm location with regard to associated controls
- o Review of annunciators to identify those common alarms which could be combined into catagory alarms.

Annunicator engraving specifications, prioritization coding and abbreviation list are contained in the Turkey Point Units 3 and 4 annunciator review report.

The following is a list of the remaining findings to be corrected by the ongoing annunciator program. The findings are listed by section number as they relate to NUREG-0700 and file number as they relate to FP&L's tracking system. A more detailed listing along with descriptions of each line item is presented in Section 3.5 of this report.

| SECTION NO. | FILE NO. |
|---|---|
| 6.3 | 5,6,7,11,12,15,16,17,19,20 |
| 6.5 | 67,80 |
| 6.6 | 57 |

### 3.2.4 CODING CONVENTION

As a result of the Detailed Control Room Design Review performed on Turkey Point Units 3 and 4, 7 of the findings (as summarized in Table 3.2-1) identified remain to be corrected as part of the established coding convention effort.

The coding convention implemented in the Turkey Point Unit 3 and 4 control rooms will be consistant and standardized to reflect the original control room design philosophy.

The subject coding conventions are applied to:

- o Indicator lights
- o Push buttons
- o Mimics
- o Power trains
- o Meter scales
- o Control handles

The following is a list of the remaining findings to be corrected by application of the developed coding conventions. The findings are listed by section number as they relate to NUREG-0700 and file number as they relate to FP&L's tracking system. A more detailed listing along with descriptions of each line item is presented in Section 3.5 of this report.

| SECTION NO. | FILE NO. |
|---|---|
| 6.2 | 3 |
| 6.5 | 12,14,26,48,55 |
| 6.6 | 70 |

### 3.2.5 ENGINEERING INTERGRATION REVIEW

As a result of the Detailed Control Room Design Review performed on Turkey Point Unit 3 and 4, there are 19 of the findings (as summarized in Table 3.2-1) identified as requiring design changes remaining to be implemented and/or engineering review completed and final dispositioning assigned.

Of the 18 findings remaining in this catagory 9 have been disposition for design enhancement corrective action and will be implemented during the units refueling outage.

The remaining 10 require engineering review with regard to design alternatives taking into account qualification of equipment, common operational concerns between the Turkey Point Control Rooms, coordination of construction support requirements and availability of equipment/materials. The remaining engineering review items will be dispositioned by Unit 3 outage of 3/85 completion and Unit 4 outage of 10/85 completion.

Turkey Point HED's were written common to both Units 3 and 4 in almost all cases. This was done because of the common/identical control room design. In this section "Engineering Intergration Review" only one of the remaining findings is specificly for Unit 3. Because of the common HED's a redundency in file number appears in the following lists which appear by unit. Those finding which have already been completed on one unit are noted-complete.

The following is a list of the findings currently scheduled for implementation during Turkey Point Units next refueling outages respectively.

Turkey Point Unit 3

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 16,23 |
| 6.4 | 1,20,22 |
| 6.5 | 2 |
| 6.8 | 1,6 |

Continued on next page.

Turkey Point Unit 4

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 16,23 - Complete |
| 6.4 | 1,20 - Complete |
| 6.4 | 21,22 |
| 6.5 | 2 - Complete |
| 6.8 | 1,6 |

The following is a list of the findings scheduled to have their evaluations and dispositioning complete by Unit 3 outage of 3/85 and Unit 4 outage of 10/85 completion. The results of the subject Engineering Intergration Review will be reported to the Nuclear Regulatory Commission Human Factors Branch by March 1, 1986 for their review of Florida Power and Light Companies proposed dispositioning.

Turkey Point Unit 3

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 30 |
| 6.2 | 6,7,8 |
| 6.4 | 8 |
| 6.5 | 64,82 |
| 6.6 | 28 |
| 6.9 | 1,4 |

Turkey Point Unit 4

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 30 |
| 6.2 | 6,7,8 |
| 6.4 | 8 |
| 6.5 | 64 |
| 6.6 | 28 |
| 6.9 | 1,4 |

Continued on next page.

Finding: (Section 6.1, File No. 16)
(HED No. 6.1.2.5.a(1))

Controls requiring precise operation are mounted outside the recommended 34 to 53 inch zone above the floor. The blowdown controls are outside the reach of the fifth percentile female.

Response: (Section 6.1, File No. 16)

The blowdown controls are being moved as part of control room modifications due to limited panel space. These controls will be lowered as much as board space permits. Florida Power and Light Company feels these changes, in relationship to the frequency of use and limited board space, will enhance the operation of subject controls. These changes are being made on PCM 82-264 Unit 3 and PCM 82-265 Unit 4.

Finding: (Section 6.1, File No. 23)
(HED No. 6.1.3.1.e(2))

There is no local indication for RCP vibration indication on Unit No. 4. The Unit No. 4 display is combined with Unit No. 3 and located on Unit No. 3.

Response: (Section 6.1, File No. 23)

Florida Power and Light Company has completed the engineering review and currently the subject recorder will be replaced with vibration indication on both units during the 1983 outage. This work will be performed under PCM 82-264 on Unit No. 3 and PCM 82-264 on Unit No. 4 which has been complete.

Finding: (Section 6.4, File No. 1)
(HED No. 6.4.1.1.b(1))

Several controls in the control room are no longer used and some have been disconnected. These controls should be removed.

Response: (Section 6.4, File No. 1)

Non-functional i.e., deactivated controls were removed from Unit No. 4's control boards. The subject controls will be removed on Unit No. 3 during the 1983 refueling outage. Controls which are active but not normally used such as NMC 10 dine particulate monitor will not be removed since they may be used under off normal conditions.

Finding: (Section 6.4, File No. 20)
(HED No. 6.4.4.1)

Several rotary controls do not move clockwise to increase. Reheater steam stop control MOV-3-1434 and purge control CV-3-2913 (PTP Unit No. 3).

Response: (Section 6.4, File No. 20)

PWO #237503 was issued to have the subject controls rewired to conform to left-close right-open convention. The subject will be corrected during Unit No. 3's 1983 outage.

Finding: (Section 6.4, File No. 21)
(HED No. 6.4.4.1)

Several rotary controls do not move clockwise to increase. Reheater steam stop; control MOV-4-1434 and purge control CV-4-2913 (PTP Unit No. 4).

Response: (Section 6.4, File No. 21)

PWO's #237504, 237540, 237542 and 237543 have been issued to correct subject control switch convention of operation.

Finding: (Section 6.4, File No. 22)
(HED No. 6.4.4.1)

The cold reheat steam piping drain control (Unit No. 3) CV-3-3722 and (Unit No. 4) CV-4-3722 move clockwise to close and counter clockwise to open. This is contrary to the normal control room convention.

Response: (Section 6.4, File No. 22)

Presently the subject control switches are scheduled to be rewired to operate consistent with control room convention schedules for implementation are as indicated in Section 3.2.5 of this report.

Finding: (Section 6.5, File No. 2)

Display of extraneous information in the prime operating area is not advised. The subject displays are non-functional:

1) Containment sump level recorder
2) DACA System
3) Power range recorder stripcharts

Response: (Section 6.5, File No,. 21)

As a result of the Turkey Point review team meeting, the DACA controls were determined to be non-functional and scheduled to be removed in accordance with the schedules presented in Section 3.2.5 of this report.

The subject recorders have been removed and relocated with new models on Unit 4. Unit 3 is being completed presently.

PCM 82-264, Unit 3
PCM 82-265, Unit 4

Florida Power and Light Company intends no future action on this item.

Finding: (Section 6.8, File No. 1)
(HED No. 6.8.1.1.c)

The grouping of Tave/Tref, pressurizer pressure, pressurizer level and power range current are not located close enough to their related controls for reading accuracy required.

Response: (Section 6.8, File No. 1)

The subject recorders are scheduled to be rearranged into a more functional arrangement during the scheduled control room modifications. The recorders of high use i.e., Tave/Tref, pressurizer pressure and pressurizer level will be better functionally grouped with their associated controls.

The subject work schedules for Units 3 and 4 are presented in section 3.2.5 of this report.

Finding: (Section 6.8, File No. 6)
(HED No. 6.8.2.2 and 3)

The displays and controls for main steam flow and feedwater flow are not consistently arranged i.e., the top row of meters if associated with the bottom row of controls and vice-versa. Also the flow selector switch positions are reversed from the display arrangement. This is true on both units.

Response: (Section 6.8, File No. 6)

The display/control and selector switch/display orientation for the main steam flow and feedwater flow display/control arrangement will be corrected to conform to a top bottom-left right ascending order. Schedules for implementation of this work are presente in Section 3.2.5 of this report.

A brief description of the subject findings and proposed design enhancement follows for those human engineering discrepancies which are schuduled to be implemented during the units refueling outages respectively. In addition a detailed listing along with descriptions of each line item is presented in Sec. 3.5 of this report.

### 3.2.6 ADMINISTRATIVE AND TRAINING

As a result of the Detailed Control Room Design Review performed on Turkey Point Units 3 and 4, 4 findings (summarized in Table 3.2-1) identified remain to be incorporated in to site administrative procedures and/or the operator training program.

The following is a list of the remaining findings still to be incorporated. The findings are listed by section number as they relate to NUREG-0700 and file number as they relate to FP&L's tracking system. A more detailed listing along with descriptions of each line item is presented in Section 3.5 of this report.

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 4,10 |
| 6.2 | 1,5 |

TURKEY POINT UNITS 3 AND 4

HUMAN ENGINEERING BACKFIT PROGRAM

| SUMMARY INDEX FOR BACKFIT PROGRAM | | | | | | | | | | |
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TABLE 3.2-1

## 3.3 WRITTEN JUSTIFICATION/NO CORRECTIVE ACTION INTENDED

### 3.3.1 LOW ERROR ASSESSMENT

As a result of the Detailed Control Room Design Review and Human Engineering Descrepancy Review Team meetings on Turkey Point Units 3 and 4 there are 169 findings (summarized in Table 3.2-1) which were identified as requiring no corrective action. These items are presented in detail along with Florida Power and Light Company's justification for taking no corrective action on these items.

The following is a list of findings by section numbers as they relate to NUREG-0700 and file numbers as they relate to FP&L's tracking system. A complete listing of all items along with a brief descriptions of each line item is presented in Section 3.5 of this report. It should be noted that no differance has been made between units since the majority of the items are generic in nature and apply to both control rooms.

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 2,3,5,8,9,11,12,14,15,17,19,25, 28,33,34,39,40 |
| 6.2 | 4,9,11,12,13,14 |
| 6.3 | 1,3,4,8,13,14,18,21,22,23 |
| 6.4 | 11,12,13,14,16,17,18,19,23,24, 25,26,27,28,30,31,32,33,34,36 |
| 6.5 | 3,4,5,8,9,10,11,16,17,18,20,21, 22,23,25,28,29,31,32,33,34,37-46, 49-54,56,57,59,60,61,63,65,66, 68,69,72,73,74,75,76,77,78,79,83-85, 87,88 |
| 6.6 | 1,6,13,14,15,20,21,23-26,29,33, 34,35,43,47,54,55,56,58,59, 61,64,67,69,71 |
| 6.7 | 2,3,4,5,6,8,9,10,11,12,13,14,15, 16,17,18,19,20,21,22,23,24 |

Continued on next page.

| | |
|---|---|
| 6.8 | 2,3,4,5 |
| 6.9 | 2,5,6 |

Finding:(Section 6.1, File No. 2)
(HED No. 6.1.1.2a)

During certain transients and when bringing either unit on the line there is inadequate staffing to control both units. Three men are required on the unit having troubles while at least one man is required to be controlling the other unit (more if that unit is having problems) they are only three control room operators for both units. The watch engineer and shift supervisor are required to stand back from the board and supervise.

Response: (Section 6.1, File No. 2)

The third operator is normally scheduled during planned transients and/or evolutions. Florida Power and Light Company feels that the staffing is adequate per the units Technical Specifications. The Watch Engineer and Nuclear Plant Supervisor are also available if their assistance is required.

Essex Corporation believes that the control room staffing is adequate as long as Florida Power and Light Company continues the practice of calling in additional operational support during scheduled startup and shutdown. In addition, increasing the control room staff by one more operator would only add to traffic flow, noise and available space problems during normal operation.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 3)
(HED No. 6.1.1.3a)

The partially concentric layout allows full view of the control board except:

1. Operator must turn around to see NIS panel (behind operators desk)

2. Operator must swivel chair to see the end of vertical panel B

Response: (Section 6.1, File No. 3)

The instrumentation located on the nuclear instrumentation panel is easily accessed by control room operators if desired as well as information provided by instrumentation located on vertical panel B.

Due to space limitations Florida Power and Light Company feels the subject displays are functionally placed.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 5)
(HED No. 6.1.1.3f(1))

Walkspace between console and vertical panel A (taking guard rail into consideration is only 36 inches to 38 inches wide instead of the minimum separation of 50 inches recommended, making two person passage difficult.

Response: (Section 6.1, File No. 5)

The handrail located on vertical panel A was provided to prevent accidental operation of the control switches located on vertical panel A. There are no controls or displays located on the back section of the subject control console. The passage and panel area in question is a low traffic area and is normally used only by authorized operating personnel. Florida Power and Light Company believes that there is adequate protection provided to preclude the inadvertant operation of control switches on vertical panel A and that there is ample passage space provided for the intended traffic and operator tasks necessary to be performed in the area.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 8)
(HED No. 6.1.1.3a)

The reactor coolant flow and steam flow displays are not visable from the control room operators desk due to obstructions.

Response: (Section 6.1, File No. 8)

Control room modification, especially the new design of the operators desk will maximize the control room visability, also the incorporation of Safety Assessment System in conjunction with existing redundent indication minimizes the potential for operator error.

Florida Power and Light Company intends no further action on this item.

Findings: (Section 6.1, File No. 9)
(HED No. 6.1.1.3g)

They are ungarded openings in the panels, where equipment has been removed. Tools or unwanted objects can be placed into the hole causing wires to short.

Response: (Section 6.1, File No. 9)

The subject holes observed were due to control panel rework and modifications. When the subject work is completed the associated equipment will be reinstalled and no ungarded opening will be present on the subject control boards. Florida Power and Light Company intends no further action on this item.

Findings: (Section 6.1, File No. 11)
(HED No. 6.1.2.2(b,c,e))

Controls associated with the chemical volume control system, reactor containment, electrical distribution and steam flow/feedwater flow are not within the extended reach of the 5th percentile female.

Response: (Section 6.1, File No. 11)

The subject controls were verified as being accessible by a 5th percentile female during the field survey. The subject female could reach and easily operate the controls in question without excessive bending or stretching.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 12)
(HED No. 6.1.2.2e(1))

The NMC Iodine Particulate display located on the hydrogen recombination panel is located outside of the visual field (75° above the horizontal line of sight). It can not be read with any accuracy without the aid of a foot stool.

Response: (Section No. 6.1, File No. 12)

The NMC monitor is an installed spare. In the event the primary and redundant backup iodine particulate monitors are not functional the NMC monitor can be used. A step stool is available in the control room such that operators can read the subject display in the unlikely event it must be used the primary and backup displays are easily accessible and are monitored and maintained by chemistry laboratory personnel.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 14)
(HED No. 6.1.2.3g)

The chart table (computer console) located between Unit 3 and 4 has no knee hole for the operator to sit and examine prints.

Response: (Section 6.1, File No. 14)

There are no operations performed at this location which require the operator to be seated. Currently the subject console configuration is being changed, however, due to the size of the control room some compromizes will be made with regard to space usage in areas normally intended as leg/knee hole space.

Florida Power and Light Company feels the current panels installed have been best optimized given the design and space constraints and considers this effort satisfactorily completed.

Findings: (Section 6.1, File No. 15)
(HED No. 6.1.2.5a(1))

Some controls on vertical panels SAS 4 (T.P.3), SAS 2 (T.P.3), Electrical (T.P.3), SFG 3 (T.P.4), Electrical (T.P.4) and Reactor Coolant System (T.P.3&4) are located below 34 inches causing the operators to stoop to operate them. These controls have a low frequency of use, low importance and also small deviation from quidelines.

Response: (Section 6.1, File No. 15)

A field inspection was performed and the subject controls identified in the above finding are infrequently used, of low importance and only two to three inches out side the guide line limits i.e. 31 inches. Florida Power and Light Company feels the subject controls are functionally grouped and their placement does not present a problem for operator performance since they are clearly labeled and operator use of these controls is infrequent.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 17)
(HED No. 6.1.2.5b(1))

There are strip charts located on vertical panels SAS 1 (T.P.3), SFG (T.P.4), Turbine Generator (T.P.3&4) and Reactor (T.P.3&4) which are below 41 inches causing the operator to stoop to read them (also causing possible parallax and readability problems).

Response: (Section 6.1, File No. 17)

The subject displays are located between 41 inches and 35 inches on the panels identified in the above finding. The chart recorders provide the operators with trend information and plant staff with historical records. These trend recorders monitor low priority items and have a low frequency of use. The subject recorders can be scaned by operators in a standing position and if more detailed information is required they may be read with little inconvience to the operator.

Florida Power and Light Company feels that with the limited space available in the subject control room the recorders in question have been optimumly placed based on their importance and frequency of use and intends no further action on this item.

Findings: (Section 6.1, File No. 19)
(HED No. 6.1.2.8e)

Chair seat depth is 21 inches. The recommended depth is 15 to 17 inches.

Response: (Section 6.1, File No. 19)

Florida Power and Light Company representatives made a field survey of the chairs located in the Turkey Point Control Room. The chairs used by control room personel are standard office equipment chairs. The subject chairs are not 21 inches deep but 17 to 19 inches deep. No operators questioned had any complaints about back or leg fatigue due to the subject chairs.

Florida Power and Light Company believes the subject chairs are adequate and intends no action on this item.

Findings: (Section 6.1, File No. 25)
(HED No. 6.1.4.1a,h)

Storage location of protective equipment is partially obscured by relay racks allowing insufficient room to dress. No breathing apparatus is stored there and there is only limitted training in its use.

(What is control room habitibility requirements? How about clorine release on site?)

Response:(Section 6.1, File No. 25)

The emergency locker inventory is correct as identified in the site emergency plan. The subject lockers are controlled storage lockers and are not located in an area which is intended for operator dressout. The personel using the equipment stored in the subject locker will dressout in the control room and office area directly behind it as they are relieved from shift responsibilities to do so.

Personel required to use breathing apparatus are trained as part of their radiation training and are periodically requalified as required by existing site procedures.

The units' control room meets all habitibility requirements and is intended to remain a radioactivity clean area. There are no requirements for storage of breathing apparatus in the control room.

The units control room meets all habitibility requirements and is intended to remain a radioactivity clean area. There are no requirements for storage of breathing apparatus in the control room.

Florida Power and Light Company believes the current emergency equipment storage space and existing training program for the use of the subject equipment is adequate and intends no further action on this item.

Findings: (Section 6.1, File No. 28)
(HED No. 6.1.5.1a)

Ambient temperature is in the range of 65 to 75 degrees F maintaining 70 degrees F most of the time at head level. The criteria recommends a range of 73 to 77 degrees F.

Response: (Section 6.1, File No. 28)

The control room operators have the ability to change the control room thermostat setting if desired. Operators maintain the control room temperature at a temperature which they feel is comfortable and is also within equipment requirements.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 33)
(HED No. 6.1.5.3f)

Rod group counter windows reflect light from above lighting causing glare.

Response: (Section 6.1, File No. 33)

The subject counters only provide rod group indication. The operator may position himself over the display while reading it to eliminate the effect of reflected light. The primary rod position indication is provided by the analog indicators located on the vertical panel of the subject bench board which are easily read and also have rod bottom bistable indication.

Florida Power and Light Company feels the subject displays are adequate for their intended function and intends no action on this item.

Findings: (Section 6.1, File No. 34)
(HED No. 6.1.5.3h)

Reflectance is below guideline values on upper wall and all vertical panels except vertical panel A on Unit No. 4. Reflectance is above guidelines on lower wall, floor and white blotters on control room operators desk.

Response: (Section 6.1, File No. 34)

The error assessment associated with this finding is low. In any environment which is illuminated from overhead, no matter what type of diffuser is used, the incedent light levels on the vertical panels will always be lower than the incident light levels on the horizontal sections. Due to the differences in colors i.e. gray panels and white floors and blotters it is only natural that the reflectance will be different. The information presented on the control panels is easily readable and the gray panel provides the operator with a soft background.

Florida Power and Light Company believes the control room lighting conditions and ambience is satisfactory and intends no action on this item.

Findings: (Section 6.1, File No. 39)
(HED No. 6.1.2,3f)

The Nuclear Plant Supervisor's phone layout is poor. Phones are difficult to reach from seat.

Response: (Section 6.1, File No. 39)

As part of the control room upgrades that were performed to the Turkey Point Unit 3 and 4 control room call directors were added to the Nuclear Plant Supervisors office. Addition of the new telephone hardware has resolved the above finding.

Florida Power and Light Company considers this finding closed and intends no further action.

Findings: (Section 6.1, File No. 40)
(HED No. 6.1.3.1e)

Bell and Pax phones on each unit have dedicated lines. A call received on Unit 4 for a 3 operator requires the call to be transferred.

Response: (Section 6.1, File No. 40)

The bell extension number and Pax extension number for the units are the same except for the last digit which designates the proper control room i.e. for Unit No. 3 control room the numbers are 233 and 303 respectively and for Unit No. 4 the numbers are 234 and 304 respectively.

Florida Power and Light Company believes the existing phone system and phone number convention is adequate and intends no action on this item.

Findings: (Section 6.2, File No. 4)
(HED No. 6.2.1.3C(2))

There is no ringing mechanism tied into the sound powered phones. There is no capability for directly switching the sound powered phone to the paging system so that a desired party can be called to the line.

Response: (Section 6.2, File No. 4)

The sound powered phones are provided so that operation and authorized personnel can perform pre-arranged tasks such as core shuffels, plant maintenance etc.

The party/page system is located through out the plant as well as plant utility phones so that plant personnel can page each other and also call specific locations using telephone communciations. Florida Power and Light Company believes the current system is adequate and provide, sufficient flexability to operating personnel.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.2, File No. 9)
(HED No. 6.2.1.8b,c)

No means of clear transmission through face mask or respirators. Dial phones are difficult to use with gloves.

Response: (Section 6.2, File No. 9)

There are no requirements for control room operators to wear protective equipment while operating the plant. The control room meets the current habitability requirements for all accident scenarios and is intended to remain a radilogically clean area during an accident with all support personnel stationed at the technical support center and emergency offsite facility.

In the event of a fire or adverse condition the control room would be evacuated and plant shutdown controlled from outside the control room.

Florida Power and Light Company intends no further action on this item.

Findings: (Section 6.2, File No. 11)
(HED No. 6.2.1.1a)

Telephone conversation is colloquial. Several radio messages were received without recall or apparent confirmation.

Simultaneous use of bell phone and radio was observed. Listener tried to listen to messages simultaneously instead of asking one party to hold the line.

Response: (Section 6.2, File No. 11)

The plant uses accepted terminology. Operation of hand held radios is up to the operator. The portable radios are used by field operators to supplement the installed permanent communciation system. Just as with the permanent communciations system it is the responsibility of the personnel operating the system to ensure that instructions and conversations are understood.

Florida Power and Light Company believes the existing communication systems are adequate and intends no further action on the above finding.

Finding: (Section 6.2, File No. 12)
(HED No. 6.2.1.1b)

Control room operator holds finger in left ear to hear conversation on phone. Either the background noise is too high or the signal intensity is to low.

Response: (Section 6.2, File No. 12)

The above finding was observed during a period of high construction activity in the control room. The construction activity in the control room is now significantly reduced as control room work has been completed. The control room operator also has the authority to clear the control room or stop any work activity if necessary.

Florida Power and Light Company believes there are adequate administrative controls and the communciation equipment is adequate for the intended use and intends no further action with regard to the above finding.

Finding: (Section 6.2, File No. 13)
(HED No. 6.2.1.6a)

The security intercom located in the nuclear plant supervisors' office has a high level of background noise and emergency messages were interupted by non-vital communcations on this single channel communciations device.

Response: (Section 6.2, File No. 13)

The security intercom system was upgraded and some stations relocated. As a result of the system rework the background static was eliminated. The security intercom system is for the use of security personel and its use is physically controlled. Contents of communciations and priority of messages is controlled by security personnel. In addition to the hard wire intercom system which is designed to be used at specific control points the security personnel have other communication means available such as radios and telephones.

Florida Power and Light Company considers the above finding resolved and intends no further action.

Finding: (Section 6.2, File No. 14)
(HED No. 6.2.2.2a)

Bell phone and Pax phone have similar rings. No sound coding is used.

Response: (Section 6.2, File No. 14)

As a result of the scheduled control room upgrades indicating lights were added to the control room operators phones to provide them with visual cues to identify the correct phone.

Call directors were added to the Nuclear Plant Supervisors' office to consolidate the number of phones. The call director has illuminated pushbuttons to select the desired phone line.

Florida Power and Light Company believes the existing communication system provides adequate visual cues for personnel to identify the proper instrument with the incomming call. Florida Power and Light Company intends no further action on the subject finding.

Finding: (Section 6.3, File No. 1)
(HED No. 6.3.1.2a(1))

The radiation monitor located next to the shift supervisors' office and copy machine has an illuminated pushbutton for "power on". When the system is energized the voltage surge causes a control room high radiation alarm concurrent with local high radiation alarms.

When control room operators have to replace the lamp associated with the power pushbutton the power to the radiation monitor system is interrupted and a number of false alarms may be generated depending on the number of times it takes the operator to remove the lamp and replace it.

Response: (Section 6.3, File No. 1)

The testing of alarms and/or maintenance work which will cause false alarms are administratively required to be announced over the public address system to notify plant personnel. Any false alarm which is not announced would cause personnel in that area to follow those plant procedures for egress from a contaminated area. In either event plant personnel safety is maintained.

Florida Power and Light Company believes the administrative controls which currently exist are adequate and intends no further action on the above finding.

Finding: (Section 6.3, File No. 3)
(HED No. 6.3.1.2a(1))

Fire alarm system false alarms have been reported by plant personnel during periods of rain.

Response: (Section 6.3, File No. 3)

As a result of normal system maintenance the points of water intrusion were identified and sealed. Since the system repairs were complete there have been no false alarms due to water intrusion into the system conduit.

Florida Power and Light Company considers the above finding resolved and intends no further action.

Finding: (Section 6.3, File No. 4)
(HED No. 6.3.1.2b(1),c(1))

The only way to determine which parameter is out of tolerance on multiple input alarm is verification of board indication or instruct field operation personnel to check equipment and take corrective action where necessary.

There is no alarm printout on the computer to give the operator specific information on multiple input alarms.

Response: (Section 6.3, File No. 4)

The plant supervisory annunciator system provides the operator with a quick means of advisory status. The supervisory annunciators located in the control room are functionally grouped with controls provided for the control room operators' use. The supervisory annunciators are placed and assigned responsibilities consistant with the plant design and Florida Power and Light Company operating philisophy. The control room operator and Nuclear Plant Supervisor direct field personnel, thus centralizing control of equipment and field personnel. The control room personnel determine proper prioritization of field work tasks based on overall plant conditions and requirements.

Florida Power and Light Company believes the existing supervisory annunciator system is sufficent and provides adequate information.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.3, File No. 8)
(HED No. 6.3.1.5a,b)

No dedicated, distinctive audible signal exists for cleared alarms. No special flash rate or color coding denotes a cleared annunciator tile.

Response: (Section 6.3, File No. 8)

It is Florida Power and Light Company operating philisophy that annunciator extinguishment is adequate indication of a clearing alarm since there should be no alarms present during normal operating conditions other than some plant permissives and equipment out of service for maintenance. During transient conditions such as plant trip the ring back feature would introduce excessive visual and auditory noise in the control room environment. Clearing the ring back feature would require an additional operator manual control action to acknowledge each clearing alarm thus taxing the control room operator and increasing the risk of operator error during a potentially critical time due to the shear volume of information which must be processed.

Under normal and steady state conditions operators take delibrate corrective actions to clear alarms and monitor system status via plant process displays to ensure the alarm condition clears. In addition, Florida Power and Light Company is implementing an annunciator prioritization color coding convention. The prioritization coding will aid the operator in assessing the importance of the alarm and thus reduce the response time to implement corrective action and clear the off normal condition.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.3, File No. 13)
(HED No. 6.3.3.2b)

Flash rate for all annunciator tiles under all alarm conditions is 1½ flashes per second instead of the recommended 3-5 flashes per second.

Response: (Section 6.3, File No. 13)

The error assessment associated with the subject finding is very low and Florida Power and Light Company believes that the existing flash rate is adequate for operators to visually identify alarming windows. In addition, operators must identify the alarm prior to acknowledging and locking the subject window in.

Florida Power and Light Company believes the existing system is adequate and intends no corrective action.

Finding: (Section 6.3, File No. 14)
(HED No. 6.3.3.2.e)

The annunciator windows violate the dark board concept. The annunciators are dim when not in alarm state and bright when in alarm state. Some look bright during normal operation.

Response: (Section 6.3, File No. 14)

The present dim, normally off annunciator scheme provides the control room operator with a constant status of annunciator lamps condition. Annunciator lamp intensity i.e., dimly lit state can be adjusted by use of a slide resistor. Florida Power and Light Company contends that there is sufficient difference in illumination intensity between dimly lit - no alarm and bright - alarmed state for operators to easily differentiate between the two. Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.3, File No. 18)
(HED No. 6.3.3.4b)

Annunciator windows such as Waste Boron Panel Trouble, Radwaste Trouble, Heat Tracing Trouble and Water Plant Trouble refer the control room operator to another more detailed annunciator panel located outside of the primary operating area.

Response: (Section 6.3, File No. 18)

The subject alarms are supervisory/catagory trouble annunciators. They are provided in the control room because it is the control room operators and Nuclear Plant Supervisors responsibility to direct field personnel. This operating philosophy maintains a centralized control allowing for the proper prioritization of field work tasks based on overall plant conditions and requirements.

Florida Power and Light Company believes the existing system design and administratives responsibilities are adequate and intends no action on the above finding.

Finding: (Section 6.3, File No. 21)
(HED No. 6.3.4.1b)

Acknowledgement of annunciators is not possible from the vertical panels. There is only one alarm acknowledge pushbutton for each unit, in the center of the bench board/console.

Response: (Section 6.3, File No. 21)

The annunciator tiles will be re-engraved as part of the relabeling/annunciator review effort to improve message readability from the existing control station. The annunciator control station is centrally located on the main control board.

Florida Power and Light Company believes that due to the small size of the control room, the increased annunciator tile letter size, the reduction of annunciator tile verbage and existing functional grouping of associated annunciator tiles that one master annunciator control station in each control room is adequate and intends no further action on the above finding.

Finding: (Section 6.3, File No. 22)
(HED No. 6.3.4.1d)

With the bright equals alarm and dim equals normal operation, it is not clear whether the window is dim or if one of the two bulbs in the window is burnt out. The dual bulb windows do not provide adequate indication of bulb failure.

Response: (Section 6.3, File No. 22)

Florida Power and Light Company believes that operators experienced in the Turkey Point Plant control room can differentiate a window with a burned out bulb, a normal state dim and an active alarm state bright. The annunciator windows have redundant bulbs, which are both illuminated, installed behind the subject tiles and extinguishment of one or both of the subject bulbs is easily identified by operation personnel and can be diagnosed with the window in either the normal or alarm state.

Florida Power and Light Company believes the system is adequate and intends no action on the above finding.

Finding: (Section 6.3, File No. 23)
(HED No. 6.3.4.2b(4),c)

The annunciator pushbuttons do not employ shape coding to differentiate between silence and acknowledge. Also the pushbutton design allows operators to defeat the control by placing a quarter in the pushbutton.

Response: (Section 6.3, File No. 23)

The subject pushbuttons are clearly labeled and there are no other control stations requiring the same convention in the control room.

Override of controls are administratively controlled. Florida Power and Light Company believes the subject pushbuttons are correctly arranged and that existing administrative controls preclude any unauthorized defeating of annunciator functions.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 11)
(HED No. 6.4.2.1)

The controls on the radiation monitor operate clockwise to stop, which is opposite to the population stereotype. The pump controls have indicator lights over them. The off (white) is over the start label and the on light (green) is over the stop label. The second control is spring return from fast to off (although it is not spring return from on to off). An operator reported that the filter has gotten clogged in the past because operators turn it to fast and let it go, assuming the center position is on rather then off.

Response: (Section 6.4, File No. 11)

The subject switching is spring return to center with start on the left and stop on the right. This system is normally on and pump status is displayed immediately above the pump control and is clearly labeled. The subject operate/fast filter switch is only used to advance the filter paper which is also indicated directly above by indicating lights. A category alarm alerts the operator to any abnormal operation. Florida Power and Light Company believes that the subject controls and associated indicating lights are adequately labeled and clearly identified.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 12)
(HED No. 6.4.2.2f(3),d)

Small silver thumb rotaries do not contrast sufficiently with the panel background.

Response: (Section 6.4, File No. 12)

The error associated with the subject rotaries is extremely low due to the fact that control room operators use deviation meters trend recorders, analog displays, etc. when making adjustments with the subject controls. In no instance is a direct reading from the subject rotary control required to perform an operational function. In some instances the rotaries are adjusted with calibrated test equipment and provide set points: However, these setting are fixed and not intended to be moved.

Florida Power and Light Company believes the subject rotaries adequately perform the intended function and intends no action on the above finding.

Finding: (Section 6.4, File No. 13)
(HED No. 6.4.2.2f(3))

Controls do not contrast sufficiently with the panel. They are silver and the panel is gray.

Response: (Section 6.4, File No. 13)

The error associated with the subject rotaries is extremely low due to the fact that control room operators use deviation meters, trend recorders, analog displays, etc. when making adjustments the subject controls. In no instance is a direct reading from the subject rotary controls required to perform an operational function. In some instances the rotaries are adjusted with calibrated test equipment and provide setpoints: However, these settings are fixed and not intended to be moved.

Florida Power and Light Company believes the subject rotaries adequately perform the intended function and intends no action on the above finding.

Finding: (Section 6.4, File No. 14)
(HED No. 6.4.2.2f(3))

Toggle switches are silver and have insufficient contrast with the gray panel.

Response: (Section 6.4, File No. 14)

The error associated with the subject toggle switches is extremely low. The subject toggle switch positions are clearly labeled.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 16)
(HED No. 6.4.3.1b)

There is no form of positive control activation feedback such as snap feel, audible click or integral light, etc. associated with pushbuttons.

Response: (Section 6.4, File No. 16)

Pressing of a pushbutton is an initiating cue for a given task which has a definite beginning and a definite end i.e., activation of process, acknowledging of an alarm, etc. The end of a task is verified by visual feedback provided by installed instrumentation, indicating lights, computer messages, etc.

Florida Power and Light Company believes that the pushbuttons in the control room do have adequate visual feedback and intends no action on this item.

Finding: (Section 6.4, File No. 17)
(HED No. 6.4.3.1c)

Check source, power and horn disable pushbuttons on the radiation monitor panel are not concave or frictionalized to increase resistance.

Response: (Section 6.4, File No. 17)

The subject pushbuttons are sufficiently large and activation pressure sufficiently low, as well as adequately separated to preclude the operators finger from slipping off the subject pushbutton and inadvertantly activating the others.

Florida Power and Light Company believes the pushbutton design is adequate and intends no action on the above finding.

Finding: (Section 6.4, File No. 18)
(HED No. 6.4.3.3a)

Pushbuttons on the radiation monitoring panel next to the supervisors office look like indicator lights on the panel. Design and labelling is the same except that the sides of the pushbuttons are white and the sides of the indicator lights are black, shape and size are the same.

Response: (Section 6.4, File No. 18)

Investigation by Florida Power and Light Company personnel revealed that the subject indicating lights and pushbuttons are sufficiently different and that control room operators can identify them correctly with out any potential for error.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 19)
(HED No. 6.4.3.3c)

It is not possible to change bulbs in illuminated pushbuttons on the radiation monitoring panel without activating the alarm.

Response: (Section 6.4, File No. 19)

This finding is a duplicate of File No. 1 of Section 6.3 (HED No. 6.3.1.2a(1)). The testing of alarms or maintenance work which will cause false alarms are adminstratively required to be announced over the public address system to notify plant personnel. Any false alarm which is not announced would cause personnel in that area to follow those plant procedures for egress from a contaminated area. In either event, plant personnel safety is maintained.

Florida Power and Light Company believes that the existing administrative controls are adequate and intends no further action.

Finding: (Section 6.4, File No. 23)
(HED No. 6.4.4.2a)

"J"-handle rotary controls are 2.25 inches in length, 1.5 inches shorter than the minimum recommended. In addition "J"-handle clearance is 2.33 inches when pulled to lockout instead of the recommended 1 to 2 inches.

Response: (Section 6.4, File No. 23)

Control room operators were questioned on the subject "J"-handle use and performance. Operation personnel indicated that the subject controls were adequate and provided no source of possible human error associated with their tasks.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 24)
(HED No. 6.4.4.3b)

Keys are inserted with the teeth pointing in either the 4 o'clock or 8 o'clock position. They should all be inserted with teeth pointing up.

Response: (Section 6.4, File No. 24)

Key switches have switch positions properly labeled and keys are consistantly oriented with teeth in the upward direction.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 25)
(HED No. 6.4.4.3d)

Key operated switch locks are not oriented so that the switch is "off" (key removed) when in the vertical position. It is diagonal either to the left or right.

Response: (Section 6.4, File No. 25)

Key operated switches have switch positions properly labeled and keys which are consistantly oriented with teeth in the upward direction.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 26)
(HED No. 6.4.4.1e(1))

Continuous rotaries with knob skirts have a knob skirt diameter of one inch rather than the recommended 2 inches.

Response: (Section 6.4, File No. 26)

The error associated with the subject rotary knob skirts is extremely low. The subject control were labeled and installed based on the existing dimensions. The current knob skirt diameters do not impare operator performance and Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 27)
(HED No. 6.4.4.4e(5))

The knobs on continuous rotaries are less than ½ inch in diameter rather than the recommended .75 inches.

Response: (Section 6.4, File No. 27)

The error associated with the subject rotary knob diameter is extremely low. The subject control knobs provide adequate gripping surface for operators to perform the desired tasks. The current knob diameters do no impare operator performance and Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 28)
(HED No. 6.4.4.5b(z))

Black discrete rotaries on the nuclear instrumentation panel and radiation monitor panel may be positioned between detented positions.

Response: (Section 6.4, File No. 28)

Florida Power and Light Company personel were unable to field verify the above finding. All discrete rotaries have detented positions and are not easily positioned between two detents. Some of the subject rotaries do have rest positions which are used in calibration procedures. The subject positions are detented and are used under administrative control. The subject rotaries are correct and Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 30)
(HED No. 6.4.3.3b(3))

Legend pushbuttons associated with process controllers have poor contrast due to collected dirt and pushbutton wear.

Response: (Section 6.4, File No. 30)

The subject pushbuttons associated with process controllers are periodically cleaned as part of the operators normal housekeeping routines and worn pushbuttons are replaced as part of normal maintenance. In addition, the subject pushbuttons are also consistantly color coded to provide the operators with visual keys as to the subject pushbuttons functions.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.4, File No. 31)
(HED No. 6.4.2.2d)

Rotary controls do not utilize size or shape coding to aid in distinguishing between different function controls. Different shapes are used based on the ability of components not on function.

Response: (Section 6.4, File No. 31)

Presently Florida Power and Light Company has employed shape coding of controls in areas where operator errors have been noted or operators have suggested that the addition of shape coding would improve their performance.

Florida Power and Light Company intends no further action on the subject finding at this time.

Finding: (Section 6.4, File No. 32)
(HED No. 6.4.3.2d)

Pushbuttons with "deepwell" type raised guards have too much resistance for some operators.

Response: (Section 6.4, File No. 32)

Pressing of a pushbutton is an initiating cue for a given task which has a definite beginning and a definite end i.e., activation of a process acknowledging of an alarm, etc. The end of a task is verified by visual feedback provided by installed instrumentation, indicating lights, computer messages, etc. or a combination there of. Those pushbottons provided with elevated guards are usually intended to be pressed once to achieve the desired result. The subject pushbottons are momentary types and are not intended to be maintained in a depressed position for any length of time by operators.

Florida Power and Light Company believes the subject pushbuttons do no provide excessive resistance to operation and do adequately perform their intended function with no operator error associated with their activation.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.4, File No. 33, 36))
(HED No. 6.4:4.5e(4))

Switch depth on small silver thumb rotaries is less than the minimum suggested depth of 0.625 inches. The subject rotaries are approximately 0.5 inch in depth.

Response: (Section 6.4, File No. 33, 36)

The error associated with the subject rotary knob depth is extremely low. The subject control knobs provide adequate gripping surface for operators to perform the desired tasks. The current knob depth does not impare operator performance and Florida Power and Light Company intends no action on the subject finding.

Finding: (Section 6.4, File No. 34)
(HED No. 6.4.4.5f)

The spring loaded momentary contact rotary selector controls for:

1) Primary water to containment isolation,
2) Component cooling make-up MOV-832, and
3) R-14 source check (switch)
4) Main steam stop bypass motor operated valves

have small handles and require prolonged operator activation. The handle shape is inappropriate for prolonged use..

Response: (Section 6.4, File No. 34)

When questioned about the functional correctness i.e. application of the subject control switch handles operation representatives present stated that the subject control switches and handle shapes were correct for the intended function (inching valves/control). The error assessment associated with the subject finding is extremely low. Operation of the subject control required that the operator verify by visual feedback that the intended task has been complete.

Florida Power and Light Company believes the subject control switch handle types are correct for the intended control function and intends no corrective action on the above finding.

Finding: (Section 6.4, File No. 36)
(HED No. 6.4.4.5.e(4))

Switch depth on small silver thumb rotaries is less than the minimum suggested depth of 0.625 inches.

Response: (Section 6.4, File No. 36)

Duplicate of File No. 33, Section 6.4.

Finding: (Section 6.5, File No. 3)
(HED No. 6.5.1.1f)

1) There is no lamp test available for illuminated pushbuttons on area radiation monitor panel.
2) Counters and digital displays continue to display a numeric valve when failed and have no indication of failure.
3) Strip chart recorders fail on scale.
4) Failure of indicator transmitters causes meters to fail on scale (high or low) and static causes meter needles to stick or read higher or lower than the actual reading.

Response: (Section 6.5, File No. 3)

1) The subject illuminated status indicators are backed up with annunciation status and an analog display. Florida Power and Light Company believes the system is adequate, performs its intended design function and intends no action on this item.

2) On loss of power LED displays extinguish. All digital displays in the Turkey Point Unit No. 3 and 4 control rooms are provided as operator aids to be used in conjunction with existing analog displays, existing controls, plant process computer and annunciator system. Florida Power and Light Company believes that there is sufficient primary indication and supervisory annunciator support to allow the control room operators to quickly and accurately identify a digital display failure.

   Florida Power and Light Company intends no action on this item.

3) The strip chart recorders in the control room provide the operator with a historical trend of various parameters. Failure of the input to the trend recorder would also disrupt the analog indicator, supervisory annunciator system and plant computer in various instances. Loss of power to the subject recorders would also be obvious since the paper would not be advancing and the pen would be lying still in one area of the chart causing large blotches.

   Florida Power and Light Company believes that there is adequate information available to the control room operators such as analog indicators, supervisory annunciator alarms, plant process computer, to allow the control room operator to quickly identify a failure associated with a strip

chart recorder. In addition, strip chart recorders are time marked and date stamped once per twenty four hours.

Florida Power and Company believes there is adequate primary information available and administrative control to ensure the control room operator can determine a strip chart failure in a timely manner and intends no action on this item.

4) Failure of a transmitter output will cause all associated displays associated with it to respond to the high or low output signal by an annunciator alarm signal. In the case of process signals such as level, pressure, temperature and flow, alarm setpoints would be reached or indicators would be outside the normal coded operating bands which would be apparent to the control room operator.

Florida Power and Light Company believes that there is adequate redundant instrumentation, implementation of range coding, supervisory annunciator alarms and normal routine watch log recordings of plant process status to allow control room operators to identify process transmitter failures.

Florida Power and Light Company intends no further action on this item.

In summary Florida Power and Light Company believes the current control room design and normal watch duties provide the control room operator with the necessary information to determine display failure or a process associated transmitter problems. It is then the responsibility of the Instrumentation and Control maintenance personnel to isolate the failure and effect the necessary repairs.

Florida Power and Light Company believes the existing equipment and administrative controls are adequate and intends no action on the above finding.

Finding: (Section 6.5, File No. 4)
(HED No. 6.5.1.3b(1),(2))

Labels on displays use font with serifs. In addition, the subject font is not consistant with the font used on all other control room labels.

Response: (Section 6.5, File No. 4)

Due to the vintage of the subject control room and equipment, various items have been repaired, replaced and added over the years. In some cases, availability of like kind replacements do not exist, therefore there will be a difference in display label font where manufactures differ. Displays provided are readable. Florida Power and Light Company will make every effort where possible to provide qualified consistent, clearly labeled and readable displays as a result of normal plant maintenance.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 5)
(HED No. 6.5.1.3.b(3))

Many components have manufacturers names on them which are not in all caps.

Response: (Section 6.5, File No. 5)

There is no operational error associated with consistency of manufacturer name plates. Florida Power and Light Company believes the manufacturer name plates are adequate and intends no action on the above finding.

Finding: (Section 6.5, File No. 8)
(HED No. 6.5.1.5a(1))

Most indicators have more than 9 graduations marks between numbered scales markings.

Response: (Section 6.5, File No. 8)

The subject indicator scales are process specific and due to the required accuracy, space limitations, and need for easily readable scales there are more than 9 graduations between numbered scale markings. However, major and minor mark coding is consistently applied with even multipliers, as well as range coding of normal and off-normal operating bands. Florida Power and Light Company believes that the existing range coding and major/minor marking conventions employed on indicator scale faces are adequate and do not pose an operating problem to control room operators.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File NO. 9)
(HED No. 6.5.1.5c)

Successive values of unit graduations do not conform to the recommended progression of values.

Response: (Section 6.5, File No. 9)

The subject indicators are process specific with scale ranges, incruments and multipliers selected based on operating range, accuracy, readability and space limitations. Florida Power and Light Company believes the present indicators which incorporate range coding are adequate and that the scale multipliers are consistent with design and operating requirements.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 10)
(HED No. 6.5.1.5c)

Successive values of unit graduations do not conform to recommendation or multiples of powers of ten.

Response: (Section 6.5, File No. 10)

The subject indicators are process specific with scale ranges, incruments and multipliers selected based on operating range, accuracy, readability and space limitations. Florida Power and Light Company believes the present indicators which incorporate range coding are adequate and that the scale multipliers are consistent with design and operating requirements.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 11)
(HED No. 6.5.1.5f)

Recorders have a single pointer with multiple-scales; such a design should be avoided, unless justified as an operational benefit.

Response: (Section 6.5, File No. 11)

The control room operator is aware of the ranges selected and information being presented on the Turbine Vibration Recorder, Turbine Valve Position/Turbine Speed Recorder, Condensate Dissolved Oxygen Recorder and Reactor Coolant Pump Vibration Recorders since all these recorder ranges are dependent on plant status and are manually selected by the control room operator. The subject recorders are clearly labeled and present a very low potential for operators error. Florida Power and Light Company believes the subject recorders do provide the control room operator with clear and easily identifiable trends. The subject recorder display formats are consistent with their intended function and Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 16)
(HED No. 6.5.2.2b(2))

Pointers on recorders are not mounted close enough to scale to avoid parallax.

Response: (Section 6.5, File No. 16)

Recorders are used for trending and operators read recorders trends off of the scaled chart paper. Recorders also provide a historical source of information to be used by control room operators and plant staff. Scales are provided on recorders as an additional operators aid and are adequate for their intended function.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 17)
(HED No. 6.5.2.3b)

Green range coding has been placed along the vertical scale of some indicators to represent the normal operating range. Because it is beside the vertical component label on the scale face, it often obscures and reduces the labeling print/background contrast which is black on white.

Response: (Section 6.5, File No. 17)

Engraved component labels are mounted directly below their associated displays. Florida Power and Light Company believes the addition of normal operating bands to selected indicators as an operator aid far outweighs the obscurity of any label such as manufacturer's name or component description located on the indicators scale. Range coding has been installed such that operators may clearly read indicator scale numerals and division mark. The existing component labels contain the components name, identification number and other important information to allow the control room operator to quickly and accurately identify the subject components. Florida Power and Light Company believes the current labeling and range coding program best optimizes control room operator performance and intends no further action on the above finding.

Finding: (Section 6.5, File No. 18)
(HED No. 6.5.3.1a(3))

1) Operator provided tool does not fit hexagon shape indicator lights and suction cup pulls flat top bulbs out correctly, but not round top bulbs. Operators use the metal clip on their identification badges to remove the bulbs which may break the bulb.

2) No tool is provided for operators to maintain legend lights and back lit pushbuttons. Operators use a pocket knife to pry off legend tiles and identifications badges to remove bulbs.

3) Other bulbs such as those on the pyro alarm panel require a screwdriver to replace them.

Response: (Section 6.5, File No. 18)

Operators are provided with the necessary tools to replace the subject lamps which are their responsibility and have been instructed that any lamps requiring disassembly of equipment and/or controlled access are changed under normal maintenance procedures.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 20)
(HED No. 6.5.5.1a(z)

On drum type counters the numeral width to height ratio is not 1 to 1. In most cases it is approximately 3 to 5.

Response: (Section 6.5, File No. 20)

The subject finding has a very low error assessment associated with it since the subject drum type counter numerals are large enough to be easily read from their respective operator control stations.

Florida Power and Light intends no further action on the above finding.

Finding: (Section 6.5, File No. 21)
(HED No. 6.5.5.2a(z))

All LED displays have characters which slant to the right instead of being upright.

Response: (Section 6.5, File No. 21)

The subject finding has a very low error assessment associated with it since the LED displays in question are large and easily read by operations personnel from the equipments control station.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 22)
(HED No. 6.5.5.2a(5))

Horizontal spacing between numerals on LED displays should be between ¼ and ½ the numeral width. The refueling water storage tank level on Unit No. 3 LED display numeral spacing is about the same width as the numeral size.

Response: (Section 6.5, File No. 22)

The subject finding has a very low error assessment associated with it since the LED display in question is easily read by control room operations personnel and can not be confused as being multiple displays or stand alone single digits.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 23)
(HED No. 6.5.5.2(a)5)

This is the same finding as File No. 22, Section 6.5 except on Unit No. 4.

Response: (Section 6.5, File No. 23)

The response for this item is the same as that for File No. 22, Section 6.5 (No action intended).

Finding: (Section 6.5, File No. 25)
(HED No. 6.5.1.1b)

Rotary switches for boron injection valves 4-841 A and B do not have status lights in array at the top of panel SFG3 as do other rotary switches for safety injection.

Response: (Section 6.5, File No. 25)

The subject valves are check valves and do not have status lights since they are automatic. The subject rotary control switches are provided for testing. The subject components are correct for their intended function and no operator error is associated with the above finding.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 28)
(HED No. 6.5.1.1f)

When there is a loss of a vital instrument bus the magawatt recorder stays where it is (fails on scale rather than off scale). There are backup analog indicators for this parameter.

