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ST-HL-AE-1422
File No.: G9.17

Mr. George W. Knighton, Chief
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Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Responses to DSER/FSAR Items Regarding Section 3.11

Dear Mr. Knighton:

The attachment enclosed provides STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items.

The item numbers listed below correspond to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

The attachment includes mark-ups of FSAR pages which will be incorporated in a future FSAR amendment unless otherwise noted below.

For the responses marked with a (P) the attachment contains a partial response to the item to account for separate statements addressing NSSS and non-NSSS scope. Other unmarked items are complete responses.

<u>Attachment</u>	<u>Item No.*</u>	<u>Subject</u>
1	D 3.10-1	Section 3.11: Environmental Design
	D 3.10-5 (P)	of Mechanical and Electrical
	D 3.11-2 (P)	Equipment
	D 3.11-4 (P)	
	D 3.11-5 (P)	
	D 3.11-6 (P)	
	D 3.11-7 (P)	
	D 3.11-8 (P)	
	D 3.11-9 (P)	

* Legend

D - DSER Open Item
F - FSAR Open Item

C - DSER Confirmatory Item
Q - FSAR Question Response Item

L1/DSER/ag

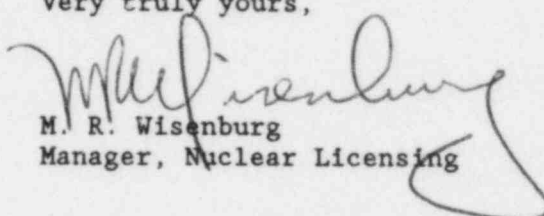
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<u>Attachment</u>	<u>Item No.*</u>	<u>Subject</u>
1 (Cont'd)	F 3.11-2 F 3.11-22 F 3.11-23	

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,


M. R. Wisenburg
Manager, Nuclear Licensing

CAA/bl

Attachments: See above

* Legend

D - DSER Open Item
F - FSAR Open Item

C - DSER Confirmatory Item
Q - FSAR Question Response Item

L1/DSER/ag

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Revised 9/25/85

3.11 ENVIRONMENTAL DESIGN OF MECHANICAL AND ELECTRICAL EQUIPMENT

Safety-related mechanical and electrical equipment is designed to remain functional during and following design basis events. In addition, ~~equipment~~ ~~nonsafety equipment, including~~ certain post-accident monitoring equipment, is also designed to remain functional during or after specified design basis events, or to not fail in a manner which could prevent satisfactory accomplishment of the plant safety functions.

Design basis events consist of normal operation and plant shutdown, ~~loss of nonsafety-related HVAC~~, loss of offsite power (LOOP) and design basis accidents (DBA). *equipment as well as* ~~loss of~~ *NSSS passive mechanical*

The following sections provide information to demonstrate acceptable performance of Non-Nuclear Steam Supply System (NSSS) (i.e., balance of plant) equipment under the specified conditions. Environmental qualification for NSSS equipment is discussed in Section 3.11N.

3.11.1 Equipment Identification and Environmental Conditions

Equipment required to be qualified is, *provided in the 10CFR50.49 submittal.* ~~listed in Table 3.11-2.~~ Environmental conditions for each area in which the subject equipment is installed are listed in Table 3.11-1. The conditions are based on the following:

1. Normal parameters are those which will be maintained during routine plant operation, shutdown, hot standby, and system testing. The range is based on the limiting conditions of peak outdoor temperature together with equipment design heat loads and minimum outdoor temperature together with no heat loads.
2. Abnormal parameters are those which may be caused by such events as loss of nonsafety-related HVAC. The majority of qualified equipment areas are served by safety class HVAC, for which outages due to LOOP are not postulated.
3. Accident conditions are those plant conditions resulting from the most limiting pipe failure for that location during which safety-related equipment must operate to mitigate the consequences of the accident.
4. Normal cumulative radiation doses are the totals projected for a 40-year plant life, utilizing the shielding assumptions of Section 12.3.1. Accident cumulative radiation doses are based on the source terms of Section 3.11.5.2 and are totaled through the period of 180 days past initiation of the accident.

