PRELIMINARY CONTROL ROOM

HUMAN ENGINEERING DESIGN REPORT

January 1982

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Nuclear Project Number 2

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R. G. DaValle, Task Force Coordinator

C. H. McGilton, Task Force Member

B. J. Van Erem, Task Force Member

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APPENDIX:

A Typical Panel Configuration Review Documentation Package (P602 Benchboard)

B Typical Annunciator Panel Review Documentation Package (P602 Benchboard)

C WNP-2 Control Room Panel Pictures

ATTACHMENTS:

1 Typical Configuration Control Drawing (P602 Benchboard)

2 WNP-2 Control Room Arrangement Drawing

3 WNP-2 Control Room Design Review Task Force Schedule

WNP-2 - PRELIMINARY CONTROL ROOM DESIGN REPORT

1.0 Review Plan

WNP-2 concurs with the intent of performing a Control Room Design Review and has undertaken an aggressive program to complete a control room review in accordance with NUREG-0660. WNP-2 methodology has been to provide a dual program approach: 1) to participate as an active member of the BWR Owner's Group Control Room Design Review Program; and, 2) to establish a WNP-2 Task Force for detailed assessment and development of recommendations, and to provide configuration control for the WNP-2 Control Room.

WNP-2 supports the BWR Owner's Group Program. The WNP-2 Task Force Coordinator is a member of the BWR Owner's Group working committee and has participated in the development of the Control Room Design Review Program and Survey Checklists. Subsequently, WNP-2 Task Force members were trained on human factor's concerns and the BWR Owner's Group Program at a Owner's Group sponsored workshop. The Task Force has supported the program as members of Owner Group Survey Teams at Nine-Mile Point, Peach Bottom 2/3, and Pilgram Nuclear Power Stations.

An Action Plan forming the WNP-2 Control Room Task Force was approved in April 1980. Upon formation, the Task Force began monitoring the industry approach and participated in the BWR Owner's Group Program. Subsequently, the Task Force utilized the BWR Owner's Group Program and training to perform a Preliminary Assessment Human Factors Review of the WNP-2 Control Room. The review was completed in December 1980. The extent of the review was based on the degree of Control Room installation, available trained operators, review criteria and checklists, and the experience of other utilities.

The preliminary assessment report was used both as a control room data base and to identify areas of greatest potential impact to project construction and schedule. Subsequent Task Force detailed reviews were prioritized and scheduled, documentation methods developed, and control room configuration controls established.

Initial review planning identified the need to:

- o Identify outstanding control room changes.
- o Identify interfacing design work or reviews affecting the control room from a human factor concern.
- o Establish management control for integration of control room activities.
- o Establish a configuration data base to control and integrate existing and subsequent changes.

Engineering change logs and controlled panel arrangement drawings were reviewed. Outstanding changes were reviewed and "Holds" placed on release for those changes that were of concern until panel configuration reviews were completed and controls established.

Project scheduling assigned full time personnel to develop and integrate control room engineering and construction schedules. The Control Room Human Factors Program was integrated into the project schedule for visibility, management tracking, and integration with other control room activities.

Supply System Project Engineering and Startup organizations identified personnel to coordinate and manage control room activities. A Project Control Room Program Manager was assigned to monitor, coordinate and expedite engineering and construction management related activities. A Startup Control Room Coordinator was assigned to monitor, coordinate, and expedite startup and construction activities related to the control room, and assist the Project Program Manager as needed.

These management levels provided direct management support for the Task Force, integration of activities affecting control room design reviews, ensured support from other organizations or personnel as required, and provided the review and approval authority for Task Force Human Engineering Discrepancy (HED) reports and corrective recommendations.

Configuration control methods were developed. A configuration control set of panel arrangement drawings, were established. All human factor changes, approved engineering changes, and proposed designs (such as RG-1.97, etc.) were incorporated. Once established, all subsequent changes are reviewed by the Task Force against the configuration control drawings and established panel criteria. Panel changes require Task Force concurrence, and the configuration drawings are updated to reflect the approved change. Annunciator panel window layout configuration controls were also established.

Priority was placed on Task Force reviews of panel design layout and annunciator system design and layout reviews in order to establish the required data base for configuration control. These areas were considered the most complex and potentially project impacting as to requiring additional engineering and construction resources.

A schedule is attached indicating the relative sequence and time table of Task Force activities presently identified. Schedule time frames are for survey reviews, HED preparation and development of recommended corrective actions. Engineering and contruction times to implement are not included.

2.0 Management and Staffing

WNP-2 Project Management has retained responsibility and functional control of the program to insure overall support to the control room review process, and integration with other studies, design changes, and related

construction activities. A Project Control Room Program Manager was assigned to coordinate all control room engineering and construction activities. The Control Room Task Force Coordinator reports to the Project Control Room Program Manager.

Human Factor affecting activities within the control room are reviewed by the Control Room Task Force before implementation to ensure configuration control and integration between related activities. Specific design and layout reviews include such areas as RG-1.97, RG-1.47, Safety Parameter Display System, new BWR Emergency Procedure Guidelines and Procedures, TMI related tasks, and other engineering changes.

The Task Force Review Team was selected to ensure integration of Control Room related engineering design activities, plant operability, and construction. To further augment the human factors experience obtained from involvement in the BWR Owner's Group Program, General Physics Corporation was contracted for human factors consultant services.

Task Force Coordinator: R. G. DaValle

Bachelor of Science in General Engineering. Experience includes fifteen (15) years in the nuclear industry. Five (5) years as a certified control room supervisor; three (3) years in project design engineering of FFTF; eight (8) years with the Supply System in plant operations holding positions of Senior Operation Engineer, Supervisor Generation Administrative Services, and Nuclear Safety Specialist.

Member of BWR Owner's Group Committee on Control Room Design Review Program. Attended ten (10) day Owner's Group Human Factors Workshop Program. Participated in BWR Owner's Group Survey of the Peach Bottom 2 and 3 Nuclear Power Station Control Rooms.

Responsibility to WNP-2 Project Management for NUREG-0660, Item I.D.1/NUREG-0700 Program Implementation. Provide administrative and document control for the program; maintain working files and HED Log; ensure adequacy of Control Room reviews; coordinate license and AE engineering changes affecting the control room; perform assigned areas of review; provide detailed overviews of Review Reports and HED Reports.

Task Force Member: C. H. McGilton

Bachelor of Science in Metallurgical Engineering, Graduate of Oak Ridge School of Reactor Technology, and NRC Licensed Senior Reactor Operator. Experience include eighteen (18) years in the nuclear industry. Four (4) years with the U. S. AEC; three (3) years as Shift Supervisor in the U. S. Navy Nuclear Program; two (2) years in engineering assignments involving BWR startup, operation, and refueling; eight (8) years at WNP-2, consisting of seven (7) years as WNP-2 Plant Operations Supervisor and presently, Manager of the WNP-2 Safety Engineering Group, which includes responsibility for coordinating plant technical specifications.

Attended ten (10) day Owner's Group Human Factors Workshop Program.

Responsible for performing assigned areas of Control Room Reviews; providing operational reviews of Review Reports and HED Reports against available operational procedures and technical specification; interfaces with experienced plant operation personnel; integrates human factors input into plant operations organization.

Task Force Member: B. J. Van Erem

Graduate of U. S. Naval Nuclear Power School, Westinghouse Reactor Design School, and U. S. Navy Electronics and Advanced Electronics Schools. Experience includes twenty-one (21) years in the nuclear field. Eight (8) years in the U. S. Navy either aboard nuclear submarines or at naval nuclear test facilities; five (5) years with the U. S. Atomic Energy Commission as Senior Inspector, Naval Reactors Division; two (2) years as Assistent Chief Nuclear Fueling Engineer with Morrison-Knudsen Company; one (1) year with Burns & Roe, Inc., as Senior Operations/Test Engineer on Nuclear and Fossil Station Test Programs; four (4) years as Senior AE Construction Superintendent at WNP-2; and one (1) year as Engineering Manager for the WNP-1 Instrumentation Contractor. Presently, Senior Instrumentation and Control Engineer for the WNP-2 Architect Engineer.

Participated in the BWR Owner's Group control room survey of Nine Mile Point Nuclear Power Station.

Responsible for performing assigned areas of control room reviews; integrating ongoing engineering changes between the Task Force and the AE; and providing detailed engineering reviews of Review Reports and HED Reports against plant design and engineering criteria.

Task Force Member (Part Time): R. E. Green

Bachelor of Arts in Business Administration, and Bachelor of Science in Industrial Technology. Experience includes seventeen (17) years in the nuclear industry. Two (2) years as a Journeyman Electrician with the Atomic Energy Commission; nine (9) years with General Electric Corporation as an Instrumentation and Control Safety System Design Engineer, which included design work on the WNP-2 Control Room Panels; and six (6) years with the Supply System as a Project Instrumentation Design Engineer and Senior Instrumentation Engineer.

Attended ten (10) day Owner's Group Human Factors Workshop Program. Participated in BWR Owner's Group Survey of the Pilgrim Nuclear Power Station Control Room.

Responsible for performing assigned areas of control room reviews; providing NSSS design and instrumentation review of Review Reports and HED Reports; interfacing with licensee's engineering staff and integrating engineering changes with the task force reviews.

Startup Control Room Manager: G. J. Freeman

Bachelor of Science in Electrical Engineering. Experience includes fourteen (14) years in the nuclear industry and twenty-one (21) years in Industrial Control Systems. Experience includes checkout, startup, and operating assistance on complex instrument and electrical control systems, such as Recirculation and Feedwater Systems; BWR NSSS experience with General Electric as a troubleshooting specialist in instrument and electrical control systems; and presently, Startup Control Room Manager responsible for coordinating WNP-2 Control Room related Startup and Construction activities. Holds professional license in Control Systems.

Authorized by Project Management to review and approve Task Force HED corrective recommendations. Provides Startup and Construction Impact Reviews and Design Coordination.

General Physics Corporation:

Donald C. Burgy, Manager, Human Factors Engineering; Ph.D Candidate, Applied Experimental Psychology.

Human Factors Engineering and Man-Machine System Design and Evaluation. Areas of human factors expertise include systems analysis, information processing, man-computer interactions, performance evaluation. training systems, and speech/non-speech communications. Applied research background includes an emphasis in experimental design and methods, multivariate statistical analysis, mini/micro computer applications, and software psychology.

Experience in nuclear power plant control room reviews includes on-site field evaluations at North Anna, Surry, Zion, LaSalle, Susquehanna (Advanced Control Room Design), and Zimmer Stations. Evaluations have included the application of current NRC Human Factors Guidelines and existing military standards to control room designs as well as field and laboratory experimentation to validate criteria used in design tradeoff analyses.

Robert J. Little: Staff Scientist, M.S., Industrial Engineering and Operations Research.

Human Factors Engineer with General Physics involved with human factors engineering design reviews of nuclear power plant control rooms. Experience includes conducting and teaching human factors seminars; currently the Lead Human Factors Engineer for review of Georgia Power Company's Plant Vogtle Control Room, and Project Manager of the Human Factors Review for Long Island Lighting Company's Shoreham Nuclear Power Station.

General Physic's Corporation is responsible for the review of assigned control room areas; review WNP-2 Program Methodology and Documentation Control; review Task Force Review Reports and HED Reports for adequacy of human factor concerns and recommended corrective action.

3.0 Documentation and Document Control

The Control Room Design Review Program involves the systematic use of a substantial number of existing documents and the preparation of new materials to record and document reviews. Reference materials, review reports, Human Engineering Deficiency (HED) forms, and other working documents were used. These enabled the Task Force to record review results, provide a design data base, identify and track HED's and resulting recommendations, and provide a document trail for traceability.

A data base reference library or access to reference material was established. Material included those noted in NUREG-0700 and, in addition, industrial reports on Control Room Human Factor Studies, Preliminary Plant Control Room Human Factor Reviews and audit reports from other plants, WNP-2 outstanding design changes, emergency procedure guidelines and procedures from other plants, standard technical specifications, and related NUREG's, regulatory guides, and TMI related reports.

Documents and forms are being prepared as each phase of the WNP-2 Control Room Review Program is identified and implemented. Standard HED forms have been prepared to identify the location of discrepancies, describe their nature and priority, and provide a record of recommended corrective actions. Initial data base review report formats, prepared prior to HED Report preparation, vary depending on the review process and data requirements.

Control and traceability of HED Reports, and their review and approval, are maintained through Task Force HED correspondence, Supply System HED Directives to the AE, and a Task Force controlled HED Status and Tracking Log. All correspondence is forwarded to the WNP-2 Controlled Site Files, and a working file is maintained in the Task Force Coordinators Office.

Appendix A and Appendix B contains representative samples of different initial data base review report formats, standard HED Reports, and control correspondence.

4.0 Review Procedure

4.1 Control Room Survey

A preliminary assessment survey was performed by the Task Force Review Team using the BWR Owner's Group Survey program and checklists. The review was completed in December 1980. The assessment provided a data base for scheduling further detailed evaluations and for integrating subsequent HED corrective recommendations.

General Physics Corporation has completed a survey of the WNP-2 Control Room using methodology and checklists developed by General Physics Corporation. Included in the survey was a review of the WNP-2 Task Force program methodology, documentation control and methods, and HED Reports with recommended corrective actions. Reports are being prepared by General Physics Corporations to document their reviews.

Completion of open survey items not reviewable at the present time will be completed as design, construction, and operational readiness allow.

4.2 Operating Experience Review

WNP-2 is a committed plant, in that it is not yet licensed, but the control room panels have been fabricated and installed. Operating Experience Review is thus limited due to the lack of hands-on experience of operations personnel, panel energization and turnover schedule.

Operations personnel are used to the extent practical at this time. Discussions of known existing control room problems and experiences from other plants are obtained from knowledgable operations personnel. Panel concerns, reviews, and HED corrective recommendations are reviewed and discussed with operations personnel to provide as much operating experience input as possible.

4.3 System Functional Review and Analysis

Formal System Functional Review and Analysis is pending scope and format acceptance of the BWR Owner's Group Program. General Physis Corporation Methodology is also under review as an alternative.

To facilitate ongoing system and operability reviews, the Task Force is using available system operating procedures, operator training guides, vendor manuals, safety analysis reports, and other reference documents, to assess instrumentation and control adequacy.

WNP-2 also supports the BWR Owner's Group on preparation of symptom oriented Emergency Procedure Guidelines. WNP-2 operations personnel are members of the working committee. Draft WNP-2 Emergency Procedures were prepared and reviewed to define instrumentation and location requirements. Findings were integrated with RG-1.97 and Safety Parameter Display System requirements.

4.4 Control Room Inventory

A reference set of data for control room instrumentation and controls is available on computerized instrument and equipment lists, panel arrangement and engraving drawings, and other reference documents, such as, panel photographs, engineering drawings, vendor files, and other inventory documents.

A photographic mosaic log is planned in early 1982 to augment in detail the present panel photographs and to document the present panel design and layout.

4.5 Verification of Task Performance Capabilities

The adequacy of the work station areas to support the operator in performance of his tasks is being evaluated by; verifying that required control room panel instrumentation and controls are available during the informal operating experience and system reviews noted in Sections 4.2 and 4.3, above; by performing human factor reviews and surveys; and by having an independant consultant, General Physics Corporations, audit, and review Task Force reports and corrective recommendations. Formal verification will be completed upon completion of the system functional review and analysis portion of the program.

4.6 Validation of Control Room Functions

Validation of control functions by walkthrough of selected procedures and event sequences is scheduled prior to fuel load. Control Room construction status, procedure preparation, and operator training does not allow for adequate verification at the present time. As an interim, operational experience, system reviews, and human factor evaluations, noted above, are used to validate HED corrective recommendations.

5.0 HED Assessment Procedure

A review report is prepared by the assigned Task Force member. The review report identifies the area of review, concerns/problems noted during the review, and provides selected corrective recommendations. The review report is distributed to all Task Force members.

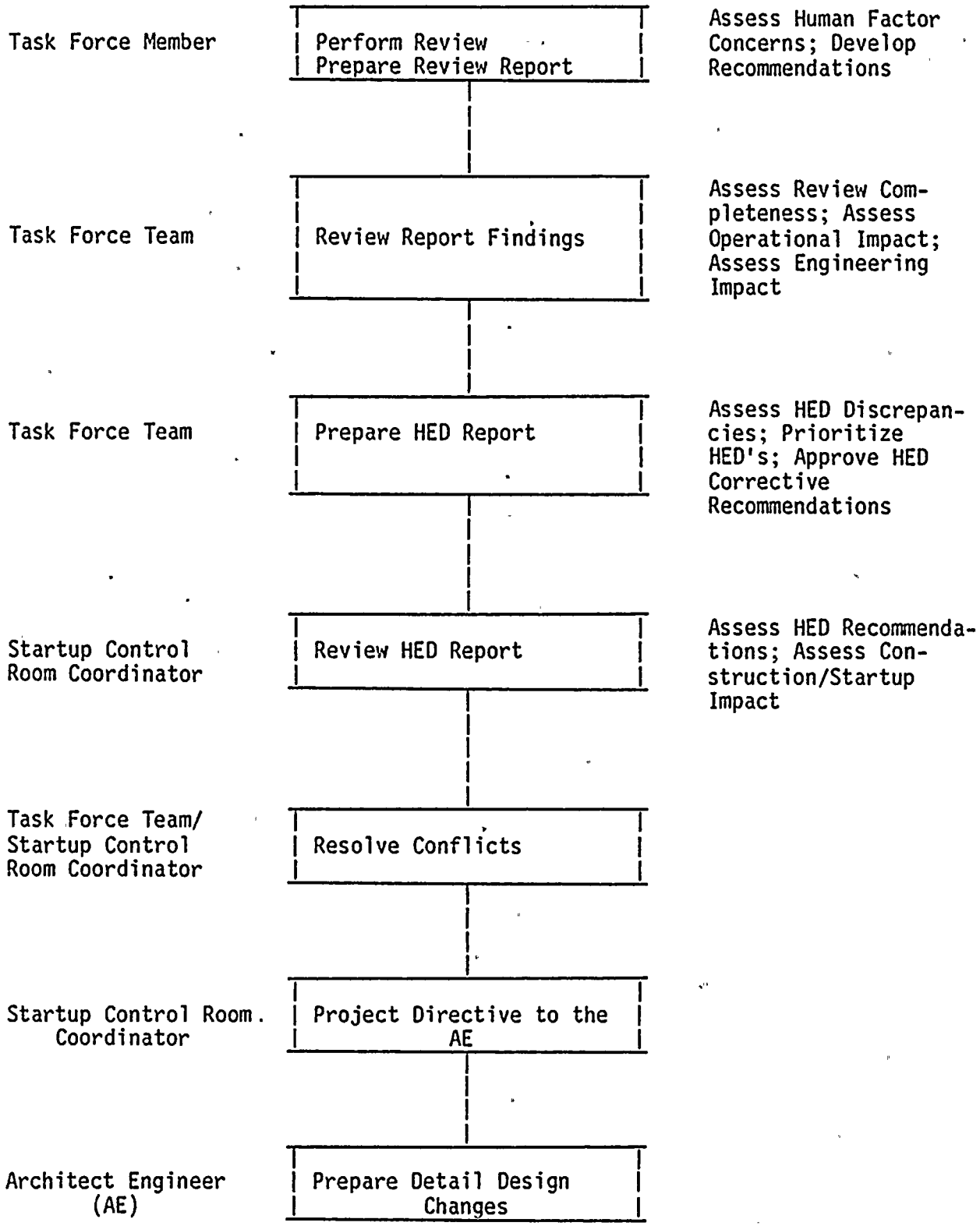
Each Task Force member reviews the report to ensure completeness and accuracy in their area of expertise. The Task Force Coordinator overviews to ensure each area of review is adequate prior to preparation of the HED Report. Each member is free to review the reports in each other's area of expertise as the need arises.

All review reports and subsequent HED's are forwarded to General Physics Corporation for their review and comment as the review process continues.

A Task Force meeting is held to discuss the Review Reports, and resulting concerns and recommendations. Review Report changes, additions and deletions are agreed to, and the report subsequently revised. All resulting concerns are reviewed against the HED Prioritization Criteria (See Appendix for sample HED and Priorization Criteria Standard). Prioritization coding requires the unanimous agreement by the Task Force Team for each item of concern. All concerns are noted on the HED Report for document completeness and traceability. The HED Report is prepared, concurred with by each Task Force member, and forwarded to Project Management.

Project Management has authorized the startup organization's Control Room Coordinator, responsible for coordinating control room startup and construction activities, to review and approve Task force HED Reports, and corrective recommendations. Upon review of the HED Report, the Startup Control Room Coordinator meets with the Task Force to resolve areas of startup or construction impacting concern. All changes from the HED Report are unaminously agreed to and documented by Project Managaement Directives to the AE.

All HED's are logged and tracked by the Task Force Coordinator in the HED Status and Tracking Log. Subsequent additions or changes are tracked by Project Directives to the AE and entry into the HED Log.


Task Force Member
Perform Review
Prepare Review Report
Assess Human Factor Concerns; Develop Recommendations
Task Force Team
Review Report Findings
Assess Review Completeness; Assess Operational Impact; Assess Engineering Impact
Task Force Team
Prepare HED Report
Assess HED Discrepancies; Prioritize HED's; Approve HED Corrective Recommendations
Startup Control Room Coordinator
Review HED Report
Assess HED Recommendations; Assess Construction/Startup Impact
Task Force Team/ Startup Control Room Coordinator
Resolve Conflicts
Startup Control Room Coordinator
Project Directive to the AE
Architect Engineer (AE)
Prepare Detail Design Changes

6.0 Review Findings

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SECTION 6.1

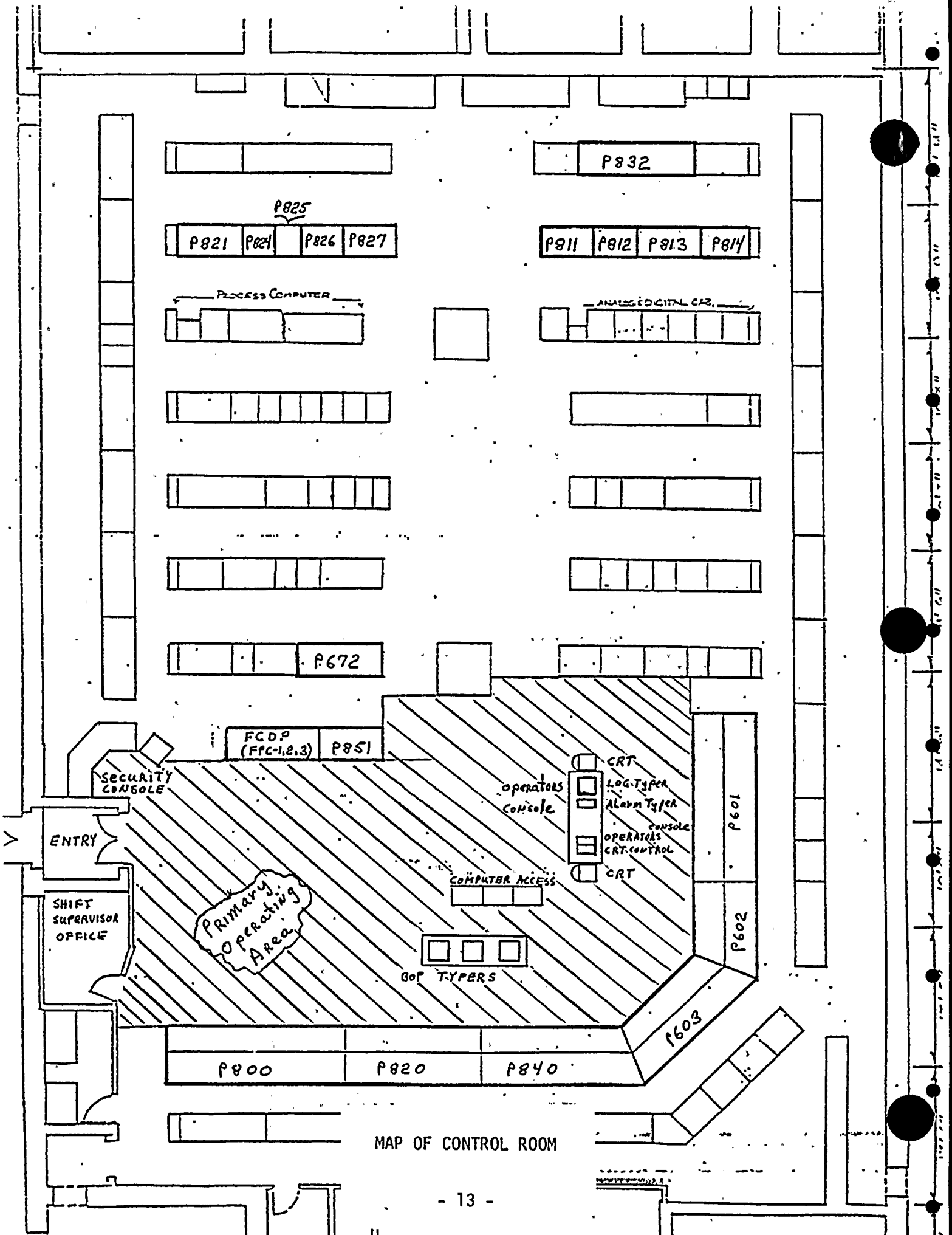
WNP-2 CONTROL ROOM PANEL ARRANGEMENT

A. Operating Panels - Primary Area

P601	Benchboard	Reactor Core Cooling Systems (ECCS)
P602	Benchboard	Reactor Water Cleanup and Recirculation Systems
P603	Benchboard	Reactor Control Systems
P800	Benchboard	Electrical Generation and Distribution Systems
P820	Benchboard	Main Turbine and Miscellaneous Systems
P840	Benchboard	Reactor Feedwater and Miscellaneous Systems
FCDP	Vertical Panel	Fire Control Display Panel
P851	Vertical Panel	General/Summary Annunciator Panel

B. Operating Panels - Outside Primary Area

P672	Vertical Panel	Off-Gas Control Panel
P811	Vertical Panel	SGT and H_2 Recombiner Panel; Division II
P812	Vertical Panel	Reactor Building H&V Panel
P813	Vertical Panel	Containment Vent and Purge Pannel
P814	Vertical Panel	Containment Monitoring Display Panel
P821	Vertical Panel	Main Steam Leakage Control Panel
P824	Vertical Panel	Cooling Tower Control Panel
P825	Vertical Panel	RCC and SW Control Panel
P826	Vertical Panel	Control Room HVAC Panel
P827	Vertical Panel	SGT and H_2 Recombiner Panel; Division I
P832	Vertical Panel	RFW Heaters, Vent and Drain Panel



MAP OF CONTROL ROOM

SECTION 6.2

CONTROL ROOM WIDE SURVEY REVIEWS

6.2.1 Workspace Environment

Much of the workspace and environment could not be surveyed at this time. However, key areas affecting design and/or ongoing procurement are being inputed to the appropriate organization; e.g., information relative to procurement of emergency protective control room equipment has been forwarded to operations personnel.

Primary areas of reviews completed or ongoing in this area of human factors review are:

- Accessibility of Instrumentation/Equipment reviews are included in the panel configuration reviews noted in Section 6.3 of this report.

- Control Room manning and primary operating area designations have been identified in the WNP-2 Plant Administrative Operating Procedures, and the information factored into the configuration and annunciator reviews noted in Sections 6.2, 6.3, and 6.5. General layout reviews of the primary operating area have commenced with the initial definition of items to be included in the work station area (desks, bookcases, file cabinets, carts, etc.). Initial layout definition is expected in early 1982.

- Anthropometric data on all operating panels was obtained. Displays and controls noted outside the guidelines were reviewed for relative importance and frequency of use. Specific reviews and recommended corrective actions were noted in the configuration reviews.

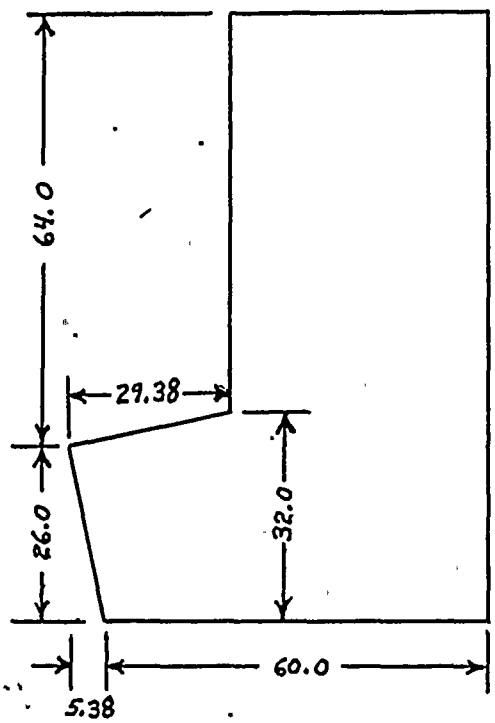
  One open item is that several controls with "J" type handles are located less than the three inch minimum clearance from panel edge on Panels P601, P602, P603, and P820. Resolution is pending development of switch and handle shape coding standards.

- Control room environment reviews cannot be performed until lighting, ventilation, and sound systems are energized. However, initial reviews of the lighting design was performed to ensure that normal, backup and emergency lighting systems met the basic system design human factors guidelines.

BENCHBOARD ANTHROPOMETRIC MEASUREMENTS (IN INCHES)

Specifications	Control Zone Min.	Control Zone Max.	Display Zone Min.	Display Zone Max.	Foot Space Min.	Foot Space Max.	Benchboard Depth Min.	Benchboard Depth Max.	Annunciator Panel Height Min.	Annunciator Panel Height Max.
o BWR Program	30	60	30	68	6	-	-	28	-	88
o NUREG-0700	26 1/2	(1)	27	90	4	-	3	25	-	90
P601	27	55	35	70	5.38	-	2	29.38	73	87
P602	27	38	35	70	5.38	-	2	29.38	73	87
P603	27	38	35	70	5.38	-	2.75	29.38	73	87
P800	27	59	35	73	5.38	-	3.25	29.38	76	88
P820	27	59	35	73	5.38	-	2	29.38	76	88
P840	27	59	35	73	5.38	-	3.25	29.38	76	88

(1) Present control layout requires a 5 inch reach by a 5th percentile women to meet NUREG-0700 Guidelines (6.1.2.2.b).



(INCHES)

BENCHBOARD MEASUREMENTS

P601, P602, P603, P800, P820, and P840

VERTICAL PANEL ANTHROPOMETRIC MEASUREMENTS (IN INCHES)

Specifications	Control Zone Min.	Control Zone Max.	Display Zone Min.	Display Zone Max.	Annunciator Height Min.	Annunciator Height Max.
o BWR Program	42	60	48	68	-	88
o NUREG-0700	34	70(53)*	41(50)*	70(65)*	-	90
P811	26	63	30	71	82	87
P812	30	60	44	72	77	87
P813	30	76	72	79	82	87
P814	-	-	24	72	80	87
P821	23	62	47	71	81	87
P824	30	59	65	72	76	87
P825	37	60	65	71	76	87
P826	33	55	59	66	76	87
P827	26	62	30	71	82	87
P832	26	78	60	74	-	-
P672	32	58	44	77	78	85
P851	37	64	-	-	53	87
P001 (1)	34	70	76	81	-	-
P100 (1)	26	52	53	68	80	84
FCP-1	36	41	-	-	43	84
FCP-2	28	28	-	-	30	84
FCP-3	39	49	45	47	51	84

* Standard for controls/displays requireing frequent or precise use, or needed for emergency operations.