Response: (Section 6.5, File No. 28)

The is no error assessment associated with the above finding. Failure of a vital instrument bus would cause all the associated indicators, measurement channel instrumentation etc. to fail. A failure of this type would require immediate operator corrective action.

A power failure to any one recorder would cause that recorder to fail, which would be the same as a recorder pen drive failure. The recorders are time checked and date stamped once per twenty-four hour shift as well as normal operator log reading of control panel indicators once per hour. These normal operator watch routines would provide the operator with ample opportunity to identify the subject recorder failure.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 29)
(HED No. 6.5.1.2.a)

Component cooling header A and B flow indicators normally read between 0-10 (green band). This scale is 0-140 which is not consistent with the degree precision needed by operator.

Response: (Section 6.5, File No. 29)

Component cooling header flow is controlled automatically by the various component temperature control valves. The control room operator needs the display in the control room to verify header flow during normal and off normal plant conditions. The flow indicator scale range is consistent with the intended operating conditions and design criteria. Florida Power and Light Company intents no action on the above finding.

Finding: (Section 6.5, File No. 31)
(HED No. 6.5.1.2e)

The condensate dissolved oxygen is multiplied by a factor. This is not clearly marked on scales or label. The bottom scale on recorder for condensate dissolved oxygen must be multiplied by 5. This is marked on paper only.

Response: (Section 6.5, File No. 31)

The error assessment associated with the above finding is extremely low due to the fact that the recorder is clearly marked as to the multiplier selected on the subject scale during unit startup. The subject recorders are normally used during unit startup along with chemistry reports. The control room operators are aware via logging of the subject reading as to the multiplier selected.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 32)
(HED No. 6.5.1.3a)

Labels on the hydrogen recombination panel, radiation monitor panel, nuclear instrumentation protection panel and LED displays are too small if viewed from the control room front operating console which is a distance of 8 feet away. The character height is to small. It does not subtend a minimum visual angle of 15 minutes.

Response: (Section 6.5, File No. 32)

For the subject labels to be read from any position in the control room, the letters would have to be ½ inch in height. The existing labels are engraved to allow operators to read them from the subject equipment control station i.e., approximately two to three feet from the subject panel. The existing labels are adequate for the designed reading distance and Florida Power and Light Company intends no further action on the above finding.

Finding; (Section 6.5, File No. 33)
(HED No. 6.5.1.3d)

The legend lights on radiation monitor panel and nuclear instrument protection panel have the following discrepancies:

> Space between character is less than the minimum requirement of one stroke width. Space between words is less than the minimum requirement of one character width. Space between lines is less than the required one half character height.

Response: (Section 6.5, File No. 33)

The subject legend lights are back illuminated making the letter to background contrast high and the subject legend easier to read. The legend lights in question are secondary backup information redundant to existing alarms and annunciators. The subject indicating lights are secondary operator aids and the error associated with them low since there are large primary displays which are used by the control room operator. In addition, the legend space limitation will not accomodate any increase in spacing since there would not be enough room for the necessary information.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 34)
(HED No. 6.5.1.4a)

Indicators for percent flux difference do not tell direction of change (positive/negative). However, this may be inferred by the position of needle on vertical meter.

Response: (Section 6.5, File No. 34)

Flux difference is not identified as positive or negative but rather as being high in the top or bottom of the reactor core i.e. axial offset. The indicators do clearly and correctly present the information being monitored.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 37 thru 40)
(HED No. 6.5.1.5.a.1)

There are more than nine major, minor and intermediate marks between numbered scale points.

Response: (Section 6.5, file NO. 37 thru 40)

The subject indicator scales are process specfic and due to the required accuracy, space limitations, and need for easily readable scales, there are more than nine graduations between numbered scale markings. Major and minor mark coding is consistently applied as well as implementation of operating range coding.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 41 and 42)
(HED No. 6.5.1.5.a.1)

There are more than nine major, minor and intermediate marks between numbered scale points.

Response: (Section 6.5, file NO. 41 and 42)

The subject indicator scales are process specfic and due to the required accuracy, space limitations, and need for easily readable scales, there are more than nine graduations between numbered scale markings. Major and minor mark coding is consistently applied as well as implementation of operating range coding.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 43 thru 45)
(HED No. 6.5.1.5b)

The height of index marks do not comply with minimum requirements and they are too small and difficult to discriminate.

Response: (Section 6.5, File No. 43 thru 45)

Trend recorders provide operators and plant staff with historical information. Trend recorder paper is scaled and clearly indexed. The subject recorder scale legends are clearly labelled and scale graduations are provided as an operator aid. Florida Power and Light Company believes the subject recorders and their scales do no pose any interpretation for control room personnel and intends no action on this item.

Finding: (Section 6.5, File No. 46)
(HED No. 6.5.1.5d)

The scales on the adjacent steam header pressure meters are different.

Response: (Section 6.5, File No. 46)

The steam header meter scales are not significantly different to cause reading errors. They all are 0 to 1000 psig in steps of 100 psig. Only the minor increments vary.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 49)
(HED No. 6.5.2.1a)

The scale value of the condenser vacuum increases with downward movement of the pointer.

Response: (Section 6.5, File No. 49)

The condenser vacuum indicator is a circular meter which depicts a decreasing pressure or conversely an increasing vacuum and is used throughout the industry.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 50)
(HED No. 6.5.2.2a.2)

The pointer on the condenser and turbine recorders conceals the graduation marks.

Response: (Section 6.5, File No. 50)

The turbine and condenser recorders are trend recorders providing historical data. The operator can easily spot abnormal trends and investigate for precise reading from the chart paper. These recorders serve the function they are intended for.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 51)
(HED No. 6.5.2.2a.2)

Pointer tip of process control meter overlaps scale graduations marks and index numeral.

Response: (Section 6.5, File No. 51)

These indicators can be accurately read because there is a significant distinction between the pointer tip and graduation mark.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 52 and 53)
(HED No. 6.5.2.2b.1)

Pointer tips on process indicators are too far from the graduation marks.

Response: (Section 6.5, File No. 52 and 53)

Currently control room process indicators i.e., analog meters are range coded indicating normal operating, off normal and upper and lower limits were necessary. Indicators requiring high accuracy of reading are provided with mirrored scales to allow error free reading.

Florida Power and Light Company contends the present indicators and implemented range coding program provides control room operators with the necessary degree of accuracy required and intends no action on this item.

Finding: (Section 6.5, File No. 54)
(HED No. 6.5.2.2.b.2)

Due to a convex scale face and height of back panel, meters are subject to reading errors from parallax.

Response: (Section 6.5, File No. 54)

Range coding has been added on selected indicators to help operators when the need to quickly verify a system's operating condition exists. In addition, a re-evaluation by Essex determined that parallax is minimal from the normal operating station.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 56)
(HED 6.5.2.3.a)

The yellow and lavender color code on vertical meters is difficult to distinguish because lines are very narrow and background has yellowed.

Response: (Section 6.5, File No. 56)

As part of normal maintenance and calibration, indicators are cleaned, range coding updated if necessary, and replaced if faded.

Florida Power and Light Company believes the existing maintenance program is adequate and intends no further action on the above finding.

Finding: (Section 6.5, File No. 57)
(HED No. 6.5.3.1a.2)

No lamp test capability on the simple indicating lights and legend lights is provided.

Response: (Section 6.5, File No. 57)

The control room operator maintains simple indicating lights as part of their normal routines. Lights, such as safety inject valve indication, are normally lit dimly to present bulk integrity. Safeguards equipment and related values are periodically tested along with their associated indicating lights. Florida Power and Light Company maintains that there is adequate information available to the operator such as analog indicators, trend recorders, and annunciators to verify equipment status as well as adequate surveillance testing and adminstrative controls to insure indicator lamp integrity.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.5, File No. 59)
(HED No. 6.5.3.1c.1)

The simple indicating lights for safety injection indicate valve status by a bright, dim or extinguished lamp. It is difficult to distinguish between bright and dim signals.

Response: (Section 6.5, File No. 59)

The present simple indicating lights provide proper indication for the intended purpose. Other parameters are used by the operator to demonstrate safety injection flow. These lights are also periodically tested to maintain system integrity.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 60)
(HED No. 6.5.3.1.c(1))

Two lights instead of one should indicate whether access to containment is properly interlocked.

Response: (Section 6.5, File No. 60)

Indication for containment access hatches provide the control room operator with indication of door position not interlock status. The subject inner and outer doors are mechanically interlocked and access to containment is administratively controlled. The purpose of the subject indicator lights is to provide the control room operator with a quick indication of one of the penetrations effecting containment integrity.

Florida Power and Light Company contends the subject indicator lights provide the operator with the necessary information intended. Florida Power and Light Company intends no action on this finding.

Finding: (Section 6.5, File No. 61)
(HED 6.5.3.1.d)

High hydrogen common alarm indicator light should be accompanied by an audible alarm.

Response: (Section 6.5, File No. 61)

The hydrogen recombiner panel is provided with an audible trouble alarm to alert control room operators of an off normal condition. Florida Power and Light Company contends the system design is adequate and intends no action on the above finding.

Finding: (Section 6.5, File No. 63)
(HED No. 6.5.3.3)

Status and indicating lights on RCS panel contain legend messages of more than three lines.

Response: (Section 6.5, File No. 63)

The legend messages are written to provide the operator with concise and adequate information and are easily comprehended. Due to the importance of these messages they cannot be shortened without some loss of information necessary to plant operation.

Florida Power and Light Company intends no further action on this item.

Finding (Sect'on 6 5. File o. 65
(HED No. 6.5.3.3a.2 and 3

The legends of various indicators are not legible when bulbs are not lit.

Response: (Section 6.5, File No. 65)

The subject indicators are operators aids by providing early warning signals. They are not intended to replace control room instrumentation for continuous monitoring and need only be acknowledged when lit.

Florida Power and Light Company contends that sufficient process information is available to minimize the effect of the faulty indicator. Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 66)
(HED No. 6.5.4.1a)

Leeds and Northrupt recorders do not have a back plate or support for stamping, causing potential for tears in chart and unclear paper identification.

Response: (Section 6.5, File No. 66)

The charts of the most significant are removed daily and date stamped by the operator. Document control verifies all charts are identified and dated for the purpose of historical recorders.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 68)
(HED No. 6.5.4.1.i)

Recorders lack capability for paper speed adjustment.

Response: (Section 6.5, File No. 68)

The majority of recorders in the control room have only a single speed setting because there is no need for speed adjustability due to the nature of the process they monitor. In some instances, dual speed recorders are provided for use during unit startup or shutdown. Their purpose is to provide the operator with better resolution of time based processes.

Florida Power and Light Company feels the recorders provided in the control room are adequate and intends no action on this item.

Finding: (Section 6.5, File No. 69)
(HED No. 6.5.4.1k)

The metal impact recorder is located at the very bottom of the panel making it difficult to read. The scale face has been altered with hand-written scales taped onto scale face making it difficult to interpret scale face.

Response: (Section 6.5, File No. 69)

The metal impact recorder was a temporary instrument used for a special test program. Its function has been replaced by a new impact monitoring system and the recorder has been disconnected and will be removed.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 72)
(HED No. 6.5.4.2b.2)

Impact recorders are not equipped with a visible wheel to display the channel being plotted.

Response: (Section 6.5, File No. 72)

The impact recorders contain an internal wheel which can be visually monitored with the recorder door open. The recorders are inspected and maintained under the Instrument and Control Department's preventive maintenance program to insure legibility of plotted points.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 73)
(HED No. 6.5.4.2b.3)

Impact recorders contain too many channels and overlapping of plotted points reduces legibility.

Response: (Section 6.5, File No. 73)

The addition of the Safety Assessment System and Safety Parameter display system will includes a data process system which will allow the operator to trend plant information. This will reduce the significance of the impact recorders.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 74)
(HED No. 6.5.4.2b.4)

There is no provision made to select a single channel for immediate display on the impact recorders.

Response: (Section 6.5, File No. 74)

The addition of the Safety Assessment System, Safety Parameter Display and Inadequate Core Cooling Display System will include a data process system which will allow the operator to obtain trend data of a single channel. This will reduce the significance of the impact recorders.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 75)
(HED No. 6.5.5.1a.3)

The batch controller display is not separated by appropriate commas, decimal points or spaces.

Response: (Section 6.5, File No. 75)

The batch controller is preset by the operator through the batch integrator. The display is representative of the preset limit and adequate for it's intended function.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 77)
(HED No. 6.5.1.2b)

The transformer and generator temperature recorder scales are in degrees celcius which does not correspond with the standard control room practice of degrees farenheit.

Response: (Section 6.5, File No. 77)

The procedurs and documents associated with the subject recorders as well as setpoints are all in degree celcius.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 78)
(HED No. 6.5.1.1b)

Indicator lights for reheater vent valves consist of only one red light which is off when valve is closed.

Response: (Section 6.5, File No.78)

The subject valves are field verified when closed to insure system integrity. Reliance on the indicating lights is minimal.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 79)
(HED No. 6.5.1.1f)

If condenser vacuum meter fails it fails low.

Response: (Section 6.5, File No. 79)

Condenser vacuum can be determined from the meter and the mercury column gauge. If the meter should fail the condenser low vacuum annunciator and the mercury column gauge will protect the condenser system, and provide adequate information to the operator.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 83)
(HED No. 6.5.4.1f)

Tracer Westronics strip chart recorders are difficult to unthread. Slack paper on the take-up reel is the normal result.

Response: (Section 6.5, File No. 83)

A Florida Power and Light field survey team tested the reloading quality of the Tracers Westronics recorder and could not reproduce the results of the finding.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 84)
(HED No. 6.5.4.2a.2)

Color coding of strip chart recorder pens are not consistent throughout the control room.

Response: (Section 6.5, File No. 84)

Recorders are individually labelled with corresponding pen coding providing the operator with the necessary information and minimizing associated errors.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 85)
(HED No. 6.5.5.1c)

RPI counter drums rotate downward rather than upward with increasing values.

Response: (Section 6.5, File No. 85)

The RPI counter drum movement is a unique case where rotation downward corresponds with less rod control. This system functions correctly because it corresponds with reactor control analog indication of rod position is also provided and is the operators primary reference point of information.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 87)
(HED No. 6.5.3.1.b)

Various 24 series bulbs are used to replace burned out indicator lamps. Bulbs in this series vary in shape and some are difficult to grip and are hard to remove.

Response: (Section 6.5, File No. 87)

Currently 24E series bulbs are supplied for lamp replacement. The subject bulbs provide the best performance and are the most easily removed from sockets. Bulbs are ordered from stores; however, depending on manufacturer availability supplies may be depleted and acceptable 24 series bulbs used in place of the 24E type.

Florida Power and Light Company intends no action on this item since the subject replacement lamps are qualified substitutes.

<u>Finding:</u> (Section 6.5, File No. 88)
(HED No. 6.5.5.2.a(3))

LED displays have characters that are to small to subtend a visual angle of 15 minutes when the operator is standing at his desk.

<u>Response:</u> (Section 6.5, File No. 88)

The control room operator has a CRT located at his desk which displays those plant parameters which are vital to plant operation. Control board displays are designed to be read from their control station not from any location in the control room. Florida Power and Light Company believes the subject displays are correctly sized for their intended reading distance and intends no action on the above finding.

Finding: (Section 6.6, File No. 1)
(HED No. 6.6)

Three letter codes used for valves is not the recommended - number/alpha/number.

Response: (Section 6.6, File No. 1)

Valves are consistantly labeled throughout the plants. The legend codes agree with plant procedures and drawings.

Florida Power and Light Company feels no further action is intended on this item.

Finding: (Section 6.6, File No. 6)
(HED No. 6.6.2.1f)

Several rotary controls are labelled in such a way that the component type and the center position label run together. This gives the impression there is only one label. This is especially true with a 3 position switch.

Response: (Section 6.6, File No. 6)

The subject labels do not provide inconsistant or confusing information to the operator. This finding was evaluated as a low error assessment. Switch escutcheon plates are consistently and clearly labelled.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 13)
(HED No. 6.6.3.2b)

Control and position labels on several rotaries make it unclear whether or not they are breakers. Inconsistant use of the words trip, close and start are confusing.

Response: (Section 6.6, File No. 13)

Convention is such that open-trip-off is on the left and closed is on the right. Error assessment due to misinterpretation of switch operation is very low.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.6, File No. 14)
(HED No. 6.6.3.2f)

The word "exhaust" is spelled incorrectly. -Exhause- this occurs on isolation valve indicating lights V2602 and V2603.

Response: (Section 6.6, File No. 14)

Upon reinspection of subject finding it was found that the correct spelling is now used - exhaust -.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 15)
(HED No. 6.6.3.3.b)

New rotaries are being added that do not use the same valve labelling/number system as existing rotaries. This occurs when there are not enough numbers in a series to include all related components.

Response: (Section 6.6, File No. 15)

Demarcation and labeling will reduce operator error. PTP-PC-82-067 (memo) explains that there were not enough numbers left in a series to completely number a system. Now numbering sequences were established and are being used as necessary.

Florida Power and Light Company feels no further action is required.

Finding: (Section 6.6, File No. 20)
(HED No. 6.6.3.8a)

Discrete rotary controls do not have all positions labelled. Some have no position labels at all, while others have positions that are marked with lines but not labelled.

Response: (Section 6.6, File No. 20)

The rotary's knob has a pointer and the active points are clearly marked.

Florida Power and Light Company feels these rotarys are marked adequately for

Finding: (Section 6.6, File No. 21)
(HED No. 6.6.3.8a)

Discrete rotary controls do not have all positions labelled. Some have no positions labelled and some just have lines.

Response: (Section 6.6, File No. 21)

Every switch position that is used is labelled. The rotary's knob has a pointer. The positions that are used are labelled and unuses positions are unlabelled, but may be scribed.

Florida Power and Light Company intends no furthere action on this subject.

Finding: (Section 6.6, File No. 23)
(NED No. 6.6.3.8c)

Continuous rotaries located at the top of the benchboard have three scales. These scales are difficult to read from the normal operating position, expecially for the 5th percentile female.

Response: (Section 6.6, File No. 23)

Some of the controllers do not require adjustment. They are preset by instrument and control personnel. The other controllers are adjusted in accordance with other visual aids such as press/level/flow indicators. These rotaries do not represent a setpoint adjustment but rather process control.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.6, File No. 24)
(HED No. 6.6.3.8c)

The shape of the rotary control handle blocks the position label on the board.

Response: (Section 6.6, File No. 24)

The position labels can be read by control room operators. In those cases where pointers cover labels only a portion of the position label is obscured. The operator or technician selecting different points on recorders which have obscured position labels can read the adjacent position labels and determine the channel selected for display.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.6, File No. 25)
(HED No 6.6.3.8c)

Continuous rotaries have a window on top through which a number can be read. These windows fill up with dust making the number unreadable.

Response: (Section 6.6, File No. 25)

The subject potentiometer readings are not significant since process indicator readings determine the setting not the engraving on the control knob.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 26)
(HED No. 6.6.3.8c)

Position labels on top draws, for rotaries, of panel are not visible because they are obscured by the rotary handle.

Response: (Section 6.6, File No. 26)

The subject controls are infrequently used. A step stool is available to allow the operator access and visual verification of switch position.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 29)
(HED No. 6.6.3.9.a)

The access panels are not labelled as to the contents within. None of the accesses leading behind the panels are labelled to identify the functions or items inside said panels.

Response: (Section 6.6, File No. 29)

Access panels are for maintenance personnel. There are no gauges, meters, switches or operational duties for operators in these spaces.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.6, File No. 33)
(HED No. 6.6.3.8c)

Large star shaped handle, load limit, obstructs view of position labels.

Response: (Section 6.6, File No. 33)

This is a momentary switch and is not held in position. Operators visual indication is a megawatt output. The subject rotary conform to switch convention increase-clockwise and decrease-counterclockwise.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.6, File No. 34)
(HED No. 6.6.3.8c)

The top set of rotary control handles, on the NIS Channel 4 and radiation monitor, block control position labels. This is because of the high location on these panels.

Response: (Section 6.6, File No. 34)

Presently the subject rotarys are infrequently used. When they are used the technician or operator uses a stool to gain better visability.

Florida Power and Light Company intends no further action at this time.

Finding: (Section 6.6, File No. 35)
(HED No. 6.6.1.1)

Components on the hydrogen recombiner panel lack functional labeling to identify components. Trend recorders are labeled by legend cards only.

Response: (Section 6.6, File No. 35)

This HED was prepared while the subject panel was still under construction. All applicable labeling has since been complete.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 43)
(HED No. 6.6.2.3.a)

Discrete rotary position labels are diagonally positioned. Guidelines recommend horizontal positioning to ensure accuracy, speed and ease of readability.

Response: (Section 6.6, File No. 43)

Due to the compactness of Turkey Point Unit 3 and 4 control room some labelling must deviated from recommended guidelines. If guidelines were followed in this case the uniformity of physical size of label and lettering size would be violated. Turkey Point control room is functionally layed out, thus error accessments is extremely low.

Florida Power and Light Company feels no action is necessary on this item.

Finding: (Section 6.6, File No. 44, 56)
(HED No. 6.6.2.3.a)

Vertical meters are labelled vertically on the scale face. In many cases, this is the ony descriptive function labelling for the components. Reading errors, accuracy, time and speed could be affected.

Response: (Section 6.6, File No. 44, 56)

Turkey Point Unit 3 and 4 control rooms are compact but functionally designed. To label vertical components with horizontal labelling, space would be needed that does not exist. Also horizontal labelling in these cases would violate label size and lettering size.

Florida Power and Light Company intends no action and feels the subject labelling does not pose a problem.

Finding: (Section 6.6, File No. 47)
(HED No. 6.6.2.4d)

There are procedures for periodic cleaning of labels by the operators. These procedures are not being conducted. It is important that horizontal bench boards that are highly prone to collecting dirt and dust be cleaned.

Response: (Section 6.6, File No. 47)

As part of the ongoing labelling effort the labels being replaced are scribed from the back. This eliminates groved areas on the label fronts where dirt and dust can collect and build up.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 54)
(HED No. 6.6.4.1)

Component labels that appear on vertical scale faces have extremely small letter sizes and character height. This is inadequate for maximum required viewing distance.

Response: (Section 6.6, File No. 54)

The subject meter faces can be read from 4 to 6 feet. Demarcation and summary labeling will be used to enhance operator performance. Due to the compact design of the control room at Turkey Point the availability of room inhabits strict adherance to some guidelines.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 55)
(HED No. 6.6.4.1)

Numeral size on scales of verticle meters, on Unit 3, is too small for optimum viewing distance.

Response: (Section 6.6, File No. 55)

Meter range coding is presently used to assist the operator in determining system status from a distance. When detailed information is required the operator reads the scale at close range.

Florida Power and Light Company intends no futher action on this item.

Finding: (Section 6.6, File No. 56)

The above finding is a duplicate of file No. 44, Section 6.6.

Finding: (Section 6.6, File No. 58)
(HED No. 6.6.4.1a(z))

Process radiation monitor panel component label letter heights for meter are shorter than other component label letter heights. (The same hierarchical level).

Response: (Section 6.6, File No. 58)

The subject labels are readable. The relabelling program will assure that new labels will be consistent in height.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 59)
(HED No. 6.6.4.1a(z))

Letter height for component labels vary from one component to another. (Within the same hierarchy).

Response: (Section 6.6, File No. 59)

In some cases, labels will be changed as part of the relabelling effort. This will hold true to the major component label preferably below the component. Labels are sized to be readable from associated control stations.

Florida Power and Light Company feels no further action needs to be taken.

Finding: (Section 6.6, File No. 61)
(HED No. 6.6.5.1d,h)

Tagout labels (tags) are in the form of red and white slips hung over the switch handle. This form of tagout does not physically prevent control actuation. The size of the tag sometimes obscures adjacent labels.

Response: (Section 6.6, File No. 61)

The use of subject tags is an industry standard and is administratively controlled. The amount of information required on these tags mandates the size. Where obsuring might take place folding the tag is recommended.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 64)
(HED No. 6.6.5.2)

There is no review procedures carried out to determine the use and implementation of temporary labelling. There seems to be no administrative control over this activity.

Response: (Section 6.6, File No. 64)

The use of temporary labels will be limited and used only when needs mandate. This is when construction is being performed and permanent labels are not ready or labels break or have to be changed.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 67)
(HED No. 6.6.4.1b)

Due to grime and dirt on labels, various functions and position labels have low contrast which degrades readability. The impact recorders on the radiation monitoring panels have degraded readability do to low contrast of printed numerals on chart paper. (Inking problem).

The mechanical red-green flags on various J-handles have low contrast do to grime.

Legends on legend pushbuttons have low contrast due to grime.

Response: (Section 6.6, File No. 67)

The new labels will have flat surfaces so dirt cannot collect. Housekeeping will also help to keep this problem to a minimum.

Normal maintenance should resolve current problems with recorders.

Red/green flags are standard breaker indication and will not be changed.

Florida Power and Light Company intends no further action on these items.

Finding: (Section 6.6, File No. 69)
(HED No. 6.6.1.1 & 6.6.3.1a)

Rotaries and meters in the DACA system are labeled "DACA" instead of LLLL (Lo Lo Load Limit).

Response: (Section 6.6, File No. 69)

The subject DACA system has been removed. Therefore, no labelling is necessary.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 71)
(HED No. 6.6.3.2a)

Load limit indicating lights associated with the load limit switch are not correctly labelled. Presently they are labelled in % but should be PSI.

Response: (Sectin 6.6, File No. 71)

The subject indicating lights are not labelled either % or PSI. Associated controls are labelled PSI.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 2)
(HED No. 6.7.1.3.a,b)

The computer system does not contain any prompting or structuring features. The present system only gives status information on selected parameters and no other information.

Response: (Section 6.7, File no. 2)

The installation of the Safety Assessment System will replace the current display and expand upon the existing plant computer system capability. The Safety Assessment System does use prompting and structured outputs along with color coding and paging features. The subject finding was determined to be resolved since installation of the Safety Assessment System will correct the above finding.

Finding: (Section 6.7, File No. 3)
(HED No. 6.7.1.3c)

The computer system only displays the task/file name. Special entries made by the operator are not displayed such as a report to be printed every 15 minutes.

Response: (Section 6.7, File No. 3)

The only special report which the control room operator can request is the poison report. The entry made to request the report is displayed only at the time of entry to allow the control room operator to verify the input. The report is then generated at the requested interval.

As a result of the review team meetings it was determined that the subject finding was invalid due to the fact that the plant computer's design intent is to serve as an outline data display system and provide a summary sequence of events _______ _______ selected plant parameters to aid in the review of the events immediately prior to and after a plant trip, and limited data retrieval.

Finding: (Section 6.7, File No. 4)
(HED No. 6.7.1.4 & 6.7.1.5)

The keyboard contains non-irelevant/unused keys that add to visual noise, confusion and crowding. Uppercase unused function keys are included on the alpha keyboard.

Response: (Section 6.7, File No. 4)

New keyboards are part of the computer system upgrade. The subject keyboards are standard Ramtee Keyboards and will have unused functions.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 5)
(HED No. 6.7.1.4d,g)

The CRT keyboard key separation of 0.19" is less than the recommended 0.25". The keyboard slope $5^{\circ}$-$10^{\circ}$ is less than the recommended $15^{\circ}$-$20^{\circ}$ from horizontal.

Response: (Section 6.7, File No. 5)

This item will be changed as part of the computer system upgrade. A standard Ramtee Keyboard will be installed as part of the upgrade.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 6)
(HED No. 6.7.1.6b,c)

The printer speed is too slow for the update on Steam Generator Level and flow of once per minute. The printer speed is 60 lines per minute instead of the recommended 300 lines per minute.

Response: (Section 6.7, File No. 6)

The finding is invalid because the printer is not intended to trend Steam Generator level or flow. These are trended by strip chart recorders on the console. The system, however, will be replaced by a high speed line printer during the SAS/SPDS/ICC upgrade.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 8)
(HED No. 6.7.1.8a2,a4)

The computer procedures seem to be written for a programmer, not an operator. These procedures do not describe the overall computer system or system components so the operator can interface.

Response: (Section 6.7, File No. 8)

Incorporated as part of the computer system upgrade will be training and functional descriptions.

Florida Power and Light Company intends no further action.

Finding: (Section 6.7, File No. 9)
(HED No. 6.7.1.8b)

The computer system does not provide cross reference indices for computer programs. The programs are indexed numerically, only by entry code number.

Response: (Section 6.7, File No. 9)

This finding is invalid because special programs such as "Flux" include the analog channels which are related to the output on the output screen or printout. Therefore, cross references are not necessary because all pertinent information is displayed in the output.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 10)
(HED No. 6.7.2.1c)

The CRT is light print on dark background in high ambient lighting. (Approximately 80 FT. candles).

Response: (Section 6.7, File No. 10)

A joint review team agreed that the CRT's are oriented so there is a minimum of reflected glare and contrast i.e., character to background is sufficient.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 11)
(HED No. 6.7.2.1f & 6.7.2.2g(2))

The CRT resolution is poor. The numbers zero and eight are hard to distinguish. The font is a 5 x 7 dot-matrix rather than the recommended 7 x 9.

Response: (Section 6.7, File No. 11)

The system upgrade will include a new 19" CRT with a 7 x 9 matrix.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 12)
(HED No. 6.7.2.1g)

The CRT screen flickers making it difficult to read.

Response: (Section 6.7, File No. 12)

This was a maintenance problem A PWO was issued and the problem was repaired as part of normal plant maintenance.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 13)
(HED No. 6.7.2.3f)

The keyboard and CRT locations are such that the operator can not operate them from the main control board. The operator must go around the desk to use the keyboard and see the CRT screen.

Response: (Section 6.7, File No. 13)

The system upgrade will include the following:

1) SPDS keyboard will be at operators panel in view of the CRT.
2) SAS has a keyboard with associated utility screen.
3) ICC and associated keyboard located together.

Florida Power and Light Company intends no further action on these items.

Finding: (Section 6.7, File No. 14)
(HED No. 6.7.2.4a,c)

Post Trip Review (PTR) readouts consist of a seven place decimal followed by "E + On". This notation requires a conversion into a usable number.

Response: (Section 6.7, File No. 14)

Operators are aware of the difference between natural logaritms and common logarithms. "E" indicates common log base 10 and is universal in control room computers.

Florida Power and Light Company intends no action on this item.

Finding: (Sectin 6.7, File No. 15)
(HED No. 6.7.2.5f)

Paragraphs on the CRT screen are layed out in continuuous text without only separation.

Response: (Section 6.7, File No. 15)

The system upgrade will incorporate this feature with a programable keyboard and set by the menu format.

Florida Power and Light Company intends no futher action on this item.

Finding: (Section 6.7, File No. 16)
(HED No. 6.7.2.5h,i)

Displays that are continued on multiple pages are not numbered and the total number of pages are not indicated. The present system does not have scrolling capability. When a hard copy is requested only 18 of the lines displayed on the CRT is printed.

Response: (Section 6.7, File No. 16)

The upgraded computer system will have paging and screen scroll capability. The CRT only displays 18 lines.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 17)
(HED No. 6.7.2.5m)

The amount of information, bearing activated screen area should not exceed 25% of the total screen area. Presently this area is 75%.

Response: (Section 6.7, File No. 17)

Only 18 lines of the text can be displayed at one time. It was determined by a joint team review that 18 lines are ledgible and not difficult to read.

Florida Power and Light Company intends no action on this item.

Finding: (Section 6.7, File No. 18)
(HED No. 6.7.2.6a)

1) The computer source range setpoints are too high and not low enough.
2) Rod position indication is set too low and not high enough.

NOTE: This data was collected during operator interviews.

Response: (Section 6.7, File No. 18)

A review of all the setpoints was made. The results of this review will be implemented in the new upgraded computer system. Also any problems concerning setpoints can be corrected through proper channels in the future.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 19)
(HED No. 6.7.2.6i & 6.7.2.7a)

The computer dialogue does not contain any feedback messages indicating changes in status of parameters that have been selected.

Response: (Section 6.7, File NO. 19)

The upgraded computer system will contain dialogue that shows continuous updating of parameters selected.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 20)
(HED No. 6.7.2.6k)

The present computer system does not contain any delay feedback messages that inform the operator to standby. The computer is searching for data or there is a normal delay.

Response: (Section 6.7, File No. 20)

The computer system is being upgraded. The new system will have a feedback function that enables the operator to know the status of the computer when searching for information.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 21)
(HED No. 6.7.2.7a,e.j)

Only one urgent message is highlighted on the computer CRT with flash coding. Any other messages are not coded or highlighted.

Response: (Section 6.7, File No. 21)

The computer system upgrade will have color coding and highlighting features for all urgent and important messages.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 22)
(HED No. 6.7.3.1e(3))

The computer printer does not have a plate of instructions for reloading paper, ribbon, ink, etc. attached to the printer.

Response: (Section 6.7, File No. 22)

Paper is reloaded similar to a typewriter and is _______ i.e., no special instructions required. The printer ribbon is a maintenance item which is replaced by instrumentation and control maintenance personnel when control room operators observe printer print becoming light. Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.7, File No. 23)
(HED No. 6.7.3.2)

There is no dedicated printer to record annunciator alarms. The sequence of events recorder is available only on command and prints information other than alarms. Alarms are not recorded in sequence of occurance. The operator can not request printouts by alarm groups. There is no coding used to distinguish alarms from other messages. Alarm messages are not specific enough for rapid identification of the nature messages.

Response: (Section 6.7, File No. 23)

The contact points monitored by the sequence of events recorder were selected by operation and engineering personnel. The contacts selected to be monitored were those identified as being necessary to analyze abnormal transients and plant trips. It was necessary to exclude contact points which provide no information with regard to plant operating status or key functions since this information would only serve to add bulk to the output and provide no directly usable information to staff personnel.

Florida Power and Light Company contends that the sequence of events recorder is not an alarm printer and is adequate for its intended function.

Coding does exist in the left hand margin and a vertical line separates the code from the alarm or messages. Abbreviations are used as a space and time saving feature. Personnel are familiarized in training and refreshed on the job.

Florida Power and Light Company intends no further action on these items.

Finding: (Section 6.7, File No. 24)
(HED No. 6.7.3.3a,b & d)

The computer printer does not contain graphic illustration capability. Groups of 5 are not separated by a space in tables with long columns of numbers.

Response: (Section 6.7, File No. 24)

The computer system is being upgraded and will incorporate trends and mimics. A plotter will also be included as part of the upgrade thus a copy of graphic displays can be printed. The spacing between long columns of numbers will be keyboard programable.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.8, File No. 2)
(HED No. 6.8.1.1c)

Important displays are located locally throughout the plant. There may be inadequate time to prevent possible hazards.

Response: (Section 6.8, File No. 2)

The criticality of all plant components was reviewed by Florida Power and Light. Florida Power and Light Company contends that the items of the highest significance are presently displayed in the control room. Some items, however, will be added to the control room during the SAS/SPDS/ICC upgrade.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.8, File No. 3)
(HED No. 6.8.1.2 & 6.8.1.2c)

. Displays located on the verticle panels must be monitored while manipulating controls on the front console.

Response: (Section 6.8, File No. 3)

The console carries the most pertinent information corresponding to the subject controls. Often the operator will confirm the console indication by checking an alternate source on the verticle panel, but items such as valve control are in direct relation to console indicators such as the steam generator level recorders. The addition of SAS/SPDS/ICC monitors will increase the console information.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.8, File No. 4)
(HED No. 6.8.1.2 & 6.8.2.1c)

The arrangement of related controls and displays of the boric acid and steam dump systems do not permit efficient operation.

Response: (Section 6.8, File No. 4)

Emergency boration and natural circulation are the key safety functions of the boric acid and steam dump systems. The parameters which are pertinent to emergency boration and natural circulation are located on the console within the areas of the boric acid and steam dump controls.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.8, File No. 5)
(HED No. 6.8.1.3b)

Panel lacks demarcation lines to faciliate control/display integration for search and identification tasks.

Response: (Section 6.8, File No. 5)

Limited demarcation will be implemented after painting of control panels. Due to the compact design of the control room and close placement of controls meters, etc.

Florida Power and Light feels extensive demarcation would only crowd the control board and hinder operators. Although compact the common control room is functionally designed with a consistant pattern of controls and displays.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.9, File No. 2)
(HED No. 6.9.1.2c.3)

Control position indicator scale and display scale do not correspond.

Response: (Section 6.9, File No. 2)

Operators are trained to recognize and interpret the display scales utilized throughout the control room.

Displays are process dependent units of measurement, function, process, etc., are clearly labelled on displays and component labels.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.9, File No. 5)
(HED No. 6.9.2.1b)

The simple indicating lights for the safety injection system do not correspond with their associated valve controllers.

Response: (Section 6.9, File No. 5)

A modification to this system is currently planned as part of the units control room upgrade modifications and proper labeling utilized to associate valve controllers with their respective indicating lights will be implemented. Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.9, File No. 6)
(HED No. 6.9.3.2a)

Inappropriate control to display ratio of process controllers, i.e. excessive rotation of controllers is required to acquire desired display response.

Response: (Section 6.9, File No. 6)

Process controller, rotation is a function of plant parameters such as flow, pressure, and temperature which change with power level and desired accuracy as well as desired rate of change. Florida Power and Light Company contends that the subject controls provide adequate signal output to turn ratio for the design functions intended.

Florida Power and Light Company intends no further action on this item.

### 3.3.2 DELETED/INVALID FINDING

(NO FURTHER ACTION REQUIRED)

As a result of the Detailed Control Room Design Review and Human Engineering Descrepancy Review Team meetings on Turkey Point 3 and 4 there were 23 findings (Summarized on Table 3.2-1) which were deleted either because they were duplicate else where or because they were invalid. These findings were dispositioned as requiring no further action as identified in the following text.

The following is a list of those findings which were deleted. The subject findings are listed by section number as they relate to NUREG-0700 and file number as they relate to FP&L's tracking system A more detailed listing along with a brief description of each line item is presented in Section 3.5 of this report.

| SECTION NO. | FILE NOS. |
|---|---|
| 6.1 | 13,37,38 |
| 6.4 | 2,4,9 |
| 6.5 | 7,13,24,27,35,36,47,58,62,71 |
| 6.6 | 10,27,31,32,65 |
| 6.7 | 1,7 |

Findings: (Section 6.1, File No. 13)
(HED No. 6.1.2.2g)

The console (bench board) kick space is three inches by 3.75 inches rather than the recommended four inches by four inches.

The guard rail extends the edge of the console out another three inches increasing the kick space to six inches there for this is not a problem.

Response: (Section 6.1, File No. 13)

As a result of review team meeting the subject finding was deleted.

The subject finding was reviewed and determined to require no corrective action since the subject bench board provides the operator with a standing work station and if seated at this station the operator would be using a draftsman type stool. The panel design is adequate for the intended use.

Florida Power and Light Company intends no action on this item.

Findings: (Section 6.1, File No. 25)
(HED No. 6.1.4.1a,h)

Storage location of protective equipment is partially obscured by relay racks allowing insufficient room to dress. No breathing apparatus is stored there and there is only limitted training in its use.

Response:(Section 6.1, File No. 25)

The emergency locker inventory is correct as identified in the site emergency plan. The subject lockers are controlled storage lockers and are not located in an area which is intended for operator dressout. The personel using the equipment stored in the subject locker, will dressout in the control room and office area directly behind it as they are relieved from shift responsibilities to do so.

Personel required to use breathing apparatus are trained as part of their radiation training and are periodically requalified as required by existing site procedures.

The units' control room meets all habitibility requirements and is intended to remain a radioactivity clean area. There are no requirements for storage of breathing apparatus in the control room.

The units control room meets all habitibility requirements and is intended to remain a radioactivity clean area. There are no requirements for storage of breathing apparatus in the control room.

Florida Power and Light Company believes the current emergency equipment storage space and existing training program for the use of the subject equipment is adequate and intends no further action on this item.

Finding: (Section 6.1, File No. 37)

This finding had two HED numbers associated with it, HED No. 6.1.1.5.e and 6.5.3.1.b. The subject finding was correctly filed and dispositioned under Section 6.5, File No. 86. File No. 37 of Section 6.1 was deleted. Florida Power and Light Company intends no action on this item.

Finding: (Section 6.1, File no. 38)

This finding had two HED numbers associated with it, HED No. 6.1.1.5.e and 6.5.3.1.b. The subject finding was correctly filed and dispositioned under Section 6.5, File No. 86. File No. 38 of Section 6.1 was deleted. Florida Power and Light Company intends no action on this item.

Finding: (Section 6.4, File 2)
(HED No. 6.4.1.1c(2))

There is a fuse holder which has been placed in a hole on the electrical console. It serves no function although it appears to be a rotary control.

Response: (Section 6.4, File No. 2)

The subject fuse holder was inserted in the hole in the electrical panel to prevent debris from being introduced into the subject panel until a suitable plug can be inserted.

The subject finding was determined to be a duplicate of File No. 1, Section 6.4 and was deleted.

Finding: (Section 6.4, File No. 4)
(HED No. 6.4.1.1c(2))

The main steam stop bypass motor operated valves and component cooling water make up motor operated valves are inching valves. The rotary control associated with these valves is spring return to center and must be held in the open position until the valve opens completely. These controls are not marked in any way to indicate that they are different from all the other spring return rotaries.

Response: (Section 6.4, File No. 4)

The subject valves are used to perform process control tasks which require the subject valves to be throttled. Florida Power and Light Company believes that the present valve labeling, operator training and procedural controls properly identify the subject valve operation and function. The subject finding is a duplicate of File No. 34, Section 6.4, and was deleted.

Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.4, File No. 9)
(HED No. 6.4.2.1)

Breakers are not consistently labelled. Position labels are labelled on-off and some are trip-close.

Response: (Section 6.4, File No. 9)

A field survey was performed and no control breakers were identified as operating opposite to normal breaker control switch convention. The subject finding was deleted as being a duplicate of File No. 13 of Section 6.6. Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 7)
(HED No. 6.5.1.3b(5))

Spacing between words is less than one character width on status legend lights, words and abbrevations are cramped together, making the legend difficult to read quickly.

Response: (Section 6.5, File No. 7)

Presently component labels are being re-engraved and replaced under File No. 6 of Section 6.5. The above finding is a duplicate of File No. 6 Section 6.5 and was deleted.

Florida Power and Light Company intends no further action on the above finding since it is being corrected via File No. 6 of Section 6.5.

Finding: (Section 6.5, File No. 13)
(HED No. 6.5.1.6d(1))

Status lights on safegards panel use the following color code: Channel I-red, Channel II-white, Channel III-blue and Channel IV-yellow. These colors are also applied to controls and displays on SF/FF panel,COND and SG/RX panels but are not used consistently.

Response: (Section 6.5, File No. 13)

The color codes for safegards measurement Channels I-red, II-white, III-blue, IV-yellow are correctly and consistently applied through out the control room. Florida Power and Light Company field, personel were unable to find any incorrect application of the subject coding convention.

The subject finding was deleted based on proper application of existing color conventions. Florida Power and Light Company intends no further action on the above finding.

Finding: (Section 6.5, File No. 24)
(HED No. 6.5.1.1c)

Condensate storage tank level has three meters provided for system function - 1 vertical and 2 horizontal, but all are on the same circuit. If one fails they all fail. A redundant display should have separate circuitry.

Response: (Section 6.5, File No. 24)

Two additional Condensate Storage Tank Level indicators were added. Each indicator signal originates from it's own transmitter. These additional indicators were added so if one failed the other would be a backup. The new indicators are also more accurate. Florida Power and Light Company feels this finding was in error and subsequently deleted. Florida Power and Light Company intends no action on this item.

Finding: (Section 6.5, File No. 27)
(HED No. 6.5.1.1.b)

Reactor coolant pump vibration recorder is located only on Unit No. 3. No local indication for point status on Unit No. 4.

Response: (Section 6.5, File No. 27)

The subject finding is a duplicate of File No. 23, Section 6.1. The subject finding was deleted as a result of the Turkey Point joint review.

Work is being performed under File No. 23, Section 6.1. Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 35)
(HED No. 6.5.1.4.f)

Secondary water conductivity recorder displays units of ____________/CM which operators cannot use directly. Parts per million is a more usable unit.

Response: (Section 6.5, File No. 35)

The subject recorder valves are correct. As a result of review team meeting it was agreed that operators view the subject recorder for trend i.e., any change in conductivity level and that acceptable ranges are clearly identified in consistent units. The subject finding was determined to be invalid. Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 36)
(HED No. 6.5.1.5a)

The power range detector current meters have three scales. The bottom two scales 0-500 and 0-100 have no minor index markings. However, meter scale does incorporate mirror back for elimination of parallex and meter pointer does extend to top scale which does have index marks.

Response: (Section 6.5, File No. 36)

The subject meters are used for calibration of the associated instrumentation. The minor graduations are located on the top scale to allow for easier readibility and accuracy. The subject indicators are correctly designed for their application and use and no operator error is expected. As a result of review team meetings the subject finding was dispositioned as invalid.

Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 47)
(HED No. 6.5.1.5f)

Power range detector current meters have a single pointer with multiply scales. A rotary selector is provided to select between four different scales.

Response: (Section 6.5, File No. 47)

The rotary selector is used strictly for calibration of the detector. Once calibration is completed, the rotary selector is positioned on the normal operating scale. The subject finding was dispositioned as invalid during review team meetings.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 58)
(HED No. 6.5.3.1.c.(1))

Power available to auxiliary feedwater pump is indicated by an illuminated status light. Extinguished light may mean bulb is burned out or loss of power to pump.

Response: (Section 6.5, File No. 58)

As a result of review team meetings it was determined that the subject illuminated status indication was consistent with plant convention and review guidelines. Extinguishment of the subject lamp requires immediate operator action to determine cause and take corrective action.

The subject finding was dispositioned as invalid. Florida Power and Light Company intends no action on the above finding.

Finding: (Section 6.5, File No. 62)
(HED No. 6.5.3.2a.1)

Each pushbutton for the 4KV Bus A and B lockout relays have a pair of indicator lights. Each light should be labelled A or B to identify approprite bus.

Response: (Section 6.5, File No. 62)

The pair of indicating lights are simple redundant indication for their corresponding pushbutton. The subject finding was dispositioned as invalid as a result of review team meetings.

Florida Power and Light Company intends no action on this item

Finding: (Section 6.5, File No. 71)
(HED No. 6.5.4.2b.1)

Three scales have been added (handwritten) to the scale face of recorders 441 making difficult to read.

Response: (Section 6.5, File No. 71)

A field inspection performed by Florida Power and Light personnel could not verify this finding. No new scales had been added and the recorders were functioning properly. The finding was dispositioned as invalid.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 10)
(HED No. 6.6.3.1a)

All units on each panel have either two lights or two pushbuttons which are labelled "High" and "Low". The high light shows when the hight radiation setpoint has been reached. The low light shows when the area sensor has failed. The low light should be labelled fail.

Response: (Section 6.6, File No. 10)

The label is consistent with the function displayed - low threshold voltage. As a result of review team meeting the subject finding was dispositioned as invalid since the subject labels did correctly identify type of equipment failure.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 27)
(HED No. 6.6.3.8a)

All rotary controls on the hydrogen recombiner panel are missing position labels.

Response: (Section 6.6, File No. 27)

Duplicate to File No. 35, Section 6.6.

This HED was written prior to completion of the subject system which requires permanent labels to be installed and was deleted.

Finding: (Section 6.6, File No. 31)
(HED No. 6.6)

Record was incorrectly located in this section and has been relocated in Section 6.4, File No. 0036.

Finding: (Section 6.6, File No. 32)
(HED No. 6.6)

Record was incorrectly located in this section and has been relocated in Section 6.5, File No. 0088.

Finding: (Section 6.6, File No. 65)
(HED No. 6.6.3.3.b)

New 6000 series valve numbers are being used as new equipment is installed. This numbering system does not conform to existing valve numbering conventions.

Response: (Section 6.6, File No. 65)

The subject finding was determined to be a duplicate of File No. 15, Section 6.6, and was deleted.

Finding: (Section 6.7, File No. 1)
(HED No. 6.7.1.2a4)

Computer dialogue "PTR lock pending" means reactor trip when stated in vocabulary and syntax of the control room operator. This does not reflect vocabulary of the user population..

Response: (Section 6.7, File No. 1)

As a result of the joint review team it was identified that "PTR locked pending" meant the digital data process system post trip review log was available for access by plant personel not reactor trip. The message is consistant with associated plant conditions and operator required response. The subject finding was determined to be invalid since the only time the log is available is after a reactor trip. If an operator attempts to access the post trip review file after it has been reset the screen message will be "PTR busy".

Finding: (Section 6.7, File No. 7)
(HED No. 6.7.1.6b,c)

The computer printout of the rod position is programmed to update and print once every minute. The operators would prefer and think it is necessary once every 5 minutes due to the distracting noise.

Response: (Section 6.7, File NO. 7)

The finding was determined to be invalid because the computer will not print any position unless requested by the operator through the CRT. Rod position is also included on the hourly report and is indicated on the console.

Florida Power and Light Company intends no further action on this item.

### 3.4 COMPLETED BACKFITS

### 3.4.1 COMPLETED ENHANCEMENT/DESIGN SOLUTIONS

As a result of the construction work effort and Turkey Point Steam Generator outage on Unit 3, there are 28 findings (summarized in Table 3.2-1) which were closed or completed. The following is a list of those findings by section number as they relate to NUREG-0700 and file numbers as they relate to FP&L's tracking system. Presently the documentation for the closed findings along with descriptions of each line is controlled by FP&L's Power Plant Engr. Group and a brief description presented in Section 3.5 of this report.

Turkey Point Units 3 and 4

| SECTION NO. | FILE NO. |
|---|---|
| 6.1 | 1,6,7,20,21,22,26,27,29,31,32,<br>35,36,41 |
| 6.2 | 2,10 |
| 6.3 | 2,9,10 |
| 6.4 | 3,6,15 |
| 6.5 | 1,15,81 |
| 6.6 | 9 (Unit 3 only)<br>52, 68 (Unit 4 only) |

Finding: (Section 6.1, File No. 1)
(HED No. 6.1.1.2b)

The utilization of additional personnel to augment staffing under emergency conditions did not satisfy NRC requirements. During the last NRC test transient personnel did not report to site until after event was over.

Response: (Section 6.1, File No. 1)

Based on test results, current procedures and planning were reviewed than revised. Call out test "L-82-303" was initated. Additional personnel in aloted amount of time arrived on site.

Florida Power and Light Company feels that procedures to augment the normal staff during an emergency is adequate.

Finding: (Section 6.1, File No. 6)
(HED No. 6.1.1.6a)

The shift supervisor and watch engineer do not have adequate visual and audible contact with the primary area of the control room. NIS panel obscures their view into the primary area. Rope barriers obstruct access. When yelling, communciations are not heard or incorrectly heard.

Response: (Section 6.1, File No. 6)

Control room modifications have minimized subject problems. Included as part of the modification effort was to extend the observation area into the control room and the incorporation of a intercom system. The changes were implemented in PCM 82-114.

