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AUTH.NAME AUTHOR AFFILIATION
VAN BRUNT,E.E. Arizona Public Service Co.
RECIP.NAME RECIPIENT AFFILIATION
KNIGHTON,G. Licensing Branch 3

SUBJECT: Forwards response to NRC 831220 request for addl info re: TMI Item II.F.2,"Instumentation for Detection of Inadequate Core Cooling."

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Arizona Public Service Company
P.O. BOX 21666 • PHOENIX, ARIZONA 85036

February 23, 1984
ANPP 28929-WFQ/MAJ

Director of Nuclear Reactor Regulation
Attention: Mr. George Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Docket Nos. STN-50-528/529/530
File: 84-056-026; G.1.01.10

Reference: 1. Letter from G. W. Knighton, NRC, to E. E. Van Brunt, Jr., APS, dated December 20, 1983. Request for Additional Information on TMI Item II.F.2.
2. Letter to G. W. Knighton, NRC, from E. E. Van Brunt, Jr., APS, dated July 29, 1983. Revised APS response to TMI Item II.F.2.

Dear Mr. Knighton:

Reference (1) requested Arizona Public Service Company (APS) to submit additional information to the NRC concerning TMI Item II.F.2, "Instrumentation for Detection of Inadequate Core Cooling." Attachment A is the APS response to the NRC request in Reference (1).

If you have any further questions, please contact me.

Very truly yours,

E. E. VanBrunt

E. E. Van Brunt, Jr.
APS Vice President, Nuclear
ANPP Project Director

EEVB/MAJ/sp
Attachment

cc: E. A. Licitra (w/a)
A. C. Gehr "
T. Huang "
G. Mazetis "

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PDR ADOCK 05000528
A PDR

A002
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STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, A. Carter Rogers, represent that I am Nuclear Engineering Manager of Arizona Public Service Company, that the foregoing document has been signed by me for Edwin E. Van Brunt, Jr., Vice President, Nuclear, on behalf of Arizona Public Service Company with full authority so to do, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

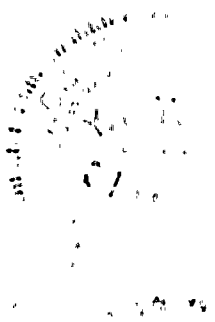
A. Carter Rogers
A. Carter Rogers

Sworn to before me this 23rd day of February, 1984.

Nora E. Meador
Notary Public

My Commission Expires:

My Commission Expires April 6, 1987



APS RESPONSE TO THE NRC REQUEST FOR ADDITIONAL INFORMATION ON TMI-2 TASK ACTION PLAN II.F.2 FOR PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2, AND 3

QUESTION: 1. Provide a functional and design description of the Emergency Response Facility Data Acquisition and Display System (ERFDADS) relative to the function and design of the Critical Function Monitoring System (CFMS) described in the CESSAR-80 submittal.

RESPONSE: The CFMS is described in the CESSAR-80 submittal as the "Heart of the Integrated Accident Monitoring System (AMS)." It is designed to meet the criteria set forth in NUREG-0696; "Functional Criteria for Emergency Response Facilities." The CFMS is a dedicated, computer based, Non-Class IE plant information and display system. Specifically, the CFMS:

1. Provides primary Safety Parameter Display System/Inadequate Core Cooling (SPDS/ICC) display in Control Room, Technical Support Center (TSC), and the Emergency Operation Facility (EOF).

2. Includes the Historical Data Storage and Retrieval (HDSR) System.

3. Provides the hardware capability for transmitting data to the NRC Operation Center via the Nuclear Data Link (NDL).

4. Provides the capability to display Regulatory Guide 1.23 and 1.97 input parameters in the Control Room, TSC and EOF.

ERFDADS is a Non-Class IE System, very similar to CFMS, that provides all the above mentioned information. Figure (1) shows the block diagram of the ERFDADS System.

The ERFDADS man/machine interface includes one color-graphic CRT per unit in the Control Room, three color-graphic CRT's per unit and two line printers, one for demand and one dedicated for alarms, in the TSC and two color-graphic CRT's per unit and a line printer in the EOF. A simplified configuration diagram for ERFDADS and the QSPDS is shown in Figure (2).

The following is a design description of the CFMS:

A. The CFMS shall provide the capability to display the status of the following critical functions:

1. Core Reactivity Control
2. Core Heat Removal Control
3. Reactor Coolant System Inventory Control
4. Reactor Coolant System Pressure Control
5. Reactor Coolant System Heat Removal Control
6. Containment Pressure/Temperature Control
7. Containment Isolation Control
8. Radiation Emission Control

B. The CFMS shall alarm deviations of the critical functions.

C. The CFMS shall provide the User with concise, understandable, integrated information to assist in accessing plant status during all modes of plant operation.

D. The CFMS shall be capable of measuring the value of plant process input signals.

E. The CFMS shall be capable of storing the values of plant process signals for a minimum of 16 hours. The values shall be time tagged.

F. The CFMS shall be capable of determining the alarm status of each process parameter.

G. The CFMS shall be capable of displaying information to the operator by means of a color cathode ray tube (CRT). The CFMS shall be capable of utilizing alphanumeric data formats, shapes, symbols, color coding, and blinking for information display in accordance with established human engineering guidelines.

H. The CFMS shall be capable of utilizing greater than 20 fixed format displays (pages) for information presentation. Page selection shall be under control of the operator. Each display station (CRT and keyboard) shall be capable of independently calling up any fixed format display page in the repertoire.

The ERFDADS has all the design capabilities as the CFMS. The ERFDADS presents plant data to personnel in the Control Room and in other areas. This presentation is primarily via a set of color monitor displays. To help personnel focus on detailed information the displays are organized in a hierarchial arrangement. The highest level in the display hierarchy is deviation bar charts, which are designated safety parameter displays (SPD). The SPDS indicates deviation from normal key safety parameters per operational mode such that an operator can rapidly access system parameters.

