Structural Analysis Division
Department of Nuclear Energy
Brookhaven National Laboratory
Upton, NY 11973

# Seismic Qualification Review Team (SQRT)
# Audit Report
# for
# Millstone Nuclear Power Station, Unit 3

Audit Date: March 4-8, 1985

## INTRODUCTION

This report documents the evaluation of seismic qualification of some preselected seismic category I equipment for Millstone Nuclear Power Station, Unit 3. The report is prepared by Brookhaven National Laboratory (BNL) based upon an audit performed by the Seismic Qualification Review Team (SQRT) at the plant site in Connecticut during March 4-8, 1985. The BNL review team consisted of J. Curreri, M. Kassir and K. Bandyopadhyay. The Nuclear Regulatory Commission (NRC) was represented by N. Romney for the SQRT audit.

A total of eighteen pieces of equipment, six from Nuclear Steam Supply System (NSSS) and twelve from the Balance of Plant (BOP), was audited. The audit consisted of site inspection of one or more samples of each equipment family followed by review of the pertinent seismic qualification documents as presented by Northwest Utilities (NU) and its agents Westinghouse Electric Corporation (W) and Stone & Webster Engineering Company (S&W). The site installation was compared with the qualification mounting, and the qualification documents were reviewed to meet the adequacy of structural integrity and functional operability of the equipment. Due to energization of the equipment and/or unaccessability of the mounting, some installations could not be properly inspected. During the audit period, NU, W and S&W described their qualification program through presentation, and interpretation and clarification of qualification reports.

The seismic evaluation of the equipment resulting from the audit is individually described in the following sections including the equipment-specific open issues requiring resolution for acceptance of its seismic qualification program. A listing of the audited equipment and a brief description of the findings including respective status are provided in the attached table. The generic open issues also requiring resolution for acceptance of the seismic qualification program are listed in the following subsection.

GENERIC OPEN ISSUES

1. Upon completion, the applicant must confirm that all safety-related equipment is qualified and properly installed.

2. For pipe-mounted equipment, the applicant shall confirm that the g-values at equipment locations obtained from as-built piping analyses do not exceed the g-values used for qualification.

3. Several pieces of equipment were observed to be installed adjacent to other safety or non-safety-related equipment without any dynamic interaction evaluation documented in the qualification package presented during the audit. As a result, the applicant must develop a program to inspect installation of all safety-related equipment and evaluate the possible dynamic interaction between two adjacent pieces of equipment. In case a gap exists between two pieces of equipment, the physical separation should be evaluated to preclude any dynamic impact.

Main Control Boards

The main control boards located in the control building at elevation 47 feet 6 inches contain numerous class 1E electrical and I&C devices that will be used to remotely supervise, monitor and operate the power plant systems. The control boards will be required for both hot standby and cold shutdown of the reactor. Eight benchboard sections, (ID 3CES*MCB-MB1 through MB8 per Reliance drawing) are installed to form the half-U-shaped control boards structure. The benchboard sections consist of a structural steel framework and sheet enclosure on which the monitoring devices are installed. The structural frame is bolted to a base channel which in its turn is welded to an embedded steel plate. Hilti expansion bolts with clip angles are used for additional connections. The control boards are supplied by Reliance Electric Co., Custom Controls Division. The design specifications are documented in S&W Spec. 2424.100-245, Rev. 6.

A field inspection was conducted on control board section MB3. Adjacent sections were bolted together. The control board sections could not be identified in the field since they did not have any ID, tag or model number marked on them. Temperature indicator 3RCS*TI413A mounted apparently on MB2 was also inspected during the site visit.

For seismic qualfication purposes, the structural frame of the control boards was analyzed for dynamic characteristics. The fundamental natural frequency was shown to be above the cut-off frequency of the RRS. Consequently, the control boards structure was statically analzyed for the seismic load and the member stresses were shown to be within the allowable limits. However, the structural adequacy of most connections was not addressed in the qualification document (Reliance report no. AAI-142, Revision 0) presented during the audit.

The electrical devices and control instruments mounted on the control boards were tested for seismic qualification. The qualification report SQR-99X2087A, Revision 1, prepared by Reliance Electric Co. was not approved by the reviewer SWEC at the time of the audit.