Florida Power and Light Company feels this will enhance control room operation.

Finding: (Section 6.1, File No. 7)
(HED No. 6.1.2.1)

The control room main entrance/exit door handle is only 28 inches above the floor. This requires operator to stop over to the reach the handle.

Response: (Section 6.1, File No. 7)

As part of the control room modifications the door was changed. Now the handle is at a normal level. This was part of the PCM 82-114 control room modification.

Florida Power and Light Company feels no further action in necessary.

Finding: (Section 6.1, File No. 20)
(HED No. 6.1.3.1e 2)

The area radiation monitor is located at the end of Unit 3. The status of this equipment should be in both control rooms capable of controlling that equipment.

Response: (Section 6.1, File No. 20)

This item is being supplemented by the new Safety Assessment System. Information will be available on utility screens in both control rooms.

Florida Power and Light Company feels no further action is necessary.

Finding: (Section 6.1, File No. 21)
(HED No. 6.1.5.1a)

There are only 3 A/C units to cool the control room. If one A/C unit fails the 2 remaining are not adequate enough to cool the equipment and personnel. Equipment has had a history of overheating.

Response: (Section 6.1, File No. 21)

The control room upgrade and control room habitability is being taken care of under PCM 82-60.

Florida Power and Light Company feels this should satisfy the needs of equipment and personnel.

Finding: (Section 6.1, File No. 22)
(HED No. 6.1.1.4b.1)

FSAR, emergency and normal operating procedures are in poor condition. There is only one set and it is stored on Unit 4. The use of color coding to distinguish between the different procedures is non-existant. Indexing is by number not by name. Binders are so full they will not stay closed and pages are falling out.

Response: (Section 6.1, File No. 22)

As part of the control room upgrade the subject procedures were color coded. New binders purchases and a central location was provided for a second set of procedures. -P.O. #202278- Florida Power and Light Company feels no further action needs to be taken on this item.

Finding: (Section 6.1, File NO. 26)
(HED No. 6.1.4.2)

Fire extinguishers are not hung in relation to the label of type of extinguisher. Accessibility to fire extinguisher is difficult do to location, behind relay racks out of primary area. Not all operator are instructed in the operation of fire extinguishers, only the fire team.

Response: (Section 6.1, File No. 26)

The subject items were evaluated. Operations will be given fire training. Fire extinguishers will be placed in their proper places. Additional equipment will be added as necessary. PWO #156302 will document corrective action.

Florida Power and Light Company feels no further action is necessary.

Finding: (Section 6.1, File No. 27)
(HED No. 6.1.4.3b)

Labelling of storage locker, whose contents are test and communciation equipment for refueling, does not adequately describe the contents.

Response: (Section 6.1, File No. 27)

The storage locker was relabelled identifing said contents.

Florida Power and Light Company feels no further action is necessary in reguard to this item.

Finding: (Section 6.1, File No. 29)
(HED No. 6.1.5.2b)

The ventalation system is producing drafts of 50 to 150 FPM. These measurements were taken at head level. Air velocities should not exceed 45 FPM.

Response: (Section 6.1, File No. 29)

Site engineers evaluated the ventalation system. The subject problem has been corrected and is documented thru PWO @237534.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.1, File No. 31)
(HED No. 6.1.5.7c)

There is no quiet area for control room operators to take a break. Due to understaffing operators are not allowed to leave the control room and have to wait to use rest room facilities by transferance of responsibility duty. There is always control room noise throughout the shift to add to operator fatigue.

Response: (Section 6.1, File No. 31)

Control room modifications have added additional toilet facilities. These modifications have reduced traffic in the control room and allowed operator better access to existing facilities. PCM #82-114 documents changes to the control room.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.1, File No. 32)
(HED No. 6.1.5.7a.35)

The control room decor and asthetics are fatiguing to the operators. Relay noise and turbine vibration tend to make operators sleepy on the night shift. Floor, ceiling, wall and control boards colors do not give eyes any relief. Tile floors create a dust problem besides fatigue for the standing operator.

Response: (Section 6.1, File No. 32)

A review of the subject finding resulted in several changes to the control room atmosphere. Color changes have been made to walls, control panel, and ceiling. The control room is virtually air tight from the outside world. Carpet has been installed. PCM #82-114 is the control room document for control room upgrade.

Finding: (Section 6.1, File No. 35)
(HED No. 6.1.1.4a & 6.1.1.5d)

Inadequate and improper storage space in the control for books, procedures, logs, coffee supplies and spare parts. Empty book shelves are outside control room, near the kitchen. Unnecessary amounts of coffee supplies are stored in the control room prime space. Spare parts are in a back room.

Response: (Section 6.1, File No. 35)

Control room modifications incorporated a new design that utilizes available storage space more efficiently. These changes are covered in PCM #82-114.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.1, File NO. 36)
(HED No. 6.1.1.5 & 6.5.4.1e)

Computer printer paper is stored on the floor in a box. The printer paper is restocked so infrequently that the control room operators do not know where to get spares thus the paper is turned over and reused.

Response: (Section 6.1, File No. 36)

The subject finding was addressed and taken into consideration as part of the control room redesign effort PCM #82-114.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.1, File No. 41)
(HED No. 6.1.1.3c & d)

The rope barriers throughout the control room tend to be a tripping hazard/obsticle for the operators.

Response: (Section 6.1, File No. 41)

Due to the control room modifications rope barriers were essential to control personnel during the upgrade effort. Upon completion of control room modifications rope barriers that are needed and do not cause a hazard will be left. PCM #82-114.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.2, File No. 2)
(HED No. 6.2.1.2b.6)

The design and location of the NRC and fire phones is not satifactory. They can be knocked out of their respected cradles by passing traffics.

Response: (Section 6.2, File No. 2)

As part of the communications upgrade this finding was corrected. The operators desk was redesigned and the phones were vertically mounted with in an enclosure to protect them from accidental bumping. PCM #82-114 covered this task.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.2, File No. 10)
(HED No. 6.2.2.1b)

The different phones at the operators desk lack individual audible coding. When a phone rings it is hard to distinguish which phone it is that is ringing. The opeator must touch each phone to determine which is the right one.

Response: (Section 6.2, File NO. 10)

This item was addressed as part of the control room modification and upgrade of communciations system. PCM #82-114 the phones now have a light that goes on when that particular phone rings enabling the operator to respond without difficulty.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.3, File No. 2)
(HED No. 6.3.1.2a.1)

Several annunciator alarms occur so frequently that they are considered a nuisance. A few of these nuisance alarms only come in during certain procedures. The others are alarming frequently all the time. Operators are defeating the alarms when they become a nuisance.

Response: (Section 6.3, File NO. 2)

A review of the alarm situation was made. The cause, frequency and necessity was surveyed to minumize the effort of nuisance alarms and correct the cause and/or eliminate same. A.P. 0103.2 Pg. 10 8.1.4 will also help with the disabling of alarms.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.3, File No. 9)
(HED No. 6.3.2.1f)

There is no audible alarm location coding except between Units 3 and 4. The different panels within each unit have the same audible alarm code.

Response: (Section 6.3, File No. 9)

New alarm systems were installed to better enhance the coding between Unit 3 and 4. Alarm coding between panels was reviewed by Florida Power and Light Company. It was determined that, due to the compactness of the control rooms and functional grouping of the annunciator, additional coding alarms would not enhance operator reaction.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.3, File No. 10)
(HED No. 6.3.2.1a)

Unit 3 annunciator audible alarm is not distinguishable over the construction noise in the control room or over Unit 4 alarms. The shared alarm panel is also responsible for the same condition.

Response: (Section 6.3, File No. 10)

During the control room modifications PCM 82-264 for Unit 3, a new alarm that can be heard over background noise was installed. This new alarm is consistent with NUREG-0700.

Florida Power and Light Company intends no further action on this subject.

Finding: (Section 6.4, File No. 3)
(HED No. 6.4.1.1.cl)

The same type of controller is used for several different funcitions. The rotary in some cases is used to set the setpoint, thus the actual value on the rotary is important. On others the rotary scale is irrelevant, the operator watches another display while working the rotary. Controllers are not identified as the which ones serve which type function.

Response: (Section 6.4, File No. 3)

The instrumentation department has reviewed this finding. Subsequently the controllers which have stationary setpoints have been identified and labeled as such.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.4, File No. 6)
(HED No. 6.4.1.2)

The control power fuses for the NI channels are not properly guarded or provided with interlocks to keep them from being pulled. This action will trip the plant.

Response: (Section 6.4, File No. 6)

The subject fuses have had guards installed. PWO #237529 initiated this activity.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.4, File No. 15)
(HED No. 6.4.2.2.f(3))

NI black rotaries are mounted on a black label engraved with the component and position labels. There is insufficient contrast between the control and the background.

Response: (Section 6.4, File No. 15)

The ongoing labelling program has replaced the labels for the subject rotaries on the NI panel. The new labels are consistent with NUREG-0700.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 1)
(HED No. 6.5.1.1e)

On Hagan Process Controller the meters displays demand rather than status information. The controllers are not labelled to indicate this fact.

Response: (Section 6.5, File No. 1)

The Hagan Displays are labelled demand signal. This item is addressed during operator training. Title - "Logic Systems with Hagan Controllers".

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.5, File No. 15)
(HED No. 6.5.1.6d(1))

The radiation monitor color code scheme is different than that used on the main control panels.

Response; (Section 6.5, File No. 15)

Operators are informed of the radiation monitor color coding being used. This information is given during training titled "Requal Cycles 82-83".

Florida Power and Light Company feels no further action is intended on this item.

Finding: (Section 6.5, File No. 81)
(HED No. 6.5.4.1)

Steam generator feedwater flow recorders fail frequently. The pens stick. These recorders are used during start-up and shutdown operations.

Response: (Section 6.5, File No. 81)

The subject recorders were replaced with improved units during the planned control room modifications program.

Finding: (Section 6.6, File No. 9)
(HED No. 6.6.3.1a)

Each auto process controller has a pushbutton which puts it in auto and then displays whether the controlled function is increasing or decreasing. The arrows and controller FCV-3-1114 are both pointing in the same direction.

Response: (Section 6.6, File No. 9)

The labelling effort has corrected this item. The left arrow is now pointing down and the right arrow up. This signifies increase and decrease.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 52)
(HED No. 6.6.3.8a)

Hydrogen monitor scales on Unit 4 have two different ranges and one unit of measurement. There is a dual selector switch with no position labels.

Response: (Section 6.6, File No. 52)

The ongoing labelling program has corrected this find. The range selector switch has been properly labelled.

Florida Power and Light Company intends no further action on this item.

Finding: (Section 6.6, File No. 68)
(HED No. 6.6.1.a)

The label on meter (TI-4-443A) for Unit 4 pressurizer is incorrect.

Response: (Section 6.6, File No. 68)

The pressurizer instrumentation is being upgraded. The subject indicator was removed and new instrumentation added to replace the mislabelled meter under PCM 82-265. Florida Power and Light Company intends no further action on this item.

### 3.4.2 SCHEDULED COMPLETION DATES FOR STANDARDIZED BACKFIT SOLUTIONS

This section provides the currently schedules completion dates for the Turkey Point Standardized Backfit Program.

| PROGRAM | COMPLETION DATE |
|---|---|
| 1. Labeling | July, 1985 |
| 2. Demarcation | July, 1986 |
| 3. Annunciator Review | July, 1985 |
| a) Hardware Installation | 1st Refueling Outage |
| 4. Coding Convention | July, 1985 |
| 5. Engineering Intergration Review * | May, 1984 |
| a) Dispositioned | |
| 1) Unit 3 Complete | December, 1984 |
| 2) Unit 4 Complete | June, 1984 |
| b) Dispostion Pending | |
| 1) Unit 3 Outage of Completion | March, 1985 |
| 2) Unit 4 Outage of Completion | October, 1985 |
| 6. Administrative and Training | July, 1984 |

*NOTE: Refer to Section 3.2.5 of this report for a list of those engineering intergration review items scheduled for installation during the units next refueling outage and those items remaining to be reviewed, dispositioned and reported on by March 1, 1986.

## 3.5 IMPLEMENTATION PROGRAM TRACKING SYSTEM AND SUMMARY REPORT

The Human Factors Implementation Program Tracking System data base has been developed for the purposes fo maintainng a:

- o Inventory Control
- o Status Update
- o Open Items List
- o Project History

### 3.5.1 INVENTORY CONTROL

The implementation Program Tracking System will account for a file of records, which are documented Human Engineering Discrepancies complied from an audit performed by Essex Corp. in collaboration with Florida Power and Light Company. These records are a brief synopsis of each Human Engineering Discrepancy containing:

1. A unique FP&L control file numbering system.
2. Human Engineering Discrepancy number based on a "as found" descrepancy .with reference to the NUREG-0700 'indexing format.
3. Identity of the general area or location in the plant were the problem exists.
4. Responsible lead for work being done.
5. A brief description of descrepancy.

### 3.5.2 STATUS UPDATE

The Implementation Program Tracking System will maintain status of each Human Engineering Discrepancies which will be within a status block designated for status (or progress) information, and will provide a current work history (or synopsis) of each controlled item.

### 3.5.3 OPEN ITEM LIST DEVELOPMENT

When inventory control and status updates are made, the Implementation Program Tracking System provides project management with a current "Open Items List", and will enable effective and systematic "closing" of each item.

Continued on next page.

The items that were completed have the associated Plant Change Modification number listed where applicable, and are included in the Implementation Program Tracking System for accountability and historical reasons.

### 3.5.4 PROJECT HISTORY

Upon completion of the task, this document will provide a project work history for reference purposes, and can be used at any point in time as an index for resolutions and applications for the work done during Human Factors Implemenation Program.

The intent of the Implemenation Program Tracking System is to provide project management and support work organization groups with an effective means of coordinating and facilitating the Human Factors work effort. The up-date of the Implementation Program Tracking System will be done on a "as needed" basis.

### 3.5.5 PROGRAM INDEX AND LISTING

The following computerized listing is the index and listing of Florida Power and Light Company Turkey Point Units 3 and 4 detailed control room design review implementation program tracking system. (See Appendix 1).

## APPENDIX 1

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|---|---|---|---|---|---|---|
| 0001 HF-0005 | 6.1.1.2B | G | CLSD | SEE STATUS | INADEQUATE PLANNING - NEED ADDITIONAL PERSONNEL UNDER EMERGENCY CONDITIONS | PROCEDURES CURRENTLY UNDER REVIEW AND ARE BEING REVISED BASED ON TEST RESULT CRITIQUE CALL OUT TEST L-82-303 |
| 0002 HF-0010 | 6.1.1.2A | G | CLSD | EPP-JUSTIF | NEED ADDITIONAL CR OPERATORS DURING TRANSIENTS. THERE ARE 3 CR OPERATORS, 1 WATCH ENGINEER, AND 1 SHIFT SUPERVISOR FOR BOTH UNITS. | STAFFING IS ADEQUATE AND MEETS TECH SPEC REQUIREMENTS. THE WATCH ENGINEER AND SHIFT SUPERVISOR MAY ASSIST IF NECESSARY |
| 0003 HF-0015 | 6.1.1.3A | G | CLSD | EPP-JUSTIF | OPERATOR MUST TURN AROUND TO SEE NIS PANEL AND HE MUST SWIVEL CHAIR TO SEE THE END OF VERTICAL PANEL B | NO ACTION REQUIRED. THE NIS SETPOINTS ARE ANNUNCIATED ON THE MAIN BOARDS. INDICATORS FOR FLUX DIFFERENTIAL ARE ON MAIN BOARDS. |
| 0004 HF-0020 | 6.1.1.3C,D | G | CLSD | PRO | ROPE BARRIERS IN CR ARE TRIPPING HAZARDS AND OBSTALES. | CR LAYOUT IS BEING MODIFIED AND ROPES WILL EVENTUALLY BE REMOVED WHEN CR IS FINISHED. |
| 0005 HF-0025 | 6.1.1.3[illegible] | [illegible] | CLSD | EPP-JUSTIF | WALKSPACE BETWEEN CONSOLE AND VERTICLE PANEL A IS ONLY 38 INCHES WIDE MAKING 2 PERSON PASSAGE DIFFICULT . 50 INCHES IS RECOMMENDED | NO FURTHER ACTION INTENDED. CURRENT CONFIGURATION MAKES BEST USE OF AVAILABLE SPACE. A HANDRAIL IS INSTALLED TO PROTECT AGAINST ACCIDENTAL ACTIVATION |
| 0006 HF-0030 | 6.1.1.[illegible] | G | CLSD | PCM82-[illegible] | SHIFT SUPERVISOR AND WATCH ENGINEER HAVE INADEQUATE VISUAL AND AUDIBLE CONTACT WITH PRIMARY AREA OF CR | CR IS BEING MODIFIED TO MINIMIZE THE PROBLEM. OBSERVATION AREA EXTENDED INTO CR AND INCORPORATION OF INTERCOM SYSTEM |
| 0007 HF-0035 | 6.1.2.[illegible] | [illegible] | CLSD | PCM82-[illegible] | EXIT DOOR HANDLE IS 72 INCHES ABOVE THE DOOR CAUSING THE OPERATOR TO STOOP TO REACH IT | DOOR CHANGED W/ CONTROL RM MODIFICATION |
| 0008 HF-0040 | 6.1.1.3A | 1 | CLSD | EPP-JUSTIF | RCS FLOW AND STM FLOW DISPLAYS ARE NOT VISIBLE FROM THE CONTROL RM OPERATOR'S DESK DUE TO OBSTRUCTIONS. | INCORPORATION OF "SAS" IN CONJUNCTION WITH EXISTING REDUNDANT INDICATION MINIMIZES THE POTENTIAL FOR OPER. ERROR. NO FURTHER ACTION INTENDED. |
| 0009 HF-0045 | 6.1.1.3G | G | CLSD | EPP-JUSTIF | UNGUARDED OPENINGS IN PANELS WHERE EQUIPMENT HAS BEEN REMOVED | HOLES ARE REPAIRED AS WORK IS COMPLETED EXISTING HOLES ARE DUE TO CR WORK IN PROGRESS. |

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| (A)14 | (B)10 | (C)4 | (D)4 | (E)10 | (F)40 | (G)40 |
| 0010 HF-0050 | 6.1.1.5F | G | 2C | ADMIN | NO INVENTORY IS KEPT ON SPARE PARTS CAUSING DELAYS | INVESTIGATE PROVIDING A FULL OR PART-TIME CLERK TO SUPPORT MAINTAINING CONSUMBALE INVENTORY AS WELL AS ASSIST IN ROUTING DOCUMENTS |
| 0011 HF-0055 | 6.1.2.2B.C | G | CLSD | EPP-JUSTIF | SEVERAL CONTROLS ARE NOT WITHIN THE EXTENDED REACH ENVELOPE OF THE FIFTH PERCENTILE FEMALE | NO ACTION. A HANDRAIL IS PROVIDED ON THE BENCHBOARD SUCH THAT THE OPERATOR COULD USE IT TO SUPPORT THEMSELVES IF NEEDED |
| 0012 HF-0060 | 6.1.2.2E1 | 6 | CLSD | EPP-JUSTIF | NMC IODINE PARTICULATE METER DISPLAY IS LOCATED OUTSIDE OF THE UPPER LIMIT OF THE VISUAL FIELD AND CANNOT BE READ ACCURATELY WITHOUT USING A FOOTSTOOL | NO ACTION INTENDED. THIS DISPLAY IS THE SECOND BACKUP TO THE PRIMARY INSTRUMENTS |
| 0013 HF-0065 | 6.1.2.2G | 3 | CLSD | EPP-JUSTIF | CONSOLE KICKSPACE IS 3 INCHES BY 3.75 INCHES RATHER THAN RECOMMENDED 4 BY 4 INCHES | DELETED. GUARDRAIL EXTENDS EDGE OF CONSOLE 3 INCHES PROVIDING ADEQUATE KICKSPACE |
| 0014 HF-0070 | 6.1.2.3C | A | CLSD | EPP-JUSTIF | NO KNEE HOLE IN COMPUTER CONSOLE DUE TO USE OF A CHART TABLE WITH DRAWERS USED TO PLACE PRINTER ON | THE SUBJECT AREA IS NOT INTENDED AS A SIT DOWN DESK HOWEVER THIS ITEM IS UNDER REDESIGN AS PART OF CR UPGRADE AND SAS/ICC AND COMMUNICATION CONSOLE WORK |
| 0015 HF-0075 | 6.1.2.5A1 | G | CLSD | EPP-JUSTIF | SEVERAL CONTROLS ARE LOCATED BELOW 34 INCHES ON THE VERTICLE PANELS CAUSING THE OPERATOR TO STOOP TO OPERATE THEM | NO ACTION INTENDED DUE TO THE LOW FREQUENCY OF USE OF THE SUBJECT CONTROLS |
| 0016 HF-0080 | 6.1.2.5A1 | [illegible] | CLSD | EPP-JUSTIF | CONTROLS REQUIRING PRECISE OPERATION ARE MOUNTED OUTSIDE THE RECOMMENDED 34 TO 53 INCHES ABOVE THE FLOOR. SOME ARE OUTSIDE THE REACH OF THE FIFTH PERCENTILE FEMALE | PANELS ARE PRESENTLY BEING REDESIGNED DUE TO AVAILABLE SPACE. SOME CONTROLS WILL BE LOCATED AT THE UPPER LIMITS OF THE 5TH PERCENTILE FEMALE |
| 0017 HF-0085 | 6.1.2.5B1 | G | CLSD | EPP-JUSTIF | STRIP CHART DISPLAYS ARE LOCATED BELOW 41 INCHES ON THE VERTICAL PANEL CAUSING THE OPERATOR TO STOOP TO READ THEM AND POSSIBLE PARALLAX PROBLEMS | THESE CHARTS PROVIDE TREND AND HISTORICAL INFORMATION. LOW FREQUENCY OF USE AND LOW PRIORITY ITEMS. NO FURTHER ACTION INTENDED |
| 0018 HF-0090 | 6.1.2.5B1 | 1,2 | 2A | PRO | SEVERAL DISPLAYS ARE LOCATED ABOVE 70 INCHES ON THE VERTICLE PANEL CAUSING THE OPERATOR TO STRETCH TO READ THEM AND POSSIBLE PARALLAX PROBLEMS | AS A RESULT OF SAS WORK THESE ITEMS WILL BE CONSOLIDATED. ESSEX REVIEW CONCLUDES PROBLEM SHOULD BE CORRECTED FOR HIGH USE AND ESSENTIAL TO SAFETY DEVICES |

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|---|---|---|---|---|---|---|
| 0019 HF-0095 | 6.1.2.8E | 7 | CLSD | EPP-JUSTIF | CHAIR SEAT DEPTH IS 21 INCHES. RECOMMEND 15 TO 17 INCHES DEEP | NO ACTION |
| 0020 HF-0100 | 6.1.3.1F2 | 13 | CLSD | EPP-JUSTIF | AREA RADIATION MONITOR IS LOCATED AT THE END OF THE UNIT 3 DISPLAYS. THE STATUS OF THIS EQUIPMENT SHOULD BE DISPLAYED IN ALL CRS CAPABLE OF CONTROLLING IT | THIS ITEM IS BEING SUPPLEMENTED BY SAS INFORMATION WILL BE AVAILABLE ON UTILITY SCREENS IN BOTH CONTROL ROOMS. NO FURTHER ACTION |
| 0021 HF-0105 | 6.1.5.1A | G | CLSD | PCM#82-60 PCM#81-117 | 3 AC UNITS ARE AVAILABLE TO COOL THE CR IF ONE FAILS THE REMAINING UNITS CANNOT ADEQUATELY COOL THE EQUIPMENT AND PERSONNEL. EQUIPMENT OVERHEATS | THIS ITEM IS BEING REVIEWED AS PART OF CR UPGRADE, ICC AND CR HABITABILITY |
| 0022 HF-0110 | 6.1.1.4B1- | G | CLSD | PO#202278 | "ISAR", EMERGENCY AND NORMAL OPERATING PROCEDURES ARE IN POOR CONDITION AND NOT EASY TO USE. INDEXED BY SIX DIGIT NUMBER. | A SECOND SET IS CENTRALLY LOCATED IN A CABINET IN THE CR. COLOR CODING WILL BE USED. BINDERS AND SHELF SPACE WILL BE REVIEWED AS PART OF CR UPGRADE |
| 0023 HF-0115 | 6.1.3.1F2 | 2 | [illegible] | SEE STATUS | NO INDICATION FOR RCP VIBRATION EXISTS ON UNIT 4. THIS PARAMETER NEEDS TO BE MONITORED ON BOTH UNITS | RECORDERS SPLIT. UNIT 4 TO BE COMPLETED DURING 1983 OUTAGE. PCM 82-264 UNIT 3 NOV. 83 CCM 82-264 UNIT 4 COMPLETE |
| 0024 HF-0120 | 6.1.3.2 | 2 | T/A | ESK | PARTIAL MIRROR IMAGING OF UNITS 3 AND 4 VERTICAL PANELS CREATES PROBLEMS IN FUNCTIONAL GROUPING OF COMPONENTS OR RELATED SYSTEMS ACROSS PANELS | TASK ANALYSIS RECOMMENDED |
| 0025 HF-0125 | 6.1.4.1A-H | G | CLSD | EPP-JUSTIF | STORAGE LOCATION OF PROTECTIVE EQUIPMENT IS PARTIALLY OBSTRUCTED BY RELAY RACKS ALLOWING INSUFFICIENT ROOM TO DRESS AND BREATHING APPARATUS. LIMITED TRAINING | OPERATORS CURRENTLY MEET TRAINING AND PROFICIENCY REQUIREMENTS FOR USE OF EMERGENCY EQUIPMENT EXEMPLIFIED BY THEIR RED BADGE STATUS |
| 0026 HF-0130 | 6.1.4.2 | G | CLSD | PWO#156302 PWO#156303 | FIRE EXTINGUISHERS ARE IMPROPERLY MOUNTED OR NOT EASILY ACCESSIBLE. ALL OPERATORS ARE NOT PROPERLY TRAINED IN THE USE OF FIRE EQUIPMENT | EXTINGUISHERS WILL BE CORRECTLY HUNG AND ADDITIONAL ONES EVALUATED AND PLACED AS REQUIRED. OPS TO FOLLOW UP WITH FIRE TRAINING |
| 0027 HF-0135 | 6.1.4.5B | G | CLSD | PWO# | LABELING OF STORAGE LOCKER FOR TEST AND COMMUNICATION EQUIPMENT FOR REFUELING DOES NOT ADEQUATELY DESCRIBE ITS CONTENT | RECOMMENDED RELABELING |

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| 0028 HF-0140 | 6.1.5.1A | G | CLSD | EPP-JUSTIF | AMBIENT TEMP. OF APPROX. 70 DEGREES FARENHEIT IS TOO COOL FOR COMFORT IN THE CONTROL ROOM. | NO ACTION |
| 0029 HF-0145 | 6.1.5.2B | G | CLSD | PWO#237534 | DRAFTS FROM VENTILATION OF 50 TO 150 FPM WERE MEASURED AT HEAD LEVEL. AIR VELOCITIES IN THIS AREA SHOULD NOT EXCEED 45 FPM. | RECOMMENDED SITE ENGINEERING EVALUATE THE DIFUSER |
| 0030 HF-0150 | 6.1.5.3A | G | 2A | EPP PCM#82-114 | CR AMBIENT LIGHTING IS BRIGHTER THAN RECOMMENDED 75 FC ON OPERATORS DESK, MAXIMUM RECOMMENDED ON MAIN CONSOLES, VPB PANELS, EMERGENCY LIGHTING TOO DIM | TO BE CORRECTED BY PROJECTS/POWER RESOURCES |
| 0031 HF-0155 | 6.1.5.7C | G | CLSD | PCM#82-114 | THERE ARE NO FACILITIES FOR OPERATORS TO USE FOR BREAKS OR EATING. PROCEDURES FOR RELIEF (POST NAME CARD) ARE CUMBERSOME | ADDITIONAL TOILET FACILITIES ARE BEING ADDED. CR IS BEING MODIFIED TO REDUCE TRAFFIC AND ALLOW OPERATORS BETTER ACCESS TO EXISTING FACILITIES |
| 0032 HF-0160 | 6.1.5.7A | G | CLSD | PCM#82-114 | WHITE NOISE FROM PLANT, MONOTONY OF WHITE AND GREY COLOR, BRIGHT LIGHTS AND TILE FLOORS ARE RELATED TO OPERATOR FATIGUE | PROBLEM REVIEWED AS PART OF CONTROL ROOM UPGRADE AND DECOR IMPROVED |
| 0033 HF-0165 | 6.1.5.3F | G | CLSD | EPP-JUSTIF | COUNTER WINDOW REFLECTS LIGHT FROM ABOVE CAUSING GLARE | LOCAL REDUNDANT INDICATION MINIMIZES POTENTIAL OPERATOR ERROR. NO ACTION REQUIRED |
| 0034 HF-0170 | 6.1.5.3H | G | CLSD | EPP-JUSTIF | REFLECTANCE IS BELOW OR ABOVE GUIDELINES ON THE FOLLOWING EQUIPMENT: PANELS, WALLS, FLOORS AND WHITE BLOTTERS ON OPERATORS DESK | NO ACTION REQUIRED |
| 0035 HF-0175 | 6.1.1.4A | G | CLSD | PCM#82-114 | INADEQUATE AND IMPROPER USE OF STORAGE SPACE FOR BOOKS, PROCEDURES, LOGS, SPARE PARTS AND COFFEE SUPPLIES | CR MODIFICATIONS, NEW DESIGN WILL INCORPORATE EFFICIENT USE OF AVAILABLE STORAGE SPACE |
| 0036 HF-0180 | 6.1.1.5 | G | CLSD | PCM#82-114 | COMPUTER PRINTER PAPER IS STORED IN BOX ON FLOOR AND NOT RESTOCKED ENOUGH CAUSING OPERATORS TO TURN PAPER OVER AND REUSE IT | PRESENTLY CONTROL ROOM IS BEING UPGRADED PRINTERS WILL BE RELOCATED AND LOGISTIC FACTORS WILL BE ADDRESSED DURING REDESIGN |

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|---|---|---|---|---|---|---|
| 0037 HE-0189 | 6.1.1.5E | N/A | CLSD | FPP-JUSTIF | THIS HED WAS CORRECTLY FILED UNDER SECTION 6.5 FILE NO.86. | REFER TO SECTION 6.5 FILE NO.86 DELETED (DUPLICATED) |
| 0038 HE-0190 | 6.1.1.5E | N/A | CLSD | FPP-JUSTIF | THIS HED WAS CORRECTLY FILED UNDER SECTION 6.5 FILE NO.87. | REFER TO SECTION 6.5 FILE NO.87. DELETED (DUPLICATED) |
| 0039 HE-0195 | 6.1.2.3E | 7 | CLSD | PCM#82-114 | N'S PHONE LAYOUT IS=POOR. PHONES ARE DIFFICULT TO REACH FROM SEAT | PRENTLY OFFICES ARE BEING UPGRADED AND PHONE DIRECTORY IS BEING REVISED. NO ACTION REQUIRED |
| 0040 HE-0200 | 6.1.3.1E | 7 | CLSD | FPP-JUSTIF | EACH UNIT HAS ITS OWN PHONE LINE. AN OPERATOR FOR UNIT 3 RECIEVING A CALL ON THE UNIT 4 PHONE HAS TO GO TO UNIT 4 TO ANSWER THE CALL | PHONE SYSTEM IS BEING UPGRADED HOWEVER CALLERS MUST CALL THE CORRECT UNIT. NO FURTHER ACTION INTENDED |
| 0041 HE-0205 | [illegible] | [illegible] | CLSD | [illegible] | EMERGENCY EQUIPMENT IS STORED IN THE BACK ROOM. DOOR DOES NOT OPEN ENTIRELY AND REQUIRES TWO POORLY LABELED KEYS. PROLONGED ACCESS TIME. NOWHERE TO DRESS | ADMINISTRATIVE CONTROLS REQUIRE LOCKS CLOTHING DONNING IS NOT AN IMMEDIATE ACTION. CAN SUIT UP IN TIME TO SUPPORT REQUIRED TASKS. INVESTING USE OF SEALS |

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| 0001 HF-0210 | 6.2.1.1C | 7 | 3 | OPS | NO PRIORITIES OR SEQUENCE OF USE PROCEDURES FOR COMMUNICATION EQUIPMENT ARE GIVEN FOR NORMAL AND EMERGENCY CONDITIONS. SHOULD BE NEAR EQUIPMENT | PRESENTLY HARDWARE IS UNDER REVIEW AND WHEN MODIFIED PROCEDURES WILL BE UPGRADED TO REFLECT EXISTING SYSTEM |
| 0002 HF-0215 | 6.2.1.2B6 | 7 | CLSD | PCM#82-114 | HANDSET CRADLES ARE NOT DESIGNED OR LOCATED TO PREVENT HANDSET FROM BEING KNOCKED OUT OF THE CRADLE BY PASSING TRAFFIC | THIS ITEM WILL BE CORRECTED AS PART OF COMMUNICATION UPGRADE |
| 0003 HF-0220 | 6.2.1.2B7 | 7 | 3 | OPS | INCONSISTENT COLOR CODING USED FOR PHONE SETS. | COLOR CODING AND/OR LABELING WILL BE INCORPORATED |
| 0004 HF-0225 | 6.2.1.3C2 | G | CLSD | EPP-JUSTIF | THERE IS NO CAPABILITY FOR DIRECTLY SWITCHING THE SOUND POWERED PHONE TO THE PAGING SYSTEM SO THAT A DESIRED PARTY CAN BE CALLED TO THE LINE | REVIEW OF PROCEDURES AND PLANT REQUIREMENTS INDICATE THAT NO RING AND PAGE INTERITE IS REQUIRED. NO ACTION. |
| 0005 HF-0230 | 6.2.1.3B1 | G | 2A | OPS PHO#156301 | SOUND POWERED PHONE HEADSETS ARE NOT COMFORTABLE AND LET OUTSIDE NOISE INTERFERE WITH COMMUNICATIONS. HEADSET GETS TANGLED UP IN CORD | HEADSETS WILL BE REPLACED AND STORAGE OF EXTENSION CORDS WILL BE RE-EVALUATED |
| 0006 HF-0235 | 6.2.1.6F-A | G | 2C | PRO | ONLY ONE PAGE LINE IS SHARED BY CONSTRUCTION AND OPERATIONS CREATING NOISE IN CR. CONSTRUCTION DOES NOT CLEAR LINE IN EMERGENCY. EQUIPMENT OFTEN BROKEN | PAGE SYSTEM REVIEW FOR UPGRADE FEASIBILITY RECOMMENDED |
| 0007 HF-0240 | 6.2.1.6E1 | G | 2C | PRO | NO PAGE SPEAKERS ARE LOCATED IN KITCHEN OR BATHROOM TO PAGE PERSONNEL ON BREAK. SHOULD BE SEPERATE SYSTEM DEDICATED TO SHIFT SUPERVISOR | PRESENTLY THE COMMUNICATION IN THE CR IS BEING UPGRADED AS WELL AS THE NDS OFFICE |
| 0008 HF-0245 | 6.2.1.7B | 7 | 2C | OPS | VOLUME ON DISPATCH SPEAKERS SHOULDN'T BE ABLE TO BE TURNED ALL THE WAY OFF. POSSIBLE MISSED COMMUNICATIONS. | FURTHER REVIEW BY OPS |
| 0009 HF-0250 | 6.2.1.8B,C | G | CLSD | PCM#81-118 | NO MEANS OF CLEAR TRANSMITION THROUGH MASK/RESPIRATOR. DIAL PHONES DIFFICULT TO USE WITH GLOVES ON | SPEACH INTELLIGIBILITY TEST WITH SPEAKEASY TRANSDUCER WAS ACCEPTABLE |

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| 0010 HF-0255 | 6.2.2.1B | 3 | CLSD | PCN#82-114 | PHONES LACK ADEQUATE AUDIBLE CODING TO AID IN DISTINCTION OF THE DIFFERENT COMMUNICATIONS DEVICES | THIS ITEM IS TO BE ADDRESSED AS PART OF CONTROL ROOM MODIFICATIONS AND UPGRADE OF COMMUNICATION SYSTEM TIE WITH FILE 3 SECTION 6.2 |
| 0011 HF-0260 | 6.2.1.1A | G | CLSD | FPP-JUSTIF | NON-STANDARD TERMINOLOGY USED DURING PHONE CONVERSATIONS EMERGENCY SITUATION RADIO MESSAGES WITHOUT CALL OR CONFIRMED SIMULTANEOUS USE OF DEVICES ATTEMPTED | IT IS UP TO THE OPERATOR TO ASK FOR THE MESSAGE TO BE REPEATED IF IT IS NOT UNDERSTANDABLE. ACCEPTED TERMINOLOGY - PLANT SPECIFIC SLANG IS USED. NO ACTION |
| 1012 HF-0265 | 6.2.1.1B | G | CLSD | FPP-JUSTIF | OPERATORS MUST COVER ONE EAR TO HEAR CONVERSATION ON PHONE. BACKGROUND NOISE IS TOO HIGH OR SIGNAL INTENSITY IS TOO LOW | RESPONSIBILITY OF OPERATOR TO REQUEST OTHER PERSONNEL TO QUIET DOWN. DURING TRANSIENTS OPERATORS HAVE CONTROL OF BACKGROUND NOISE. NO ACTION INTENDED |
| 1013 HF-0270 | 6.2.1.pA | G | CLSD | FPP-JUSTIF | HIGH BACKGROUND NOISE IS TRANSMITTED THROUGH SECURITY INTERCOM AND EMERGENCY MESSAGES WERE INTERRUPTED BY NON-VITAL COMMUNICATIONS | THIS ITEM WAS CORRECTED WHEN INTERCOM STATIONS RELOCATED. NO EXCESSIVE BACKGROUND NOISE PRESENT AT THIS TIME |
| 0014 HF-0275 | 6.2.2.2A | G | CLSD | FPP-JUSTIF | NUCLEAR PLANT SUPERINTENDENT AND WATCH ENGINEER'S PHONES SOUND IDENTICAL, NO CODING | NO ACTION |

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| 0001 HF-0285 | 6.3.1.2A1 | 13 | CLSO | EPP-JUSTIF | THE CR HIGH RAD ALARM IS SET OFF WHEN THE POWER IS SWITCHED OFF AND ON TO THE ASSOCIATED PANEL. THE OPERATOR DOES NOT ALWAYS WARN CR PERSONNEL. | THIS ITEM IS ADMINISTRATIVELY CONTROLLED. EFFORTS WILL BE MADE TO WARN CR PERSON-NEL WHEN THE PANEL IS TURNED OFF AND ON. |
| 0002 HF-0290 | 6.3.1.2A1 | G | CLSO | SEE STATUS | THERE ARE SEVERAL ALARMS THAT OCCUR SO FREQUENTLY THAT THEY BECOME A NUISANCE AND THE OPERATORS DISCONNECT THEM. | THE NUSIANCE ALARMS ARE BEING REVIEWED. THEIR CAUSE WILL BE CORRECTED BY ELIMIN-ATING ALARMS THAT ARE NOT NEEDED. A.P. 0103.2 PG.10 8.1.6 |
| 0003 HF-0295 | 6.3.1.2A1 | G | CLSO | SEE STATUS | FALSE FIRE ALARMS IN CONTAINMENT ARE CAUSED BY STEAM AND HUMIDITY. | THE FIRE ALARMS HAVE BEEN CORRECTED SO THAT THEY ARE NO LONGER MOISTURE SENSI-TIVE. ITEM CLOSED. LER 250-83-11 |
| 0004 HF-0300 | 6.3.1.2B1. | G | CLSO | EPP-JUSTIF | THERE ARE SEVERAL DUAL ANNUNCIATOR WINDOWS. | DUAL ALARMS ARE USED ON RELATED FUNC-TIONS WHEN OPERATOR RESPONSE TIME IS SUFFICIENT TO DETERMINE THE CAUSE. ITEM CLOSED |
| 0005 HF-0305 | 6.3.1.2C1. | G | 2C | PRO | SOME ALARM WINDOWS WITH MULTIPLE INPUTS DO NOT HAVE REFLASH. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED. SIGNIFICANT PROBLEMS WILL BE CORRECTED. |
| 0006 HF-0310 | 6.3.1.3A1 | G | 2C | PRO | REACTOR TRIP AND TURBINE FIRST OUT ANNUNCIATORS ARE GROUPED WITH NON-TRIP ALARMS. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED. |
| 0007 HF-0315 | 6.3.1.4 | G | 2C | PRO | THERE IS NO PRIORITIZATION OF VISUAL ALARMS. THERE IS NO AUDIABLE DIFFEREN-TIATION OF ALARMS. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED. |
| 0008 HF-0320 | 6.3.1.5 | G | CLSO | EPP-JUSTIF | THERE IS NO AUDIBLE SIGNAL OR LIGHTED FLASH OR COLOR CODING OF A CLEARED ALARM. | THE ALARM CLEARS WHEN THE PARAMETER IS NO LONGER IN ALARM. NO FURTHER INDICA-TION IS REQUIRED. ITEM CLOSED. |
| 0009 HF-0325 | 6.3.2.1F | G | CLSO | PCM#82-264 PCM#82-265 | THERE IS NO FREQUENCY CODING TO DIFFER-ENTIATE BETWEEN ALARMS EXCEPT BETWEEN UNITS 3 & 4. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |

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| 0010 HF-0330 | 6.3.2.1A | G | CLSO | PCM#82-264 | UNIT 3 ALARM IS NOT AUDIBLE OVER THE CONSTRUCTION NOISE NOR OVER THE UNIT 4 ALARM | AN ALARM THAT CAN BE HEARD OVER BACKGROUND NOISE WILL BE INSTALLED. |
| 0011 HF-0335 | 6.3.3.1C1 | G | 2A | PRO | ANNUNCIATOR TILES ARE NOT MARKED WITH MATRIX CODE. THEREFORE TILES COULD BE INTERCHANGED WHEN CHANGING BULBS. | TILES WILL BE ENGRAVED WITH MATRIX LOCATION. |
| 0012 HF-0340 | 6.3.3.1A | G | 2C | EPP | SOME ANNUNCIATOR WINDOWS ARE NOT LOCATED OVER THEIR RELATED CONTROLS. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |
| 0013 HF-0345 | 6.3.3.2B | G | CLSO | EPP-JUSTIF | ANNUNCIATOR FLASH RATE IS 1.5 FLASHES PER SEC. INSTEAD OF 3 - 5 FLASHES. | THE FLASH RATE IS ADEQUATE FOR VISUAL IDENTIFICATION |
| 0014 HF-0350 | 6.3.3.2E | G | CLSO | EPP-JUSTIF | THE ANNUNCIATORS VIOLATE THE DARK BOARD CONCEPT. THE ANNUNCIATORS ARE DIM WHEN NOT IN ALARM AND BRIGHT WHEN IN ALARM. SOME ARE BRIGHT DURING NORMAL OPERATION. | THE ANNUNCIATORS IN ALARM FOR NORMAL OPERATION WILL BE CHANGED. FP&L BELIEVES THAT THE DIM ANNUNCIATOR IS A POSITIVE INDICATION THAT IT IS FUNCTIONAL. |
| 0015 HF-0355 | 6.3.3.2E | G | 2C | EPP | SOME ALARMS ARE NORMALLY ON DURING NORMAL CONDITIONS. | THESE ANNUNCIATORS WILL BE CHANGED. COLOR CODING OR RETURNING ANNUNCIATOR TO CLEARED CONDITION WOULD RESOLVE PROBLEM. |
| 0016 HF-0360 | 6.3.3.3C1 | G | 2C | PRO | ALPHANUMERICS ARE NOT USED TO LABEL THE ANNUNCIATOR WINDOW MATRIX. NUMERICS ALONE ARE USED. THIS COULD CAUSE CONFUSION. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |
| 0017 HF-0365 | 6.3.3.4A | G | 3 | UPS | SOME ANNUNCIATOR LABELS ARE NOT ACCURATELY WORDED AND LABELED CONDITION MAY NOT EXIST WHEN IN ALARM. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |
| 0018 HF-0370 | 6.3.3.4B | G | CLSO | EPP-JUSTIF | SOME ALARMED ANNUNCIATORS REFER THE OPERATOR TO A MORE DETAILED ANNUNCIATOR PANEL OUTSIDE THE PRIMARY OPERATING AREA | THESE ALARMS ARE USED TO CALL ATTENTION TO PROBLEMS OUTSIDE THE PRIMARY OPERATING AREA. THERE IS ADEQUATE TIME TO SEND FIELD PERSONNEL TO WORK AREA. |

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| 0001 HF-0400 | 6.4.1.1B1 | G | 3 | PRO PCM#82-264 PCM#82-265 | SEVERAL CONTROLS ARE NO LONGER USED AND SOME HAVE BEEN DISCONNECTED. THESE CONTROLS SHOULD BE REMOVED. SOME CONTROLS ARE NOT FUNCTIONAL. | CONTROLS NOT NEEDED ON CONTROL BOARDS WILL BE REMOVED. CONTROLS THAT ARE NEEDED BUT NOT FUNCTIONAL WILL BE REPAIRED. |
| 0002 HF-0405 | 6.4.1.1C1 | G | CLSD | EPP-JUSTIF | A FUSE WHICH APPEARS TO BE A ROTARY CONTROL IN BOARD A8 IS NOT CONNECTED TO ANYTHING. | DELETED. |
| 0003 HF-0410 | 6.4.1.1C1 | G | CLSD | PWO# | CONTINUOUS ROTARY SWITCHES ON CONTROLERS ARE USED TO INPUT SETPOINTS AND SOME ARE JUST FOR THE OPERATOR TO VARY WHILE WATCHING THE DISPLAY, BUT NOT MARKED. | THE CONTROLERS WHICH HAVE STATIONARY SETPOINTS WILL BE LABELED. |
| 0004 HF-0415 | 6.4.1.1C2 | G | CLSD | EPP-JUSTIF | SOME VALVE ROTARY CONTROL SWITCHES MUST BE HELD IN THE OPEN POSITION UNTIL THE VALVE OPENS COMPLETELY, BUT THEY ARE NOT MARKED DIFFERENT FROM VALVES THAT DO NOT. | THE OPERATORS HAVE HAD ADEQUATE SYSTEM TRAINING TO KNOW WHAT VALVES ARE OFF-ON CONTROLLED AND WHICH ARE NOT. INVALID - NO ACTION INTENDED (DUPLICATED) |
| 0005 HF-0420 | 6.4.1.1E1 | G | 2C | OPS | SOME LABEL ON CONTROLS HAVE DETERIORATED TO THE POINT THAT THE POSITIONS ARE ALMOST UNREADABLE. | THIS ITEM WILL BE CORRECTED IN THE RELABELING EFFORT. |
| 0006 HF-0425 | 6.4.1.2 | 12 | CLSD | PWO#237529 | CONTROL POWER FUSES FOR THE NI CHANNELS ARE NOT GUARDED NOR DO THEY HAVE INTERLOCKS. IF PULLED THEY WILL TRIP THE PLANT. | GUARDS WILL BE ADDED. |
| 0007 HF-0430 | 6.4.1.2 | G | 2C | I&C | CONTROLLERS THAT THE OPERATOR SHOULD NOT CHANGE THE SETPOINT ARE MARKED WITH A RED DOT. HOWEVER THE ARE INTERSPERSED WITH OTHER IDENTICAL CONTROLERS. | THE CONTROLERS WHICH HAVE STATIONARY SETPOINTS WILL BE LABELED. |
| 0008 HF-0435 | 6.4.1.2B2 | 2 | 2C | OPS | MOVABLE ROTARY CONTROL COVERS SOMETIMES COVER PART OF THE LABEL MAKING THE SAID LABEL HARD TO READ. SOMETIMES THE COVERS ARE PLACED OVER THE WRONG CONTROLS. | FP&L WILL IMPROVE AND REPLACE THE COVERS |
| 0009 HF-0440 | 6.4.2.1 | G | CLSD | EPP-JUSTIF | BREAKERS ARE NOT CONSISTANTLY LABELLED. SOME ARE LABELLED ON-OFF AND SOME ARE TRIP-CLOSE. SOME LABELS INDICATE OPPOSITE DIRECTION OF SWITCH MOVEMENT. | NO BREAKER CONTROLS IDENTIFIED AS OPERATING OPPOSITE TO CONVENTION. REF - HED 6.6.3.2B FILE#0013 INVALID - NO ACTION INTENDED (DUPLICATED) |

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| 0019 HF-0375 | 6.3.3.5A1, | G | 2A | PRO | ANNUNCIATOR WINDOWS ARE SMALL AND LETTER SIZE IS TOO SMALL. LETTER SIZES ARE NOT STANDARD. | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |
| 0020 HF-0380 | 6.3.3.3C | G | 2C | PRO | TEMPORARY NONE ENGRAVED LABELS ARE USED. THESE LABELS OBSCURE OTHER LABELS, DIM THE BRIGHT ALARMED CONDITION, AND SOMETIMES FALL OFF | AN ANNUNCIATOR REVIEW IS BEING CONDUCTED |
| 0021 HF-0385 | 6.3.4.1B | G | CLSD | EPP-JUSTIF | THERE IS ONLY ONE ALARM ACKNOWLEDGE PUSHBUTTON FOR EACH UNIT, IN THE CENTER OF THE BENCHBOARD/CONSOLE. | NO ACTION REQUIRED |
| 0022 HF-0390 | 6.3.4.1D | G | CLSD | EPP-JUSTIF | ANNUNCIATORS USE TWO BULBS. IT IS DIFFICULT TO SEE THE DIFFERENCE BETWEEN A BURNED OUT BULB AND THE DIM (NORMAL) OR BRIGHT (ALARMED) CONDITION. | THE CR OPERATORS CAN DISTINGUISH THE DIFFERENCE OF A BURNED OUT BULB AND DIM STATE OF ANNUNCIATOR ITEM CLOSED. |
| 0023 HF-0395 | 6.3.4.2B4, | G | CLSD | EPP-JUSTIF | NO SHAPE CODING IS USED TO DIFFERENTIATE BETWEEN ALARM SILENCE AND ACKNOWLEDGE PUSH BUTTONS. PUSHBUTTONS CAN BE DEFEATED. | SHAPE CODING NOT REQUIRED SINCE CLEARLY LABELED. DEFEAT OF CONTROLS ARE ADMINISTRATIVELY CONTROLED |