Below the SPD hierarchy are piping and instrumentation diagrams, displays (P&ID's) and various plots. The P&ID's present plant data using simplified diagrams of plant systems identifying key process parameters. Thus, the operator can focus on a particular plant function. The plots available include time-history plots and pressure versus temperature plots. The time-history plots show parameter value versus time curves. The pressure versus temperature plots allow the operator to quickly access the state of the primary and secondary systems. Other displays, such as demand and summary displays, are also available.
While ERFDADS employs a three-level hierarchy of displays, menus also allow the operator to quickly determine the position of a display in the hierarchy. Additionally, menus are also hierarchial in nature and can easily be selected from the local keyboard. The top-level menu, from which all other menus can be displayed, includes the following:

1. SPD Menu

2. P&ID Menu

3. Demand Display Menu

4. Summary Display Menu, and

5. System Interface Menu.

Table (1) provides a comparison of the CFMS and ERFDADS in relation to the NRC regulatory requirements.

QUESTION 2. Provide a figure to show the Accident Monitoring System (AMS) including all of the components of the final Inadequate Core Cooling Instrumentation (ICCI) System which will clearly identify the primary and backup display system for Core Exit Thermocouples (CETs) and the location of the ICCI display system in the control room. Describe any deviation from the standard CESSAR-80 system design.

RESPONSE: The Accident Monitoring System (AMS) consists of two major subsystems:

1. Critical Function Monitoring System (CFMS).

2. Qualified Safety Parameter Display System (QSPDS). (Including processing and display for Inadequate Core Cooling).

The Emergency Response Facility (ERF) computer system is similar to the AMS and consists of three major subsystems:

1. ERFDADS (Emergency Response Facility Data Acquisition and Display System) which is identical to the CFMS as explained in Item No. 1.

2. QSPDS (Qualified Safety Parameter Display System) including processing and display for Inadequate Core Cooling. This item is provided by C-E and is identical to the System 80 QSPDS.

3. Chemical and Radiological Analysis Computer System (CRACS). Provides post-accident sampling and dose projection.

These major systems communicate with each other, and provide information collection, processing, and a display capability to the emergency operation crew. Figure (1) shows the block diagram of the ERFDADS System.

The QSPDS (Qualified Safety Parameter Display System) provides a two-channel, seismically qualified Class IE display of safety parameters including the Inadequate Core Cooling processing information.
The QSPDS utilizies a microprocessor based design for the signal processing equipment in conjunction with an alphanumeric display and associated keyboard for each of the two channels. Each channel will accept and process QSPDS/ICCI input parameter signals such as core exit thermocouples and transmit its output to the alphanumeric display. In addition, each channel will transmit its output to the ERFDADS.

Figure (3) shows the block diagram of the QSPDS. It also identifies the primary and backup display systems.

Figure (4) shows the location of the QSPDS in the Control Room.

Figure (5) provides the sensor locations for the Inadequate Core Cooling instrumentation.

QUESTION 3. Describe locations of the Heated Junction Thermocouple (HJTC) sensors in the reactor vessel and identify any deviation from the standard CESSAR-80 system design.

RESPONSE: The HJTC design incorporates two separate probe assemblies which enter the reactor vessel through the two Reactor Vessel Level Monitoring System (RVLMS) nozzles located on the top of the reactor vessel head as shown in Figure (6).

There are a total of 8 HJTC sensors on each of the two probe assemblies. Their respective locations are shown on Figure (7) relative to the fuel alignment plate.

The Palo Verde Nuclear Generating Station (PVNGS) RVLMS design is identical with the Standard System 80 design. There are no plant specific deviations. Therefore, the discussion in CESSAR Appendix B, Section II.F.2 is applicable to the PVNGS System.

QUESTION 4. In the CESSAR SER it is required that the CE Owners Group (CEOG) should provide a modification to the generic CEOG Emergency Procedure Guidelines (EPG), CEN-152, Revision 1, for use of the RLVMS. Discuss the status of the CEOG effort with respect to this requirement including the completion schedule and provide the completion schedule for Arizona Public Service Company (APS) to incorporate this CEOG EPG into the PVNGS ICC procedures.

RESPONSE: In a letter to D. G. Eisenhut, USNRC, from R. W. Wells, CEOG, dated October 28, 1983, the NRC was informed that the CEOG authorized the incorporation of the RVLMS information into the EPGs as Revision 2 to CEN-152. The CEOG is to submit this revision to the EPGs to the NRC by April 1984. Once Revision 2 to CEN-152 is issued, APS will review the EPG modifications for the RVLMS information and determine what revisions to the PVNGS Procedure Generation Package (PGP) are required, or what deviations are necessary.