(1) Remote Shutdown Panels.

6.2.2 Communications

Due to the present state of construction, review of the communication system design and functional testing of voice and audible systems can not be completely performed. Human factor design and functional reviews have been scheduled into three parts:

1. Section 6.2 of NUREG-0700 will be forwarded to the responsible system engineer to review, check off, and provide a response back to the Task Force against the present design in early 1982.

2. The Task Force will perform a review of the responsible engineer's findings. and if required, issue a Review Report, HED's, and prepare corrective recommendations, about August 1982.

3. The Task Force and operations personnel will perform a functional review of the system, and complete any open items, prior to Fuel Load.

6.2.3 Computer Systems

Due to the present state of construction, review of the computer system design and functional testing of displays, printers, and other controls can not be completely performed. Human factor design and functional reviews have been scheduled into three parts.

1. Section 6.7 of NUREG-0700 has been forwarded to the responsible operations technical engineer to review, check off, and provide a response back to the Task Force early in 1982 on the system design.

2. The Task Force will perform a review of the responsible engineer's findings, and if required, issue a Review Report, HED's, and prepare corrective recommendations, about May 1982.

3. The Task Force and operations personnel will perform a functional review of the system, and complete any open items, prior to Fuel Load.

6.2.4 Indicating Light Review

The purpose of the control room indicating light review was to review all control room indicating lights for light test capability, bulb replacement ease, color coding, meaning, and function (normally on or off). All control room and remote shutdown panels were reviewed, not just the operating panels. The annunciator system was not within the scope of this review.

1. Light Test Capability - Only vertical Panel P634 (Recirculation Control Panel) has a light test capability. The balance of the Control Room Panels essentially have no light test capability except for annunciator lights.

   Engineering has been requested to review the reliability of the indicating light system presently installed at WNP-2. Methods to improve the indicating light reliability will be evaluated. Tack Force recommendations are scheduled about June 1982.

2. Bulb Replacement Ease - Bulb Replacement ease and safety is acceptable. No operator concerns were expressed, nor have any known problems occurred to date.

3. Color, Meaning, and Function of Indicating Lights

   .1. Green/Red combinations are consistent in sequence and meaning except for a few isolated cases. Green meaning closed (valves) and de-energized (motors). Red meaning open or energized.

   2. The use of Amber, Clear, White, Blue, and Miscellaneous Red and Green indicators are not consistently applied. Examples are:

      a) Clear lights are used on P631 to indicate trips. Other NSSS panels use white lights for the same purpose. This is also the case on redundant panels P609 and P611.

      b) In general, white lights on BOP panels are normally lighted. On NSSS panels, this is not the case. Some white lights are normally lighted and some are not normally lighted.

      c) Red lights on P672 are used to indicate various modes of control. White lights are used for this purpose on other panels.

      d) Several panels (P611, P606, P609, P840, P602, and P821) have one or more lights of a color different than specified on engineering elementary drawings.

e) White lights on some panels are used to indicate an abnormal condition while on other panels white lights indicate a normal condition. The same is true for amber lights and red lights.

An indicating light standard has been prepared and agreed to by the Task Force. Final approval is pending trial application in January 1982. The standard will ensure consistency of color code, meaning, and function.

A data base was completed on all indicating lights in the control room and remote shutdown room. Each light was traced to its initiating point (valve position switches, circuit interlock, etc.). A light listing for each panel was prepared in a matrix format, listing the specific color, the meaning of the light in a "lite" state, function (normally on or off) and any pertinent remarks. Attached is a matrix listing for Panel P602.

A review of the data base light listing against the indicating light standard is scheduled to be completed in March 1982.

Also, it was noted, that many lights do not have separate legend plates to identify their meaning. This presupposes operators will be knowledgeable on their meaning and application. The present bulb-lenses are round dome shaped and panel space does not easily allow for proper legend plating. Reviews are under way to locate speciality manufacturers to design and prepare square headed engravable lenses to replace existing bulb lenses. If feasible, a Task Force recommendation is expected about March 1982.

WNP-2 CONTROL ROOM INDICATING LIGHT REVIEW

PANEL P602

DATE 7-7-81

	LIGHT	COLOR	MEANING	REMARKS
RRC Section	Lights (1 each) above switches S106A and S106B (FW pump trip interlock reset switches).	White	Lighted - Indicates "reactor vessel low water level and feedwater flow is below minimum" interlocks are sealed in. Interlock initiates flow control valve partial closure.	a) Normally not lighted b) Possibly should be amber color.
	Lights (1 each) above switches S107A and S107B (total FW low flow interlock reset switches).	White	Lighted-Indicates "low total FW flow and RRC-V-60A(B) is less than 18% open" interlocks are sealed in. Interlock initiates RRC pump transfer to slow speed	a) Normally not lighted b) Possibly should be amber color.
	Lights (1 each) above switches S108A and S108B (main steam line/ pump suction low ΔT interlock reset switches.	White	Lighted-Indicates "main steam line/RRC pump suction low ΔT" interlock is sealed in. Interlock initiates RRC pump transfer to slow speed.	a) Normally not lighted b) Possibly should be amber color.
	Lights (1 each) above switches S110A and S110B (spare switches)	White	None-associated with spare switch circuit.	a) Switches (S110A and S110B) and associate white lights should be removed from panel
	Lights (1 each) above switches S113A and S113B (Reactor vessel low water level interlock reset switches).	White	Lighted-Indicates "reactor vessel low water level" interlock is sealed in. Interlock initiates RRC pump transfer to slow speed.	a) Normally not lighted b) Possibly should be amber color c) GE dwg 761E791AD sheet 1 states lights are amber, but sheet 9 shows them as white
	Lights (1 each) above switches S109A and S109B (flow control valve motion inhibit interlock reset switches.	Amber	Lighted-Indicates "flow control valve motion inhibit" interlock is sealed in.	a) Normally not lighted b) Should be amber as presently is, however, is not consistent with rest of interlock seal in lights on panel.

WNP-2 CONTROL ROOM INDICATING LIGHT REVIEW

PANEL P602

DATE July 7, 1981

LIGHT	COLOR	MEANING	REMARKS
FEL-1 above switch S122 (Flux Estimator Bypass Switch)	White	Lighted-Indicates Flux Estimator Bypass Switch is "Normal." Light goes out when switch is placed in "Bypass."	a) Normally lighted b) Possibly should be changed to amber color and rewired to light when switch is place in bypass. c) Being added by FDI-TCHI
FEL-2 above switch S123 (Flux Estimator alarm reset switch)	White	Lighted-Indicates "Flux Estimator ~~Failure~~ Needs Maintenance" alarm is sealed in	a) Normally not lighted b) Possibly should be amber color c) Being added by FDI-TCHI
FEL-3 above switch S123 (Flux Estimator alarm reset switch	White	Lighted-Indicates "Flux Estimator Failure" alarm is sealed in	a) Normally not li b) Possibly should [illegible] amber color c) Being added by FDI-TCHI
White light above switch S-114A (LFMG motor breaker 1A control switch)	White	Lighted-Indicates protective relaying lockout reset for LFMG motor breaker 1B	a) Normally lighted b) Being added by PED-218 E-2005
White light above switch S114B (LFMG motor breaker 1B control switch).	White	Lighted-Indicates protective relaying lockout reset for LFMG motor breaker 1B	a) Normally lighted b) Being added by PED-218-E-2005
White light above switch S121A (RRC-P-1A pump motor breaker control switch).	White	Lighted-Indicates protective relaying lockout reset for RRC-P-1A breaker.	a) Normally lighted b) Being added by PE[illegible] 218-E-2005

WNP-2 CONTROL ROOM INDICATING LIGHT REVIEW

PANEL P602

DATE July 7, 1981

LIGHT	COLOR	MEANING	REMARKS
White light above switch S121B (RRC-P-1B pump motor breaker control switch)	White	Lighted-Indicates protective relaying lockout reset for RRC-P-1B breaker.	a) Normally lighted b) Being added by PED-218-E-2005
Lights (1 each) above Hyd valve isolation to RRC-V-60A and B control switches	White	Lighted-Indicates containment isolation signal closed Hyd. isolation valves (Hy-v-17,18, 19,20 A/B)	a) Normally not lighted b) To be installed by PED-218-E-5079. PED should be modified to delete white lights-they are not needed.

6.2.5 ANNUNCIATOR SYSTEM DESIGN REVIEW

The purpose of this review is to evaluate the design of the WNP-2 Annunciator System against NUREG-0700. Only those items of a system design nature are included. Those items covered under individual panel HED's or those to be later incorporated on panel enhancement packages were not incorporated herein. This review covers both the Control Room and Remote Shutdown Panels.

Concern

1.0 General System Characteristics

1.1 Alarm Parameter Selection

a. Set points or limits for initiating the annunciator warning system should not occur so frequently as to be considered a nuisance, and should be established to give the operator adequate time to respond.

o Present design to be reviewed during startup testing and verified during subsequent plant operation. No present review required.

b. General and multichannel or shared alarms.

o An approved "Annunciator System Multiple Input/ General Alarm Standard" was prepared for WNP-2 and review results are included in individual panel HED Reports (see Section 6.5).

1.2 First-out annunciators should be provided for identifying the initiating event associated with automatic plant shutdowns. Separate first-out panels should be provided for the reactor systems and the turbine-generator systems. The panels should be placed directly above the main control stations for the respective systems, and should consist of separate annunciator tiles for each of the automatic trip functions.

o A first-out system does not exist.

1.3 Auditory signal coding of alarm priority is also "appropriate" along with color, shape, or symbolic coding.

o Present priortization of alarms is by color coding.

1.4 Cleared Alarms

a. Cleared alarm auditory signals should have a dedicated, distinctive, audible signal which should be of finite duration.

- o No finite duration circuit exists.

b. The visual signal should have a special flash rate equal to either twice or one-half the alert flash rate to allow discrimination.

- o Design in compliance. Uses one-half the alert flash rate, about one (1) flash per second, with equal times on and off.

2.0 Auditory Alarm Subsystem

2.1 Signal detection and intensity reviews cannot be reviewed until sound measurements are performed later.

2.2 Signal identification should be such that the operator is able to identify the operator work station or the system where the auditory alert signal originates. Separate auditory signals at each work station within the primary operating area are recommended.

- o Signal identification for the P601/P602/P603 work area, computer system and the fire panels meet design. However, the P800/P820/P840 work station area and the back vertical panels have one common auditory system. This area does not comply.

2.3 Localization coding should be used when the operator work station associated with the alarm is not in the primary area.

- o The P800/P820/P840 work station area does not have separate auditory location coding but is in common with the back vertical panels. This design does not comply.

3.0 Visual Alarm Subsystem

3.1 Lamp replacement should not require the removal of legend tiles or subject the operator to a shock hazard.

- o Present design complies.

3.2 Flash rates should be from three to five flashes per second with approximately equal on and off times.

- o The present "alert" flash rate is about two cycles per second with 50% on and 50% off times.

3.3 In case of flasher failure, the alarm tile should immediately light and burn steady.

- o Present design complies.

3.4 A "dark" annunicator panel concept should be used.

- o Present design concept complies. Verification of design will occur during subsequent plant operation.

3.5 Out-of-Service alarm recognition cues should be designed into the system.

- o "Loss of 125VDC" annunciators powered from separate AC sources identify overall system power loss for each audible/visual alarm system. Individual panel and tile alarm power loss can be verified by use of the individual panel's "test" control. Present benchboard panel design complies; vertical panel design needs verification.

3.6 Blank or unused annunciator tiles should not be illuminated (except during testing).

- o Present design complies.

3.7 The operator should be able to read all the annunciator tiles from the position at the work station where the acknowledge control is located.

- o Panels P601, P840, and P820 are not in compliance.

4.0 Operator Response Subsystem

4.1 Control Functions

a. Controls should include a separate silence pushbutton for the "alert" auditory system.

- o Present design does not comply. Separate alert silence controls do not exist.

b. It should be possible to silence an auditory alert signal from any set of controls in the primary operating area.

- o Present design does not comply. Only within the tone grouping for panels does this apply. Silencing between tone groupings does not exist within the primary operating area.

c. Acknowledge should only be possible at the work station where the alarm originated.

- o Present design complies.

d. Reset control should "silence" the audible signal indicating clearance and should extinguish tile illumination only at work station where the alarm initiated.

- o Present design complies.

e. A "test" control should be provided to test the auditory signal and flashing illumination of all tiles.

- o Present design complies.

4.2 Control Set Design

a. Control sets should have the same arrangement and relative location at different work stations.

- o P601: Arranged on vertical section of benchboard rather then horizontal area along panel edge. Located on right side of panel rather then center.
- o P820: Located on left side of panel rather then center.
- o P840: Located on right side of panel rather then center, very close to P820 controls. Operators have responded erroneously to the opposite panel controls due their closeness.
- o Fire Panels: Sequence of controls for FCP-1 and FCP-2 is "ACK/Test/Reset" instead of "ACK/ Reset/Test" as used throughout the control room. FCP-2 only has "ACK" and "Test" controls, no "Reset" control exist.
- o P851: System status monitoring panels SD-1, 2, and 3 are being deleted due to RG-1.47 redesign. The new SRV acoustic monitoring system subpanels will replace SD-1 and SD-2. This leaves the Division I and Division II annunciator panels and associated controls in a configuration that places the Division I Controls closer to the Division II Panel than the Division II Controls, and separated by the new acoustic monitoring system subpanels.

- o Back Vertical Panels: Control locations are generally below anthropometric limits and are not all consistent in location.

B.2 Control coding techniques for easy recognition of controls should be used. Recommended techniques are color, color shading, demarcation, and shape.

- o Controls are not distinguishable in shape.
- o Color coding is inconsistent.
  - 24 controls have black pushbuttons with silver collars.
  - 61 controls have silver pushbuttons with silver collars.
  - 1 control has a silver pushbutton with a yellow collar.
  - The fire control panels use "Red" escutcheon plates for the "ACK" control rather than black, and the shutdown panel P100 has no escutcheon plates.

c. Annunciator design should not allow the operator to defeat the controls.

- o Problem is minor but probabilty does exist.

RECOMMENDATIONS

1.0 General System Characteristics

1.1 Alarm Parameter Selection - No action required.

1.2 First-Out Annunciation - The sequence of events printer provides printout of annunciator alarms for reactor, Turbine Generator, and Balance of Plant systems, identifying both the initiating event and the sequence of events associated with plant shutdowns. Buffer capacity, computer speed and printout speed are such that operator information will not be lost, and the response time is adequate for immediate operator access for first-out identification in the primary operating area. To ensure visibility of the initiating event, the printer provides a distinctive coding to sequence of event alarms versus other alarm printouts.

A review is required to ensure all first-out events are included in the sequence of events system.

1.3 Auditory Signal Coding audible prioritization of alarms is not recommended. Operator response on lower priority alarms may become relaxed and additional tones may add to operator confusion. Operators are to respond to any "alert" alarm equally. Present color prioritization can be visibly seen throughtout the primary operating area on main benchboards. Audible prioritization would not add to directivity or operator response significently to warrent modification.

1.4 Cleared Alarms

a. Auditory Signal Duration - To provide duration control for the "Clear" tone, the audio response circuits in each annunciator control card would need to be modified. This would be a major change and possibly schedule impacting. An alternative, which meets the intent of NUREG-0700, would be to modify the Reset controls to allow the operator to silence the "Clear" tone from any set of response controls in the primary operating area. Reseting of the flashing "Clear" light would only be allowed at the specific panel. Thus the reset "Clear" circuit would be identical to the acknowledge "Alert" circuit noted in 4.1.b, below. This would provide the operators the added advantage of consistency of control function, and control over the audible "Clear" tone. Modify the audio "Clear" portion of the Reset controls accordingly.

b. Clear Alarm Flash Rate - No action required. Design in compliance.

2.0 Auditory Alarm Subsystem

2.1 Signal Detection/Intensity - No action until control room sound studies have been completed.

2.2 Use the Off-Gas Panel P672 alarm audible system for P851 and the back vertical panels, providing a third tone system. This places the main operating work area P800/P820/P840 onto one audible/visual system, and places P851 and all the back panels out of the primary area, and onto one independent system.

A general alarm for P672 will need to be incorporated onto P851.

2.3 Localization Coding - See Recommendation 2.2, above.

3.0 Visual Alarm Subsystem

3.1 Lamp Replacement - No action required. Design in compliance.

3.2 Alert Flash Rate - No action required. Present flash rate is very close to the minimum guideline and meets the design intent.

3.3 Flasher Failure - No action required. Design in compliance.

3.4 Dark Panel Concept - No action required. Design in compliance.

3.5 Out-of-Service Alarms - "Loss of 125VDC" alarms need to be installed on P851 for the back vertical panels when the annuciator system is separated from the primary operating area as noted in Recommendation 2.2, above. Corrective recommendations pending design verification of vertical panel system design.

3.6 Blank Alarm Tiles - No action required. Design in compliance.

3.7 Tile Readibility - See Recommendation 4.2.a, below.

4.0 Operator Response Subsystem

4.1 Control Functions

a. Silence Control - Modifying the present control set design to add separate "Silence" controls for the audible "Alert" signals is not feasible on the main ECCS, RFW, and T-G panels where the feature may most be wanted. Layout changes on these panels would be necessary to provide room, which would affect system configuration control and layout. The addition of the silence control to other panels would provide inconsistency in design and layout, and be of little added value without incorporation on the ECCS, TG, and RFW panels. The annunciator system as is meets the intent of NUREG-0700 design. Inclusion of a silence control is not recommended.

b. Acknowledge Auditory Function - Modify the Acknowledge Control to silence any control room "Alert" tone (P601/P602/P603, P800/P820/P840, and back vertical panels) from any acknowledge control in the primary operating area. Acknowledging from any back vertical panel should only silence the back vertical panel audible alarm, and not any primary area alarm. The fire system alarm is to remain separate and independent.

c. Illumination Acknowledge - No action required. Design in compliance.

d. Reset Control Functions - Modify design of the audio reset system per Recommendation 1.4.a, above.

e. Test Control Functions - No action required. Design in compliance.

4.2 Control Set Design

a. Arrangement and Location

- P601: No horizontal room is available on the front panel edge to provide for location and arrangement consistency without affecting panel configuration and control symmetry. Vertical orientation was selected as the only plausible alternative without significant relocation changes.

Redundant sets were provided due to the length of the panel to improve visibility of the annunciator tile from the Acknowledge control. See attached control location drawings. A second test control is not required.

- o P820: Relocate the response controls to the center of the panels horizontally along the panel edge for consistency. See attached layout drawing. Besides improving alarm visibility, controls for P820 and P840 are placed too close together confusing operators as to which set of response controls to initiate. Relocation would improve both annunciator tile readability from the acknowledge control, and avoid confusion with the P840 controls.

- o P840: Provide a redundant set of response controls near the RFW systems to increase visibility of annunciator tiles, and to increase operator access and response to RFW alarms from P603 without having to leave the P603 area. See attached layout drawings. A second test control is not required.

- o Fire Panels: Resequence the controls for FCP-1 and FCP-2 to a "ACK/Reset/Test" Sequence. Addition of a "Reset" control to FCP-3 is still pending resolution.

- o P851: Contrast and grouping recognition between Division I and Division II annunciator panels and response controls is pending resolution.

- o Back Vertical Panels: Most panels have little available room to relocate the controls within anthropometric limits. Relocation would mix them within control areas, reducing their visibility and possibly adding to operator confusion. Also, as they are, most are consistent in location and height. Relocation would increase the inconsistency. No action required.

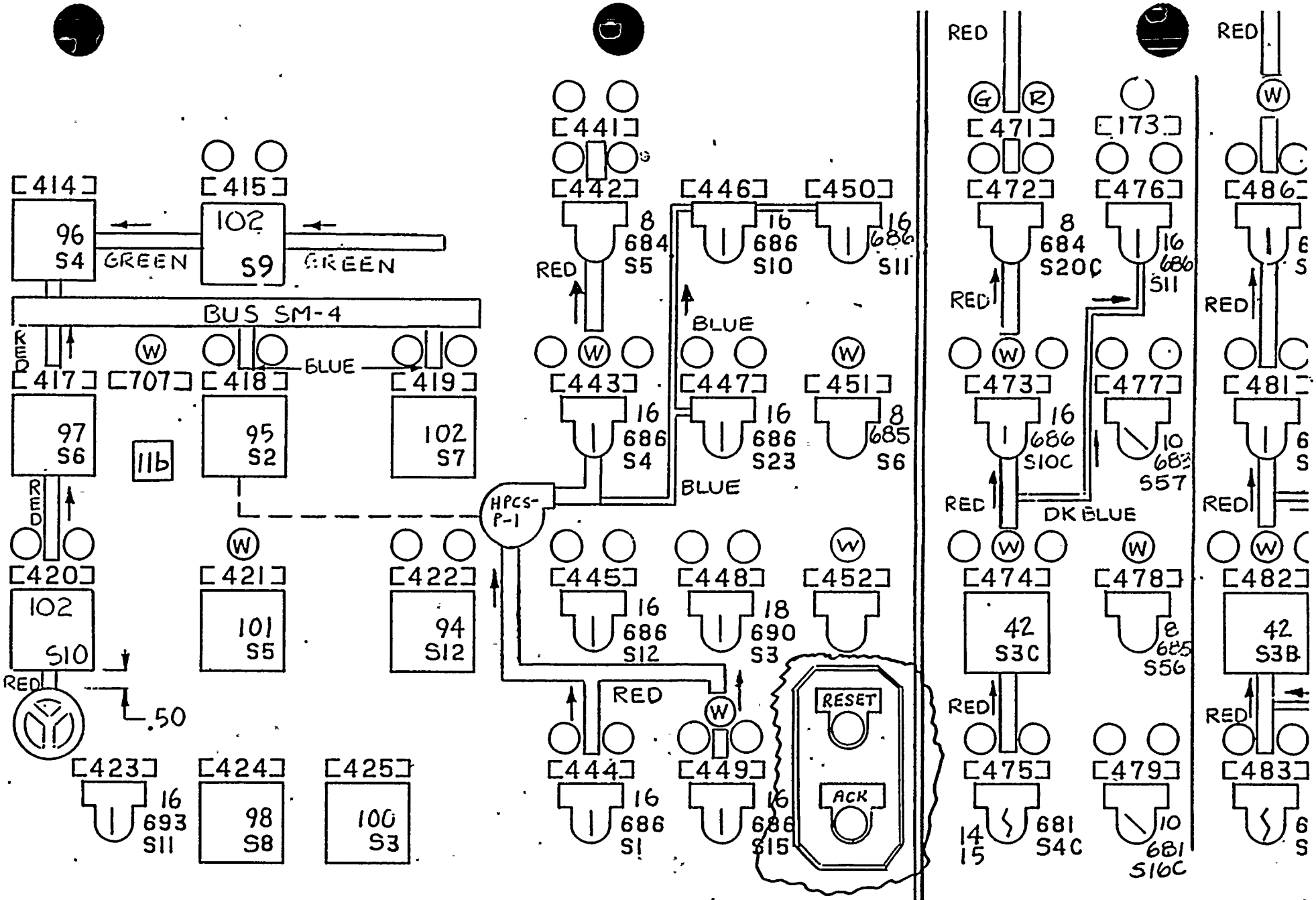
b. Control Coding

- o Shape - Use "White" mushroom heads on Acknowledge controls only on the main benchboards. Congestion is higher and increased visibility is required on benchboards. Vertical panel visibility of controls is better, and congestion around annunciator response controls is in general far less than the benchboards. Mushroom heads not required on vertical panels.

- o Control Color - Use silver pushbuttons except for the Shutdown Panel P100, fire panels and P851, these will use black. Locking ring and escutcheon colors will be decided in the enhancement packages. Change out the three black controls on P821 and the one black control on P840 to silver to provide consistency in these areas. Since the fire panels and P851 form one panel area (row), and all controls are consistently black and are about the only controls on these panels, no conflicts or confussion is expected. The same rational applys to Panel P100. Leave P100, P851, and the fire panels as they are.

- o Demarcation, escutcheon plates, and color shading will be included in the enhancement packages when total color scheme is defined.

c. Defeatable Controls - Use of mushroom heads noted in Recommendation 4.2.b, above, will prevent defeating the most important of the controls (Alert) in the primary operating area. No further action required.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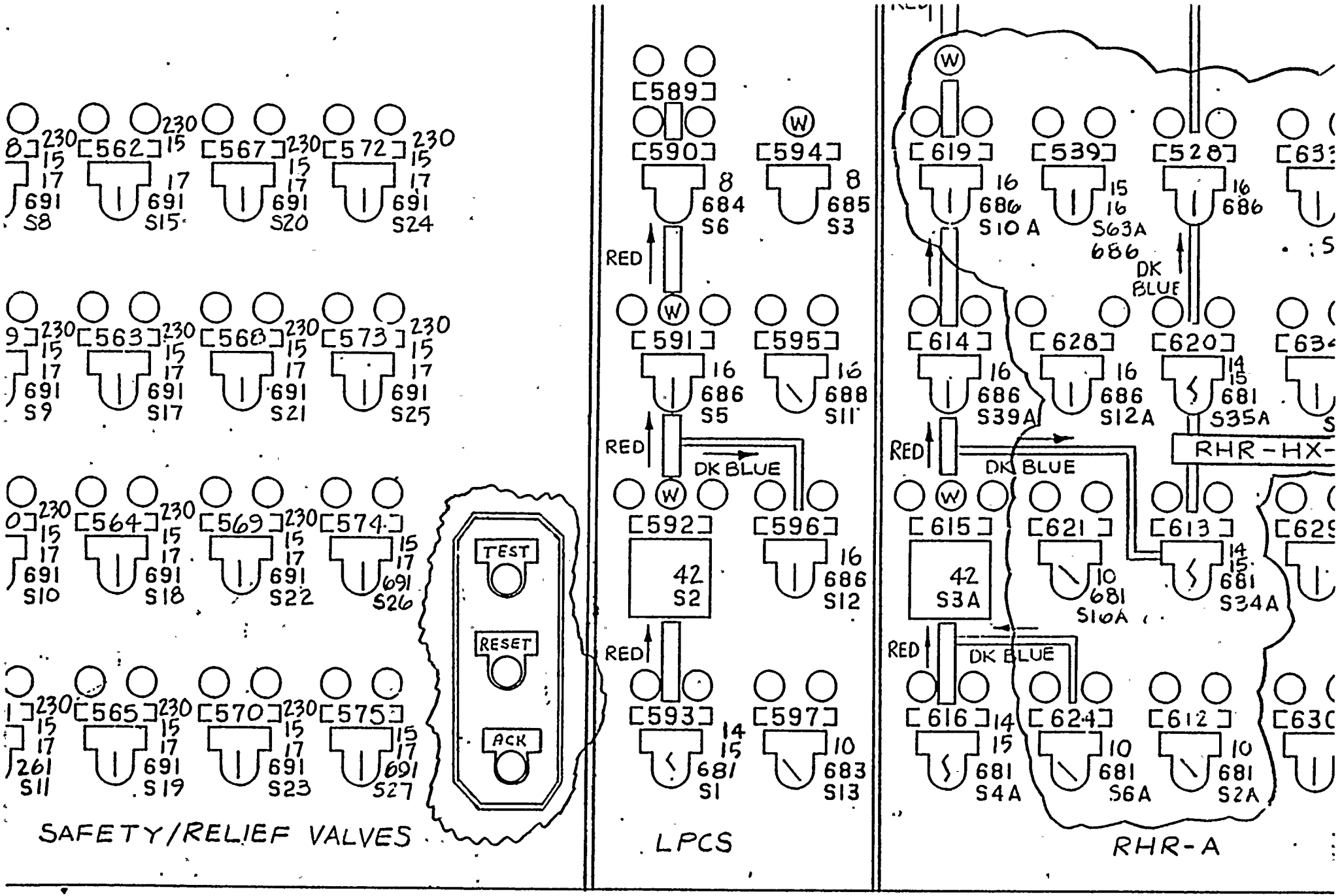
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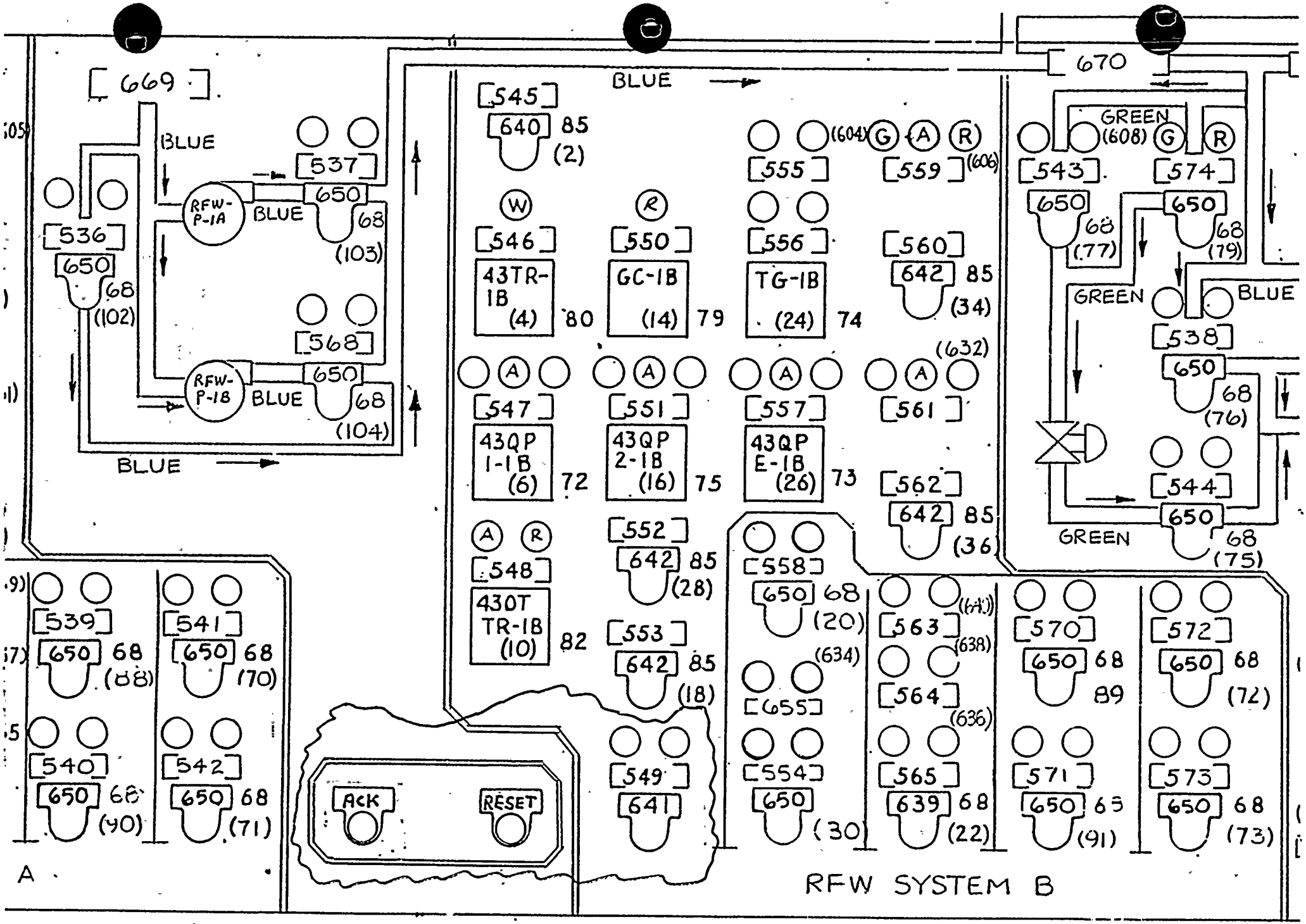
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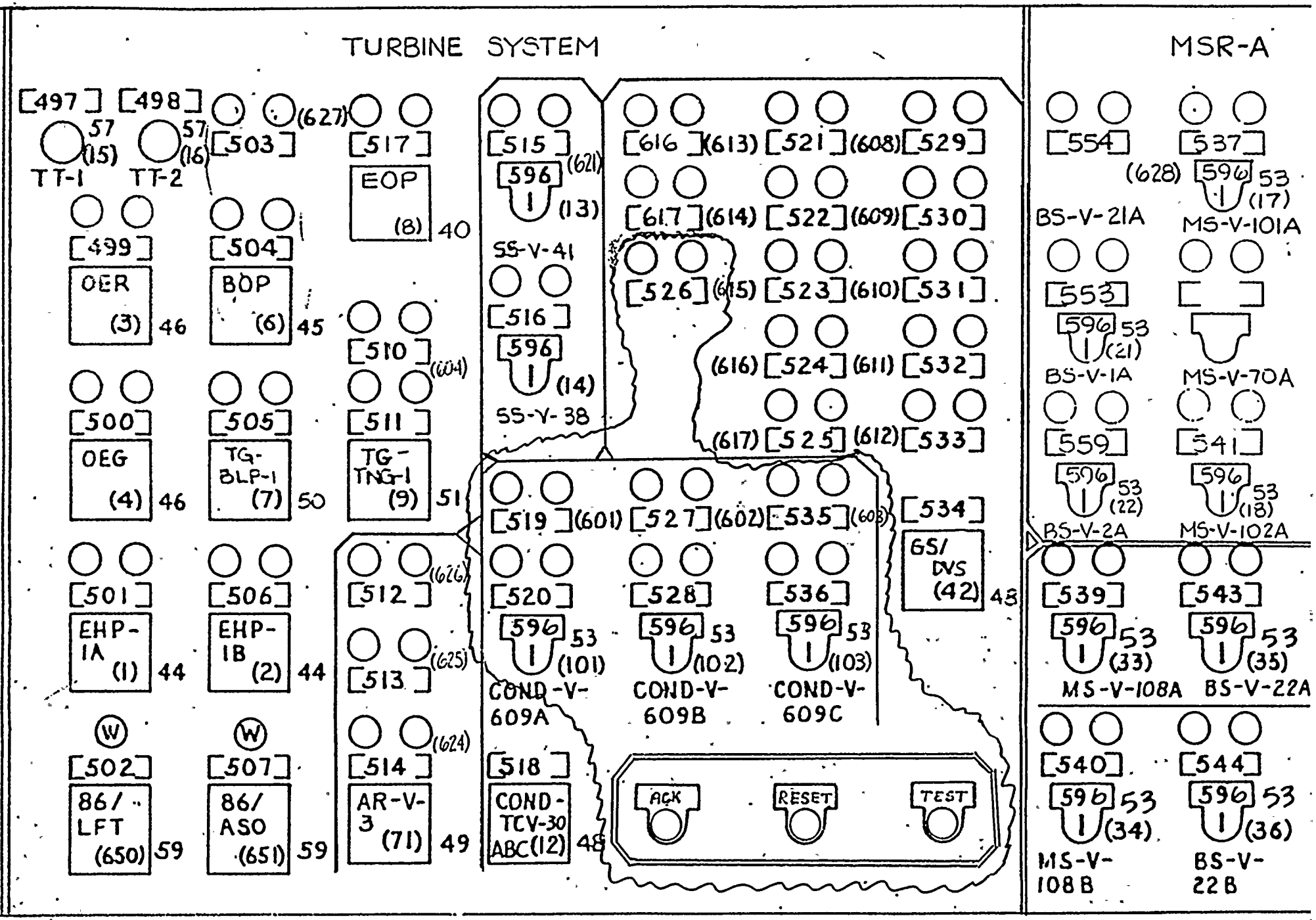
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Section 6.3 - Panel Configuration Reviews