Based upon our review of the available documents, inspection of the equipment and the interpretation provided by SWEC during the audit, we have come to the conclusion that in order to qualify the equipment the applicant should resolve the following comments:

1. Demonstrate adequacy of the structural connections.

2. Provide an auditable link between the qualification documents and the installed control baord sections, preferably by marking appropriate ID or tag number on the installed equipment.

# 4.16 KV Emergency Switchgear
## 3ENS*SWG

The 4.16 KV Emergency Switchgear supplies power for all emergency auxiliary loads, such as the 480 V load center and the MCC and associated loads, that are connected to this unit. There are two such trains to provide redundancy for their safety function.

The 4.16 KV Switchgear system consists of about 22 panels placed side to side and secured to each other in a row about 50 feet long. The equipment contains three types of units. These are:

1) 4160V - 350 MVA - 3000 Ampere M26H vertical lift switchgear and equipment and a 3000 Ampere Non-Segregated Bus Duct.

2) 4160V - 350 MVA - 1200 Ampere M26H vertical lift switchgear and equipment.

3) 4160V - 350 MVA - 3000 Ampere M26H vertical lift switchgear single breaker unit.

The equipment is located in the Control Building at the 4'-6" level.

The 4.16 KV Switchgear is qualified by tests which were done on substantially similar units. Only a summary report was available during the audit, of the tests that were done by General Electric and by Wyle Labs.

The summary report documents the nature of the tests and the overall results. The tested relays were calibrated before and after the test program. There were no significant changes in the relay calibrations or pick-up and drop-out coil parameters due to the seismic testing.

A 4160V-1200A-350MVA Switchgear was subjected to a series of 64 single axis and biaxial tests at levels which were considerably in excess of the Millstone 3 environment. During all of these tests, it is reported that the equipment met minimum performance requirements.

A 4160V-3000A-350MVA Switchgear was subjected to a test series in excess of 47 single axis tests consisting of sine sweeps and sine beat tests.

A frequency search in the range of 4-35 Hz determined that the major resonances were found to be between 8 and 13 Hz. After the resonant frequencies were determined, a series of sine beat tests consisting of five beats with ten cycles per beat were conducted in each of three mutually perpendicular axes.

A number of accelerometers and strain gages were used to monitor the responses and the stress in the critical breaker lifting mechanism assembly. Some relays were energized so as to be capable of falsely tripping or closing the breaker while the contacts of other relays were monitored to detect contact closure.

The test results showed that the equipment sustained all testing without any damage. All mechanisms operated successfully during and after the tests. The report describes that even under the most severe test at 2.3 g input, the peak stress in the lifting mechanism jackscrew was only 40,500 psi. This did not exceed the yield strength of the material.

Similar tests were performed on the other portion of the 4.16 KV Switchgear. The conclusions were similar, i.e., the equipment passed the seismic qualification tests with no failure, malfunctions or excessive contact chatter.

The summary report that was available during the audit is, however, not adequate to review the details of the test procedure, instrumentation, test mounting and anomalies that may have occurred. A review of the actual test documents is required for the audit and so remains as an open item.

During the course of the equipment inspection, it was noted that there is a larger bus duct supported from the floor above and which appears to abut a top portion of the 34-D-2H. The generation of possible interactive effects was raised during the audit. A General Electric report No. 76-SED-4, dated May 21, 1976 was produced. The title is, "Seismic Interaction Effects Analysis Between 4.16 KV 350 MVA 3000 Ampere Metal Clad Switchgear, Non-Segregated Bus Ducts and Cable Termination Boxes". The essence of the report is that restraint is required. As a result of the analysis, the bus duct is now rigid, as installed. However, the report does not discuss the motion at the top of the switchgear which might cause interference. This aspect of the problem is still an open issue.

Motor-Driven SG Auxiliary Feedwater Pump
(3FWA*P1)

The auxiliary feedwater pump is required to provide water for cooling the reactor core during emergency shutdown and containment isolation. There are two such units in the safety system. The inspected assembly consists of 10-stage centrifugal pump which is driven by a 600hp induction motor. Both components are bolt-anchored to concrete pedestal on the floor. The overall weight of the assembly is 9920 lbs. and is located at elevation 21'-6" of the engineered safety features building.