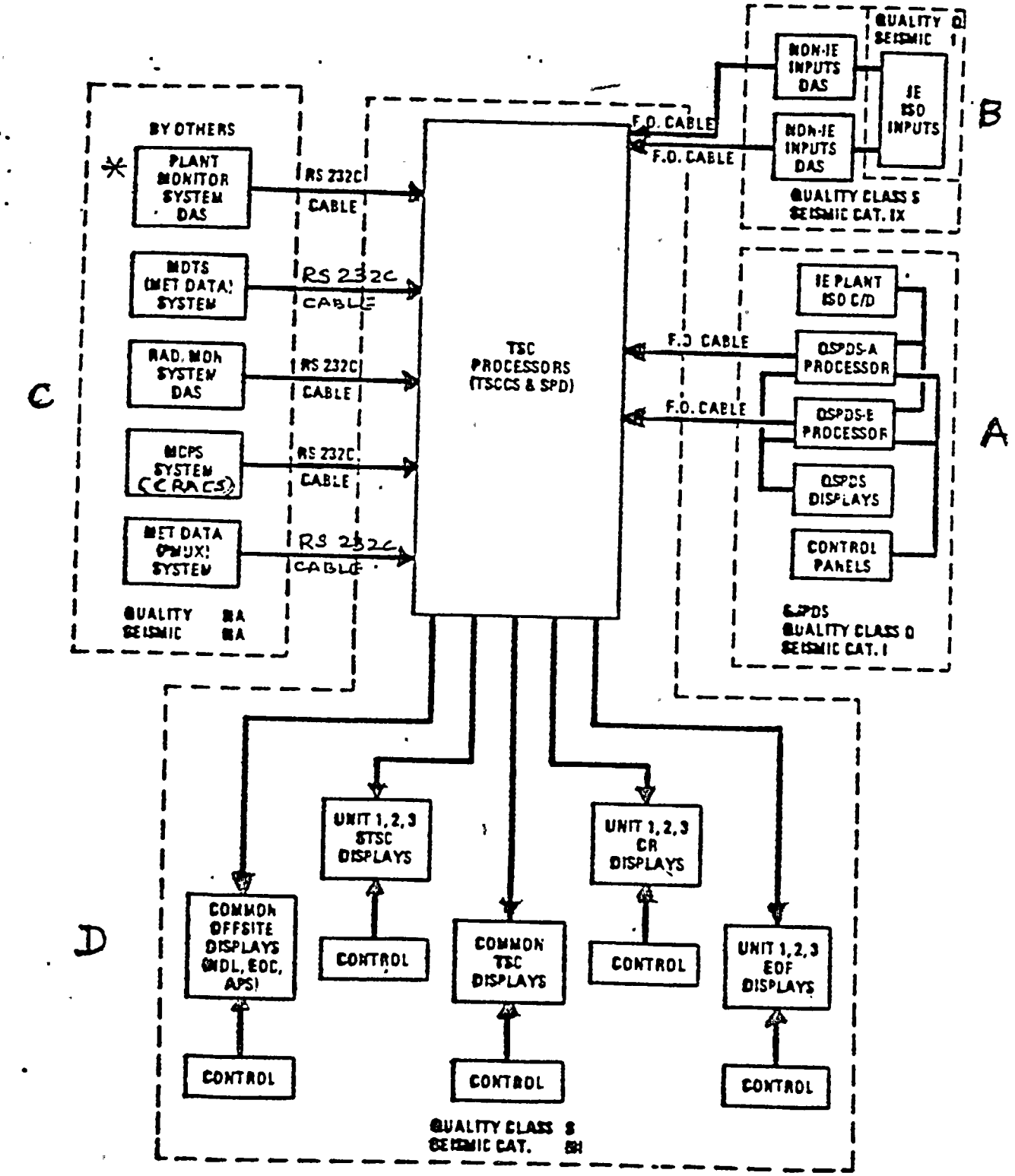
Any revisions made to the PVNGS PGP will be made in accordance with the description and schedule (shown in Figure 8) identified in the letter to G. W. Knighton, NRC, from E. E. Van Brunt, Jr., APS, (ANPP-23213) dated June 30, 1983. Even though the above

referenced letter pertains to the TMI Action Plan Item II.K.3.5, the plan and schedule for the plant specific activities of factoring the CEOG program results into the PVNGS EOPs and operator training applies to the subject of incorporation of the RVLMS information. Therefore, the evaluation and inclusion of the CEN-152, Revision 2 changes into the PVNGS PGP will be completed within 6 months of receipt of the NRC approval of the Revision 2 changes.

QUESTION 5. Clarify the implementation schedule for declaring that the final ICCI system is fully operational.

RESPONSE: The final ICCI installation and verification will be four (4) weeks after the completion of the fuel load on PVNGS Unit 1.

DATE	ARIZONA NUCLEAR POWER PROJECT JOB 10407	SYSTEM DESCRIPTIONS	
11/03/83		TITLE EMERGENCY RESPONSE FACILITIES DATA ACQUISITION AND DISPLAY SYSTEM	DESIGNATION SD
REVISION 0			



