

Equipment Qualification Branch  
Input for Supplemental Safety Evaluation Report  
Comanche Peak, Unit 1  
Docket No. 50-445

3.10 Seismic and Dynamic Qualification of Safety Related  
Mechanical and Electrical Equipment

3.10.1 Seismic and Dynamic Qualification

Introduction

Our evaluation of the applicant's program for qualification of safety-related electrical and mechanical equipment for seismic and dynamic loads consists of: (1) a determination of the acceptability of the procedures used, standards followed, and the completeness of the program in general, and (2) an audit of the selected equipment items to develop the basis for the staff judgement on the completeness and adequacy of the implementation of the entire seismic and dynamic qualification program. The Seismic Qualification Review Team (SQRT) consists of engineers from the Equipment Qualification Branch (EQB) and the Brookhaven National Laboratory (BNL). The SQRT has reviewed the equipment dynamic qualification information contained in the pertinent Final Safety Analysis Report (FSAR) Sections 3.9.2, 3.9.3 and 3.10 and made a plant site audit on August 9 through August 13, 1982 to determine the extent to which the qualification of equipment, as installed at Comanche Peak 1, meets the current licensing criteria as described in Regulatory Guides 1.100 and 1.92, Standard Review Plan (SRP) Section 3.10, and Institute of Electrical and Electronics Engineers' IEEE 344-1975 standards. Conformance with these criteria are required to satisfy the applicable portions of the General Design Criteria in 1, 2, 4, 14, and 30 of Appendix A to 10 CFR Part 50, as well as, Appendix B to 10 CFR Part 50 and Appendix A to 10 CFR Part 100.

## Discussion

During the site visit, the SQR T audited a representative sample of safety-related electrical and mechanical equipment as well as instrumentation included in both the nuclear steam supply system (NSSS) and the balance of plant (BOP) systems. The scope of the audit included field observations of the actual, final equipment configuration and its installation and a review of the corresponding test and/or analysis documents in the applicant's central files. The SQR T observed the field installation of the equipment to verify and validate equipment modeling employed in the qualification program.

On the basis of the audit, the staff identified both generic and equipment specific concerns, as detailed in the staff's trip report (from V. S. Noonan to B. J. Youngblood, dated 11/24/82) issued after the audit. The applicant was requested to develop an acceptable approach and a plan to implement the resolution of all the staff concerns.

In responding to the staff concerns as identified in the aforementioned trip report, the applicant has provided additional information during the conference call of February 16, 1983 between the staff, BNL and the applicant, the follow-up meeting of March 2, 1983, and subsequently the submittal of June 10, 1983. The SQR T reviewed the submittal and issued a follow-up evaluation report on August 10, 1983 (from M. Subudhi of BNL to G. Bagchi of NRC) which summarized the remaining open items at the time. Since then, there were additional applicant's responses provided in the letters of September 16, 1983, May 17, 1984, August 31, 1984, and November 6, 1984, to resolve the remaining open items. The staff has reviewed these submittals and found the applicant response to be acceptable in resolving all the staff concerns of both generic and equipment specific issues. The resolution of the generic items is summarized in Table 3.10.1.1, whereas the findings and subsequent resolutions for the equipment audited during the site visit are summarized in Table 3.10.1.2.

According to the staff licensing criteria as stated in Introduction, all the safety-related equipment including those not audited at the site should be completely qualified prior to the fuel load. Exception to this is when proper justification for interim operation (JIO) is approved by the staff. Based on letters of June 19, September 19, September 20 and November 6, 1984, from the applicant, such JIO was provided for the five equipment items which are still undergoing qualification process and was not specifically included among the items reviewed by the SQRT. The staff reviewed the JIO and found that it is acceptable for interim operation of the plant. A summary discussion of the JIO for each of the five equipment items is given in Table 3.10.1.3. The review summary and the corresponding staff proposed license conditions, as a result, are presented in the next section.

#### Summary and License Conditions

Based on the SQRT site audit and the submittals from the applicant, the staff concludes that the applicant's equipment seismic and dynamic qualification program, having been satisfactorily defined and implemented according to the current staff licensing criteria, is in conformance with the pertinent portion of the General Design Criteria as stated in Section 3.10.1. The staff, therefore, recommends issuance of the operating license, subject to the following conditions:

1. The applicant's resolution of Generic Item 1 is found to be acceptable. However, this acceptance is subject to overall acceptance by the NRC Technical Review Team of the adequacy of the quality assurance program instituted at the Comanche Peak Plant.
2. The applicant should complete all the necessary wiring changes for NSSS Auxiliary Relay Rack (ESE-XX) prior to the fuel load. See Table 3.10.1.3
3. The applicant should complete qualification, including full documentations, prior to exceeding 5% power of operation for BOP Analog Control System (MS-611B), 7300 Series Process Protection System (ESE-13), Differential Pressure Indicating Switches (ESE-40), Nuclear Instrumentation System Cabinet and accessories (ESE-47), and Auxiliary Relay Rack (ESE-XX). See Table 3.10.1.3.

