



Carolina Power & Light Company

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SHEARON HARRIS NUCLEAR POWER PLANT
TECHNICAL SUPPORT CENTER (TSC)

SUMMARY OF DESIGN STANDARDS AND
CRITERIA FOR THE TSC ENCOMPASSING
HUMAN FACTORS ENGINEERING

I. Introduction

Human factors engineering is the science of designing machines and the immediate physical surroundings of the workplace to fit human physical and mental limitations, and to ensure comfort and well being in order to maximize human abilities. The design for the Technical Support Center (TSC) has been based on widely recognized industry and technical standards and building codes which encompass many aspects of good human factors engineering principles. The standards and specific considerations used for the TSC which relate to human factors engineering are described below.

II. Applicable Standards

The primary standard governing the design of the TSC is the
NUREG-0696, Functional Criteria for Engineering Response

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Facilities, which identifies various parameters for physical layout, staffing, size requirements, habitability, communications, data systems and operational capabilities.

Structural and internal features were based on the Uniform Building Code and the North Carolina State Building Code, Volumes I, II, and III. The American Institute of Architects Architectural Graphic Standards was used for sizes, clearances, and features not specifically covered in the codes. Seismic design considerations, safe and sufficient layout parameters, requirements for construction materials and installation are some of the areas covered by these particular codes and standards.

Heating, air conditioning, and ventilation were designed utilizing the American Society of Heating, Refrigeration and Air Conditioning Engineering Handbook and the Industrial Ventilation Handbook.

Power and lighting design conform to the National Electrical Code and the Illuminating Engineering Society standards.

Safety and equipment systems were based on National Fire Protection Association and Occupational Health and Safety Administration standards.

III. Specific Considerations

In designing the TSC, the physical arrangement, interior, noise control, data display systems and computers, environmental characteristics, communications and protective/emergency systems specifically incorporate good human factors engineering principles.

A. Physical Layout and Location

The physical layout of the TSC is designed for optimum grouping of employees to accomplish the functions that will be performed therein. A copy of the TSC floor plan is attached. Rooms and personnel are logically arranged according to work functions for an orderly flow and interaction of task to ensure efficient and expedient response for decision-making purposes. Adequate working area for personnel and equipment has been provided. The amount of partitioned and open-plan work areas allows flexible use of space and personnel. For example, in the Site Emergency Coordinators Staff room, the use of low-height movable partitions allows quick functional rearrangement or addition of personnel. Open-plan areas are used to accommodate team functions. Adjoining partitioned rooms having view windows where necessary to permit observation of work activities in the open-plan areas, but maintain privacy when required. Circulation patterns provide sufficient and convenient access to services and work areas.

The interior features have been finished in a manner suitable to an office environment. Finish surface colors are to be consistent throughout and light in value, glare-free, and relatively neutral so as not to create visual contrast and confusion with surrounding display charts and equipment. The location of the TSC in a concrete structure provides seismic (earthquake) protection in addition to direct radiation shielding.

B. Noise Control

Measures to control noise have been incorporated into the TSC design to ensure proper acoustics and to preclude interference with the work of support personnel. External noise is blocked by the dense concrete envelope of the TSC. Built-in equipment, such as air-handling units, fans, pumps, piping systems, and ductwork, has design features to isolate vibration and, thus, to attenuate background noises. Partitions are sufficiently constructed and sealed to reduce sound transmission between walls. Individual rooms and particularly large spaces will have length, width, and height proportions that avoid long, narrow rooms with high ceilings which can cause objectionable reverberations (echoes). Speech, phones, movement of people, equipment printers, keyboard punching, and other internally-generated noise is dampened by an absorbent acoustical ceiling system throughout the TSC.

C. Display Systems and Computers

Anthropometric design features have been incorporated into the display systems equipment and computers. These features are intended to optimize human, physical motion and perceptual capabilities relative to equipment control methods and sequences, motion and time manipulations, and display quality. The ultimate purpose is to ensure efficient, accurate, and expedient use of essential display equipment. Two such display systems, the Emergency Response Facility Information System (ERFIS) and Safety Parameter Display System (SPDS), monitor plant instrumentation for various critical safety functions, such as pressures, temperatures, fluid levels, valve status and other critical readout data. The equipment and computers for these vital display systems have glare-free screens, large-character graphic displays, logical and easily operated controls, and require minimum arm-and-head movement to manipulate and view equipment.

