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EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards conceptual design descriptions for energency response facility data sys & safety parameter display sys, per Generic Ltr 81-10 & TMI Item III.A.1.2.

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ATTORNEYS

November 6, 1981

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Docket No. 50-275
Docket No. 50-323
Diablo Canyon Units 1 and 2

Dear Mr. Eisenhut:

In accordance with the NRC Generic Letter 81-10 on Post TMI Requirements for the Emergency Operations Facility (Section III.A.1.2, Upgrade Emergency Support Facilities) and PGandE letter of April 8, 1981 to you, enclosed are the Conceptual Design Descriptions for Emergency Response Facility Data Systems and Safety Parameter Display System and its associated two system diagram sketches:

SK-YM1: Emergency Assessment and Response System

SK-YM2: Emergency Response Facilities Data System.

This submittal is intended to essentially satisfy the documentation requirement on Items (2) through (6) of Section III.A.1.2.

(1) Task functions of the individuals required to report to the TSC and EOF upon activation and for each emergency class. The documentation for this Item was submitted to Mr. Darrell G. Eisenhut (NRR) in a letter on April 8, 1981.

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(2) Descriptions of TSC instrumentation, instrument quality, instrument accuracy and reliability.

(3) Descriptions of TSC power supply systems, power supply quality, reliability and availability, and consequence of power supply interruption.

(4) Descriptions of the design of the TSC data display systems. The description of plant records and data available and record management systems will be submitted later as a separate submittal.

(5) Descriptions of the data transmission system to be installed between the TSC and control room.

(6) Description of data to be provided to the EOF.

PGandE will continue to maintain the interim emergency support facilities until the final facilities are completed in accordance with Item 2.C(8)p. of Diablo Canyon Unit 1 License.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it to me in the enclosed addressed envelope.

Very truly yours,

Philip A. Crane, Jr.

Enclosures

cc(w/enc): Service List

CONCEPTUAL DESIGN

DIABLO CANYON UNITS 1 AND 2

EMERGENCY RESPONSE FACILITY DATA SYSTEMS

AND SAFETY PARAMETER DISPLAY SYSTEM

The Emergency Response Facilities (ERFs) are designed to improve response and assessment of accident conditions in a nuclear power plant. To perform these functions, the personnel in the ERFs must be supplied with accurate and timely data on plant conditions.

The necessary plant data will be supplied by two systems: the Emergency Assessment and Response System (EARS) and the Emergency Response Facilities Data System (ERFDS). The EARS System monitors and supplies data specified in Reg. Guide 1.23 and NUREG-0654 to the ERFs. Reg. Guide 1.23 deals with meteorological conditions and is titled "Meteorological Programs in Support of Nuclear Power Plants." NUREG-0654, titled "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plant", deals with monitoring potential radiation release points at a nuclear power plant. The list of plant variables input to the EARS System is presented in Table 1.

The second system, the ERFDS, will monitor post accident monitoring variables specified in Reg. Guide 1.97 titled, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." The list of variables in this system is shown in Table 2.

Both of the above systems are high quality systems designed to meet the 0.01 unavailability goal defined in NUREG-0696. Both systems generally interface with the existing nuclear plant quality instrumentation. Provisions will be made to allow the addition of new instrumentation as the plant is brought into full compliance with Reg. Guide 1.97.

EMERGENCY ASSESSMENT AND RESPONSE SYSTEM DESCRIPTION

The EARS has been designed and sized to address several requirements, including the radiation related portion of NUREG-0696.

EARS consists of three functional subsystems:

Input Data Subsystem

The data acquisition subsystem provides real time radiological and meteorological input data needed by the central computer for the radiation dose projection models.

Central Computer Subsystem

This includes the computer, peripherals, and software needed to manage input and output communications, maintain a data base, and to execute the dose projection models.

Communications and Display Subsystem

This subsystem includes communications modules, remote computer, color graphics display terminals, and software to support the remote emergency response facilities.

Subsystem Functions

Input Data Subsystem

The input data subsystem provides information from five primary sources; primary and backup met towers, fixed plant radiation and process effluent monitors, offsite radiation dose rate monitors, mobile environmental monitoring laboratory, and other mobile instruments. A discussion of the type of data required from each source is given below.