~~5. The non-seismic vibration of safety-related equipment conforms to the requirements of the following standards or requirements:~~

INSERT 3

<u>Equipment</u>	<u>Standard or Requirement</u>
Diesel engine generators	DEMA Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines
Electric motors	NEMA MG-1
Safety-related pumps	Hydraulic Institute Stan- dards

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The length of time that each item of equipment is required to operate in the accident environment following accident initiation appears in the equipment specification.

3.11.2 Qualification Tests and Analyses

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INSERT 4 Equipment and components are qualified by tests, analyses, and/or documented operating experience or a combination thereof. Qualification of equipment meets the intent of NUREG-0588, Rev.1. Qualification testing is accomplished either by tests on the particular equipment or by type tests performed on similar equipment under environmental conditions at least as severe as the specified conditions. Equipment which performs its required function in a mild environment may be accepted by meeting lesser requirements to the extent that an item of equipment does not have to be pre-aged prior to a seismic test, qualification testing may be waived. A preventative maintenance program will be used to guard against normal wear and degradation for the life of the plant. Qualification tests for the electrical portion of equipment are specified in accordance with the guidelines set down in the IEEE Standards as noted in Sections 3.11.2.1 and 3.11.2.2.

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Project compliance with environmental qualification criteria can be found in the following sections:

FSAR Sections

10CFR50, Appendix A,

GDC 1
GDC 4
GDC 23
GDC 50

3.1.2.1
3.1.2.1
3.1.2.3
3.1.2.5

10CFR50, Appendix B

USNRC Regulatory Guides

RG 1.30 — RC 1.33
RG 1.40
RG 1.63
RG 1.73
RG 1.89 — RG 1.97
RG 1.131

17.2

3.12
3.12
3.12
3.12
3.12 — 3.12
3.12

STP FSAR
(SECTION 3.11)

INSERT 1

A list of all category 1 and 2 post-accident monitoring equipment (in response to R61.97 Rev.2) that is included in the equipment qualification program is provided in Table 7.5-1.

INSERT 2

The length of time that each item of equipment is required to operate in the accident environment following accident initiation is provided in the ~~appendix~~ ⁱⁿ 10 CFR 50.49 submittal.

INSERT 3

For pipe or line mounted electrical or electro-mechanical devices, the plant vibration effects are considered in accordance with the guidelines provided in IEEE 382-1972. For floor and wall mounted equipment the simulation of five OBEs before an SSE are considered to include ^{the} vibration aging effects on equipment.

INSERT 4

Safety-related electrical equipment and components located in a harsh environment are qualified by Test

a. combination of test and analysis in accordance with the requirements of 10CFR 50.49 and NUREG-0588, Rev. 1

INSERT 5

Safety-related mechanical equipment including NSSS passive mechanical equipment located in a harsh environment is qualified in accordance with GOC 4. The evaluation of mechanical equipment qualification includes the following:

1. Identification of the mechanical equipment including their required operating time;
2. Identification of the nonmetallic subcomponents;
3. Identification of the environmental conditions to which the equipment must be qualified;
4. Identification of nonmetallic material capabilities; and
5. Evaluation of environmental effects on the nonmetallic materials

INSERT 6

The programs for preventive maintenance, surveillance and periodic testing have been developed in accordance with R.G. 1.33 Rev. 2. These programs are based on manufacturer's recommendations, experience and the results of the project qualification programs. This will ensure that all safety related equipment in mild and harsh areas will be operable and qualified throughout the life of the plant.

The programs provide for replacement of parts and equipment prior to the end of qualified life.

Qualification requirements to vendor
STP FSAR

3.11.2.1 Equipment in the Applicant's Scope of Supply. Suppliers of safety-related equipment listed in Table 3.11-2 are required to qualify equipment in accordance with requirements listed in Tables 3.11-3 and 3.11-4.

The following information and requirements were specified in equipment purchase specifications.