* POSSIBLE IMPLEMENTATION IN FUTURE

DATA ACQUISITION AND DISPLAY SYSTEM
BLOCK DIAGRAM

Figure SD-1

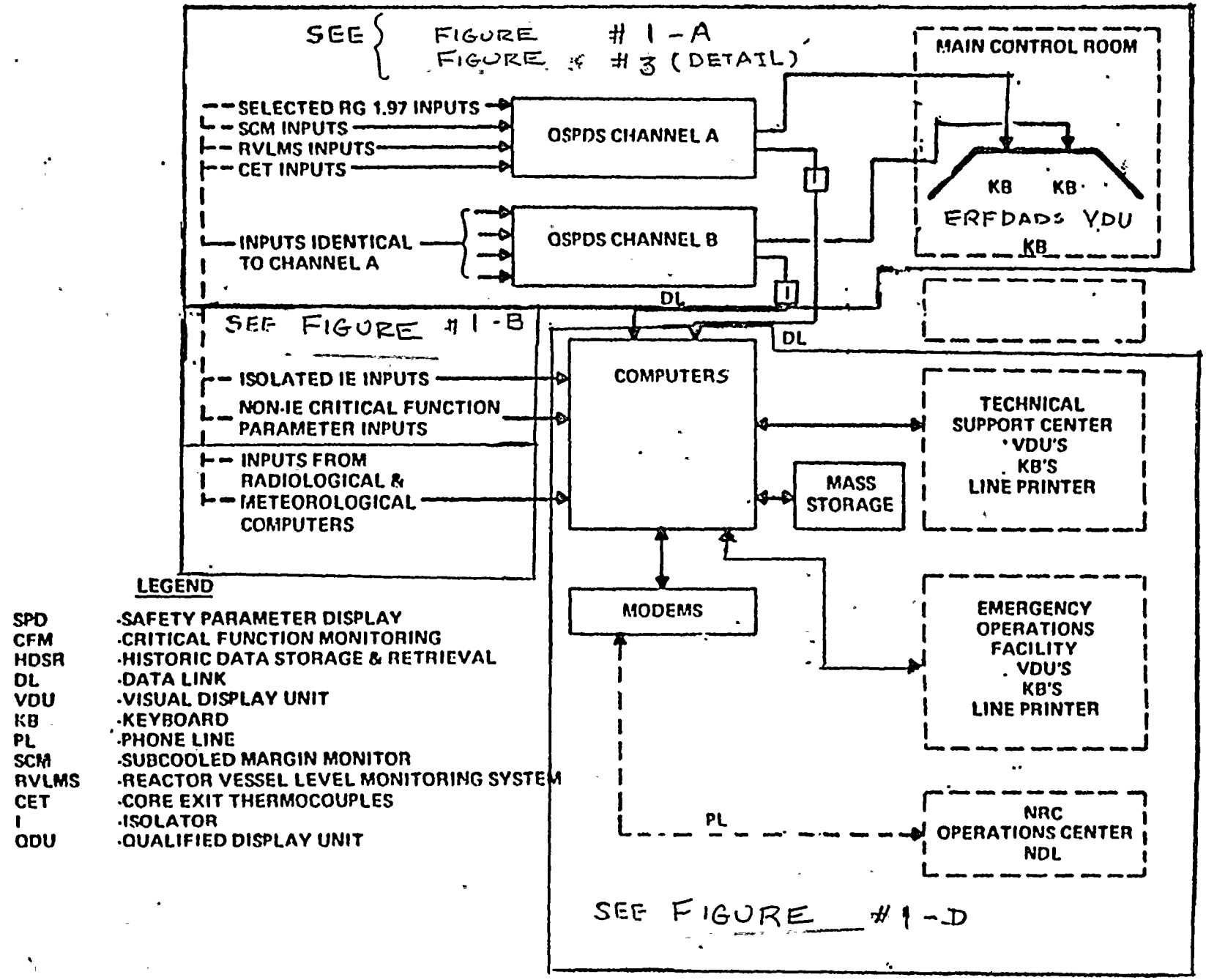
TABLE 1

COMPARISON BETWEEN CFMS AND ERFDADS

Regulation Requirement

Regulation	CFMS Non-Class IE	ERFDADS Non-Class IE
NUREG 0696 Emergency Response Facility Criteria	o Human Engineered Safety Parameter Display System	o Human Engineered Safety Parameter Display System
	o Nuclear Data Link (Hardware Portion)	o Nuclear Data Link (Hardware Portion)
	o Technical Support Center Data System	o Technical Support Center Data System
	o Emergency Operation Facility Data System	o Emergency Operation Facility Data System
NUREG 0737	o Human Engineered Primary Display	o Human Engineered Primary Display
Regulatory Guide 1.97 Accident Monitoring Instrument and Display	o Categories 2 and 3 Signal processing and display (Category 1 signal processing met by Class IE QSPDS data link to CFMS)	o Categories 2 and 3 Signal processing and display (Category 1 signal processing met by Class IE QSPDS data link to ERFDADS. Additionally, Category 1 signals are available for display on ERFDADS.)
Regulatory Guide 1.23 Meterological Data Acquisition, Recording and Retention	o Category 3 Signal processing and display	o Category 3 Signal processing and display