Meteorological Tower

Meteorological data of averaged wind speed and wind direction at two elevations, and temperature at the two elevations are provided from the onsite meteorological tower. The data averaging period is fifteen minutes. A backup tower with similar instrumentation is also accessible under software control to the central computer.

Fixed Plant Monitors

Fifty (50) variables from both Units 1 and 2 inplant radiation monitoring and process instruments are available to the Technical Support Center-Computation Center (TSC-CC) computer (see Table 1). These signals are provided as isolated analog (4-20 ma) signals to a terminal strip in the cable spreading room. Analog-to-digital conversion and multiplexing will be performed by two independent sets of equipment in the cable spreading room. The digital outputs from the multiplexers are linked to the TSC-CC computer and the health physics computer. The computer-controlled digital links between the multiplexers and the computers provide independent 9600-baud digital communications between these units.

The second identical multiplexer and communication link to the RAD Protection Office (RPO) computer provides redundancy of the monitor signals, since these signals are important for emergency radiation dose projections. The digital link from the second multiplexer is connected to the health physics computer in the RPO which is normally used for health physics records. Redundancy is enhanced by selection of the same type of computer for the health physics and TSC-CC applications. Plant monitor data stored in the health physics computer is also accessible by a 9600-baud digital data link to the Effluent Systems computer in the counting room. Monitor and met data are required to perform routine effluent release calculations.

Offsite Radiation Dose Rate Monitors

The offsite monitoring system consists of twelve low-level gamma dose-rate monitors installed at selected locations at distances of approximately five to ten miles from the Diablo Canyon Plant.

In addition, three other units with transmitters, will be available in the mobile lab, and can be left in any desired location. The fixed locations were chosen with a dual purpose of providing measurement stations at population centers, and of including the largest practical number of land based sectors from the site.

The monitors in the system are digitally linked and controlled by the TSC-CC computer, and communicate five minute averaged readings at 300 baud to the central computer. The fixed units will be land-line linked to the computer while the portable units are RF-linked.

The monitors have a range of 1 μR/hour to 10 R/hour over an incident gamma ray energy range of 50 keV to 3 MeV. Battery backup for at least ten hours of operation is provided to assure operation in case of loss of AC line power.

Mobile Laboratory

The Mobile Lab is an integral part of the emergency response system for Diablo Canyon.

In addition to the analysis capabilities found in existing radiological environmental mobile labs, this lab has computing and color graphic systems, plus radio frequency communications capabilities for both technician voice contact and digital data transmission with the EARS computers. The computer communication link allows the lab, the TSC, and EOF to display the same analytical results and maps with calculated plume results for discussion by the voice communication link. If necessary, the onboard computer can function alone as a radioanalytical computation computer.

Other Mobile Monitors

Previous experience during accident airborne releases has established the value of data obtained by traversing the plume with various radiation measurement instruments. For the DCPP emergency assessment and response system, provisions are included for aircraft flights or ground traverses through the plume with voice communication to the TSC-CC and EOF. Measured radiation levels at selected locations can be obtained as needed to confirm the dose projections of the computer system.

Central Computer Subsystem

The central computer subsystem is part of an integrated system for emergency assessment and response. For effective response during an emergency, the computer is configured in a manner to assure that it will not become overloaded during a demanding emergency situation. Functional requirements for the EARS computer include the following:

1. The computer must have the computing capability in terms of CPU capability, memory size, processing speed, multi-tasking ability, and I/O features needed to execute meteorological models for dose calculations.

2. The computer must support color graphics, offer a convenient graphics language, and provide peripherals for CRT and hard copy graphics output.

3. The computer must provide at least 40 I/O ports, with each I/O port having the capability to handle multiplexer inputs of at least 100 analog signals.

4. The computer must offer a load-sharing capability with a similar computer. An absolutely redundant system is not required; however, the capability to operate the system from backup files and input/output circuits must be provided.

5. The computer must be supported by the manufacturer in terms of a formal systems training program, formal system update procedures.