The design specifications used for the equipment are documented in Stone and Webster Spec. 2275-200-041 for the pump and Spec. 2441-003-009 for the motor. The combination of pump and motor is qualified by analysis. The qualification document for the pump is report No. ME-590, "Seismic Stress Analysis of Motor Driven Pumps", prepared by McDonald Engineering Analysis Company, Inc., dated November 7, 1978. This is essentially a static analysis for determining the lowest natural frequency. It utilizes a standard STRUDL base-element computer program. The loading considered includes seismic, internal pressure, shaft torsional and generic nozzle loads. For the pump-motor-base-plate assembly, the fundamental natural frequency is 21.4 Hz, which is greater than the cut-off frequency of the specified RRS at the pertinent elevation of the plant site. The report shows that the stress levels in the pump's components as well as in the anchoring bolts to the pedestal are adequate for the specified loading. The maximum critical deflection under the seismic excitation is calculated to be 0.006" at the impeller. Since the allowable is 0.007", it is concluded that the operability of the pump to function as specified is not impaired. However, due to the proximity of these numbers, NEU should recheck the impeller deflection when the as-built nozzle loads become available to assure the pump's operability. The pump's torsional frequency is 3600 RPM which is less that the critical frequency (7000 RPM).

The qualification document for the motor is report No. 34A181312, "Stress and Deflection Analysis of Seismic Forces on Horizontal Induction Motor Model No. 5K821051C40", dated February 23, 1979. The report is prepared by General Electric Co., and reviewed by SWEC. Basically, it is a static analysis using acceleration coefficients. The report demonstrates that the calculated stresses and deflections are less than the allowable ASME values. Also, the natural frequency is greater than 20 Hz, which is adequate for that location in the Millstone plant. During the audit, it was noted that the computer program used by GE in the analysis was not available in the qualification report and, therefore, can not be verified. It is suggested that NEU personnel should examine the computer code and verify its methodology and results.

Based on the above information, it is concluded that the motor driven auxiliary feedwater pump will be qualified for the seismic loads at Millstone - Unit 3 site.

Isolator Cabinets
3CES*PNL

The isolation panels are used to perform the electrical isolation function required by R.G. 1.75. Briefly, this states that a fault developed in a non-Class 1E circuit should not be transmitted to a Class 1E circuit. The panels are intended to maintain the integrity of Class 1E circuits.

There are 32 such panels in the safety system of Millstone 3. Each panel consists of a single cabinet about 30"W x 24"D x 90"H. The panel is welded to an imbedded beam with four 1/4" fillet welds, each 6" long on the front and back. The panel contains 72 isolator relays. The inspected panel was located in the Emergency Safeguard Feature Building at the 36'-6" level.

The seismic qualification is done by both analysis and test. The analysis was carried out to establish that the basic structure of the cabinet was essentially rigid for the seismic enviornment. The test portion was done to establish the qualification of the particular equipment housed by the panel.

The basic structure was manufactured by Struthers-Dunn. The analysis of the structure was carried out by Acton Environmental Testing Corporation. Their report is entitled, "Static Analysis of Isolation Cabinet for Northeast Nuclear Energy Company", dated January 29, 1982, Report No. 16824.

Qualification of the isolation cabinet was done by showing that a finite element model of the cabinet has a high natural frequency. The System Development Corporation/STARDYNE Analysis System was used. Quadrilateral and triangular plate elements were used to represent the external skin areas, sub-panels and gussets. Beam elements were used to represent the main structural members.

There were two local natural frequencies at 32 Hz where no equipment was located. All other natural frequencies were above 33 Hz. Hence, a static analysis was performed using acceleration levels of 0.8 g horizontally and 1.73 g vertically to represent the SSE event. These loads were applied along three mutually perpendicular directions. Fatigue effects were calculated on the basis of 5 OBE events and 1 SSE.

All stress and deflections were below the allowable values. The allowable stress values used were $\sigma_{OBE} < 0.75$ Sy and $\sigma_{SSE}$ is the lesser of $0.70\ \sigma_{ult}$ or 1.0 Sy but that both SSE and OBE are satisfied by limiting both SSE and OBE to 0.75 Sy.