Table 3.10.1.1. Summary of Generic Items and Their Resolutions

<u>ID No.</u>	<u>Subject</u>	<u>Description of Findings</u>	<u>Resolution</u>	<u>Status</u>	<u>Remarks</u>
1	Equipment Installation	Most of the equipment audited were not completely installed.	An independent inspection of the installation of a representative sample of equipment has been completed. All deficiencies - minor problems, will be corrected in the final close-out inspection.	Closed	Based on CPSES 9/16/83 Letter
2	Dynamic Loads	Other dynamic loads were not considered in some cases.	Proper design has been employed to preclude two-phase flow during pump operation. Steam hammer & relief valve discharge were considered in qualification which envelop other transients	Closed	Based on CPSES 6/10/83
3&11	Aging/Maintenance & Surveillance	Effect of aging on some mech. equip. was not considered. Qualified life and surveillance & maintenance program for mechanical equip. were not adequately addressed.	It is assured by CPSES that mech. equipment in both harsh and mild environment can survive a seismic event at any time during its installed life, based on the design, procurement, installation, location, as well as a surveillance and maintenance program of which the program plan and samples have been found to be acceptable.	Closed	Based on CPSES 6/10/83 Letter
4	Equipment Operability	Operability qualification of many equipment types by analysis alone needed additional justification.	Justification has been provided and found acceptable	Closed	Based on CPSES 6/10/83 & 5/17/84 Letters

(Table 3.10.1.1 cont'd)

5	Damping Values	Higher damping values were used for SSE analyses with no regard for the actual stress level.	For NSSS equipment (CRDM, for example), it was confirmed that stresses are not significantly less than yield for faulted condition loads. For BOP equipment, even if OBE damping values were used, the stresses would still be acceptable.	Closed	Based on CPSES 6/10/83 Letter
6	Semi-Rigid Equipment	Needed confirmation that (NSSS) equipment with only one natural freq. below 33 Hz was adequately qualified by static analysis.	Such confirmation was provided for quasi-static analysis using peak spectra acceleration at the equipment's freq.	Closed	Based on CPSES 6/10/83 Letter
7	Qualification Status	Qualification status was not properly reflected in the equipment master list (e.g. Electrical Hydrogen Recombiner, and Nuclear Inst. system)	Adequate status of each piece of equipment is being maintained by the proper groups to monitor all facets of the construction process, incl. receipt inspection, turn-over to the startup group and turn-over to the operation group.	Closed	Based on CPSES 6/10/83 & 11/6/84 Letters
8	Westinghouse Scope	Needed a clear definition of qualification file maintained by Westinghouse. Need to include surveillance & maintenance information in the file.	Westinghouse and vendors maintains all qualification files for all NSSS equipment. CPSES also maintains summary of qualification files for NSSS electrical equipment. Surveillance and maintenance requirements (if any) are included in the files.	Closed	Based on CPSES 6/10/83 Letter

(Table 3.10.1.1 cont'd)

9	Torque Requirements	Torque requirements were often not specified in the basic mounting information (e.g. Hydrogen Recombiner).	The requirements have now been specified as part of WCAP-8587, for Hydrogen Recombiner. In general, the information is specified by the qualification report or is established on site.	Closed	Based on CPSES 6/10/83 Letter
10	Nitrogen Supply System	Nitrogen Supply System was not seismically qualified at the time of site audit.	The system need not be qualified because it is well supported and uses well-protected tube runs, and, therefore, the pressure would not be lost following a seismic event. Also, either control room alarm or local pressure indication will provide signals of any penetration failure.	Closed	Based on CPSES 6/10/83 Letter