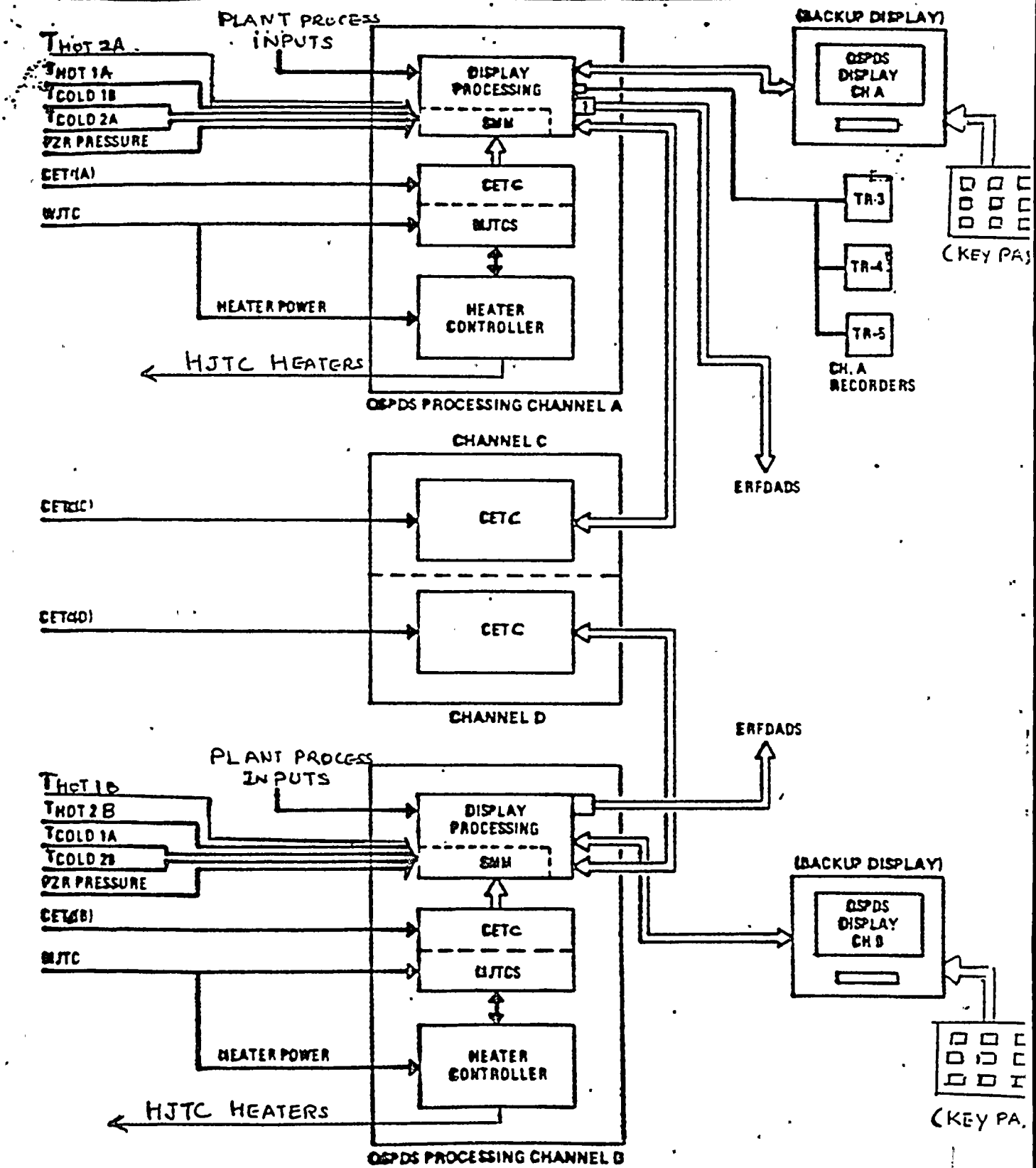
ERFDADS / QSPDS CONFIGURATION



LEGEND

SPD	-SAFETY PARAMETER DISPLAY
CFM	-CRITICAL FUNCTION MONITORING
HDSR	-HISTORIC DATA STORAGE & RETRIEVAL
DL	-DATA LINK
VDU	-VISUAL DISPLAY UNIT
KB	-KEYBOARD
PL	-PHONE LINE
SCM	-SUBCOOLED MARGIN MONITOR