Communications and Display Subsystem

The communications and display systems provide display of parameters and calculated results to the control room, TSC, and EOF. In addition, desk top computers at these locations provide redundancy for radiation dose calculations should the central computer be unavailable.

Display formats include maps with plume projections, offsite monitor readings, meteorological data, messages, etc.

The color display systems are raster scan CRT's, with resolution of 400 x 400 or greater. Hard copy graphics dumps are provided by dot matrix printers.

EMERGENCY RESPONSE FACILITIES DATA SYSTEM DESCRIPTION

The post-accident monitoring variables specified in Reg. Guide 1.97 will be handled by the Emergency Response Facilities Data System (ERFDS). The system is micro-computer based with distributed processors dedicated to various functions.

The system is divided into four subsystems:

High Speed Data Acquisition Subsystem

Data Handler Subsystem

Data Storage Subsystem

Display Subsystem

High Speed Data Acquisition Subsystem

The data acquisition subsystem is a high speed, remote multiplexing system that interfaces with the plant instrumentation, converts the data to a digital form, and then transmits the data to other parts of the ERFDS.

The data acquisition subsystem will provide Class IE isolation in the remote multiplexers between the different Class IE instrument loops and also between the Class IE instrument loops and the rest of the system. Remote multiplexers will be located so as to minimize additional wire runs. Each remote multiplexer has a 12 bit A/D converter for high accuracy. The remote multiplexers can also interface with bi-level signals. The digital information from the remote multiplexers is transmitted to master control units which interface with the data handler subsystem and the data storage subsystem.

Data Handler Subsystem

The Data Handler Subsystem is made up of two redundant dedicated processors that control data transfer between the data acquisition subsystem and the different processors making up the data display subsystem. The data handler processors access and transmits only the data requested through the display processors. Display data is updated at one second intervals.

Data Storage Subsystem

The data storage subsystem receives data from the data acquisition subsystem independent of the data handler subsystem. This independence improves reliability. This subsystem continuously records all plant variables listed in Table 2 at one second interval on magnetic tape. The tapes can be used with the TSC or EOF display computers for transient analysis.

Display Subsystem

The display subsystem provides the system interface for the operators and emergency personnel. The subsystem has independent functional stations in the TSC, EOF, and control room as described below.

The TSC display equipment includes a display computer dedicated to the TSC. The computer receives data requests from the TSC personnel through interactive terminals, interfaces with the data handler subsystem for the necessary data, and makes the data available in the TSC. The display computer also interfaces with a tape recorder to play back data tapes generated by the data storage system. The peripheral devices for actual data display include an alpha-numeric CRT, graphic plotting CRT with hard copy output, and a line printer. All of the variables listed in Table 2 will be accessible for display in the TSC through the display subsystem. The displays will be human engineered with functional groupings of variables. Available will be parameter magnitudes, trends and time history displays. The TSC will also include two video monitors slaved to the redundant control room SPDS displays.

The EOF portion of the display subsystem is identical to the TSC display subsystem except for the SPDS. Because of the distance between the SPDS display generators and the EOF, the EOF will have its own redundant SPDS display computers and display generators identical to the control room SPDS. Only data to update displays will be transmitted from the plant to the EOF.

The SPDS equipment includes redundant display computers, video generators, color video monitors, and display selector control panels.

Each redundant "train" functions independently, and receives data from the redundant data handler computers. The display computers and video generators will be located in the TSC. The color video monitors and the display selector control panels will be located in the control room. Each display computer will communicate with its respective data handler computer through a RS-232-C serial data link.

The SPDS displays will integrate with the Diablo Canyon operating procedures. Appropriate human factors considerations will be used in developing displays. Parameter magnitudes and trends will be part of the displays.

The SPDS equipment in the EOF includes redundant display computers, video generators, video montiors, and display control panels. The SPDS displays available in the EOF are identical to those in the control room.

Power Supply to the TSC and EOF

The EARS and ERFDS equipment is powered by a reliable power source designed so the systems will meet the 0.01 unavailability goal. The EARS processors will have their own internal uninterruptible power supplies to maintain programs in core memory during short power interruptions. Incoming data would not be recorded during a power interruption, but the system would be able to resume full operation as soon as power was restored.