The qualification of the CX317NE reed isolation device was done by similarity to reed relay CX3916NE. The two types of relays are the same in all respects except for the material at the surface of contact. The CX3917 has tungsten contacts while the CX3916 has rhodium contacts. The CX3916NE and the CX3917NEE use the same enclosure and all weights are exactly the same. All non-metallic materials are exactly the same. All physical dimensions and characteristics are the same. Only their electrical rating is different, but their dynamics is claimed to be the same, as noted in a letter dated December 31, 1981 signed by J. Carr of Struthers-Dunn to M. Sanick of Stone and Webster.

The qualification tests were done on twelve CX3916 isolatiors. The test items were subjected to biaxial multiple frequency excitation at a level that envelops the required response spectra at the appropriate location in Millstone 3. The test was done to demonstrate the capability of the isolators to withstand the dynamic environment without any evidence of mechanical damage, deterioration, false closure of contacts (non-operational portion) or contact chatter (operational and transition portions) in excess of one millisecond, or failure of the isolators to transfer state properly (transition portion).

The test data shows that the 10 year qualification for CX3916NE will apply to CX3917NE except that the electrical ratings for CX3917NE are different.

It is concluded that the isolation panels are seismically qualified for their use in Millstone 3. There are no open items.

Motor Operated Damper
(3HVR*MOD72B)

The equipment inspected during the audit consists of 48"x48"x10" damper supplied by American Warming and Ventilation, an ITT control actuator and Namco Limit Switches. It is duct-mounted and supported at the wall at elevation 71'-11" of the auxiliary building. Its overall weight is approximately 550 lbs. The damper is part of the fuel building exhaust system and its function is to provide ventilation for fuel handling. There are 18 such units in the safety system.

Stone and Webster specification No. 2472.900-594 requires a rigid support for all category I dampers and a 3.0 g test input. The damper assembly is qualified by test, while its mounting support system is qualified by analysis.

The qualification of the damper is documented in Wyle Laboratories report No. 45894-1, "Seismic Simulation Test Program on Five Damper Assemblies", dated February 18, 1982. Bi-axial resonance search and sine beat testing in each of two test excitations were performed in accordance with IEEE 344-1975. During the sine beat excitation at 29 Hz, out-of-phase, in the longitudinal/vertical test orientation, the ITT NH-95 actuator failed to open. Post-run inspection revealed that the solder joint which held the capacitor in the actuator had broken. This failure is to be resolved at Millstone plant - Unit 3 by using an alternative capacitor clip anchoring device which passed seismic qualification.

The ITT actuator NH95 series was also tested and the qualification is documented in Wyle Laboratories report No. 58784 - revision B, "Qualification Test Program on Hydromotor Actuators for ITT General Controls", dated April 12, 1984, and reviewed by SWEC. The field mounting appears to be better than

the as-tested condition. Resonance search and sine sweep as part of vibration aging were performed. The input g level was greater than 3.0 g. The least resonance detected was at 27 Hz. Since the category I damper is rigidly mounted, the test input condition was conservative. Three anomolies were recorded:

1. Flexure in the balance beam flapper assembly broke.
2. Limit switch vibrated and broke.
3. Solder joint between capacitor and clip broke.

The first two failures were attributed to cyclic fatigue due to an overtest condition. The required input acceleration is 0.75 g, while the actual one used in the test was 2.5 g for frequencies between 100 to 200 Hz. Following identification of the over-test condition, the actuator was rebuilt and re-tested under realistic load levels without changing any non-metallic part. The actuator completed the vibration test and was found to function satisfactorily. It appears that the third failure (which was also observed in the damper testing previously mentioned) is due to the nature of the clip used in the actuator.

The qualification of the NAMCO control limit switches is documented in report, "Qualification of NAMCO Controls Limit Switch Model EA.740", prepared by ACME Cleveland Development Company, dated February 22, 1979 and reviewed by SWEC. The test report does not describe the laboratory mounting conditions. However, it appears that the limit switches, on the prototype damper assembly tested at Wyle Laboratory, were mounted as installed in the field. Resonance search was performed. In each orientation, each switch was subjected to a continuous sine sweep from 1-35 Hz at a rate of one octave/minute. The sine sweep was run as follows: 1-10 Hz frequency with 1" displacement and 10-35 Hz frequency with 0.01" displacement. No anomolies were recorded in the report and it appears that the limit switches are qualified.