Panel configuration reviews cover specifically the human factor areas of Control-Display Integration, Panel Layout, and Controls. Other areas of human factor concerns, such as, anthropometrics, mimicing, and demarcation, hierarchy labeling, color coding, etc., were also integrated in with the panel layout design reviews. This was to ensure that all design aspects were covered in the review and that recommended correction configuration changes would later allow for the addition of panel enhancements.

Reviews were performed on a panel and system basis. Each system was reviewed for operability, layout and integration with supporting systems and systems it supports. Corrective recommendations and reports were prepared for each panel noted on Table 6.3, below. In addition, proposed regulatory, engineering, and operational changes were integrated into the reviews. These specifically included RG-1.47, RG-1.97, SPDS, and Emergency Procedure requirements.

Prior to finalizing panel configuration design on the primary area benchboards, panel arrangement drawing were prepared to reflect the proposed layout design, incorporating additions of potential mimicing, demarcation, and label grouping changes. Final configuration, including mimicing and demarcation, were mocked on the the ECCS Panel P601 in the WNP-2 Control Room to provide perspective of the recommended corrective actions and potential enhancement capabilities.

To date, all Panel Configuration Reviews have been completed. Appendix A contains a typical documentation package for Control Room Panel Configuration Reviews. The typical package includes a Review Report, HED Report and Task Force and Project Directive transmittals for implementation. Further Configuration Reviews will be documentated in the WNP-2 final control room report.

TABLE 6.3

PANEL CONFIGURATION REVIEW LISTING

Panel	
A. Operating Panels - Primary Area	
P601	Reactor Core Cooling Systems (ECCS)
P602	Reactor Water Cleanup and Recirculation
P603	Reactor Console
P800	Electrical Generation and Distribution
P820	Main Turbine Systems
P840	Reactor Feedwater and Miscellaneous Systems
B. Operation Panels - Outside Primary Area	
P672	Off-Gas System
P811	SGT and H_2 Recombiner; Division II
P812	Reactor Building H&V
P813	Containment Vent and Purge
P814	Containment Monitoring System
P821	Main Steam Leakage Controls
P824	Cooling Tower Controls
P825	RCC and SW Systems
P826	Control Room HVAC
P827	SGT and H_2 Recombiner; Division I
P832	RFW Heaters; Vents and Drains
C. Operating Panels - Remote Shutdown Area	
P001	RCIC and RHR-B Systems
P100	SW-B System

SECTION 6.4

CONTROL ROOM ENHANCEMENT REVIEWS

The purpose of the Control Room Enhancement Reviews is to identify areas of human factor visual enhancements, prepare appropriate standards for consistent application, and recommend appropriate enhancing or corrections on a panel by panel basis. WNP-2 Standards are presently under preparation and scheduled for approval in early 1982. Enhancement reviews will include application of such areas as:

- o Abbreviations (standard approved October 1981)
- o Mimicing and Demarcation
- o Color Coding and Color Padding
- o Legend Plate Structure and Content
- o Control Switch and Handle Application
- o Range and Setpoint Identification
- o Switch Escutcheons
- o Indicator/Recorder Scale Standards
- o Recorder Chart Paper Application
- o Unique Identification of Post Accident Monitoring Instrumentation

Panel enhancement reviews are scheduled to start in February 1982 and complete in December 1982.

Observations noted during the Preliminary Assessment Report of December 1980 are:

1.0 PANEL LAYOUT AND DESIGN

1.1 Demarcation and Mimics

1.1.1 Demarcation lines do not exit on any panel. Panels have poor contrast between systems and subsystems controls, and their display/control relationship. Preliminary reviews note that application of system separation lines will not be a problem. But application to the subsystem level may require some relocations of displays/controls and/or color coding and/or better legend plates. This was reviewed in conjunction with the panel configuration reviews noted in Section 6.3.

1.1.2 Mimic Displays

1. Panel P851 is heavily conjested hindering operator status review. No summary indication available to operator to identify status of valve isolations.

2. Yellow is used for 4.16 kv power on P601 and 480 volt power on P800. Blue is used for 4.16 kv power on Panel P800.

3. Color legend identification plates are not located on mimic panels for operator reference.

4. Mimics are used only on seven panels.

5. P840 and P601 do not have arrows indicating direction of flow or energization. For the few arrows that are used, 3 are backwards.

6. P813 containment vent and purge ventilation mimic is crowded, incomplete and a small section has its arrows backwards.

7. Minor mimic additions and relocations are needed on P820 and P800 to improve display information and avoid conjestion.

8. Color coding of P800 needs to be changed from a "voltage level" concept to a "source-distribution" concept which provides more useful information to the operator.

9. Bus Legend plates on P800 are not located on or in close enough proximity to the mimic lines for easy of Bus identification. In most cases they look more like switch legend plates due to their close location to the switches.

10. Panel P832 mimic is not accurate.

1.2 Color Coding

1.2.1 An overall color coding review was not completed. However, the following was noted:

1. No overall plant color standard exists for the selected use of demarcation lines, alarm prioritization, indicating lights, labels, legend plates, graphic displays, mimics, tags, etc.

2. The primary area of concern noted-to-date is in the use of indicating light colors to provide consistent information to the operator. See "Indicating Lights", Section 6.2.4 of this report.

1.3 Legend Plates, Labels, and Escutcheons

1.3.1 Use of technical terminology and abbreviations is not consistently applied.

1. REVAB is still used on P601 and P602.

2. CRD on P603 flow indicator is written "CONT. ROD DR."

3. Some pump and valve switches are identified by motor number, while others are identified by the pump or valve number.

4. Controls and Displays are identified on some panels by their GE equipment piece number (e.g. P601, P602, P603) while other panels identify them by their Burns & Roe equipment piece number (e.g. P800, P820, P840).

5. Motor Control Center notation to define power source is not noted on the legend plates. Operators have started placing labeling tape at controls.

1.3.2 Use of standardized abbreviations and there application needs improvement. 209 different terms are abbreviated. Most are easily identifiable to the operator, and some identifiable due to their panel association. Areas of concern are:

1. 43 terms (20%) have more than one abbreviation. Of these; 32 have two methods of abbreviations
   6 have three methods of abbreviations
   3 have four methods of abbreviations
   1 has seven methods of abbreviations

   This is 58 extra abbreviations that may not be needed, and in some cases cause confusion due to conflicting usage.

2. Application of abbreviations in some cases was unwarranted and increases operator confusion.

   This was especially notable where adjacent controls of repetitive function were labeled differently; one abbreviated, the other spelled out or both abbreviated differently.

3. Conflicting abbreviations exist which reduce clarity of description.

   a. Containment is highly used throughout the control room and has seven different abbreviations.

b. "Neut" is used for neutral and neutron.

c. Neutral and normal terms and abbreviations are used interchangeably, and neither provides definite information to the operator.

d. "STG" is used for stage and storage.

e. "FL" is used for floor and flow.

f. "CL" is used for coil and cooiling coil, whereas "CLG" is used for cooling, and "CLG CC" used for cooling coil.

g. "Cond" is used for condensate and condenser.

h. "DR" is used for drain and drive.

1.3.3 Application of legend plates were generally found to be acceptable.

1. Legend plates are located consistently above switches and below controllers, lights and indicating devices.

2. Legend plates were of consistent type, size and color. Size length varied due to its application.

3. Size and style of lettering was consistent.

1.3.4 Legend plates used on relay or test panels are not sufficiently worded with respect to function or input signal. E.g., use of relay piece numbers do not adequately provide the operator information about the relay's function or relationship to plant systems.

1.3.5 System and group labeling, and other general type labels, are not consistently applied, do not always have contrast, and in some cases are difficult to distinguish and distracts from process legend plates. System legend plates of a light color and large size are used on P601, P602 and P603. Those are distinctive and help the operator to focus on systems and controls. System legend plates on P840, P820, P800 are colored black, the same as process legend plates, and are difficult to spot. Summary type labeling is ineffectively used in the control room as an operator aid.

1.3.6 Panel Identification Labeling was found to be inconsistent.

1. Yellow panel legend plates are intermixed with black panel legend plates without apparent purpose or consistent application.

2. Yellow plates with black lettering are about 50% larger than the labels using black plates with white lettering.

3. Size of legend plates and lettering is fairly uniform, except for:

   a. P634 panel label and print is about 5 times larger than any other.

   b. P825 label print is excessively small, conjested and difficult to read.

4. Inconsistent terminology is used to identify the vertical panels (Board, Board "H", G-II without the term board or panel, and combinations of terms like H13 - P851 (s).

   a. The use of conflicting terminology is confusing from a training and operating view point.

   b. Abbreviations are used unnecessarily and inconsistently with the space available (VB, vert BD, vert board).

5. Front main panels do not have panel legend plates in their design.

6. RCC is used twice in P825's label without need.

2.0 INSTRUMENTATION AND HARDWARE

2.1 Manual and Automatic Controllers

2.1.1 With a few exceptions, green band color markings are normally used to aid the operator to spot deviations. However, the green bands are located on the covers and not on the scales. This increases parallax.

2.1.2 Correlating scales to process units and to backup indicators was found inconsistent. Several controller scales were noted as 0-100% for level rather than actual level. Quite a few controllers differed from their backup indicators by multiples of 10 to 1000. One controller on P840 had taped on makeshift scales.

2.1.3 Wording of legend plates was inconsistent. Some identified their controllers by equipment number, most by description, some without identifying the function (flow, temp., pressure). Wording differences, in a few cases, between the controller and backup indicators made it difficult to quickly verify response.

2.1.4 Units of measurement were not noted on some controller scales or legend plates. Flow could be CFM, gpm or lbs. per hour; temperature could be ^{o}F or ^{o}C; etc. This is particularly bad for controllers without backup indicators.

2.2 Recorders

2.2.1 Color Review

1. Red is consistently used for the upper scale on dual pen recorders.

2. Red is usually used to designate the high range on dual pen recorders. Exceptions are:

   a. Panel "J" where low range is red.

   b. Panels "KI" and "KII" recombiner readings for gas and recycle flows, low range is red.

3. Red is usually used to designate the first of two items; ex: Loop A vs. Loop B. Exceptions are:

   a. P602, Recirc Flow/Suc. Temp. Recorders (2). Loop A is red on one recorder and Loop B is red on the other. Side by side proximity creates confusion.

2.2.2 Recording Speed Review

1. Wetwell level and pressure are single speed at 4"/hr. (Panel P814). Wetwell temperature and drywell parameters are monitored at 2"/hr.

2. Flux recorders and computer trend recorders are manual switchable from 1"/hr to 60"/hr, and 6"/hr to 60"/hr respectively (P602, P603 and P840). The recorders have to be slid out of their cases to reach the speed control switch.

2.2.3 Chart Paper and Recorder Scales

1. Of the 85 recorders in the Control Room, 30 had no paper installed as yet.

2. Of those 55 installed, 21 had scales different than the scales of the recorder or had single scale paper for dual scale recorders.

3. Of the 85 recorders, 43 did not have the units of process measurement either noted or readily visible on the recorder scales, nor their multiplication factors; eg. CFM, GPM, ^{o}F, x100, x1000, etc.

4. Of the 51 dual pen recorders, 24 had no or partial designation as to the parameters being recorded. In a few cases, equipment piece numbers were given rather than the parameters. Eg., post-Accident Monitoring Recorder, parameters measured are "Press XMTR B22-N051A" and "LVL XMTR B22-N026A."

5. Several scales are noted as 0-100. Without the parameter or units of measurement being noted, it is difficult to establish if the scales are actually the process variable or simply 0-100 percent. Several have already been temporarily marked to actual process units.

   a. Panel P824, cooling tower flow is 0-40,000 gpm, not 0-100%.

   b. P840, blowdown flow recorder was 0-100% and a makeshifted scale now reads 0-7500 gpm.

   c. There are 12 other recorders having 0-100 scales that may need to have scales changed out.

2.2.4 Miscellaneous

1. "^{o}F" is used throughout the control room except for the scales on P820, transformer temperature recorder, which read in ^{o}C.

2. No color coding or markings were noted to indicate:

   a. Normal or abnormal range of operation.

   b. System trip or alarm settings.

3. Many recorders have doors with white strips on both sides. The color is sharp and eye catching, and hinders quick focusing on the recorder chart.

4. Multipoint recorder on P600 has foggy glass making readability of the print out very difficult.

2.3 Indicators (Meters)

2.3.1 Marking and Scale

1. Process units are labeled clearly on scale faces, use fairly large print and easily readable. Exception noted:

   a. P601; RHR A&B "Cond." indicators has no process units identified.

2. Abbreviations were kept to a minimum and are considered acceptable.

3. Color coding or other markings are not used to indicate normal or abnormal ranges of operation or as indicators of system limits or trips.

4. Scales are generally unconjested, have good contrast, are numbered in either whole units or easily divisible units of 1, 2, or 5. Noted exceptions are:

   a. P603; identical steam flow and feedwater flow scales (6) are heavily conjested making it difficult to read and extrapolate, and one of the steam flow scale's length is different than the other three.

   b. P840; CW inlet plenum indicators (2) and recorder (1) have uneven scale values making it difficult to read and extrapolate.

5. Indicators are marked in actual process units and percentage is generally used for valve position or air/moisture content. Noted exceptions are:

   a. P601; RHR HX shell level (2) scaled from 0-100%, and not actual level.

   b. P617; jet pump flow indicators (20) are 0-100%.

2.3.2 Legend Plates

1. Legend plates should provide a description of the function being monitored (RHR A Shell Level), state the parameter being monitored (Level) and/or state the unit of measurement (feet). P601 legend plates are considered the poorest in this regard and should be improved.

2. Some inconsistency in labeling was noted. Some panel labels use equipment piece number, some use description, a few are intermixed.

3. Use of similar descriptions on legend plates of related pieces of equipment (Pump A, B & C) was generally found to be very good. A few exceptions were noted on Panels P812, P603, P840 and P820.

4. Group labeling of indicators needs improvement. Use of individual legend plates for indicators in clustered groups adds excess wording, unnecessarily use of abbreviations due to small available space, cause

excess redundancy, panel conjestion and is more difficult for the operator to focus on and read. Combining several legend plates into one (e.g. P603 Feedwater Indicators) helps the operator to quickly identify an individual indicator and its relationship to others. Also, improved hierarchy labeling would help considerably. P840 and P820 are prime examples of this problem.

2.4 Switches - Primary Operating Area

2.4.1 Pushbuttons

1. Emergency trip buttons on P601, P602 and P603 are generally consistent in application. They are raised, shielded to prevent inadvertent operation, colored red for visibility and have arm/disarmed features. Several concerns noted are:

   a. Emergency trips for the Diesel Generators (2), RFW pumps (2), T.G. (2), and Generator Unit (2) on P840, P820 and P800 are inconsistent (type switch, color, etc.) with the above and also between themselves. They lack visibility and contrast with surrounding controls.

   b. RCIC turbine and manual steam isolation trips on P601 have the same problem as "a" above.

2. Pushbutton "Containment N_2 Backup Valve CIV-V-39B" is mislabled. The control is used for testing the Digital Electric-Hydraulic pumps.

2.4.2 SBM Switches

1. The use of SBM switches with colored flags are not consistent in application. No policy or criteria was located to define when a "flag" SBM control head should be used. In general bus control switches have "flags". Noted inconsistencies are:

   a. Bus controls on HPCS P601 do not use SBM's with flags, while bus controls on P800 do.

   b. HPCS diesel control switch on P601 does not use a flag, while diesel control switches on P800 do.

2. SBM switches are used for control of all pumps except for the auxiliary lube oil pumps, water leg pumps and vapor extractor oil reservoir pumps. These used CR 2940 switches. Also, some SBM switches are used for valve control, where normally CR 2940 switches are used.

3. SBM switches for synchronizing DG busses #1 and #2 on P800 use special handles. Yet synchronizing switches for HPCS and the normal bus controls on P601 and P800 use regular J-handles. Special handles are applied inconsistently.

2.4.3 CR 2940 Switches

1. Black colored direction arrows located on top of the switch operators have little visibility and lack contrast.

2.4.4 Escutcheons

1. Lettering size and font on SBM switches vary. Some are bold and large and some extremely small and unreadable. Added on position markers do not follow lettering size or font pattern of existing markings.

2. Escutcheon nomenclature is inconsistently applied and, in some cases, misleading.

   a. "Neutral" is used on P820 in place of "Normal".

   b. "Normal" is sometimes stated in full and sometimes abbreviated "Nor" or "Norm".

   c. "START, ON, and RUN" are used interchangeably for pumps and motors.

   d. "CLOSE and OFF" or "STOP and OFF" are used interchangeably for valves and pumps.

   e. No designation is noted on escutcheons, legend plates, or by type of switch, as to whether switches are jog control, seal-in, or spring return to center.

   f. Escutcheon markings on CRD pump switch, P601, notes no center position, yet the SBM is a spring return to center.

g. Ecutcheon markings on RFW main oil pump switch, P840, notes no center position, yet the SBM has a stop with no spring return.

h. "OFF and CLOSE" are sometimes used in the center escutcheon position, contrary to the normal "LEFT" position.

i. "NORMAL and AUTO" are normally in the center switch position, but in a few cases, are on the right.

3. TSW-P-1A & B, P840, escutcheons reads "Normal Stop - Auto Stop". "Normal Stop" is unclear and confusing. and "Stop" should be "Start".

4. Diesel control (starting) switches on P800 are a SBM flag type labeled Trip/Reset rather than Start/Stop.

2.4.5 Miscellaneous

1. IRM Range Selection Switches on P603 have thin color coded lines, red and black, for referencing the switch position to the appropriate colored scale on the recorders. The switches color coding lacks visibility and contrast.

2.5 Switches - Vertical Panels

2.5.1 Pushbuttons

In general, "Test" pushbuttons are black, while annunciator and other "reset" pushbuttons are silver colored. This is not consistent with the main panels where both reset and test pushbuttons are silver.

2.5.2 SBM Switches

Use of SBM switches with and without flags in not consistently applied.

1. Panel P812 - 10 SBM switches for supply and exhaust fans use "flags" while three SBM switches for fans do not have them. Fans on P811, P813, P826, P827 Vertical Panels use SBM switches without flags.

2. Panel P813 has four (4) SBM switches with flags for valve control and one (1) SBM without a flag for valve control.

2.5.3 CR 2940 Switches

Two different sizes of CR 2940 operators are used on Panels P811, P825, and P827.

2.5.4 Escutcheons

1. "Neutral" is used on some SBM switches in place of "normal".

2. Some SBM switches have added-on center position markers which are small and hard to read.

2.5.5 Miscellaneous

1. Motor Control Center notation to define power source is not noted on legend plates. Operators have started applying labeling tape above switches.

2. Color coding for special switches on Panels P813, P824, and P832 are generally consistent in color coding (green/closed, red/open). Exceptions are:

   a. Panel P832 - Switch legend on upper right grouping of switches. third row, second column, have there "AUTO" and "Hi Level" colors reversed.

   b. CSP-V-6 on Panel P813 is green to open instead of red.

3. Special switches on Panel P832 do not have a positive "Auto" position stop. The operator could turn the switch towards auto, but not be engaged in auto.

4. Panel P811 and P827 air heater controls and indicators are inconsistent in nomenclature and location. Located above SGT-EHC-1A-1 switch are coil, trip and temperature control indicators specified for 1A-2, not 1A-1. SGT-EHC-1A-2 related indicators are noted as 1A-1, not 1A-2 as they should be. Equipment identification is reversed. The same applies to SGT-EHC-1B-1 and 1B-2.

3.0 ANNUNCIATOR SYSTEM

3.1 Grouping

3.1.1 Contrast within annunciator panels is poor. Use of demarcation lines to contrast groups of alarms within a panel and/or minor regrouping would aid the operator in quickly focusing on or scanning systems or similar activities.

3.2 Legend Plates and Windows

3.2.1 Panel P813 uses HI and HII in the general annunciator legend plates. This is confusing and inconsistent with other panel legend plates. They should specify Division I and Division II.

3.2.2 Abbreviations need to be upgraded to be consistent. Section 6.5 of this report will handle window engraving concerns.

3.2.3 Window legends do not specify trip points or parameters.

3.3 Display and Layout

3.3.1 Panel alarm numbering is in a row/column sequence using a numeric/numeric scheme.

3.3.2 Annunciator panels are not marked for identification. Plant Operations intends to attach Annunciator Response Booklets, for each annunciator panel, to the associated control panel's front face for availability and ease of reference.

3.3.3 Annunciator circuit pushbuttons lack contrast and visibility amid other panel controls. Operators have bracketed them with colored tape.

SECTION 6.5

CONTROL ROOM ANNUNCIATOR PANEL REVIEWS

The purpose of this review is to evaluate individual annunciator tiles, panel by panel, for grouping, color prioritization; window wording, general or multiple actuation input concerns, and the need for adding or deleting annunciators. The review covers all the annunciators in the Control Room and the Remote Shutdown Panels. In addition, the proposed RG-1.47 changes have been factored in.

1. Annunciator Grouping - annunciator tiles are reviewed within each annunciator panel for grouping by major system or function, and for location relative to respective controls, displays, and operator response requirements.

2. Annunciator Window (Tile) Color Priortization - A "WNP-2 Control Room Annunciator Window Color Standard" was prepared and approved by the Task Force in November 1981. Present design has only NSSS benchboards P601, P602, and P603 prioritized by color. The Task Force approach was to prepare a uniform WNP-2 standard and apply it to all annunciator panels under the scope of this review.

3. Annunciator Window Wording - Each annunciator tile is being traced to its orginating source to verify its function and determine the informational requirements for the operator. Besides wording and clarification changes, window tiles are reviewed against the "WNP-2 Standard List of Acronyms and Abbreviations for Control Room Labels and Legend Plates". The standard was prepared and approved by the Task Force in October 1981.

4. General/Multiple Input Annunciators - A "WNP-2 Annunciator System Multiple Input Alarm Standard" was prepared and approved by the Task Force in November 1981. The WNP-2 annunciator system does not have reflash circuitry installed. The standard provides guidance for determining the acceptability of annunciator alarms with mutiple inputs, and acceptable methods of corrective actions to resolve multiple input concerns.

5. Addition and/or Deletion of Annunciators - This area of review covers RG-1.47 integration with its resulting additions and/or deletions of alarms; relocation of tiles between control room benchboards and vertical panels, or to remote local panels outside the control room: identifying outstanding design changes; and other additions, deletions, or circuit modifications noted by the Task Force.

There are over 1500 annunciator alarms in the WNP-2 Control Room, with about 1200 in the primary operating area. These are located on 47 annunciator panels. The Task Force has completed Review Reports on 44 of the annunciator panels, and has prepared HED Reports, which include corrective recommendations, on 40 of these panels. Task Force reviews are scheduled to be completed in January 1982.

Appendix "B" contains a typical documentation package for Control Room Annunciator Panel Reviews. The package includes a Review Report and a HED Report. Project directives for implementation are not included as in the typical documentation package of Appendix "A". Project directives on annunciator panel changes are scheduled to be issued by end of January 1982. Further Annunciator Panel Reviews will be documented in the WNP-2 final control room report.

APPENDIX A

TYPICAL PANEL CONFIGURATION REVIEW DOCUMENTATION PACKAGE

PANEL P602

	Page
Review Report	A-1
HED Report	A-5
Prioritization Criteria	A-6
Letters of Direction	A-14

CONTROL ROOM PANEL LAYOUT DESIGN REVIEW
PANEL P602

RWCU and RRC Control Panel

Concern

Panel P602 provides controls for the Reactor Water Cleanup (RWCU) and Reactor Recirculation Control (RRC) systems, with several miscellaneous groupings of Main Steam Line (MSL) drain valves, radwaste equipment drains, and Reactor Feedwater (RFW) isolation valves. Except for the lack of contrast between systems or groups of controls, which in general, applies to all the control room panels, specific concerns noted are:

1. The RFW isolation valves are not grouped with the feedwater system controls on P840, and are essential equipment whose controls are located on a non-essential panel. No functional need exists for the controls on P602.

2. The MSL drain grouping of controls can be arranged into four basic flow paths or control groupings: RPV head vent, MSL drains, and drains from main steam isolation valves MS-V-28 (A, B, C, D) and from MS-V-22 (A, B, C, D). There is a lack of contrast between the four groups, and some controls are not arranged with their respective drain groups or consistent in operating sequence. Specific conserns noted are:

   a) MD-V-73 drain control is not grouped with its respective bypass valve or operationally sequenced with the other main steam line drain controls, and is mixed with the MS-V-28 isolation valve drain controls.

   b) MD-V-60 drain control for isolation valves MS-V-28 (A, B, C, D) is not grouped with the respective bypass valve, and is mixed with the main steam line drain controls.

   c) MS-V-21 and MS-V-156 drain controls for isolation valves MS-V-22 (A, B, C, D) are not consistent in arrangement with the other drain groups. This section of P602 has the drain controls arranged in a horizontal sequence, except for these two controls, which are in a vertical sequence.

3. The RWCU system lack visibility as to flow path or operating sequence. The arrangement requires increased operator knowledge and awareness of the system flow path to function. Specific concerns noted are:

   a) The RPV vessel reject controller is separated from its respective valve controls, and should be grouped together to facilitate operation.

b) The RWCU system controls are not arranged to facilitate ease of operation. The two system bypass valve controls are not grouped together, the system suction controls are reverse of normal sequence convention (BA rather than AB) and control operating sequence jumps both vertically and horizontally rather than a smooth sequence from left to right.

c) RWCU-V-40 is an essential control valve whose control is located on P602, a non-essential panel. Per engineering, RWCU-V-40 should be moved off of P602.

d) The two RWCU system conductivity recorders are reverse of normal convention (outlet before inlet).