RVLMS	-REACTOR VESSEL LEVEL MONITORING SYSTEM
CET	-CORE EXIT THERMOCOUPLES
I	-ISOLATOR
QDU	-QUALIFIED DISPLAY UNIT

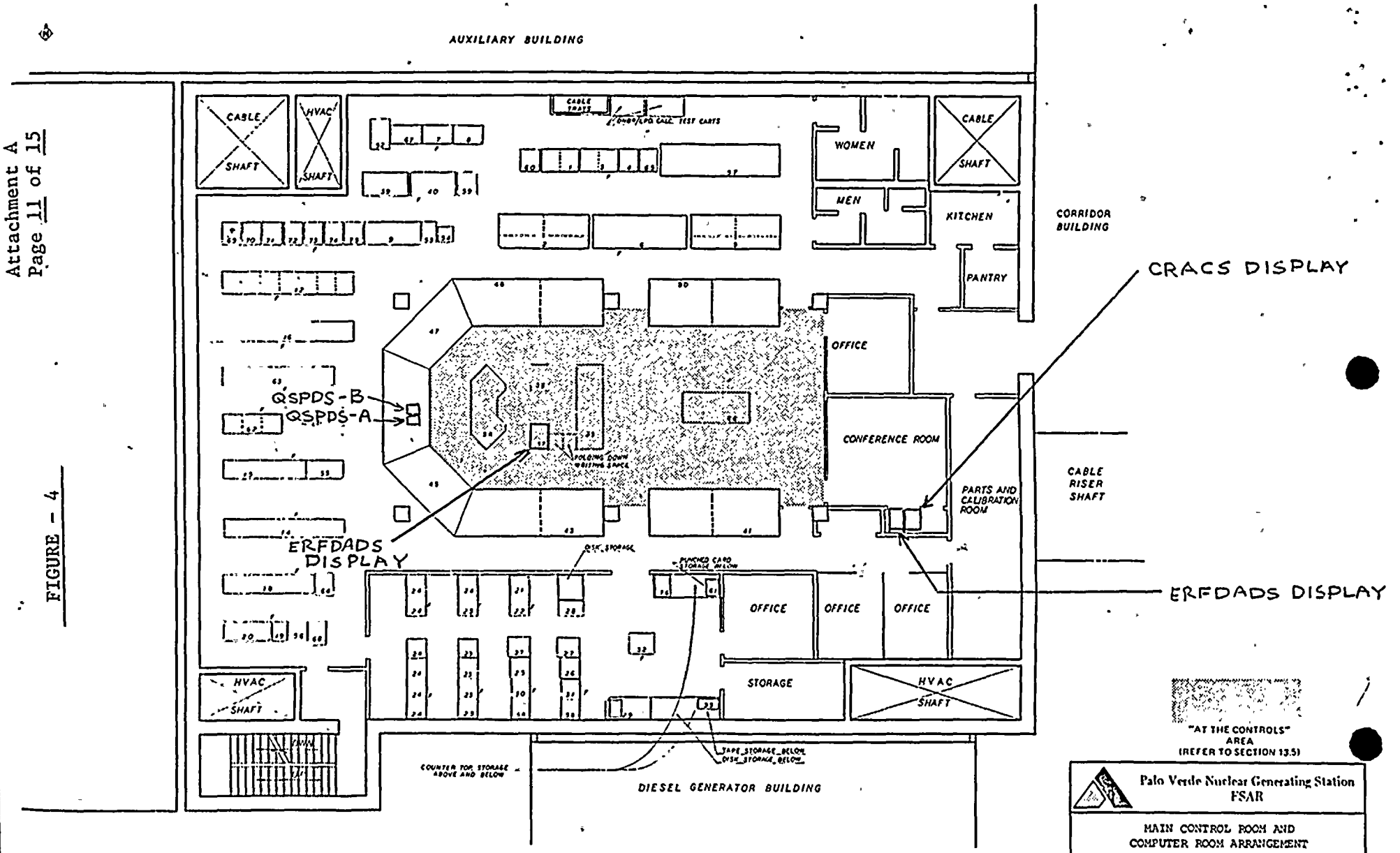
DATE 9/22/83	ARIZONA NUCLEAR POWER PROJECT JOB 10407	SYSTEM DESCRIPTIONS	
REVISION 10		TITLE QUALIFIED SAFETY PARAMETER DISPLAY SYSTEM	DESIGNATION SH