System Availability

The EARS and ERFDS will be designed so that the functional unavailability of each system addresses the unavailability goal of 0.01. The functional unavailability is defined as follows: The system is functional and therefore available if all the functions of the system are capable of being performed. An availability analysis will be performed on both the EARS and the ERFDS Systems.

Verification and Validation

Verification and validation will be performed on both the EARS and ERFDS. This will include both hardware and software verification along with the necessary final system tests to validate the completed systems.

Radiological Monitoring in the ERFs

Radiation monitoring is provided in the TSC and the EOF. The TSC has a fixed monitor in each room with continuous indication and alarm capabilities. The ability to distinguish radioiodines at the required low concentration is provided by a dedicated portable monitor. The EOF will have dedicated portable monitoring equipment. This equipment also will have continuous indication, alarming capabilities, and be able to detect radioiodines at the required concentrations.

TABLE 1

PLANT VARIABLES TRANSMITTED TO THE EARS

No. of Signals for Unit 1	No. of Signals for Unit 2	Common Signals for Both Units	Signal Name
1	1		Containment Area Monitor
		1	Oily Water Separator Discharge Monitor
1	1		Containment Air Particulate Monitor
1	1		Containment Radio-Gas Monitor
2	2		Plant Vent Gas Monitor
1	1		Condenser Air Ejector Gas Monitor
		1	Waste System Discharge Liquid Monitor
1	1		Gas Decay Tank Discharge Monitor
1	1		Steam Generator Blowdown Monitor
1	1		Plant Vent Iodine Monitor
2	2		Plant Vent Air Particulate Monitor
1	1		Plant Vent Gross Gamma Monitor
2	2		Containment High Range Area Monitor
1	1		Mid-Range Iodine Monitor
1	1		Mid-Range Noble Gas Monitor
1	1		Plant Vent Sampling Area Monitor
1	1		Iodine Grab Sample Area Monitor

TABLE I (cont'd.)

PLANT VARIABLES TRANSMITTED TO THE EARS

No. of Signals for Unit 1	No. of Signals for Unit 2	Common Signals for Both Units	Signal Name
1	1		Plant Vent Flow Rate
1	1		Containment Purge Flow Rate
		1	Liquid Waste Discharge Flow Rate
1	1		Steam Generator Blowdown Flow Rate
1	1		Condenser Air Ejector Flow Rate
1	1		Circulating Water Flow Rate
		1	Oily Water Separator Discharge Flow Rate