4. RRC system reviews noted the following concerns:

a) RRC Loop A and B isolation valve controls blend too well into the panel arrangement. Contrast is needed to improve their visibility for access and to prevent inadvertent operation.

b) RRC two pen recorders R650 and R614 are inconsistent in use of pen color code. R650 has Loop A and B temperatures as red and black, respectively, while R614 has Loop A and B flows as black and red, respectively. Color coding is not consistent.

c) A design change (FDI-TCHI) has located controls and indicating lamps for the flux discriminator master controller (located on P603) with RRC Loop B displays on P602. This needs to be reviewed with respect to system grouping and demarcation application before installation.

d) Flow control valves RRC-V-60 (A, B) are hydraulically operated. PED 218-E-5079 specifies that the hydraulic system isolation valve controls HY-V-17, 18, 19, 20 (A/B) be located on P602. Per engineering, the PED must be changed to relocate the essential hydraulic isolation valve controls from P602, which is a "non-essential" panel. A new location is required.

5. Two CRT's will be used for the Safety Parameter Display System (SPDS). A location is required for the CRT's.

Recommendations

1. Relocate RFW-V-32 (A, B) and RFW-V-65 (A, B) to Panel P840. The four feedwater controls are for manually isolating the RFW system. Since these are not automatic isolation valves, placing them on P601 NS4 area would be inconsistent with the present controls at the NS4 area. The RFW controls were therefore, relocated to P840 and grouped with the other RFW system controls. See P840 for details.

b) The RWCU system controls are not arranged to facilitate ease of operation. The two system bypass valve controls are not grouped together, the system suction controls are reverse of normal sequence convention (BA rather than AB) and control operating sequence jumps both vertically and horizontally rather than a smooth sequence from left to right.

c) RWCU-V-40 is an essential control valve whose control is located on P602, a non-essential panel. Per engineering, RWCU-V-40 should be moved off of P602.

d) The two RWCU system conductivity recorders are reverse of normal convention (outlet before inlet).

4. RRC system reviews noted the following concerns:

a) RRC Loop A and B isolation valve controls blend too well into the panel arrangement. Contrast is needed to improve their visibility for access and to prevent inadvertent operation.

b) RRC two pen recorders R650 and R614 are inconsistent in use of pen color code. R650 has Loop A and B temperatures as red and black, respectively, while R614 has Loop A and B flows as black and red, respectively. Color coding is not consistent.

c) A design change (FDI-TCHI) has located controls and indicating lamps for the flux discriminator master controller (located on P603) with RRC Loop B displays on P602. This needs to be reviewed with respect to sys- tem grouping and demarcation application before installation.

d) Flow control valves RRC-V-60 (A, B) are hydraulically operated. PED 218-E-5079 specifies that the hydraulic system isolation valve controls HYD-V-17, 18, 19, 20 (A/B) be located on P602. Per engineering, the PED must be changed to relocate the essential hydraulic isolation valve controls from P602, which is a "non-essential" panel. A new location is required.

5. Two CRT's will be used for the Safety Parameter Display System (SPDS). A location is required for the CRT's.

Recommendations

1. Relocate RFW-V-32 (A, B) and RFW-V-65 (A, B) to Panel P840. The four feedwater controls are for manually isolating the RFW system. Since these are not automatic isolation valves, placing them on P601 NS4 area would be inconsistent with the present controls at the NS4 area. The RFW controls were therefore, relocated to P840 and grouped with the other RFW system controls. See P840 for details.

2. Rearrange the MSL drain controls to improve grouping and visibility of the four groups of drain controls. The air operated valve controls were located to the right of their respective bypass controls for consistency of arrangement, and demarcation lines applied to provide contrast.

3. Rearrange the RWCU system.

   a) The RPV vessel reject controls were grouped together in an operational sequence, and the RWCU system flow path arranged in a smooth operating sequence from left to right. With the addition of mimicing demarcation lines and a system flow diagram legend plate, operability of the system is significantly enhanced.

   b) Retain the control for RWCU-V-40 on P602. On review of RWCU-V-40 isolation valve control, a more appropriate operational location could not be identified than with the RWCU system on P602. Upgrade Panel P602 to an "essential" panel.

4. The RRC system arrangement was found to be satisfactorily arranged and grouped by Loop A and Loop B. The concerns noted earlier were resolved as follows:

   a) Install mimicing on RRC Loop A and B per the configuration drawing. The added mimicing provides contrast and visibility as to the relationship between the isolation valves, flow control valve controller, and pump controls.

   b) Modify recorders R650 and R614 such that the red pen in each recorder is used for Loop A readout. This is consistent with other two pen recorders.

   c) Relocate controls S122 and S123, and lamps FEL-1, 2, and 3 per the configuration drawing. This removes the controls from the RRC Loop B area of the panel, placing them in a general area close to its associated master flux controller on P603.

   d) Retain the HYD-V-17, 18, 19, 20 (A/B) hydraulic line isolation valve controls on Panel P602. Lockup of the RRC loop flow control valves is required under certain operational conditions. Access near the flow valve controllers is needed. The hydraulic isolation valves were therefore kept on P602. Upgrade Panel P602 to an "essential" panel.

5. Locate the two SPDS CRT's on P601 and P602. Tentative locations have been identified and reserved for the CRT's. The planned location on P602 appears to provide ready access and clear visibility to the operator from the feedwater and reactivity control area of the control room. Final layout approval is pending engineering design, hardware selection and operational review of the Emergency Procedures.

EQUIPMENT AFFECTED BY RECOMMENDATIONS

RWCU AND RRC PANEL - P602

A. RFW System

1. Remove to Panel P840:

RFW-V-32A	RFW-V-65A
RFW-V-32B	RFW-V-65B

B. Main Steam Line Drain System

1. Rearrange per configuration drawing:

MS-V-20	MS-V-71
MS-V-21	MS-V-72
MS-V-69	MS-V-73
MS-V-156	

C. RWCU System

1. Rearrange per configuration drawing:

RWCU-V-31	RWCU-V-40
RWCU-V-34	RWCU-V-42
	RWCU-V-44
RWCU-V-1A	RWCU-V-100
RWCU-V-1B	RWCU-V-104
	RWCU-V-106

D. RRC System

1. Modify recorders R614 and R650 such that the red pens are used for Loop A, and black pens for Loop B.

2. Modify FDI-TCHI rearrangement per configuration drawing:

B35-S122	FEL-1
B35-S123	FEL-2
	FEL-3

3. Change PED 218-E-5079 to locate HY-V-17, 18, 19, 20 (A/B) controls on Panel P602 per recommendations.

E. SPDS

1. Install SPDS CRT per configuration drawing.

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL P602 SYSTEM MS (63.1) REPORT NO. 016 DATE 6/15/81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
1) The main steam line valve control switches can ben arranged into four basic flow paths or control groupings: RPV head vent, MS line drains, drains from Main Steam isolation valves (MS-V-28A through D) and Main Steam isolation valves (MS-V-22A through D). There is lack of contrast between the four groups and some controls are not arranged with their respective drain groups or in a consistent operating sequence.	1) Rearrange the following MS line drain valve controls per the attached configuration drawing (Page 3 of 3). MS-V-20 (Item 444) MS-V-21 (Item 445) MS-V-69 (Item 495) MS-V-156 (Item 441) MD-V-71 (Item 496) MD-V-72 (Item 497) MD-V-73 (Item 443)	IV	b	1	ENG. 30 CONST. 82	
2) Enhancement is inadequate.	2) Add demarcation lines and other enhancements defined in the Enhancement Guidelines.	III	a	1	NA	2) WPPSS to perform.

Category I- Safety Related, Minimum Opportunity to Correct Error

Category II- Safety Related, Some Opportunity to Correct Error

Category III- Reliability Related, Minimum Opportunity to Correct Error

Category IV- Reliability Related, Some Opportunity to Correct Error

Category V- No Impact on Safety or Reliability

In Terms of Need:

Category 1 - To enhance safe operation, the change should be made.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 2 - To enhance safe operation, the change should be made.

Category 3 - To enhance reliable operation, the change may be desirable.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 4 - To enhance reliable operation, the change may be desirable.

Category 5 - Change may improve operations.

Note 2) Licensing Risk

a. High
b. Medium
c. Minimal

Risk Assignment Based on:
- Guidance in draft NUREG-1580, 0659 & 0700.
- NRC audits of other control rooms.
- BWR Owner's Group decisions.

Note 3) Schedule to Complete

1. Prior to fuel load
2. After fuel load
3. Never

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL P602 SYSTEM RWCU (4.1) REPORT NO. 017 DATE 6/15/81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
1) The RWCU system lacks visibility as to flow path or operating sequence. Specific concerns are: a) The RPV vessel reject controller is separated from its respective valve controls. b) The RWCU system controls are not arranged to facilitate ease of operation. The two system bypass value controls are not grouped together, the system suction controls are reverse of normal convention (BA rather than AB) and control operating sequence jumps both vertically and horizontally rather than a smooth sequence from left to right.	1) Rearrange the following RWCU control switches per the attached configuration drawing. RWCU-V-31 (Item 462) RWCU-V-34 (Item 457) RWCU-P-1A (Item 450) RWCU-P-1B (Item 455) RWCU-V-40 (Item 456) RWCU-V-42 (Item 460) RWCU-V-44 (Item 461) RWCU-V-100 (Item 458) RWCU-V-104 (Item 451) RWCU-V-106 (Item 453)	IV	b	1	ENG. 40 CONST. 119	
2) The two RWCU system conductivity, recorders (G33-R601 and R603) are reverse of normal convention (outlet before inlet).	2) None	IV	c	3	NA	2) This is not considered to be a significant problem.
3) Enhancement is inadequate.	3) Add mimic, demarcation lines and other enhancements as defined in Enhancement Guidelines.	III	a	1	NA	3) WPPSS to perform.

Category I- Safety Related, Minimum Opportunity to Correct Error

Category II- Safety Related, Some Opportunity to Correct Error

Category III- Reliability Related, Minimum Opportunity to Correct Error

Category IV- Reliability Related, Some Opportunity to Correct Error

Category V- No Impact on Safety or Reliability

In Terms of Need:

Category 1 - To enhance safe operation, the change should be made.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 2 - To enhance safe operation, the change should be made.

Category 3 - To enhance reliable operation, the change may be desirable.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 4 - To enhance reliable operation, the change may be desirable.

Category 5 - Change may improve operations.

Note 2) Licensing Risk

a. High
b. Medium
c. Minimal

Risk Assignment Based on:
- Guidance in draft NUREG-1580, 0659 & 0700.
- NRC audits of other control rooms.
- BWR Owner's Group decisions.

Note 3) Schedule to Complete

1. Prior to fuel load
2. After fuel load
3. Never

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL P602 SYSTEM RRC (3.0) REPORT NO. 018 DATE 6-18-81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
1) Recorder B35-R614 displays RRC loop flow as follows: Loop A flow - Black Pen Loop B flow - Red Pen Adjacent recorder B35-R650 displays RRC loop temperature as follows: Loop A Temp. - Red Pen Loop B Temp. - Black Pen This is not consistent color convention.	1) Modify recorder B35-R614 as follows: Red pen shall be used to monitor Loop A flow and the black pen shall be used to monitor Loop B flow.	IV	a	1	ENG. 10 CONST. 1	1) The NRC has expressed significant concern about this type of problem.
2) GE change FDI-TCHI has located controls and indicating lamps for the flux discriminator master controller (located on P603) with RCC Loop B displays. This is improper grouping and could cause operator confusion.	2) Revise FDI-TCHI to locate the following controls and indicating lamps as shown on the attached configuration drawing. B35-S122 B35-S123 FEL-1 FEL-2 FEL-3	V	c	1	ENG. 12. CONST. NA	2) GE has agreed to modify FDI-TCHI. This is an engineering change only. The field work has not yet been performed.
3) Enhancement is inadequate.	3) Add demarcation lines and other enhancements as defined in the Enhancement Guidelines.	III	a	1	NA	3) WPPSS to perform.

Note 1) - Category

Category I- Safety Related, Minimum Opportunity to Correct Error

Category II- Safety Related, Some Opportunity to Correct Error

Category III- Reliability Related, Minimum Opportunity to Correct Error

Category IV- Reliability Related, Some Opportunity to Correct Error

Category V- No Impact on Safety or Reliability

In Terms of Need:

Category 1 - To enhance safe operation, the change should be made.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 2 - To enhance safe operation, the change should be made.

Category 3 - To enhance reliable operation, the change may be desirable.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 4 - To enhance reliable operation, the change may be desirable.

Category 5 - Change may improve operations.

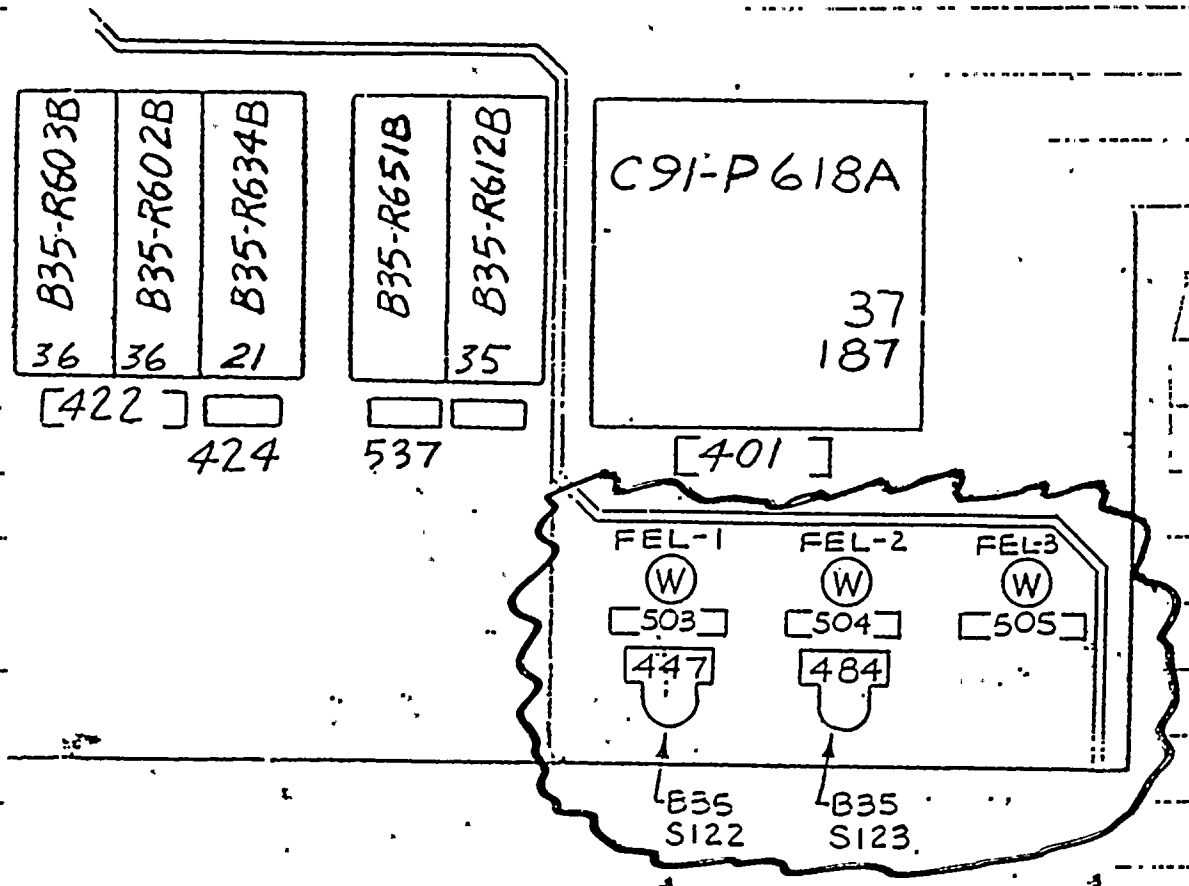
Note 2) Licensing Risk

a. High
b. Medium
c. Minimal

Risk Assignment Based on:
- Guidance in draft NUREG-1580, 0659 & 0700
- NRC audits of other control rooms.
- BWR Owner's Group decisions.

Note 3) Schedule to Complete

1. Prior to fuel load
2. After fuel load
3. Never



PROPOSED LOCATION FOR GE FDI-TCHI CONTROLS AND INDICATING LIGHTS ON P602 VERTICAL SECTION

REFERENCE DRAWING

GE 828E351 TC REV. 9

Sheet No. 2

B+R FILE NO. 2-36-5202

HED REPORT NO. 018, ITEM 2

PAGE 3 OF 3

INTEROFFICE MEMORANDUM

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

F-81-5885
Distribution:
☐ EDC WNP-1/4
☒ EDC WNP-2
☐ EDC WNP-3/5
☐ Admin File
EA Fredenburg
H. McGilton-90
B. Vanerem-926
BA Holmberg-90
sf(2)
EAF/lb
RGD/lb

Date: June 30, 1981

To: B. A. Holmberg - Deputy Project Manager, Engineering WNP-2 904A

From: R. G. DaValle - Control Room Design Review Coordinator 906D

Subject: HUMAN ENGINEERING CHANGES TO PANEL P602 R G DaValle

Reference:

The following Human Engineering Discrepancy (HED) reports are attached for your concurrence.

HED Report No. 016 through 018

When your concurrence is received, I will prepare a formal letter of direction, for your signature, to Burns and Roe, Incorporated, to implement the subject changes.

kjf

CONCURRENCE

R J Van Eren — Burns & Roe Engineering Control Room Review Task Force Member

C H M Hilton — Supply System Operations Control Room Review Task Force Member

WP-102 R2

INTERNAL DISTRIBUTION

GK Afflerbach - 927M
RG Davalle - 906D
SU/db
GJF/lb
BAH/lb
UA
f (2)

THIS LETTER SATISFIES COMMITMENT NO.

THIS LETTER (DOES) (DOES NOT) ESTABLISH A NEW COMMITMENT.

WPPSS CORRESPONDENCE NO. WPBR-RO-81-146

August 31, 1981
WPBR-RO-81-146

Mr. J. A. Forrest
Project Director
Burns & Roe, Inc.
601 Williams Blvd.
Richland, WA 99352

RESPONDS TO: N/A
RESPONSE REQUESTED BY: Sept. 4

Subject: SUPPLY SYSTEM NUCLEAR PROJECT NO. 2
HED REPORTS/H13-P602

Dear Mr. Forrest:

This letter is your authorization to direct General Electric to prepare one FDDR to cover the Human Engineering Layout changes within panel H13-P602. The changes do not involve any external BOP hardware, therefore no PED's should be involved. However, if during the FDDR preparation a BOP change is uncovered, a copy of the FDDR will be transmitted to B&R for your incorporation into a PED.

FILE COPY

The changes that are to be made on H13-P602 are as follows:

HED Report	Item No.
HED-016	1
HED-017	1
HED-018	1

A copy of HED Reports, 016, 017 and 018 are attached for your reference.

The letter of direction to General Electric should be issued by September 1, 1981. This work is a part of B&R Task No. 3810.

Very truly yours,

Orig. signed by

B. A. Holmberg
Deputy Project Manager,
Engineering, WNP-2

BAH/GJF/lll

cc: WNP-2 Files - w/attachment
W. S. Chin - BPA

AUTHOR: GJ Freeman GJ Freeman			FOR SIGNATURE OF: BA Holmberg		
SECTION					
FOR APPROVAL OF	GK Afflerbach				
APPROVED	GK Afflerbach				
DATE	1-31-81				

WP-387

Burns and Roe, Inc.

601 Williams Blvd. ■ Richland, Washington 99352 ■ Tel. (509) 943-8200

Subject: Work Order 3900
WNP-2
Washington Public Power Supply System
Contract No. 2
Control Room Modifications
Responds to: NA

September 15, 1981
BRGE-2-RO-81-523
Response Req'd By: 9/26/81

General Electric Company
Nuclear Energy Division M/C 394
175 Curtner Avenue
San Jose, California 95125

Attention: Mr. F. A. MacLean

Reference: Supply System (B.A. Holmberg) to B&R (J.A. Forrest) letter, (WPBR-RO-81-146), WNP-2 HED Reports/H13-P602

Gentlemen:

The referenced letter authorized Burns and Roe, Inc. to direct General Electric to prepare one Field Deviation Disposition Request (FDDR) to accomplish modifications to Panel H13-P602. The modifications are a result of the Human Factors Engineering design review being performed by the Supply System.

The required modifications are detailed in Attachment 1 to this letter.

Your response is requested no later than September 26, 1981. Please contact this office with any questions you have concerning this matter.

Very truly yours,

FOR THE PROJECT DIRECTOR

J. A. Ogawa
Nuclear Group Supv.

JAO:BJVE:tw

Attachment

cc: B. A. Holmberg - Supply System - 3
R. G. DaValle - Supply System - 1
G. F. Freeman - Supply System - 1
J. P. Cooper - Supply System - 1
E. A. Fredenburg - Supply System - 1
J. H. M Miller - GE Site - 1
W. S. Chin - BPA - 1
WNP-2 File
J. H. Ralphs - Supply System - 1

APPENDIX B

TYPICAL ANNUNCIATOR PANEL REVIEW DOCUMENTATION PACKAGE

PANEL P602

	Page
Review Report	B-1
HED Report	B-15
Prioritization Criteria	B-18
Letters of Direction	B-28

WNP-2 CONTROL ROOM PANEL ANNUNCIATOR REVIEW

PANEL P602

Date: October 30, 1981

Rev.: 1

I. PURPOSE

The purpose of this review was to evaluate the annunciators on P602 for the following:

- Annunciator Grouping
- Annunciator Window (Tile) Color Prioritization
- Annunciator Window Wording
- Annunciators that have multiple actuation inputs which are independent and can exist at the same time.
- Need for Addition and/or Deletion of Annunciators

II. SCOPE

The scope covers all the annunciators for the systems controlled from P602. There are no R.G.-1.47 changes to the P602 annunciators.

III. FINDINGS

A. Annunciator Grouping

1. Annunciator grouping on panel P602 is good. The only discrepancy noted was that the Radwaste System annunciators were unnecessarily on both annunciators A5 and A13. Attachment 4 of this review shows the existing P602 annunciator grouping.

B. Annunciator Window Color Prioritization

1. In general, the window color prioritization is good. Some inconsistancies were, however, noted and are detailed in Attachment 1 of this review.

2. There are eight (8) windows on annunciator A13 which are white. GE drawing 761E791AD specifies amber color for these windows. See Attachment 5 of this review for the specific windows.

C. Annunciator Window Wording

1. Annunciator window wording on panel P602 is good. Some minor discrepancies were noted, however, and are detailed in Attachment 2 of this review.

D. Annunciators Having Multiple Actuation Inputs

1. Eight (8) annunciators have multiple actuation inputs which are independent and can exist at the same time, which prevents the operator of being alerted to additional alarm conditions after one alarm comes in and remains in the alarm state. Attachment 3 contains a listing of the above annunciators. Annunciators with multiple inputs from redundant channels monitoring the same parameter are not listed in Attachment 3.

E. Need for Addition and/or Deletion of Annunciators

1. There are four (4) RHR/RCIC annunciators on P602 which should be relocated to P601.

IV. RECOMMENDATIONS

A. Annunciator Grouping

1. Relocate three (3) annunciator windows as shown in Attachment 5. Attachment 4 shows "as-is" grouping. The proposed grouping locates all RadWaste system windows on annunciator A13.

2. Correct GE drawing 807E174TC, Rev. 9 to show that annunciator A13-1.2 is actually installed in A13-1.1.

NOTE: Proposed Annunciator Wording Changes are not shown in Attachment 5.

B. Annunciator Window Color Prioritization

1. Make annunciator window color changes proposed in Attachment 1. Justification is stated in Attachment 1. Attachment 5 also shows the proposed colors.

2. Change the color of eight (8) windows on annunciator A13 from white to amber to conform to GE drawing 761E791AD. See Attachment 5 for specific annunciator windows.

C. Annunciator Window Wording

1. Review annunciator window wording as shown in Attachment 2.

2. All acronyms and abbreviations shall be in accordance with the "WNP-2 Standard List of Acronyms and Abbreviations for Control Room Labels and Legend Plates".

3. Correct any wrong spelling.

4. Change all GE MPL Numbers to B&R Tag Number.

D. Annunciators Having Multiple Actuation Inputs

1. A determination should be made concerning the need for an annunciator "Reflash" capability or an acceptable alternative, such as administrative procedures. Attachment 3 lists the annunciators having multiple and independent actuation inputs.

E. Need for Addition or Deletion of Annunciators

1. Relocate the four (4) RHR/RCIC annunciators on annunciator A13 to P601. See Panel P601 annunciator review for the specific locations on P601.

2. To allow room on P603 Annunciator Panel A7, relocate P603 annunciator A7-4.8 to P602 annunciator A13-6.1.

ATTACHMENTS

1. - Proposed Annunciator Window Color Changes

2. - Proposed Annunciator Window Wording Changes

3. - Annunciators Having Multiple Inputs

4. - As Is Annunciator Arrangement (Grouping)

5. - Proposed Annunciator Color Prioritization

PROPOSED ANNUNCIATOR WINDOW COLOR CHANGES

Panel P602

Window Number	Window Wording	Color Change	Basis for Change
A5-2.2	MS Line Monitors Downscale	Amber to White	To be consistent with all other "Downscale" annunciators which are white.
A5-3.3	Off Gas High-High Radiation	Amber to Red	Both the Off Gas "High-High" Radiation and the Off Gas "High" Radiation windows are presently amber. This change will also match the light colors on P604.
A5-3.4	Off Gas Vent Pipe High-High Radiation	Amber to Red	Both the "High-High" and the "High windows for this parameter are presently amber. This change will also match the light colors on P604.
A5-3.2	Off Gas Post-Treatment High-High Radiation	Amber to Red	Same as above.
A5-1.5	Reactor Building Vent High Radiation	Red to Amber	Both the "High-High" and the "High" windows for this parameter are presently red.
A5-2.5	Reactor Building Vent Monitors Downscale	Amber to White	To be consistent with all other "Downscale" annunciators which are white.
A6-5.1	Recirc Drywell High Press Switch A In Test	Amber to White	Is an operator information annunciator.
A6-3.4	Flow Cont Valve A Hyd Power Unit Standby Hyd Pump Operating	Amber to White	Is an operator information annunciator.

PROPOSED ANNUNCIATOR WINDOW COLOR CHANGES Rev. 1

Panel P602

Window Number	Window Wording	Color Change	Basis for Change
A6-5.5	Recirc Drywell High Press Switch B in Test	Amber to White	Is an operator information annunciator.
A6-3.8	Flow Cont Valve B Hyd Power Unit Standby Hyd Pump Operating	Amber to White	Is an operator information annunciator.
A6-6.7	ATWS A or B Test Switch in Test	Amber to White	Is an operator information annunciator.
A13-2.2	Reactor Bldg Floor Drain Sump Level C002B High-High	White to Amber	For consistency and to conform to GE drawing 807E174TC.
A13-1.3 A13-2.3 A13-3.3 A13-4.3	See Attachment 4	White to Amber	To conform to GE drawing 761E791AD.
A13-1.4 A13-2.4 A13-3.4 A13-4.4	See Attachment 4	White to Amber	To conform to GE drawing 761E791AD.
Existing P603 A7-4.8 Proposed A13-6.1	Annunciator Loss of 125 VDC	White to Amber	Operator warning.

PROPOSED ANNUNCIATOR WINDOW WORDING CHANGES

Attachment 2

Panel P602

Window Number	Existing Wording	Proposed Wording
A5-3.7	Reac Water Cleanup Pump Flow High/Low	Reac Water Cleanup Pump Flow Low.
Existing A5-1.8 Proposed A13-4.2	Radwaste Controller 1 Trouble	Radwaste Logic Controller 1 Trouble.
Existing A5-2.8 Proposed A13-5.2	Radwaste Controller 2 Trouble	Radwaste Logic Controller 2 Trouble.
Existing A5-3.8 Proposed A13-6.2	Radwaste Controller 3 Trouble	Radwaste Logic Controller 3 Trouble.
A6-4.1	Recirc Motor A Lockout Bus Under Voltage	Recirc Motor A Breaker Aux. Trip Circuit Under Voltage.
A6-4.5	Recirc Motor B Lockout Bus Under Voltage	Recirc Motor B Breaker Aux. Trip Circuit Under Voltage.
A6-5.5	Recirc Drywell High Press Switch In Test	Recirc Drywell High Press Switch B In Test.

Panel/ Annunciator	Annunciator Meaning	Remarks
P602 / A5-4.7	Reactor Water Cleanup Pump Cooling Water High Temperature	Actuated by high temperature on either RWCU pump.
P602 / A5-3.1	Reactor Building High Radiation	Actuated by any 1 of 13 ARM's.
P602 / A5-4.1	Turbine Building High Radiation	Actuated by any 1 of 5 ARM's.
P602 / A5-5.1	Radwaste Building High Radiation	Actuated by any 1 of 9 ARM's.
P602 / A5-6.1	Area Radiation Monitors Downscale	Actuated by any 1 of 30 ARM's.

Panel/ Annunciator	Annunciator Meaning	Remarks
P602 A5-1.6	Remote Shutdown Transfer Switch In Emergency Position	Actuated by any 1 of 20 switches.
P602 A6-6.6	Recirculation Motor A/B High Temperature	Actuated by any 1 of 12 temp sensors on either pump.