Table 3.10.1.2 SQRT Review Summary for Equipment Audited

<u>ID No</u>	<u>Equipment Name and Description</u>	<u>Safety Function</u>	<u>Findings</u>	<u>Resolution</u>	<u>Status</u>	<u>Remarks</u>
BOP-1	45KVA Class 1E Lighting Transformers & Accessories	Provide elec. power to essential lighting system.	Qualified		Closed	Based on site audit
BOP-2	DC Switchboard and DC Distr. Panels	Distribute DC power to plant instrumentation systems.	Qualified pending completion of installation.	Has been resolved via Generic Issue #1	Closed	Based on CPSES 9/16/83 Letter
BOP-3	Electrical Pene. Assemblies	Provide means for continuity in power control and signal circuit.	Non-seismic category.	Seismic qual. not required	Closed	Based on site audit
BOP-4	Iso. Equipment & Cabinet CR-16	Provide elec. iso. and physical separation.	Discrepancies found in installation. Needed justification on single freq./ single axis testing method.	Has been resolved via Generic Issue #1. Justification of testing method is acceptable.	Closed	Based on CPSES 8/31/84 & 9/16/83 Letters
BOP-6	Chilled Water Recirc. Pump Motor	Provide motive force to recirc. pump during recirc. phase of plant operation.	Qualified pending estab. of an aging/ surveillance and maintenance program.	Has been resolved via Generic Issues #3 and 11	Closed	Based on CPSES 6/10/83 Letter
BOP-7	Limatorque Motor Operator	Open the valve that provides sodium hydroxide flow.	Qualified		Closed	Based on site audit
BOP-9	16 inch 150 lb. gate valve with motor operator	Allow recirc. of containment spray water	Qualified pending verification of design g- load	Verification has been made	Closed	Based on CPSES 11/6/84 Letter

(Table 3.10.1.2 cont'd)

BOP-8/10	18 inch 900 lb. feed-water iso. valve with Pneum. Hydr. Operator.	Perform feedwater isolation.	Qualified pending verification of design g- load.	Verification has been made	Closed	Based on CPSES 11/6/84 Letter
BOP-11	Service water system-traveling water screens-motors	Drive the traveling water screens.	Qualified		Closed	Based on site audit
BOP-12	Diesel generator local control panel (CPI-MED GEE-01 & -02)	Controls diesel generator electric power during loss of all normal aux. power sources.	Qualification documents for sequential test of age-sensitive components were not made available at site audit. Operability of devices were not demonstrated.	Documents have been identified. Evidences of components operability demonstrated	Closed	Based on CPSES 8/31/84 Letter
BOP-13	Main Steam Iso. Valve	Seal off uncontrolled steam flow in case of a steam line rupture.	Needed to be included in a surveillance and maintenance program. Needed to assess effects of impact due to sudden closure of the valve.	Has been revolved thru generic issues #3/11. Valve closure loading is determined to be insignificant compared to water hammer loading already considered due to turbine stop valve closure.	Closed	Based on CPES 6/10/83 & 8/31/84 Letters
BOP-14	Main Steam Relief Valve	Relieve steam pressure from main steam line.	Qualified		Closed	Based on site audit
BOP-15	CVI Filter Units	Used as part of the primary plant exhaust system.	Final Qualification package was not complete at site audit.	Qualification Documentation has been completed.	Closed	Based on CPSES 8/31/84 Letter



BOP-16	Refrigeration Compressor Unit	Used for control room air conditioning system.	Needed to address surveillance and maintenance program. Lacked evidences of equip. operability. Improper field mounting identified.	Has been resolved thru Generic Issue #3. Evidence of operability demonstrated. A new rigid mounting is acceptable.	Closed	Based on CPSES 5/17/84 & 6/10/84 Letters
BOP-18	Control Room HVAC Control Panel	Control temp. & ventilation of control room.	Installation was not completed during site audit. Qualification report was not completed.	Has been resolved thru Generic Issue #1. Qualif. report has been completed.	Closed	Based on CPSES 8/31/84 & 9/16/84 Letters
BOP-19	Motors-General (Incl. R-12 compressor motor, fan motors, & air compressor motors)	Provide driving powers for the compressors & fan)	Installation was not completed during site audit. Qualif. was done by analysis alone. Needed to address surveillance & maintenance program for age-sensitive components.	Has been resolved thru Generic Issue #1. Surveillance & maintenance program has been addressed in Generic Issues #3 and 11.	Closed	Based on CPSES 5/17/84, 6/10/83 & 9/16/83 Letters
BOP-24	Electronic Transmitters	Monitor pressure or flow.	Qualified		Closed	Concluded at site
NSSS-26	Control Rod Drive Mechanism	Control insertion and withdrawal of control rods.	Concerns identified relating to use of high damping value, nonlinear analysis with gap, fundamental frequencies of control rod, safe drop of rod, and site specific qualif. document.	All concerns resolved	Closed	Based on information provided in 3/2/84 meeting