1. Vendors have been required to submit a description of the method of qualification performed on each specified safety-related item located in the Containment and elsewhere to assure it will perform satisfactorily in the ~~combined~~ accident environment of temperature, pressure, humidity, chemical, and radiation doses.
normal, abnormal and
2. Vendors have been required to provide evidence concerning the satisfactory behavior of proposed materials under the environmental conditions specified. Data on changes in material properties have been evaluated for adequacy.

Acceptable qualification programs, at the minimum, demonstrate the end-of-life qualification.

Qualification programs which do not demonstrate the qualification of equipment for its specified period of design life are identified with a supporting maintenance, replacement, and surveillance program. Acceptable qualification programs include prototype tests and/or analysis under conditions simulating the environmental conditions expected over the 40-year life plus the 30 days post-accident period for temperature and pressure and 180 days post-accident period for radiation in accordance with standards listed in Tables 3.11-3, and 3.11-4 and 3.11-4A.

The conditions imposed for test and/or analysis include normal, abnormal, and DBA environmental conditions postulated to occur during the period of life for which the equipment is qualified.

Class 1E cables, field splices, and terminations for use on the STP with the exception of single conductor high temperature silicon insulated cables meet the requirements of IEEE 383-1974 as modified by RG 1.131. Single conductor high temperature silicon insulated cables when used in a class 1E circuit are installed in conduit only.

3.11.3 Qualification Test Results

INSERT 7 The results of qualification tests for the equipment in the applicant's scope of supply are provided in Table 3.11-5.

3.11.4 Loss of Ventilation

The majority of qualified equipment areas are served by safety class HVAC. These HVAC systems are designed to the single failure criteria and are supplied from the Onsite Standby Power System. Consequently, the normal environmental conditions which they provide will be maintained during all plant modes.

INSERT 8 A small amount of qualified equipment is in areas served only by nonsafety HVAC. For these areas, the abnormal ranges of environmental conditions are based on the loss of HVAC.

INSERT 7

Detailed qualification results for
electrical and mechanical equipment
located in a harsh environment appear
in the 10 CFR 50.49 submittal

(including NSSS passive
mechanical)

INSERT 8

However, certain areas of the plant
served by safety class HVAC may
experience abnormal temperature conditions
due to loss of offsite power which
would result from switchover to a
different cooling medium.

Table 3.11-1 provides a listing of the worst-case environmental conditions for various areas in the plant. These conditions were determined by the criteria listed in Section 3.11.1.

3.11.5 Estimated Chemical and Radiation Environment

3.11.5.1 Chemical Environment. Safety-related systems are designed to perform their functions in the temperature, pressure, and humidity conditions listed in Table 3.11-1 and Section 6.2. In addition, components of safety-related systems are designed to perform their functions on long-term contact with boric acid and sodium hydroxide solutions recirculated through the Emergency Core Cooling System and Containment Spray System. Containment spray pH and sump pH are described in Section 6.5.2.

The Containment atmosphere is maintained below 4-volume-percent hydrogen consistent with the recommendations of RG 1.7, as discussed in Section 6.2.5. Chemical environment conditions are listed in Table 3.11-1.

3.11.5.2 Radiation Environment. Safety-related systems and components are designed to perform their safety-related functions after normal operation radiation exposure plus a DBA exposure. The normal operational exposure is based on the design basis source terms presented in Sections 11.1, 11.2, 11.3, and 12.2.1 and the equipment and shielding configurations given in Section 12.3.

Safety-related system and component radiation exposures are dependent on equipment location and the particular DBA involved. In the Containment and control room area, equipment exposures are based on the DBA LOCA. For in-Containment equipment, the DBA LOCA source term is based on a release of 100 percent of the core noble gases, 50 percent of the halogens and 1 percent of the solids. This is consistent with the guidance given in RG 1.89. Control room exposures following a postulated LOCA, based on the source term specified in Section 15.6.5.3, are controlled to 5 rads or less consistent with the requirements of GDC 19 of 10CFR50, Appendix A.