ANNUNCIATOR A5 - BOARD P602

Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	Radwaste Controller 1 Trouble W
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale A	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale A	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	Radwaste Controller 2 Trouble W
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample FLow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	Radwaste Controller 3 Trouble W
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump Cooling Water High Temp W	SPARE
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Or Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

W - White
A - Amber
R - Red

ANNUNCIATOR A6 - BOARD P602

SPARE W	Recirc Pump A Trip ATWS Initiated R	Recirc Motor A Bearing Oil High Level A	Recirc Motor B Bearing Oil Low Level A	SPARE W	Recirc Pump B Trip ATWS Initiated R	Recirc Motor B Bearing Oil High Level A	Recirc Motor B Bearing Oil Low Level A
Recirc Pump A Seal Cooling Water Low Flow A	Recirc Pump A Outer Seal High Leakage A	Recirc Pump A Seal Staging Flow High/Low A	Recirc Motor A High Vibration A	Recirc Pump B Seal Cooling Water Low Flow A	Recirc Pump B Outer Seal High Leakage A	Recirc Pump B Seal Staging Flow High/Low A	Recirc Motor B High Vibration A
Recirc Motor A Winding Coolant Leakage A	Recirc Motor A Winding Coolant Low Flow A	Flow Cont Valve A Hyd Power Unit Startup Inhibited A	Flow Cont Valve A Hyd Power Unit Standby A Hyd Pump Operating	Recirc Motor B Winding Coolant Leakage A	Recirc Motor B Winding Coolant Low Flow A	FLow Cont Valve B Hyd Power Unit Startup Inhibited A	Flow Cont Valve B Hyd Power Unit Standby A Hyd Pump Operating
Recirc Motor A Lockout Bus Under Voltage A	Recirc Motor A Bkr Trip Circuit Under Voltage A	Recirc Motor A Overcurrent Or Ground A	Flow Cont Valve A Hyd Power Unit Control System Abnormal A	Recirc Motor B Lockout Bus Under Voltage A	Recirc Motor B Bkr Trip Circuit Under Voltage A	Recirc Motor B Overcurrent or Ground A	Flow Cont Valve B Hyd Power Unit Control System Abnormal A
Recirc Drywell High Press Switch A In Test A	System A Drywell High Pressure Interlock A	Flow Cont Valve A Motion Inhibited A	Flow Cont Valve A Maximum Open Limited A	Recirc Drywell High Press Switch In Test A	System B Drywell High Pressure Interlock A	Flow Cont Valve B Motion Inhibited A	Flow Cont Valve B Maximum Open Limited A
Flow Cont Valve A Servo Input Control Signal Abnormal A	FLux Controller Output Signal Abnormal A	Master Controller Output Signal Abnormal A	SPARE W	Flow Cont Valve B Servo Input Control Signal Abnormal A	Recirc Pump/Motor A or B High Temp A	ATWS A or B Test Switch In Test A	Recirc System Approaching Auto Flow Range Limit A

W - White
A - Amber
R - Red

ANNUNCIATOR A13 - BOARD P602

REACTOR BLDG FLOOR DRAIN SUMP LEVEL HIGH-HIGH A	SPARE W	Recirc Pump A Low Speed Auto Transfer CKT Not Avail W	Recirc Pump B Low Speed Auto Transfer CKT Not Avail W	Recirc Motor A Breaker Trip R
Reactor Bldg Floor Drain Sump Level (C002A) High-High A	Reactor Bldg Floor Drain Sump Level (C002B) High-High W	Recirc Pump Motor A Auto Transfer Incomplete W	Recirc Pump Motor B Auto Transfer Incomplete W	Recirc Motor A Lockout R
Reactor Bldg Equip Drain Sump High Level W	SPARE W	Recirc Pump MTR A Auto Trip Or Transfer to Low Speed W	Recirc Pump MTR B Auto Trip Or Transfer to Low Speed W	SPARE W
Reactor Bldg Equip Drain Sump High Temp W	SPARE W	Recirc MG Set A Protective Relay Trip W	Recirc MG Set B Protective Relay Trip W	Recirc Motor B Breaker Trip R
RCIC To RHR A STEAM TRAP HIGH LEVEL W	RCIC To RHR B STEAM TRAP HIGH LEVEL W	Recirc MG Set A Interlock Bypass A	Recirc MG Set B Interlock Bypass A	Recirc Motor B Lockout R
RCIC To RHR A/B STEAM TRAP HIGH LEVEL W	RCIC TURBINE EXH DRAIN LEG LEVEL HIGH W	SPARE W	SPARE W	SPARE W

W - White
A - Amber
R - Red

PROPOSED ARRANGEME[illegible]ND COLOR PRIORIZATION
Attachment 5

ANNUNCIATOR A5 - BOARD P602

ARM	PRM				RWCU	
Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	SPARE W (1)
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale W	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale A	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	SPARE W (1)
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample FLow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	SPARE W (1)
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump A Cooling Water High Temp (2)W	Reac Water Cleanup Pump B Cooling Water High Temp W(2)
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Dr Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE W
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

Notes: (1) Relocated to annunciator A13-P602
(2) Existing annunciator A5-4.7 split into two (2) annunciators.

W - White
A - Amber
R - Red

ANNUNCIATOR A13 - BOARD P602

Radwaste		Recirc.		
Reactor Bldg Floor Drain Sump Level (C003) High-High A(1)	SPARE	Recirc Pump A Low Speed Auto Transfer A CKT Not Avail A(4)	Recirc Pump B Low Speed Auto Transfer A CKT Not Avail A(4)	Recirc Motor A Breaker Trip R
Reactor Bldg Floor Drain Sump Level (C002A) High-High A	Reactor Bldg Floor Drain Sump Level (C002B) High-High A	Recirc Pump Motor A Auto Transfer Incomplete A(4)	Recirc Pump Motor B Auto Transfer Incomplete A(4)	Recirc Motor A Lockout R
Reactor Bldg Equip Drain Sump High Level W	SPARE W	Recirc Pump MTR A Auto Trip Or Transfer to Low Speed A(4)	Recirc Pump MTR B Auto Trip Or Transfer to Low Speed A(4)	SPARE W
Reactor Bldg Equip Drain Sump High Temp W	Radwaste Controller 1 Trouble W (3)	Recirc MG Set A Protective Relay Trip A(4)	Recirc MG Set B Protective Relay Trip A(4)	Recirc Motor B Breaker Trip R
SPARE W (2)	Radwaste Controller 2 Trouble W (2)(3)	Recirc MG Set A Interlock Bypass A	Recirc MG Set B Interlock Bypass A	Recirc Motor B Lockout R
Annunciator Loss of 125 VDC A (5)(2)	Radwaste Controller 3 Trouble W (2)(3)	SPARE W	SPARE W	SPARE W

Notes: (1) Currently in window 1.1. GE drawing 807E174TC Rev. 9 specifies window 1.2. GE Drawing should be corrected.
(2) Existing annunciator relocated to P601, see P601 annunciator review for specific location.
(3) Relocated from annunciator A5-P602.
(4) Windows are currently white. GE drawing 761E791AD specifies amber.
(5) Relocated from P603 annunciator A7-4.8.

W - White
A - Amber
R - Red

PROPOSED ARRANGEME[illegible]ND COLOR PRIORIZATION

Attachment 5

ANNUNCIATOR A6 - BOARD P602

Recirc A				Recirc B			
SPARE W	Recirc Pump A Trip AIWS Initiated R	Recirc Motor A Bearing Oil High Level A	Recirc. Motor A Bearing Oil Low Level A	SPARE W	Recirc Pump B Trip AIWS Initiated R	Recirc Motor B Bearing Oil High Level A	Recirc Motor B Bearing Oil Lo Level A
Recirc Pump A Seal Cooling Water Low Flow A	Recirc Pump A Outer Seal High Leakage A	Recirc Pump A Seal Staging Flow High/Low A	Recirc Motor A High Vibration A	Recirc Pump B Seal Cooling Water Low Flow A	Recirc Pump B Outer Seal High Leakage A	Recirc Pump B Seal Staging Flow High/Low A	Recirc Motor B High Vibration A
Recirc Motor A Winding Coolant Leakage A	Recirc Motor A Winding Coolant Low Flow A	Flow Cont Valve A Hyd Power Unit Startup Inhibited A	Flow Cont Valve A Hyd Power Unit Standby W Hyd Pump Operatin	Recirc Motor B Winding Coolant Leakage A	Recirc Motor B Winding Coolant Low Flow A	FLow Cont Valve B Hyd Power Unit Startup Inhibited A	Flow Cont Valve B Hyd Power Unit Standby W Hyd Pump Operating
Recirc Motor A Lockout Bus Under Voltage A	Recirc Motor A Bkr Trip Circuit Under Voltage A	Recirc Motor A Overcurrent Or Ground A	Flow Cont Valve A Hyd Power Unit Control System Abnormal A	Recirc Motor B Lockout Bus Under Voltage A	Recirc Motor B Bkr Trip Circuit Under Voltage A	Recirc Motor B Overcurrent or Ground A	Flow Cont Valve B Hyd Power Unit Control System Abnormal A
Recirc Drywell High Press Switch A In Test W	System A Drywell High Pressure Interlock. A	Flow Cont Valve A Motion Inhibited A	Flow Cont Valve A Maximum Open Limited A	Recirc Drywell High Press Switch In Test W	System B Drywell High Pressure Interlock A	Flow Cont Valve B Motion Inhibited A	Flow Cont Valve B Maximum Open Limited A
Flow Cont Valve A Servo Input Control Signal Abnormal A	FLux Controller Output Signal Abnormal A	Master Controller Output Signal Abnormal A	SPARE W	Flow Cont Valve B Servo Input Control Signal Abnormal A	Recirc Pump/Motor A or B High Temp A	AIWS A or B Test Switch In Test W	Recirc System Approaching Auto Flow Range Limit A

W - White
A - Amber
R - Red

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL H13-P602 SYSTEM Annunciators (49.0) REPORT NO. 036 DATE 10/30/81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
1) Space is needed on P603 Annunciator Panel A7 for an additional annunciator.	1) Relocate the following annunciator as indicated. Existing Location — New Location P603 — P602 A7-4.8 — A13-6.1	II	c	1		1) This change must be coordinated with Item No. 2 below.
2) The following RHR/RCIC annunciators are on P602. All RHR/RCIC controls are on P601. A13-5.1 - RCIC to RHR A Steam Trap High Level A13-5.2 - RCIC to RHR B Steam Trap High Level A13-6.1 - RCIC to RHR A/B Steam Trap High Level A13-6.2 - RCIC Turbine Exh. Drain Leg High Level	2) Relocate the following annunciators as indicated. Existing Location — New Location P602 — P601 A13-5.1 ------- A4-4.1 A13-5.2 ------- A2-5.3 A13-6.1 ------- A2-6.3 A13-6.2 ------- A4-2.4	II	b	1		2) This Item is for information only. The modification is detailed in the P601 annunciator modification package. (See HED-033).
3) Several P602 annunciators have multiple inputs which are independent and can exist at the same time, which prevents the operator of being alerted to an additional alarm after one alarm comes in and remains in the alarm state. Attachment 1 contains a listing of these annunciators.	3) Separate existing annunciator A5-4.7 as follows: A5-4.7 - Reac Water Cleanup Pump A Cooling Water High Temp. A5-4.8 - Reac Water Cleanup Pump B Cooling Water High Temp. See attached drawing (page 5 of 15) for elementary diagram.	IV	b	1		3) The balance of the annunciators with multiple inputs are acceptable and meet the requirements of the "WNP-2 Annunciator Multiple Input Alarm Standard". Indication for the multiple input parameters is available in the Control Room. Administrative Procedures will be prepared to specify monitoring requirements.

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL H13-P602 SYSTEM Annunciators (49.0) REPORT NO. 036 DATE 10/30/81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
4) P602 Annunciator window color prioritization is not totally in compliance with the "WNP-2 Control Room Annunciator Window Color Standard".	4) Change the window color on the following P602 annunciators as indicated: Location — Color Change A5-2.2 ---------- A to W A5-3.3 ---------- A to R A5-3.4 ---------- A to R A5-3.2 ---------- A to R A5-1.5 ---------- R to A A5-2.5 ---------- A to W A6-5.1 ---------- A to W A6-3.4 ---------- A to W A6-5.5 ---------- A to W A6-3-8 ---------- A to W A6-6.7 ---------- A to W *A13-6.1 ---------- W to A *This annunciator was relocated from P603 A7-4.8 (see Item No. 1. above).	IV	b	1		4) W - White A - Amber R - Red
5) The following P602 Annunciator window colors do not conform to the associated GE elementary drawing or the "WNP-2 Control Room Annunciator Window Color Standard".	5) Change the window color on the following P602 annunciators as indicated. Location — Color Change A13-2.2 ---------- W to A A13-1.3 ---------- W to A A13-2.3 ---------- W to A A13-3.3 ---------- W to A A13-4.3 ---------- W to A Continued on page 3.	IV	b	1		5a) Construction changes only. GE elementary drawings are correct. 5b) W - White A - Amber

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

PANEL H13-P602 SYSTEM Annunciators (49.0) REPORT NO. 036 DATE 10/30/81

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
	5) continued for page 2. Location — Color Change A13-1.4 -------- W to A A13-2.4 -------- W to A A13-3.4 -------- W to A A13-4.4 -------- W to A					
6) The "Reactor Bldg Floor Drain Sump Level (C003) High-High" annunciator is installed in location A13-1.1. GE drawing 807-E174TC specifies location A13-1.2	6) Change drawing 807E174TC to specify location A13-1.1 for the following annunciator to conform to the "as built" location. a) Reactor Bldg Floor Drain Sump Level (C003) High-High.	IV	b	1		6) None
7) P602 Radwaste System annunciators are located on Annunciator Panels A5 and A13.	7) Relocate the following annunciators as indicated. Existing Location — New Location A5-1.8 ---------- A13-4.2 A5-2.8 ---------- A13-5.2 A5-3.8 ---------- A13-6.2	IV	b	1		7) This item must be coordinated with Item No. 2 above.
8) There are minor wording discrepancies on several P602 annunciators.	8) Revise window wording as required.	IV	b	1		8) Supply System to perform.

Note 1) - Category

Category I- Safety Related, Minimum Opportunity to Correct Error

Category II- Safety Related, Some Opportunity to Correct Error

Category III- Reliability Related, Minimum Opportunity to Correct Error

Category IV- Reliability Related, Some Opportunity to Correct Error

Category V- No Impact on Safety or Reliability

In Terms of Need:

Category 1 - To enhance safe operation, the change should be made.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 2 - To enhance safe operation, the change should be made.

Category 3 - To enhance reliable operation, the change may be desirable.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category 4 - To enhance reliable operation, the change may be desirable.

Category 5 - Change may improve operations.

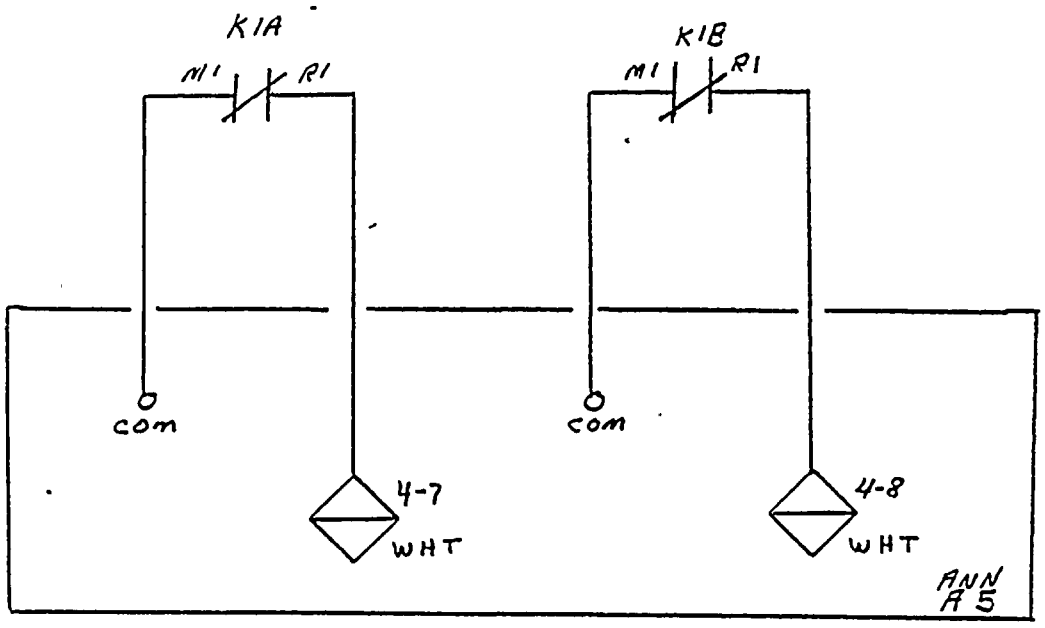
Note 2) Licensing Risk

a. High
b. Medium
c. Minimal

Risk Assignment Based on:
- Guidance in draft NUREG-1580, 0659 & 070
- NRC audits of other control rooms.
- BWR Owner's Group decisions.

Note 3) Schedule to Complete

1. Prior to fuel load
2. After fuel load
3. Never



Reac Water Cleanup
Pump A Cooling Water
High Temp

Reac Water Cleanup
Pump B Cooling Water
High Temp

Reference Drawing 807E175TC

HED Report No. 036, Item 3

Page 5 of 5

WNP-2 CONTROL ROOM ANNUNCIATOR REVIEW

Panel/ Annunciator	Annunciator Meaning	Remarks
P602 A5-4.7	Reactor Water Cleanup Pump Cooling Water High Temperature	Actuated by high temperature on either RWCU pump.
P602 A5-3.1	Reactor Building High Radiation	Actuated by any 1 of 13 ARM's.
P602 A5-4.1	Turbine Building High Radiation	Actuated by any 1 of 5 ARM's.
P602 A5-5.1	Radwaste Building High Radiation	Actuated by any 1 of 9 ARM's.
P602 A5-6.1	Area Radiation Monitors Downscale	Actuated by any 1 of 30 ARM's.

WNP-2 CONTROL ROOM ANNUNCIATOR REVIEW

Panel/ Annunciator	Annunciator Meaning	Remarks
P602 A5-1.6	Remote Shutdown Transfer Switch In Emergency Position	Actuated by any 1 of 20 switches.
P602 A6-6.6	Recirculation Motor A/B High Temperature	Actuated by any 1 of 12 temp sensors on either pump.

ANNUNCIATOR A5 - BOARD P602

Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	Radwaste Controller 1 Trouble W
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale A	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale R	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	Radwaste Controller 2 Trouble W
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample Flow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	Radwaste Controller 3 Trouble W
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump Cooling Water High Temp W	SPARE
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Or Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

W - White
A - Amber
R - Red

ANNUNCIATOR A6 - BOARD P602

SPARE W	Recirc Pump A Trip ATWS Initiated R	Recirc Motor A Bearing Oil High Level A	Recirc Motor B Bearing Oil Low Level A	SPARE W	Recirc Pump B Trip ATWS Initiated R	Recirc Motor B Bearing Oil High Level A	Recirc Motor B Bearing Oil Low Level A
Recirc Pump A Seal Cooling Water Low Flow A	Recirc Pump A Outer Seal High Leakage A	Recirc Pump A Seal Staging Flow High/Low A	Recirc Motor A High Vibration A	Recirc Pump B Seal Cooling Water Low Flow A	Recirc Pump B Outer Seal High Leakage A	Recirc Pump B Seal Staging Flow High/Low A	Recirc Motor B High Vibration A
Recirc Motor A Winding Coolant Leakage A	Recirc Motor A Winding Coolant Low Flow A	Flow Cont Valve A Hyd Power Unit Startup Inhibited A	Flow Cont Valve A Hyd Power Unit Standby Hyd Pump Operating A	Recirc Motor B Winding Coolant Leakage A	Recirc Motor B Winding Coolant Low Flow A	FLow Cont Valve B Hyd Power Unit Startup Inhibited A	Flow Cont Valve B Hyd Power Unit Standby Hyd Pump Operating A
Recirc Motor A Lockout Bus Under Voltage A	Recirc Motor A Bkr Trip Circuit Under Voltage A	Recirc Motor A Overcurrent Or Ground A	Flow Cont Valve A Hyd Power Unit Control System Abnormal A	Recirc Motor B Lockout Bus Under Voltage A	Recirc Motor B Bkr Trip Circuit Under Voltage A	Recirc Motor B Overcurrent or Ground A	Flow Cont Valve B Hyd Power Unit Control System Abnormal A
Recirc Drywell High Press Switch A In Test A	System A Drywell High Pressure Interlock A	Flow Cont Valve A Motion Inhibited A	Flow Cont Valve A Maximum Open Limited A	Recirc Drywell High Press Switch In Test A	System B Drywell High Pressure Interlock A	Flow Cont Valve B Motion Inhibited A	Flow Cont Valve B Maximum Open Limited A
Flow Cont Valve A Servo Input Control Signal Abnormal A	FLux Controller Output Signal Abnormal A	Master Controller Output Signal Abnormal A	SPARE W	Flow Cont Valve B Servo Input Control Signal Abnormal A	Recirc Pump/Motor A or B High Temp A	ATWS A or B Test Switch In Test A	Recirc System Approaching Auto Flow Range Limit A

W - White
A - Amber
R - Red

ANNUNCIATOR A13 - BOARD P602

REACTOR BLDG FLOOR DRAIN SUMP LEVEL HIGH-HIGH A	SPARE W	Recirc Pump A Low Speed Auto Transfer CKT Not Avail W	Recirc Pump B Low Speed Auto Transfer CKT Not Avail W	Recirc Motor A Breaker Trip R
Reactor Bldg Floor Drain Sump Level (C002A) High-High A	Reactor Bldg Floor Drain Sump Level (C002B) High-High W	Recirc Pump Motor A Auto Transfer Incomplete W	Recirc Pump Motor B Auto Transfer Incomplete W	Recirc Motor A Lockout R
Reactor Bldg Equip Drain Sump High Level W	SPARE W	Recirc Pump HTR A Auto Trip Dr Transfer to Low Speed W	Recirc Pump HTR B Auto Trip Dr Transfer to Low Speed W	SPARE W
Reactor Bldg Equip Drain Sump High Temp W	SPARE W	Recirc MG Set A Protective Relay Trip W	Recirc MG Set B Protective Relay Trip W	Recirc Motor B Breaker Trip R
RCIC To RHR A STEAM TRAP HIGH LEVEL W	RCIC To RHR B STEAM TRAP HIGH LEVEL W	Recirc MG Set A Interlock Bypass A	Recirc MG Set B Interlock Bypass A	Recirc Motor B Lockout R
RCIC To RHR A/B STEAM TRAP HIGH LEVEL W	RCIC TURBINE EXH DRAIN LEG LEVEL HIGH W	SPARE W	SPARE W	SPARE W

W - White
A - Amber
R - Red

ANNUNCIATOR A5 - BOARD P602

ARM	PRM				RWCU	
Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	SPARE W (1)
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale W	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale A	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	SPARE W (1)
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample FLow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	SPARE W (1)
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump A Cooling Water High Temp (2)W	Reac Water Cleanup Pump B Cooling Water ~~High Temp W(2)~~
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Or Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE W
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

Notes: (1) Relocated to annunciator A13-P602

(2) Existing annunciator A5-4.7 split into two (2) annunciators.

W - White

A - Amber

R - Red

ANNUNCIATOR A13 - BOARD P602

Radwaste		Recirc.		
Reactor Bldg Floor Drain Sump Level (C003) High-High A(1)	SPARE	Recirc Pump A Low Speed Auto Transfer A CKT Not Avail (4)	Recirc Pump B Low Speed Auto Transfer A CKT Not Avail (4)	Recirc Motor A Breaker Trip R
Reactor Bldg Floor Drain Sump Level (C002A) High-High A	Reactor Bldg Floor Drain Sump Level (C002B) High-High A	Recirc Pump Motor A Auto Transfer Incomplete A(4)	Recirc Pump Motor B Auto Transfer Incomplete A(4)	Recirc Motor A Lockout R
Reactor Bldg Equip Drain Sump High Level W	SPARE W	Recirc Pump MTR A Auto Trip Or Transfer to Low Speed A(4)	Recirc Pump MTR B Auto Trip Or Transfer to Low Speed A(4)	SPARE W
Reactor Bldg Equip Drain Sump High Temp W	Radwaste Controller 1 Trouble W (3)	Recirc MG Set A Protective Relay Trip A(4)	Recirc MG Set B Protective Relay Trip A(4)	Recirc Motor B Breaker Trip R
SPARE W (2)	Radwaste Controller 2 Trouble W (2)(3)	Recirc MG Set A Interlock Bypass A	Recirc MG Set B Interlock Bypass A	Recirc Motor B Lockout R
Annunciator Loss of 125 VDC A (5)(2)	Radwaste Controller 3 Trouble W (2)(3)	SPARE W	SPARE W	SPARE W

Notes: (1) Currently in window 1.1. GE drawing 807E174TC Rev. 9 specifies window 1.2. GE Drawing should be corrected.
(2) Existing annunciator relocated to P601, see P601 annunciator review for specific location.
(3) Relocated from annunciator A5-P602.
(4) Windows are currently white. GE drawing 761E791AD specifies amber.
(5) Relocated from P603 annunciator A7-4.8.

W - White
A - Amber
R - Red

ANNUNCIATOR A6 - BOARD P602

Recirc A				Recirc B			
SPARE W	Recirc Pump A Trip ATWS Initiated R	Recirc Motor A Bearing Oil High Level A	Recirc. Motor A Bearing Oil Low Level A	SPARE W	Recirc Pump B Trip ATWS Initiated R	Recirc Motor B Bearing Oil High Level A	Recirc Motor B Bearing Oil Lo Level A
Recirc Pump A Seal Cooling Water Low Flow A	Recirc Pump A Outer Seal High Leakage A	Recirc Pump A Seal Staging Flow High/Low A	Recirc Motor A High Vibration A	Recirc Pump B Seal Cooling Water Low Flow A	Recirc Pump B Outer Seal High Leakage A	Recirc Pump B Seal Staging Flow High/Low A	Recirc Motor B High Vibration A
Recirc Motor A Winding Coolant Leakage A	Recirc Motor A Winding Coolant Low Flow A	Flow Cont Valve A Hyd Power Unit Startup Inhibited A	Flow Cont Valve A Hyd Power Unit Standby W Hyd Pump Operatin	Recirc Motor B Winding Coolant Leakage A	Recirc Motor B Winding Coolant Low Flow A	FLow Cont Valve B Hyd Power Unit Startup Inhibited A	Flow Cont Valve B Hyd Power Unit Standby W Hyd Pump Operating
Recirc Motor A Lockout Bus Under Voltage A	Recirc Motor A Bkr Trip Circuit Under Voltage A	Recirc Motor A Overcurrent Or Ground A	Flow Cont Valve A Hyd Power Unit Control System Abnormal A	Recirc Motor B Lockout Bus Under Voltage A	Recirc Motor B Bkr Trip Circuit Under Voltage A	Recirc Motor B Overcurrent or Ground A	Flow Cont Valve B Hyd Power Unit Control System Abnormal A
Recirc Drywell High Press Switch A In Test W	System A Drywell High Pressure Interlock A	Flow Cont Valve A Motion Inhibited A	Flow Cont Valve A Maximum Open Limited A	Recirc Drywell High Press Switch In Test W	System B Drywell High Pressure Interlock A	Flow Cont Valve B Motion Inhibited A	Flow Cont Valve B Maximum Open Limited A
Flow Cont Valve A Servo Input Control Signal Abnormal A	FLux Controller Output Signal Abnormal A	Master Controller Output Signal Abnormal A	SPARE W	Flow Cont Valve B Servo Input Control Signal Abnormal A	Recirc Pump/Motor A or B High Temp A	ATWS A or B Test Switch In Test W	Recirc System Approaching Auto Flow Range Limit A

W - White
A - Amber
R - Red

F-81-9694

INTEROFFICE MEMORANDUM

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Distribution:
- ☐ EDC WNP-1/4
- ☒ EDC WNP-2
- ☐ EDC WNP-3/5
- ☐ Admin File

Date: November 2, 1981

To: GJ Freeman, Control Room Program Manager

From: RG DaValle, Control Room Design Review Coordinator

Subject: HUMAN ENGINEERING CHANGES
P602 - ANNUNCIATOR SYSTEM PANELS

R G DaValle

Reference:

L Carey - 917Q
WP Gilles - 906D
CH McGilton - 906D
B Van Erem - 926
EAF/LB
RGD/LB
sf (2)
pf

The following Human Engineering Discrepancy (HED report is attached for your concurrence.

HED Report No. 036

The Task Force will be available to discuss and resolve any concerns you might have on the recommended changes. When your reviews are completed, a letter of concurrence is required for our files to identify approved HED changes.