Based upon the environmental testing performed, a maintenance program of 12.9-yearlife for NAMCO Limit Switch Model EA740 and 5.9-year for the ITT actuator are suggested.

During the audit, NEU personnel were requested to submit qualifying documents for the damper's support system. A report (No. 12179-MP2545-F-689) issued by SWEC, dated March 5, 1985, was submitted. It is essentially a static analysis using STRUDL computer program to check stiffness and critical stresses in the connection means of the damper to the ducts and wall. All connections were found to be structurally adequate.

Based upon our review of the various reports and the field installation, we conclude that the following item should be resolved for seismic qualification of the equipment:

1. The present solder joint capacitor clip in the ITT general control actuator must be replaced by a proven seismically qualified anchoring devise.

Motor Operated Globe Valve
(3LMS*MOV40A)

The 1-1/2" motor operated globe valve is part of the containment leakage monitoring system. It is required to monitor the leak rate testing of the containment structure. There are four such units in the safety system. The assembly with ID No. 3LMS*MOV40A was inspected during the audit. It is pipe mounted (forged at an angle) and supported by a system of structural steel members with box type cross sections. The equipment (valve body is supplied by Yarway and operater by Limitorque) weighs 222 lbs and measures approximately 22"x24". It is located in the auxiliary building at elevation 16'-0-3/4".

The design requirements are described in S&W specification 2262.350.655. The qualification documents show that the equipment is qualified by a combination of test (operator) and analysis (valve). The overall assembly operability was demonstrated through a static deflection test. The motor operator which contained non-metallic age-sensitive components was also tested for the normal and accidental environmental parameters.

The structural adequacy of the valve is documented in report No. 1030-2, "Seismic Qualification of the Yarway 1-1/2" Welbond Globe Valve for MNPS - Unit 3", dated May 22, 1978, prepared by Nuclear Qualification Services and reviewed by SWEC. It is essentially a static analysis utilizing STARDYNE computer code of structural analysis. The lowest natural frequency of the model was extracted to demonstrate compliance with the 33 Hz rigidity specification. A dead weight acceleration of 1.0 g was added to a 3.0 g static seismic acceleration. The resulting 4.0 g acceleration was imposed in 3 axes independently and the resulting axial contributions were combined by SRSS summation. The pressure stress and motor induced stress were computed independently, and the resulting critical stresses were compared to those in ASME Sec. III and were found to be satisfactory. Since the analysis did not

address the additional support system which is present at the Millstone plant, a question can be raised whether these additional structural members will change the values of the critical stresses as well as the lowest natural frequency of the model.

The qualification of the valve operator is discussed in report No. B0058 (dated January 11, 1980), "Limitorque Valve Actuator Qualification for Nuclear Power Station". It is based on tests performed by Aero Nav Laboratories, Inc., and documented in report No. 5771, "Report of Seismic Test on SMB-000-5 Motor Actuator for Limitorque Corporation". Both reports were reviewed by SWEC. No resonance was evident after performing sine sweep test. The magnitudes and duration of the other tests were adequate for the Millstone Unit 3 site.

In order to verify operability of the valve, the assembly was installed in a test facility simulating the plant installation. The valve stem was placed in the vertical position. Static loads of 6.0 g horizontal and 6.0 g vertical (max. specified SSE value is 3.0 g) were applied at the center of gravity of the actuator. The assembly was pressurized to the design pressure of the valve and cycled (open-to-close, close-to-open). In all cases, valve operating time was less than the specified value. The test showed that there was no binding to interfere with functional operability.

A test program was also conducted to ensure environmental aging of the motor operator and to qualify it for the life of the plant.

Based on the above information, we have concluded that in order to qualify this equipment, NEU should resolve the following issues:

1. Demonstrate that the additional structural members added to restrain the valve assembly do not alter the conclusion of the qualifying analysis.

2. Prepare seismic qualification of the stuctural support system using the as-built loading level of the piping system.

# Distribution Panels

The 120/240V AC Single Phase, 3-wire grounded distribution panels are used to supply power to a compartment heater in the Motor Control Center and to a limit switch for motor operated valves. They contain various kinds of electrical equipment, including relays and switches. There are 11 such units at Millstone 3. Redundancy is provided to the distribution panels in the event of their failure. The back-up system is a General Electric panel identified as 3SCV*PNL240.