Radiation source terms for safety-related components which are exposed to post-accident recirculation fluid are consistent with the recommendations of RG 1.89 (i.e., 50 percent of the core halogen inventory and 1 percent of the remaining core solid fission product inventory are mixed in the recirculation water).

Normal and accident radiation doses for the various plant areas are presented in Table 3.11-1. Safety-related equipment design doses are the sum of normal plus accident exposures.

Organic materials in the Containment are identified in Section 6.1.2. The design radiation exposures delineated in Table 3.11-1 are based on gamma and beta radiation. Radiation source terms for safety-related components outside Containment are based on gamma radiation. For the organic coating materials used inside Containment (see Section 6.1.2.1), irradiation tests performed by Oak Ridge National Laboratory have been performed for an integrated gamma dose of 1×10^9 rads (which exceeds the design calculated value in Table 3.11-1). These doses conservatively account for the surface exposure due to beta radiation in the design basis LOCA environment.

STP FSAR

ATTACHMENT I
ST-HL-AE 1422
PAGE 9 OF 17

Page 3.11-5 has
been deleted.

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REFERENCES

Section 3.11:

3.11-1

"Methodology for Qualifying Westinghouse WRD
Supplied NSSS Safety-Related Electric Equipment,"
WCAP-8587, Rev. 5 (April 1982).

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Table 3.11-2 has been deleted. ~~It will be provided later.~~

TABLE 3.11-3

SAFETY-RELATED EQUIPMENT (INSIDE CONTAINMENT)
OPERATIONAL AND QUALIFICATION REQUIREMENTS

Equipment	Purpose	Qualification Requirements	
Class 1E electric cables	Supply power, instrumentation, and control of those devices required to function during and after an accident	Test and analysis, in accordance with IEEE 383-1974, RG 1.131 and NUREG-0558, Rev. 1 0588	38 40
Electrical penetration assemblies	Provide means of electrical access into Containment without impairing Containment integrity	Test, analysis, and IEEE 317-1976, RG 1.63 and NUREG-0588, Rev. 1	
Safety-related Component Cooling Water System gas-operated valves	Containment isolation and various other system-dependent safety-related functions.	Combined test and analysis, IEEE 382-1972, RG 1.73, and NUREG-0588, Rev. 1	
Reactor Containment fan cooler motors	Containment heat removal	Combined test and analysis, IEEE 334-1971, and NUREG-0588 Rev. 1 RG 1.40	38
Containment hi-range area radiation monitors	Post-Accident radiation monitoring	Test and IEEE 323-1974, RG 1.97 and NUREG-0588, Rev. 1	
Containment Water Level Instrumentation	Post-Accident Monitoring	Combined test and analysis, IEEE 323-1974, and NUREG-0588, Rev. 1 RG 1.97	
Reactor Vessel Water Level Instrumentation	Post-Accident monitoring	Combined test and analysis, IEEE 323-1974, and NUREG-0588, Rev. 1 RG 1.97	
Post-Accident Monitoring transmitters/sensors (RG 1.97, Category 1 and Category 2)	Post-Accident monitoring	Combined test and analysis, IEEE 323-1974, and NUREG-0588, Rev. 1 RG 1.97	40
Steam generator Level & flow instrumentation	Post-Accident monitoring	IEEE 323-1974, RG 1.97 and NUREG-0588, Rev. 1	
Pressure Operated Relief Valves	Relief vent to atmosphere	IEEE 382-1972, IEEE 323-1974 RG 1.73, and NUREG-0588, Rev. 1	