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| 0010 HF-0445 | 6.4.2.1 | G | 2C | OPS | SEVERAL CONTROLLERS ARE LABELLED 0-100% WHERE 100% MEANS CLOSED FOR SOME AND WHERE 100% MEANS OPEN FOR OTHERS. | THIS ITEM WILL BE CORRECTED DURING THE THE RELABELING EFFORT. |
| 0011 HF-0450 | 6.4.2.1 | 13 | CLSD | EPP-JUSTIF | THE PUMP AND FILTER CONTROLES FOR THE RADIATION MONITOR ARE NOT CONSISTANT WITH OTHER CONTROL SWITCH CONVENTIONS.. | THESE SWITCHES ARE CLEARLY LABELLED AND ARE EXCEPTIONS TO THE NORMAL CONVENTIONS THEREFORE NO ACTION IS INTENDED. ITEM CLOSED |
| 0012 HF-0455 | 6.4.2.2F3. | G | CLSD | EPP-JUSTIF | SOME SMALL SILVER THUMB ROTARY SWITCHES DO NOT CONTRAST SUFFICIENTLY WITH THE PANEL BACKGROUND. | ERROR PROBABILITY IS VERY SMALL SINCE OPERATOR OBSERVES A DEVIATION OR OTHER INDICATOR OR SETPOINT IS FIXED. |
| 0013 HF-0460 | 6.4.2.2F3 | G | CLSD | EPP-JUSTIF | KEYSWITCH CONTROLS DO NOT SUFFICIENTLY CONTRAST WITH THE PANEL. THEY ARE SILVER AND THE PANEL IS GREY. | THIS DOSE NOT CAUSE A PROBLEM. NO FURTHER ACTION INTENDED |
| 0014 HF-0465 | 6.4.2.2F3 | G | CLSD | EPP-JUSTIF | TOGGEL SWITCHES ARE SILVER AND THE PANEL BOARD IS GREY. | NO FURTHER ACTION INTENDED |
| 0015 HF-0470 | 6.4.2.2F3 | G | CLSD | PWO# | ROTARY SWITCHES ON NI PANELS ARE BLACK AND MOUNTED ON A LARGE BLACK LABEL. THE CONTRAST IS INSUFFICIENT. | THIS WILL BE LOOKED AT DURING THE RE-LABELLING PROGRAM. |
| 0016 HF-0475 | 6.4.3.18 | G | CLSD | EPP-JUSTIF | THERE IS NO AUDIBLE OR TACTILE FEEDBACK FOR PUSHBUTTON SWITCHES. | THE PUSHBUTTON SWITCHES INITIATE AN ACTION PROCESS. OTHER INSTRUMENTATION, ALARMS, OR COMPUTER PROVIDES FEEDBACK. |
| 0017 HF-0480 | 6.4.3.1C | 12 | CLSD | EPP-JUSTIF | AREA RAD MONITOR PUSHBUTTONS ARE NOT CONCAVE OR FRICTIONALIZED TO INCREASE RESISTANCE. | NO ACTION REQUIRED |
| 0018 HF-0485 | 6.4.3.3A | 12 | CLSD | EPP-JUSTIF | SOME RAD MONITOR PUSHBUTTONS LOOK LIKE INDICATOR LIGHTS, SINCE THEY ARE THE SAME SIZE AND DESIGN. | FP&L PERSONNEL REVIEWED THIS FINDING AND FOUND THE LIGHTS AND SWITCHES TO BE EASILY DISTINGUISHABLE |

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| 0019 HF-0490 | 6.4.3.3C | 12 | CLSD | EPP-JUSTIF | IT IS NOT POSSIBLE TO CHANGE BULBS IN AREA RAD MONITOR PUSHBUTTONS WITHOUT ACTIVATING THE CONTROL AND SETTING OFF RAD ALARMS. | THIS ITEM WILL BE ADMINISTRATIVELY CONTROLLED. THE OPERATOR WILL NOTIFY PERSONNEL OF THESE FALSE ALARMS. |
| 0020 HF-0495 | 6.4.4.1 | G | 2C | PWO#237503 PWO#237539 | SEVERAL ROTARY SWITCHES DO NOT MOVE CLOCKWISE TO INCREASE. | THESE SWITCHES WILL BE CORRECTED. |
| 0021 HF-0500 | 6.4.4.1 | G | 2C | OPS SEE STATUS 40,42,43 | SEVERAL ROTARY SWITCHES DO NOT MOVE CLOCKWISE TO INCREASE. | THESE SWITCHES WILL BE CORRECTED. PWO#'S- 237504, 237540, 237542, 237543 |
| 0022 HF-0505 | 6.4.4.1 | 1 | 2C | EPP PWO#237539 | CV-4-3722 SWITCH MOVES CLOCKWISE TO CLOSE | THIS SWITCH WILL BE REWIRED. |
| 0023 HF-0510 | 6.4.4.2A | G | CLSD | EPP-JUSTIF | J HANDLE ROTARY CONTROLS ARE 2.25 IN. LONG (1.5 IN. SHORTER THAN RECCOMENDED) J HANDLE CLEARENCE IS 2.33 IN WHEN PULLED TO LOCKOUT INSTEAD OF 1 TO 2 IN. | NO ACTION REQUIRED. |
| 0024 HF-0515 | 6.4.4.3B | G | CLSD | EPP-JUSTIF | KEY OPERATED CONTROLS ARE NOT MOUNTED SO THAT KEYS ARE INSERTED WITH THEIR TEETH POINTING UP. | NO ACTION REQUIRED |
| 0025 HF-0520 | 6.4.4.3D | G | CLSD | EPP-JUSTIF | KEY CONTROLS ARE NOT MOUNTED SO THAT THE KEY IS VERTICLE WHEN REMOVED. | NO ACTION REQUIRED |
| 0026 HF-0525 | 6.4.4.E1 | G | CLSD | EPP-JUSTIF | CONTINUOUS ROTARY SWITCHES WITH KNOB SKIRTS HAVE A SKIRT OF 1 IN. DIAMETER INSTEAD OF 2 IN. | THIS DOES NOT IMPARE OPERATOR PERFORMANCE. |
| 0027 HF-0530 | 6.4.4.E5 | G | CLSD | EPP-JUSTIF | KNOBS ON CONTINUOUS ROTARY SWITCHES HAVE LESS THAN A 0.5 IN DIAMETER INSTEAD OF 0.75 IN. | DIAMETER IS ADEQUATE FOR OPERATORS. |

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| 0028 HF-0535 | 6.4.4.5B2 | G | CLSD | EPP-JUSTIF | DISCRETE ROTARY SWITCHES MAY BE POSITIONED BETWEEN DETENTED POINTS. | SOME SWITCHES DO HAVE REST POSITIONS BETWEEN DETENTS. CALIBRATION PROCEEDURES ADDRESS THESE SWITCHES. |
| 0029 HF-0540 | 6.4.4.5D1 | 12 | 3 | I&C | ROTARY SWITCHES ON NI CHANNELS WERE PROVIDED WITH A PAINTED LINE ON THE KNOB SKIRT. THE PAINT HAS CHIPPED OFF ON SOME SWITCHES AND SOME ARE ABOVE EYE LEVEL. | THESE SWITCHES WILL BE CORRECTED. |
| 0030 HF-0545 | 6.4.3.5B3 | G | CLSD | EPP-JUSTIF | LEGEND LETTERING AND CONTRAST IS NOT ADEQUATE DUE TO COLLECTED DIRT AND WEAR ON PUSHBUTTONS. | GENERAL HOUSE KEEPING DURING NORMAL MAINTENANCE WILL CORRECT THIS. |
| 0031 HF-0550 | 6.4.2.2D | G | CLSD | EPP-JUSTIF | SIZE OR SHAPE CODING HAS NOT BEEN USED TO DISTINGUISH BETWEEN DIFFERENT FUNCTION CONTROLS | THE NEW DEMARCATION AND SUMMARY LABELING WILL ASSIST THE OPERATOR IN IDENTIFING BOARD SECTIONS ASSOCIATED WITH SYSTEM TASKS. ITEM CLOSED |
| 0032 HF-0555 | 6.4.3.2D | G | CLSD | EPP-JUSTIF | PUSHBUTTONS WITH "DEEP WELL" TYPE RAISED GUARDS HAVE TOO MUCH RESISTANCE. | OPERATORS AT THE REVIEW MEETING STATED THAT THE PUSHBUTTON TENSION WAS ACCEPTABLE. |
| 0033 HF-0560 | 6.4.4.5E4 | G | CLSD | EPP-JUSTIF | DEPTH ON SMALL SILVER THUMB ROTARY SWITCHES IS LESS THAN 0.5 IN. THE SUGGESTED MINIMUM IS 0.625 IN. | THE GRIPPING SURFACE IF ADEQUATE FOR EASE OF CONTROL. |
| 0034 HF-0565 | 6.4.4.5F | G | CLSD | EPP-JUSTIF | THE SPRING LOADED MOMENTARY CONTACT ROTARY CONTROLS ON PANELS VPA AND VPB HAVE HANDLES THAT ARE SMALLER THAN THOSE RECOMMENDED. | OPERATORS STATED THAT THESE SWITCHES WERE ADEQUATE. |
| 0035 HF-0570 | 6.4.3.5B | 1 | 2C | OPS | MANY LEGENDS ON STATUS LIGHTS ARE AMBIGUOUS. | THIS ITEM WILL BE CORRECTED IN THE RELABELING EFFORT. |
| 0036 HF-0571 | 6.4.4.5E4 | G | CLSD | EPP-JUSTIF | SWITCH DEPTH ON SMALL SILVER THUMB ROTARIES IS LESS THAN 0.5 INCHES. THE MINIMUM SUGGESTED DEPTH IS 0.625 INCH | REF- HED 6.4.4.5E4 FILE#33 INVALID- NO ACTION INTENDED (DUPLICATED) |

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| 0001 HF-0575 | 6.5.1.1E | G | CLSD | SEE STATUS | ON ALL HAGAN PROCESS CONTROLLERS THE METERS DISPLAY DEMAND RATHER THAN STATUS INFORMATION BUT ARE NOT LABELLED TO INDICATE SUCH | THE HAGAN DISPLAYS ARE LABELED DEMAND SIGNAL. THIS ITEM IS ADDRESSED DURING TRAINING. TITLE "LOGIC SYSTEMS WITH HAGEN CONTROLLERS" |
| 0002 HF-0580 | 6.5.1.1C | G | 2C | PRO PCM#82-264 PCM#82-265 | SEVERAL DISPLAYS IDENTIFIED AS NON-FUNCTIONAL, NOT CONNECTED OR NO LONGER USED | THESE ITEMS ARE TO BE RESOLVED AS PART OF CR MODIFICATIONS. MOST ARE TO BE REMOVED |
| 0003 HF-0585 | 6.5.1.1F | G | CLSD | EPP-JUSTIF | THERE IS NO LAMP TEST AVAILABLE FOR ILLUMINATED PUSHBUTTONS. NO FAILURE INDICATION FOR DIGITAL DISPLAYS. NO FAIL INDICATION ON STRIP CHART OR TRANSMITTER | NO ACTION INTENDED. DEVICES INDICATE OR ARE BACKED UP BY AN AUDIBLE ALARM FUNCTION. ON LOSS OF POWER OR SIGNAL LED WILL EXTINGUISH OR GO TO ZERO |
| 0004 HF-0590 | 6.5.1.3B12 | G | CLSD | EPP-JUSTIF | TYPE AND STYLE OF PRINT ON CR LABELS IS NOT CONSISTENT | NO ACTION REQUIRED |
| 0005 HF-0595 | 6.5.1.3B3 | G | CLSD | EPP-JUSTIF | MANY COMPONENTS HAVE MANUFACTURES NAMES ON THEM WHICH ARE NOT IN ALL CAPS | NO ACTION REQUIRED |
| 0006 HF-0600 | 6.5.1.3D | G | 2C | OPS | INCONSISTENCY IN CHARACTER DIMENSIONS ON COMPONENT AND POSITION LABELS | RELABELING EFFORT. |
| 0007 HF-0605 | 6.5.1.3D5 | G | CLSD | EPP-JUSTIF | SPACING BETWEEN WORDS IS LESS THAN ONE CHARACTER WIDTH ON STATUS LEGEND LIGHTS WORDS AND ABBREVIATIONS ARE CRAMMED TOGETHER | DELETED. DUPLICATE OF ITEM 6 SECTION 6.5 |
| 0008 HF-0610 | 6.5.1.5A1 | G | CLSD | EPP-JUSTIF | THERE ARE MORE THAN NINE GRADUATION MARKS BETWEEN NUMBERED SCALE MARKINGS | INDICATORS ARE SPECIFIC AND MANY REQUIRE ADDITIONAL GRADUATIONS FOR MORE DETAILED READING. NO ACTION INTENDED |
| 0009 HF-0615 | 6.5.1.5C | G | CLSD | EPP-JUSTIF | SUCCESSIVE VALUES OF GRADUATIONS DO NOT CONFORM TO RECOMMENDATION OR THESE VALUES MULTIPLIED BY 10 | INDICATORS ARE RANGE CODED WHERE NECESSARY AND GRADUATION VALUES ARE PROCESS DEPENDANT NO ACTION REQUIRED |

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| 0010 HF-0620 | 6.5.1.5C | G | CLSD | EPP-JUSTIF | SUCCESSIVE VALUES OF GRADUATIONS DO NOT CONFORM TO RECOMMENDATION OR THESE VALUES MULTIPLIED BY 10 | NO ACTION REQUIRED |
| 0011 HF-0625 | 6.5.1.5F | G | CLSD | EPP-JUSTIF | IMPACT RECORDERS HAVE ONE POINTER WITH MULTIPLE SCALES POSSIBLY LEADING TO CONFUSION | THE SUBJECT RECORDERS AND SCALE SELECTION ARE BASED ON PLANT STATUS AND OPERATORS SHOULD BE AWARE OF THEIR SELECTED RANGE. NO ACTION INTENDED |
| 0012 HF-0630 | 6.5.1.6D1 | 6 | 2C | I&C | COLOR CODING FOR HIGH AND LOW RADIATION PUSHBUTTONS IS INCONSISTENT ON PANEL AND WITH OTHER PANELS PROCESS RADIATION MONITOR | CONSISTENCY WILL BE ACHIEVED THROUGH THE NORMAL I&C MAINTENANCE PROGRAM |
| 0013 HF-0635 | 6.5.1.6D1 | 9 | CLSD | EPP-JUSTIF | STATUS LIGHTS ON SAFEGUARDS PANEL ARE NOT COLOR CODE COMPATIBLE WITH OTHER CONTROLS AND DISPLAYS | DELETED. COLOR CODES ARE CORRECTLY USED |
| 0014 HF-0640 | 6.5.1.6D1 | 6 | 2C | I&C | ILLUMINATED PUSHBUTTONS ON PROCESS CONTROLLERS HAVE INCONSISTENT COLOR CODING | I&C WILL MAKE ILLUMINATED BUTTONS CONSISTENT, ESTABLISH COLOR CODE CONVENTION |
| 0015 HF-0645 | 6.5.1.6D1 | 13 | CLSD | SEE STATUS | THE RADIATION MONITOR COLOR CODE SCHEME IS DIFFERENT THAN THAT USED ON THE MAIN PANELS | INCORPORATED IN TRAINING PROGRAM. OPERATORS NOTIFIED OF RADIATION MONITOR COLOR CODING USE REQUAL CYCLES 82&83 |
| 0016 HF-0650 | 6.5.2.2B2 | G | CLSD | EPP-JUSTIF | RECORDER POINTERS ARE NOT MOUNTED CLOSE ENOUGH TO SCALE TO AVOID PARALLAX | RECORDERS ARE DESIGNED TO PROVIDE INFO. FOR ANALYSIS AFTER TRANSIENTS. THEY ARE CALIBRATED TO THE PAPER SCALE AND NOT THE RECORDER SCALE |
| 0017 HF-0655 | 6.5.2.3B | G | CLSD | EPP-JUSTIF | NORMAL OPERATING RANGES HAVE BEEN INDICATED ON VERTICLE METERS IN A MANNER THAT INTERFERES WITH LABELING PRINT ON THE METER | COMPONENT LABELS ARE ENGRAVED AND PLACED BENEITH ASSOCIATED DISPLAYS. NO ACTION INTENDED |
| 0018 HF-0660 | 6.5.3.1A5 | G | CLSD | EPP-JUSTIF | OPERATORS ATTEMPTING TO CHANGE INDICATING LAMPS FIND IT EXTREMELY DIFFICULT BECAUSE PROPER TOOLS ARE NOT PROVIDED | BULB TOOL WILL BE AVAILABLE FOR OPERATOR USE. OPERATORS TO WRITE PWO WHERE ASSISTANCE IS REQUIRED |

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| 0019 HF-0665 | 6.5.4.2A1 | G | 2C | I&C PCN#82-264 PCN#82-265 | TRACOR WESTRONIC TREND RECORDER LABELS LIST PEN COLORS AND MEANINGS IN THE REVERSE ORDER OF THE SCALES | THIS ITEM WILL BE RESOLVED WHEN NEW RECORDERS ARE INSTALLED AS PART OF CR MODIFICATION PROGRAM |
| 0020 HF-0670 | 6.5.5.1A2 | G | CLSD | EPP-JUSTIF | DRUM TYPE COUNTERS DISPLAY NUMERALS WHERE THE WIDTH TO HEIGHT RATIO IS NOT 1 TO 1 | LOW ERROR ASSESSMENT. NUMERALS ARE LARGE ENOUGH TO BE EASILY READ. NO ACTION INTENDED |
| 0021 HF-0675 | 6.5.5.2A2 | G | CLSD | EPP-JUSTIF | ALL LEDS HAVE CHARACTERS THAT SLANT TO THE RIGHT INSTEAD OF BEING UPRIGHT | DISPLAYS ARE EASILY READABLE BY OPERATOR NO ACTION INTENDED |
| 0022 HF-0680 | 6.5.5.2A5 | G | CLSD | EPP-JUSTIF | R[illegible]T LEVEL LED DISPLAY HAS APPROXIMATELY ONE NUMERAL WIDTH BETWEEN DIGITS. RECOMMENDED 1/4 TO 1/2 OF NUMERAL WIDTH | NO ACTION INTENDED. DISPLAY IS EASILY INTERPERTED BY OPERATORS |
| 0023 HF-0685 | 6.5.5.2A5 | G | CLSD | EPP-JUSTIF | RWST LEVEL LED DISPLAY HAS APPROXIMATELY ONE NUMERAL WIDTH BETWEEN DIGITS. RECOMMENDED 1/4 TO 1/2 OF NUMERAL WIDTH | NO ACTION INTENDED. DISPLAY IS EASILY INTERPERTED BY OPERATORS |
| 0024 HF-0690 | 6.5.1.1C | G | CLSD | EPP-JUSTIF | DELETED. CONDENSATE STORAGE TANK LEVEL REDUNDANT DISPLAYS IDENTIFIED AS BELONGING TO SAME CIRCUITRY | DELETED |
| 0025 HF-0695 | 6.5.1.1B | G | CLSD | EPP-JUSTIF | NO STATUS INDICATION IS PRESENT FOR ROTARY SWITCHES FOR SAFETY INJECTION VALVE | NO ACTION. DO NOT NEED STATUS LIGHTS ON CHECK VALVES |
| 0026 HF-0700 | 6.5.1.1B | G | 2C | I&C | COLOR CODED ZONE MARKINGS ON METERS NEED TO BE UPDATED. NORMAL OPERATING ZONES HAVE CHANGED. IN SOME CASES THE TAPE IS FALLING OFF | ZONE MARKINGS UPDATED BY I&C SCALE CODING PROGRAM EXCEPT QUALIFIED SIGMA METERS. |
| 0027 HF-0705 | 6.5.1.1B | 2 | 2C | EPP-JUSTIF SEE STATUS PCN#82-264 PCN#82-265 | RCP VIBRATION TREND RECORDER TAKES TWO MINUTES TO PROVIDE NECESSARY TREND. PUMP MALFUNCTION IS A MAJOR PARAMETER AND THERE ARE NO OTHER INDICATIONS | THIS SYSTEM IS BEING MODIFIED SUCH THAT PRINT OUT TIME WILL BE LESS ALSO THIS INFORMATION WILL BE ADDED TO SAS. DELETED- INVALID |

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| 0028 HF-0710 | 6.5.1.1F | 1,2 | CLSD | EPP-JUSTIF | MEGAWATT STRIP CHART RECORDER FAILS ON SCALE RATHER THAN RESETTING WHEN INSTRUMENT POWER IS LOST LEADING TO POSSIBLE MISINTERPRETATION | DUPLICATE OF ORIGINAL. NO ACTION INTENDED |
| 0029 HF-0715 | 6.5.1.2A | 1,2 | CLSD | EPP-JUSTIF | COMPONENT COOLING FLOW VERTICAL METER SCALE RANGE IS 0 TO 140 AND IS NOT CONSISTENT WITH THE DEGREE OF PRECISION NEEDED BY OPERATOR | NO ACTION INTENDED. THE FLOW INDICATORS ARE CONSISTENT WITH INTENDED USE AND SYSTEM DESIGN |
| 0030 HF-0720 | 6.5.1.2B | 2 | 2C | I&C | AN ADDITIONAL SCALE HAS BEEN ADDED IN PENCIL TO THE FACE OF THE RHR INTERLOCK VERTICLE METER INDICATING SATURATION TEMPERATURE. SHOULD BE MADE PERMENANT | SCALES WILL BE MODIFIED TO PROVIDE DESIRED INFORMATION |
| 0031 HF-0725 | 6.5.1.2E | G | CLSD | EPP-JUSTIF | RECORDER READINGS REQUIRING USE OF A MULTIPLICAND ARE NOT MARKED ON SCALES OR LABELS CLEARLY. EXAMPLE CONDENSATE DISSOLVED OXYGEN STRIP CHART | OPERATORS ARE AWARE VIA LOGGING OF SUBJECT READINGS OF THE SCALE RANGE AND MULTIPLIER USED. EXAMPLE IS NORMALLY USED DURING START-UP. NO ACTION INTENDED |
| 0032 HF-0730 | 6.5.1.3A | G | CLSD | EPP-JUSTIF | LED CHARACTERS ARE TOO SMALL TO SUBTEND A VISUAL ANGLE OF 15 MINUTES WHEN THE OPERATOR IS STANDING AT THE DESK. THIS IS ALSO TRUE FOR LABEL CHARACTERS | OPERATORS ARE TO STAND IN FRONT OF PANEL TO READ DISPLAYS. LABELS ARE ADEQUATE FOR THEIR INTENDED USE. LEDS ARE LIGHTED TO ENHANCE READABILITY. NO ACTION REQ. |
| 0033 HF-0735 | 6.5.1.3D | G | CLSD | EPP-JUSTIF | LEGEND LIGHT LABEL LETTERING IS NOT SPACED PROPERLY BETWEEN CHARACTERS BETWEEN WORDS AND BETWEEN LINES. | THESE ITEMS ARE ADDITIONAL STATUS AIDS WHICH PROVIDE NO INFORMATION THAT IS NOT ALREADY PROVIDED VIA ALARMS AND INDICATORS. NO ACTION INTENDED |
| 0034 HF-0740 | 6.5.1.4A | G | CLSD | EPP-JUSTIF | INDICATORS FOR PERCENT FLUX DIFFERENCE DO NOT TELL DIRECTION OF CHANGE POSITIVE OR NEGATIVE ALTHOUGH THIS MAY BE INFERRED. METERS SHOULD INDICATE THIS | FLUX DIFFERENCE IS NOT PLUS AND MINUS BUT TOP AND BOTTOM. NO PLUS OR MINUS SIGNS WILL BE ADDED. NO ACTION INTENDED |
| 0035 HF-0745 | 6.5.1.4F | G | CLSD | EPP-JUSTIF | SECONDARY WATER CONDUCTIVITY RECORDER DISPLAYS UNITS OF MICROMHOS/CM WHICH OPERATORS CAN NOT USE DIRECTLY. PARTS PER MILLION IS A MORE USABLE UNIT | THESE VALUES ARE CORRECT AND REQUIRE AN ANALYSIS. DELETED |
| 0036 HF-0750 | 6.5.1.5A | G | CLSD | EPP-JUSTIF | SEMI-CIRCULAR METER HAS 4 SCALES. BOTTOM 2 SCALES HAVE NO INDEX MARKINGS BUT INCLUDES A MIRROR AND POINTER WHICH EXTENDS TO TOP SCALE INDEX | MIRRORED SCALE PROVIDED FOR GRADUATED SCALE READING METER IS CORRECT FOR INTENDED FUNCTIONS. DELETED |

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| 0037 HF-0755 | 6.5.1.5A1 | 13 | CLSD | EPP-JUSTIF | MORE THAN NINE GRADUATION MARKS SEPERATE SCALE NUMERALS FOR RADIATION MONITORS AND NUCLEAR INSTRUMENT PROTECTION | GRADUATIONS ARE CORRECT FOR INTENDED USE. NO ACTION REQUIRED. |
| 0038 HF-0760 | 6.5.1.5A1 | G | CLSD | EPP-JUSTIF | CONTAINMENT PRESSURE IMPACT RECORDER SCALES HAVE MORE THAN NINE GRADUATION MARKS BETWEEN SCALE MARKINGS | RECORDERS PROVIDE TRENDS AND ARE NOT INTENDED AS PRECISION DISPLAYS. RECORDER USES SCALED PAPER TO PROVIDE DOCUMENTATION. NO ACTION REQUIRED. |
| 0039 HF-0765 | 6.5.1.5A1 | G | CLSD | EPP-JUSTIF | FOR RELIEF TANK PRESSURE AND FEEDWATER PUMP AMPERE METERS THERE ARE MORE THAN NINE GRADUATIONS BETWEEN THE SCALE MARKINGS | IMPORTANT DISPLAYS ARE RENGE CODED AND DISPLAYS ARE GRADUATED DEPENDENT ON ACCURACY FOR THE DESIRED PROCESS INVOLVED. NO ACTION REQUIRED. |
| 0040 HF-0770 | 6.5.1.5A1 | G | CLSD | EPP-JUSTIF | FOR IMPACT RECORDERS AND TRIP CHART RECORDERS THERE ARE MORE THAN NINE GRADUATION MARKS BETWEEN THE SCALE MARKINGS | RECORDERS PROVIDE TRENDS AND ARE NOT INTENDED AS PRECISION DISPLAYS. RECORDER USES SCALED PAPER TO PROVIDE DOCUMENTATION. NO ACTION REQUIRED. |
| 0041 HF-0775 | 6.5.1.5A3 | G | CLSD | EPP-JUSTIF | METER SCALES HAVE MORE THAN FIVE GRADUATIONS BETWEEN NUMERALS HOWEVER MARKS ARE NOT GRADUATED BY MAJOR, MINOR AND INTERMEDIATE INCREMENTS | IN MANY CASES ADDITIONAL GRADUATIONS ARE NEEDED FOR MORE DETAILED READINGS. SELECTED METERS ARE COLOR CODED. NO ACTION INTENDED |
| 0042 HF-0780 | 6.5.1.5A3 | G | CLSD | EPP-JUSTIF | ON VERTICLE METERS THERE ARE FIVE OR MORE GRADUATIONS BETWEEN NUMERALS BUT MARKS ARE NOT GRADUATED BY MAJOR, MINOR AND INTERMEDIATE INCREMENTS | THE INDICATORS ARE PROCESS SPECIFIC AND MANY CLEARLY READABLE. SELECTED SCALES ARE RANGE CODED. NO FURTHER ACTION INTENDED |
| 0043 HF-0785 | 6.5.1.5B | G | CLSD | EPP-JUSTIF | THE GRADUATION MARKS ON VERTICLE METERS ARE TOO SHORT IN HEIGHT | IN MANY CASES MAJOR MARKS ARE WIDER. NUMBERS ARE AT MAJOR DIVISIONS AND SELECTED DISPLAYS ARE RANGE CODED. NOT SIGNIFICANT TO CHANGE METERS. NO ACTION |
| 0044 HF-0790 | 6.5.1.5B | G | CLSD | EPP-JUSTIF | THE HAGAN PROCESS CONTROLLERS AND SEMI-CIRCULAR METERS HAVE GRADUATION MARKS THAT ARE TOO SHORT | DIVISIONS PROVIDE A VISUAL KEY AND ARE NOT READ PER SAY BUT ARE COMPARED TO ONE ANOTHER. FPL FEELS THE SUBJECT DISPLAYS ARE ADEQUATE. NO ACTION INTENDED |
| 0045 HF-0795 | 6.5.1.5B | G | CLSD | EPP-JUSTIF | THE GRADUATION MARKS ON VERTICLE METERS ARE TOO SHORT. MAJOR MARKS 0.05 INCHES MINOR MARKS 0.06 INCHES IN HEIGHT | NO ACTION REQUIRED |

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| 0046 HF-0800 | 6.5.1.5D | G | CLSD | EPP-JUSTIF | STEAM HEADER PRESSURE SCALE GRADUATION FORMAT IS DIFFICULT TO READ AND DIFFERENT FROM THAT ON ADJACENT METER | THIS METER HAS BEEN REPLACED WITH A QUALIFIED METER THAT THE VENDOR HAS CHANGED SCALE DESIGN. IMPORTENT INDICATORS ARE RANGE CODED. NO ACTION RQ |
| 0047 HF-0805 | 6.5.1.1F | G | CLSD | EPP-JUSTIF | SEMICIRCULAR CURRENT METER HAS A SINGLE POINTER WITH MULTIPLE SCALES. THERE ARE 4 SCALES WITH A ROTARY SELECTOR PROVIDED TO SELECT SCALES | THIS ROTARY IS USED FOR CALIBRATION AND TESTING. DELETED |
| 0048 HF-0810 | 6.5.1.6D | 8 | 2A | OPS | HIGH HYDROGEN INDICATOR LIGHTS COLOR CODING IS INCONSISTENT. ONE COVER IS YELLOW AND THE OTHER RED. FOR BOTH THE MEANING INTENDS TO ALERT THE OPERATOR | LENSES WILL BE MADE THE SAME COLOR |
| 0049 HF-0815 | 6.5.2.1A | G | CLSD | EPP-JUSTIF | CONDENSER VACUUM CIRCULAR METERS SCALE VALUES INCREASE WITH MOVEMENT OF POINTER DOWNWARD | SUBJECT INDICATOR IS THE STANDARD USED THROUGHOUT THE INDUSTRY. SCALE DEPICTS DECREASING PRESSURE OR INCREASE INCHES VACUUM->IS REALATIVE. NO ACTION. |
| 0050 HF-0820 | 6.5.2.2A2 | G | CLSD | EPP-JUSTIF | IMPACT RECORDER POINTER TIP CONCEALS THE GRADUATION MARKS AND/OR NUMERALS | OBSERVATION IS NOT COMPLETE. TREND RECORDERS PROVIDE HISTORICAL INFORMATION ON SCALED PAPER. INSTANTANIOUS READINGS CAN BE EASILY READ. NO ACTION INTENDED |
| 0051 HF-0825 | 6.5.2.2A2 | G | CLSD | EPP-JUSTIF | THE POINTER TIP ON PROCESS CONTROL HORIZONTAL METER AND SEMI-CIRCULAR METER OVERLAPS SCALE GRADUATION MARKS AND INDEX NUMERALS | INDICATORS CAN BE ACCURATELY READ. RANGE CODING HAS BEEN ADDED TO SELECTED INDICATORS. NO FURTHER ACTION INTENDED |
| 0052 HF-0830 | 6.5.2.2A1 | G | CLSD | EPP-JUSTIF | THE POINTER TIP ON SVERAL VERTICAL METERS IS MORE THAN 1/16 INCH FROM THE GRADUATION MARKS | METERS PROVIDE DESIRED ACCURACY. PARRALLAX IS MINIMUM. NO ACTION INTENDED |
| 0053 HF-0835 | 6.5.2.2A1 | G | CLSD | EPP-JUSTIF | THE POINTER TIP ON SOME METERS IS MORE THAN 1/16 INCH FROM THE GRADUATION MARKS | METERS PROVIDS DESIRED ACCURACY. PARALLAX IS MINIMUM. NO ACTION INTENDED |
| 0054 HF-0840 | 6.5.2.2A2 | G | CLSD | EPP-JUSTIF | DUE TO A CONVEX SCALE FACE AND HEIGHT OF BACK PANEL, VERTICAL METERS ARE SUBJECT TO READING ERRORS FROM PARRALLAX | RANGE CODING HAS BEEN ADDED TO HELP MINIMIZE PROBLEM. ESSEX REVIEW INDICATES THAT FROM NORMAL WORK STATIONS PARRALLAX IS MINIMAL. NO FURTHER ACTION INTENDED |

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| 0055 HF-0845 | 6.5.2.2C | 2 | 2C | I&C | POINTER BACKGROUND CONTRAST FOR RWST LEVEL IS INSUFFICIENT. BLACK LABEL BEHIND BLACK POINTER | THESE POINTERS WILL BE PAINTED RED |
| 0056 HF-0850 | 6.5.2.3A | G | CLSD | EPP-JUSTIF | THE YELLOW AND LAVENDER COLOR CODE ON VERTICLE METERS IS DIFFICULT TO DISTINGUISH BECAUSE LINES ARE VERY NARROW AND BACKGROUND HAS YELLOWED | AS PART OF THE RECODING PROGRAM METER RANGES WILL BE UPGRADED AND/OR CLEANED COLOR CODES WILL REMAIN THE SAME NO FURTURE ACTION. |
| 0057 HF-0855 | 6.5.3.1A1 | G | CLSD | EPP-JUSTIF | THERE IS NO CAPABILITY PROVIDED FOR TESTING BULBS FOR STATUS LIGHTS. DUAL BULB OR DUAL FILAMENT LAMP ASSEMBLIES ARE NOT USED TO INCREASE ALMP LIFE | GENERICALLY REDUNDANT INFORMATION SUCH AS PROCESS STATUS PROVIDE SUFFICIENT INFORMATION TO DETERMINE LAMP STATUS. SAS ADDITION WILL HELP. NO ACTION |
| 0058 HF-0860 | 6.5.3.1C1 | G | CLSD | EPP-JUSTIF | POWER TO AUX FEEDWATER PUMP IS INDICATED BY A STATUS LIGHT. EXTINGUISHED LIGHT MAY MEAN BULB IS BURNT OUT OR LOSS OF POWER TO PUMP | IS CONSISTANT WITH NUREG 0700 GUIDELINES NO ACTION INTENDED- INVALID |
| 0059 HF-0865 | 6.5.3.1C1 | 3 | CLSD | EPP-JUSTIF | SAFETY INJECTION STATUS LIGHTS ARE DIFFICULT TO INTERPERT. 3 FUNCTIONS ARE REPRESENTED BRIGHT, DIM OR EXTINGUISHED. VARIABLE OPACITY OF LIGHT COVERS | FPL FEELS THAT THE INDICATION IS SUITED FOR THE INTENDED PURPOSE. NO ACTION REQUIRED |
| 0060 HF-0870 | 6.5.3.1C1 | G | CLSD | EPP-JUSTIF | TWO LIGHTS INSTEAD OF ONE SHOULD INDICATE WHETHER ACCESS TO CONTAINMENT IS PROPERLY INTERLOCKED. THE ADDITIONAL TO SHOW ALTERNATE STATUS | FP&L FEEL THAT THE INDICATION IS SUITED FOR THE INTENDED PURPOSE. NO ACTION INTENDED. |
| 0061 HF-0875 | 6.5.3.1D | G | CLSD | EPP-JUSTIF | HIGH HYDROGEN COMMON ALARM INDICATOR LIGHTS SHOULD BE ACCOMPANIED BY AN AUDIBLE ALARM | ANNUNCIATOR WILL BE INSTALLED FOR HYDROGEN MONITOR, WITHIN SYSTEM DESIGN. THERE ARE ALARMS FOR THE POWER RANGE CHANNELS. NO FURTHER ACTION INTENDED |
| 0062 HF-0880 | 6.5.3.2A1 | G | CLSD | EPP-JUSTIF | PUSHBUTTON INDICATOR LIGHT PAIR SHOULD HAVE A LABEL FOR EACH LIGHT INDICATING APPRORIATE 4KV BUS | THESE ARE REDUNDANT INDICATION. DELETED |
| 0063 HF-0885 | 6.5.3.3 | G | CLSD | EPP-JUSTIF | LEGEND LIGHTS MESSAGES CONTAIN MORE THAN THREE LINES OF LETTERING | MESSAGES ARE WRITTEN TO PROVIDE THE OPERATOR WITH CONCISE AND ADEQUATE INFORMATION. NO ACTION INTENDED |

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| 0064 HF-0890 | 6.5.3.3 | 1 | 2C | I&C | STATUS INDICATOR LIGHTS HAVE ONE BLOCK SPLIT WINDOW. IF ONE SIDE LIGHTS UP IT APPEARS AS THOUGH BOTH ARE LIT | I&C WILL INSTALL DIVIDER IN STATUS LIGHT BOX TO MAKE STATUS MORE APPARENT |
| 0065 HF-0895 | 6.5.3.3A23 | G | CLSD | EPP-JUSTIF | FOR LEGEND LIGHTS AND PUSHBUTTONS. LEGENDS ARE NOT LEGIBLE WITH INDICATOR LIGHTS OFF. THIS IS LARGELY DUE TO VERY SMALL CHARACTER SIZE AND DARK BACKGROUND | NO ACTION INTENDED. THESE ARE AN OPERATORS AID. THE SAS, DDPS AND QUALIFIED SPDS PROVIDE THE OPERATOR WITH THE REQUIRED INFORMATION |
| 0066 HF-0900 | 6.5.4.1A | G | CLSD | EPP-JUSTIF | TRACOR WESTRONIC STRIP CHART RECORDER PENS VIBRATE LEAVING STRAY MARKS. LN TYPE RECORDERS HAVE NO SUPPORT FOR STAMPING POTENTIAL TORN PAPER | THE INSTRUMENT RESET HAS BEEN READJUSTED TO INCREASE DAMPING THUS RESOLVING THE PROBLEM. PRESENT DOCUMENT CONTROL VERIFIES STAMPS REQUIRED. NO ACTION |
| 0067 HF-0905 | 6.5.4.1B | 1 | 3 | OPS PWO#237511 PWO#237546 [illegible] | SCALE ON RECORDER CHART PAPER DOSE NOT CORRESPOND WITH SCALE ON RECORDER. SOME SCALES MUST BE MULITPLIED BY TEN OR SHOW ONLY ONE SCALE ON PAPER | A CHART INVENTORY LIST FOR APPLICABLE RECORDERS IN THE CR WILL BE DEVELOPED TO INSURE PROPER SCALES AND THAT MINIMUM SUPPLIES ARE MAINTAINED |
| 0068 HF-0910 | 6.5.4.1[illegible] | G | CLSD | EPP-JUSTIF | TREND IMPACT RECORDERS LACK CAPABILITY FOR PAPER SPEED ADJUSTMENT | ADDITION OF DDPS WILL HAVE THE CAPABILITY OF SELECTABLE FUNCTIONS AND TREND TIME SPANS ALSO CHARTS ARE DATE AND TIME STAMPED. NO FURTHER ACTION NOW |
| 0069 HF-0915 | 6.5.4.1[illegible] | G | CLSD | EPP-JUSTIF | LOCATION OF METAL IMPACT RECORDER NEAR FLOOR MAKES IT VIRTUALLY INACCESSIBLE. SCALE FACE HAS HAND-WRITTEN SCALES TAPED ONTO SCALE FACE AND IS ILLEGIBLE | THIS HAS A TEMPORARY INSTRUMENT USED FOR A SPECIAL TEST. A NEW SYSTEM WILL BE INSTALLED AND THE EXISTING RECORDER REMOVED. NO FURTHER ACTION INTENDED |
| 0070 HF-0920 | 6.5.4.2A | 1 | [illegible] | OPS | [illegible] CHART RECORDER LACKS A LEGEND CARD TO IDENTIFY THE APPROPRIATE PEN WITH THE ASSOCIATED PARAMETER | THIS ITEM WILL BE ADDRESSED AS PART OF THE RELABELING EFFORT |
| 0071 HF-0925 | 6.5.4.2B1 | G | CLSD | EPP-JUSTIF | THREE HANDWRITTEN SCALES HAVE BEEN ADDED TO IMPACT RECORDER 441 SCALE FACE. TOO MANY CHANNELS MAKES IT DIFFICULT TO READ DUE TO THE ADDITIONAL SCALES | DELETED. INVALID |
| 0072 HF-0930 | 6.5.4.2B2 | G | CLSD | EPP-JUSTIF | IMPACT RECORDERS ARE NOT EQUIPPED WITH VISIBLE WHEEL TO DISPLAY THE CHANNEL BEING PLOTTED. PARTICULARLY NECESSARY DUE TO CROWDING AND BLURRING OF DIGITS | A PWO SHOULD BE ISSUED FOR I&C MAINTENANCE WHEN RECORDER IMPACT POINTS ARE ILLEGIBLE. NO FURTHER ACTION INTENDED |

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| 0073 HF-0935 | 6.5.4.2B3 | G | CLSD | EPP-JUSTIF | ALL IMPACT RECORDERS HAVE TOO MANY CHANNELS. NUMBERS RUN TOGETHER BECAUSE TRENDS OVERLAP OR SCALES TOO NARROW. THE PRINT IS TOO SMALL AND IS BLURRED | THESE ARE NON-SAFETY SYSTEMS. THE ADDITION OF DDPS WILL ALLOW OPERATIONS TO SELECT AND TREND PLANT INFORMATION. NO FURTHER ACTION INTENDED |
| 0074 HF-0940 | 6.5.4.2B4 | G | CLSD | EPP-JUSTIF | FOR IMPACT RECORDERS NO PROVISION IS MADE TO SELECT A SINGLE CHANNEL FOR IMMEDIATE DISPLAY BEFORE AWAITING COMPLETION OF THE SAMPLING CYCLE | PRESENTLY ADDING DDPS WHICH WILL ALLOW PERSONNEL TO SELECT AND TREND VARIOUS INFORMATION POINTS. NO FURTHER ACTION REQUIRED |
| 0075 HF-0945 | 6.5.4.1A3 | G | CLSD | EPP-JUSTIF | BATCH CONTROLLER TOTALIZER BORIC ACID AND PRIMARY WATER COUNTER DISPLAYS. DIGIT GROUPINGS ARE NOT SEPERATED BY COMMAS, DECIMAL POINTS OR SPACES | DISPLAYS ARE ACCURATE FOR THEIR INTENDED FUNCTION. OPERATOR SELECTS DESIRED ADDITION AND PLACES IN AUTO. NO ACTION INTENDED |
| 0076 HF-0950 | 6.5.4.2A2 | G | CLSD | EPP-JUSTIF | THE CONDENSATE DISSOLVED OXYGEN STRIP CHART RECORDER HAS TWO SCALES AND IT IS NOT CLEAR WHICH IS TO BE USED | PRESENTLY THE SUBJECT RECORDERS ARE BEING RELOCATED TO THE CHEMISTRY LAB NO FURTURE ACTION |
| 0077 HF-0955 | 6.5.1.2B | G | CLSD | EPP-JUSTIF | TRANSFORMER AND GENERATOR TEMPERATURE SCALES ARE IN DEGREES CELSIUS. ALL OTHER DISPLAYS USE FARENHEIT SCALE | PROCEDURES, DOCUMENTS AND SETPOINTS FOR THE SUBJECT RECORDERS ARE ALL IN DEGREES CELSIUS. NO ACTION INTENDED |
| 0078 HF-0960 | [illegible] | G | CLSD | EPP-JUSTIF | VENT LINES FROM THE SEPERATOR REHEATERS [illegible] VENT [illegible] HAVE ONLY RED LIGHTS [illegible] CLOSED INDICATION. NO LIGHT MEANS VENT CLOSED OR BULB IS BURNED OUT | NO ACTION REQUIRED. THE SUBJECT VALVES [illegible] ARE OPENED DURING START-UP AND ARE [illegible] VERIFIED CLOSED WHEN THE ARE CLOSED |
| 0079 HF-0965 | [illegible] | G | CLSD | EPP-JUSTIF | ROBERT SHAW CIRCULAR METERS FAIL ON SCALE WHEN POWER SOURCE INTERRUPTED OR METER FAILS. NO INDICATION OF FAILURE | NO ACTION. LOW CONDENSER VACUUM IS ALARMED. IF METER FAILS IT GOES TO ZERO |
| 0080 HF-0970 | 6.5.1.6D | G | 2C | OPS | INDICATOR LIGHT COLOR CODING IS INCONSISTENT. EXAMPLE RED CAN MEAN HAZARDOUS CONDITION FOR ONE DISPLAY AND NORMAL CONDITION FOR ANOTHER | A CR REVIEW FOR COLOR CONVENTION SHOULD BE PERFORMED, CONVENTION ESTABLISHED AND DOCUMENTED FOR CONSISTENCY WITH EXCEPTIONS LABELED |
| 0081 HF-0975 | 6.5.4.1 | G | CLSD | PCM# | STEAM GENERATOR FEED FLOW RECORDERS FAIL FREQUENTLY. THE PENS STICK AND HAVE BEEN JURYRIGGED FOR YEARS. VITAL DURING START-UP AND SHUTDOWN OPERATIONS | RECORDERS HAVE BEEN REPLACED AS PART OF PLANNED SYSTEM UPGRADE |

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| 0082 HF-0980 | 6.5.4.1D | 2 | 2C | PRO | METEOROLOGY CHART RECORDER IS ONLY 8.5 INCHES FROM FLOOR CAUSING PAPER TO NOT STACK PROPERLY AND BACK UP INTO THE MACHINE. DIFFICULT TO CHANGE PAPER ALSO | PRESENTLY BEING REVIEWED FOR RELOCATION |
| 0083 HF-0985 | 6.5.4.1F | G | CLSD | EPP-JUSTIF | TRACOR WESTRONICS STRIP CHART DESIGN MAKES IT DIFFICULT TO CUT OUT A SECTION OF THE CHART AND RETHREAD THE PAPER | NO ACTION REQUIRED |
| 0084 HF-0990 | 6.5.4.2A2 | G | CLSD | EPP-JUSTIF | COLOR CODING OF PENS AND INKS ARE NOT CONSISTENT WITH OTHER RECORDER DESIGNS | RECORDER LABELS IDENTIFY PEN CODING. NO ACTION REQUIRED |
| 0085 HF-0995 | 6.5.5.1C | G | CLSD | EPP-JUSTIF | COUNTER DRUM MOVES DOWNWARD WITH INCREASING VALUES. THIS IS A VIOLATION OF POPULATION STEREOTYPES | NO ACTION REQUIRED |
| 0086 HF-1000 | 6.5.5.1B | 1 | 2C | OPS | GROUND INDICATION BULBS CAN BE REPLACED WITH BULBS WITH THE SAME SOCKET BUT DIFFERENT VOLTAGE RATINGS. IMPROPERLY USED THEY CAUSE EXTRAENEOUS INDICATIONS | WILL ADD LABEL TO INDICATE BULB REPLACEMENT TYPE |
| 0087 HF-1005 | 6.5.5.1B | G | CLSD | EPP-JUSTIF | VARIOUS 24 SERIES BULBS ARE USED TO REPLACE BURNED OUT INDICATOR LAMPS. MANY BULBS IN THIS SERIES DONT FIT PROPERLY, ARE HARD TO GRIP ETC. NEED TO STANDARDIZE | PRESENTLY CONTROL ROOM IS USING 24E TYPE BULBS. BULB TYPE IS BASED ON STORES AVAILABILITY. NO FURTURE ACTION |
| 0088 HF-1006 | 6.5.5.2A | [illegible] | CLSD | EPP-JUSTIF | EDIS HAVE CHARACTERS THAT ARE TOO SMALL. SUBTEND A VISUAL ANGLE OF 15 MINUTES WHEN THE OPERATOR IS STANDING AT THE DESK. | THE SUBJECT DISPLAYS ARE ILLUMINATED THUS ENHANCING THEIR READABILITY. NO FURTHER ACTION INTENDED |

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| 0001 HF-1010 | 6.6 | G | CLSD | EPP-JUSTIF | (VD-111/1580) THREE LETER CODES USED FOR VALVES NOT THE RECOMMENDED NUMBER-ALPHA NUMBER. | VALVES ARE CONSISTANTLY LABELED. NO ACTION INTENDED. |
| 0002 HF-1015 | 6.6 | G | N/A | OPS | (?A-46/1580) MANY LABELS USE PERIODS AFTER ABBREVIATIONS. | LABELS WILL BE CONSISTANTLY ENGRAVED AS PART OF THE RELABELING PROGRAM. |
| 0003 HF-1020 | 6.6.1.1 | 19 | 2C | OPS | EXTRANEOUS AND MISLEADING MARKS EXIST ON LEVEL CONTROL TRANSFER SWITCH LABEL. TWO VALVES LABELED TURBINE CONTROL LOWER LEFT DRAIN. STORAGE AREAS POORLY LABELED. | INCORPORATED INTO LABELING EFFORT 3 SHEETS 1&3 NO ACTION |
| 0004 HF-1025 | 6.6.1.1 | 2 | 2C | OPS | PRIMARY INFORMATION IS PLACED VERTICALLY ON THE METER FACE MAKING IT LESS VISIBLE THAN THE COMPONENT NUMBER AND CAN BE MISLEADING | TO BE ADDRESSED AS PART OF THE LABELING EFFORT |
| 0005 HF-1030 | 6.6.1.2B | G | 2C | OPS | COMPONENT CABLES ON ROTARY CONTROLS ARE USUALLY LESS THAN 25% LARGER THAN POSITION LABELS. SOMETIMES BOTH ARE SAME SIZE. INCONSISTENT FORM LABEL TO LABEL | INCORPORATED AS PART OF RELABELING EFFORT STANDARDIZE LABELING PRINCIPLES |
| 0006 HF-1035 | 6.6.2.1E | G | CLSD | EPP-JUSTIF | ROTARY CONTROLS ARE LABELED SUCH THAT THE COMPONENT TYPE AND POSITION LABEL CAN BE INTERPERTED AS ONE LABEL | LOW ERROR ASSESSMENT. LABELS DO NOT PROVIDE INCONSISTENT OR CONFUSING DATA. NO ACTION REQUIRED |
| 0007 HF-1040 | 6.6.2.1[illegible] | [illegible] | 2C | I&C | FOR VERTICAL METERS LOCATION OF LABELING PRINTING IS INCONSISTENT AND CAN BE HARD TO UNDERSTAND. | THIS ITEM WILL BE ADDRESSED AS PART OF THE ONGOING INDICATOR SCALE CODING PROGRAM AND LABELING EFFORT. |
| 0008 HF-1045 | 6.6.2.4B | 6 | 3 | I&C | LABELS FOR ROTARY CONTROL POSITIONS ARE OBSCURED BY THE KNOB SKIRT | THIS WILL BE ASSRESSED DURING THE RELABELING EFFORT |
| 0009 HF-1050 | 6.6.3.1A | G | CLSD | PCM# | PRIMARY WATER FLOW TO BLENDER PROCESS CONTROLLER DISPLAYS LEFT ARROW UPSIDE DOWN AND SHOULD BE REVERSED | THIS ITEM HAS BEEN CORRECTED |