The distribution panel is relatively small, measuring 50"H x 24" W x 10" deep. They are mounted on the wall at levels of 24.5' and 43.5' in the Auxiliary Building and at the 19.5' elevation in the ESF Building.

The panels are qualified by test. The test was done by the Wyle Laboratory in Huntsville, Alabama. The results of the tests are contained in Wyle Test Report #46368-1, dated January 18, 1983.

The test report documents that two AC panels and one DC switchboard were tested on the Wyle Triaxial Seismic Simulator. The AC panels were mounted to a Wyle supplied rigid wall mount fixture. Each panel was secured with (4) 1/2-13, grade 5, bolts. This is in accordance with its field mounted condition. The panels were oriented on the test table so that their principal axis was co-linear with the table. To simulate the combined weight of cable and conduit, additional dummy weights were secured to the outside of the tested panel.

The seismic test program consisted of single axis resonant search testing and triaxial random multifrequency testing. For the random testing, three simultaneous, but independent, random signals were used to produce phase incoherent motions in the vertical and two horizontal axes. The RRS that was

used for the test program was the envelop of all locations of the panel boards. Five OBE tests were performed followed by 1 SSE.

The circuits were powered and functional during the tests. A total of nine channels of electrical monitoring were used to detect contact separation in excess of 2 miliseconds.

It was demonstrated that the tested specimens possessed sufficient integrity to withstand, without compromise of structure or function, the required seismic environment.

The tested panels were larger than the inspected distribution panel. They were also heavier. However, the same gauge material was used for all panels. The weight of the installed panel was about half of the weight of the tested panel. From a panel point of view, with the same material and similar unit loading, the inspected panel should have a higher natural frequency capability and therefore, by comparison and by similarity, should be no less fragile than the panel tested. However, the relays for the inspected panel are different from those tested with the panels. Their relative fragilities have not been documented. This information will have to be supplied and remains as an open item.

RHS Inlet Isolation Valve
(3RHS*MV8702C)

The function of the valve is to isolate the low power RHS system from the high pressure RCS system during power operation. It is part of the residual heat removal system. There are 4 such valves in the safety system. The inspected unit consists of a Westinghouse valve operated by a Limitorque motor. It is mounted in a vertical position in the containment internal structure at elevation 13'-6-9/16". In addition, there is a structurally restraining ring connecting the valve to its bonnet which is itself butt welded to the piping system. The overall assembly weighs 6005 lbs and measures approximately 38" wide (at the motor end) x 100" long.

The design specification covering the assembly is S&W spec. No. 2282.060-468. A combination of test and analysis is used to qualify the equipment.

The actuator is qualified by test in report No. B0058, "Limitorque Valve Actuator Qualification for Nuclear Power Station", by Limitorque Corporation and dated January 11, 1980. It is based on dynamic and seismic tests performed by Aero Nav Laboratories, Inc., and documented in report No. ETL-578, "Report of Seismic Test on SB-4-100 Motor Actuator for Limitorque Corp., of King of Pressia, PA.", dated October 16, 1975. Both reports are reviewed by SWEC. The actuator is mounted in a test fixture which is capable of simulating the seating thrust-position (vertical position) and a resonance search by sine scan is performed. The least resonance found in all three directions is reported to be greater than 33 Hz. Although the seismic tests were performed on motor actuator type SB-3 which is slightly lighter than the SBD-3 type, actually installed in the field, the results of the qualification tests are deemed acceptable. The same report also describes environmental aging tests of the electrical components of the motor.

The qualifying document for the valve is report No. 4857 - revision 2, "Stress Report for Westinghouse Class I Nuclear Valves", prepared by Westinghouse Corporation, dated June 3, 1977 and reviewed by SWEC. Essentially, it contains static analysis (least natural frequency is greater than 33 Hz) utilizing computer code FEAAS-6 for the valve bonnet and hand calculations for other portions of the valve and the connecting bolts to the bonnet. The loads considered include seismic, operating pressure, design temperatuare loading, transients and reactions. The critical stresses and deflections are found to be within the limits prescribed by ASME - Sec. III code and industry practices.