D. Heating, Cooling, and Ventilation System

The heating, cooling, and ventilation system is designed to provide complete habitability of the TSC in the event of a release of airborne radioactivity from in-plant sources. A microprocessor-based, programmable thermostat regulates

constant air comfort for the heating and cooling cycles. Humidity control is provided for both human comfort and optimum operation of essential computer equipment. Air within the TSC is maintained at a positive pressure to prevent any infiltration of contamination. Nuclear grade, high-efficiency particulate air (HEPA) and charcoal filter systems protect the TSC air supply from airborne radiation. These filter systems are designed to remove essentially all of the particulates, gases, iodine, and other impurities from the air supply.

E. Electrical System

The electrical system is designed to provide a wide range of services for the TSC. In addition to providing adequate service for the mechanical systems, communications equipment and computer systems, the electrical system will provide sufficient space lighting and convenient outlets. Office area lighting will be evenly distributed and maintain a minimum illumination of 75 footcandles. Some work areas will have a dimmer switch for light-level control. Other light levels in the TSC are designed in conformity with Illuminating Engineering Society-recommended standards for each particular space use. The electrical system has an emergency back-up system in case of a loss of normal power.

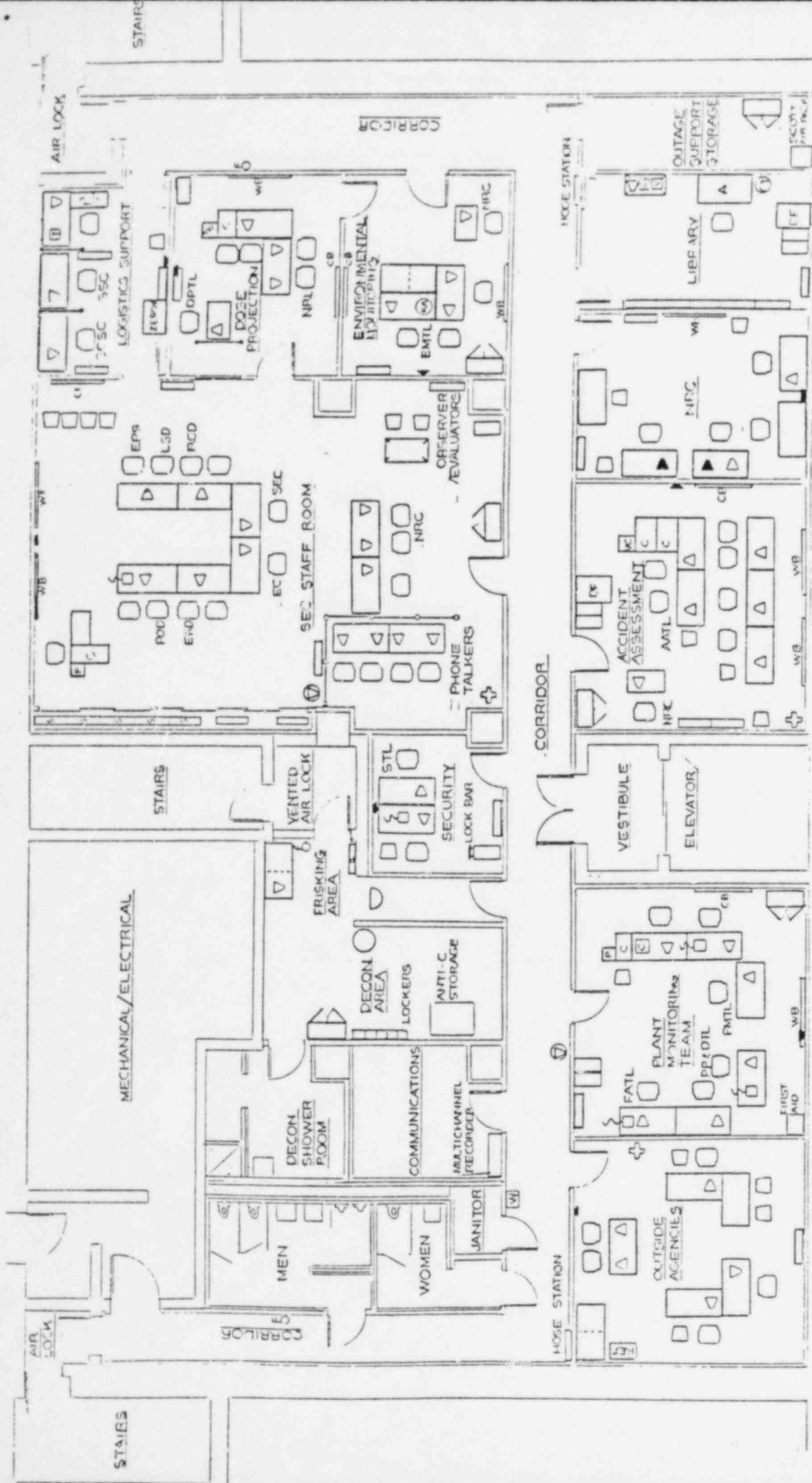
F. Communications

In designing the TSC, consideration was given to providing adequate communications equipment and procedures for expeditious interfacing, transfer of vital information, and problem solving. Automatic ring down (ARD) phones, for example, are provided from the control room to the TSC and from the TSC to the NRC and other off-site agencies, such as state and local organizations with emergency preparedness responsibilities. This communications feature gives a hotline capability to key emergency response personnel for use in making prompt notifications of emergency conditions and possible recommendations for protective actions. Regular telephones will be located throughout work areas to ensure adequate numbers. Display status boards, in addition to the ERFIS/SPDS systems, were designed for the purpose of expediting the communication of vital information among the TSC, the plant, and the CP&L corporate office. This will enhance command, control, and decision making. These large graphic displays present such information as Time/Event Logs, Vital Equipment Out-of-Service, Organization/Assignment Charts and Radiological Status Charts. The design of these displays takes into consideration size, location, visibility, readability, accessibility, and need for data.