TABLE II

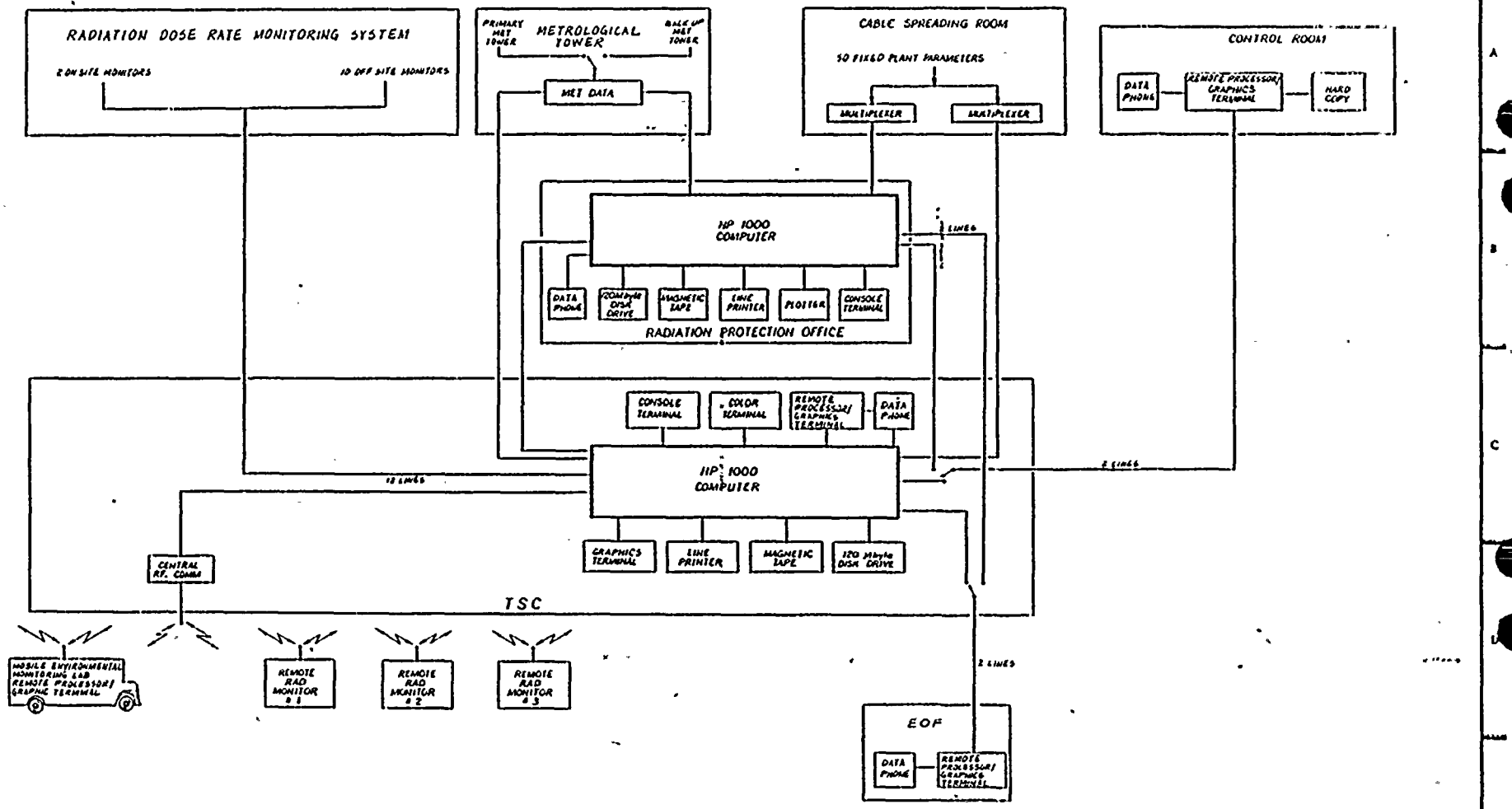
PLANT VARIABLES TRANSMITTED TO THE ERFDS

No. of Signals Per Unit	Signal Names
4	RCS Cold Leg Water Temp.
4	RCS Hot Leg Water Temp.
2	RCS Pressure
65	Core Exit Temperature
6	Coolant Level in Reactor
1	Degrees of Subcooling
4	Containment Sump Water Level
4	Containment Pressure
2	Containment Hydrogen Concentration
2	RHR System Flow
2	RHR Heat Exchange Outlet Temp.
16	Accumulator Tank Level and Pressure
1	Boric Acid Charging Flow
2	Flow in HPI System
2	Refueling Water Storage Tank Level
1	Quench Tank Level
1	Quench Tank Temperature
1	Quench Tank Pressure
4	Steam Generator Level
8	Steam Generator Pressure
8	Main Steam Flow
8	Main Feedwater Flow
4	Auxiliary Feedwater Flow

TABLE II (cont'd.)

PLANT VARIABLES TRANSMITTED TO THE ERFDS

No. of Signals Per Unit	Signal Names
2	Condensate Storage Tank Water Level
5	Heat Removal by the Containment Fan Heat Removal System
1	Containment Atmosphere Temperature
1	Makeup Flow-In
1	Letdown Flow-Out
2	Volume Control Tank Level
2	Component Cooling Water Temp. to ESF System
3	Component Cooling Water Flow to ESF System
38	Status of Standby Power
1	Condenser Air Ejector Gas Monitor
2	Containment High Range Area Monitor
1	Plant Vent Iodine Monitor
2	Plant Vent Gas Monitor
64 digitals	Control Rod Position
79 digitals	Containment Isolation
4 digitals	Accumulator Isolation Valve Position
8 digitals	Reactor Coolant Pump Status
6 digitals	Primary System Safety Relief Valve Position
4 digitals	Pressurizer Heater Status
71 digitals	Emergency Ventilation Damper Positions
2	Pressurizer Level