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| 0010 HF-1055 | 6.6.3.1A | G | CLSD | EPP-JUSTIF | INDICATOR LIGHTS ARE LABELED HIGH AND LOW. THE INTENT OF THE LOW LIGHT IS TO INDICATE SENSOR FAILURE AND SHOULD BE LABELED FAILED | THE LABEL IS CONSISTENT WITH THE FUNCTION DISPLAYED-LOW THRESHOLD VOLTAGE NO ACTION INTENDED |
| 0011 HF-1060 | 6.6.3.2A | 1 | 3 | OPS | LABEL ON ROTARY CONTROL DOSE NOT FULLY EXPLAIN COMPONENT FUNCTION | TO BE ADDRESSED AS PART OF RELABELING EFFORT |
| 0012 HF-1065 | 6.6.3.2A | 3 | 2C | OPS | POSITION LABEL ON ROTARY CONTROL ARE IN SERV AND OUTSERV INSTEAD OF RAISE AND LOWER | ADDRESSED BY RELABELING EFFORT |
| 0013 HF-1070 | 6.6.3.2B | G | CLSD | EPP-JUSTIF | CONTROL AND POSITION LABELS ON ROTARY CONTROLS IMPLY THAT THEY ARE CIRCUIT BREAKS THOUGH THEY ARE NOT. INCONSISTENT USE OF THE WORDS TRIP, CLOSE, START ETC. | CONVENTION IS SUCH THAT OPEN/TRIP/OFF IS ON LEFT AND CLOSED ON IS ON THE RIGHT. MISINTEPERATION OF SWITCH OPERATION IS EXTREMELY LOW. NO ACTION REQUIRED. |
| 0014 HF-1075 | 6.6.3.2F | G | CLSD | EPP-JUSTIF | THE WORD EXHAUST IS SPELLED INCORRECTLY ON TWO INDICATOR LIGHT LABELS | NO ACTION REQUIRED |
| 0015 HF-1080 | 6.6.3.3B | G | CLSD | EPP-JUSTIF | NEW ROTARY CONTROLS ARE BEING ADDED THAT DO NOT USE THE SAME VALVE LABELING SYSTEM AS EXISTING ROTARIES | DEMARCATION AND LABELING WILL REDUCE OPERATOR ERROR. REF- LTR. PTP PC-82 067 NO FURTHER ACTION INTENDED |
| 0016 HF-1085 | 6.6.3.4E | 3 | 3 | OPS | STEAM FLOW CONTROL TRANSFER ROTARY CONTROLS HAVE POSITION LABELS WHICH USE ROMAN NUMERALS. ALSO DECIMAL 1 IS USED AND SPACING IS INCONSISTENT | RELABELING EFFORT WILL ENSURE CONSISTENCY IN USE OF ROMAN NUMERALS |
| 0017 HF-1090 | 6.6.3.4E | 3 | 3 | OPS | STEAM FLOW CONTROL TRANSFER ROTARY CONTROLS HAVE POSITION LABEOS WHICH USE ROMAN NUMERALS | RELABELING PROGRAM WILL INSURE CONSISTENCY IN USE OF ROMAN NUMERALS |
| 0018 HF-1095 | 6.6.3.6 | G | 2C | OPS | MANY ADJACENT LABELS ARE IDENTICLE EXCEPT FOR A DIFFERENT VALVE NUMBER OR TRAIN IDENTIFICATION. MANY DISPLAYS ARE LABELED ONLY WITH INSTRUMENT NUMBERS | THIS ITEM WILL BE ADDRESSED AS PART OF THE RELABELING EFFORT |

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| 0019 HE-1100 | 6.6.1.2 | G | 2C | OPS | GROUPS AND SYSTEMS OF CONTROLS ARE NOT LABELED ACCORDINGLY EXCEPT ON AN INDIVIDUAL BASIS MAKING LABELS LONG AND SIMILAR | THIS ITEM WILL BE ADDRESSED AS PART OF THE LABELING AND DEMARCATION EFFORT |
| 0020 HE-1105 | 6.6.3.8A | G | CLSD | EPP-JUSTIF | DISCRETE ROTARIES DO NOT HAVE ALL POSITIONS LABELED. SOME HAVE LINES BUT NO LABELS | FURTURE REVIEW BY ELECT. RECOMMENDED NO FURTURE ACTION INTENDED WITH REGARD TO INSTALLING SWITCH POSITION LIMITER |
| 0021 HE-1110 | 6.6.3.8A | G | CLSD | EPP-JUSTIF | DISCRETE ROTARY CONTROLS DO NOT HAVE ALL POSITIONS LABELED. SOME HAVE NO POSITION LABELS AND SOME HAVE JUST LINES | EVERY SWITCH POSITION THAT IS USED IS LABELED. NO UNUSED POSITIONS ARE LABELED BUT MAY BE SCRIBED. NO ACTION REQUIRED |
| 0022 HE-1115 | 6.6.3.8B | G | 2C | OPS | KEY OPERATED SWITCHES ARE NOT LABELED FOR POSITION OR DIRECTION OF MOTION | THIS ITEM WILL BE ADDRESSED AS PART OF THE RELABELING EFFORT |
| 0023 HE-1120 | 6.6.3.8C | G | CLSD | EPP-JUSTIF | CONTINUOUS ROTARIES LOCATED AT THE TOP OF THE BENCHBOARD HAVING THREE SCALES ARE DIFFICULT TO READ FROM THE NORMAL OPERATING POSITION | SOME OF THESE CONTROLS ARE SET BY I&C AND DO NOT NEED ADJUSTMENT. SOME ARE ADJUSTED ACCORDING TO OTHER VISUAL AIDS. DIALS ARE NOT SETPOINTS. NO ACTION INTD. |
| 0024 HE-1125 | 6.6.3.8C | G | CLSD | EPP-JUSTIF | CONTROL POSITION LABELS ARE BLOCKED BY HANDLE SHAPE ON ROTARY CONTROLS | NO ACTION REQUIRED |
| 0025 HE-1130 | 6.6.3.8C | G | CLSD | EPP-JUSTIF | CONTINUOUS ROTARIES HAVE A WINDOW THROUGH WHICH A NUMBER MUST BE READ. THESE WINDOWS FILL UP WITH DUST MAKING THE NUMBER UNREADABLE | THE SUBJECT POT READINGS ARE NOT SIGNIFICANT SINCE PROCESS INDICATOR READINGS DETERMINE THE POT SETTING NOT THE DISPLAY. NO FURTURE ACTION INTENDED |
| 0026 HE-1135 | 6.6.3.8C | G | CLSD | EPP-JUSTIF | POSITION LABELS ON ROTARIES ON TOP DRAWER OF PANEL ARE NOT VISIBLE BECAUSE THEY ARE OBSCURRED BY THE ROTARY HANDLE | THE SUBJECT ITEMS ARE INFREQUENTLY USED. A STEP STOOL IS AVAILABLE TO ALLOW THE OPERATOR VISUAL VERIFICATION OF SWITCH POSITION |
| 0027 HE-1140 | 6.6.3.8A | G | CLSD | EPP-JUSTIF | ALL ROTARY CONTROLS ON HYDROGEN RECOMBINER PANEL ARE MISSING POSITION LABELS | HED WAS WRITTEN AGAINST TEMPORARY EQUIPMENT. DELETED |

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| 0028<br>HE-1145 | 6.6.3.8A | 8 | 2C | I&C | THE SHARED ACOUSTIC MONITOR ON UNIT 3<br>HAS INCONSISTENT LABELING. ONE SWITCH IS<br>UP FOR TEST AND THE OTHER DOWN FOR TEST | THIS ITEM WILL BE CORRECTED. |
| 0029<br>HE-1150 | 6.6.3.9A | G | CLSD | FPP-JUSTIF | ACCESS LEADING TO INSIDE OF PANELS THAT<br>OPERATORS MAY NEED TO ENTER SHOULD BE<br>LABELED AND LIST FUNCTIONS OF ITEMS<br>ACCESSIBLE IN THEM | NO ACTION REQUIRED |
| 0030<br>HE-1155 | 6.6.4.1A1 | 1 | 2C | OPS | LABEL CHARACTERS ARE TOO SMALL TO<br>SUBTEND A VISUAL ANGLE OF 15 MINUTES AT<br>THE EXPECTED VIEWING DISTANCE | DEMARCATION AND SUMMARY LABELING WILL<br>ENHANCE THE SUBJECT BOARD SECTIONS THUS<br>REDUCING OPERATOR ERROR |
| 0031<br>HE-1160 | 6.6 | | | | RECORD WAS INCORRECTLY LOCATED IN THIS<br>SECTION AND HAS BEEN RELOCATED IN<br>SECTION 6.4 FILE NO.0036. | RECORD HAS BEEN RELOCATED TO SECTION<br>6.4 FILE NO.0036 OF THIS REPORT.<br>RECORD MISFILED IN THIS SECTION. |
| 0032<br>HE-1165 | 6.6 | | | | RECORD WAS INCORRECTLY LOCATED IN THIS<br>SECTION AND HAS BEEN RELOCATED IN<br>SECTION 6.5 FILE NO.0088<br>DESK | RECORD HAS BEEN RELOCATED TO SECTION 6.5<br>FILE NO.0088 OF THIS REPORT.<br>RECORD WAS MISFILED IN THIS SECTION |
| 0033<br>HE-1170 | 6.6.3.8C | G | CLSD | FPP-JUSTIF | LARGE STAR SHAPED HANDLE ON LOAD LIMIT<br>ROTARY OBSTRUCTS VIEW OF POSITION LABELS | THIS IS A MOMENTARY SWITCH AND IS NOT<br>HELD IN POSITION. OPERATORS VISUAL<br>INDICATOR IS MEGAWATT OUTPUT. NO ACTION<br>INTENDED |
| 0034<br>HE-1175 | 6.6.3.8C | G | CLSD | FPP-JUSTIF | CONTROL POSITION LABELS ARE BLOCKED BY<br>HANDLE SHAPE DUE TO THE HIGH LOCATION<br>OF THESE CONTROLS ON PANEL. A STOOL<br>SHOULD BE REQUIRED FOR ACCURACY | SUBJECT ARRAYS ARE INFREQUENTLY USED.<br>OPERATOR USES A STOOL TO GET BETTER<br>VISIBILITY WHEN NECESSARY. NO FURTHER<br>ACTION INTENDED |
| 0035<br>HE-1180 | 6.6.1.1 | G | CLSD | FPP-JUSTIF | COMPONENTS LACK FUNCTIONAL LABELING TO<br>IDENTIFY COMPONENTS. TREND RECORDERS ARE<br>LABELED BY LEGEND CARD ONLY<br>(HYDROGEN RECOMBINER PANEL) | THIS HED WAS PREPARED WHILE THE PANEL<br>WAS UNDER CONSTRUCTION. COMPONENTS HAVE<br>BEEN LABELED |
| 0036<br>HE-1185 | 6.6.1.1 | 13 | 2C | OPS | A SYSTEM IMPACT RECORDED MONITORS 24<br>CHANNELS. EACH GROUP OF INSTRUMENTS<br>SHOULD HAVE A DESCRIPTIVE LABEL FOR THE<br>CHANNEL IT REPRESENTS | THIS ITEM WILL BE ADDRESSED AS PART OF<br>THE RELABELING EFFORT |

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| 0037 HF-1190 | 6.6.1.2A3 | 3 | 2C | OPS | RECORDERS HAVE LEGEND CARD ONLY WITHOUT A DESCRIPTIVE FUNCTIONAL LABEL OR WITH FUNCTIONAL LABEL IN VERTICLE ORIENTATION | DEMARCATION AND SUMMARY LABELING WILL ENHANCE THE SUBJECT PANELS |
| 0038 HF-1195 | 6.6.1.2A3 | 3 | 2C | OPS | METERS HAVE A DESCRIPTIVE LABEL LOCATED VERTICALLY ALONG THE SCALE FACE. THE GUIDELINE REQUIRES ENGRAVED LABEL LOCATED ABOVE THE ELEMENT | SUMMARY LABELING AND DEMARCATION WILL ENHANCE THE SUBJECT PANELS |
| 0039 HF-1200 | 6.6.2.1A | 6 | 2C | OPS | SUBSYSTEM LABELS ARE PLACED BELOW RATHER THAN ABOVE THE PANEL ELEMENTS THEY DESCRIBE | THIS ITEM WILL BE ADDRESSED AS PART OF THE RELABELING EFFORT |
| 0040 HF-1205 | 6.6.2.1A | G | 2C | OPS | COMPONENT LABEL HAS BEEN BROKEN OFF AND TAPED BACK ON IN A PRECARIOUS FASION. | THIS ITEM WILL BE ADDRESSED AS PART OF THE RELABELING EFFORT |
| 0041 HF-1210 | 6.6.2.1D | [illegible] | 2C | OPS | LABELS ARE NOT CLOSE ENOUGH TO PROPER CONTROL OR LIGHT. | THIS ITEM WILL BE CORRECTED IN THE RELABELING EFFORT |
| 0042 HF-1215 | 6.6.2.1D | G | 2C | OPS | LABELS ARE NOT CLOSE ENOUGH TO PROPER CONTROL OR LIGHT. | THIS ITEM WILL BE CORRECTED IN THE RELABELING EFFORT |
| 0043 HF-1220 | [illegible] | [illegible] | [illegible] | [illegible] | DISCRETE ROTARY POSITION LABELS ARE DIAGONALLY POSITIONED. GUIDELINES RECOM... AND HORIZONTAL POSITIONING | NO ACTION REQUIRED |
| 0044 HF-1225 | 6.6.2.3A | G | 2C | OPS | VERTICAL METERS HAVE VERTICAL LABELS. | WILL BE CORRECTED AS PART OF LABELING EFFORT. |
| 0045 HF-1230 | 6.6.2.4A | G | 2C | OPS | LABELS AND LEGEND CARDS ON DISPLAY FACE OF SOME METERS AND RECORDERS OBSCURE PORTIONS OF RECORDER OR SCALES. | DOORS ON RECORDERS CAN BE OPENED TO ALLOW AN UNOBSCURED VIEW. ALSO THE RELABELING EFFORT WILL ADDRESS THE PROBLEM. |

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| 0046 HF-1235 | 6.6.2.4A | G | 2C | OPS | LABELS AND LEGEND CARDS ON DISPLAY FACE OF SOME METERS AND RECORDERS OBSURE PORTIONS OF RECORDER OR SCALES. | DOORS ON RECORDER CAN BE OPENED. THE RELABELLING EFFORT WILL ADDRESS THE PROBLEM. |
| 0047 HF-1240 | 6.6.2.4D | G | CLSD | EPP-JUSTIF | THE OPERATORS ARE NOT PERIODICALLY CLEANING LABELS. | NO ACTION REQUIRED |
| 0048 HF-1245 | 6.6.3.1A | 6 | 2C | OPS | RAD. MONITOR RECORDER LACKS A LEGEND CARD. | A RECORDER LEGEND CARD WILL BE ADDED. |
| 0049 HF-1250 | 6.6.3.1A | 1 | 2C | OPS | LABELING OF PUSHBUTTONS SHOULD INCLUDE "RESET" TO IDENTIFY SPECIFIC FUNCTION. | THE RELABELING EFFORT WILL ADDRESS THE PROBLEM. |
| 0050 HF-1255 | 6.6.3.7A | G | 2C | OPS | LABELS ARE NOT CONSISTANTLY PLACED. | THE RELABELING EFFORT WILL ADDRESS THE PROBLEM. |
| 0051 HF-1260 | 6.6.3.7B | G | 2C | OPS | LABELS ARE NOT CONSISTANTLY PLACED. | THE RELABELING EFFORT WILL ADDRESS THE PROBLEM. |
| 0052 HF-1265 | 6.6.3.[illegible] | [illegible] | CLSD | [illegible] | THE HYDROGEN RECOMBINER SCALES HAVE TWO DIFFERENT RANGES AND ONE UNIT OF [illegible] MEASUREMENT. | THIS ITEM HAS BEEN CORRECTLY LABELED [illegible] |
| 0053 HF-1270 | 6.6.3.8 | G | 2C | OPS | A TEMPORARY POSITION LABEL HAS BEEN ADDED TO RECLOSER SELECTOR SWITCH. | THE RELABELING EFFORT WILL ADDRESS. |
| 0054 HF-1275 | 6.6.4.1 | G | CLSD | EPP-JUSTIF | COMPONENT LABELS ON VERTICAL METERS HAVE TOO SMALL LETTER SIZES. | METERS CAN BE READ FROM 4 TO 6 FEET AWAY |

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| 0055 HF-1280 | 6.6.4.1 | G | CLSD | EPP-JUSTIF | LABELS ON VERTICAL METERS HAVE TOO SMALL LETTER SIZES | METERS ARE READ AT CLOSE RANGE. |
| 0056 HF-1285 | 6.6.4.1 | G | CLSD | EPP-JUSTIF | LETTERING ON VERTICAL METERS IS TOO SMALL. | THE METERS ARE READ AT CLOSE RANGE |
| 0057 HF-1290 | 6.6.4.1 | 2 | 2C | NED | SCALE HAS BEEN ALTERED ON 4B RESIDUAL HEAT REMOVAL PUMP 4AB15 METER. NUMBER SIZE AND STYLE IS INCONSISTANT.. | THE METER SCALE WILL BE REPLACED. |
| 0058 HF-1295 | 6.6.4.1A | 6,13 | CLSD | EPP-JUSTIF | LETTER SIZES ON RAD MONITOR METERS ARE SMALL THAN OTHER LABELS. | THE LABELS ARE READABLE. |
| 0059 HF-1300 | 6.6.4.1A2 | G | CLSD | EPP-JUSTIF | LETTER HEIGHTS FOR LABELS VARY BETWEEN COMPONENTS. | NO ACTION REQUIRED |
| 0060 HF-1305 | 6.6.4.1B1 | G | 2C | OP | LABELS HAVE WHITE LETTERS ON DARK BACKGROUNDS. | THE RELABELING EFFORT WILL ADDRESS THIS. |
| 0061 HF-1310 | 6.6.5.1 | G | CLSD | EPP-JUSTIF | TAG-OUT LABELS ARE RED OR WHITE TAGS HUNG ON THE SWITCH HANDLE. THEY DO NOT PHYSICALLY PREVENT OPERATION. THEY SOMETIMES OBSCURE ADJACENT LABELS. | THE USE OF THESE TAGS IS AN INDUSTRY STANDARD AND ADMINISTRATIVE CONTROL IS USED. THE AMOUNT OF INFO. MANDATES TAG SIZE. THEY CAN BE FOLDED... ITEM CLOSED |
| 0062 HF-1315 | 6.6.5.1A,B | G | 3 | OP | THERE IS WIDESPREAD USE OF TEMPORARY LABELS. THIS USE SHOULD BE LIMITED TO CONDITIONS OF HIGH NECESSITY. | THE RELABELING EFFORT WILL CORRECT THIS. |
| 0063 HF-1320 | 6.6.5.2 | G | 3 | OPS | USE OF TEMPORARY LABELS SHOULD BE LIMITED. | THE RELABELING EFFORT WILL CORRECT THIS. |

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|---|---|---|---|---|---|---|
| 0064 HF-1325 | 6.6.5.2 | G | CLSD | EPP-JUSTIF | ADMINISTRATIVE CONTROL AND REVIEW PROCEDURES ARE NOT USED FOR TEMPORARY LABELS. | THE USE OF TEMPORARY LABELS WILL BE LIMITED AND USED WHEN NEEDS MANDATE. |
| 0065 HF-1330 | 6.6.3.3.8 | | 2C | EPP-JUSTIF | NEW 6000 SERIES VALVE NUMBERS BEING ADDED TO CONTROL ROOM. | THIS IS A DUPLICATE OF FILE NO.15 SECTION 6.6- ALL INFORMATION FILE THERE. |
| 0066 HF-1335 | 6.6.1.1 | G | 3 | I&C | PUSHBUTTON ON ELEC. CONSOLE IS UNLABELED AUTO SYNC. | THE RELABELING EFFORT WILL CORRECT THIS. |
| 0067 HF-1340 | 6.6.4.18 | G | CLSD | EPP-JUSTIF | DIRT ON LABELS AND RED/GREEN FLAGS ON J-HANDLES HAVE LOW CONTRAST. IMPACT PRINTERS ON RECORDERS HAVE LOW CONTRAST DUE TO INKING PROBLEM. | HOUSEKEEPING WILL CORRECT THE DIRT PROBLEM. NORMAL MAINTENANCE WILL CORRECT THE INKING PROBLEM. |
| 0068 HF-1345 | 6.6.3.1A | 2 | CLSD | EPP-JUSTIF | LABEL ON METER (TI-4-443A) FOR UNIT 4 PRESSURIZER IS INCORRECT. | PRESSURIZER INSTRUMENTATION IS BEING UPGRADED. THIS METER WILL BE REMOVED. UNIT 4 PCM 82-265 COMPLETE |
| 0069 HF-1350 | 6.6.1.1 | G | CLSD | SEE STATUS | COMPONENTS LABELED "DACA" ARE NOT ADEQUATELY LABELED. | THE RELABELING EFFORT WILL CORRECT THIS. THIS SYSTEM WAS REMOVED PCM 82-264 UNIT 3 PCM 82-265 UNIT 4 |
| 0070 HF-1355 | 6.6.2.2A | | 2C | | COLOR CODED ZONE MARKINGS ON METERS WERE APPLIED 8 YEARS AGO . SINCE THEN SOME OF THESE ZONES HAVE CHANGED. | SIGMA METERS WILL NOT BE MODIFIED DUE TO VENDORS REFUSAL TO REQUALIFY THE METERS. METERS NOT NEEDING QUALIFICATION WILL HAVE SCALE CODING MODIFIED. |
| 0071 HF-1360 | 6.6.3.2A | G | CLSD | EPP-JUSTIF | INDICATOR LIGHTS FOR LOAD LIMIT SWITCH ARE LABELED IN PERCENT INSTEAD OF PSI. | NO ACTION REQUIRED |

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|---|---|---|---|---|---|---|
| 0001 HF-1365 | 6.7.1.2A4 | N/A | CLSD | EPP-JUSTIF | "?RT LOCKPENDING" MEANS REACTOR TRIP. DIALOGUE DOESNOT REFLECT VOCABULARY OF USER POPULATION. | NOT VALID. DELETED |
| 0002 HF-1370 | 6.7.1.3.A. | COMP | CLSD | EPP-JUSTIF | COMPUTER SYSTEM DOES NOT CONTAIN PROMPTING OR STRUCTURTING. OPERATOR RECIEVES STATUS ON SELECTED PARAMETERS, NO ADDITIONAL INFO. | SAS / ICC / SPDS SYSTEM BEING UPGRADED |
| 0003 HF-1375 | 6.7.1.3.C | COMP | CLSD | EPP-JUSTIF | COMPUTER SYSTEM ONLY DISPLAYS TASK/FILE NAME. NO SPECIAL ENTRIES BY OPERATOR SUCH AS A REPORT PRINTED OUT EVERY 15 MIN. | INSTALLATION OF NEW COMPUTER SYSTEM SYSTEM BEING UPGRADED |
| 0004 HF-1380 | 6.7.1.4.A | G | CLSD | EPP-JUSTIF | NON-RELEVANT UNUSED KEYS ON KEY BOARD ADD TO VISUAL NOISE/CONFUSION & CROWDING UNUSED FUNCTION KEYS INCLUDED AS UPPER CASE | NO ACTION INTENDED SYSTEM BEING UPGRADED |
| 0005 HF-1385 | 6.7.1.4.D8 | G | CLSD | EPP-JUSTIF | KEYBOARD KEY SEPARATION LESS THAN RECOMMENDED 0.25 KEYBOARD SLOPE LESS THAN RECOM. 15-20 DEG FROM HORIZ. | SAS / ICC / SPDS SYSTEM BEING UPGRADED STANDARD TYPE WRITTER KEYBOARD NO ACTION INTENDED |
| 0006 HF-1390 | 6.7.1.6.B. | COMP | CLSD | EPP-JUSTIF | COMPUTER PRINTOUT STM. GEN. LVL./FLOW. PRINTER UPDATE & SPEED TOO SLOW. UPDATE ONCE / MIN. SPEED 60 VS 300 LINES / MIN. RECOMMENDED | SAS / SPDS ICC UPGRADE TO INCLUDE HIGH SPEED LINE PRINTER. 300 LINES/MINUTE. |
| 0007 HF-1395 | 6.7.1.6.B. | COMP | CLSD | EPP-JUSTIF | COMPUTER PRINTOUT ROD POSITION PROGRAM. ROD POSITION UPDATED EVERY MINUTE OPERATORS PREFER EVERY 5 MIN. | SYSTEM BEING UPGRADED. UPDATE CHANGED BY PROPER PROCEDURES NO FORTURE ACTION |
| 0008 HF-1400 | 6.7.1.[illegible].A2 | COMP | CLSD | EPP-JUSTIF | COMPUTER PROCEDURES NOT WRITTEN CLEARLY ENOUGH TO AID OPERATORS. | SYSTEM UPGRADE WILL INCLUDE FUNCTIONAL DESCRIPTIONS & TRAINING. |
| 0009 HF-1405 | 6.7.1.[illegible].8 | G | CLSD | EPP-JUSTIF | COMPUTER PROCEDURES INDEX DOESNOT HAVE A CROSSREFERENCE. | SYSTEM UPGRADE WILL HAVE ADDRESS/INSTRUMENT CALL FUNCTION TO ALLOW OPER. ACCESS TO PLANT INFO. |

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|---|---|---|---|---|---|---|
| 0010 HF-1410 | 6.7.2.1.C | D | CLSD | EPP-JUSTIF | CRT USES LIGHT PRINT ON DARK BACKGRND. IN HI AMBIENT LIGHT APP. 80FT. CANDLES. | NO ACTION REQUIRED. CRT LOCATED AS TO MINIMIZE REFLECTIVE GLARE. |
| 0011 HF-1415 | 6.7.2.1.F | COMP | CLSD | EPP-JUSTIF | CRT POOR RESOLUTION ZERO AND EIGHT LOOK ALIKE. FONT IS 5X7 INSTEAD OF 7X9 AS RECOMMENDED. | NEW CRT IS 19" WITH 7X9 MATRIX. SYSTEM BEING UPGRADED. |
| 0012 HF-1420 | 6.7.2.1.G | COMP | CLSD | EPP-JUSTIF | CRT SCREEN FLICKERS. DIFFICULT TO READ. | MAINTENANCE ITEM PWO WILL BE ISSUED |
| 0013 HF-1425 | 6.7.2.3.F | COMP | CLSD | EPP-JUSTIF | CRT & KEYBOARD NOT OPERABLE FROM CONTROL BOARD. OPERATOR MUST GO AROUND DESK. | SPDS KEYBOARD DEDICATED AT OPER. PANEL IN VIEW OF CRT. SAS HAS OWN KEYBOARD AND ASSOC. UTILITY SCREEN. ICC & ASSOC. KEY BOARD LOCATED TOGETHER. SYS. UPGRADE. |
| 0014 HF-1430 | 6.7.2.4.A | G | CLSD | EPP-JUSTIF | PTR COMPLEX NUMERIC PRINTOUT REQUIRES A CONVERSION. | UNIVERSAL READ OUT IN CONTROL RM. COMPUTERS. NO ACTION INTENDED. |
| 0015 HF-1435 | 6.7.2.5.F | COMP | CLSD | EPP-JUSTIF | CRT SCREEN LAYOUT PARAGRAPHS NOT SEPARATED BY AT LEAST ONE BLANK LINE. | SYSTEM UPGRADE WILL HAVE THIS FUNCTION. KEYBOARD PROGRAMABLE. SYSTEM BEING UPGRADED |
| 0016 HF-1440 | 6.7.2.5.H | COMP | CLSD | EPP-JUSTIF | COMPUTER SYSTEM NO PAGE POSITION [illegible] FOR MULTIPLE PAGES. | SYSTEM UPGRADE - PAGING AND SCREEN SCROLL CAPABILITY. |
| 0017 HF-1445 | 6.7.2.5.M | G | CLSD | EPP-JUSTIF | CRT SCREEN LOADING AMOUNT OF INFO.-BEARING ACTIVATED SCREEN AREA EQUALS 75% INSTEAD OF RECOM. 25%. | ONLY 18 LINES CAN BE DISPLAYED AT ONE TIME AND ARE LEGIBLE. NO ACTION INTENDED. |
| 0018 HF-1450 | 6.7.2.6.B | COMP | CLSD | EPP-JUSTIF | OPERATOR INTERVIEW COMPUTER SET PTS. INAPPROPRIATE RANGES | SYSTEM UPGRADE THIS CONDITION WILL BE RESOLVED. |

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|---|---|---|---|---|---|---|
| 0019 HF-1455 | 6.7.2.6.11 | G | CLSO | EPP-JUSTIF | COMPUTER DIALOGUE NO FEEDBACK INDICAT- ING PARAMETERS HAVE CHANGED. | ANNUNCIATOR ALARMS ALERT OPERATOR THAT PARAMETERS ARE APPROCHING SET POINTS |
| 0020 HF-1460 | 6.7.2.n.K | COMP | CLSO | EPP-JUSTIF | COMPUTER DIALOGUE DOES NOT PROVIDE DELAY FEED BACK MESSAGES TO INFORM OPERATOR TO STANDBY. | SYSTEM UPGRADE FEEDBACK FUNCTION PROV- IDED ON SAS |
| 0021 HF-1465 | 6.7.2.7.A. | COMP | CLSO | EPP-JUSTIF | COMPUTER PRINTER MAINT. NO INSTRUCTIONS FOR RELOADING PAPER INK RIBBON ECT. 6 NT MESG. NOT HIGHLIGHT OR CODED | SYSTEM UPGRADE COLOR CODING & OTHER HI- LIGHT FEATURES INCORP. PRINTER IS TYPEWRITER TYPE AND PAPER LOAD RIBBON LOADING IS OBVIOUS |
| 0022 HF-1470 | 6.7.3.1.E3 | G | CLSO | EPP-JUSTIF | ALARM MESSAGES COMP. PRINT. NO ALARM PRINTOUT IN SEQUENCE. OPER. CAN'T REQUES T BY ALARM GROUP. CAN'T DIST. ALARM FROM OTHER MESG. ALARM MESG NOT SPECIFIC ENGH | NO ACTION REQUIRED SYSTEM BEING UPGRADED |
| 0023 HF-1475 | 6.7.3.2 | G | CLSO | EPP-JUSTIF | COMPUTER PRINTER GRAPHIC CAP. TRENDS LINE AND BAR GRAPHS TABLES AND FLOW DIAG NOT AVAIL. GROUPS OF 5 NOT SEP. BY A SPACE. | NO ACTION INTENDED SYSTEM BEING UPGRADED |
| 0024 HF-1480 | 6.7.3.3.AB | 135 | CLSO | EPP-JUSTIF | GRAPHIC ILLUSTRATIONS SUCH AS TRENDS ARE NOT AVAILABLE. GROUPS OF 5 ARE NOT SEP- ARATED BY A SPACE IN TABLES WITH LONG COLUMNS OF NUMBERS. | SYSTEM BEING UPGRADED SAS SPDS ADDED TO PROVIDE OPERATOR WITH PLOTS AND INFOR- MATION- TRENDS MIMICS ECT. |

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| 0001 HF-1485 | 6.8.1.1.C | 1,3 | IIC | PRO | GROUPING AND CRITICALITY OF RECORDERS-T-AVE, T-RED PRZR PRESS AND LVL. NOT LOCATED CLOSE ENOUGH TO RELATED CONTROLS POWER RANGE RARLY USE-IN PRIME LOCATION | ITEMS ARE BEING REARRANGED, PART OF CONT RM MODIFICATION. |
| 0002 HF-1490 | 6.8.1.1.C | G | CLSD | EPP-JUSTIF | LOCAL DISPLAY FEEDBACK TO CONROL RM NOT ADEQUATE IE AC VITAL BUS VOLTAGE, MOIST. SEP. REHTR. TUBE LEAK, NEW SEC. MAKEUP TK LVL. & BYPASS VLV. STATUS NOT IN CR | INFO. WILL BE ADD. TO COMPUTER AS DETERMINED. NO FURTURE ACTION INTENDED |
| 0003 HF-1495 | 6.8.1.2 | G | CLSD | EPP-JUSTIF | EFFECTIVE PNL. LAYOUT FUNCTIONAL CONSIDERATIONS. VERTICAL PNL. OBSERVATIONS VS CONTROLS ON FRT. CONSOLE VIEWING DIST. NOT EFFECTIVE FOR ONE OPERATOR. | NO ACTION TREND RECORDERS AVAILABLE AT CONTROL STATION. SPDS DISPLAY WILL PROVIDE SAME INFO. AS CONTROL STATION. |
| 0004 HF-1500 | 6.8.1.2 | G | CLSD | EPP-JUSTIF | EFFECTIVE PNL. LAYOUT / FUNCTIONAL GROUPING. VIEWING AND OPERATION OF RELATED CONTROLS DOES NOT AFFORD ACCURATE MONITORING. | NO ACTION SPDS INTENDED TO ASSIST OPER. OPERATION MEMBERS STATED THEY HAD NO PROBLEMS. |
| 0005 HF-1505 | 6.8.1.3.B | G | CLSD | EPP-JUSTIF | ALL PANELS LACK DEMARCATION LINES. | NO ACTION. DEMARCATION WILL BE IMPLEMENTED AFTER PAINTING OF RIGB. |
| 0006 HF-1510 | 6.8.2.2 | 3 | IIC | EPP | INCONSISTENT ARRANGEMENT OF CONT. & DISP. STM FLOW & FEED FLOW- TOP ROW OF METERS ARE ASSC. WITH BOTTOM ROW OF CONTROLS. FLOW SELECT SW ARE REV FROM DISP ARRAGMT | CONTROL RM MODIFICATION WILL CORRECT CONDITION. |
| 0007 HF-1515 | 6.8.3.2.B | [illegible] | IIC | OPS | MORE THAN 5 SIMILAR COMPONENTS IN A ROW OR COLUMN WITHOUT DEMARCATION OR DIFFER. SPACING | SUMMARY LABELS AND DEMARCATION WILL BE IMPLEMENTED TO MINIMIZE EFFECTS OF THIS FINDING WHERE EXCESSIVELY LONG STRINGS EXIST |

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|---|---|---|---|---|---|---|
| 0001 HF-1520 | 6.9.1.2.C2 | G | 11C | PRO | ROTARIES ASSC. WITH METERS ARE IN THE WRONG ORDER HORIZ & VERTICLE. | SWITCHES & INDICATORS WILL BE REARRANGED TO CONFORM WITH STANDARD CONTROL RM CON- VENTION. |
| 0002 HF-1525 | 6.9.1.2.C3 | G | CLSD | EPP-JUSTIF | UNITS ON SCALE DON'T MATCH POSITIONER. | NO ACTION REQUIRED. |
| 0003 HF-1530 | 6.9.1.2.C3 | 1,3 | 111 | EPP | STEAM&FEED FLOW MISMATCHED CHANNEL-METER SCALE LABELS ARE INCORRECT EXP CHANNEL 3 METER LABELD CHANNEL 1 AND 4 LABELED 2 | ITEM WILL BE ADDRESSED AS PART OF RELABE LING.-PRESENTLY COLOR CODED- |
| 0004 HF-1535 | 6.9.2.1.B | 1 | 11C | EPP | SEQUENCE OF USE VERT. METER- INTAKE CH B,A RATHER THAN NORMAL A,B. LEFT TO RIGHT CONVENTION VIOLATED | INDICATORS WILL BE CONFIGURED TO AGREE WITH A,B. |
| 0004 HF-1540 | 6.9.2.1.B | 1 | 11C | EPP | SEQUENCE OF USE INTAKE CH PR BKA VERT. RATHER THAN A&B LEFT TO RIGHT CONVENTION VIOLATED | CONFIG WILL BE CHANGED TO A&B |
| 0005 HF-1545 | 6.9.2.1.B | 4 | CLSD | EPP-JUSTIF | UNIT 3 SAS 2 UNIT 4 SFG 3 SEQUENCE OF USE. NO LOGIC OF ARRANG. VALVES NOT IN SEQ. NOT ARRANG. IN ASSC. WITH ROTARY SW | SEE 6.5 PG.59 LAMPS TO BE REGROUPED; RE LABELING TO ID ASSC. VALVES. |
| 0006 HF-1550 | 6.9.3.2.A | G | CLSD | EPP-JUSTIF | CONTROL-DISPLAY RATIO PROCESS CONTROLLERS OPERATION OF KNOBS IS TIMELY DUE TO EXCESS ROTATION | NO ACTION REQUIRED NO TURN TO RATIO SCALE INCRUMENT CORRELATION. |

# APPENDIX A

# TABLE OF CONTENTS

# HUMAN ENGINEERING CHECKLIST

OPERATOR INTERVIEW

| EVALUATION GUIDELINE | REF. |
|---|---|
| 1. Senior operators who supervise or assist operations of more than one unit need to be stationed so that they can communicate effectively with operators in each unit and have an unobstructed visual path to each units' control boards. | 6.1.3.1 b. |
| 2. Operational crews will be committed to one or the other unit and will not be allowed to alternate between the two mirrored units. | 6.1.3.2 a. |
| 3. The distinction between the mirrored units will be heightened as much as possible. | 6.1.3.2 b. |
| 4. All equipment such as fire, radiation and rescue equipment, will be checked periodically for its condition. | 6.1.4.2 a. |
| 5. All equipment will be easily and readily accessible. | 6.1.4.2 b. |
| 6. Operators will be trained in the use of all emergency equipment. | 6.1.4.2 c. |
| 7. An administratively approved procedure for each type of emergency will be written. | 6.1.4.2 d. |
| 8. There will be an automatic fire warning system for control room fires. | 6.1.4.2 e. |
| 9. Emergency equipment will be stored in an orderly fashion. | 6.1.4.3 a. |
| 10. Storage location(s) will be accessible, clearly marked, and known to all personnel. | 6.1.4.3 b. |

# HUMAN ENGINEERING CHECKLIST

NOISE

*Criteria are different.

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Speech Intelligibility** | |
| 1. # Verbal communications between points are intelligible under slightly raised voice levels for ambient noise levels. | 6.1.5.5 a. |
| **Noise** | |
| 2. # Background noise levels do not exceed 65dB(A). | 6.1.5.5 b. CRE-11 |
| 3. # When voice transmission systems are not provided between the primary operating area and other control room locations, background noise is further reduced. | 6.1.5.5 c. |
| 4. # Noise distractions are minimized. | 6.1.5.5 d. |
| **Acoustical Treatment** | |
| 5. # Acoustical treatment limits reverberation time to one second or less. | 6.1.5.5 e. |
| **Auditory Signals** | |
| 6. # To assure gaining the operator's attention, a normal signal-to-noise (S/N) ratio of 10dB(A) is maintained in the control room with a S/N or 20dB in one octave band between 200 and 5000 Hz being adequate. | 6.2.2.6 a. AD-15 |
| 7. # Auditory signal intensity does not cause auditory discomfort. | 6.2.2.6 b. |
| 8. # Auditory signal intensities do not exceed 90dB(A) with the exception of 115dB(A) for evacuation alarms. | 6.2.2.6 c. |
| 9. # Auditory signal frequencies are between 200 and 5000 Hz with the maximum range of 500 to 3000 Hz. | 6.2.2.5 a. AD-12 |
| 10. # Wide-band auditory signals of approximately 200 Hz are used. | 6.2.2.5 b. |
| 11. # The signal intensity is discernible above ambient CR noise. | 6.3.2.1 a.* AD-23 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

LIGHTING

*Criteria are different.

| EVALUATION GUIDELINE | REF. |
|---|---|
| 1. Illuminated indicators are at least 10% greater in illumination than surrounding panel. | 6.5.3.2 b. and 6.5.3.3 a.(1) VD-90 |
| 2. Ambient lighting avoid reflection or refraction that cause light indicators to appear to be glowing when they are not. | 6.5.3.1 b. VD-91 |
| 3. Changes in ambient lighting do not affect discrimination of color coding. | 6.5.1.6 e.(3) VD-65 |
| 4. The emergency illumination system provides a minimum of 10 footcandles at all work stations in the primary operating area. | 6.1.5.4 c. |
| 5. Failure of the normal lighting system does not degrade the emergency lighting system. | 6.1.5.4 b. |
| 6. An automatically activated emergency lighting system that is independent of any other lighting system is provided. | 6.1.5.4 a. |
| 7. Surface colors are recognizable under both normal and emergency conditions. | 6.1.5.3 h. CRE-7 |
| 8. Reflectance conforms to guidelines. | 6.1.5.3 g. CRE-6 |
| 9. Glare does not interfere with readability of displays, labels, or indicators. | 6.1.5.3 f. CRE-3 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 10. Labels, instructions and other written information are not in a shadowed position. | 6.1.5.3 e.(2) |
| 11. Ambient illumination is provided via direct or diffuse lighting. | 6.1.5.3 e.(1) CRE-5 |
| 12. To reduce operator fatigue and eyestrain, shadows are avoided. | 6.1.5.3 e. |
| 13. Luminance ratios for task areas conform to guidelines. | 6.1.5.3 d. CRE-8 |
| 14. Supplemental lighting provides for specialized visual tasks in areas where fixed illumination is not adequate. | 6.1.5.3 c. CRE-10 |
| 15. Illumination levels do not vary greatly within work stations. | 6.1.5.3 b. |
| 16. Illumination levels conform to guideline. | 6.1.5.3 a.* CRE-10 |
| 17. The illuminated condition is recognizable under the highest predicted ambient light condition and is at least 10% brighter than the surrounding panel. | 6.4.3.3 b.(2) |
| 18. When the CRT uses light characters on a dark background, character luminance is 23 ft-L minimum and 46 ft-L preferred. | 6.7.2.1 c.(4)* VD-47 |
| 19. When the CRT uses dark characters on a light background, screen background luminance is 23 ft-L minimum and 46 ft-L preferred. | |

# HUMAN ENGINEERING CHECKLIST

LIGHTING

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| 20. When ambient illumination in the vicinity of the CRT is in the medium to high range, the CRT uses dark characters and symbols on a light background. | 6.7.2.1 c.(2) VD-47 | | |
| 21. Ambient illumination contributes no more than 25% to screen luminance through diffuse reflection and phosphor excitation. | 6.7.2.1 c.(1) VD-47 | | |
| 22. CRT screens are installed to minimize or eliminate reflected glare at normal operator viewing angles. | 6.7.2.1 b. VD-47 | | |
| 23. Alphanumeric and graphic characters are easy to read under all control room lighting conditions. | 6.7.2.1 a. VD-47 | | |
| 24. Proper lighting of at least 8 ft.C is provided in work access areas. | CRE-17 | | |
| COUNTERS | | | |
| Visibility | | | |
| 25. # Counters are self-illuminated when used in areas which provide display luminance below 1 ft.-L. | VD-83 | | |

# HUMAN ENGINEERING CHECKLIST

CR ENVIRONMENT

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **Workspace Arrangement** | | |
| 1. # | Control room arrangement facilitates efficient unobstructed movement and communication. | 6.1.1.3 d.(1) |
| 2. # | Equipment is arranged with movement and communications patterns in mind. | 6.1.3.1 a. |
| 3. # | Visual relief from arrays of instrumentation is provided. | 6.1.5.7 a.(3) |
| 4. @ | Controls are located so that simultaneous operation of 2 controls does not require a crossing or interchanging of hands. | WA-4 |
| **Workspace Location** | | |
| 5. # | The shift supervisor's office is readily accessible to the control room. | 6.1.1.6 a. |
| 6. # | Operators at desks and consoles have full view of all control and display panels in the primary operating areas. | 6.1.1.3 a. WA-28 |
| 7. # | Desk and console placement facilitates voice communications from seated operators to any point in the primary operating area. | 6.1.1.3 b. |
| 8. # | Out-of-the-way storage is provided for operators' coats and personal belongings. | 6.1.5.6 a. |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 9. # | Shelves are located so that contents can be seen and reached. Under no circumstances is the top shelf higher than 76 inches. | WA-8 |
| 10. # | The CRT screen data and messages are within unobstructed view of the operator at normal work station. | 6.7.2.3 f. |
| 11. # | If writing space is on the console, it does not interfere with viewing and operation of controls and displays. | 6.1.2.3 h.(2) |
| 12. # | If writing space is not provided on the console, it is located at a nearby desk or table. | 6.1.2.3 h.(3) |
| 13. @ | Controls are placed close to the display they affect and with an equal distribution of work between right and left hands (finest adjustment reserved for the right hand). | WA-3 |
| 14. # | Controls on a vertical surface are located in an area no greater than 8 inches above the head and no further than 18 inches from the center line. Controls frequently operated or critical are located between shoulder level and waist height. | WA-6 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

CR ENVIRONMENT

| EVALUATION GUIDELINE | REF. |
|---|---|
| 15. # Finger-operated controls are located with 29 inches from operator's shoulder. | WA-3 |
| 16. # Controls operated with the whole hand are located within approximately 27 inches of the operator's shoulder. | WA-3 |
| **Workspace Size, Shape, Design** | |
| 17. @ Operators are able to perform tasks at any work station. | 6.1.1.3 c.(2) |
| 18. @ A means for voice communications is provided in restrooms and eating areas. | 6.1.5.7 b.(3) |
| 19. @ Desks provide enough space for all materials required during task performance. | 6.1.2.7 a. |
| 20. # Desks have adequate knee space. | 6.1.2.7 c. |
| **Workspace Coding/Identification** | |
| 21. @ Operators are able to work comfortably at desks as permitted by desk dimensions. | 6.1.2.7 b. |
| 22. @ Adequate space is allowed between the chair and desk/console so the operator can easily get in and out of the chair or can view equipment behind. | 6.1.1.3 e. |
| 23. # Panels and equipment enclosures are designed so that no unwanted objects can be introduced. | 6.1.1.3 g. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 24. # Lockers are large enough for storage of personal items. | 6.1.5.6 b. |
| 25. # The minimum lateral workspace for racks with drawers: a) racks with drawers weighing less than 45 lbs., 18 inches clearance on one side and 4 inches clearance on the other; and b) racks having drawers weighing over 45 lbs., 18 inches clearance on each side. | WA-15 |
| 26. # Segmented, wraparound consoles are used when the panel space for a single seated operator exceeds 44 inches of flat surface. | WA-28 |
| 27. # If vision over top is required, the width of central segment does not exceed 44 inches and the left and right segments do not exceed 24 inches. | WA-28 |
| 28. # Controls used for performing the same function on different items or equipment are the same size. | CON-17 |
| 29. # Labels are located on main chassis of the equipment. | PA-44 |
| 30. # When instructions applying to a covered item are labeled on a hinged door, the lettering is properly oriented so that it can be read when door is open. | PA-29 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CR ENVIRONMENT

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Workspace Visibility** | |
| 31. # Total left-to-right viewing angle does not exceed 190°. | WA-29 |
| 32. # Where functional groups are outlined with contrasting lines, a 1/16 inch border designates secondary or non-critical groups. | CDI-13 |
| 33. # Where functional groups are outlined with contrasting lines, a 3/16 inch border designates primary, emergency, or extremely critical operations. | CDI-13 |
| **Workspace Safety** | |
| 34. # Operators are able to get to any work station without encountering any obstacles. | 6.1.1.3 c.(1) |
| 35. # Handset cords are positioned to avoid entangling critical controls or endangering passing traffic. | 6.2.1.2 b.(5) |
| 36. # Vertically mounted handset cradles are located out of the way of traffic. | 6.2.1.2 b.(6) |
| 37. # Handrails are provided for platforms, stairs, and floor openings or wherever personnel may fall from an elevation. | CRE-17 |
| 38. Skid-proof flooring on stair or step-tread coverings are used. | WA-39 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 39. # Stairs, stair-ladders, ramps, etc., are equipped with handrails on each side. Where one or both sides are open, guardrails are provided. | WA-36 |
| 40. # Stair-ladders are made of metal; handrails have non-slip surface. | WA-39 |
| 41. # Emergency doors/exits are accessible and easily opened. The doors are designed to be opened by a single motion of hand or foot. There are emergency exits from secure or classified areas. | CRE-17 |
| 42. # Exposed edges are rounded to a minimum radius of .4 inch and corners to a minimum of .5 inch. | VD-6 |
| **Workspace Climate** | |
| 43. # The climate control system is capable of maintaining temperature and humidity. | 6.1.5.1 a. CRE-1 |
| 44. # Air temperature at floor and head levels do not differ by more than 10°F. | 6.1.5.1 b. CRE-1 |
| 45. # Capacity of ventilation system is at least 15 cubic feet per minute per occupant. | 6.1.5.2 a. CRE-15 |
| 46. # Air velocity in the primary operating area does not exceed 45 feet per minute measured at operator head level and does not produce a noticeable draft. | 6.1.5.2 b. CRE-15 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

CR ENVIRONMENT

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| | **Workspace Comfort** | |
| 47. | Control room colors are coordinated. | 6.1.5.7 a.(1) |
| 48. # | Color and lighting creates a cheerful atmosphere. | 6.1.5.7 a.(2) |
| 49. # | Comfortable seating is provided. | 6.1.5.7 a.(4) |
| 50. # | Carpeting is provided. | 6.1.5.7 a.(5) |
| | Chairs pivot so that operators can readily adjust position. | 6.1.2.8 a. |
| 51. # | A restroom and kitchen or eating area are located within or near control room. | 6.1.5.7 b.(1) |
| 52. # | Restroom and eating facilities are easily accessible. | 6.1.5.7 b.(2) |
| 53. # | A rest area is provided. | 6.1.5.7 c. |
| 54. | Chairs pivot so that operators can readily adjust position. | 6.1.2.8 a. |
| 55. # | Chairs support the lower back; the angle between the back and seat is about 100° for office tasks and greater for reading and resting. | 6.1.2.8 b. WA-17 |
| 56. # | Chairs with armrests are preferred for personnel who remain seated for long periods of time. | 6.1.2.8 c. |
| 57. # | Seats and backrests are padded with at least 1" of compressible material. | 6.1.2.8 d. WA-17 |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 58. # | The backrest reclines between 103° and 115°. The backrest engages the lumbar and thoracic regions of the back, and supports the torso so that the operator's eyes can be brought to "eye line" with no more than 3 inches of forward body movement. If only lumbar support is given, lateral curvature does not exceed 7.3 inches in radius. | WA-17 |
| | **Workspace Accessory Hardware** | |
| 59. # | Lighting systems use light baffles or diffused indirect lighting. | CRE-3 |
| 60. # | Trademarks, company names, or other markings are not displayed on the panel face. | CRE-6 |
| | **Workspace Acoustics** | |
| 61. # | The average room sound absorption coefficient is at least .20. | CRE-14 |
| 62. # | Acoustical treatment in accordance with the figure on back is used to reduce reverberation time. | CRE-12 |
| | **Workspace Illumination** | |
| 63. | Luminaires are placed at least 60° from the viewer's line of sight. | CRE-3 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CR ENVIRONMENT

| EVALUATION GUIDELINE | REF. |
|---|---|
| 64. # Instrument panels have a dull matte finish. | CRE-3 |
| 65. # Pastels and light grays are used for ceilings, walls, or consoles rather than dark grays, green, blue, red, and brown. | CRE-5 |
| Control Room Performance Aids | |
| 66. # Procedures and other references are readily accessible. | 6.1.1.4 a.(1) WA-33 |
| 67. # Reference documents are stored out in the open where they are easy to locate and use. | 6.1.1.4 a.(2) WA-33 |
| 68. # Specific documents are clearly labeled. | 6.1.1.4 b.(1) |
| 69. # Labels distinguish documents. | 6.1.1.4 b.(2) |
| 70. # A method of organizing documents to reduce search time is used, such as separating operational documentation from other documents. | 6.1.1.4 b.(3) |
| 71. # Documents are removable from racks. | 6.1.1.4 c.(1) |
| 72. # Documents are bound and permit fixed opening at a desired place. | 6.1.1.4 c.(2) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 73. # Documents are protected from being dog-eared, dirty, loose, torn, and difficult to read. | 6.1.1.4 d. |
| 74. # Sets of procedures are stored separately for each unit in a multi-unit control room. | 6.1.1.4 e. |
| 75. @ Procedures are accessible while tasks are being performed. | 6.1.2.6 |
| 76. # Annunciator response procedures are available in the control room. | 6.3.4.3 a. |
| 77. # Annunicator response procedures are indexed by panel identification and annunciator tile coordinates. | 6.3.4.3 b. |
| 78. # Each plant unit has its own set of procedures. | 6.1.3.1 d. |
| Control Room Procedures Design | |
| 79. @ Nonessential personnel have limited access to various areas within the control room. | 6.1.1.7 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