The valve support restraint is qualified in report EM6028, "NEU Valve Restraint Analysis", prepared by Westinghouse Electric Corporation, dated December 17, 1984 and reviewed by SWEC. It consists of hand calculations to show that the critical stress is within the code allowable for the material used.

The valve operability test is discussed in Westinghouse report #4995 (revision 0), "Operability Test Report of Westinghouse Nuclear Gate Valves", issued by the Electro-Mechanical Division, and dated January 28, 1977. Its intent is to demonstrate capability of the motor-operated gate valve to function during and after the application of seismic inertia loads and pipe end loads to the valve structure. In reviewing the report, it is apparent that the seismic inertia loads were applied at a level coinciding with the interface between the actuator and the valve body rather than through the center of gravity of the actuator (which happens to be situated at a higher level). Although the magnitude of the applied static loads (equal to loads produced by 4.5 g) were higher than the specified SSE values of 3.0 g, NEU personnel should demonstrate that the valve was adequately deflected during the operability test.

Based on this information, we have reached the conclusion that in order to quality the RHS inlet isolation valve, NEU should demonstrate operability of the valve by proper use of the static deflection test method.

# Diesel Generator Sequence Panel

The Diesel Generator Sequence Panel is used on the occasion of the loss of off-site power. Sequential loading is achieved by an emergency generator load sequencer (EGLS). The EGLS automatically performs the functions of load shedding, load blocking and sequential load application under the conditions of loss of off-site power (LOP), safety injection signal and LOP, and containment depressurization and actuation and LOP.

There are two such panels located in the same general area in the Control Building Instrument Rack Room which is at the 47.5' elevation. The panels are bolted with (8) 1/2"-13 bolts to a channel which is secured to the floor.

The Sequence Panel is qualified by a test performed by Wyle Labs, Huntsville, Alabama. The test results are contained in the Wyle Report No. 44680-1, dated October 1, 1983. Thermal aging tests were performed prior to the seismic tests. The seismic test program consisted of a single axis resonant search and triaxial random multifrequency testing. The panel was secured to the vibration table during the tests in accordance with the in-situ mounting. The resonances found during the tests were 5.9 Hz (S/S), 12.6 Hz (F/B) and 40.5 Hz (V).

The test specimen was subjected to 33 second duration triaxial multi-frequency random motion which was amplitude controlled in one-third octave bandwidths. Three independent random signals were used as the excitation to produce phase-incoherent motions in the vertical and two horizontal axes. The amplitude of each one-third octave bandwidth was independently adjusted in each of the three axes until the TRS enveloped the RRS. Five OBE tests were applied, followed by one SSE test.

The panel was electrically powered and functional during the tests. Seven channels of electrical instrumentation were installed to monitor the operations of the test specimen. These channels were used to ascertain electrical continuity, voltage levels, spurious operation and contact chatter before, during and after the seismic excitation. The instrumentation could detect a discontinuity of 2 miliseconds or greater.

The specimen demonstrated sufficient integrity to withstand, without compromise of structure or functions, the required seismic environment.

The on-site inspection of the panel showed that it was mounted in accordance with the test. However, it was noted that 3RPS*PNLESCA was mounted adjacent to a monitor cabinet. In addition, there was a base plate with screw holes which appeared to be prepared to mount another cabinet or panel. Either or both of these side mounted cabinets is different from the tested situation and would require justification.

After these questions were raised, additional documents were supplied to clarify the installation condition. The clearance problem was recongnized and is discussed in S&W E&DCR#P-E 4131, "Modifications to Panels for Seismic Qualification", dated March 9, 1982. The conclusion of this document is that the monitor cabinet will be moved 2" away from 3RPS*PNLESCA. The clearance requirement is shown on S&W DWG 12179-EE-27B-14. It is calculated on page 18 of document #12179-Nm(B)-489-CG. The calculations show that a 2-inch clearance requirement is adequate and must be maintained all around. It is stipulated that this is the amount of clearance, based upon a rigid panel being placed next to the seismically resonant panel 3 RPS*PNLESCA.

The Diesel Generator Sequence Panel is therefore qualified for the seismic loads at Millstone 3 contingent upon removal of the monitor cabinet by 2" away from the sequence panel.