TABLE 3.11-4

- Harsh Environment

SAFETY-RELATED EQUIPMENT (OUTSIDE CONTAINMENT)
OPERATIONAL AND QUALIFICATION REQUIREMENTS

<u>Equipment</u>	<u>Purpose</u>	<u>Qualification Requirements</u>	
Diesel generators	Provide emergency electrical ac power after loss of all offsite power	Test, analysis, or combined, IEEE 323-1974	38
4.16 kV Switchgear	Class 1E power distribution	Test, analysis, or operating experience and maintenance, IEEE 323-1974	
480 V Load centers	Class 1E power distribution	Test, analysis, or operating experience and maintenance, IEEE 323-1974	
480 V Motor control centers	Class 1E power distribution and motor control	Test, analysis, or operating experience and maintenance, IEEE 323-1974	
120 vac Class 1E distribution panels	Distribution and control of Class 1E instrumentation power	Test, analysis, or operating experience and maintenance IEEE 323-1974	
125 vdc Batteries	Supply power for instrumentation ac inverters, solenoid valves, switchgear control, etc.	Test, analysis, or maintenance, IEEE 323-1974	38
125 vdc Distribution panels	Distribution and control of vital ESF dc power	Test, analysis, or combined, IEEE 323-1974	
480 vac/125 vdc Battery chargers	Supply dc power to 125 vdc ESF batteries	Test, analysis, or combined, IEEE 323-1974	
Class 1E Electric cables	Supply power, instrumentation, and control to those devices required to function during and after an accident	Combined test, and analysis, IEEE 383-1974, IEEE 323-1974 as modified by RG 1.131, NUREG 0588, Rev. 1	38
Motors	Drive for pumps, fans, etc.	Test, analysis, or combined, IEEE 334-1971, RG 1.40, NUREG 0588 Rev. 1	
INSERT 9			
Load sequencers	Provide sequenced starting of selected ESF loads	Test, analysis, or combined, IEEE 323-1974	
INSERT 10			
Safety-related instrumentation *	Various system-dependent safety-related functions	IEEE 323-1974, NUREG 0588, Rev. 1.	

* Some equipment may be located in a mild environment.

SIP FSAR

TABLE 3.11-4 (Continued)

POSTACCIDENT EQUIPMENT (OUTSIDE CONTAINMENT)
OPERATIONAL AND QUALIFICATION REQUIREMENTS

Equipment	Purpose	Qualification Requirements
<p>INSERT 9</p> <p>Motor-operated valves * Safety-related</p>	Containment isolation and various other system-dependent safety-related functions.	Combined test and analysis, IEEE 382-1972, and RG 1.73, NUREG-0588, Rev. 1
<p>9</p> <p>Main control board (including post-accident monitoring indicators)</p>	Control of Class 1E equipment and postaccident monitoring	Combined test and analysis and IEEE 323-1974
Inverters	Supply 120 vac vital bus power	Combined test and analysis and IEEE 323-1974
Voltage Regulators	Supply 120 vac vital bus power	Combined test and analysis and IEEE 323-1974
Relay Panels	Protect distribution system	Combined test and analysis and IEEE 323-1974
Isolation Transformers	Isolate Class 1E from non-Class 1E power	Combined test and analysis and IEEE 323-1974
Hydrogen Monitors	Post-Accident hydrogen monitoring and hydrogen recombiner activation	Test and IEEE 323-1974, NUREG 0588, Rev. 1
<p>INSERT 10</p> <p>Post-Accident Monitoring transmitters/sensors (RG 1.97, Category 1 and Category 2)*</p>	Post-Accident monitoring and other functions as required	Combined test and analysis and IEEE 323-1974, NUREG-0588, Rev. 1
<p>Main steam safety relief valve position indication (non-1E, RG 1.97, Category 2)*</p>	Post-Accident monitoring	Combined test and analysis and IEEE 323-1974, NUREG-0588, Rev. 1
<p>Class 1E and non-1E, RG 1.97, Category 2 radiation monitors</p>	Post-Accident monitoring and ventilation system control post-DBA	Combined test and analysis and IEEE 323-1974, RG 1.97, NUREG 0588, Rev. 1
<p>9</p> <p>Qualified Display Processing System (QDPS)</p>	Post-Accident monitoring	Combined test and analysis and IEEE 323-1974
<p>Class 1E and RG 1.97, Category 1 and Category 2*</p>		
<p>Insert 10 continued</p> <p>(Auxiliary Shutdown station panels)</p>	Control of Class 1E equipment for shutdown from outside main control room	IEEE 323-1974, Refer to Section 3.11.2.