*Criteria are different.

| EVALUATION GUIDELINE | REF. |
|---|---|
| PUSH-PULL | |
| Arrangement | |
| 1. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| Coding/Identification | |
| 2. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 3. @ If there is labeling on this slide control, control shaft is locked in position to maintain correct label orientation. | CON-61 |
| 4. All discrete functional control positions are identified. | 6.6.3.8 a. |
| 5. @ When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| Size, Shape, Design | |
| 6. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| Operations | |
| 7. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.12 e CON-13 |
| 8. If controls are recessed, shielded or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 9. @ When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 10. # On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 11. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| 12. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 13. Push-Pull controls have the operating position in the OUT position. | CON-61 |
| **Direction/Rate of Motion** | |
| 14. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| **Visibility** | |
| 15. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 16. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| **Maintenance** | |
| 17. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| TOGGLE SWITCHES | |
| Arrangement | |
| 18. Where a horizontal row of displays is associated with a vertical column of switches (or vice versa), the farthest left horizontal item corresponds to the topmost vertical item. | CDI-11 |
| 19. Where switches are arranged in fewer rows than displays, switches associated with top row of displays are positioned at far left; switches associated with second row of displays are placed immediately to the right, etc. | CDI-11 |
| 20. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| Coding/Identification | |
| 21. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 22. All discrete functional control positions are identified. | 6.6.3.8 a. PA-28 PA-49 |
| 23. @ When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| Size, Shape, Design | |
| 24. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 25. # Toggle switches conform to the dimensions in the figure on the back of this page. | 6.4.5.3 c. CON-64 |
| 26. # Omitted. | |
| Operations | |
| 27. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike them accidentally in any sequence of control movement. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| | e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| | f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 28. | If controls are recessed, shielded or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |
| 29. @ | When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 30. # | On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 31. @ | Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 32. @ | When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 33. # | If this switch requires only occasional resetting it is provided with cover to protect it against inadvertent actuation. | |
| 34. | If used, the guard is either: | CON-68 |
| | a. # Lift-to-unlock mechanism - resistance does not exceed 48 oz. | |
| | b. Safety cover - location does not interfere with activation of guarded control or any adjacent controls. | |
| | c. Any equivalent method. | |
| | **Direction/Rate of Motion** | |
| 35. | Control movements conform to population stereotypes (see table in back). | 6.4.2.1 CON-11 |
| | **Feedback** | |
| 36. @ | Toggle switches have an audible check, or provide some other source of feedback upon activation. | 6.4.5.3 b. CON-67 |
| | **Visibility** | |
| 37. | The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 38. @ | Control position information is visible to the operator during control operation. | 6.6.3.8 c. |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
| --- | --- |
| **Maintenance** | |
| 39. Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | REF. |
| --- | --- |
| **ROCKER SWITCHES** | |
| *Arrangement* | |
| 40. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| 41. Rocker switches are oriented vertically unless the location of the controlled function or equipment requires it to be horizontal. | 6.4.5.4 a.(2) CON-71 |
| *Coding/Identification* | |
| 42. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 43. All discrete functional positions are identified. | 6.6.3.8 a. PA-28 PA-49 |
| 44. @ When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| *Size, Shape, Design* | |
| 45. Rocker Switch displacement (see figure) is a minimum of 30 degrees and a maximum of 120 degrees for two positions and a minimum of 18 degrees, a maximum of 60 degrees, and an optimum of 25 degrees for three positions. | 6.4.5.4 e(3)(4) CON-70 |
| 46. # Rocker switches conform to the dimensions in the figure on the back of this page. | 6.4.5.4 e. CON-70 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 47. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| **Operations** | |
| 48. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator does not strike or move them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 49. If controls are recessed, shielded or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |
| 50. @ When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 51. # On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 52. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 53. @ When sequential activation is necessary, controls are provided with locks to prevent controls form passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| 54. @ In the on position, the top of the switch is flush with the panel surface. | 6.4.5.4 b.(2) CON-71 |
| 55. @ Controls that have critical functions are protected to prevent inadvertent activation. | 6.4.5.4 d. CON-71 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Direction/Rate of Motion** | |
| 56. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 57. Activation of the upper part controls the ON or INCREASE function. | 6.4.5.4 a.(1) CON-71 |
| **Feedback** | |
| 58. @ Activation is indicated by a snap feel, an audible check, or an integral light. | 6.4.5.4 b.(1) |
| **Visibility** | |
| 59. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 60. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| **Maintenance** | |
| 61. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **SLIDE SWITCH** | |
| **Arrangement** | |
| 62. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| **Coding/Identification** | |
| 63. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 64. All discrete functional control positions are identified. | 6.6.3.8 a. PA-28 PA-49 |
| 65. @ When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| **Size, Shape, Design** | |
| 66. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 67. # Slide switch length is 1.0 inch. | 6.4.5.2 b.(2) CON-73 |
| 68. # The surface of slide switches is serrated or knurled. | 6.4.5.2 a. CON-73 |
| 69. # Slide switch thickness is 0.25 inch. | 6.4.5.2 b.(1) CON-73 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Operations** | |
| 70. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movement. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 71. If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |
| 72. @ When the guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 73. # On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 74. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 75. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| **Direction/Rate of Motion** | |
| 76. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| **Visibility** | |
| 77. The control color will contrast with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 78. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Maintenance** | |
| 79. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **THUMBWHEELS** | |
| **Arrangement** | |
| 80. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| **Coding/Identification** | |
| 81. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 82. If the thumbwheel is used as an input device, the OFF, zero, or normal position will be coded. | 6.4.5.1 b.* CON-91 |
| 83. When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| 84. All discrete functional control positions are identified. | 6.6.3.8 a. |
| **Size, Shape, Design** | |
| 85. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 86. Thumbwheel readouts are visible from the thumbwheel operating position. | 6.4.5.1 a. CON-89 |
| 87. # Discrete setting thumbwheels conform to the figure and exhibit recommended dimensions. | 6.4.5.1 d.(1) CON-95 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **Operations** | | |
| 88. | Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| | a. Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movement. | 6.4.1.2 a. CON-13 |
| | b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| | c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| | d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| | e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| | f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 b(2) CON-13 |
| 89. | If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |
| 90. @ | When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 91. # | On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 92. @ | When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| 93. # | Continuous adjustment thumbwheels have at least one inch of the wheel exposed to permit easy manipulation. | 6.4.5.1 c.(1) CON-97 |
| 94. @ | When continuous adjustment thumbwheels have an OFF position, a detent is provided for feedback at that point. | 6.4.5.1 c.(3) CON-99 |
| **Direction/Rate of Motion** | | |
| 95. | Control movements conform to population stereotypes (see table in back). | 6.4.2.1 CON-11 |
| 96. | Direction of motion is identified for continuous motion rotary controls. | 6.6.3.8 b. PA-32 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **Resistance, Force, Torque** | | |
| 97. @ | Thumbwheel controls which have discrete settings are detented between positions and snap into each position. | 6.4.5.1 d.(1) CON-95 |
| **Visibility** | | |
| 98. | The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 99. @ | Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| **Readability** | | |
| 100. | Digits on this thumbwheel are bold, black numerals engraved on a light background. | CON-90 |
| **Maintenance** | | |
| 101. @ | Control surface has not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **PUSHBUTTONS** | | |
| **Arrangement** | | |
| 102. # | Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| 103. @ | Lamps on panels having less than 4 lights may be tested by individual press to test function on legend push-buttons. | VD-92 |
| 104. | Displays are arranged consistently from panel to panel on legend pushbuttons. | VD-18 |
| 105. @ | Simultaneous testing of lamps on all control panels is available on legend pushbuttons. | VD-91 |
| 106. # | Barriers are used when legend pushbuttons are located too close to each other. | 6.4.3.3 d.(1)* CON-56 |
| **Coding/Identification** | | |
| 107. @ | Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 108. @ | When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Size, Shape, Design** | |
| 109. Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 110. # Size dimensions for legend pushbuttons are a minimum of 0.75 inch and a maximum of 1.5 inches. | 6.4.3.3 e.(1) CON-56 |
| 111. # Barrier depth for legend pushbuttons is a minimum of 0.183 inch and a maximum 0.250 inch. | 6.4.3.3 c.(4) CON-56 |
| 112. # Barrier width for legend pushbuttons is a minimum of 0.125 inch. | 6.4.3.3 e.(3)* CON-56 |
| 113. # Pushbutton diameter for thumb or heel of hand operation is a minimum of 0.75 inch. | 6.4.3.2 b. CON-50 |
| 114. # Diameter for fingertip operation of unguarded and nonrecessed pushbuttons is a minimum 0.385 inch and of guarded or recessed pushbuttons is a minimum of 0.75 inch. | 6.4.3.2 a.* CON-50 |
| 115. # Barriers have rounded edges. | 6.4.3.3 d.(2) CON-56 |
| 116. # The surface of a pushbutton offers slip resistance or is concave. | 6.4.3.1 c. CON-52 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Operations** | |
| 117. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for actuation. | 6.4.1.2 e. CON-13 |
| 118. If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 119. @ When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 120. @ On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 121. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 122. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| Direction/Rate of Motion | |
| 123. Control movement conforms to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| Feedback | |
| 124. @ A positive indication is provided in the form of a snap feel, an audible check, or an integral light for pushbuttons. | 6.4.3.1 b. CON-53 |
| 125. @ Pushbutton displacement for thumb or finger operation is a minimum of 0.125 inch. | 6.4.3.2 c. CON-50 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 126. @ Displacement for legend pushbuttons is a minimum of 0 inch (touch plate) minimum 0.125 inch (all others) and a maximum of 0.250 inch. | 6.4.3.3 e.(2)* CON-56 |
| Visibility | |
| 127. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 128. # Transilluminated numerals and letters do not vary in engraving depth on legend pushbuttons. | VD-103 |
| 129. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| Maintenance | |
| 130. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **HAND CRANK** | | |
| **Arrangement** | | |
| 131. # | Control separation will conform the Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| **Coding/Identification** | | |
| 132. @ | Each control will be recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 133. | All discrete functional control positions will be identified. | 6.6.3.8 a. PA-28 PA-45 |
| 134. | When color coding is used to relate a control to its corresponding display, the same color will be used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| **Size, Shape, Design** | | |
| 135. | Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 136. # | Hand Crank switches conform to the dimensions in the figure on the back. | CON-103 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **Operations** | | |
| 137. | Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| | a. @ Controls are located and oriented so that the operator does not strike or more them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| | b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| | c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| | d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| | e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| | f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 138. | If controls are shielded, recessed, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |

# HUMAN ENGINEERING CHECKLIST

CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 139. When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 140. # On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 141. @ Rotary action controls are used when linear or pushbutton control would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 142. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| Direction/Rate of Motion | |
| 143. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 144. Direction of motion is identified for continuous motion rotary controls. | 6.6.3.8 b. PA-32 |
| Visibility | |
| 145. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 146. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| Maintenance | |
| 147. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
| --- | --- |
| HANDWHEELS | |
| Arrangement | |
| 148. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| Coding/Identification | |
| 149. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 150. All discrete functional control positions are identified. | 6.6.3.8 a. PA-28 PA-45 |
| 151. @ When color coding is used to relate a control to its corresponding display, the same color will be used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| Size, Shape, Design | |
| 152. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |

| EVALUATION GUIDELINE | REF. |
| --- | --- |
| Operations | |
| 153. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator does not strike or more them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 154. If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 155. @ | When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 156. # | On moveable covers or guards, safety or lock wires will not be used. | 6.4.1.2 c.(2) CON-13 |
| 157. @ | Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 158. @ | When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| | **Direction/Rate of Motion** | |
| 159. | Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 160. | Direction of motion is identified for continuous motion rotary controls. | 6.6.3.8 b. PA-32 |
| | **Resistance, Force, Torque** | |
| 161. # | This handwheel's rim is provided with contoured molding and has a high degree of frictional resistance. | CON-101 |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| | **Visibility** | |
| 162. | The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 163. @ | Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| | **Maintenance** | |
| 164. @ | Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| DISCRETE ROTARY — GENERAL | | |
| Arrangement | | |
| 165. # | Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| Coding/Identification | | |
| 166. @ | Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 167. | All discrete functional control positions are identified. | 6.6.3.8 a. |
| 168. @ | When color coding is used to relate a control to its corresponding display, the same color will be used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| 169. # | Shape coding techniques are visually and tactually identifiable and free of sharp edges. | |
| Size, Shape, Design | | |
| 170. | Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| Operations | | |
| 171. | Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ | Controls are located and oriented so that the operator does not strike or move them accidentally in any sequence of control movement. | 6.4.1.2 a. CON-13 |
| b. | Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # | Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ | Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ | Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ | Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 172. | If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 173. @ | When the guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 174. # | On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-13 |
| 175. @ | Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 176. @ | When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| | **Direction/Rate of Motion** | |
| 177. | Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 178. | Rotary control settings increase in value with a clockwise rotation. | 6.4.4.1 a. CON-26 |
| | **Visibility** | |
| 179. @ | Control position information is visible to the operator during control operation. | 6.6.3.8 c. |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 180. | The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| | **Maintenance** | |
| 181. @ | Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |
| | **DISCRETE ROTARY — STAR HANDLES** | |
| | **DISCRETE ROTARY — ROTARY SELECTOR** | |
| | **Size, Shape, Design** | |
| 182. # | Rotary selector switch length is a minimum of 1.0 inch and a maximum of 4.0 inches. | 6.4.4.5 e.(1) CON-32 |
| 183. # | Rotary selector switch width is a maximum of 1.0 inch. | 6.4.4.5 e.(2) CON-32 |
| 184. # | Rotary selector switch diameter is a minimum of 1.0 inch. | 6.4.4.5 e.(3) |
| 185. # | Rotary selector switch depth is a minimum of 0.625 inch and a maximum of 3.0 inches. | 6.4.4.5 e.(4) CON-32 |
| 186. # | Controls have a moving pointer and fixed position settings. | 6.4.4.5 c. CON-24 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 187. This rotary control is provided with a reference line on the pointer. This line has 50% minimum contrast with the control cover under all lighting conditions. | CON-24 |
| 188. Position indication is provided by either illuminated indicator lights, a line engraved both on the top of the knob and down the side, or a pointer shape. | 6.4.4.5 d.(1) |
| 189. The position of the knob in reference to position markers does not result in confusion. To minimize the problem of parallax, pointers on knobs will be mounted close to the settings to which they point. | 6.4.4.5 d.(2)** CON-24 |
| 190. Rotary selector controls are used when there are 3 or more detended positions required, and may be used for 2-detented position operation. | 6.4.4.5 a.* CON-30 |
| 191. It is not be possible to position a control between detented positions. | 6.4.4.5 b.(2) CON-35 |
| 192. A maximum of 24 positions is used. | 6.4.4.5 b.(3) CON-33 |
| 193. @ Stops are provided at the limits of the control range. | 6.4.4.5 b.(4) CON-34 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| Resistance, Force, Torque | |
| 194. @ Detents are provided at each control position. | 6.4.4.5 b.(1) CON-35 |
| DISCRETE ROTARY — J-HANDLE | |
| Size, Shape, Design | |
| 195. J-handle clearance is between 1 and 2 inches. | 6.4.4.2 a.(2) CON-44 |
| 196. Where smaller J-handles are used, the handle preportion has a flattened or flared tip for finger placement, and the clearance between handle and panel surface can be less. | 6.4.4.2 b. |
| 197. # J-handle length is between 1 and 2 inches. | 6.4.4.2 a.(1) CON-44 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| | **KEY OPERATED** | |
| | **Arrangement** | |
| 198. # | Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| | **Coding/Identification** | |
| 199. @ | Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 200. | Control positions are labeled on key-operated switches. | 6.4.4.3 f. CON-48 6.6.3.8 a. PA-28 PA-49 |
| 201. | Direction of motion is identified for key operated switches. | 6.6.3.8 b. PA-32 |
| 202. @ | When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| | **Size, Shape, Design** | |
| 203. # | Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 204. # | Keys with a single row of teeth are inserted into the lock with the teeth pointing up or forward. | 6.4.4.3 b. CON-45 |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 205. # | If keys have teeth on both edges, they fit the lock with either side up or forward. | 6.4.4.3 c. CON-45 |
| 206. # | The height of key in inches is a minimum of 0.5 and a maximum of 3.0. | 6.4.4.3 g.(2) CON-46 |
| 207. @ | Key-operated controls are used solely when system requirements dictate that the function being controlled should be secured against activation by unauthorized personnel. | 6.4.4.3 a. |
| | **Operations** | |
| 208. | Locks are oriented so that the switch is OFF (or SAFE) when the key is in the vertical position. | 6.4.4.3 d. CON-45 |
| 209. @ | Operators normally are not able to remove the key from the lock unless the switch is turned to the OFF or SAFE position. | 6.4.4.3 e. CON-45 |
| 210. | The angular displacement is a minimum of 80° and a maximum of 90°. | 6.4.4.3 g.(1) CON-46 |
| 211. @ | When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |

# ON-SITE EVALUATION @ OPERATOR-ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Direction/Rate of Motion** | |
| 2. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 213. Control settings increase in value with a clockwise rotation. | 6.4.4.1 a. CON-26 |
| **Visibility** | |
| 214. The control color constrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 215. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |
| **Maintenance** | |
| 216. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **CONCENTRIC KNOBS** | |
| **Arrangement** | |
| 217. # Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| **Coding/Identification** | |
| 218. @ Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 219. All discrete functional control positions are identified. | 6.6.3.8 a. |
| 220. @ When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| **Size, Shape, Design** | |
| 221. # Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| **Operations** | |
| 222. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movement. | 6.4.1.2 a. CON-1 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with the movable barrier. | 6.4.1.2 c.(1) CON-15 |
| d. Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 223. If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-13 |
| 224. When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 225. # On moveable covers or guards, safety or lock wires will not be used. | 6.4.1.2 c.(2) CON-13 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 226. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 227. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| **Direction/Rate of Motion** | |
| 228. Control movement conforms to population stereotypes (see table in back). | 6.4.2.1* CON-11 |
| 229. Control settings increase in value with a clockwise rotation. | 6.4.4.1 a. CON-26 |
| 230. Direction of motion is identified for continuous motion rotary controls. | 6.6.3.8 b. |
| **Visibility** | |
| 231. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 232. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **Maintenance** | | |
| 233. | Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **CONTINUOUS (ALL)** | | |
| **Arrangement** | | |
| 234. # | Control separation conforms to Table 6.8-2 and 6.8-3. | 6.8.3.1 |
| **Coding/Identification** | | |
| 235. @ | Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 236. @ | When color coding is used to relate a control to its corresponding display, the same color is used for both the control and the display. | 6.4.2.2 f.(2) CON-20 |
| **Size, Shape, Design** | | |
| 237. # | Selected controls make best use of space for the intended purpose and requirements for activation. | 6.4.1.1 b.(4) |
| 238. # | Knobs for continuous adjustment controls are round in shape, with knurled or serrated edges. | 6.4.4.4 a. CON-37 |
| 239. # | Fingertip grasp knobs conform to the following dimensions: height (inches) minimum 0.5 and maximum 1.0; diameter (inches) minimum 0.375 and maximum 4.0. | 6.4.4.4 c.(1) CON-39 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 240. # Thumb and forefinger encircled knobs conform to the following dimensions: diameter (inches) minimum 1.0 and maximum 3.0. | 6.4.4.4 c.(2) CON-39 |
| 241. # Controls used with knob skirts have a minimum skirt diameter of 2.0 inches. | 6.4.4.4 e.(1) CON-29 |
| 242. # Controls used with knob skirts have a minimum skirt height of 0.25 inch. | 6.4.4.4 e.(2)* CON-29 |
| 243. Controls used with knob skirts have a minimum finger stop diameter of 1.25 inches. | 6.4.4.4 e.(3)* CON-29 |
| 244. # Controls used with knob skirts have finger stop height plus rotary knob height of a total minimum of 0.75 inch. | 6.4.4.4 e.(4) CON-29 |
| 245. # When controls are used with knob skirts, minimum knob diameter is 0.75 inch. | 6.4.4.4 e.(5)* CON-29 |
| **Operations** | |
| 6. Accidental activation of controls is minimized by one or more of the following methods (check those which apply): | |
| a. @ Controls are located and oriented so that the operator will not strike or move them accidentally in any sequence of control movements. | 6.4.1.2 a. CON-13 |
| b. Controls are recessed, shielded, or otherwise surrounded by physical barriers. | 6.4.1.2 b.(1) CON-13 |
| c. # Controls are covered or guarded with movable barriers. | 6.4.1.2 c.(1) |
| d. @ Controls are provided with interlocks so that extra movement is required. | 6.4.1.2 d.(1) CON-13 |
| e. @ Controls are provided with interlocks so that prior operation of a related or locking control is required. | 6.4.1.2 d.(2) CON-13 |
| f. @ Controls are provided with resistance so that distinct or sustained effort is required for activation. | 6.4.1.2 e. CON-13 |
| 247. If controls are recessed, shielded, or otherwise guarded, the control is entirely contained within the envelope described by the recess or barrier. | 6.4.1.2 b.(2) CON-15 |
| 248. @ When a guard is in the open position, it does not interfere with the operation of the guarded control or other adjacent controls. | 6.4.1.2 c.(3) CON-15 |
| 249. # On moveable covers or guards, safety or lock wires are not used. | 6.4.1.2 c.(2) CON-15 |

# HUMAN ENGINEERING CHECKLIST

## CONTROLS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 250. @ Rotary action controls are used when linear or pushbutton controls would be subject to inadvertent operation and fixed protective structures are impractical or inappropriate. | 6.4.1.2 g. CON-14 |
| 251. @ When sequential activation is necessary, controls are provided with locks to prevent controls from passing through a position. Further movement requires a new control action. | 6.4.1.2 f. CON-14 |
| **Direction/Rate of Motion** | |
| 252. Control movements conform to population stereotypes (see table in back). | 6.4.2.1* CON-1 |
| 253. Rotary control settings increase in value with a clockwise rotation. | 6.4.4.1 a. CON-26 |
| 254. Direction of motion is identified for continuous motion rotary controls. | 6.6.3.8 b. PA-32 |
| **Visibility** | |
| 255. The control color contrasts with the panel background. | 6.4.2.2 f.(3) CON-3 |
| 256. @ Control position information is visible to the operator during control operation. | 6.6.3.8 c. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Readability** | |
| 257. When an indication of positon is desirable, pointers conform to those in guideline. When more accuracy is required, a line is engraved on the top and side of pointer. | 6.4.4.4 b. CON-40 |
| **Maintenance** | |
| 258. @ Control surfaces have not been allowed to break, chip or crumble. | 6.4.1.1 e.(1) |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **MIMICS** | |
| *Coding/Identification* | |
| 1. Component representations on mimic lines are identified. | 6.6.6.4 b.(6) PA-65 |
| 2. All mimic origin points are labeled or begin at labeled components. | 6.6.6.4 b.(4) PA-64 |
| 3. All mimic destination or terminal points are labeled or end at labeled components. | 6.6.6.4 b.(5) PA-64 |
| 4. Flow directions are clearly indicated by distinctive arrowheads. | 6.6.6.4 b.(3) PA-64 |
| *Visibility* | |
| 5. There is adequate contrast between the mimic colors and the panel. | 6.6.6.4 a.(3) |
| *Readability* | |
| 6. No more than 4 mimic lines of the same color run in parallel if the operator must quickly identify them. | 6.6.6.4 a.(5) PA-65 |
| 7. Overlapping of mimic lines is avoided. | 6.6.6.4 b.(2) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **COUNTERS** | |
| *Arrangement* | |
| 8. # Counters are constructed and arranged to minimize reflection of ambient illumination from the display cover. | VD-23 |
| *Location* | |
| 9. # The viewing distance to counters is at least 13 inches and preferably at least 20 inches. | VD-24 |
| *Operations* | |
| 10. # Numbers change by snap action rather than continuous movement. | 6.5.5.1 c.(1) VD-82 |
| 11. @ This counter used to indicate the sequence of equipment automatically resets upon completion of the sequence. | VD-83 |
| *Direction/Rate of Motion* | |
| 12. # Counter drums move upward with increasing values. | 6.5.5.1 c.(2) VD-82 |
| 13. @ For counters, one knob revolution equals about 50 counts (the right hand drum rotates 5 times). | VD-82 CDI-5 |

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Readability** | |
| 14. Multi-digit numbers are read horizontally from left to right. | 6.5.5.1 a.(1) VD-83 |
| 15. # Window size permits only one digit to appear at any one time. | 6.5.5.1 b.(3) VD-83 |
| 16. If more than 4 digits are used, grouping of digits separated by appropriate commas, decimal points, or spaces will be used. | 6.5.5.1 a.(3) VD-83 |
| 17. Counters are mounted perpendicular to line of sight. | 6.5.5.1 b.(1) VD-82 |
| 18. # Counters are mounted close to panel surface. | 6.5.5.1 b.(2) VD-82 |
| 19. # Surface of drum and surroundings have matte finish to minimize glare. | 6.5.5.1 a.(5) VD-84 |
| 20. Valid messages on the displays face will be brief. | 6.5.1.4 c. PA-55 |
| 21. @ Displays indicate values in a form immediately usable by the operator without requiring mental conversion. Values may, however, be multiplied or divided by a power of ten. | 6.5.1.2 b. and 6.5.1.4 f. VD-6 |
| PROJECTION — ELECTRONIC COUNTERS | |
| **Direction/Rate of Motion** | |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 22. # Numerals intended to be read consecutively do not follow each other faster than two per second. | 6.5.5.2 b. |
| **Readability** | |
| 23. Multi-digit numbers will be read horizontally from left to right. | 6.5.5.2 a.(1) |
| 24. Valid messages on the display face are brief. | 6.5.1.4 c. |
| 25. @ Displays indicate values in a form immediately usable by the operator without requiring mental conversion. Values may, however, be multiplied or divided by a power of ten. | 6.5.1.2 b. and 6.5.1.4 f. VD-6 |
| LEGEND LIGHTS | |
| **Operations** | |
| 26. @ Status is inferred by illuminated indicators and never by absence of illumination. | 6.5.3.1 c.(1) VD-89 |
| 27. @ Indicator lights are not used to alert operators to unfavorable status. | 6.5.3.1 d. |

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Visibility** | |
| 28. @ For legend pushbuttons used under varied ambient lighting, a dimming control is provided that permits display legibility under all ambient lighting conditions. | VD-90 |
| 29. @ Circuitry is design to test operation of total indicator circuit. | VD-92 |
| 30. @ Control room contains only minimum numbers of lights required. | VD-94 |
| **INDICATOR LIGHTS** | |
| **Location** | |
| 31. @ Changes critical to safety or effectiveness have a high priority in the operator's central field of view and contain stimuli demanding high attention. | VD-8 |
| **Operations** | |
| 32. @ Status is inferred by illuminated indicators and never by absence of illumination. | 6.5.3.1 c.(1) VD-89 |
| 33. @ Indicator lights are not used to alert operators to unfavorable status. | 6.5.3.1 d. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **IMPACT RECORDERS** | |
| **Coding/Identification** | |
| 34. @ When readings must be multiplied or divided by a power of ten, the component is clearly marked as to whether the reading should be multiplied or divided, and what the factor is. | 6.5.1.2 e. |
| **Size, Shape, Design** | |
| 35. # Moving scale fixed-pointer meters are not used. | 6.5.2.5 PA-41 PA-62 |
| 36. @ A selection of low paper speeds and a high paper speed is available. | 6.5.4.1 i. |
| 37. @ It is convenient to annotate information on the recordings. | 6.5.4.1 j. VD-79 |
| 38. @ Means are provided to receive completed recordings and for tearing off records for storage. | 6.5.4.1 d. VD-78 VD-79 |
| **Operations** | |
| 39. # The number of channels does not exceed capacity. | 6.5.4.2 b.(1) |
| 40. @ A channel is selected for display without awaiting completion of sampling cycle. | 6.5.4.2 b.(4) |

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Readability** | |
| 41. # Printed numbers on recording are clear, sharp and small enough to avoid data crowding. | 6.5.4.2 b.(3) |
| 42. # Channels are easily viewed on display and instrument. | 6.5.4.2 b.(2) |
| 43. # All recorded data is visible through the window. | 6.5.4.1 k. VD-80 |
| 44. Numerals on fixed scale meters are vertical. | 6.5.2.4 a. VD-65 |
| 45. Valid messages on the display face are brief. | 6.5.1.4 c. PA-55 |
| 46. # Single pointer with multiple scales are not used. | 6.5.1.5 f. VD-69 |
| 47. Pointer tips are simple. Examples are shown in the figure. | 6.5.2.2 a.(1) VD-70 |
| 48. Pointer tips do not conceal scale graduation marks or numerals. | 6.5.2.2 a.(2) VD-70 |
| 49. # Pointer tip extends to within about 1/16 inch of (but does not overlap) the smallest graduation marks. | 6.5.2.2 b.(1) VD-70 |
| 50. Pointers are mounted to avoid parallax problems. | 6.5.2.2 b.(2) VD-70 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 51. # Pointer/background contrast and pointer size provide good indication of pointer position. | 6.5.2.2 c. |
| 52. @ Displays indicate values in a form immediately usable by the operator without requiring mental conversion. Values may, however, be multiplied or divided by a power of ten. | 6.5.1.2 b. and 6.5.1.4 f. VD-6 |
| 53. Zone markings are conspicuous and distinctively different for different zones. | 6.5.2.3 a. |
| 54. @ Zone markings do not interfere with display reading. | 6.5.2.3 b. |
| **Scaling** | |
| 55. # Scales on paper correspond to scales shown on recorder. | 6.5.4.1 b. |
| 56. No more than 9 graduations separate numerals in the scale markings. | 6.5.1.5 a.(1) VD-63 |
| 57. Major and minor graduations are used if up to four graduations are used between numerals. | 6.5.1.5 a.(2) |
| 58. Major, intermediate and minor graduations are used if 5 or more graduations are used between numerals. | 6.5.1.5 a.(3) |

# ON-SITE EVALUATION      @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 59. # Graduation height for scale markings conform to figure. | 6.5.1.5 b. VD-32 |
| 60. Successive values of unit graduations conform to figure or those values multiplied by powers of ten. | 6.5.1.5 c. VD-71 |
| 61. Scale values increase with movement of the pointer upward, clockwise, or to the right. | 6.5.2.1 a.b.c. VD-65 VD-67 |
| 62. Logarithmic scales for scale markings are not used except where a large range of values are required. | 6.5.1.5 e. VD-63 |
| **STRIP CHARTS** | |
| **Coding/Identification** | |
| 63. # Chart paper is white, the graph lines black, and pen tracing red or green. | VD-80 |
| **Size, Shape, Design** | |
| 64. # Moving scales fixed-pointer meters are not used. | 6.5.2.5 PA-41 PA-62 |
| 65. @ A selection of low paper speeds and a high paper speed are available. | 6.5.4.1 i. |
| 66. @ It is convenient to annotate information on the recordings. | 6.5.4.1 j. VD-79 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 67. # Printed information on this trend recorder is comprehensible and minimizes need for decoding, interpolating, etc. Aids are provided when operator must interpret graphic data. | VD-78 |
| 68. # If multiple scales appear on this trend recorder, color coding is used to associate correct scale with correct selector-switch position. | VD-69 |
| 69. # A means is provided to receive completed recordings and for tearing off records for storage. | 6.5.4.1 d. VD-78 VD-79 |
| **Direction/Rate of Motion** | |
| 70. # Pens for this single sheet chart system move from left to right. | VD-80 |
| 71. # Moving chart system paper moves from right to left. | VD-80 |
| 72. # Printer paper moves from bottom to top. | VD-80 |
| 73. # The numerical progression on this trend recorder increases clockwise, from left to right or from the bottom up, depending on display design or orientation. | VD-65 |

# ON-SITE EVALUATION          @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| | **Readability** | |
| 74. # | All recorded data are visible through the window. | 6.5.4.1 k. VD-80 |
| 75. | Numerals on fixed scale meters are vertical. | 6.5.2.4 a. VD-65 |
| 76. | Valid messages on the display face are brief. | 6.5.1.4 c. PA-55 |
| 77. | Single pointer with multiple scales are not used. | 6.5.1.5 f. VD-69 |
| 78. | Pointer tips are simple. Examples are shown in the figure. | 6.5.2.2 a.(1) VD-70 |
| 79. | Pointer tips do not conceal scale graduation marks or numerals. | 6.5.2.2 a.(2) VD-70 |
| 80. # | Pointer tip extends to within about 1/16 inch of (but does not overlap) the smallest graduation marks. | 6.5.2.2 b.(1) VD-70 |
| 81. # | Pointers are mounted to avoid parallax problems. | 6.5.2.2 b.(2) VD-70 |
| 82. # | Pointer/background contrast and pointer size provide good indication of pointer position. | 6.5.2.2 c. |
| 83. # | The printer incorporates internal illumination to enhance readability of printed material under inadequate ambient illumination. | VD-79 |
| 84. @ | Displays indicate values in a form immediately usable by the operator without requiring mental conversion. Values may, however, be multiplied or divided by a power of ten. | 6.5.1.2 b. and 6.5.1.4 f. VD-6 |
| 85. | Zone markings are conspicuous and distinctively different for different zones. | 6.5.2.3 a. |
| 86. @ | Zone markings do not interfere with display reading. | 6.5.2.3 b. |
| | **Scaling** | |
| 87. # | Scale on paper corresponds to scales shown on recorder. | 6.5.4.1 b. |
| 88. | No more than 9 graduations separate numerals in the scale markings. | 6.5.1.5 a.(1) VD-63 |
| 89. | Major and minor graduations are used if up to 4 graduations are used between numerals. | 6.5.1.5 a.(2) |
| 90. | Major, intermediate and minor graduations are used if 5 or more graduations are used between numerals. | 6.5.1.5 a.(3) |
| 91. # | Graduation height for scale markings conform to figure. | 6.5.1.5 b. VD-32 |

# HUMAN ENGINEERING CHECKLIST

DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 92. Successive values of unit graduations conform to figure or those values multiplied by powers of 10. | 6.5.1.5 c. VD-71 |
| 93. @ Logarithmic scales for scale markings are not used except where a large range of values are required. | 6.5.1.5 e. VD-63 |
| METERS | |
| Location | |
| 94. Pointers are located to the right of vertical scales and at the bottom of horizontal scales. | VD-67 |
| Coding/Identification | |
| 95. @ When readings must be multiplied or divided by a power of ten, the component is clearly marked as to whether the reading should be multiplied or divided, and what the factor is. | 6.5.1.2 e. |
| Size, Shape, Design | |
| 96. # Moving scales fixed-pointer meters are not used. | 6.5.2.5 PA-41 PA-62 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 97. Linear scales are used in preference to nonlinear scales. Nonlinear scales are used to condense a large range into a small space for sensitive readings at critical ranges of the scale. | VD-61 |
| 98. This meter's scale indicators are used to display quantitative and qualitative information (such as trend and direction-of-motion). | VD-62 |
| 99. @ For this moving scale display, if the control is a gross approximator of position and has position detents, the numbers increase from right to left. | PA-41 |
| Operations | |
| 100. The pointer color is the same as that of numbers and indices. | VD-70 |
| 101. The scale indicators for various applications are based on the criteria in table on the back. | VD-62 |
| Direction/Rate of Motion | |
| 102. # Scale values increase with movement of the pointer upward, clockwise or to the right. | 6.5.2.1 a.b.c. VD-67 VD-65 |

# ON-SITE EVALUATION    @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 103. # | For knobs used to make coarse display element settings (0.016 to 0.100 inch tolerance), one complete knob turn results in approximately 6 inches of display element movement. | CDI-5 |
| 104. # | For knobs used to make fine display settings (0.007 to 0.015 inch tolerance), one complete knob turn results in approximately 1-2 inches of display element movement. | CDI-5 |
| | **Readability** | |
| 105. | Numerals on fixed scale meters will be vertical. | 6.5.2.4 a. VD-65 |
| 106. | Valid messages on the display face are brief. | 6.5.1.4 c. PA-55 |
| 107. # | Single pointer with multiple scales are not used. | 6.5.1.5 f. VD-69 |
| 108. | Pointer tips are simple. Examples are shown in the figure. | 6.5.2.2 a.(1) VD-70 |
| 109. | Pointer tips do not conceal scale graduation marks or numerals. | 6.5.2.2 a.(2) VD-70 |
| 110. # | Pointer tip extends to within about 1/16 inch of (but does not overlap) the smallest graduation marks. | 6.5.2.2 b.(1) VD-70 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 111. # | Pointer is mounted to avoid parallax problems. | 6.5.2.2 b.(2) VD-70 |
| 112. # | Pointer/background contrast and pointer size provide good indication of pointer position. | 6.5.2.2 c. |
| 113. @ | Displays indicate values in a form immediately usable by the operator without requiring mental conversion. Values may, however, be multiplied or divided by a power of ten. | 6.5.1.2 b. and 6.5.1.4 f. VD-6 |
| 114. | Zone markings are conspicuous and distinctively different for different zones. | 6.5.2.3 a. |
| 115. @ | Zone markings do not interfere with display reading. | 6.5.2.3 b. |
| | **Scaling** | |
| 116. | No more than 9 graduations separate numerals in the scale markings. | 6.5.1.5 a.(1) VD-63 |
| 117. | Major and minor graduations are used if up to 4 graduations are used between numerals. | 6.5.1.5 a.(2) |
| 118. | Major, intermediate and minor graduations are used if 5 or more graduations are used between numerals. | 6.5.1.5 a.(3) |
| 119. # | Graduation height for scale markings conform to figure. | 6.5.1.5 b. VD-32 |

# ON-SITE EVALUATION    @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## DISPLAYS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 120. Successive values of unit graduations conform to figure or those values multiplied by powers of 10. | 6.5.1.5 c. VD-71 |
| 121. @ Logarithmic scales for scale markings are not used except where a large range of values are required. | 6.5.1.5 e. VD-63 |
| CIRCULAR ONLY | |
| Visibility | |
| 122. The two ends of the pointer are identifiable when reciprocal readings are required. | VD-70 |
| Readability | |
| 123. Where positive and negative values are displayed around a zero position, the zero is at 12 o'clock. | 6.5.2.4 b.(2) VD-66 |
| 124. # This meter has a moving pointer against a fixed scale and is used for qualitative check readings. | VD-1 |
| 125. If pointer movement is more than 360°, the zero point is at 12 o'clock position. | 6.5.2.4 b.(1) |
| 126. # Where the scale covers less than a full rotation of the pointer, scale end-points are indicated by a break in scale of at least one numbered interval and should be oriented at 6 o'clock. | 6.5.2.4 c.(1-3) VD-66 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 127. @ If this circular meter dial is to be scanned rapidly, the normal position of the pointer is at the 9 o'clock position. | VD-85 |
| 128. @ Information is displayed on this meter only to the degree of specificity and precision required for a specific operator action or decision. | VD-6 |
| Scaling | |
| 129. Dial scale on this meter is oriented so that the critical range to be read appears left to right. | PA-40 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONVENTIONS

*Criteria are different.

| EVALUATION GUIDELINE | REF. |
|---|---|
| **AUDITORY CODING** | |
| **Coding/Identification** | |
| 1. @ Auditory coding methods are distinct and unambiguous, without conflict. | 6.2.2.3 a. AD-1 |
| 2. @ Auditory pulse codes are limited to 2 or 3, ensuring proper discrimination. | 6.2.2.3 b. AD-19 |
| 3. # Center frequencies are between 500 and 1000 Hz for signals using frequency modulation for coding. | 6.2.2.3 c. AD-14 |
| 4. @ No more than 5 separate frequencies are used within the limited range of 200-5000 Hz for discrete coding. | 6.2.2.3 d. AD-15 |
| 5. @ Coding by intensity is avoided. | 6.2.2.3 e. |
| 6. @ Auditory coding techniques are used when the work station associated with the alarm is not in the primary operating area. | 6.3.2.2 a.(1) |
| 7. @ Coded signals from a single audio source is not used to identify individual work stations within the primary operating area. | 6.3.2.2 a.(2) |
| 8. @ Coding is used to indicate alarm priority. | 6.3.2.2 b. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **SIZE CODING** | |
| **Size, Shape, Design** | |
| 9. # No more than 3 different sizes of controls are used for discrimination by absolute size. | 6.4.2.2 c.(1) CON-17 |
| 10. @ Controls used for performing the same function on different items of equipment are the same size. | 6.4.2.2 c.(2) CON-17 |
| 11. # When knob diameter is used as a coding parameter, differences between diameters are at least 0.5 inch. | 6.4.2.2 c.(3) CON-17 |
| 12. # When knob thickness is a coding parameter, thickness differences are at least 0.4 inch. | 6.4.2.2 c.(4) CON-18 |
| 13. # Control shapes are visually identifiable. | 6.4.2.2 d.(1) CON-18 |
| 14. @ Control shapes are tactually identifiable. | 6.4.2.2 d.(2) CON-18 |
| **SHAPE CODING** | |
| **Coding/Identification** | |
| 15. @ Rotating knob controls for different types of control actions are distinguishable by sight and touch and cannot be confused with each other. | 6.4.2.2 e. CON-18 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONVENTIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 16. # Shape-coded rotary controls are visually identifiable. | 6.4.4.1 c.(1) CON-28 |
| 17. @ Shape-coded rotary controls are tactually identifiable. | 6.4.4.1 c.(2) CON-28 |
| **Size, Shape, Design** | |
| 18. Annunciator response controls, especially the silence control, use shape coding. | 6.3.4.2 b.(4) |
| 19. If rotary controls used for widely different functions are placed on the same panel, shape coding is employed. | 6.4.4.1 b. CON-27 |
| CONTROL CODING | |
| **Coding/Identification** | |
| 20. @ The coding system for controls is uniform throughout the control room. | 6.4.2.2 a. CON-14 |
| 21. Color coding follows the recommendations of Guideline 6.5.1.6. | 6.4.2.2 f.(1) |
| 22. # Annunciator response controls are coded using techniques such as color coding, demarcation, shape coding or group shading. | 6.3.4.2 b.(1) & (2) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| COLOR CODING | |
| **Coding/Identification** | |
| 23. @ Color coding provides redundant information. | 6.5.1.6 a. CON-17 |
| 24. The number of colors for coding is kept to a minimum, not exceeding 11. | 6.5.1.6 b.(1)* & (2) CON-19 VD-108 CON-20 |
| 25. @ Color meanings are narrowly defined. | 6.5.1.6 c.(1) VD-107 |
| 26. @ Red, green, and amber are used in accordance to guideline. | 6.5.1.6 c.(2) VD-107 |
| 27. Color meanings are consistent across all applications including panel surfaces, projected signal lights, and CRTs. | 6.5.1.6 d.(1) & (2) VD-107 |
| 28. @ Color meanings remain the same within and among systems to which they are applied. | 6.5.1.6 d.(3) |
| 29. # Color coding of meter zone markings conform to Guideline 6.5.1.6.c. | 6.5.2.3 c.* VD-75 |
| 30. # The color of indicator lights conforms to convention. | 6.5.3.2 a.(2) VD-107 |

# HUMAN ENGINEERING CHECKLIST

## CONVENTIONS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 31. # | The color of indicator lights is clearly identifiable. | 6.5.3.2 a.(3) VD-108 |
| 32. # | The color of lit legend background conforms to color conventions. | 6.5.3.3 d. VD-110 |
| 33. | Color coding of label print conforms to color conventions. | 6.6.4.1 b.(2) |
| 34. | The color coding scheme applied to specific functions or conditions is consistent throughout the control room. | 6.6.6.3 |
| 35. @ | Color coding is consistent with conventions. | 6.7.2.7 k.(1) |
| 36. @ | No more than one color is assigned for the same meaning or purpose. | 6.7.2.7 k.(2) |
| 37. @ | Red is used for unsafe conditions, danger, immediate operator required, or critical parameter value out of balance. | 6.7.2.7 l.(1) & 6.5.1.6 c.(2) VD-107 |
| 38. @ | Green is used for safe conditions, no operator action required, or parameter is within balance. | 6.7.2.7 l.(2) & 6.5.1.6 c.(2) VD-107 |
| 39. @ | Yellow/amber is used for hazard, potentially unsafe, caution, attention required, or marginal parameter exists. | 6.7.2.7 l.(3) & 6.5.1.6 c.(2) VD-107 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| | Visibility | |
| 40. | Color shading enhances recognition of controls, displays or functional groups, providing adequate contrast, and is consistent with other color coding throughout the control room. | 6.8.1.3 c. CDI-13 |
| 41. | Distinctive enhancement techniques are used for emergency controls. | 6.8.1.3 d. |
| 42. | Colors which do not have the immediate safety implications are used to ensure that each color is recognized as different from any other. | 6.5.1.6 e.(1) |
| 43. | Colors used for coding provide good contrast with background. | 6.5.1.6 e.(2) VD-108 |
| 44. # | Each trend recorder pen uses a distinctly different color for channel identification providing good contrast with paper. | 6.5.4.2 a.(2) |
| 45. @ | Where possible, the red/green combination is not used in CRT displays. | 6.7.2.7 m.(1) |
| 46. @ | Red symbols/characters on a green CRT background are not used. | 6.7.2.7 m.(2) |

# HUMAN ENGINEERING CHECKLIST

## CONVENTIONS

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **USE OF SYMBOLS** | | |
| **Coding/Identification** | | |
| 47. | Legend light symbols are clear and unambiguous in meaning. | 6.5.3.3 b.(3) |
| 48. @ | Abstract symbols are used only if they have a commonly accepted meaning for all intended users. | 6.6.3.4 a. PA-56 |
| 49. @ | Symbols are distinguishable from each other. | 6.6.3.4 b. |
| 50. @ | A commonly accepted standard configuration is used for symbols. | 6.6.3.4 c. |
| 51. | Symbols are consistently used within and across panels. | 6.6.3.4 d. |
| 52. @ | Graphic symbols such as those in mimics are readily understood and commonly used. | 6.6.6.4 c.(1) PA-65 |
| 53. | Symbols are used consistently. | 6.6.6.4 c.(2) |
| **STANDARD ABBREVIATIONS AND ACRONYMS** | | |
| 54. # | A list of standard names, acronyms, abbreviations, and part/system numbers is consistently used and is administratively controlled. | 6.6.3.3 a. & b. PA-46 and 6.5.3.3 b.(6) PA-46 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| **CONFUSION** | | |
| **Arrangement** | | |
| 55. # | Strings of small displays do not exceed 20 inches on the control board. | 6.8.3.2 b. |
| 56. | No more than 5 similar components are laid out in an unbroken row or column. | 6.8.3.2 c.(1) |
| 57. | If more than 5 similar components must be together, the string or cluster is broken up by techniques such as physical spacing or demarcation. | 6.8.3.2 c.(2) |
| 58. # | Mirror-imaging is avoided. | 6.8.3.3 CDI-16 |
| **Coding/Identification** | | |
| 59. | The group of annunciator controls are demarcated. | 6.3.4.2 b.(3) |
| 60. @ | Legend pushbuttons are readily distinguishable from legend lights and is achieved by distinctive shape, labeling, location, or other techniques. | 6.4.3.3 a. |
| 61. | Large matrices of similar components have the coordinate axes labeled for identification of any single component within the grid. | 6.8.3.2 d.(1) |
| 62. | Large matrices are subdivided by appropriate demarcation. | 6.8.3.2 d.(2) |

# ON-SITE EVALUATION     @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## CONVENTIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Size, Shape, Design** | |
| 63. @ Legend indicators are distinguishable from legend pushbuttons by form, size, or other factors. | 6.5.3.3 c. |
| **MIMICS** | |
| **Coding/Identification** | |
| 64. Mimic flow paths are color coded in conformance with the selected color scheme. | 6.6.6.4 a.(1) |
| 65. Mimic colors are discriminably different from each other. | 6.6.6.4 a.(2) |
| 66. Mimic lines depicting flow of the same contents are colored the same throughout the control room. | 6.6.6.4 a.(4) PA-64 |
| 67. No more than 7 colors are used for mimic lines. | PA-64 |
| 68. Summary labels/demarcation lines are used to identify and separate systems and subsystems surrounding this mimic on panel. | PA-64 |
| 69. Primary mimic lines are obviously larger than secondary lines. | PA-64 |
| **Size, Shape, Design** | |
| 70. Differential line widths will be used to code flow paths for mimics. | 6.6.6.4 b.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **Visibility** | |
| 71. # Total mimic can be seen at operational distances without head movement. | VD-14 |
| 72. # At or below eye level, labels are placed above mimic areas (including branches and components) they describe. (If panel is above eye level, labels may be below.) | PA-45 |
| **Readability** | |
| 73. Flow direction for this mimic is always on the horizontal or vertical axis. | PA-65 |
| **LEGEND LIGHTS** | |
| **Size, Shape, Design** | |
| 74. # Legend design is consistent throughout the control room. | 6.5.3.3 b.(1) |
| **IMPACT RECORDERS** | |
| **Coding/Identification** | |
| 75. Abbreviations are consistent with plant conventions. | 6.5.1.4 d. PA-46 |

# HUMAN ENGINEERING CHECKLIST

CONVENTIONS

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| STRIP CHARTS | | | |
| Coding/Identification | | | |
| 76. # Abbreviations are consistent with plant conventions. | 6.5.1.4 d. PA-46 | | |
| METERS | | | |
| Coding/Identification | | | |
| 77. # Abbreviations are consistent with plant conventions. | 6.5.1.4 d. PA-46 | | |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

*Criteria are different.