RGD/jca

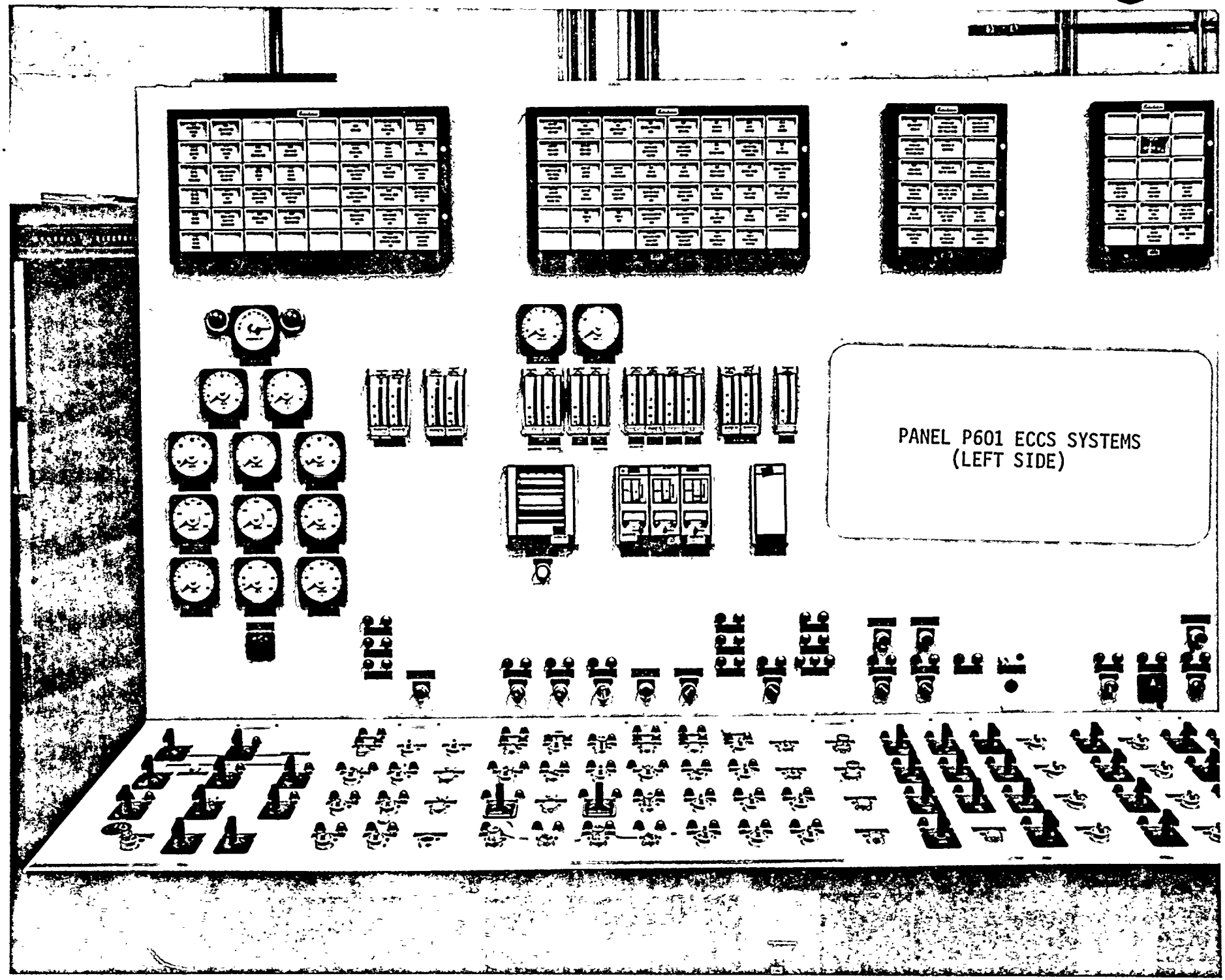
Concurrence:

B Van Erem — Burns & Roe Engineering Control Room Review Task Force Member

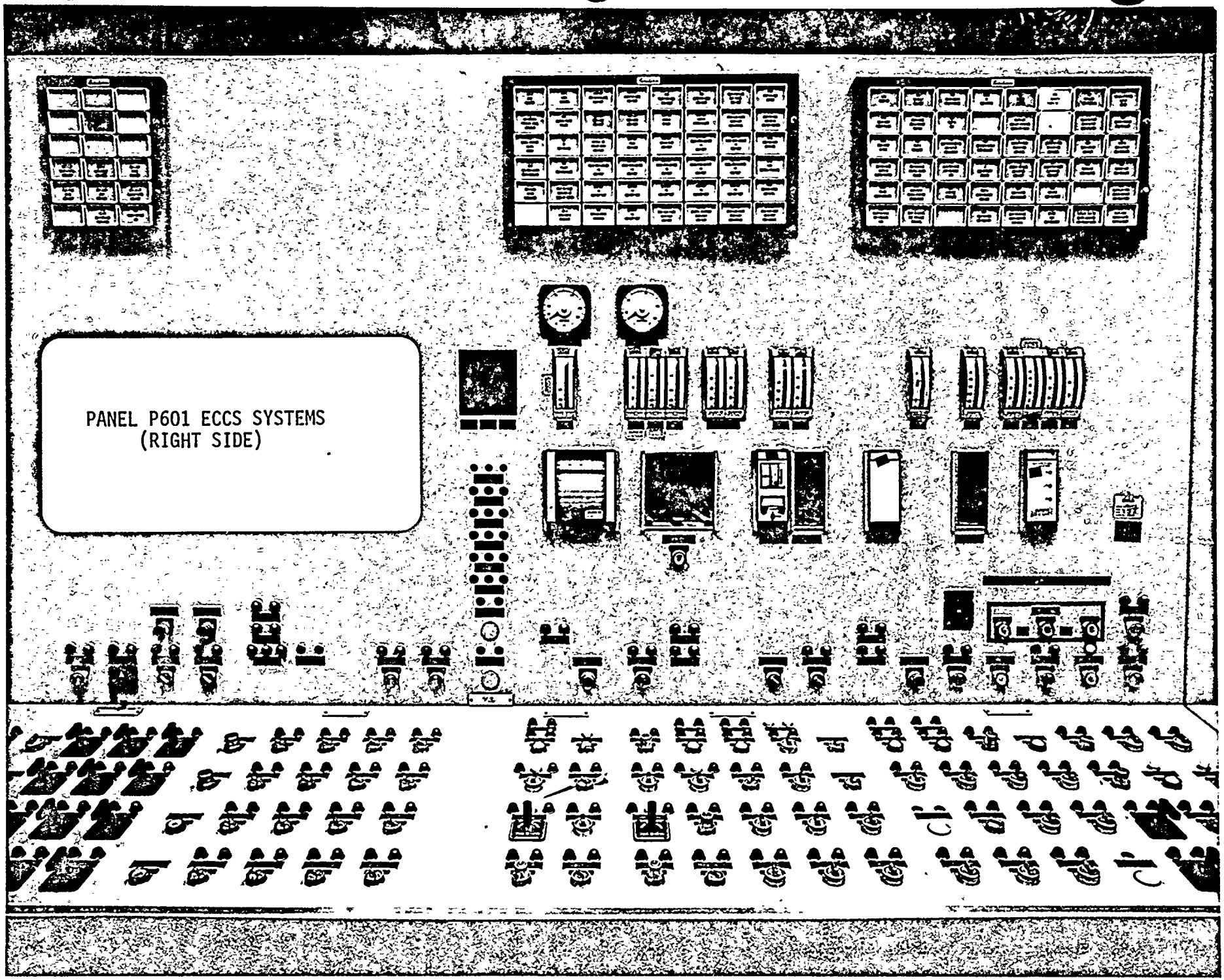
C H McGilton — Supply System Operations Control Room Review Task Force Member

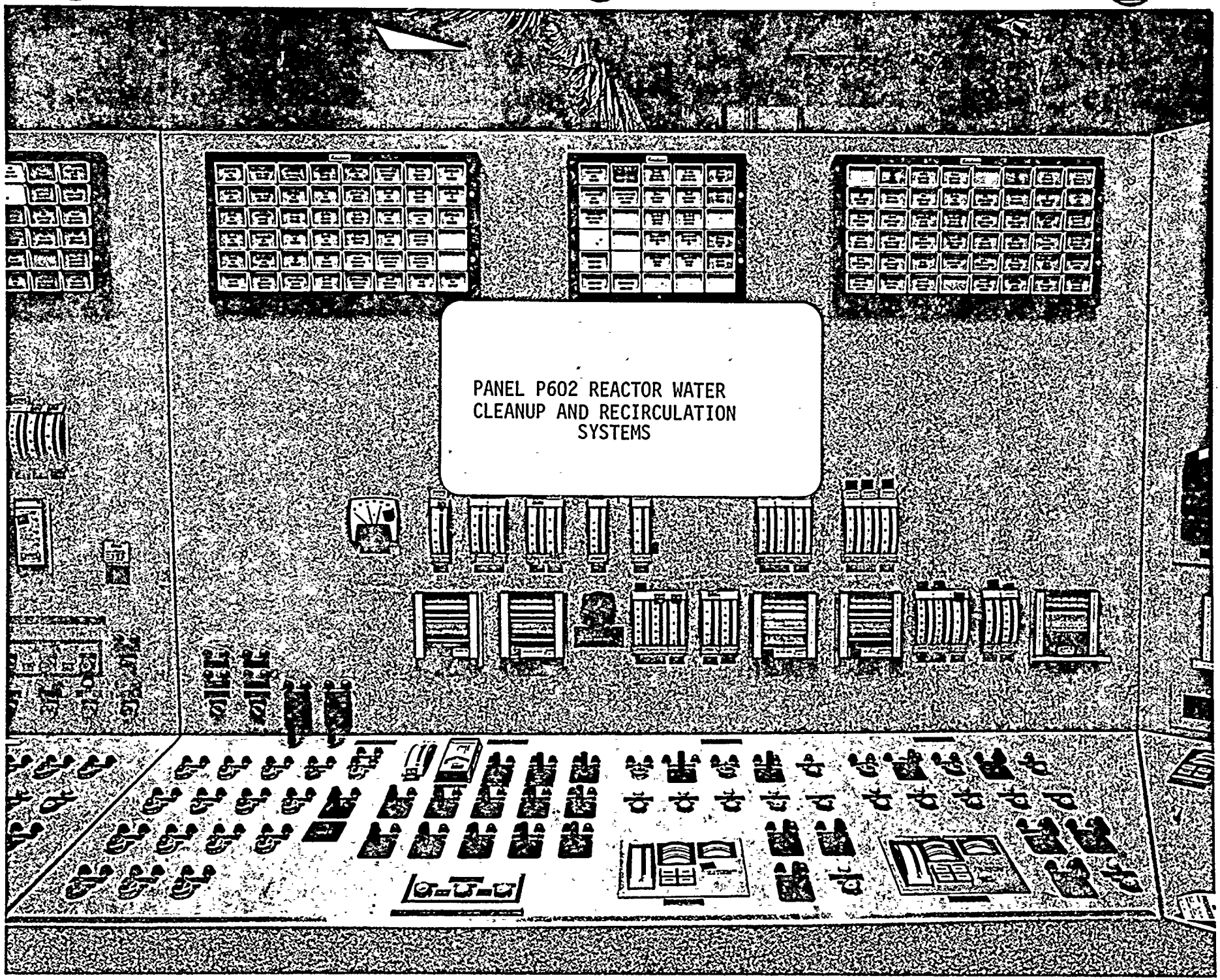
APPENDIX C

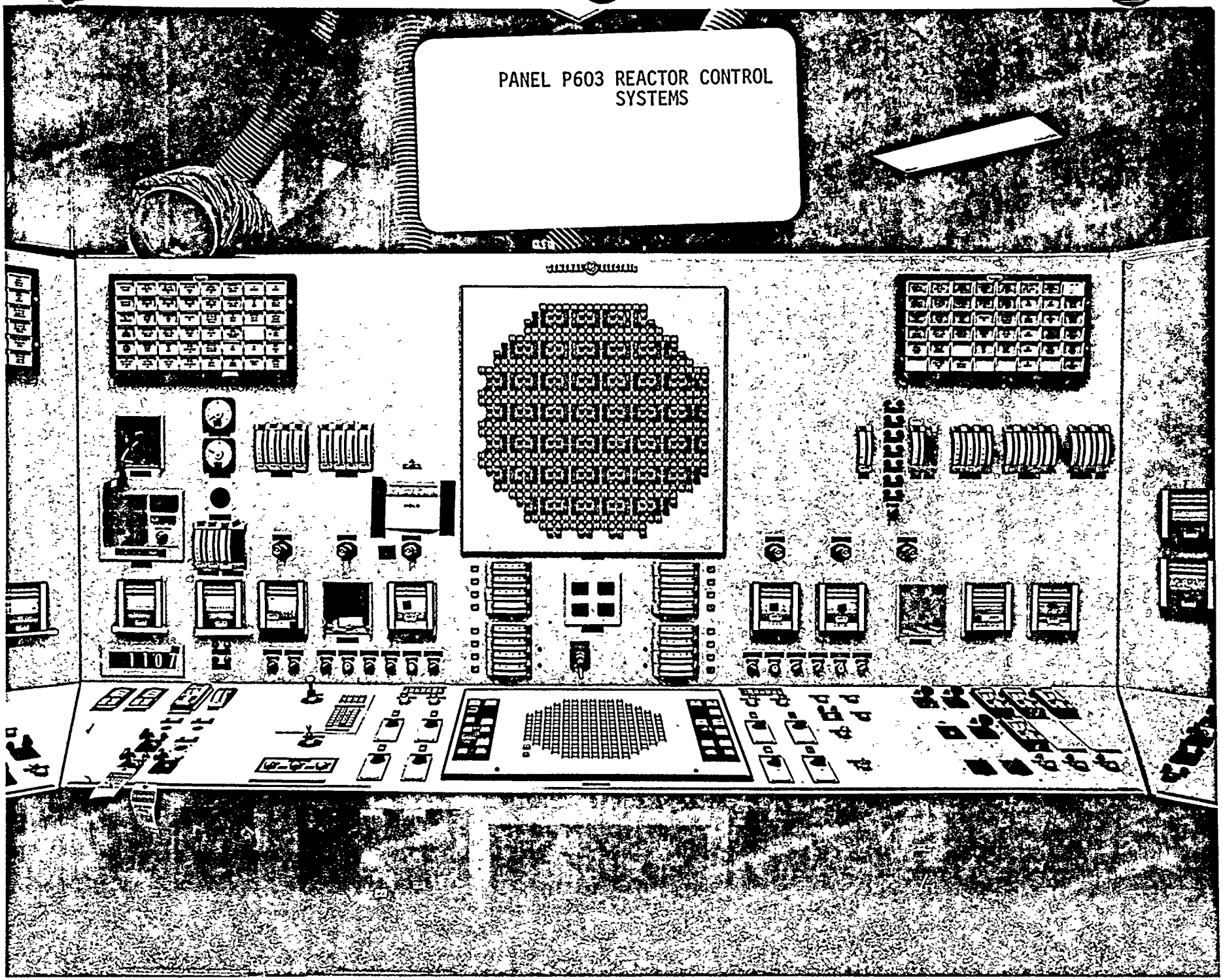
WNP-2 - CONTROL ROOM PICTURES



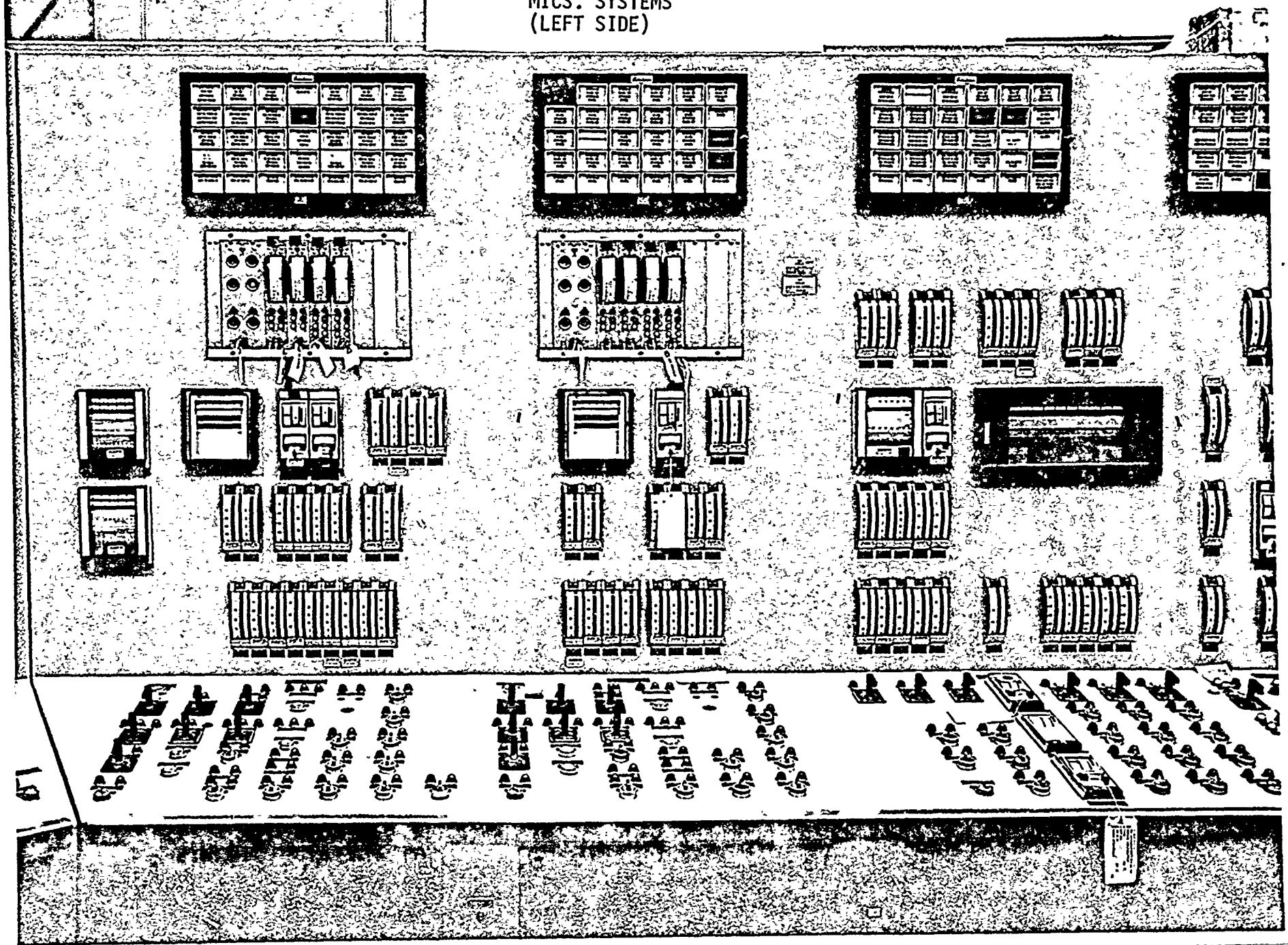
PANEL P601 ECCS SYSTEMS
(LEFT SIDE)


PANEL P601 ECCS SYSTEMS
(RIGHT SIDE)


PANEL P602 REACTOR WATER
CLEANUP AND RECIRCULATION
SYSTEMS

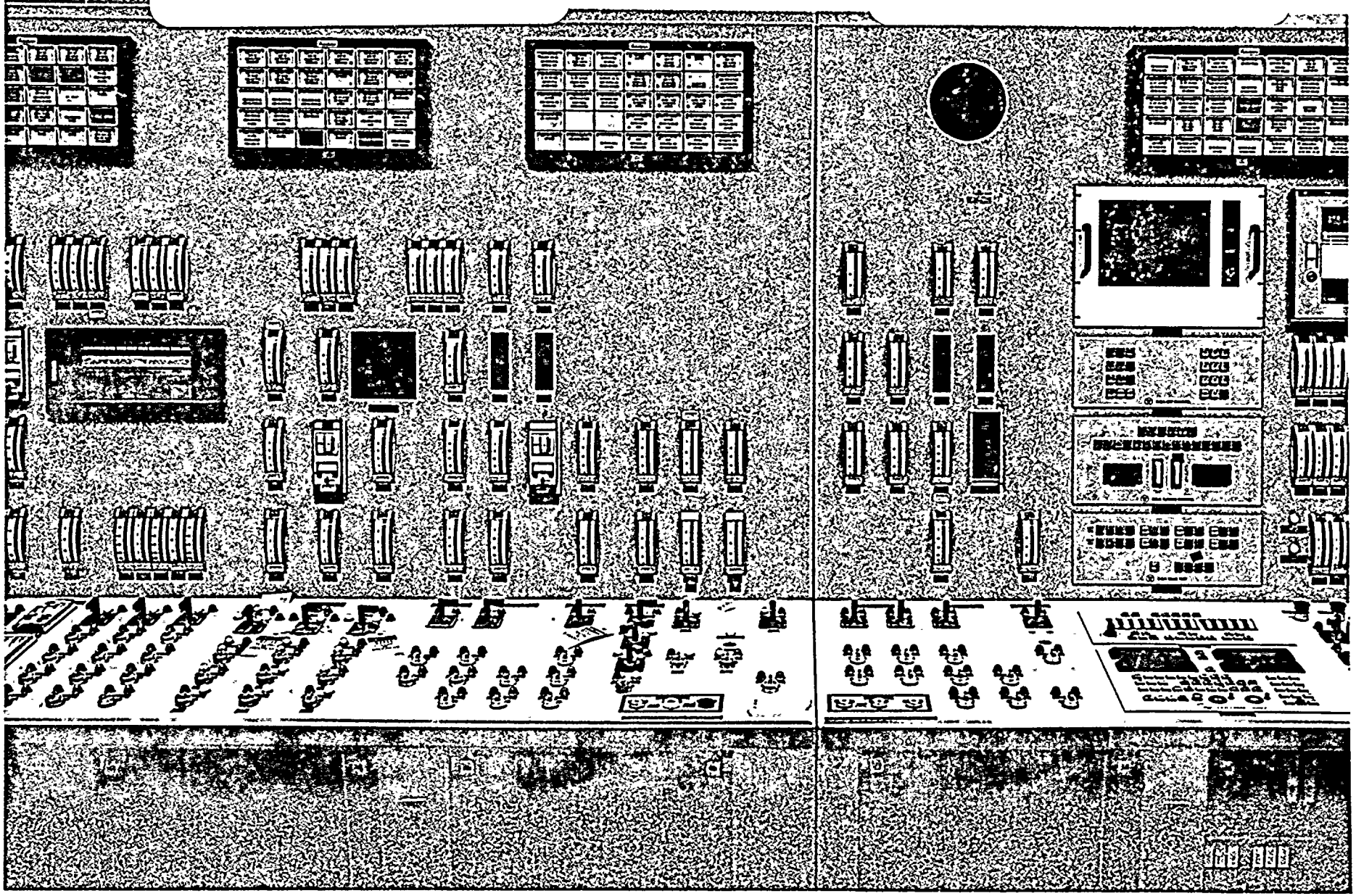

PANEL P603 REACTOR CONTROL
SYSTEMS

PANEL P840 REACTOR FEEDWATER AND
MICS. SYSTEMS
(LEFT SIDE)

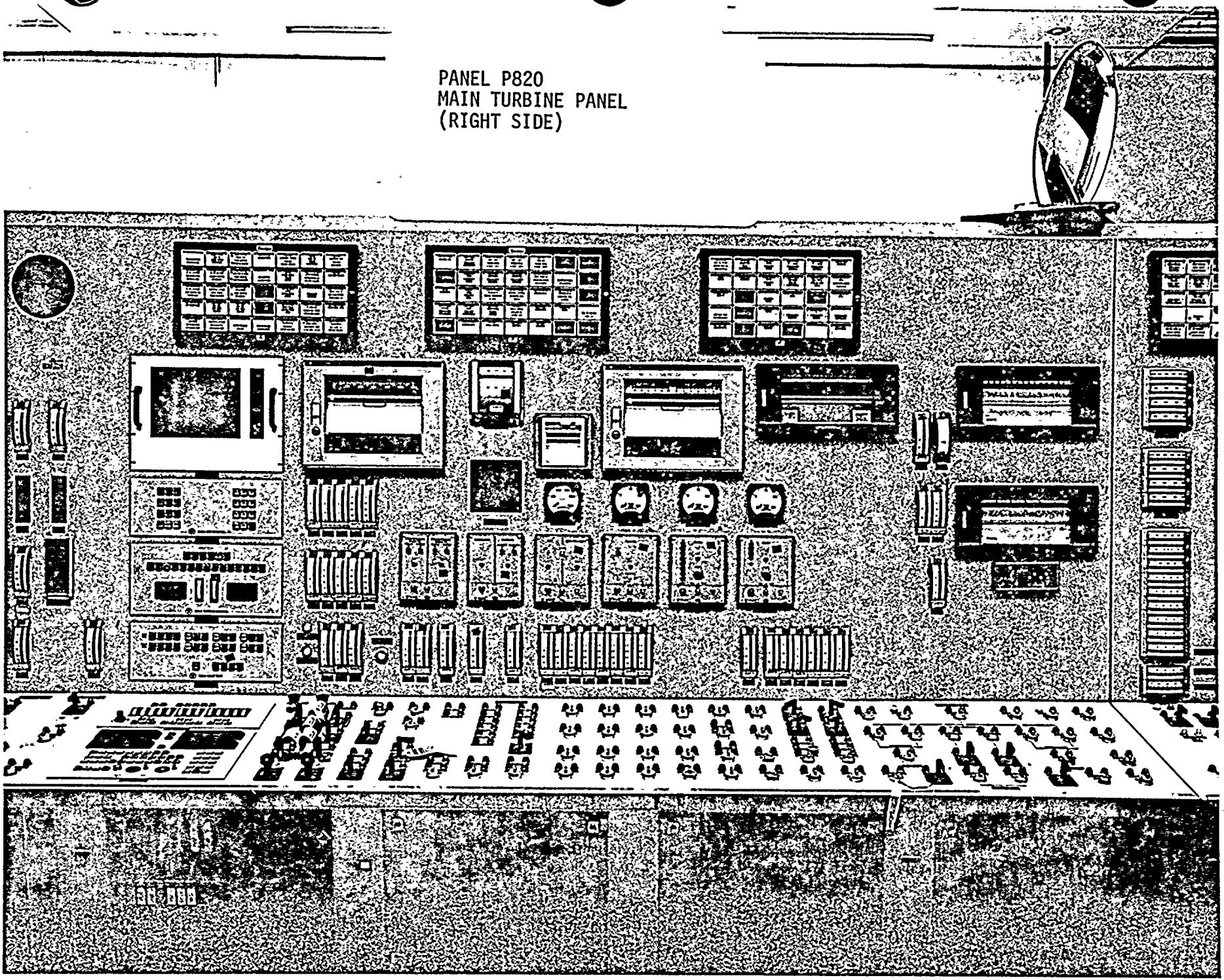


PANEL P840
REACTOR FEEDWATER AND MISC
SYSTEMS (RIGHT SIDE)

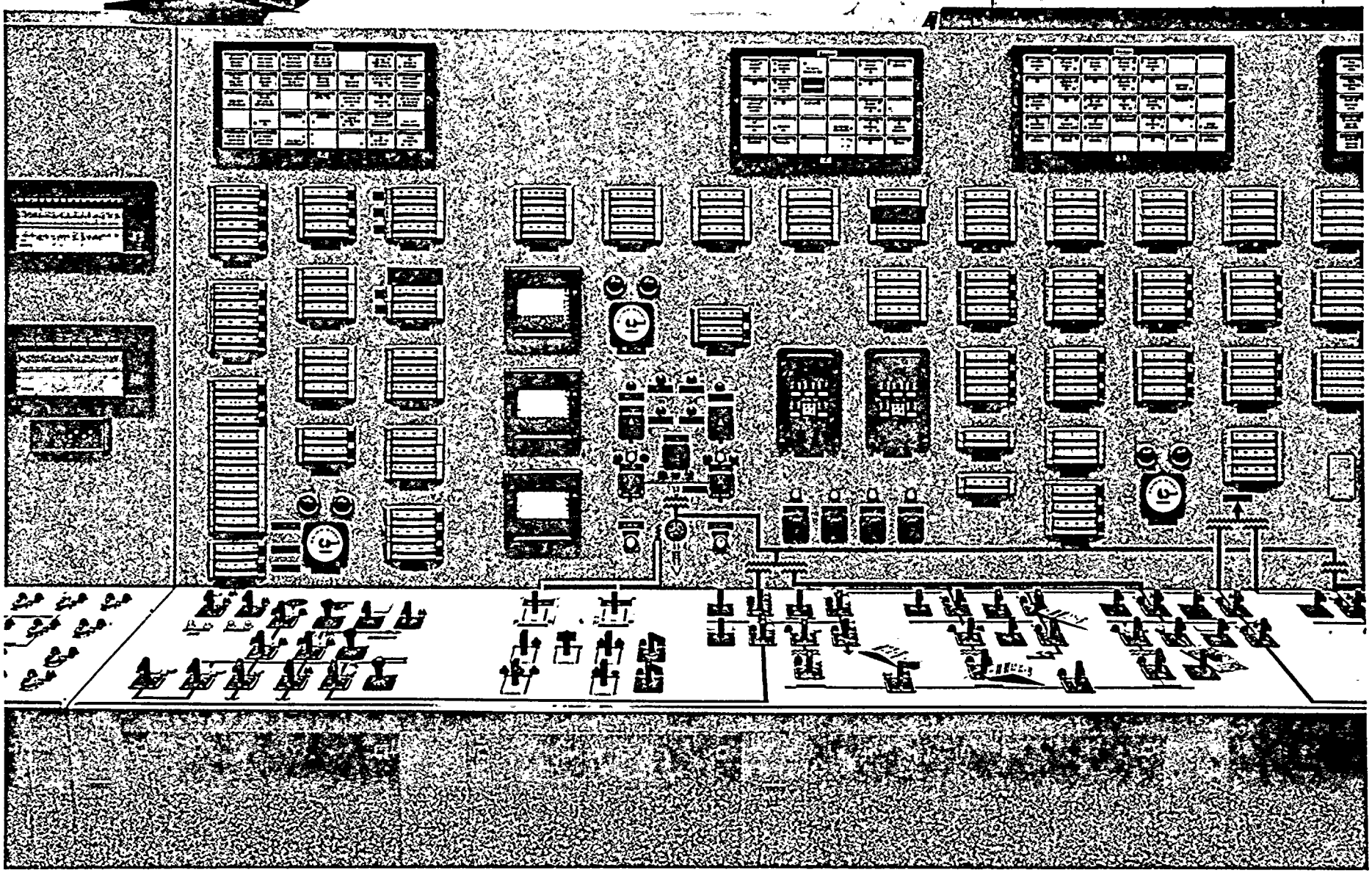
PANEL 820
MICELLANEOUS SYSTEMS (LEFT SIDE)



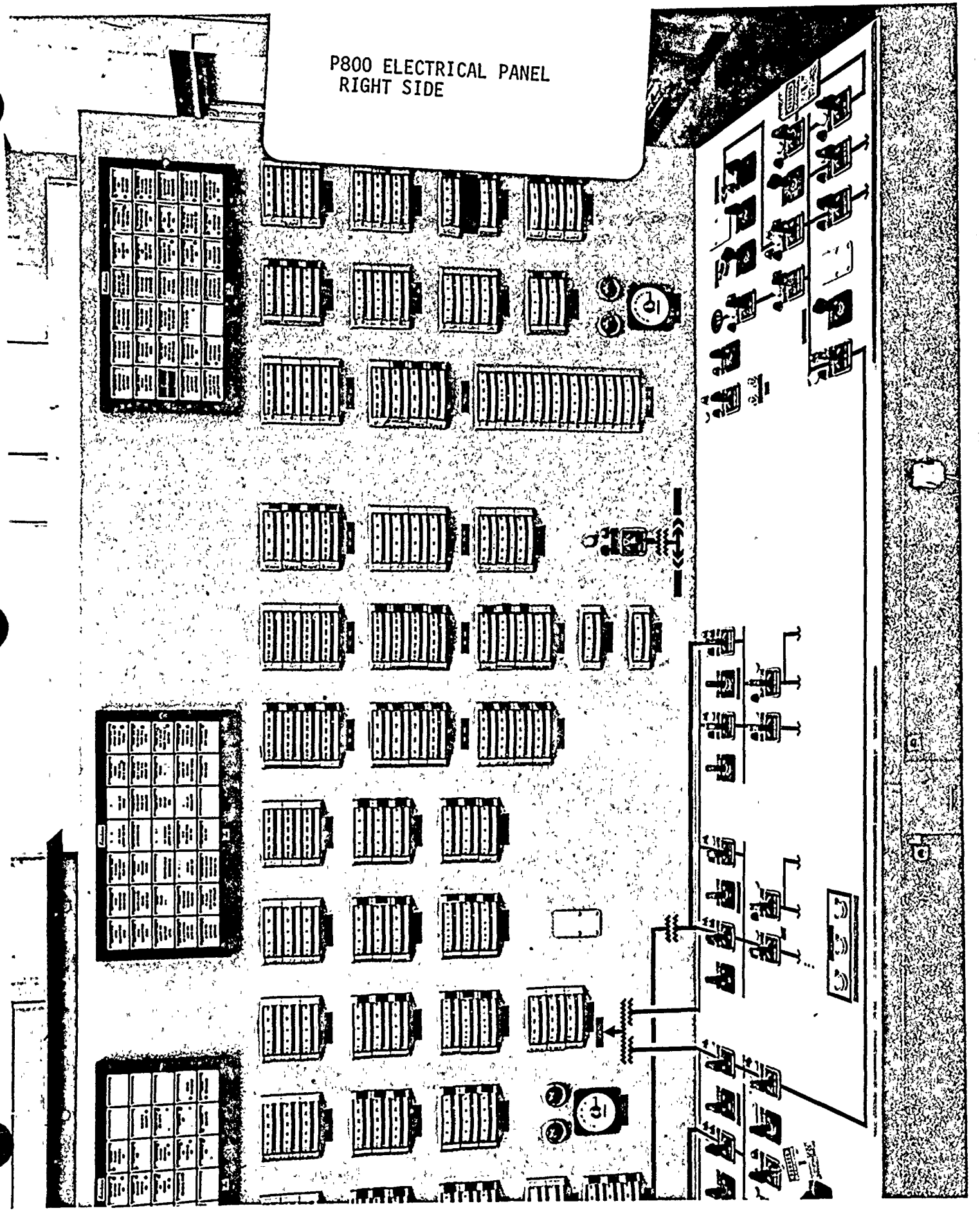
PANEL P820
MAIN TURBINE PANEL
(RIGHT SIDE)