QUALIFIED SAFETY PARAMETER DISPLAY SYSTEM DIAGRAM

Attachment A
Page 11 of 15

FIGURE - 4



Palo Verde Nuclear Generating Station
FSAR

MAIN CONTROL ROOM AND
COMPUTER ROOM ARRANGEMENT
(Sheet 1 of 2)
Figure 7.5-1

FIGURE - 5

SENSOR LOCATIONS FOR INADEQUATE CORE COOLING INSTRUMENTATION

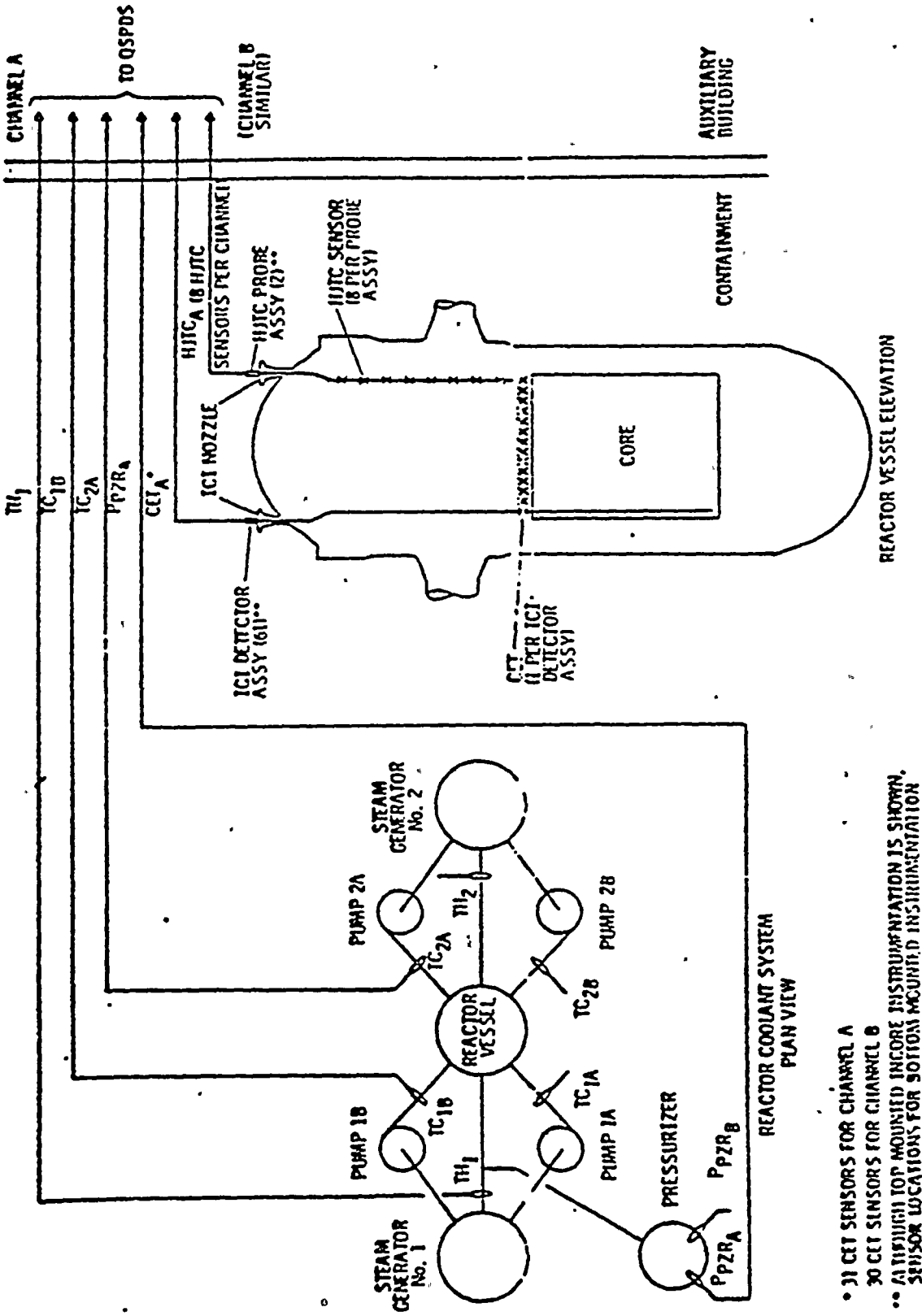
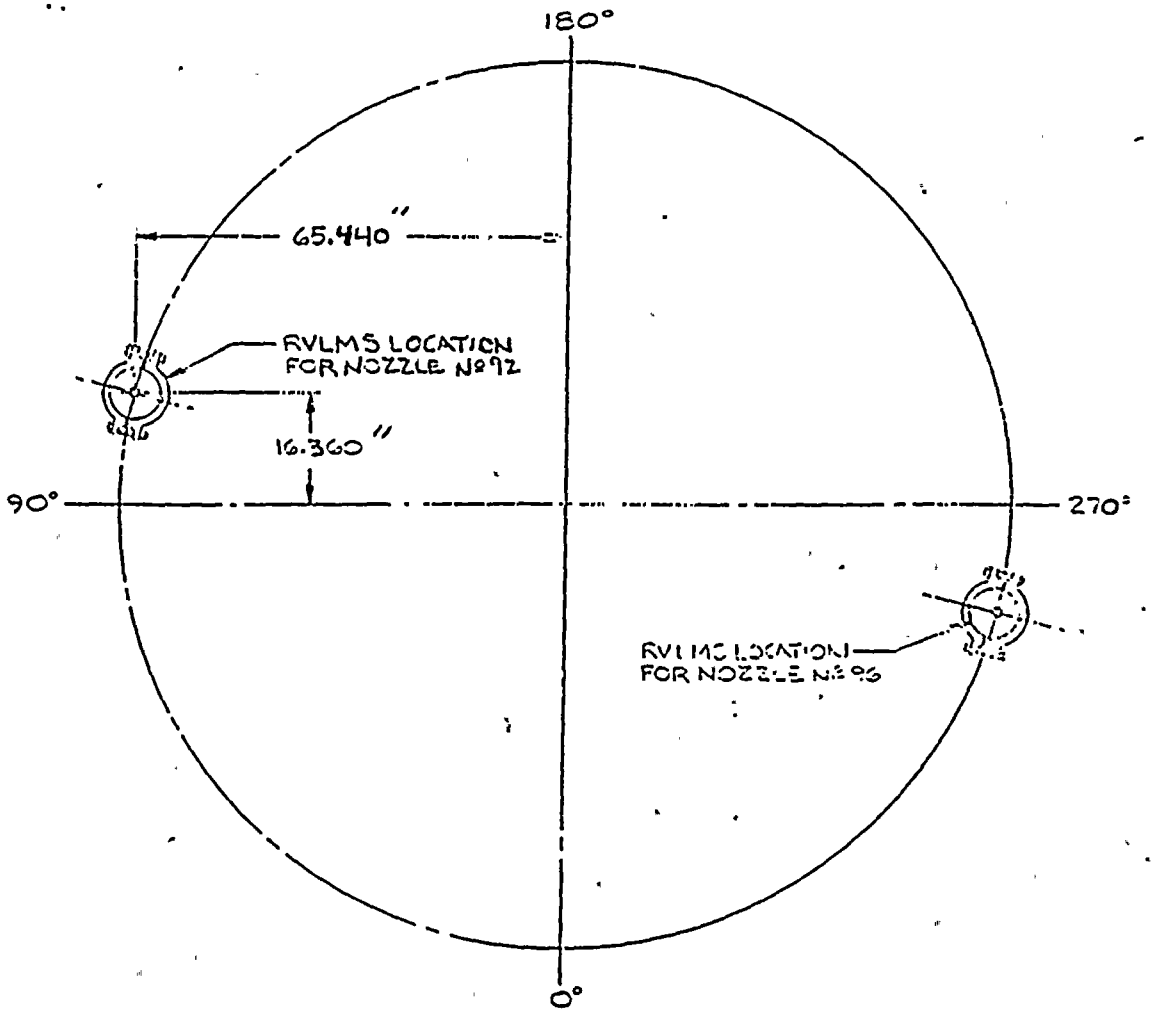