| EVALUATION GUIDELINE | REF. |
|---|---|
| CRT DISPLAYS | |
| 1. Cumulative effects of all geometric distortion does not displace any point within the viewable area of the screen from its correct position by more than 5% of picture height. | 6.7.2.1 e.* VD-50 |
| 2. CRTs for displaying simple alphanumeric text have a minimum of 20 resolution elements per inch. | 6.7.2.1 f.(1)* VD-49 |
| 3. Symbols and graphic detail have a minimum of 100 resolution elements per inch. | 6.7.2.1 f.(2)* VD-49 |
| 4. Complex symbols have a minimum of 10 resolution elements for the longest dimension of the symbol when used with other complex shapes. | 6.7.2.1 f.(3) |
| 5: Alphanumeric characters have a minimum of 10 resolution elements per character height. | 6.7.2.1 f.(4)* VD-49 |
| 6. If a camera generated display is used, at least 10 shades of gray are used in CRT displays. | VD-47 |
| 7. Symbol size is at least 20 minutes of arc at normal viewing distance. | VD-45 |
| 8. Contrast between symbols and background is between 88% and 94%. | VD-47 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 9. Signal-to-noise ratio is at least 10:1. | VD-48 |
| 10. Displays having high regeneration rates and slow image movements use phosphers with short persistence (decay rates less than 1 millisecond). | VD-48 |
| 11. Displays with moderate image movements use medium persistence phosphers (decay rates $\leq$ 0:1 second). | VD-48 |
| 12. Where characters subtend visual angle of less than 16, the character separation is about 25% the symbol height. | VD-46 |
| 13. The regeneration rate for particular CRT display is above critical frequency of fusion. | 6.7.2.1 g. VD-49 |
| 14. Brightness, contrast and color of CRT are adjustable by control room operator. | 6.7.2.1 h.(1) |
| 15. Adjustment controls on CRT conform to Section 6.4 (Controls) and Section 6.9 (Control/Display Integration). | 6.7.2.1 h.(2) |
| 16. Alphanumeric characters are composed of uppercase letters with a resolution of no less than 10 lines per symbol height. | VD-45 |
| 17. Contrast between symbols and background is between 88% and 94%. | VD-47 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 18. Light source is located at least 60° on either side of viewer's central field of view. | VD-45 |
| 19. Red symbols on a green background are avoided. | VD-48 |
| 20. Where illumination is low (1.0 fL), character separation is 25% of the symbol height. | VD-46 |
| 21. Rectangular or polar-coordinate displays use alphanumeric, geometric, or color coding rather than coding by line lengths, angular orientation, inclination, or visual number (dots). | VD-45 |
| 22. The use of brightness coding is avoided. | VD-47 |
| 23. One or more of the following is used to eliminate reflected glare from CRT: - Proper placement of CRT in relation to lighting - Filters (directional or spectrum) - A hood or shield - Coatings or filters over lighting. | CRE-3 |
| KEYBOARDS | |
| 24. Each control is recognizable in terms of its function. | 6.4.1.1 c.(1) |
| 25. Control movements conform to population stereotypes. | 6.4.2.1 CON-11 |
| 26. All discrete functional control positions are identified. | 6.6.3.8 a. PA-28 PA-49 |
| 27. All annunciator alarms are recorded. | 6.7.3.2 a.(2) |
| 28. Alarm messages are recorded in the sequence of their occurrence. | 6.7.3.2 b. |
| 29. Provisions are included to provide, upon operator request, printouts by alarm group (e.g., system, subsystem, component). | 6.7.3.2 c. |
| 30. Alarm messages should be readily distinguishable from other messages. | 6.7.3.2 d. |
| 31. Alarm messages provide rapid identification of the nature of the alarm. | 6.7.3.2 e. |
| 32. Wording in alarm messages: | |
| o Clearly relate to the specific annunciator tile that is illuminated. | 6.7.3.2 f.(1) |
| o Contain at least that information (i.e., wording) presented in the illuminated annunciator tile. | 6.7.3.2 f.(2) |
| o Provide additional specific data. | 6.7.3.2 f.(3) |
| 33. The "QWERTY" arrangement is used on keyboards that combine alphabetic and numeric functions. | 6.7.1.4 a. CON-78 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 34. On keyboards used to enter solely numeric data, a 3x3+1 matrix is used in either "calculator" or "telephone" style. | 6.7.1.4 b.* CON-79 |
| 35. When more than one keyboard exists in the control room, alphanumeric and/or numeric-only key configuration are the same in all cases. | 6.7.1.4 c. CON-77 |
| 36. To minimize effectiveness of keyboards, key dimensions and separation are as shown in Exhibit 6.7-3. | 6.7.1.4 d. CON-74 |
| 37. Key displacement is as shown in Exhibit 6.7-3. | 6.7.1.4 e.(1) CON-74 |
| 38. Key resistance is as shown in Exhibit 6.7. | 6.7.1.4 e.(2) CON-74 |
| 39. There is a definite indication of key activation provided to operator (e.g., snap, audible click, release of resistance). | 6.7.1.4 f. CON-53 |
| 40. The slope of CRT keyboard is between 15° and 25° from the horizontal. | 6.7.1.4 g. CON-76 |
| 41. Data being entered via keyboards are displayed as they are keyed. | 6.7.1.4 h. |
| 42. CRT keyboards contain only keys that are relevant to computer operation. | 6.7.1.4 i. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 43. This keyboard uses no more than 3 different sizes in coding controls for discrimination by absolute size. | CON-17 |
| PRINTERS | |
| 44. Printers are located in the primary operating area. | 6.7.3.1 a.(1) |
| 45. Printers record alarm data, trend data, and plant status data. | 6.7.3.1 a.(2) |
| 46. Printer supplies a hard copy of any single page on the CRT at the request of the operator. | 6.7.3.1 b.(1) OCI-25 |
| 47. If copy is printed remote to the operator, a print confirmation or denial message is displayed. | 6.7.3.1 b.(2) OCI-25 |
| 48. Printer operation does not alter screen content. | 6.7.3.1 b.(3) OCI-25 |
| 49. Printed information is in a directly usable form. | 6.7.3.1 c. VD-78 |
| 50. Printer capacity is 300 lines per minute or more. | 6.7.3.1 d. |
| 51. Hand-finished matte paper is used on the printer to prevent smudges and glare. | 6.7.3.1 e.(1) |
| 52. A positive indication of remaining supply of recording materials is provided. | 6.7.3.1 e.(2) VD-79 |

# ON-SITE EVALUATION    @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 53. Instructions for reloading paper, ribbon, ink, etc., are attached to printer. | 6.7.3.1 e.(3) |
| 54. A printer is provided for recording alarm messages. | 6.7.3.2 a.(1) |
| 55. When printer is down, data and information which would normally be printed is not lost. | 6.7.3.1 e.(4) |
| 56. A take-up device for printed materials is provided. | 6.7.3.1 e.(5) VD-78 |
| 57. Operator can read the most recently printed line. | 6.7.3.1 f.(1) VD-80 |
| 58. Printed material has adequate contrast ratio. | 6.7.3.1 f.(2) VD-80 |
| 59. Print copy can be annotated while in machine. | 6.7.3.1 f.(3) VD-79 |
| 60. Recorded matter is not obscured, marked, or otherwise hidden to prevent reading of printed material. | 6.7.3.1 f.(4) VD-80 |
| 61. A graph is used if the shape of the function is important in decisionmaking. | 6.7.3.3 a. |
| 62. If interpolation is necessary, line graphs are preferred to bar graphs and tables. | 6.7.3.3 b. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 63. Graphs are constructed so that numbered grids are bolder than unnumbered grids. | 6.7.3.3 c.(1) |
| 64. If 10-grid intervals are used, the fifth intermediate grid is less bold than the numbered grid, but bolder than the unnumbered grid. | 6.7.3.3 c.(2) |
| 65. Tables are simple, concise and readable. | 6.7.3.3 d.(1) |
| 66. When table columns are long, numbers are separated into groups by providing a space between groups of five. | 6.7.3.3 d.(2) |
| 67. When columns are not separated by vertical lines, the columns are separated by at least 2 character widths. | 6.7.3.3 d.(3) |
| COMPUTER FUNCTION CONTROLS | |
| 68. Design of function controls on the computer conform to appropriate guidelines. | 6.7.1.5 a. ALL CON |
| 69. Terms, nomenclature, and abbreviations used on function controls are consistent with those of selected computer function that is displayed. | 6.7.1.5 b. OCI-12 |
| 70. A positive indication is provided at the CRT master control to identify displays under local or master control. | 6.7.1.5 c.(1) |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 71. A positive identification is provided at the individual CRT to indicate if it is under local or master control. | 6.7.1.5 c.(2) |
| 72. Dedicated keys that initiate/activate functions are grouped together. | 6.7.1.5 d.(1) CON-9 |
| 73. Function controls are easily distinguishable from other types of console keys. | 6.7.1.5 d.(2) |
| 74. Function controls are clearly labeled to indicate function. | 6.7.1.5 d.(3) CON-1 |
| 75. Design and layout of function controls are consistent for all consoles in control room. | 6.7.1.5 d(4) CON-77 |
| 76. Function keys are physically separated from alphanumeric keys on the console. | 6.7.1.5 d.(5) |
| OTHER CONTROLS | |
| 77. Control devices (such as light pens, selector pens, RAND tablets, etc.) are operable from most favorable position for computer interaction. | 6.7.1.6 a. |
| 78. Control devices provide rapid positioning of cursors or selection of choices. | 6.7.1.6 b. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 79. The accuracy of control method or device is commensurate with the functions to be served. | 6.7.1.6 c. |
| 80. Control design allows the operator freedom of movement to perform other duties. | 6.7.1.6 d. |
| COMPUTER-OPERATOR RELATIONSHIP | |
| 81. Correct response is provided within response times listed in Exhibit 6.7-6 for each type of query. | 6.7.1.7 a. |
| 82. When response time exceeds 3 seconds, a delay message is presented in order to maintain the operator's attention and to confirm normal computer operation. | 6.7.1.7 b. |
| 83. Procedures are in hard copy form at a minimum. | 6.7.1.8 a.(3) |
| 84. A complete set of operations and contingency procedures is available in control room. | 6.7.1.8 a.(1) |
| 85. Procedures are prepared from control room operator's point of view. | 6.7.1.8 a.(2) |
| 86. Viewing distance on CRT is greater than 18 inches. | 6.7.2.3 a. VD-46 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 87. Mode designation and the file(s) being processed are displayed by the computer system. | 6.7.1.3 c., OCI-24 |
| 88. Viewing angle is at least 30° for standing observer, or 45° for seated observer. | VD-46 |
| 89. Maximum viewing distance for single seated operator is 28 inches for 12 inch diagonal screen. | VD-46 |
| 90. Visual axis of operator is perpendicular to center of CRT screen. | VD-45 |
| 91. A 12-inch diagonal screen size at 28-inch viewing distance is used for by single seated operated. | VD-46 |
| COMPUTER-OPERATOR DIALOGUE | |
| 92. Dialogue is based on operator's point of view, not programmers. | 6.7.1.2 a.(1) OCI-25 |
| 93. Computer dialogue is logical. | 6.7.1.2 a.(2) OCI-21 |
| 94. Computer dialogue is used in a consistent manner. | 6.7.1.2 a.(3) OCI-21 |
| 95. Computer dialogue reflects the vocabulary and syntax of expected user population. | 6.7.1.2 a.(4) OCI-21 |
| 96. Input words (keywords) approximate real words. | 6.7.1.2 a.(5) OCI-22 |
| 97. Computer dialogue requires an explicit command to terminate an interaction. | 6.7.1.2 a(6)* OCI-24 |
| 98. Computer input words do not exceed 7 characters. | 6.7.1.2 b.* OCI-22 |
| 99. Abbreviations are used as computer input words when possible. | 6.7.1.2 c.(1) OCI-22 |
| 100. The same synonym or abbreviation for a system command name is used for messages, prompts, etc., to operator. | 6.7.1.2 c.(2) OCI-22 |
| 101. Use of abbreviations or contractions for output data is avoided. | 6.7.1.2 c.(3)* OCI-22 |
| 102. Operator inputs, responses, or actions which could significantly degrade computer system or plant performance are not dependent on a single keystroke. | 6.7.1.2 d. OCI-22 |
| 103. Prompting and structuring features allow operator to request additional information. | 6.7.1.3 a. OCI-24 |
| 104. Prompting and structuring features are available upon request when an error is detected. | 6.7.1.3 b. OCI-24 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 105. Corrections of individual errors are made without requiring re-entry of correct data. | 6.7.1.3 d. OCI-24 |
| 106. The computer system contains a sequential file of operator entries, available upon operator request. | 6.7.1.2 e. OCI-24 |
| 107. When many subsystems require monitoring, information is filtered by software or machine function. | VD-9 |
| 108. Operator is provided instructions for correcting computer diagnosed errors. | OCI-19 |
| 109. System recognizes and reports detectable errors. | OCI-19 |
| COMPUTER ACCESS | |
| 110. Only properly authorized personnel are allowed to make changes by entry, deletion of alteration of data. | 6.7.1.1 a. |
| 111. At least one copy of current operating software is securely and remotely stored. | 6.7.1.1 b. |
| 112. When characters, words, or phrases are to be inserted, such items are first collected and displayed on a buffer area of screen, and then inserted by one operator command. | 6.7.1.1 c. OCI-26 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 113. Before the operator requests that result in permanent changes are processed, the computer system requires operator acknowledgement. | 6.7.1.1 d. OCI-24/25 |
| ACCESS AIDS | |
| 114. Operating procedures describe:<br>o The overall computer system,<br>o The computer system components with which the operator can interface,<br>o The specific procedures necessary to accomplish all operator-computer interface functions. | 6.7.1.8 a.(4) (a,b,c) |
| 115. Contingency procedures describe indications which identify failure or malfunctioning of computer system and necessary actions to be performed by the operator in case of malfunction. | 6.7.1.8 a.(5) (a,b) |
| 116. Specific codes or addresses that the operator may request are cross-indexed by alphanumeric or numeric code program name, system/subsystem identification, and functional group identification. | 6.7.1.8 b.(1) (a,b,c, &d) |
| 117. Cross-indices of data displays are available in at least hardcopy form in control room. | 6.7.1.8 b.(2) |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| **MESSAGES** | |
| 118. Messages on CRT are concise. | 6.7.2.6 a.(1) OCI-14 |
| 119. Messages provide necessary information to complete a specific action or decision sequence. | 6.7.2.6 a.(2) OCI-14 |
| 120. Messages are necessary, complete, and readily usable. | 6.7.2.6 b. OCI-14 |
| 121. Prompts are displayed whenever operator may need direction or guidance to initiate or complete an action to sequence of actions. | 6.7.2.6 c. |
| 122. Prompts contain clear and specific cues and instructions which are relevant to action to be taken. | 6.7.2.6 d. |
| 123. Directions are placed in the sequence to be used by operator. | 6.7.2.6 e. |
| 124. Whenever operator error or invalid input is detected, an error message is displayed. | 6.7.2.6 f. OCI-19 |
| 125. Error messages contain instructions for corrective action. | 6.7.2.6 g. |
| 126. Capability is provided for operator to correct errors without affecting adjacent valid entries. | 6.7.2.6 h. OCI-19 |
| 127. Feedback is provided to indicate changes in status of system functioning. | 6.7.2.6 i. OCI-10 |
| 128. When an option is selected as input to system, the subject item is highlighted. | 6.7.2.6 j. OCI-10 |
| 129. When system response is delayed, periodic feedback is provided to indicate normal operation and reason for delay. | 6.7.2.6 k. OCI-10 |
| 130. Results and requirements for subsequent actions are provided after a process or sequence is completed. | 6.7.2.6 l. OCI-10 |
| 131. Feedback describes type and location of error. | OCI-19 |
| 132. Displays of complex configurations avoid use of unnecessary detail. | VD-6 |
| 133. Information critical to safety or effectiveness has a high priority in the operator's central field of view and is composed of stimuli demanding high attention. | VD-10 |
| 134. Feedback is provided that light pen has actuated. | OCI-28 |
| 135. Feedback concerning light pen placement is available. | OCI-28 |
| 136. Feedback is provided indicating that light pen input has been received by system. | OCI-28 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 137. Message occurring in multiple frames occupies constant physical location on screen. | OCI-17 |
| 138. Formats minimize cursor positioning movement. | OCI-5 |
| 139. Each data group or message contains descriptive title, phrase, word, or other device to indicate its content. | OCI-12 |
| 140. Data, text, formats, etc., essential to system performance are under system control. | OCI-17 |
| 141. Information required for next operator entry is presented at the end of the message. | OCI-14 |
| 142. Critical information is presented at the beginning of a message. | OCI-14 |
| 143. Messages requiring operators to reference external data sources are avoided. | OCI-14 |
| 144. Counting tasks start with the number "one," while measuring tasks start with "zero." | OCI-1 |
| 145. For messages containing variable option lists and occurring in multiple frames, physical relationships among common elements are maintained. | OCI-17 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 146. Where multi-input annunciators are used, an alarm printout capability is provided. | 6.3.1.2 c.(2) |
| LABELING | |
| 147. Visual angles of complex symbols on CRT subtend not less than 20 minutes of arc at the required viewing distance. | 6.7.2.2 a. VD-51 |
| 148. The height of alphanumeric characters have a visual angle of not less than 12 minutes of arc at the required viewing distance. | 6.7.2.2 b.(1) VD-45 |
| 149. Alpha-numeric characters are upper-case letters. | 6.7.2.2 b.(2) VD-45 |
| 150. The width-to-height ratio for alphanumerics is between 3:5 and 1:1. | 6.7.2.2 c. VD-45 |
| 151. Stroke-width-to-character-height ratio is between 1:5 and 1:10. | 6.7.2.2 d. VD-45 |
| 152. Graphic lines contain a minimum of 50 resolutions per inch. | 6.7.2.2 e. VD-50 OCI-7 |
| 153. Horizontal separation between characters or symbols is between 10% and 65% of character or symbol height. | 6.7.2.2 f.(1) |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 154. | The height:width ratio for alphanumerics is between 7:5 and 3:2. | VD-45 |
| 155. | Stroke width:height ratio of characters is in the range of 1:6 to 1:10. | VD-45 |
| 156. | Character separation is between 25% and 63% of character height. | VD-46 |
| 157. | Two individual light pennable characters are separated by at least one symbol area. | VD-45 |
| 158. | If label presents list of operator options, the decision or action required of operator is also indicated. | OCI-13 |
| 159. | Separation is at least 25% of character or symbol height: | |
| | o When character or symbol width is less than 85% of height, | 6.7.2.2 f.(2) (a)* VD-46 |
| | o When character or symbol luminance is less than 12 ft.-L, | 6.7.2.2 f.(2) (b)* |
| | o When luminance contrast is less that 88%, | 6.7.2.2 f.(2) (c)* |
| | o When CRT screen location is greater than 25% to the left or right of operator's straight-ahead line-of-sight, | 6.7.2.2 f.(2) (d)* |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| | o When visual angle subtended by symbol height is less than 15 minutes, | 6.7.2.2 f.(2) (e)* |
| | o When visual angle subtended by character height is less than 12 minutes of arc. | 6.7.2.2 f.(2) (f)* |
| 160. | Simple character fonts are used without serifs, variable stroke width, slanting, etc. | 6.7.2.2 g(1) |
| 161. | When dot-matrix characters are used, 7x9 dot matrix is used in preference to 5x7 dot-matrix. | 6.7.2.2 g(2). |
| 162. | Character styles such as Lincoln/Mitre or Leroy are used. | 6.7.2.2 g(3) |
| 163. | Labels reflect unique characteristic of content of data group or message. | 6.7.2.4 m.(2) OCI-12 |
| 164. | Labels are located in consistent manner either above or to the right or left of data group or messages the describe. | 6.7.2.4 n. OCI-12 |
| 165. | Labels are oriented horizontally. | 6.7.2.4 o. OCI-12 |
| 166. | Labels are highlighted to facilitate operator scanning recognition. | 6.7.2.4 p.(1) OCI-12 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 167. The technique used to highlight labels is distinguishable from one used to highlight emergency/critical messages. | 6.7.2.4 p.(2) OCI-12 |
| 168. Option labels reflect questions or choices posed to operator. | 6.7.2.4 q. OCI-13 |
| DATA PRESENTATION AND SCREEN LAYOUT | |
| 169. Data are presented to operator in readily usable format. | 6.7.2.4 a(1) OCI-1 |
| 170. Data do not have to be transposed, computed, interpolated or mentally translated to be usable to the operator. | 6.7.2.4 a.(2) OCI-1 |
| 171. Illustrations are used to supplement or explain text wherever possible. | 6.7.2.4 b. OCI-1 |
| 172. When five or more digits and/or non-text alphanumerics are displayed and no natural organization exists, characters are grouped in blocks of 3-4. | 6.7.2.4 c.(1) OCI-1 |
| 173. Groups of data are separated by a minimum of one blank space. | 6.7.2.4 c.(2) OCI-1 |
| 174. Where multi-input annunciators must be used, an alarm printout capability is provided. | 6.3.1.2 c.(2) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 175. Elements in data field are displayed in logical order. | 6.7.2.4 d. OCI-1 |
| 176. The manner of presentation of identical data is based on uses to which the data will be put by the operator. | 6.7.2.4 e.(1) OCI-1 |
| 177. Identical data in different presentations is displayed in consistent, standardized manner. | 6.7.2.4 e.(2) OCI-1 |
| 178. Numbers are used as menu designators. | 6.7.2.4 f.(1) OCI-2 |
| 179. Numerical designators start with the number "1", not zero. | 6.7.2.4 f.(2) OCI-2 |
| 180. If numbers as designators is confusing, alphabetic characters are used. | 6.7.2.4 f.(3) |
| 181. When used, alphabetic designators start with the letter "A". | 6.7.2.4 f.(4) |
| 182. Lists are vertically aligned and left-justified. | 6.7.2.4 g.(1) OCI-2 |
| 183. Indentations are used for subclassifications on lists. | 6.7.2.4 g.(2) OCI-2 |
| 184. Quantitative data (to be scanned) is in tabular or graphic form. | 6.7.2.4 h. OCI-2 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 185. | The use of hyphenation is minimized. | 6.7.2.4 i. OCI-2 |
| 186. | When presented in tabular form, alphanumeric data is left-justified. | 6.7.2.4 j.(1) OCI-2 |
| 187. | When presented in tabular form, numeric data is right-justified with decimal points aligned. | 6.7.2.4 j.(2) OCI-2 |
| 188. | Periods are placed after item selection designators and at the end of a sentence. | 6.7.2.4 k. OCI-2 |
| 189. | Telephone numbers are presented in following format: (914) 555-1212. | 6.7.2.4 l.(1) OCI-2 |
| 190. | Time is presented in the following format: HH:MM:SS, HH:MM. MM:SS(.S) | 6.7.2.4 l.(2) OCI-2 |
| 191. | The date is presented in the following format: MM:DD:YY. | 6.7.2.4 l.(3) OCI-2 |
| 192. | Each individual data group or message has a descriptive title. | 6.7.2.4 m.(1) OCI-2 |
| 193. | Displayed data are organized logically and consistently. | 6.7.2.5 a.(1) OCI-4 |
| 194. | Displayed data reflect an obvious and inherent quality of the data groups (hierarchical, sequential, or mimic). | 6.7.2.5 a.(2) OCI-4 |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 195. | Physical location of data groups (alarms, menus) are consistent on screen. | 6.7.2.4 b. OCI-4 |
| 196. | Organization and separation of data subgroups are apparent to operator through the use of blank lines, etc. | 6.7.2.5 c. OCI-4 |
| 197. | Lists of options are organized by probability of selection, with high probability items presented first. | 6.7.2.5 d. OCI-5 |
| 198. | Non-option lists of equal-probability options are presented in alphabetical or numerical order. | 6.7.2.5 e. OCI-5 |
| 199. | Paragraphs are separated by at least one blank line. | 6.7.2.5 f. OCI-5 |
| 200. | Selection designators in menus are separated from text descriptors by at least one blank space. | 6.7.2.5 g. OCI-5 |
| 201. | When data are contained on multiple pages, each page displays both page number and total number of pages. | 6.7.2.5 h. OCI-5 |
| 202. | Items of a numbered list "continue" on following pages relative to the first number on the first page of the list. | 6.7.2.5 i. |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 203. When directions to the operator accompany an options list, the directions precede the list. | 6.7.2.5 j. OCI-5 |
| 204. Urgent messages are highlighted on the CRT screen. | 6.7.2.5 k.(1) OCI-7 |
| 205. Urgent messages are displayed in the same location on the CRT screen. | 6.7.2.5 k.(2) |
| 206. In systems in which selection is made by use of a cursor formats are organized to minimize positioning movements of the cursor. | 6.7.2.5 l. |
| 207. The amount of information-bearing activated screen area does not exceed 25% of the total screen area. This does not include demarcation lines used to separate groups of data. | 6.7.2.5 m. |
| 208. CRT displayed trend plot scales are consistent with the intended functional use of the data. | 6.7.2.5 n. |
| 209. CRT screen lines are composed of at least 20 points per cm (50 points per inch). | VD-50 |
| 210. Data, text, formats, etc., essential to system performance are under system control. | OCI-17 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 211. Alphanumeric characters (if used) are grouped into words, sentences, or text in a meaningful way. | VD-38 |
| GRAPHIC CODING AND HIGHLIGHTING | |
| 212. Highlighting of important messages is used on CRT. | 6.7.2.7 a. OCI-7 |
| 213. Highlight coding methods are consistent. | 6.7.2.7 b.(1) |
| 214. Highlighting methods for emergency conditions are not used in association with normal conditions. | 6.7.2.7 b.(2) |
| 215. If contrast enhancement is used for highlighting, no more than three brightness levels are used in a single presentation. (Two is preferred.) | 6.7.2.7 c. |
| 216. Blinking for purposes of highlighting is not used except for emergency conditions. | 6.7.2.7 d. OCI-7 |
| 217. If blinking is used for highlighting, no more than two blink rates are used. | 6.7.2.7 e.(1) |
| 218. For single blink rate, 2-3 blinks per second with a minimum of 50 msec "on" time between blinks is used. | 6.7.2.7 e.(2) OCI-7 |

* ON-SITE EVALUATION    @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. |
|---|---|
| 219. If two blank rates are used for highlighting, the rates are about 4 per second and 1 per second. | 6.7.2.7 e.(3) |
| 220. If 2 blink rates are used, the on-off ratio is about 50%. | 6.7.2.7 e.(4) |
| 221. If 2 blink rates are used, the higher rate is used for the most critical information. | 6.7.2.7 e.(5) |
| 222. Where blinking is used for highlighting, the blinking rate is between 2-3 Hz with a minimum flash duration of 50 msec. | OCI-7 |
| 223. If inverse video or image reversal is used for highlighting, it is used to highlight in dense data field, such as a word or phrase in a paragraph of text or a set of characters in a table of data. | 6.7.2.7 f. |
| 224. If graphic coding is used, it is used to present standard qualitative information or to draw attention to a portion of the display. | 6.7.2.7 g. |
| 225. Graphic codes are consistently used. | 6.7.2.7 h. |
| 226. If symbols are used for coding, they vary widely in shape. | 6.7.2.7 i. |
| 227. The number of symbols used for coding is kept small. | 6.7.2.7 j.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 228. The number of coding symbols under optimum conditions does not exceed 20. | 6.7.2.7 j.(2) |
| 229. The number of coding symbols under adverse display conditions is six. | 6.7.2.7 j.(3) |
| 230. Other techniques (i.e., color, filled versus unfilled) to display different states or qualities of a basic symbol are used if needed. | 6.7.2.7 j.(4) |
| MULTI-PAGE CONSIDERATIONS | |
| 231. Page design and content minimize operator memory requirements. | 6.7.2.8 a.(1) |
| 232. All data relevant to a specific entry is displayed on a single page. | 6.7.2.8 a.(2) |
| 233. When pages are organized in hierarchical fashion, a visual audit trail of choices is provided upon operator request. | 6.7.2.8 b. |
| 234. Location references within a scrolling frame are provided in viewable portion of frame. | 6.7.2.8 c.(1) OCI-16 |
| 235. Sectional coordinates are used for panning large schematics. | 6.7.2.8 c.(2) |
| 236. Means are provided for operator to control the amount, format, and complexity of information being displayed. | 6.7.2.8 d. OCI-16 |

# HUMAN ENGINEERING CHECKLIST

PROCESS COMPUTER

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| 237. If message is a variable option list, common elements maintain their physical relationship to other recurring elements. | 6.7.2.8 .e. OCI-17 | | |
| LIGHT PENS | | | |
| 238. Light pen cord is retractable or guarded to avoid catching on console shelf. | VD-55 | | |
| 239. Cord connecting light pen to console is positioned to minimize interference with viewed screen data. | VD-55 | | |
| 240. Light pens are equipped with a push-tip switch requiring 2-5 oz. of force to active. | OCI-28 | | |
| 241. Light pennable characters are not coded by blink rate. | | | |
| 242. Light pens are approximately 0.5 in. in diameter and 6.0 in. in length. | OCI-28 | | |

# HUMAN ENGINEERING CHECKLIST

## EMERGENCY GARMENTS

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 1. | Protective equipment includes protective clothing and breathing apparatus. | 6.1.4.1 a. |
| 2. | Protective equipment will be compatible with body sizes and will allow adequate tactile sensitivity and ability to see, move, communicate, reach and hear. | 6.1.4.1 b. |
| 3. | Protective equipment will be checked periodically to make sure it is in good condition. | 6.1.4.1 c. |
| 4. | Protective equipment will be available in sufficient number and sizes to accommodate all operators. | 6.1.4.1 d. |
| 5. | Sizes will be marked clearly. | 6.1.4.1 e. |
| 6. | An adequate supply of personal protection equipment expendables will be provided. | 6.1.4.1 f. |
| 7. | Protective equipment will be easily and readily accessible. | 6.1.4.1 g. |
| 8. | Operators will be well practiced in donning equipment. | 6.1.4.1 h. |
| 9. | Instructions for donning, doffing, and controlling protective equipment will be provided. | 6.1.4.1 i. |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 10. | Personnel wearing protective equipment will be able to operate communications equipment. | 6.2.1.8 b. |
| 11. | Emergency face masks will be equipped with diaphragms for transmitting speech. | 6.2.1.8 c.(1) COM-13 |
| 12. | Diaphragms are capable of separating voice from exhaust valve action. | 6.2.1.8 c.(2) COM-13 |
| 13. | An electronic speech system will be used if face mask is not equipped with diaphragms. | 6.2.1.8 c.(3) |
| 14. | Controls will be easily identified while wearing emergency gear. | 6.4.1.1 d.(1) |
| 15. | Controls will be easy to activate while wearing protective equipment. | 6.4.1.1 d.(2) CON-4 |

# HUMAN ENGINEERING CHECKLIST

## LABELING

*Criteria are different. **0700 is more specific. ***1580 is more specific.

| EVALUATION GUIDELINE | REF. |
|---|---|
| **LABEL CONTENT** | |
| 1. @ Labels describe the equipment functions and, if needed for clarity, engineering characteristics or nomenclature are also described. | 6.6.3.1 a. & b. PA-56 |
| 2. Label wording expresses the exact intended action. | 6.6.3.2 a. PA-55 |
| 3. Instructions are clear and direct. | 6.6.3.2 b. & c. PA-55 |
| 4. Words that have a commonly accepted meaning for all intended users are used in labels. | 6.6.3.2 d. PA-55 |
| 5. @ Unusual technical terms are avoided. | 6.6.3.2 e. PA-55 |
| 6. Words are spelled correctly. | 6.6.3.2 f. |
| 7. Use of Roman numerals is avoided. | 6.6.3.4 e. |
| 8. @ Words on labels are concise and convey the intended meaning. | 6.6.3.5 PA-55 |
| 9. Words and abbreviations of similar appearance are avoided. | 6.6.3.6 PA-56 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 10. Labels are used to identify functionally grouped controls or displays. | 6.6.3.7 a. PA-32 |
| 11. This warning notice is clear, direct, and attention getting and of 25% larger letter size than any detailed instructions (e.g., "Danger! Deadly Shock Hazard" rather than "Warning —High Voltage"). | PA-29 |
| 12. This label uses no periods, except to preclude misinterpretation. | PA-46 |
| 13. Categories of information not needed in using a display are avoided. | 6.5.1.4 b. VD-7 PA-47 |
| **LABEL LOCATION** | |
| 14. Labels are located above the functional groups and components and the panel elements they identify. | 6.6.3.7 b. PA-45 and 6.6.2.1 a. & b. PA-45 PA-49 |
| 15. # Component labels located above eye level are positioned to ensure visibility. | 6.6.2.1 c. PA-45 |
| 16. Labels are placed close to the components they describe. | 6.6.2.1 d. PA-46 |

* ON-SITE EVALUATION @ OPERATOR-ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## LABELING

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 17. # @ | Labels are placed where they are not obscured for an extended time period during operation. | 6.6.2.1 e.* PA-44 and 6.6.2.4 b. & c. PA-44 PA-45 PA-47 |
| 18. | Adjacent labels are separated by sufficient space so they are not read as one continuous label. | 6.6.2.1 f. PA-46 |
| 19. # | Labels are mounted to preclude accidental removal. | 6.6.2.2 a. PA-44 |
| 20. # | Labels are mounted on a flat surface. | 6.6.2.2 b. PA-44 |
| 21. | Labels are positioned horizontally. | 6.6.2.3 a.(1) PA-43 |
| 22. | This label is not a manufacturers' label placed directly on an instrument face. | PA-47 |
| 23. | Vertical orientation of labels is used only when space is limited. | 6.6.2.3 a.(2) PA-43 |
| 24. | Curved labels are avoided. | 6.6.2:3 b. PA-43 |
| 25. | Labels do not obscure figures or scales which must be read. | 6.6.2.4 a. PA-47 |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 26. @ | Administrative procedures are in place for the periodic cleaning of labels. | 6.6.2.4 d. |
| 27. # | Control position indicators will correspond with display labels. | 6.9.1.2 c.(3) |
| 28. | Printing is on the display face. | 6.5.1.4 a.(1) |
| | GENERAL LABELING PRINCIPLES | |
| 29. | Controls, displays, and other equipment that will be located, identified, or manipulated are appropriately and clearly labeled. | 6.6.1.1 PA-28 |
| 30. | Major labels are used to identify major systems on panel sections. | 6.6.1.2 a.(1) PA-29 |
| 31. | Subordinate labels are used to identify subsystems or functional groups. | 6.6.1.2 a.(2) PA-49 |
| 32. | Component labels are used to identify each component. | 6.6.1.2 a.(3) PA-49 |
| 33. | Labels do not repeat information contained in higher-level labels. | 6.6.1.2 a.(4) |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## LABELING

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 34.<br>#| Labels will be graduated in letter size as follows: | |
| | o Major labels are 25% larger than subsystem/functional group labels. | 6.6.1.2<br>b.(1)<br>PA-50<br>PA-31 |
| | o Subsystem/functional group labels are 25% larger than component labels. | 6.6.1.2<br>b.(2)<br>PA-50<br>PA-31 |
| | o Component labels will be 25% larger than control position identifiers. | 6.6.1.2<br>b.(3)<br>PA-50<br>PA-31 |
| 35.<br>@ | Displays are identified as to whether they reflect demand or actual status. | 6.5.1.1<br>e.(1)<br>VD-89 |
| 36. | Display markings are black on a white background to provide high contrast. | 6.5.1.3<br>c.(1)<br>PA-59 |
| | **TEMPORARY LABELS** | |
| 37. | Temporary labels are used only when necessary and conform to good human engineering principles. | 6.6.5.1<br>a. & b. |
| 38.<br># | Temporary labels do not obscure prior permanent labels unless the old label is to be replaced. | 6.6.5.1<br>c. |
| 39.<br># | Tag-out labels clearly identify out-of-service components and equipment, are securely affixed, do not obscure the label associated with the non-operable component and any adjacent devices, and are designed to physically prevent actuation of a control. | 6.6.5.1<br>d. - h. |
| 40.<br>@ | The use of temporary labels is administratively controlled. | 6.6.5.2<br>a. |
| 41.<br>@ | A review procedure is used to determine if temporary labels will be used: (1) when needed; (2) how used; (3) content; (4) installation; (5) impact on other system equipment; (6) documentation requirements; (7) retraining requirements; (8) periodic review; and (9) removal. | 6.6.5.2<br>b.(1-9) |
| | **LOCATION AIDS** | |
| 42.<br># | Demarcation lines are visually distinctive from the panel background. | 6.6.6.2<br>b.<br>CDI-13 |
| 43.<br># | Lines of demarcation are attached permanently. | 6.6.6.2<br>c. |
| | **GENERAL LABELING READABILITY** | |
| 44.<br># | Character height subtends a minimum visual angle of 15 minutes or 0.004 X viewing distance. | 6.5.1.3<br>a. and*<br>6.6.4.1<br>a.(1)<br>PA-34 |

[illegible]

# HUMAN ENGINEERING CHECKLIST

## LABELING

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 45. | Type style is consistent with recommended figures or a similar style and used with consistency. | 6.5.1.3<br>b.(1) &<br>(2)*<br>PA-36<br>VD-36 |
| 46. | Only upper case letters are used. | 6.5.1.3<br>b.(3)<br>PA-36 |
| 47.<br># | Color combinations provide good contrast. | 6.5.1.3<br>c.(2)*<br>PA-59 |
| 48. | Letter height is identical for all labels within the same hierarchical level based on the maximum viewing distance. | 6.6.4.1<br>a.(2) |
| 49.<br># | This engraved label is filled with a paint pigment or covered with a clear plastic cover. | PA-53 |
| 50. | Dark letters are provided on a light background to ensure adequate contrast and prevent readability errors. | 6.6.4.1<br>b.(1)<br>PA-53<br>PA-59 |
| 51. | Labels are in capital letters. | 6.6.4.2<br>a.(1) |
| 52.<br># | Stroke width-to-character-height ratios are between 1:6 and 1:8. | 6.5.1.3<br>d.(1)*<br>VD-39<br>and<br>6.6.4.2<br>c.<br>PA-38 |

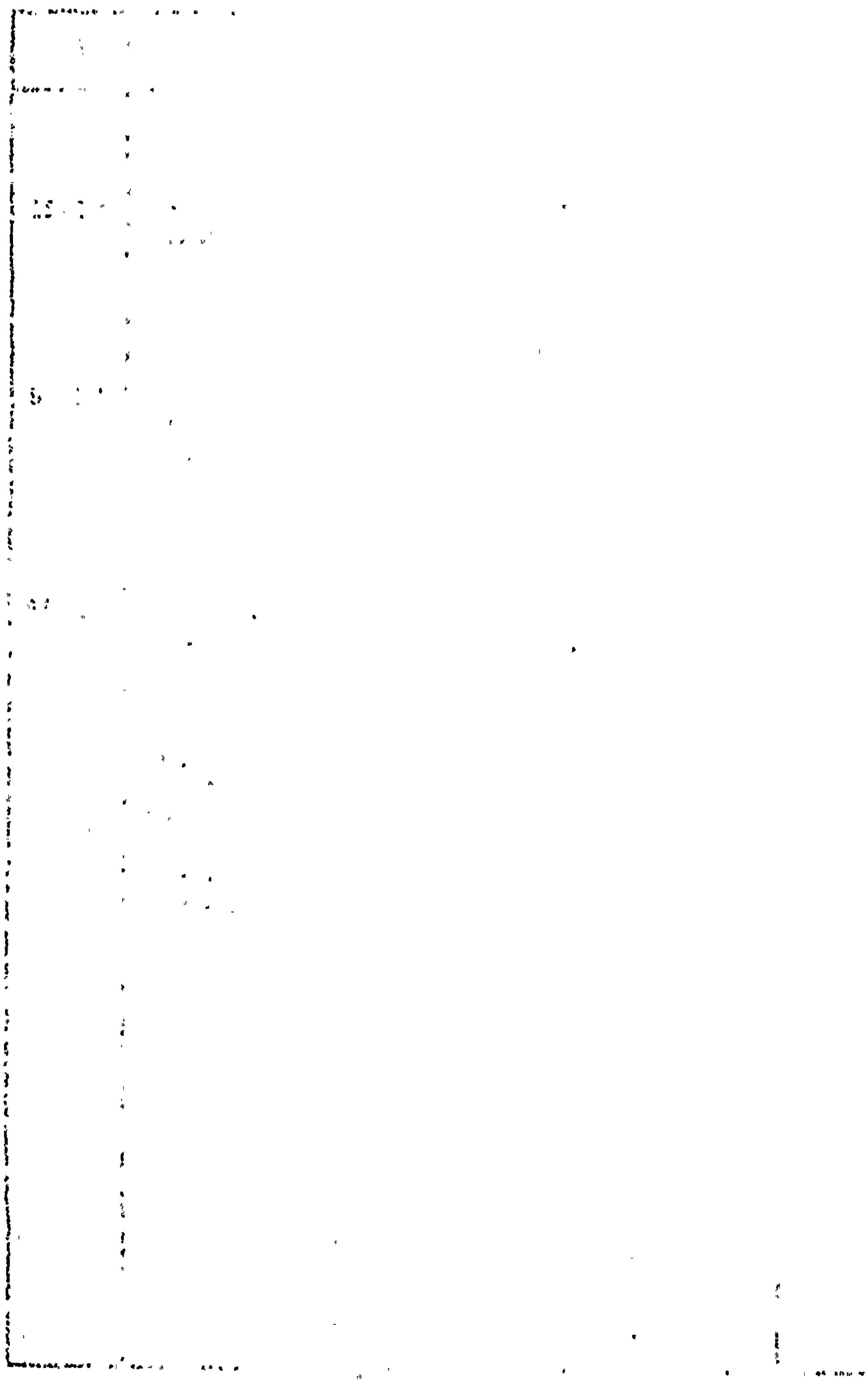
| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 53.<br># | Letter width-to-height ratios are between 1:1 and 3:5. | 6.5.1.3<br>d.(2)<br>VD-40<br>and<br>6.6.4.2<br>b.(1)<br>PA-37 |
| 54.<br># | Numeral width-to-height ratios are 3:5 except for the number "4" which is one stroke width wider and the number "1" which is one stroke in width. | 6.5.1.3<br>d.(3)<br>VD-40<br>and<br>6.6.4.2<br>b.(2)<br>PA-37 |
| 55.<br># | Minimum space between characters is one stroke width. | 6.5.1.3<br>d.(4)<br>PA-60<br>and<br>6.6.4.2<br>d.(1)<br>PA-60 |
| 56.<br># | Minimum space between words is one character width. | 6.5.1.3<br>d.(5)<br>PA-61<br>and<br>6.6.4.2<br>d.(2)<br>PA-61 |
| 57.<br># | Minimum space between lines will be one-half the character height. | 6.5.1.3<br>d.(6)<br>PA-62<br>and<br>6.6.4.2<br>d.(3)<br>PA-62 |

# HUMAN ENGINEERING CHECKLIST

## LABELING

| EVALUATION GUIDELINE | REF. |
|---|---|
| 58. Lettering is simple and without flourishes or serifs and conforms to conventions for style and size. | 6.5.3.3 b.(2)** PA-36 VD-36 and 6.6.4.2 a.(2) PA-36 |
| **COUNTERS** | |
| 59. # For drum-type counters, width to height ratio of numerals is 1:1. | 6.5.5.1 a.(2) VD-83 |
| 60. # For drum-type counters, numeral-to-background contrast is high. | 6.5.5.1 a.(4) VD-84 |
| 61. Simple character font is used; variable stroke widths and slanted characters are not used for electronic counters. | 6.5.5.2 a.(2) |
| 62. # Numerals subtend a visual angle of 15 minutes from furthest anticipated viewing distance of electronic counter. | 6.5.5.2 a.(3) |
| 63. # Electronic counter numeral width-to-height ratio is 3:5. | 6.5.5.2 a.(4) |
| 64. # Horizontal spacing between numerals is 1/4-1/2 numeral width for electronic counters. | 6.5.5.2 a.(5) |
| 65. # Character-to-background contrast ratio is between 15:1 and 20:1 for electronic counters. | 6.5.5.2 c. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **LEGEND LIGHTS** | |
| 66. # The legend is readable under ambient light conditions, with or without internal illumination. | 6.4.3.3 b.(1) and 6.5.3.3 a.(2) CON-57 |
| 67. Legend lettering and contrast and use of color is consistent throughout the control room. | 6.4.3.3 b.(3) |
| 68. The legend messages are specific, unambiguous, and concise. | 6.4.3.3 b.(4) PA-35 and 6.5.3.3 b.(4) VD-6 |
| 69. The legend messages contain no more than three lines of lettering. | 6.4.3.3 b.(5) and 6.5.3.3 b.(5) CON-58 |
| 70. Where meaning of the light is not apparent, labeling is provided close to a legend light indicator. | 6.5.3.2 a.(1)** VD-96 |
| 71. # Legend lettering contrasts well with background when light is both on and off, under both ambient and transilluminated lighting. | 6.5.3.3 a.(3) PA-59 |
| 72. @ Legends are worded to indicate status indicated by glowing light. | 6.5.3.3 b.(7) |



# HUMAN ENGINEERING CHECKLIST

LABELING

| EVALUATION GUIDELINE | REF. |
|---|---|
| MISCELLANEOUS | |
| Access Openings | |
| 73. # Each access opening is labeled to identify the function of items accessible through it. | 6.6.3.9 a. PA-29 |
| Danger Safety Instructions | |
| 74. # All danger, warning, and safety instruction labels are in accordance with appropriate safety standards. | 6.6.3.9 b. PA-29 |
| Trend Recorders | |
| 75. # Labeling for trend recorders identifies the parameters recorded. If multi-pen, parameters are listed in order of associated scales or recorders. | 6.5.4.2 a.(1) |
| CONTROLS | |
| 76. # This switch must be used with the cover panel off and duplicate switch position labels are placed on the internal unit. | PA-51 |
| 77. # See illustration on back. This label for concentric controls uses the following hierarchy: small solid dot, larger solid line, and larger broken circle. Nomenclature is adjacent to controls and identifies the function of each knob. Color coding is used to increase code-symbol reliability. | PA-52 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| LABELS — ORIENTATION | |
| 78. # The angle for viewing this label is as shown in the figure on the back. | VD-21 |
| LABELS — COLOR | |
| 79. White alphanumeric characters on black background have thinner stroke widths than black characters on white background. | VD-38 |
| LABELS — PANELS | |
| 80. # This panel is illuminated by ambient or individual illumination, and the stroke width on its label conforms with the following guidelines: a. Dark characters on light background have a stroke width 1/16 of the letter height. b. Light characters on dark background have a stroke width 1/8 of the letter height. | PA-38 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## ANNUNCIATORS

*Criteria are different. **0700 criteria are more specific. ***1580 is more specific.

| EVALUATION GUIDELINE | REF. |
|---|---|
| **VISUAL DISPLAYS** | |
| **Maintainability** | |
| 1. @ Lamps may be replaced rapidly and conveniently from the front of the display panel. | 6.3.3.1 c. VD-92 |
| 2. @ If necessary, operator aids are provided for lamp replacement. | 6.3.3.1 c. |
| 3. @ Bulbs may be removed and replaced while power is on without causing circuit component failure or personnel safety hazards. | 6.3.3.1 c. VD-92 |
| 4. Legend screen or indicator covers are designed to prevent inadvertent interchange or to provide a check of proper installation. | 6.3.3.1 c. VD-92 |
| 5. Incandescent display lamps have dual bulbs or filament redundancy to indicate need for replacement of a bulb or filament without degrading operator performance. | VD-91 |
| 6. Annunciators are designed so that failure of the circuits or bulbs is immediately apparent. | VD-2 |
| 7. Failure of the annunciator circuit will not cause failure in the equipment associated with the display. | VD-7 |
| 8. Master light test control exists for each control panel using incandescent bulbs. | VD-91 |
| **Identification/Coding** | |
| 9. High-priority or safety-related annunciators flash red, while all other lights do not flash or are a different color. | VD-95 |
| 10. Annunciators or warning lights are separate from and clearly distinguishable from status indicators. | VD-96 |
| 11. This annunciator is discriminably larger and brighter than other less critical legend lights. | VD-110 |
| 12. This warning device attracts the attention of a busy or bored operator. | 6.3.3.2 a. VD-112 |
| 13. The specific tile(s) on an annunciator panel use flashing illumination to indicate an alarm condition. | 6.3.3.2 a. VD-109 VD-99*** |
| 14. This warning device specifies what is wrong or what action to take. | VD-112 |
| 15. This warning device allows continued attention to other duties. | VD-112 |
| 16. This warning device is not likely to fail or give false warnings. | VD-112 |

[illegible]

| | |
|---|---|
| [illegible] | |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
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| [illegible] | [illegible] |

# HUMAN ENGINEERING CHECKLIST

## ANNUNCIATORS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 17. Each matrix is labeled with alphanumeric codes for identification of individual tiles. The number of alarm tiles and the matrix density are kep low. | 6.3.3.3 d.(1) |
| 18. Appropriate alphanumeric codes appear on matrix axes for ready coordinate designation of a particular visual tile; coordinate designation is preferred on the left and top sides of the annunciator panel. | 6.3.3.3 c.(1)(2) |
| 19. Summary labels identify major alarm groups. | 6.3.3.3 |
| 20. If used, brightness coding uses only two levels (bright and dim). | VD-111 |
| 21. If brightness coding is used, bright represents primary items and dim represents background or supplementary information. | VD-111 |
| 22. The maximum number of chromatic colors used on annunciators is five (total of seven, including black and white). | VD-108 |
| C/D Relationships | |
| 23. Flashing lights have a flash [illegible] | 6.3.3.2 [illegible]VD-89 |
| 31. Status lights depicting the [illegible] system components. | VD-100 VD-109 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 24. Size-coded annunciators use a maximum of three sizes/steps. | VD-111 |
| 25. Compound coding is usually less satisfactory than single coding if the single code used is the best available. | VD-106 |
| 26. Coding in this annunciator system is consistent throughout the control room. | VD-106 |
| 27. No color combinations which can be easily confused (e.g., red and orange; blue and purple) are used for coding annunciators in the control room. | VD-97 |
| 28. If used, symbols are clearly associated with the objects/conditions they represent. | VD-110 |
| 29. Symbology codes use only simple, symmetrical symbols with enclosed areas, sharp angles, and/or smooth curves. | VD-110 |
| 30. Symbolic codes avoid using variations of a single geometric form. | VD-110 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## ANNUNCIATORS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 32. Control devices associated with this annunciator are within readily reachable distances. | 6.3.4.1 VD-88 |
| 33. Critical function indicators are located within 15° of the operator's normal line of sight. | VD-90 |
| Readability | |
| 34. Annunciator visual tile legends are specific and unambiguous. | 6.3.3.4 a.* PA-55 VD-6 |
| 35. Tile legends address specific conditions. | 6.3.3.4 c. VD-6 |
| 36. Legends are engraved. | 6.3.3.5 c.(1)* VD-103 |
| 37. Only upper-case type is used on visual tiles. | 6.3.3.5 b.(3) VD-103 |
| 38. Type styles are simple (no flourishes or seriphs). | 6.3.3.5 b.(1) VD-103 VD-41 |
| 39. Numerals and letters do not vary in engraving depth. | VD-103 |
| 40. Letter width-to-height ratio is between 1:1 and 3:5 or 100% to 60% for black letters on white background. | 6.3.3.5 d.(2) VD-105 VD-40 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 41. Numeral width-to-height ratio is 3:5. | 6.3.3.5 d.(3)* VD-103 VD-40 |
| 42. Letter height is identical for all tiles. | 6.3.3.5 a.(2) |
| 43. Type styles are consistent on all visual tiles. | 6.3.3.5 b.(2) |
| 44. Stroke-width-to-character-height ratio is between 1:6 and 1:8. | 6.3.3.5 d.(1)* VD-105 |
| 45. Minimum space between characters is one stroke width. | 6.3.3.5 d.(4) PA-60 |
| 46. Minimum space between words is the width of one character. | 6.3.3.5 d.(5) PA-61 |
| 47. Minimum space between lines is one-half the character height. | 6.3.3.5 d.(6) PA-62 |
| 48. The operator is able to read all the annunciator tiles from the position at the work station where annunciator acknowledge control is located. | 6.3.3.5 a. VD-90 VD-35 |
| 49. Legends provide high contrast with the tile background. | 6.3.3.5 c.* PA-59 |
| 50. Legends are dark lettering on light background. | 6.3.3.5 c.(2) VD-93 |