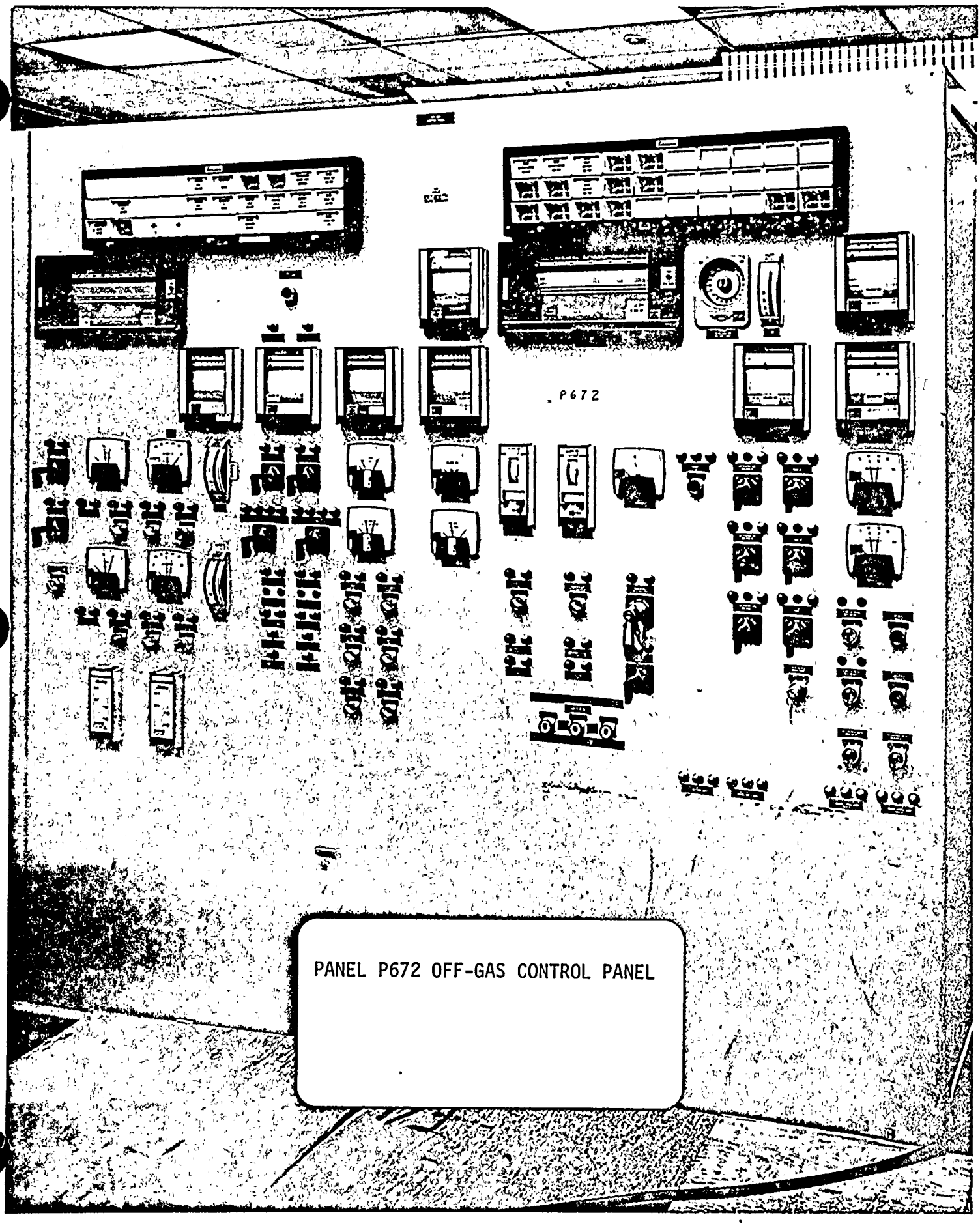


PANEL P800 ELECTRICAL
PANEL (LEFT SIDE)

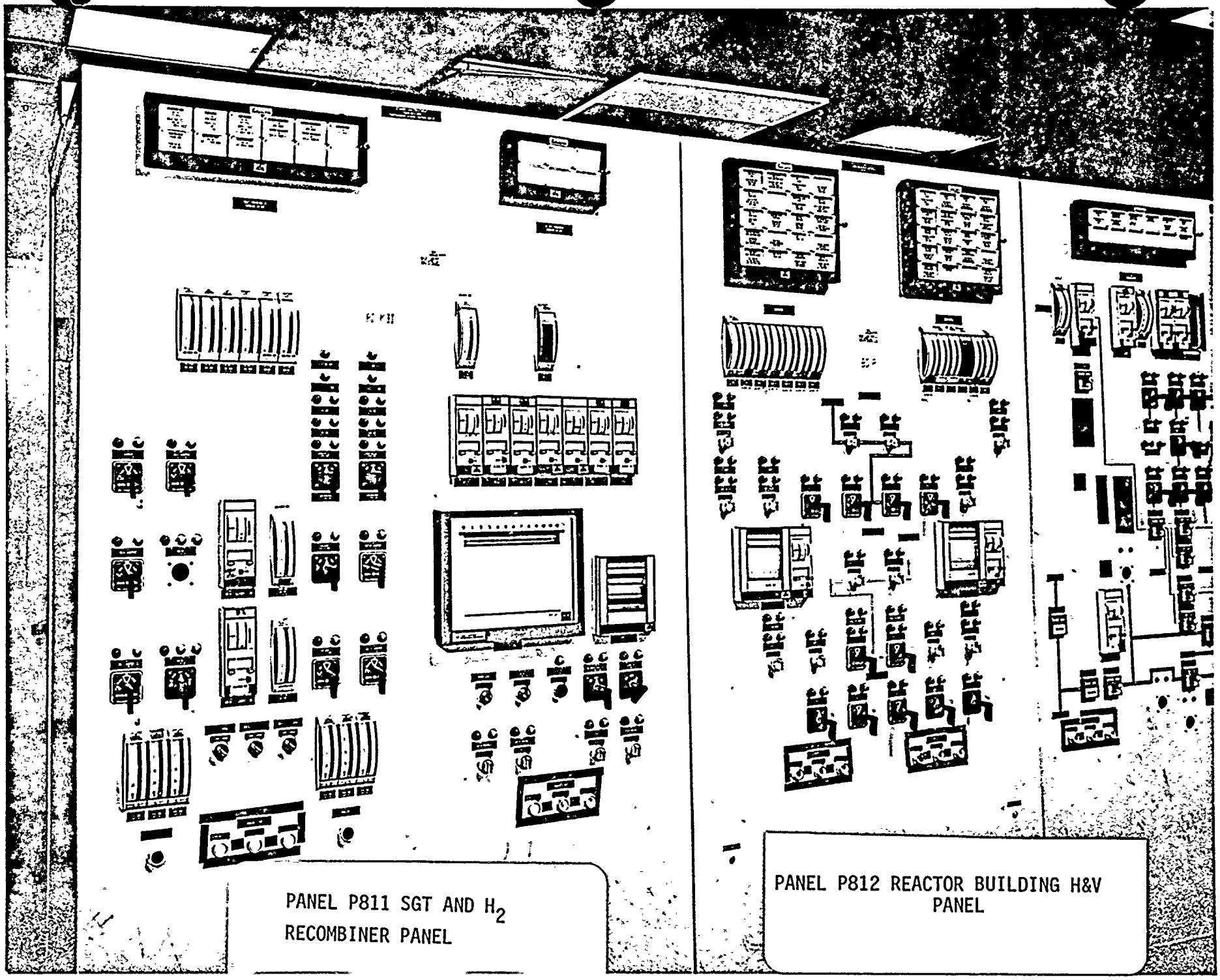


P800 ELECTRICAL PANEL
RIGHT SIDE



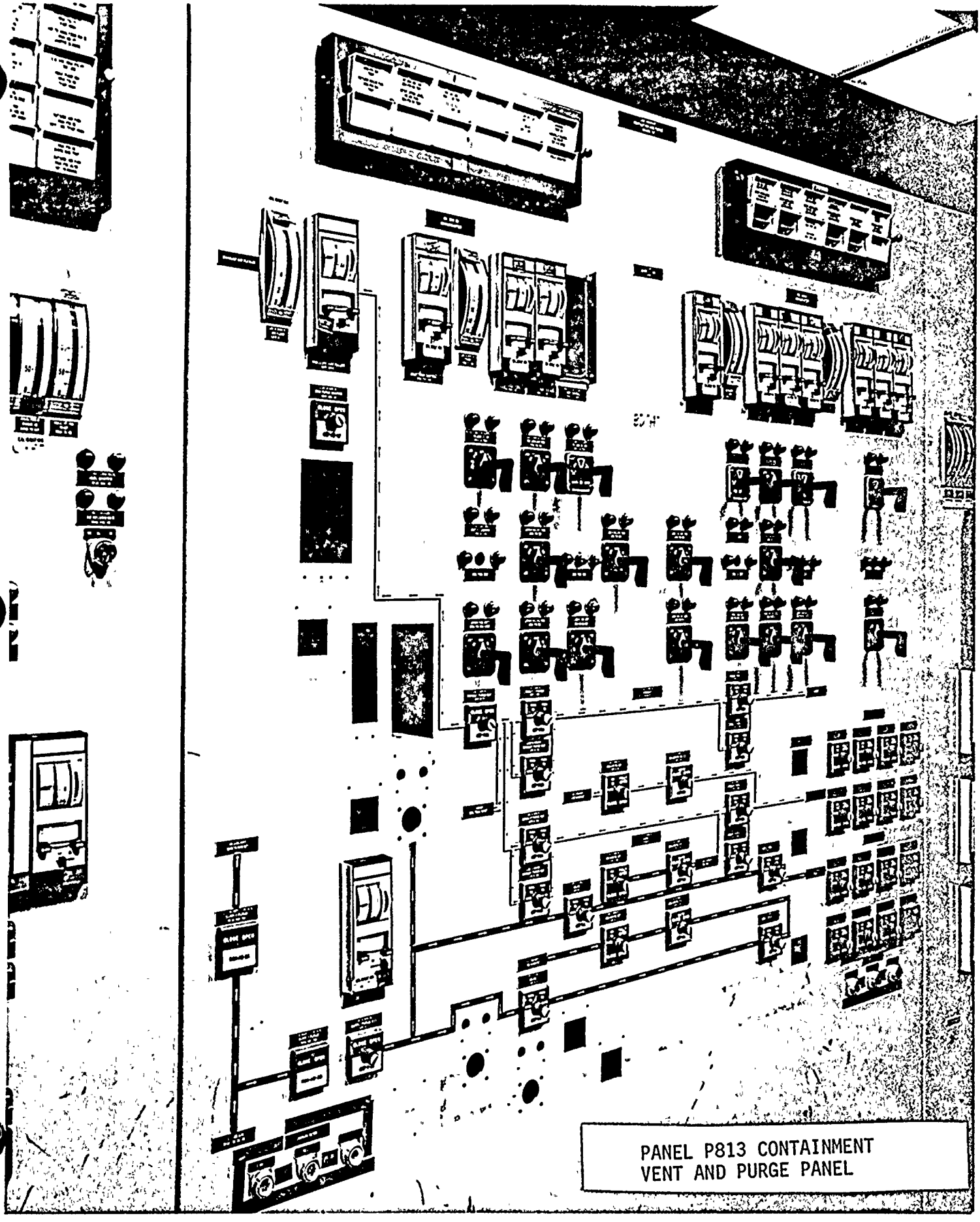


PANEL P672 OFF-GAS CONTROL PANEL



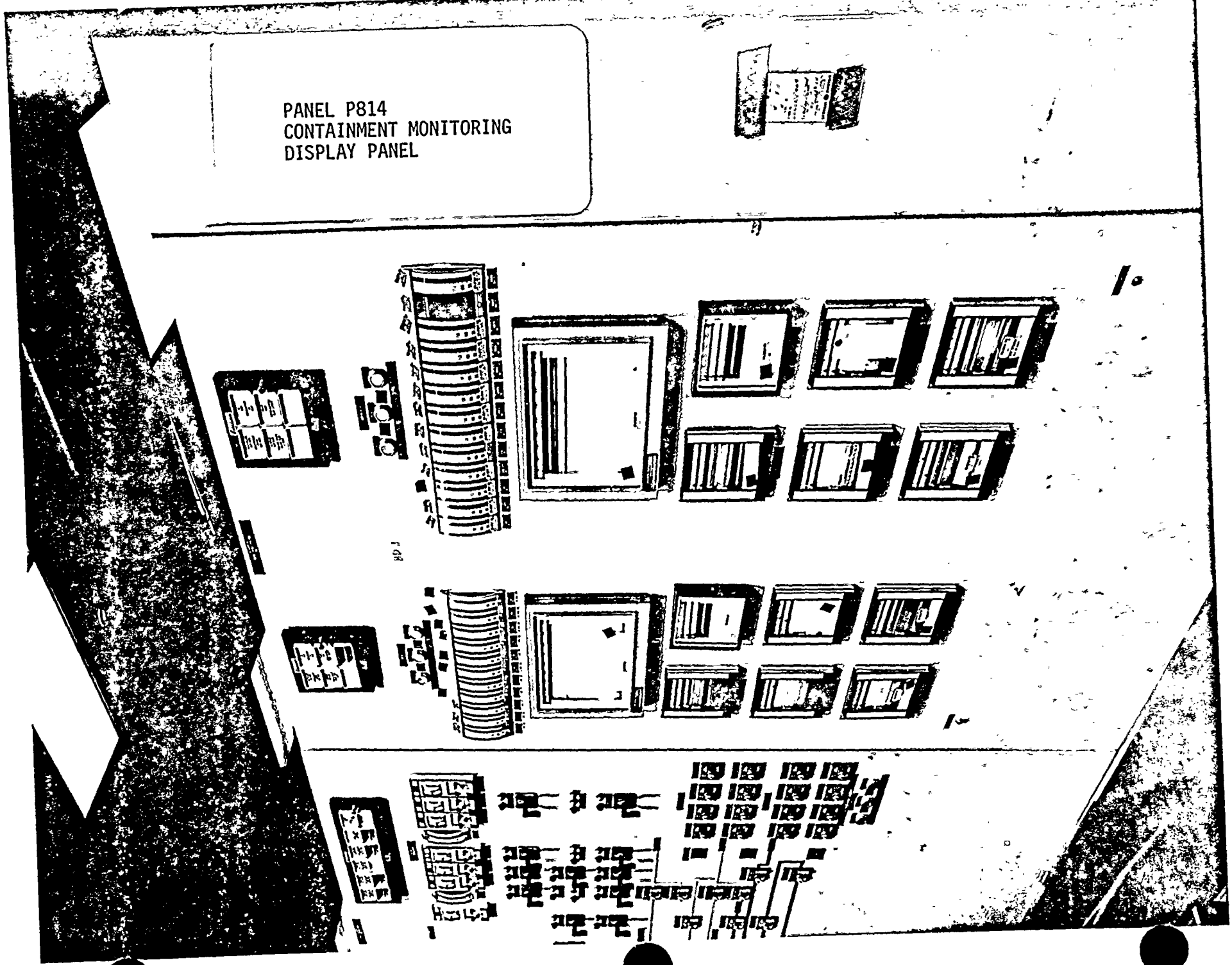
PANEL P811 SGT AND H_2 RECOMBINER PANEL

PANEL P812 REACTOR BUILDING H&V PANEL

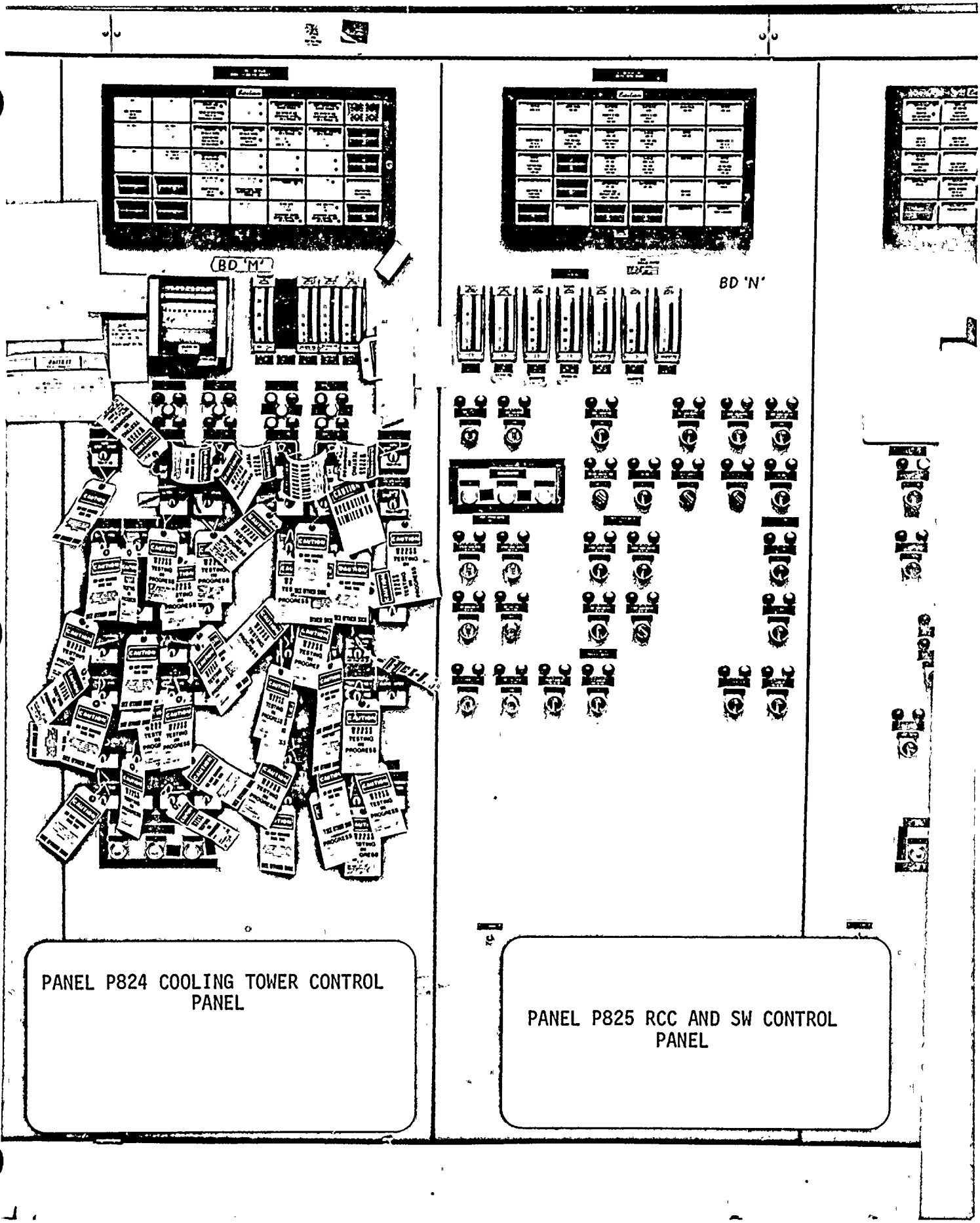


PANEL P813 CONTAINMENT
VENT AND PURGE PANEL

PANEL P814
CONTAINMENT MONITORING
DISPLAY PANEL



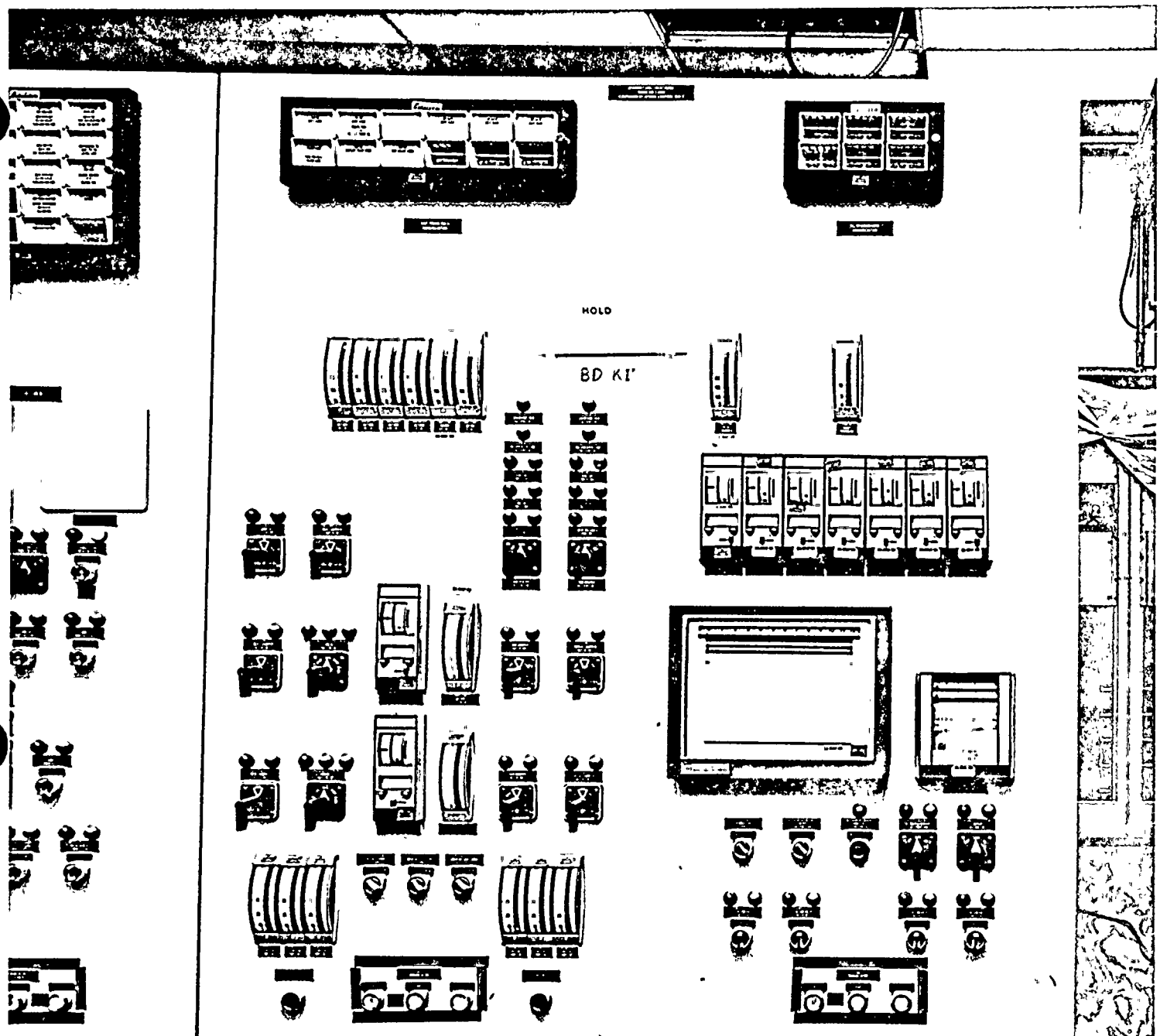
PANEL P821 MAIN STEAM
LEAKAGE CONTROL PANEL



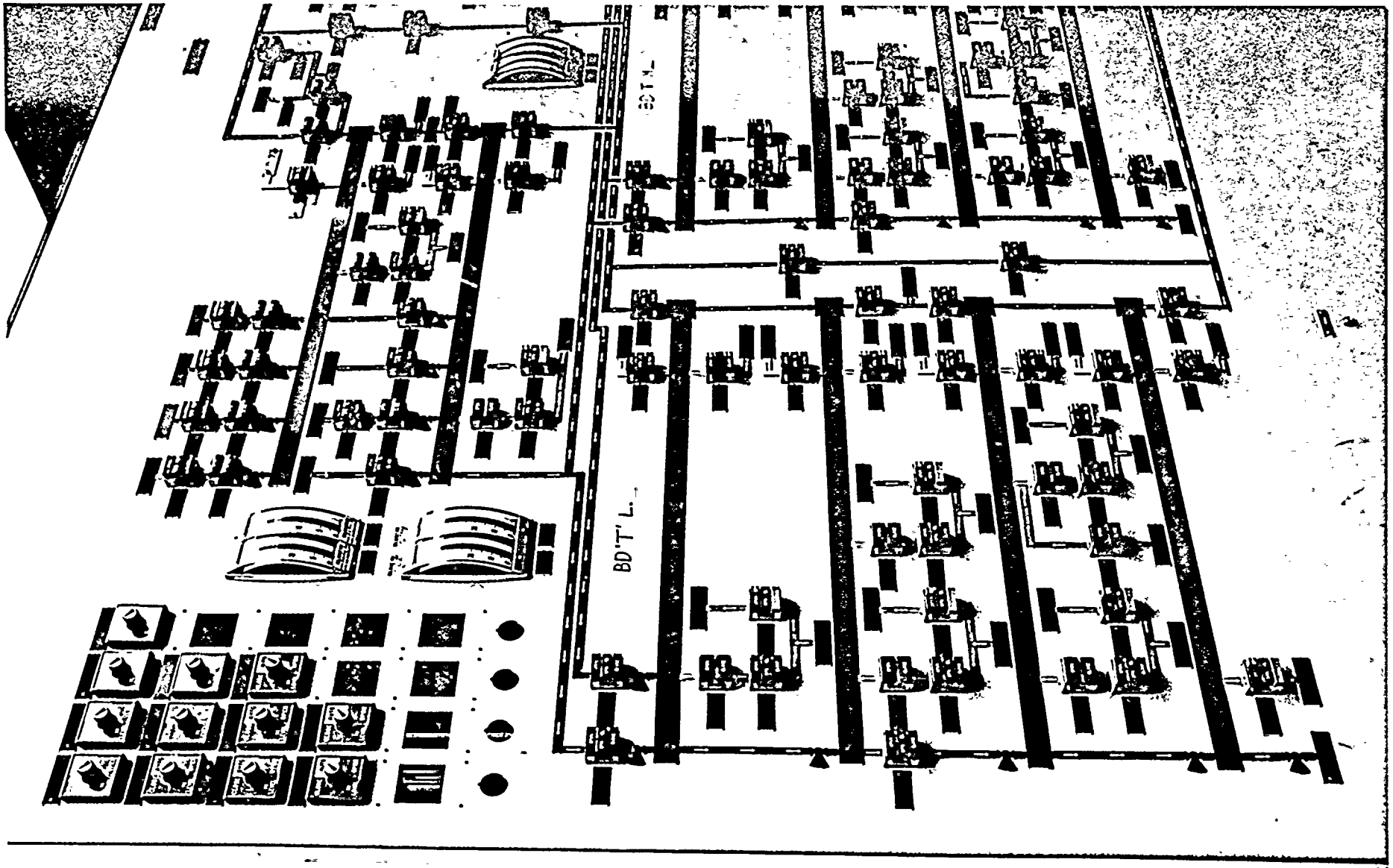
PANEL P824 COOLING TOWER CONTROL PANEL

PANEL P825 RCC AND SW CONTROL PANEL

PANEL P826 CONTROL ROOM HVAC PANEL

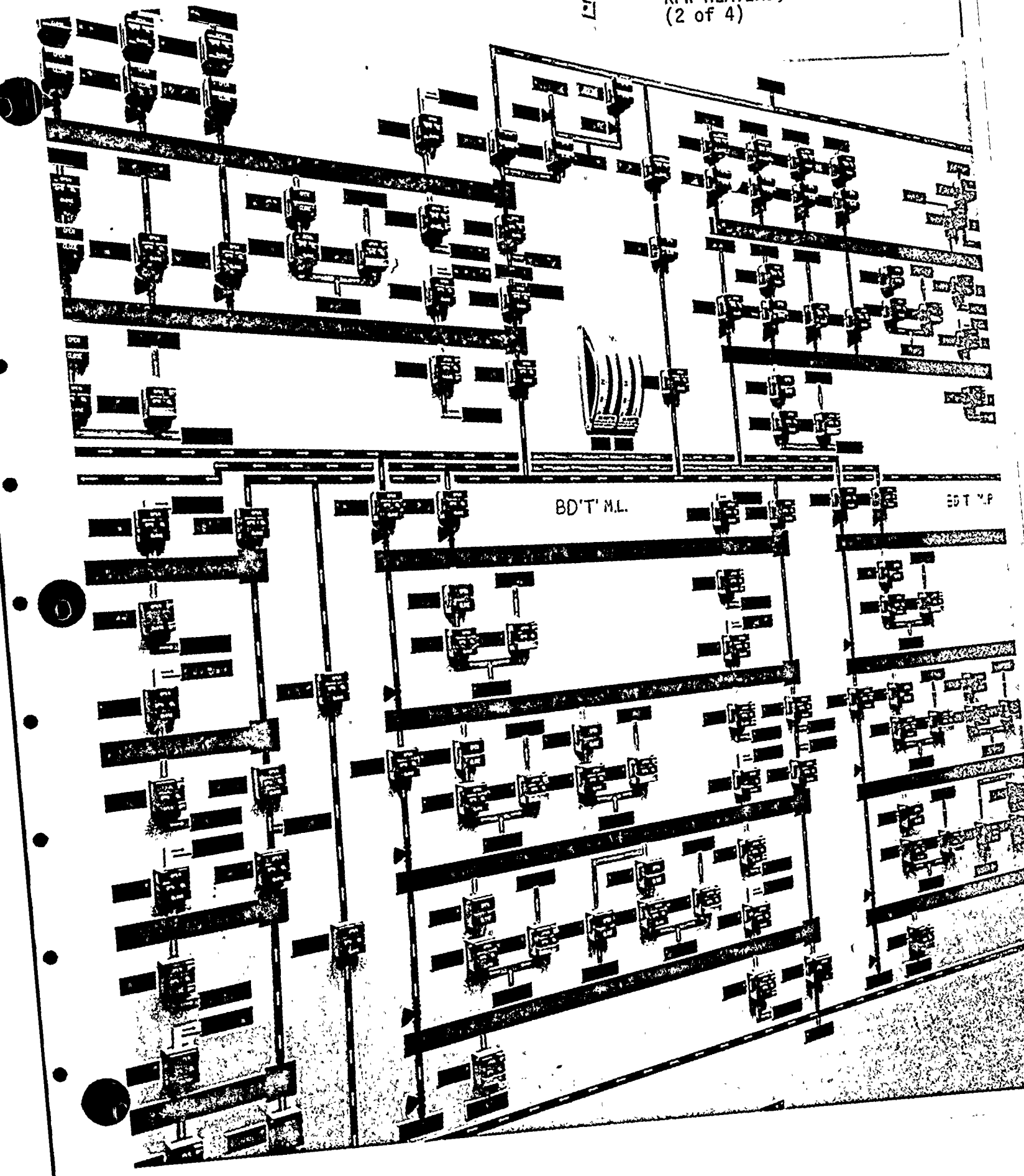


PANEL P827 SGT AND H_2
RECOMBINER PANEL

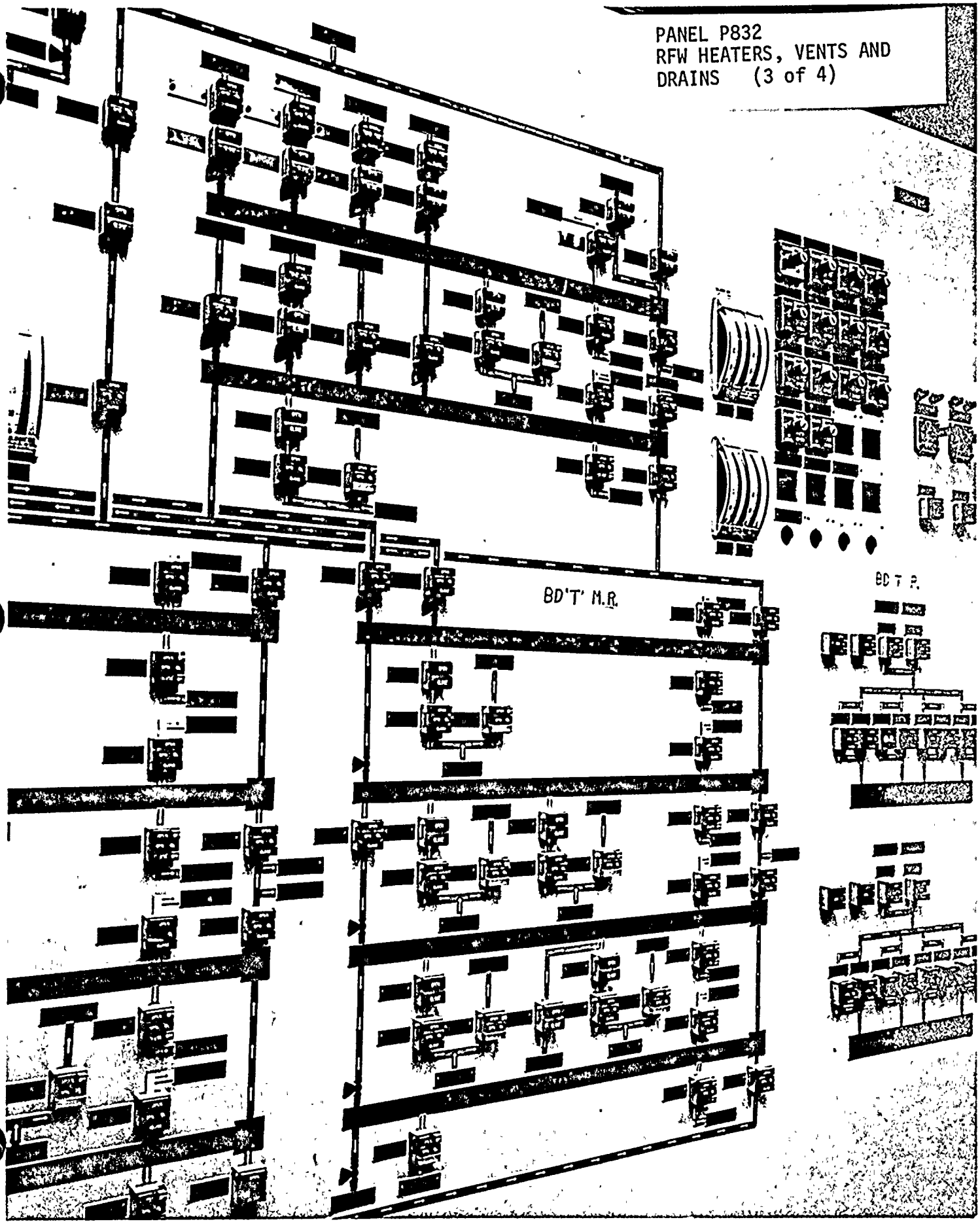


PANEL P832
RFW HEATERS
VENTS AND DRAINS (1 of 4)