FIGURE - 6

RVLMS Locations



PLAN VIEW
SCALE: NONE
CEDM LOCATIONS
92 & 96

FIGURE 7.

HJTC Sensor Locations

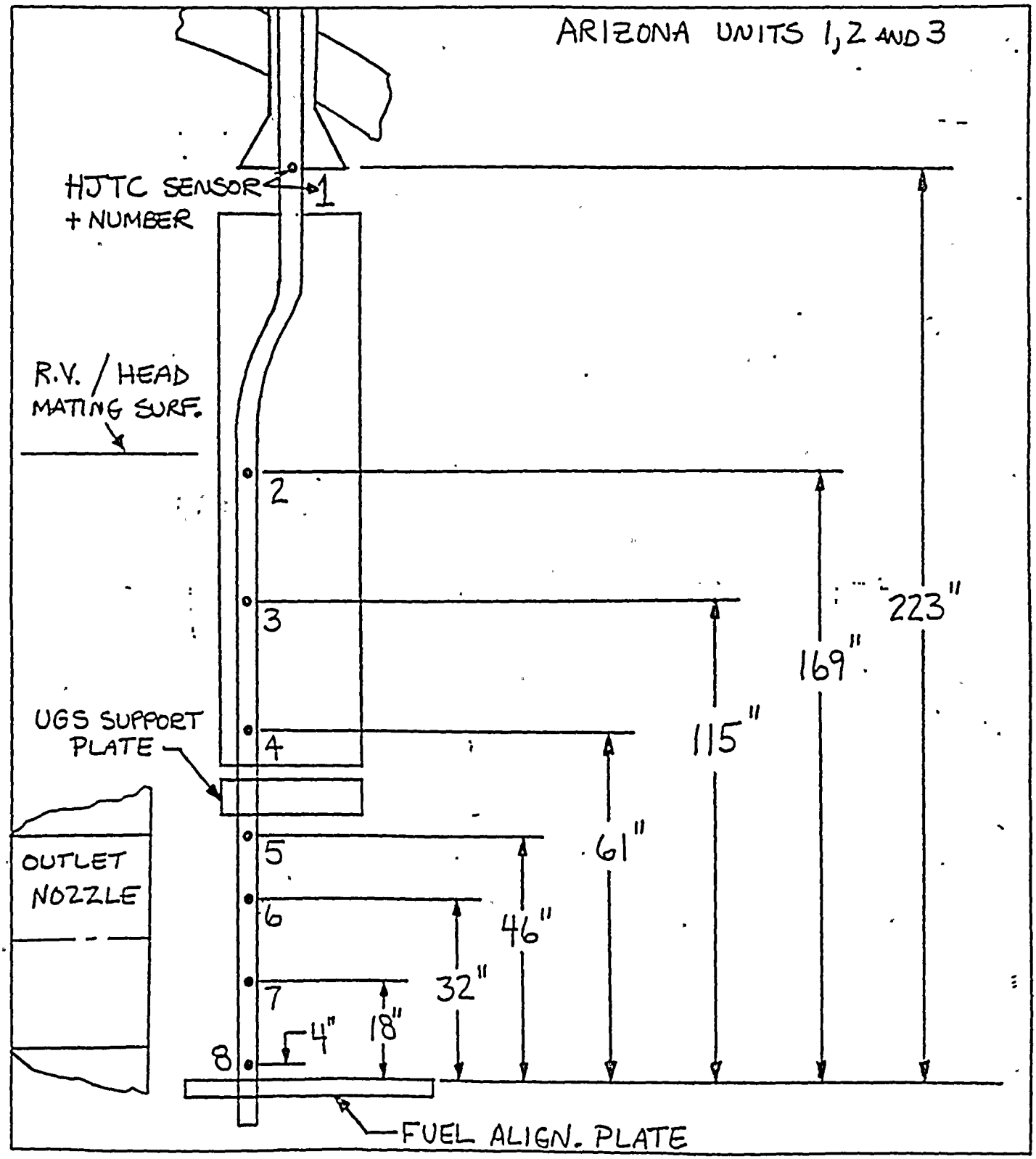
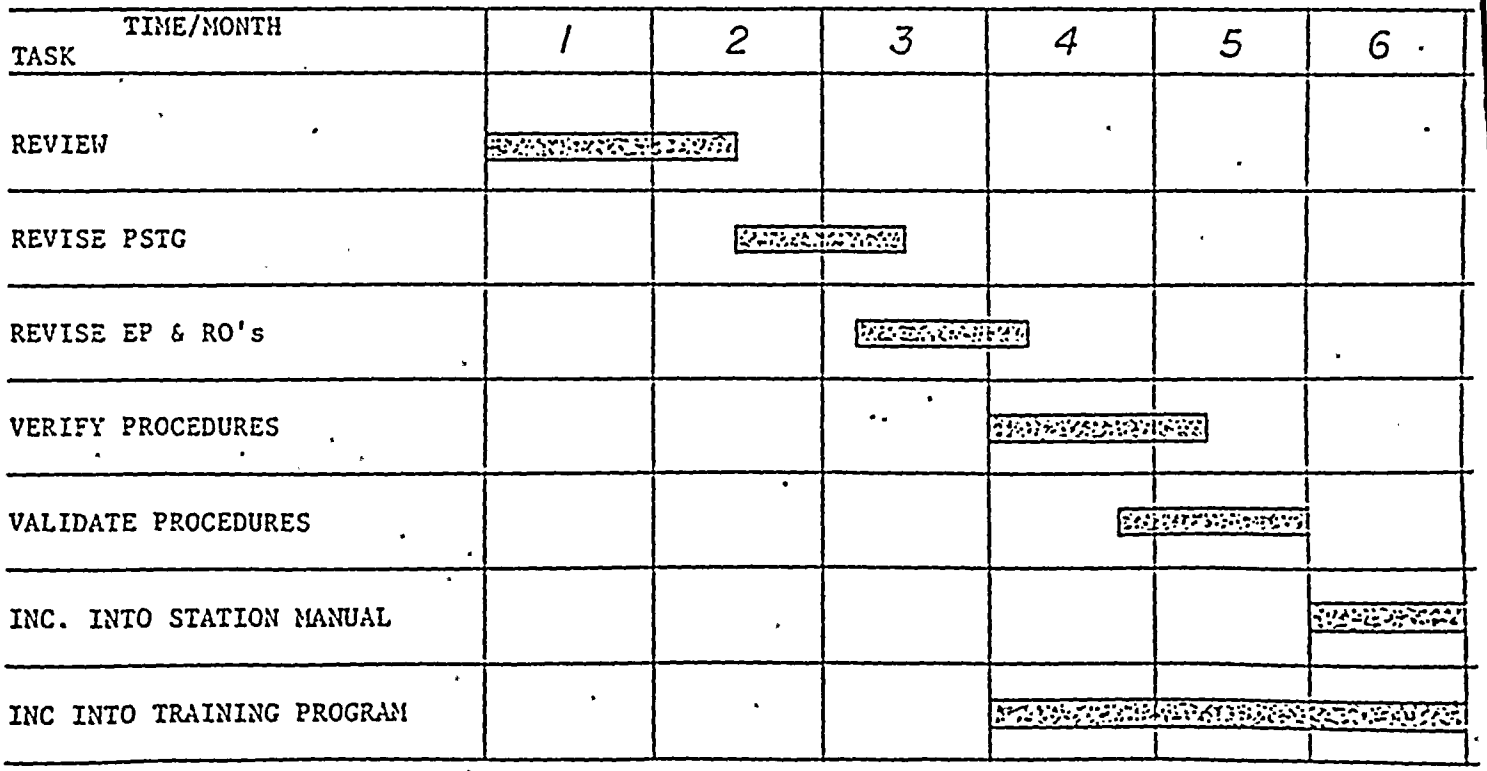


FIGURE 8



6 - 10 months for results from CE
6 months for incorporation into PVNGS
12 - 16 months from start to completion