# HUMAN ENGINEERING CHECKLIST

## ANNUNCIATORS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 51. There is a high enough contrast between alarming and steady-on tiles, and between illuminated and nonilluminated tiles. | 6.3.3.2 d.* VD-93 |
| 52. In case of flash or failure of an alarmed tile, the tile light illuminates and burns steadily. | 6.3.3.2 c. VD-109 |
| 53. Trademarks, company names, or other markings not related to the annunciator are not displayed on the window face. | VD-6 |
| 54. Each panel is identified by a label above the panel. | 6.3.3.1 b.(1) PA-49 |
| **Operations** | |
| 55. Changes in display status signify changes in functional status rather than results of control activation alone. | 1472C |
| 56. Extinguishment of a signal or visual indication will not be used to denote a "go ahead" or "ready" condition. | VD-89 |
| 57. Some type of visual indication is provided for recurring alarms (ringback) such as: | |
| o A special flash rate (twice or one-half the normal flash rate). | 6.3.1.5 b.(1) |
| o Reduced brightness. | 6.3.1.5 b.(2) |
| o A special color. | 6.3.1.5 b.(3) |

AUDITORY WARNINGS

Coding

| EVALUATION GUIDELINE | REF. |
|---|---|
| 64. A maximum of five auditory signal combinations is used where coded by both intensity and frequency. | AD-16 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 58. Blank or unused annunciator tiles are not illuminated. | 6.3.3.3 f. |
| 59. Flash rates are from 3 to 5 flashes per second with approximately equal on and off times. | 6.3.3.2 b. VD-109 1472C |
| **Location** | |
| 60. This annunciator is located so that it can be read easily and accurately by personnel in normal operating positions. | 1472C |
| 61. Panel identification label height is consistent with a subtended visual angle of at least 15 minutes when viewed from a control position within the primary operating area. | 6.3.3.1 b.(2) |
| 62. Letter height for coordinate designation is consistent with a subtended visual angle of at least 15 minutes. | 6.3.3.3 c.(3) |
| 63. Annunciator tile(s) letter heights subtend a minimum visual angle of 15 minutes. | 6.3.3.5 a.(1) VD-35 |

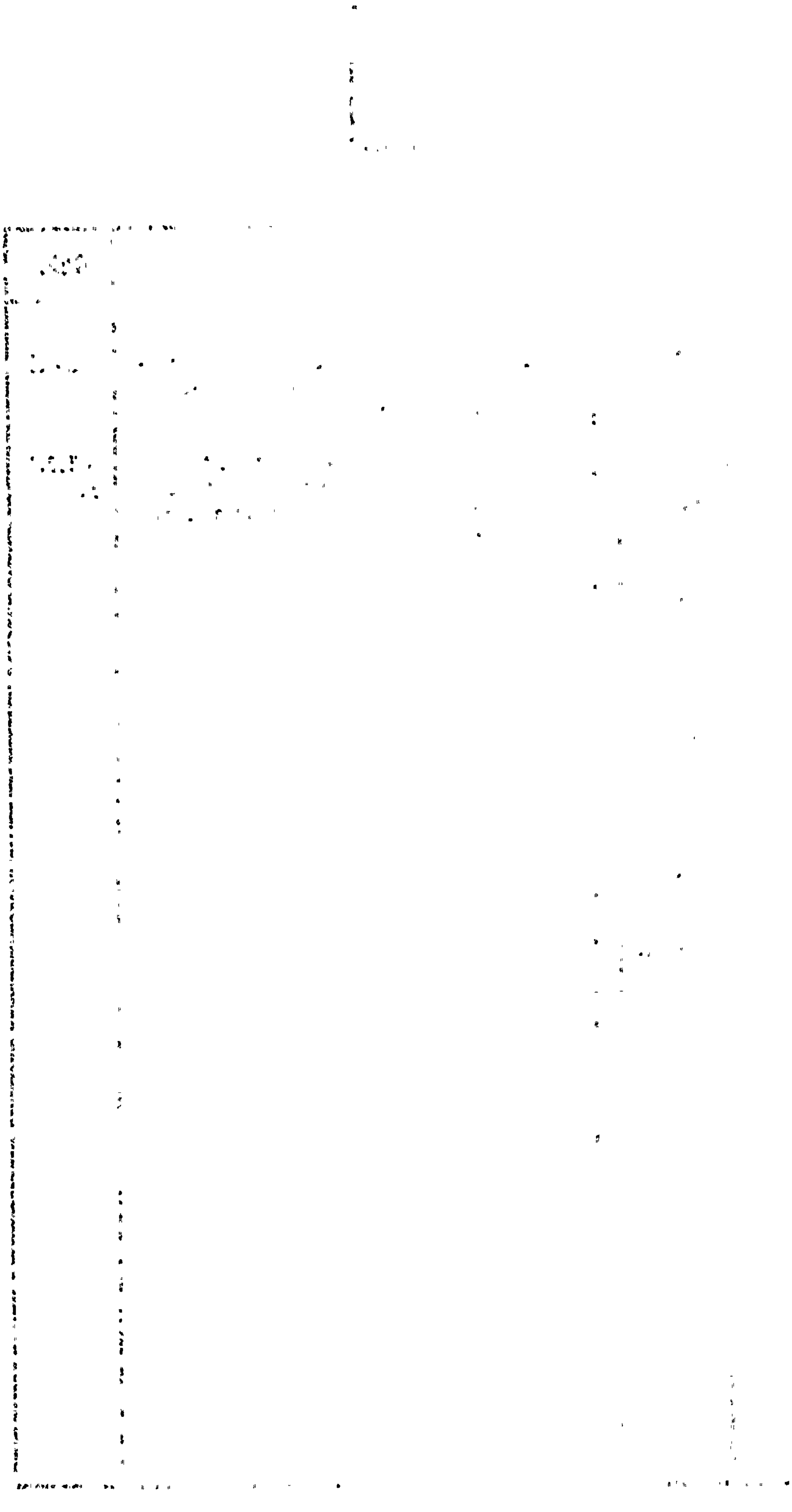
# HUMAN ENGINEERING CHECKLIST

## ANNUNCIATORS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 65. The maximum number of audible signal codes by sound duration at any given time does not exceed three. | AD-19 |
| 66. Changes in signal intensity are used as a spatial coding cue. Frequency is not used for spatial coding. | AD-20 |
| 67. The maximum number of spatially coded signals (via intensity changes) does not exceed four. | AD-20 |
| 68. Differences in sound intensity are distinct. | AD-21 |
| 69. The same signal should designate the same information at all times. | 6.3.3.2 c.(2) AD-1 |
| 70. More critical auditory signals are clearly distinguishable from those of lesser importance. | AD-3 |
| 71. No more than seven different frequencies are used for coding all auditory displays, including warning systems. | AD-15 |
| 72. Auditory signals direct operator to location requiring action (localization). | 6.3.2.1 f. AD-3 |
| 73. Coded signals are used to alert operator to an alarm that is not within primary operating areas. | 6.3.2.2 a. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| Operations | |
| 74. Caution signals are distinguishable from warning signals. | AD-31 |
| 75. Similar audible signals are not contradictory in meaning. | AD-18 |
| 76. Signals that increase progressively in level are not used where manual silencing is required. | AD-7 |
| 77. Communication systems for warnings, such as loudspeakers, horns, etc., are not used for other purposes. | AD-12 |
| 78. Auditory signals capture operator's attention without causing irritation or a startled reaction. | 6.3.2.1 c. |
| 79. Auditory alert mechanisms automatically reset after activation. | 6.3.2.1 e. |
| 80. Audible alarms are used in conjunction with warning lights, unless alarm is for evacuation. | AD-23 |
| 81. Alarm system can be silenced. | AD-8 |
| 82. Auditory signals are not presented simultaneously. | AD-3 |
| 83. Alarm audibles are shut off only after initiation of the signals. | AD-8 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION



# HUMAN ENGINEERING CHECKLIST

ANNUNCIATORS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 84. System is equipped with manual initiation as a supplement to automatic initiation (e.g., evacuation, testing, etc.). | AD-30 |
| 85. An audible alarm is provided to indicate malfunctions in unmonitored equipment. | CRE-21 |
| 86. Cleared alarms have a dedicated distinctive audible signal of finite duration. | 6.3.1.5 a. |
| 87. Audible alarms are discernible over ambient control room noise (level approx. 10 dB over ambient). | 6.3.2.1 a. |
| Arrangement | |
| 88. Sound sources are directed towards the operator. | AD-6 |
| 89. Sound sources are placed at or above the head of the operator. | AD-10 |
| Maintenance | |
| 90. Audio displays are equipped with circuitry test devices or other means of operability testing. | AD-10 |
| 91. Systems failures do not affect operability of audible alarm systems. | AD-11 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 92. Failure of audible alarm circuitry does not adversely affect equipment. | AD-11 |
| 93. Where signal intensity is adjustable, such adjustment is governed by administrative procedure. | 6.3.2.1 b. |

# ON-SITE EVALUATION        @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

ANTHROPOMETRIC

*Criteria are different. **0700 is more specific.

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| WORKSPACE ARRANGEMENT | | |
| 1. # | Minimum separation from the back of any desk to any opposing surface is 36 inches. | 6.1.1.3* e.(1) WA-21 |
| 2. # | Minimum lateral space for a seated operator is 30 inches. | 6.1.1.3* e.(2) WA-21 |
| 3. # | Minimum separation between a single row of equipment/panel and a wall is 50 inches. | 6.1.1.3 f.(1) WA-20 |
| 4. # | Minimum separation between two rows of facing equipment if operated by one person is 50 inches. | 6.1.1.3 f.(2) WA-20 |
| 5. # | Minimum separation between opposing rows of equipment where more than one person works simultaneously will be 8 feet. | 6.1.1.3 f.(3) WA-20 |
| STANDING OPERATIONS | | |
| 6. # | Console height will not exceed 58 inches when a standing operator must see over it. | 6.1.2.2 a. |
| 7. $ | The highest controls on a stand-up console allows a 5th percentile female to reach without stretching or using a stool, ladder, etc. | 6.1.2.2 b.(1)** VD-22 |

| EVALUATION GUIDELINE | | REF. |
|---|---|---|
| 8. $ | The lowest controls on a stand-up console allows a 95th percentile male to reach without bending or stooping. | 6.1.2.2 b.(2)** VD-22 |
| 9. $ | Benchboard slope permits a 5th percentile female to reach all controls. | 6.1.2.2 c. |
| 10. # | Controls are set back a minimum of 3 inches from the front edge to protect against accidental activation. | 6.1.2.2 d.(1) |
| 11. # | No control is more than 25 inches from the front edge of the console. | 6.1.2.2 d.(2) |
| 12. $ | All displays, including annunciators, are mounted so that they are within the upper limit of the visual field of the standing 5th percentile female. | 6.1.2.2 e.(1)(a) |
| 13. $ | All displays and annunciators are mounted so that the angle from the line of sight to the face plane is 45° or greater. | 6.1.2.2 e.(1)(b) VD-22 |
| 14. $ | The oblique angle from the line of sight to a display located to either side of the working position from which the display must be read is at least 45°. | 6.1.2.2 e.(2) |
| 15. # | The maximum lateral spread of controls and displays at a single-operator work station does not exceed 72 inches. | 6.1.2.2 f. |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

·08

[illegible]

# HUMAN ENGINEERING CHECKLIST

## ANTHROPOMETRIC

| EVALUATION GUIDELINE | REF. |
|---|---|
| 16. # A clearance of 4 inches vertical and 4 inches horizontal is provided for foot room at the control board. | 6.1.2.2 g. WA-25 |
| SEATED OPERATIONS | |
| 17. # Console height for seated operators is no higher than 45 inches above the floor if the operator must see over the console. | 6.1.2.3 a.(1) |
| 18. When the seated operator need only monitor (not read) status lights and annunciators beyond the console, see-over console heights above 45 inches are acceptable. | 6.1.2.3 a.(2) |
| 19. # All controls on a sit-down console are within the reach of the 5th percentile female. | 6.1.2.3 b. |
| 20. $ The benchboard slope is within the functional reach of the 5th percentile female. | 6.1.2.3 c. |
| 21. # Controls are set back a minimum of 3 inches from the front edge to protect against accidental activation. | 6.1.2.3 d.(1) |
| 22. # Controls are not mounted farther than 25 inches from the console edge. | 6.1.2.3 d.(2) |
| 23. $ All displays and annunciators are mounted so that they are less than 75° above the horizontal line-of-sight of the seated 5th percentile female. | 6.1.2.3 e.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 24. $ Displays are mounted so that the angle from the line-of-sight to the display face plane is 45° or greater. | 6.1.2.3 e.(2)** VD-22 |
| 25. # Controls and displays for a seated operating sequence will be within maximum extended reach and viewing range of the seated operator specified on Figure 6.1-11. | 6.1.2.3 f.(1) |
| 26. # The operator will not have to bend/stretch significantly for operating sequences and sustained or precise control action. | 6.1.2.3 f.(2) |
| 27. # Sufficient foot and leg room will be provided under all tables, consoles, etc. | 6.1.2.3* g. WA-27 |
| 28. # A surface at least 16 inches deep and 24 inches wide is provided for writing; for other kinds of seated tasks, the surface will be 16 inches deep and 30 inches wide. | 6.1.2.3* h.(1) WA-27 |
| SIT-STAND WORK STATIONS | |
| 29. $ Height and lateral limits for controls and displays conforms to 6.1.2.2 (see attached). | 6.1.2.4 (a) |
| 30. # A high chair is available so that seated eye level is the same as standing eye level. | 6.1.2.4 (b) |

$ ON-SITE EVALUATION  @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## ANTHROPOMETRIC

| EVALUATION GUIDELINE | REF. |
|---|---|
| 31. # Knee room and comfortable foot support are provided at sit-stand work stations. | 6.1.2.4 (c) |
| **VERTICAL PANELS** | |
| 32. # Controls are placed in an area between 34 and 70 inches above the floor. | 6.1.2.5* a.(1) WA-4 |
| 33. # Controls requiring precise or frequent operation and emergency controls are placed in an area between 34 and 53 inches above the floor. | 6.1.2.5* a.(2) WA-4 |
| 34. # Displays are placed in an area between 41 and 70 inches above the floor. | 6.1.2.5 b.(1) WA-1 |
| 35. # Displays which are read frequently or precisely are mounted in an area between 50 and 65 inches above the floor. | 6.1.2.5 b.(2) WA-1 |
| **DESKS** | |
| 36. # For seated work only, a desk is 26 to 31 inches above the floor. | 6.1.2.7* d.(1) WA-16 |
| 37. # For sit-stand desks, the height is 36 to 38 inches. | 6.1.2.7 d.(2) |
| 38. # Work surface area depth is 16 inches minimum. | 6.1.2.7 d.(3) WA-16 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 39. Work surface area width is 24 inches minimum if tasks involve reading and writing only; 30 inches if other tasks are involved. | 6.1.2.7* d.(4) WA-16 |
| 40. # Knee room height is 25 inches from the floor for 5th to 95th percentile males and females at sit-down-only stations. | 6.1.2.7* d.(5) WA-16 |
| 41. # Knee room depth is 18 inches minimum for desks or consoles. | 6.1.2.7 d.(6) |
| 42. Knee room width is 20 inches minimum for sit down work station. | 6.1.2.7* d.(7) |
| **SEATS AND CHAIRS** | |
| 43. # Seats are at least 17 inches wide and 15-17 inches deep. | 6.1.2.8* e. WA-17/18 |
| 44. # Chairs at sit-down stations are adjustable from 15-18 inches in height and for sit-stand stations, from 26-32 inches. | 6.1.2.8* f. WA-18 |
| 45. # An adjustable footrest is provided at a level of no more than 18 inches below the seat surface. If it is part of the chair, a circular design of 18 inches in diameter is recommended. | 6.1.2.8 g. |

# HUMAN ENGINEERING CHECKLIST

## ANTHROPOMETRIC

| EVALUATION GUIDELINE | REF. |
|---|---|
| **CRT DISPLAYS** | |
| 46. The minimum angle between the operator is line-of-sight (LOS) and the display screen plane is $45^{\circ}$ or greater horizontally and vertically. | 6.7.2.3* b. VD-46 |
| 47. # CRT displays that are monitored frequently will not be more than $35^{\circ}$ to the left or right of the operators' straight-ahead LOS or not more than $20^{\circ}$ above and $40^{\circ}$ below the operators' horizontal LOS. | 6.7.2.3* c.(1)(a) & (b) VD-47 |
| 48. # CRT displays that are not monitored frequently will be not more than $95^{\circ}$ to the left or right of the operators' straight-ahead LOS and not more than $70^{\circ}$ above and $90^{\circ}$ below the operators' horizontal LOS. | 6.7.2.3 c.(2)(a) & (b) |
| 49. # CRT displays requiring frequent monitoring are not more than $35^{\circ}$ to the left or right of the operators' straight-ahead LOS and not more than $35^{\circ}$ above and $25^{\circ}$ below the operators' horizontal LOS. | 6.7.2.3 d.(1)(a) & (b) |
| 50. # CRT displays not requiring frequent monitoring are not more than $95^{\circ}$ to the left or right of the operators' straight-ahead LOS and not more than $85^{\circ}$ above and $90^{\circ}$ below the operators' horizontal LOS. | 6.7.2.3 d.(2) (a) & (b) |
| 51. # Consoles in which CRTs are installed will conform to the guidelines of Section 6.1.2. | 6.7.2.3 e. VD-54 |

# ON-SITE EVALUATION     @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## FORCE/TORQUE

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 1. | Toggle switches have an elastic resistance that increases as the control is moved and drops as the switch snaps into position. | 6.4.5.3 a. CON-65 |
| 2. | Knobs for spring-loaded momentary contact rotary selector controls are large enough to be easily held against the spring torque for as long as necessary. | 6.4.4.5 f. |
| 3. | The resistance for rocker switches is a minimum of 10 ounces and a maximum of 40 ounces. | 6.4.5.4 e.(2) CON-70 |
| 4. | Rocker switch resistance gradually increases, then drops to zero when the control snaps into position. | 6.4.5.4 c.(1) CON-71 |
| 5. | This resistance precludes the switch being placed between positions. | 6.4.5.4 c.(2) CON-71 |
| 6. | Resistance of a large toggle switch is 10 ounces minimum and 40 ounces maximum. | 6.4.5.3 c.(4) CON-64 |
| 7. | Resistance of a small toggle switch is a minimum of 10 ounces and a maximum of 16 ounces. | 6.4.5.3 c.(3) CON-64 |
| 8. | Resistance of thumbwheel controls is a minimum of 6 ounces and a maximum of 20 ounces. | 6.4.5.1 d.(2)(e) CON-92 |
| 9. | Resistance of continuous adjustment thumbwheels is between 3 and 6 ounces. | 6.4.5.1 c.(2) CON-97 |
| 10. | Resistance of rotary selector controls is a minimum of 1.0 inch/lb. and a maximum of 6.0 inch/lbs. | 6.4.4.5 e.(5) CON-32 |
| 11. | Knob torque for continuous adjustment rotaries is within the range of 4.5 to 6.0 inch/ounces. | 6.4.4.4 d. CON-39 |
| 12. | Resistance of key-operated controls is 1.0 inch/lb. minimum and 6.0 inch/lbs. maximum. | 6.4.4.3 g.(3) CON-46 |
| 13. | Resistance for legend push-buttons is a minimum of 10 ounces and a maximum of 40 ounces. | 6.4.3.3 e.(5) CON-56 |
| 14. | Resistance for round push-buttons is a minimum of 10 ounces and a maximum of 40 ounces. | 6.4.3.2 d. CON-50 |
| 15. | Control knobs or handles do not rotate, slip, or move loosely on their shafts so as to retain full characteristics during its service life. | 6.4.1.1 e.(2) |
| 16. | No internal wear or breakage occurs to alter the "feel" or other sensory feedback of the control. | 6.4.1.1 e.(3) |

# ON-SITE EVALUATION     @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

COMMUNICATIONS

*Criteria are different. **0700 is more specific.

| EVALUATION GUIDELINE | REF. |
|---|---|
| 1. Fixed-base UHF transceivers provide a frequency response of at least 200-3300 Hz and sufficient dynamic range for handling speech characteristics. | 6.2.1.5 a. COM-1 |
| 2. Gain is adjustable, with the lowest setting allowing audibility. | 6.2.1.5 b. COM-4 |
| 3. Procedures are established and posted for the use of the UHF system. | 6.2.1.5 c. |
| 4. The announcing system provides a good frequency response of 200-3300 Hz, to achieve intelligibility. | 6.2.1.6 a.(1) COM-1 |
| 5. Loudspeakers are placed to adequately cover all necessary areas without "Dead Spots". | 6.2.1.6 a.(2) COM-9 |
| 6. Microphone frequency response is compatible with the system. | 6.2.1.6 b.(1) COM-15 |
| 7. Powered telephones, used with the system, have microphones compatible with the announcing system. | 6.2.1.6 b.(2) |
| 8. Microphones are highly sensitive to speech signals. | 6.2.1.6 b.(3) |
| 9. Microphone dynamic range permit 50dB variations in signal input. | 6.2.1.6 b(4) COM-15 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 10. Microphone input is provided within the control room. | 6.2.1.6 b.(5) |
| 11. Speakers are provided in all areas where control room personnel might be. | 6.2.1.6 c.(1) COM-26 |
| 12. Speakers are placed to yield an intelligible level of signal throughout the area. | 6.2.1.6 c.(2) |
| 13. Procedures are outlined for the proper manner of speaking on the announcing system. | 6.2.1.6 d. |
| 14. Speaker volume is adjustable to allow detection of auditory alarms. | 6.2.1.6 e.(1) COM-4 |
| 15. Lowest gain control setting allows audibility of communication. | 6.2.1.6 e.(2) COM-4 |
| 16. Control room inputs have priority to interrupt or bypass messages on the announcing system. | 6.2.1.6 f. |
| 17. Point-to-point intercoms connect the control room with important plant areas. | 6.2.1.7 |
| 18. The system provides adequate frequency response from 200-3300 Hz. | 6.2.1.7 a. |
| 19. Gain is adjustable at each intercom unit, with lowest setting allowing audibility. | 6.2.1.7 b. |

| REF. | [illegible] | [illegible] | |
|---|---|---|---|
| [illegible] AD-11 | [illegible] | [illegible] | [illegible] |
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| [illegible] AD-10 | [illegible] | [illegible] | [illegible] |
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# HUMAN ENGINEERING CHECKLIST

COMMUNICATIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 20. Internal and external communications backup is provided during emergencies. | 6.2.1.8 a. |
| 21. Systems dedicated to non-verbal auditory signals are used only for that purpose. | 6.2.2.1 a. |
| 22. Auditory signals provide location cues, directing operators to area of required attention. | 6.2.2.1 b. AD-3 |
| 23. Auditory signals are selected to avoid confusion with ambient noise. | 6.2.2.1 c.(1) AD-1 |
| 24. Auditory signals do not interfere with other auditory sources, including verbal communication. | 6.2.2.1 c.(2)* AD-3 |
| 25. The meaning of each auditory signal is clear and unambiguous. | 6.2.2.2 a.* AD-1 |
| 26. Similar auditory signals are not contradictory in meaning. | 6.2.2.2 b. AD-18 |
| 27. Alerting auditory signals are distinct from routine signals such as bells, buzzers, etc. | 6.2.2.2 c. |
| 28. Sound sources direct sound toward the center of the primary operating area. | 6.2.2.4 a. AD-6 |
| 29. Auditory alert and warning signals are audible in all parts of the control room. | 6.2.2.4 b. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 30. Failure of auditory alarm does not adversely affect plant equipment. | 6.2.2.7 a. AD-11 |
| 31. False auditory alarms are avoided. | 6.2.2.7 b. |
| 32. Auditory test capabilities are provided. | 6.2.2.7 c. AD-10 |
| 33. Dedicated communication links exist between primary operating areas and the shift supervisor's office. | 6.1.1.6. b. |
| 34. Operating instructions are provided for each communication system including alternatives if system becomes inoperable. | 6.2.1.1 a. |
| 35. Periodic maintenance is performed to ensure that all communication systems are normally operative and effective under varying ambient noise levels. | 6.2.1.1 b. |
| 36. Priority procedures are established and are made known to all operators for the transmission of emergency messages from the control room by any of the communication systems. | 6.2.1.1 c.(1) |
| 37. Procedures are established for handling communications during an emergemcy. | 6.2.1.1 c.(2) |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

COMMUNICATIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 38. Conventional powered telephone systems provide good frequency response within the auditory spectrum of 200-3000 Hz. | 6.2.1.2 a. COM-6 |
| 39. Size and shape of handset is compatible with operator's hand size and mouth-ear distance. | 6.2.1.2 b.(1) COM-17 |
| 40. Handsets maintain firm ear contact by receiver while transmitter is positioned to receive voice waves directly from mouth. | 6.2.1.2 b.(2) COM-17 |
| 41. Cords are non-link or self-retracting. | 6.2.1.2 b.(3) COM-17 |
| 42. Cords are of sufficient length to permit mobility. | 6.2.1.2 b.(4) COM-27 |
| 43. Telephone instruments are coded to indicate circuit or function in a multiple phone set-up. | 6.2.1.2 b.(7) |
| 44. Press-to-talk buttons are convenient to both left and right hand operation. | 6.2.1.2 b.(8) COM-17 |
| 45. Switching is designed or programmed to minimize delays in connection making under normal and emergency conditions. | 6.2.1.2 c.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 46. Switching is programmed to give the control room automatic priority access to the switching system. | 6.2.1.2 c.(2) |
| 47. Loudness of ringing is adjustable at individual telephone sets. | 6.2.1.2 d. |
| 48. Powered telephone system transmitters, when used as microphone inputs to the announcing system, are compatible with the rest of the announcing system. | 6.2.1.2 e. |
| 49. Good frequency response from 200-3000 Hz is provided for sound-powered telephone systems. | 6.2.1.3 a.(1) |
| 50. The sound-powered system provides in-phase feedback to the user. | 6.2.1.3 a.(2) |
| 51. Earphones in head set cover the outer ear with cushioning to provide comfort for extended wear. | 6.2.1.3 b.(1) COM-21 |
| 52. Earpiece supporting structures in headset do not impose discomforts of weight, concentrated pressures, or metal contact with the skin. | 6.2.1.3 b.(2) COM-21 |
| 53. The earpiece is held firmly in place, yet is easy to remove. | 6.2.1.3 b.(3) COM-22 |

# HUMAN ENGINEERING CHECKLIST

## COMMUNICATIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 54. Headsets provide hands-free operation, except where push-to-talk switches become necessary in areas of high ambient noise. | 6.2.1.3 b.(4) COM-20* |
| 55. Binaural headsets are used in areas with high ambient noise, remote from the control room. | 6.2.1.3 b.(5) |
| 56. Headset storage area is well-marked and accessible. | 6.2.1.3 b.(6) |
| 57. Need for ringing is determined by the plant depending on sound-powered phone procedures. | 6.2.1.3 c.(1) |
| 58. If ringing is not installed, the user is provided the capability for switching the sound-powered transmitter to the paging system to call a party to the line. | 6.2.1.3 c.(2) |
| 59. Plug-in jacks for the sound-powered system are provided in the control room. | 6.2.1.3 d.(1) |
| 60. Jacks are located close to the work stations to prevent the need for unduly long cords. | 6.2.1.3 d.(2) |
| 61. Jacks accommodate only the sound-powered phone system (not conventionally powered phone systems). | 6.2.1.3 d.(3) |
| 62. Requirements for switching with sound-powered phones are assessed for the plant based on procedures for use of sound-powered phones. | 6.2.1.3 e.(1) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 63. Patch panels are marked conspicuously and located in accessible areas, especially in back-panel areas. | 6.2.1.3 e.(2) |
| 64. A complete set of patch cords are provided at each panel. | 6.2.1.3 e.(3) |
| 65. Walkie-talkies have a good frequency response between 200 and 3300 Hz. | 6.2.1.4 a.(1) |
| 66. There is sufficient dynamic range and gain to handle instantaneous speech pressures and to develop necessary signal level at headphone or loudspeaker of walkie-talkies. | 6.2.1.4 a.(2) COM-1 |
| 67. Walkie-talkie radio frequency is broad enough for uninterrupted communication with control room. | 6.2.1.4 b.(1) |
| 68. Use of walkie-talkies is restricted in areas where low-level analog or digital equipment are affected by frequency bands. | 6.2.1.4 b.(2) |
| 69. Walkie-talkies are light and portable. | 6.2.1.4 c.(1) |
| 70. Walkie-talkie portability allows one hand, and preferably both, free for other tasks. | 6.2.1.4 c.(2) |
| 71. Microphones are integrated into the transciever package of the walkie-talkie. | 6.2.1.4 c.(3) |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## COMMUNICATIONS

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 72. | Party identification is required and provided for when more than two parties are using the same channel on the walkie-talkie at separate locations. | 6.2.1.4 d. |
| 73. | Adjustable signal detection for warning systems is controlled by administrative procedure. | 6.3.2.1 b. |
| 74. | The warning signal captures the operator's attention but does not cause irritation or startled reaction. | 6.3.2.1 c. |
| 75. | Each auditory signal is adjusted to result in approximately equal detection levels at normal operator work stations in the primary operating area. | 6.3.2.1 d. |
| 76. | The annunciator auditory alert mechanism automatically resets when it is silenced. | 6.3.2.1 e. AD-9 |
| 77. | The operator is able to identify the work station or the system where the auditory alert signal originated. | 6.3.2.1 f.* AD-5 |
| 78. | This communications system uses auditory signals only for a few of the most urgent warnings. | VD-4 |
| 79. | Reach to communication devices and controls is unobstructed. | |

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 80. | Communication devices are labeled and color-coded (emergency, normal, etc.). | COM-19 |
| 81. | Emergency and most frequently used communication devices are immediately accessible. | COM-19 |
| 82. | Communication devices are easily reached. | |
| 83. | Microphones for this equipment are protected against breath blast and moisture condensation. | COM-16 |
| 84. | Receiver control layout for this device is "station-select" by the right hand and volume control by the left hand. | COM-23 |
| 85. | This communications system allows emergency messages top priority. | AD-3 |
| 86. | This communications device has individual visual signals for each channel to show which channel is in use. | COM-10 |
| 87. | This device does not use channel sharing. | COM-10 |
| 88. | For this infrequently used device, instructions are provided. | |
| 89. | This microphone does not overload with signals as high as 125-130 dB. | COM-15 |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## COMMUNICATIONS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 90. This is a directional microphone if feedback "squeal" is a problem. | COM-16 |
| 91. This communications system has loudspeakers of different communication channels separated at least 10° from the operator's position. | COM-12 |
| 92. This headset has a frequency response as broad as that of the remainder of the system. | COM-21 |
| 93. These headphones and loudspeakers can reproduce sound from 100 to 4000 Hz. | COM-5 |
| 94. This headset receiver has a uniform frequency response between 300 and 4000 Hz. | COM-23 |
| 95. This device transmits sounds from 250 to 4000 Hz. | COM-1 |
| 96. This headset has 2 speech channels, and one channel is fed into one ear and the other channel into other channel into the other ear <u>or</u> both signals are "picket-fenced" at 30-40 Hz. | COM-10 |
| 97. This headset receiver has enough electrical power to drive peak sound-pressure level to 131 dB when using two earphones. | COM-23 |
| 98. This headset/handset . allows speaker to hear own voice in phase with speech. | COM-8 |
| 99. This emergency communication device is permanently installed. | |
| 100. Where speaker reverberation is a problem, many low powered loudspeakers are present, rather than a few powerful loudspeakers. | COM-9 |
| 101. High-quality communications have a dynamic range of 60 dB; commercial broadcast 40-45 dB. | COM-1 |
| 102. This microphone has high pass filters to reduce frequency noises, and frequency-selective filters to give characteristic timbre to signals. | COM-3<br>COM-10 |
| 103. This device has controls capable of controlling sound pressure levels to 110 dB. | COM-4 |
| 104. This carbon microphone has no "packing" of the carbon granules. | COM-15 |
| 105. Carbon microphone is avoided if quality criteria demand a truly linear response characteristic of very low background noise. | COM-15 |
| 106. A ribbon microphone is not used for close talking unless specifically designed for this use. | COM-15 |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

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# HUMAN ENGINEERING CHECKLIST

COMMUNICATIONS

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| 107. Audio signals provided over operator headsets are coded the same as their respective annunciators. | | | |
| 108. This microphone has a high sensitivity to acoustic speech signals. | COM-7 | | |
| 109. This microphone rejects distracting acoustic signals and noises at the speaker's location. | COM-6 | | |
| 110. This headset receiver has gain control with dynamic range to make the signal 15 dB more intense than ambient noise. | COM-23 | | |

# ON-SITE EVALUATION     @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

## MAINTAINABILITY

*Criteria are different. **0700 is more specific.

| EVALUATION GUIDELINE | REF. |
|---|---|
| 1. There is an adequate supply of expendables and spare parts — fuses, bulbs, ink, inking pens, recorder charts, printer paper, etc. | 6.1.1.5 a. |
| 2. Expendables and spare parts are readily accessible. | 6.1.1.5 b. |
| 3. All necessary tools to install expendables and spare parts are available. | 6.1.1.5 c. |
| 4. There is adequate storage space for expendables and spare parts. | 6.1.1.5 d.** WA-33 |
| 5. The variety of expendables is clearly and distinctively marked to avoid misapplication. | 6.1.1.5 e. |
| 6. Records of the status of expendables and spare parts are kept. | 6.1.1.5 f. |
| 7. For lighted displays, a lamp test capability is provided. | 6.4.3.3 c.(1) CON-57 |
| 8. Pushbutton lamps are replaceable from front of panel. | 6.4.3.3 c.(2) CON-57 |
| 9. Legend pushbuttons do not malfunction or activate inadvertently during lamp removal or replacement. | 6.4.3.3 c.(3) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 10. @ Legend lights which provide a "maintenance or adjustment" status are uncovered or non-visible during normal operation, but are readily accessible. | VD-90 |
| 11. Legend covers are keyed to prevent interchanging. | 6.4.3.3 c.(4) CON-57 |
| 12. Display failure is apparent to the operator. | 6.5.1.1 f. VD-7 VD-2 |
| 13. Dual-bulbs or dual-filaments are used. | 6.5.3.1 a.(1) VD-91 |
| 14. Bulb test capability is provided. | 6.5.3.1 a.(2) VD-91 |
| 15. Bulb replacement while power is on is provided without being hazardous to personnel. | 6.5.3.1 a.(3) VD-92 |
| 16. For lighted displays, all light covers are keyed to prevent interchangeability. | 6.5.3.1 c.(2) VD-92 |
| 17. Paper, ink, and other expendables are provided and accessible in the control room. | 6.5.4.1 e. |
| 18. Recorder design permits quick and easy replenishment of paper and ink. | 6.5.4.1 f. VD-78 |

# ON-SITE EVALUATION    @ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| 19. Fresh replacement batteries for walkie-talkie transceivers are stored in an accessible and well-marked area. | 6.2.1.4 e.(1) | | |
| 20. Stock of batteries is large enough to support continuous emergency operation of walkie-talkies. | 6.2.1.4 e.(2) | | |
| 21. If lamp replacement requires tile removal, there is a way to ensure that the tile is replaced in the correct location. | 6.3.3.1 c.(1) VD-92 | | |
| 2. Lamp replacement does not subject the operator to a shock hazard. | 6.3.3.1 c(2)* VD-92 | | |
| 23. Operator aids are provided if needed for lamp replacement. | 6.3.3.1 c.(3) | | |

# ON-SITE EVALUATION @ OPERATOR ASSISTED EVALUATION

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# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| **UNIT INTEGRATION** | |
| 1. All controls and displays needed for (1) detection of abnormal conditions and (2) bringing the plant to a safe shutdown condition are included in the control room. | 6.1.1.1 a. |
| 2. Control of plant equipment from one control room does not affect the ability of operators of other control rooms to maintain control of their units. | 6.1.3.1 e.(1) |
| 3. The status of plant equipment under the control of one control room is displayed in all control rooms capable of controlling that equipment. | 6.1.3.1 e.(2) |
| 4. Availability status indications are displayed in all control rooms if control of plant renders that equipment unavailable to other control rooms. | 6.1.3.1 e.(3) |
| 5. A single, centrally located control panel/console is used for dual-unit control rooms. | 6.1.3.1 e.(4) |
| 6. Administrative procedures are in place which assign responsibility for allocation of use of controls of shared plant equipment to a single control room. | 6.1.3.1 e.(5) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| **GENERAL PRINCIPLES** | |
| 7. Each control provides a sufficient range of control. | 6.4.1.1 a.(1) |
| 8. There is a good reason to require a control for the function concerned. | 6.4.1.1 b.(1) |
| 9. The precision and range of a control does not exceed the need. | 6.4.1.1 b.(3) |
| 10. Controls are functionally grouped and are in the same location from panel to panel. | 6.4.2.2 b. CON-8/9 |
| 11. Pushbuttons in a row or matrix are positioned in a logical order, or in an order related to the procedural sequence. | 6.4.3.1 a. |
| 12. Analysis of operator tasks is recommended to establish operator information requirements. | 6.5.1.1 a. |
| 13. Visual displays provide all information about the system status and parameter values that is needed in all situations of plant operation. | 6.5.1.1 b.** VD-6 |
| 14. Only needed information is displayed in the operating area. | 6.5.1.1 c.** VD-7 |
| 15. Visual display of actual system/equipment status is displayed for all important parameters. | 6.5.1.1 e.(2) |

# ON-SITE EVALUATION

@ OPERATOR ASSISTED EVALUATION

# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 16. Scale units is consistent with the degree of precision and accuracy needed by the operator. | 6.5.1.2 a. |
| 17. Percentage indication is used when the parameter is meaningfully reflected by percentage. | 6.5.1.2 c. VD-6 |
| 18. Scales span the expected range of operational parameters. | 6.5.1.2 d.(1) |
| 19. Scales employ the appropriate scale ranging techniques. | 6.5.1.2 d.(2) |
| 20. Scales are supported by auxiliary wide-range instruments. | 6.5.1.2 d.(3) |
| 21. Display dynamic sensitivity is selected to minimize the display of normal random variations in equipment performance. | 6.5.1.2 f. |
| 22. Scales are compatible in numerical progression and scale organization. | 6.5.1.5 d. VD-71 |
| 23. Recorders are used to record trend information and material which may be needed for later reference. | 6.5.4.1 g. VD-78 |
| 24. Recorders are located within primary operating areas. | 6.5.4.1 h. |
| 25. There will be no mismatch between nomenclature used in procedures and that printed on the labels. | 6.6.3.3 c. PA-63 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 26. Controls and displays are functionally grouped within the constraints of grouping by task sequence. | 6.8.1.1 b. CDI-8 |
| 27. Controls and displays are grouped according to importance and frequency of use within the constraints of grouping by task sequence. | 6.8.1.1 c. CDI-9 |
| 28. The location of controls and displays within a single panel makes the most effective use of the viewing and manual manipulative areas. | 6.8.1.2 |
| 29. Groups of components on a panel are physically spaced so that the boundaries of each group are obvious. | 6.8.1.3 a.** CDI-14 |
| 30. Demarcation lines circumscribe functional or selected groups of controls and displays with a contrasting line. | 6.8.1.3 b.** CDI-13 |
| 31. Displays observed in a specified sequence are grouped together, preferably in a left-to-right, top-to-bottom, or natural sequence. | 6.8.2.1 a.(1) VD-18 |
| 32. Controls operated sequentially are grouped together, preferably in a left-to-right, top-to-bottom, or natural sequence. | 6.8.2.1 a.(2)** CON-10 |
| 33. Layout of related controls and displays is symmetrical. | 6.8.2.1 a.(3) CDI-8 |

# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 34. Frequently used controls and displays are near the center of the preferred visual and manual areas. | 6.8.2.1 b.(1) |
| 35. Frequently used controls and displays are positioned so as to be easily identified. | 6.8.2.1 b.(2) |
| 36. Functionally related controls and displays are grouped together when they are: | |
| o Used together to perform tasks related to a specific function. | 6.8.2.1 c.(1) |
| o Identical in purpose. | 6.8.2.1 c.(2) |
| 37. Components are arranged left-to-right and/or top-to-bottom and are in alphabetical or numerical order. | 6.8.2.2 a. CDI-11 |
| 38. Components are arranged to match operator expectations. | 6.8.2.2 b. |
| 39. The layout of identical control and display sets is consistent at all locations. | 6.8.2.3 a. CDI-15 |
| 40. Layouts of repeated functions are not mirror-imaged. | 6.8.2.3 b. CDI-16 |
| 41. Standardization is maintained where similar functions or panels are located at several work stations or units and must be used by the same personnel. | 6.8.2.4 a. CON-8 CDI-15 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 42. Standardization is maintained where simulators or procedure trainers are used that simulate the actual operational equipment. | 6.8.2.4 b. |
| 43. Simultaneous actuation of adjacent controls is possible. | 6.8.3.1 c. |
| 44. Horizontal rows of similar displays are used instead of vertical columns. | 6.8.3.2 a. |
| SINGLE CONTROL AND DISPLAY PAIRS | |
| 45. Displays are associated with related controls. | 6.9.1.1 c.(1) CDI-8 |
| 46. The direction of control/display movement is associated. | 6.9.1.1 c.(2) CDI-7 |
| 47. The operator is immediately aware of the rate and limits of control/display movement. | 6.9.1.1 c.(3) CDI-7 |
| MULTIPLE CONTROLS OR DISPLAYS | |
| 48. Controls are mounted below the display. | 6.9.1.2 a.(1) CDI-11 |
| 49. Controls are centered on the display. | 6.9.1.2 a.(2) |
| 50. Controls are grouped in a line or matrix. | 6.9.1.2 a.(3) |

# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 51. If not feasible to mount controls directly below the display, controls are mounted to the right of the display. | 6.9.1.2 a.(4) |
| 52. Where there is a normal order of use, controls are arranged for use in left-to-right, top-to-bottom, or other natural sequence. | 6.9.1.2 a.(5) CDI-10 |
| 53. When techniques in (50) or (51) cannot be employed, layout enhancement techniques are employed —spacing, demarcation, color coding. | 6.9.1.2 a.(6) CDI-13 |
| SINGLE CONTROL, MULTIPLE DISPLAYS | |
| 54. Displays are located above the control. | 6.9.1.2 b.(1) CDI-11 |
| 55. Controls are placed near the display and preferably under the center of the display array. | 6.9.1.2 b.(2) CON-11 |
| 56. Displays are arranged horizontally or in a matrix. | 6.9.1.2 b.(3) CON-11 |
| 57. If not feasible to mount displays above the control, they are mounted to the left of the control. | 6.9.1.2 b.(4) |
| Where there is a normal order of use, displays will read from left-to-right, top-to-bottom, or in other natural sequence. | 6.9.1.2 b.(5) CDI-10 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 59. When techniques (50) and (51) do not apply or a c/d relationship is not apparent, layout enhancement techniques are employed (see 6.8.1.3). | 6.9.1.2 b.(6) CDI-13 |
| DISPLAY SELECTORS | |
| 60. The control moves clockwise from OFF through settings 1, 2, 3... n. | 6.9.1.2 c.(1) |
| 61. The control position sequence conforms to the display sequence. | 6.9.1.2 c.(2) CDI-8 |
| 62. Multiple controls or displays related to the same function are grouped together. | 6.9.2.1 a. CDI-8 |
| 63. Sequence of use is left-to-right, top-to-bottom. | 6.9.2.1 b. CDI-8 |
| SINGLE PANEL ARRANGEMENTS | |
| 64. Each display is located directly above its associated control. | 6.9.2.2 a.(1) CDI-10 |
| 65. Display/control pairs are arranged in rows. | 6.9.2.2 a.(2) CDI-11 |
| 66. Each control occupies the same relative position as the display to which it is associated. | 6.9.2.2 b.(1) |

# ON-SITE EVALUATION

# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 67. Controls and displays have corresponding labels. | 6.9.2.2 b.(2) PA-32 |
| MULTI-ROW DISPLAYS WITH SINGLE-ROW CONTROLS | |
| 68. Displays are ordered left-to-right, top-to-bottom, and matched to controls ordered left to right. | 6.9.2.2 c.(1) CDI-11 |
| 69. Controls and displays have corresponding labels. | 6.9.2.2 c.(2) PA-32 |
| CONSISTENCY | |
| 70. Arrangement of functionally similar controls and displays conform throughout the control room. | 6.9.2.2 d. |
| 71. Modular control/display packages are selected and arranged to achieve maximum conformity to 6.9.2.2 (a-d). | 6.9.2.2 e. |
| 72. Where displays are on separated panels, they are preferably on the adjacent upper panel from their associated controls. | 6.9.2.3 a. |
| 73. Related controls and displays are not located on separate panels that face each other. | 6.9.2.3 b. |

| EVALUATION GUIDELINE | REF. |
|---|---|
| GENERAL MOVEMENT RELATIONSHIPS | |
| 74. A clockwise turn of a rotary control results in its associated linear scales moving up or to the right. | 6.9.3.1 a.(1) CDI-1 |
| 75. A clockwise turn of a rotary control results in its associated digital display to increase in value. | 6.9.3.1 a.(2) |
| 76. A clockwise turn of a rotary control results in its associated strings of indicator lights moving from bottom to top or from left to right. | 6.9.3.1 a.(3) |
| 77. A clockwise turn of a rotary control results in its associated circular meters moving clockwise. | 6.9.3.1 a.(4) CDI-1 |
| 78. Movement of a linear control up or to the right causes associated linear scales to move up to the right. | 6.9.3.1 b.(1) |
| 79. Movement of a linear control up to the right causes associated digital display to increase in value. | 6.9.3.1 b.(2) |
| 80. Movement of a linear control up to the right causes associated strings of indicator lights, to move from bottom to top or left to right. | 6.9.3.1 b.(3) |

# HUMAN ENGINEERING CHECKLIST

TASK ANALYSIS

| EVALUATION GUIDELINE | REF. |
|---|---|
| 81. Controls provide easy and precise parameter control and are efficient and effective under all conditions. | 6.9.3.2 a. |
| 82. Displays provide a capability to distinguish significant levels of the system parameter controlled. | 6.9.3.2 b. |
| 83. Controls and displays have a precision which does not exceed that required. | 6.9.3.2 c. |
| 84. Printing on the display face is consistent with procedure nomenclature. | 6.5.1.4 e. PA-63 |

| EVALUATION GUIDELINE | REF. |
|---|---|
| | |

# HUMAN ENGINEERING CHECKLIST

WALK-THROUGH

| EVALUATION GUIDELINE | REF. |
|---|---|
| 1. When continuous monitoring or the timing of control actions are critical, operators do not have to leave the primary operating area. | 6.1.1.1 b. |
| 2. Control room manning and task assignments ensure complete and timely coverage of controls, displays, and other equipment during plant operation. | 6.1.1.2 a. |
| 3. Activities and task assignments are planned to ensure proper coordination of additional personnel who augment the normal crew. | 6.1.1.2 b. |
| 4. Control room arrangement minimizes interference between members of the operational crew. | 6.1.1.3 d.(2) |
| 5. Potential task loading is evaluated to ensure that every unit can be covered adequately in all situations. | 6.1.3.1 c. |
| 6. Controls are easily adjusted with the required level of precision. | 6.4.1.1 a.(2) |
| 7. Duplication of controls not occur, except for a specific reason. | 6.4.1.1 b.(2) |
| 8. Each control is the type normally anticipated for the operation concerned. | 6.4.1.1 c.(2) |

| EVALUATION GUIDELINE | REF. |
|---|---|
| 9. Controls and displays are assigned to work stations so as to minimize operator movement. | 6.8.1.1 a. CDI-8 |
| 10. Control actuation does not result in inadvertent actuation of an adjacent control. | 6.8.3.1 b. CON-13 |
| 11. A visual display that is monitored during control manipulation is located sufficiently close so an operator can read it clearly and without parallax from a normal operating posture. | 6.9.1.1 a. CDI-8 |
| 12. Controls and displays are located so that displays are not obscured during control operation. | 6.9.1.1 b. CDI-10 |
| 13. Displays are not obscured by manipulation. | 6.9.1.2 b.(7) CDI-11 |
| 14. There is no lag time between system condition change and display indication. | 6.9.3.1 c.(1) |
| 15. When there is a time lag between control actuation and ultimate system state, there is an immediate feedback indication of the process and direction or parameter change. | 6.9.3.1 c.(2) |
| 16. Feedback from the display is apparent for any deliberate movement of a control. | 6.9.3.2 d. |

HUMAN ENGINEERING CHECKLIST

WALK-THROUGH

| | EVALUATION GUIDELINE | REF. |
|---|---|---|
| 9. | Controls and displays are assigned to work stations so as to minimize operator movement. | 6.8.1.1 a. CDI-8 |
| 10. | Control actuation does not result in inadvertent actuation of an adjacent control. | 6.8.3.1 b. CON-15 |
| 11. | A visual display that is monitored during control manipulation is located sufficiently close so an operator can read it clearly and without parallax from a normal operating posture. | 6.9.1.1 a. CDI-8 |
| 12. | Controls and displays are located so that displays are not obscured during control operation. | 6.9.1.1 b. CDI-10 |
| 13. | Displays are not obscured by manipulation. | 6.9.1.2 b.(7) CDI-11 |
| 14. | There is no lag time between system condition change and display indication. | 6.9.3.1 c.(1) |
| 15. | When there is a time lag between control actuation and ultimate system state, there is an immediate feedback indication of the process and direction or parameter change. | 6.9.3.1 c.(2) |
| 16. | Feedback from the display is apparent for any deliberate movement of a control. | 6.9.3.2 d. |

# HUMAN ENGINEERING CHECKLIST

WALK-THROUGH

| EVALUATION GUIDELINE | REF. | EVALUATION GUIDELINE | REF. |
|---|---|---|---|
| 17. Redundancy in the presentation of information is limited to cases where needed for backup or to avoid excessive operator movement. | 6.5.1.1 d. VD-2 VD-6 | | |

# HUMAN ENGINEERING CHECKLIST

WALK-THROUGH

| REF. | EVALUATION GUIDELINE | REF. | ... GUIDELINE |
|---|---|---|---|
| | | 6.5.1.1 d. VD-2 VD-6 | ...cy in the ...n of information is ... cases where needed ...lup or to avoid ...operator movement. |