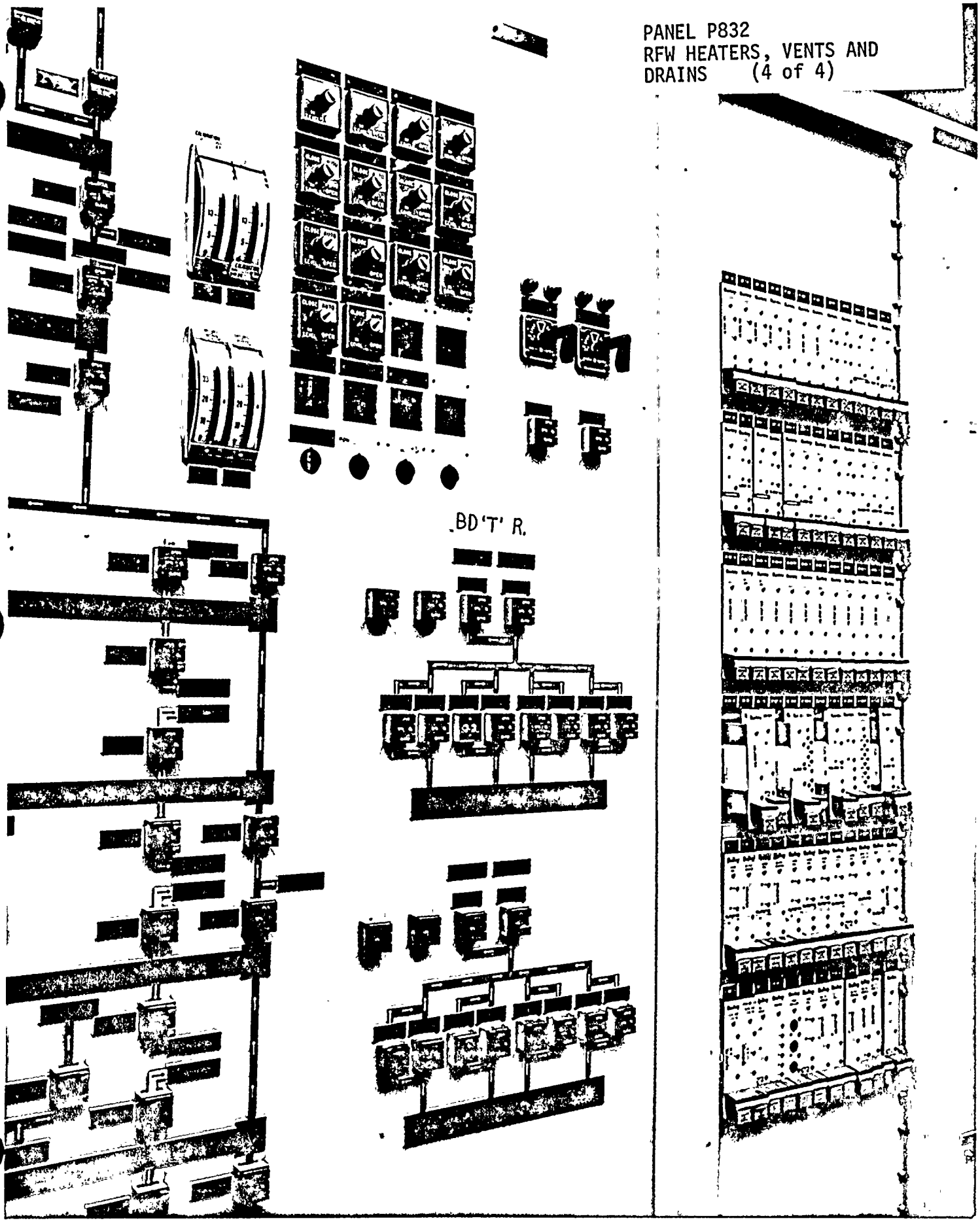
PANEL P832
RFW HEATERS, VENTS AND DRAINS
(2 of 4)

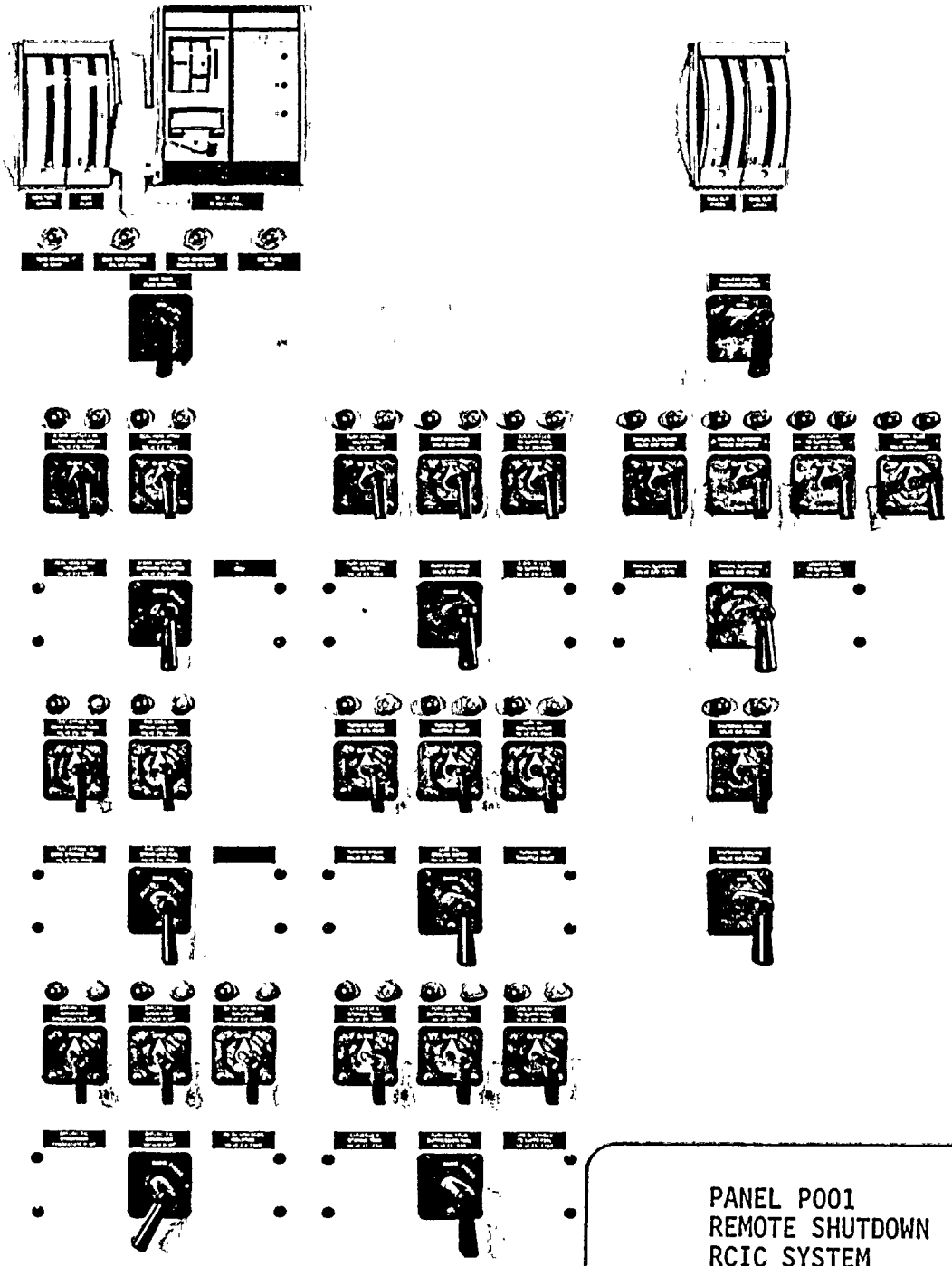


PANEL P832
RFW HEATERS, VENTS AND
DRAINS (3 of 4)

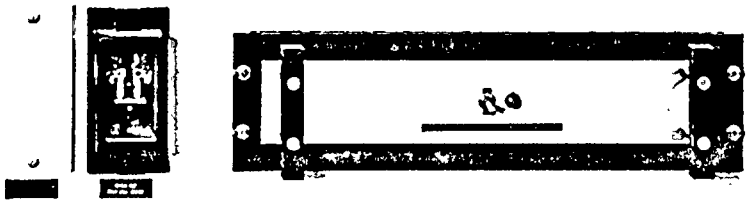


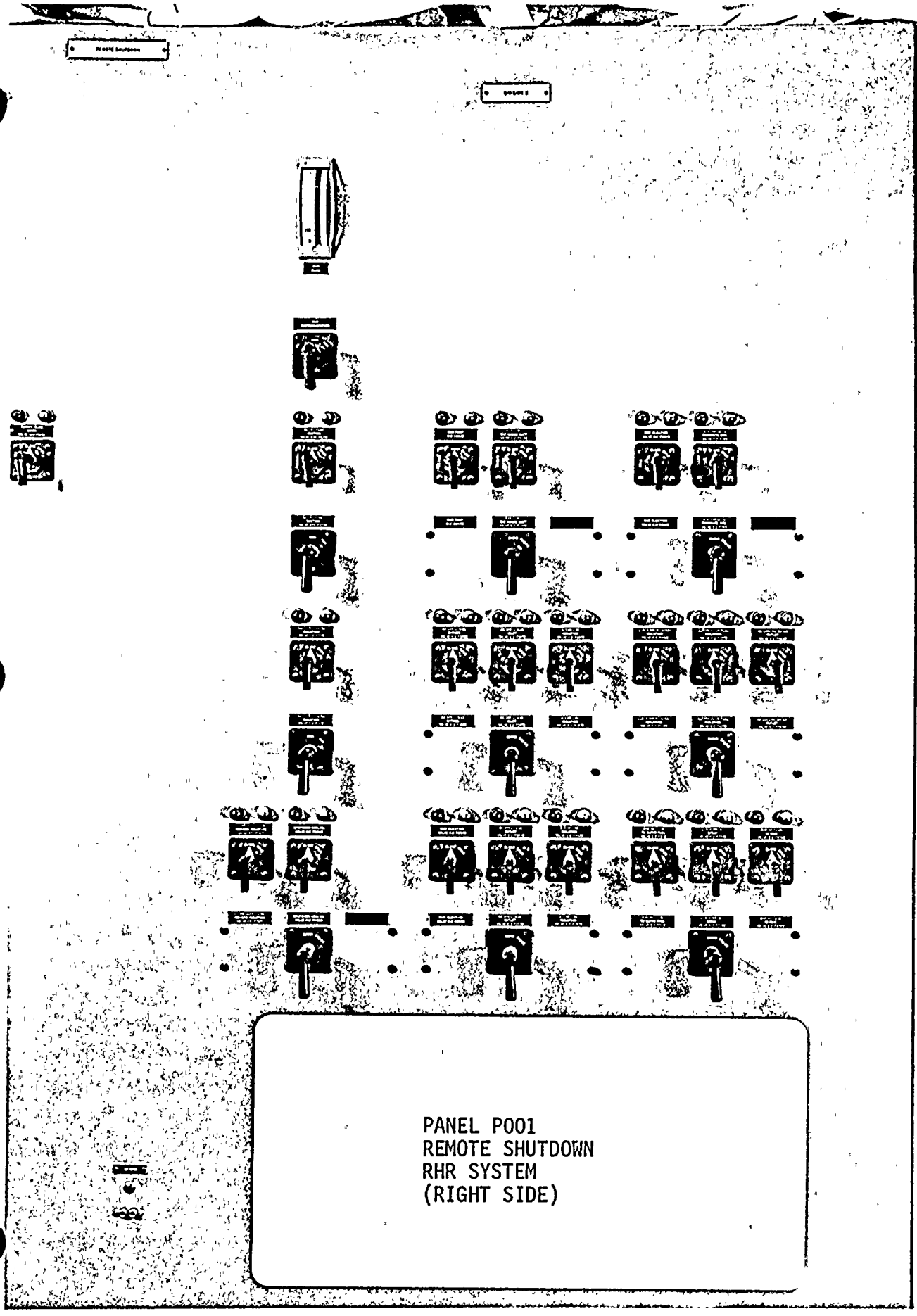
PANEL P832
RFW HEATERS, VENTS AND
DRAINS (4 of 4)





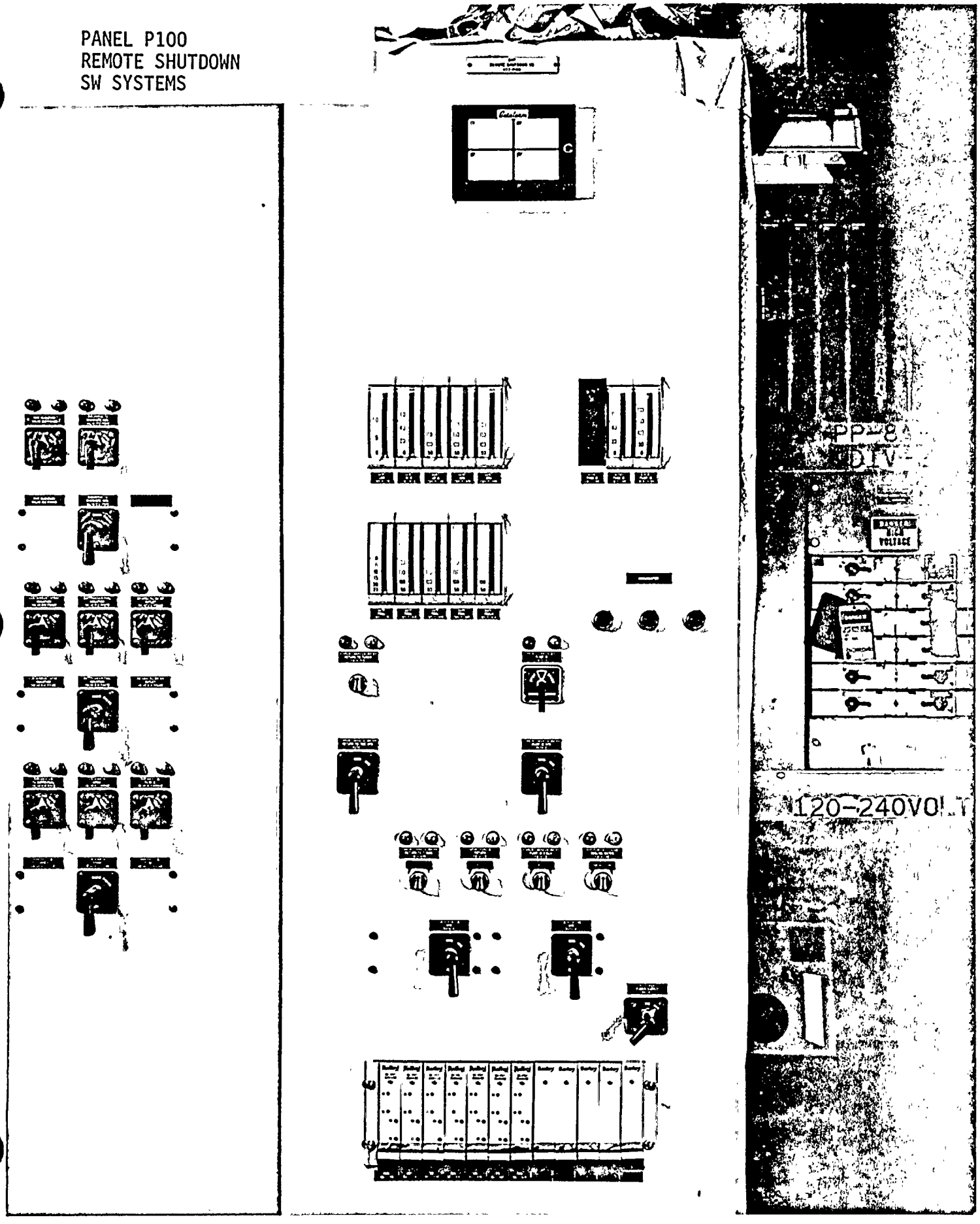
PANEL P001
REMOTE SHUTDOWN
RCIC SYSTEM
(LEFT SIDE)





PANEL P001
REMOTE SHUTDOWN
RHR SYSTEM
(RIGHT SIDE)

PANEL P100
REMOTE SHUTDOWN
SW SYSTEMS



CONTROL ROOM
Elev. 501'

LEGEND

- Req. Guide 1.47
- Req. Guide 1.97
- TDAS
- CRHF
- P600 Not Installed- On Site
- P600 Not Installed- NOT On Site
- NSSS
- BOP

STATUS
- To Go Work
- In Progress
- Completed

N

Docket # 50-397
Ltr # 8202020152 2/11/82 of Document
REGULATORY DOCKET FILE

APERTURE CARD

POOR ORIGINAL

Docket # 50-397
Ltr # 8202020152 2/11/82 of Document
REGULATORY DOCKET FILE

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2
DATE 12-11-81

D

8202020153-02

1981 AUG 7 14 21 28 | SEP 4 11 18 25 | OCT 9 16 23 30 | NOV 6 13 20 27 | DEC 4 11 18 25
1982 JAN 8 15 22 29 | FEB 5 12 19 26 | MAR 5 12 19 26 | APR 9 16 23 30 | MAY 7 14 21 28 | JUN 4 11 18 25 | JUL 9 16 23 30 | AUG 6 13 20 27 | SEP 3 10 17 24 | OCT 8 15 22 29 | NOV 5 12 19 26 | DEC 10 17 24 31
1983 JAN 7 14 21 28 | FEB 4 11 18 25 | MAR 4 11 18 25 | APR 8 15 22 29 | MAY 6 13 20 27 | JUN 3 10 17 24 | JUL 8 15 22 29 | AUG 5 12 19 26 | SEP 9 16 23 30 | OCT 7 14 21 28 | NOV 4 11 18 25 | DEC 9 16 23 30

(A) TASK FORCE PRIORITIZE (B&R-R.O. / S.S.)
(B) PREPARE HED (B&R-R.O.)
(C) SUPPLY SYSTEM APPROVAL
(D) ISSUE CHANGE TO B&R SITE (B&R-R.O.)
(E) ISSUE CHANGE TO G.E. (B&R-R.O.)

PANELS 811 & 827 HAVE BEEN PUT ON HOLD. THESE ARE CONCERNS REGARDING SWITCHES USED IN THE PANELS, ACTUATION/ANNUNCIATION CONFIRMATION AND THE REVISED NUMBERING SCHEME. SEE LETTER WPPSS-RO-81-211.

(1) ISSUE RG-1.47 & HF CHANGE TO GE (B&R-R.O.)
(2) ISSUE RG-1.47 & HF CHANGE TO B&R SITE (B&R-R.O.)
(3) ISSUE HF CHANGES TO GE (B&R-R.O.)
(4) ISSUE HF CHANGES TO B&R SITE (B&R-R.O.)

(A) ISSUE CIRCUIT CHANGES TO B&R SITE & GE (B&R-R.O.)

ABBREVIATIONS
B&R – BURNS & ROE
G.E. – GENERAL ELECTRIC
GPC – GENERAL PHYSICS CORPORATION
HED – HUMAN ENGINEERING DISCREPANCY
HF – HUMAN FACTORS
R.O. – RICHLAND OFFICE
S.S. – SUPPLY SYSTEM
TASK NUMBER 3210
RESPONSIBLE ENGINEER: B. VAN EREM

APERTURE CARD

POOR ORIGINAL

RICHLAND OFFICE
ENGINEERING APPROVAL

	ANSHAW	ME	NE	TALE	LIKEN	MGR.
DATE			9/29/81		10/2/81	
ENGR.			RAM		[illegible]	
SUPVR.			LWS			

STR PLANNER: (TECH'S FIELD)

LEGEND
- ENGINEERING
- MILESTONE
- PROBLEM AREA
- ACTIVITY
- RESTRAINT
- FLOAT
- ACTUAL
- TIME NOW

LEVEL: 1
DATE: 9/28/81
SHEET 1 OF 2

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N.J. HEMPSTEAD, N.Y. LOS ANGELES, CALIF.

CONTROL ROOM DESIGN REVIEW
RLTCKHF

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD No. 2

8201020153-03
E

Docket # 50-397
C 9 8201020153
1 3/15 E of Document
REGULATORY DOCKET FILE

1981: AUG 7 14 21 28 | SEP 4 11 18 25 | OCT 4 16 23 30 | NOV 6 13 20 27 | DEC 4 11 18 25
1982: JAN 8 15 22 29 | FEB 5 12 19 26 | MAR 5 12 19 26 | APR 9 16 23 30 | MAY 7 14 21 28 | JUN 4 11 18 25 | JUL 9 16 23 30 | AUG 6 13 20 27 | SEP 3 10 17 24 | OCT 8 15 22 29 | NOV 5 12 19 26 | DEC 10 17 24 31
1983: JAN 7 14 21 28 | FEB 4 11 18 25 | MAR 4 11 18 25 | APR 8 15 22 29 | MAY 6 13 20 27 | JUN 3 10 17 24 | JUL 8 15 22 29 | AUG 5 12 19 26 | SEP 9 16 23 30 | OCT 7 14 21 28 | NOV 4 11 18 25 | DEC 9 16 23 30

EMERGENCY PROCEDURE GUIDELINES

- DEFINE RG-1.97 INSTRUMENTATION (BER) (CE)
- DEFINE EPG INSTRUMENTATION (CE, BER)
- PROVIDE LOCATION ON S.R. PANELS (BER) (CE)
- TASK FORCE APPR.
- ISSUE CONFIGURATION CONTROL PANEL ARRANGEMENT DRAWINGS (BER, CE)
- HF CONFIGURATION MTG APP.
- R.G. 1.97
- EPGS.)

PANEL ENHANCEMENT

- PREPARE MODIFICATION STANDARD (BER) (CE)
- REVIEW & ISSUE (BER)
- PREPARE ENHANCEMENT STANDARD (CE)
- TASK FORCE APPROVAL
- PREPARE P601 PKG. (BER) — S.S. APPROVAL
- PREPARE P602 PKG. (BER) — S.S. APPROVAL
- PREPARE P683 PKG. (BER) — S.S. APPROVAL
- PREPARE P800 PKG. (BER) — S.S. APPROVAL
- PREPARE P806 PKG. (BER) — S.S. APPROVAL
- PREPARE P810 PKG. (BER) — S.S. APPROVAL
- PREPARE P601 & P602 PKG. (BER) — S.S. APPROVAL
- PREPARE P615 P827 PKG. (BER) — S.S. APPROVAL
- PREPARE P812 PKG. (BER) — S.S. APPROVAL
- PREPARE P813 PKG. (BER) — S.S. APPROVAL
- PREPARE P819 PKG. (BER) — S.S. APPROVAL
- PREPARE P821 PKG. (BER) — S.S. APPROVAL
- PREPARE P824 PKG. (BER) — S.S. APPROVAL
- PREPARE P823 PKG. (BER) — S.S. APPROVAL
- PREPARE P826 PKG. (BER) — S.S. APPROVAL
- PREPARE P832 PKG. (BER) — S.S. APPROVAL
- PREPARE P672 PKG. (BER) — S.S. APPROVAL

PANEL ENHANCEMENT PACKAGE "CORE"

A. MIMIC ADDITIONS/CHANGES
B. DEMARCATION/COLOR PAINTING
C. LABELING CHANGES/ADDITIONS
D. CONTROL SWITCH HANDLE CODING (i.e. PUMPS, VALVES, THROTTLE VALVES)
E. ADDITION OF NORMAL OPERATING RANGES AND SET POINTS TO INDICATORS, CONTROLLERS, AND RECORDERS
F. SPECIFIC IDENTIFICATION OF R.G.-1.97 INSTRUMENTS
G. SWITCH ESCUTCHEON STANDARDIZATION
H. INDICATOR/RECORDER SCALE CHANGES/RANGES
I. ANNUNCIATOR WINDOW MARKING

- PREPARE ENHANCEMENT PACKAGES FOR OTHER PANELS (24 PANELS) (BER, CE)
- CE APPROVAL

MISCELLANEOUS ITEMS

1. TASK ANALYSIS REVIEW — (SCHEDULE PENDING NRC ACCEPTANCE OF BWR OWNERS GROUP)

2. COMPUTER REVIEW
   - TASK FORCE PRIORITIES: PROGRAM/HARDWARE/DESIGN REVIEW (CE, BER) — PREPARE H.E.D. — S.S. APPROVAL — ISSUE CHANGES TO BER SITE — ISSUE CHANGES TO S.S.

3. COMMUNICATION SYSTEMS AND FUNCTIONAL REVIEW
   - COMMUNICATION SYSTEMS DESIGN REVIEW (BER & CE/BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E.

4. LIGHTING
   - LIGHTING COMPLETE AND FUNCTIONAL
   - LIGHTING DESIGN REVIEW (BER & CE, BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E. (BER & CE)

5. LAYOUT EQUIP REVIEW
   - CONTROL ROOM FLOOR COMPLETE - OPERATOR PANELS & PRINTERS INSTALLED.
   - TASK FORCE PRIORITIES: PROGRAM/HARDWARE/LAYOUT REVIEW (G.S. BARR) — PREPARE H.E.D. — S.S. APPROVAL — ISSUE CHANGES TO BER SITE — ISSUE CHANGES TO S.S.
   - T&C/EEP DESIGN COMPLETE SYSTEM TURNOVER
   - COMMUNICATIONAL/FUNCTIONAL REVIEW (BER & CE/BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E.
   - PENDING G.E. FLOOR AND OPERATOR INSOLES
   - LAYOUT AND EQUIPMENT REVIEW (BER & CE/BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E.

6. NOISE & WALKABLE REVIEW
   - H.E.V. SYSTEM COMPLETE AND BALANCED
   - NOISE AND WALKSPACE REVIEW (BER & CE/BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E.

7. EP WALKTHROUGH
   - ANDING COMPLETION OF R&W/HVAC/MCC PANELS PER G.E. 1976 SCDS
   - EMERGENCY PROCEDURE WALK THROUGH (BER & CE/BPA) — TASK FORCE — H.E.D. (BER & CE) — S.S. APPROVAL — NOTIFY BER SITE OR G.E.

STATUS 11/20/80

* REGRATION STANDARD ISSUED 10/30/81 (WBER-RD-81-207)

ABBREVIATIONS
BER - BURNS & ROE
C.R. - CONTROL ROOM
G.E. - GENERAL PHYSICS CORPORATION
H.E.D. - HUMAN ENGINEERING DISCIPLINE
R.O. - RICHLAND OFFICE
S.S. - SUPPLY SYSTEM

TASK NUMBER 3310
RESPONSIBLE ENGINEER B. VAN EKEM

RICHLAND OFFICE

ENGINEERING APPROVAL				
DIVISION	ME	NE	G.E.	REMARKS
DATE			10-29-81	
INITIAL			BVE	
SIGNATURE				

BAR PLANNER: (TELE) T.S. POST

LEGEND: ENGINEERING; MILESTONE; PROBLEM AREA; ACTIVITY; REGRAIN; FLOAT; ACTUAL; TIME NOW

LEVEL II — DATE 11/3/81 — SHEET 2 OF 2

POOR ORIGINAL

APERTURE CARD

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N.J. HEMPSTEAD, N.Y. LOS ANGELES, CALIF.

CONTROL ROOM DESIGN REVIEW

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD No. 2

8202020153-04
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Docket # 50-397
Control # 8202020153
Date 2/1/82 of Document
REGULATORY DOCKET FILE