NSSS-27	Letdown Heat Exchanger	Cool the letdown flow	1" piping off the end of the heat exchanger was not properly installed. Reference document, WCAP-8230, was not available for review at site.	Has been resolved thru Generic Issue #1. WCAP report has been reviewed and found acceptable.	Closed	Based on information provided in 9/16/83 Letter & in 3/2/84 meeting
NSSS-28	Centrifugal Charging Pump	Injects concentrated boric acid solution into the RCS cold legs in case of a steam break and a small RCS break.	Evidences of sequential test of age-sensitive materials were not available at site audit. Qualified life was not assessed.	A sequential test has been performed for critical portions of the motors. Qualified life of motor is calculated to be 5 yr. and is acceptable.	Closed	Based on information provided in 3/2/84 meeting
NSSS-29	ECCS Accumulator	Provides cooling water for primary system depressurization.	Computer program WECAN and report WCAP-8230 were not available at site audit. Installation of several piping restraints were incomplete.	WECAN & WCAP-8230 have been reviewed and found to be acceptable. Installation concern has been resolved thru Generic Issue #1.	Closed	Based on information provided in 3/2/84 meeting & in 9/16/83 Letter
NSSS-30	Residual Heat Removal Pump and Motor	Provide necessary flow in the RHR system.	Use of the methodology of WCAP-8230 needed to be verified. Needed to sequentially test the motor.	Confirmation was provided. Motor insulation system was sequentially tested.	Closed	Based on information provided in 3/2/84 meeting
NSSS-31	24-inch Motor Operated Butterfly Valve		Qualified pending verification of design g load.	Verification has been made.	Closed	Based on CPSES 11/6/84 Letter

(Table 3.10.1.2 cont'd)

NSSS-32	Electric Hydrogen Recombiner ("surprise item")	Combine hydrogen following a LOCA.	Equipment was not installed. Qualification details were not available at site audit.	Has been resolved thru Generic Issue #1. Other information has been provided, reviewed and accepted.	Closed	Based on information provided in 9/16/83 letter & in 3/1/84 meeting
NSSS-33	Nuclear Instrumentation System ("surprise item")	Provides indication of reactor power from 0 to 120% of full rated.	Installation was not completed.	Has been resolved thru Generic Issue #1 prior to the fuel load.	Closed	Based on CPSES 9/16/83 Letter

Table 3.10.1.3 SQRT Review Summary for Equipment Yet To Be Qualified

<u>ID No.</u>	<u>Equipment Name Description</u>	<u>Safety Function</u>	<u>Justification Interim Operation</u>	<u>License Action Required</u>	<u>Status</u>	<u>Remarks</u>
NS-611B	BOP Analog Control System (7300 Series)	Monitor and control containment spray, aux. feed-water, and component cooling water, etc.	The NTD card exhibited intermittent output during testing. Its physical integrity was maintained. The effect was determined to have no safety significance. Westinghouse is to demonstrate that Manual/Automatic Stations have no thermal aging mechanism.	Complete qualification documentation prior to exceeding 5% power of operation.	JIO acceptable	Based on CPSES 6/29/84 Letter
ESE-13	7300 Series Process Protection System	Process analog signals which are used for reactor trip, engineered safeguards actuation, and post-accident monitoring.	Initial Westinghouse evaluation indicates that margins are available to absorb system inaccuracies resulted from errors exhibited by NPC, NCH, NSC, and cabinet power supply cards during	Complete qualification prior to exceeding 5% power of operation.	JIO acceptable	Based on CPSES 6/29/84 Letter

(Table 3.10.1.3 cont'd)

			the testing. Contact bounce exhibited by NTC card can not degrade safety system performance. All anomalies are being resolved.			
ESE-40	Diff. Pressure Indicating Switches	Actuate the minimum flow bypass valve to assure adequate flow thru RHR pump.	Intermittent switch actuation would occur when the measured differential pressure is 10% or less full scale from the switch set-point. All conceivable conditions in which the point bounce could occur have been analyzed and found acceptable.	Complete qualification documentation prior to exceeding 5% power of operation.	JIO acceptable	Based on CPSES 6/29/84 Letter
ESE-47	NIS cabinet, source range detector and source range pre-amplifier as used for boron dilution event detection and mitigation.	Provide indication and mitigation of a boron dilution event when reactor power is in the source range.	The redesigned tri-axial connector of Comanche Peak pre-amplifier (model MK II) failed during the pre-amplifier test. The older style connector was installed and subsequent seismic test results were satisfactory.	Replace the old style connector prior to the fuel load. Complete all qualification documentation prior to exceeding 5% power of operation.	JIO acceptable	Based on CPSES 6/29/84 Letter

(Table 3.10.1.3 cont'd)

ESE- XX	NSSS Auxiliary Relay Rack TBX-ESELAR-01	Provides the housing for certain control grade circuits and relays.	Final qualification study needs to be completed. Adequate evidences from pre- vious test data indicates that the auxiliary relay racks and relays will pass all seismic testing and analyses. In addition, the great- est degree of physical independence of train and non-train circuits will be achieved by employing separate wirings and terminal blocks. The necessary wiring changes will be completed by FCN Number TBXM106-33 prior to fuel load. Finally, testing and engineering judge- ment confirm the suit- ability of relays to act as electrical isolators.	Complete qualifica- tion, including documentation, prior to exceeding 5% power of operation.	J10 acceptable	Based on CPSES 9/20/84 Letter
------------	--	--	--	--	----------------	--