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TABLE 3.11-4A

- Mild Environment

SAFETY-RELATED EQUIPMENT (OUTSIDE CONTAINMENT)
OPERATIONAL AND QUALIFICATION REQUIREMENTS

<u>Equipment</u>	<u>Purpose</u>	<u>Qualification Requirements</u>	
Diesel generators	Provide emergency electrical ac power after loss of all offsite power	Test, analysis, or combined, IEEE 323-1974, Refer to Section 3.11.2	38
4.16 kV Switchgear	Class 1E power distribution	Test, analysis, or operating experience, and maintenance, IEEE 323-1974, Refer to Section 3.11.2	
480 V Load centers	Class 1E power distribution	Test, analysis, or operating experience and maintenance, IEEE 323-1974, Refer to Section 3.11.2	
480 V Motor control centers	Class 1E power distribution and motor control	Test, analysis, or operating experience and maintenance, IEEE 323-1974, Refer to Section 3.11.2	
120 vac Class 1E distribution panels	Distribution and control of Class 1E instrumentation power	Test, analysis, or operating experience and maintenance, IEEE 323-1974, Refer to Section 3.11.2	
125 vdc Batteries	Supply power for instrumentation ac inverters, solenoid valves, switchgear control, etc.	Test, analysis, or maintenance, IEEE 323-1974, Refer to Section 3.11.2	38
125 vdc Distribution panels	Distribution and control of vital ESF dc power	Test, analysis, or combined, IEEE 323-1974, Refer to Section 3.11.2	
480 vac/125 vdc Battery chargers	Supply dc power to 125 vdc ESF Batteries	Test, analysis, or combined, IEEE 323-1974, Refer to Section 3.11.2	
Class 1E Electric cables	Supply power, instrumentation, and control to those devices required to function during and after an accident	Combined test, and analysis, IEEE 383-1974, IEEE 323-1974 as modified by RG 1.131	38
Motors	Drive for pumps, fans, etc.	Test, analysis, or combined, IEEE 334-1971	
ESF Load sequencers	Provide sequenced starting of selected ESF loads	Test, analysis, or combined, IEEE 323-1974, Refer to Section 3.11.2	

INSERT 11

INSERT 12

TABLE 3.11-4 (Continued)

POSTACCIDENT EQUIPMENT (OUTSIDE CONTAINMENT)
OPERATIONAL AND QUALIFICATION REQUIREMENTS

<u>Equipment</u>	<u>Purpose</u>	<u>Qualification Requirements</u>
Motor-operated valves	Containment isolation and various other system-dependent safety-related functions.	Combined test and analysis, IEEE 382-1972, and RG 1.73

INSERT
11

Main control board (including post-accident monitoring indicators)	Control of Class 1E equipment and post-accident monitoring	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2
Inverters	Supply 120 vac vital bus power	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2
Voltage Regulators	Supply 120 vac vital bus power	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2
Relay Panels	Protect distribution system	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2
Isolation Transformers ^{Devices}	Isolate Class 1E from non-Class 1E power and for Class 1E- Class 1E train separation/isolation	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2

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Hydrogen Monitors	Post-Accident hydrogen monitoring and hydrogen recombiner activation	Test and IEEE 323-1974
Post-Accident Monitoring transmitters/sensors	Post-Accident monitoring and other functions as required	Combined test and analysis and IEEE 323-1974
Main steam safety relief valve position indication (non-1E RG 1.97, Category 2)	Post-Accident monitoring	Combined test and analyses and IEEE 323-1974
Class 1E and non-1E, RG 1.97, Category 2 radiation monitors	Post-Accident monitoring and ventilation system control post-DBA	Combined test and analysis and IEEE 323-1974

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Qualified Display Processing System (QDPS)	Post-Accident monitoring	Combined test and analysis and IEEE 323-1974, Refer to Section 3.11.2
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has been
Table 3.11-5 ~~will be deleted~~
~~provided later.~~