G. Protective/Emergency Systems

Protective/emergency systems have been incorporated into the design to ensure habitability and reliability of the TSC. A smoke detection system has been designed to alarm in the event of smoke in the TSC. A fire sprinkler system protects the TSC in case of fire. A Halon system, using a nontoxic gas fire suppressant that prevents damage to sensitive electronic equipment, will protect the communications equipment room. An automatic radiation detector at the air intake to the TSC will activate the flow of outside make-up air to the HEPA and charcoal filter systems. The filter systems will have an integral fire alarm and deluge system to protect them in the event of fire. To determine radiation dose rates and airborne radioactivity concentrations in the TSC on a continuous basis, portable radiation monitoring equipment will be maintained.

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



































SHNPP-TSC-FURNISHINGS PLAN

EMERGENCY PERSONNEL KEY

AATL - ACCIDENT ASSESSMENT TEAM LEADER
 DPTL - DOSE PROJECTION TEAM LEADER
 EC - EMERGENCY COMMUNICATIONS
 EMTL - ENVIRONMENTAL MONITORING TEAM LEADER
 EPL - EMERGENCY PLANNING SPECIALIST
 ERD - EMERGENCY REPAIR DIRECTOR
 FATL - FIRST AID TEAM LEADER
 LSD - LOGISTICS SUPPORT DIRECTOR
 NRC - NUCLEAR REGULATORY COMMISSION
 PMTL - PLANT MONITORING TEAM LEADER
 POD - PLANT OPERATIONS DIRECTOR
 PP(DTL) - PERSONNEL PROTECTION & DECONTAMINATION TEAM LEADER
 RCD - RADIOLOGICAL CONTROL DIRECTOR
 SCSC - SITE COMMUNICATIONS SYSTEM COORDINATOR
 SEC - SITE EMERGENCY COORDINATOR
 SSC - SUPPORT SERVICES COORDINATOR
 STL - SECURITY TEAM LEADER

LEGEND

 STANDARD OFFICE DESK
 SINGLE PEDESTAL DESK
 SECRETARIAL UNIT W/ IBM DISPLAY, WATER, MODEM, AND TELECOPY
 REFERENCE TABLE
 OFFICE SWIVEL CHAIR
 OFFICE SIDE CHAIR
 BOOKCASE
 FILE CABINET
 STEELCASE SHELVES
 DOUBLE DOOR METAL STORAGE CABINET
 FOLDING TABLE
 CONSOLE
 CLOTH PARTITIONS
 METAL PARTITIONS
 WHITE BOARDS OR CORK BOARDS W/MAP RAIL
 WALL CLOCK
 WASTE BIN
 APERTURE CARD READER/PRINTER
 DRAWING FILE
 WATER COOLER
 COAT RACK
 TELEPHONE ▼ NRC TELEPHONE
 HAND HELD RADIO TRANSCEIVER
 AREA RADIATION MONITOR
 CRT (STAIRS/RIMS)
 IGMM MICROFILM VIEWER
 RADIO CONSOLE
 HALON FIRE EXTINGUISHER
 TELEPRINTER
 MICROFILM CARTRIDGE TREE
 PORTAL PERSONNEL RADIATION MONITOR
 STEP OFF PAD
 VIDEO COPIER
 PRINTER/PLOTTER

SERVICE LIST

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