EMERGENCY ASSESSEMENT & RESPONSE SYSTEM

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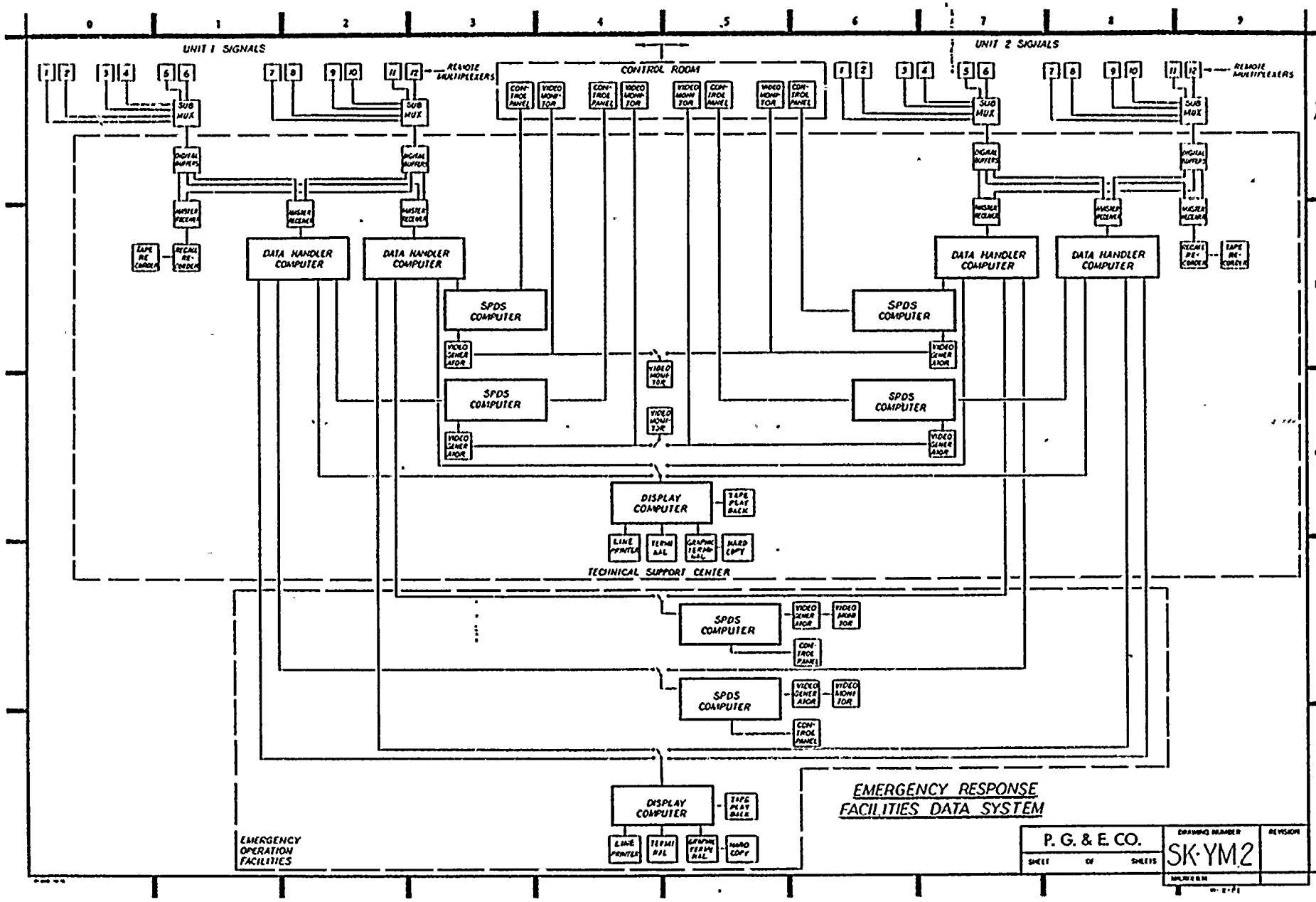
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