# Auxiliary Shutdown Panel

The Auxiliary Shutdown Panel is used as a back-up for the main control board reactor shutdown controls. The main control board relies on the auxiliary shutdown panel for redundancy. The panel is located in the Control Building at the 4'-6" elevation. There are actually three panels which comprise the auxiliary panel. These include Trains A and B and a Non-Train which is located between the other two. Each panel is 78" high and 45" deep. Trains A and B are 56" wide and the Non-Train is 31" wide.

All three panels are bolted together. During the field inspection it was noted that two of the front end panel connecting bolts were loose. On the rear end, one bolt was missing. This equipment, however, has not undergone the final inspection when such problems should be picked up.

The auxiliary panel is qualified by analysis. The analysis is contained in Acton Report 1825-82N, dated September 10, 1982. This shows that a finite element analysis was done to establish that the natural frequencies of the panel are above 25 Hz. The panels were modeled as quadrilateral and triangular plate elements to represent external skin areas, sub-panels, gussets and doors. Beam elements were used to represent main structural members, stiffeners, etc. Additional weights were added to account for the mounted equipment and the abundance of wiring that is used inside the panel.

The analysis shows that the seismic loadings are relatively low, since the natural frequencies are high. All maximum computed principal stress values are below the allowable stresses. The maximum deflections exhibited during the seismic loadings are within acceptable values. The analysis shows that all stresses and deflections are within the levels in Specification No. 2424.300-246. Therefore, the structure of the panels is qualified for the seismic environment at Millstone 3.

The qualification of the instruments housed within the panels is done by a separate document (Acton Report No. 15889). Aging effects were evaluated for the environment expected within the auxiliary panel.

The seismic tests were done on unaged equipment. The test items were mounted to the seismic table in a manner which closely simulates the service mounting. The test fixture was rigid and was securely attached to the biaxial shaker system with phase coherent components. The structure was instrumented and the equipment was functional during the tests. Relays were monitored for contact chatter exceeding 2 miliseconds. Five operating basis earthquakes and one safe shutdown earthquake were applied along each axis.

The results of the test showed that the equipment mounted within the auxiliary panel can withstand the seismic environment without failure or malfunction.

It is concluded that the auxiliary shutdown panel is seismically qualified for Millstone 3. There are no open items for this equipment.

# 15KVA Transformer

A typical 15KVA transformer, tag number 3SCV*XD100, was audited. This class 1E transformer provides power supply to maintain proper environment in the motor control centers and to control circuitry of HVAC dampers, one hydrogen recombiner, hydroyen recombiner valves and a radiation monitoring micropressor. The equipment located at 36 feet elevation of the Engineered Safety Features Building is a 16" x 31" x 16" box-shaped wall-mounted equipment weighing about 290 lbs. The transformer is supplied by Sorgel, Square D Co. under the scope of S&W specification 2421.400-678, Addendum 1.

The installation of the transformer was inspected at the site. The base framing channels are bolted to a wall bracket which in its turn is expansion bolted to the wall with four Hilti bolts. The front top edge of the transformer is held by means of a strap and two tie rods connected to the diagonal braces of the wall bracket.

For seismic qualification purposes, S&W presented a Wyle Lab report (No. 44509-1, Revision B) documenting testing of two 45KVA transformers, as listed in the SQRT form. Since the document does not address the transformers supplied for Millstone, Unit 3, upon request, S&W provided the Square D equipment similarity report B116900, dated 7-14-82, not listed in the SQRT form. S&W also presented their support analysis report.

Based upon our reivew of the available documents, site inspection and interpretation provided by the applicant, we conclude that the following comment should be resolved for complete qualification of the equipment:

1. Since both the Square D equipment similarity report B116900 and the S&W support analysis report are required for qualification of the equipment, they shoould be made part of the qualification package.

# Static Inverter

The Static Inverter is a class 1E equipment. It converts emergency battery power to 120V AC and supplies power to control and instrumentation for the Plant Protection Systems. There are four inverters in the plant. The equipment was supplied by Elgar Corp. under the scope of SWEC specification 2445.300-622, Rev. 1, dated 9-10-81.

The inverter 3VBA*INV-1 was inspected at the site. The unit is located in the switchgear room at elevation 4'-6" of the control building and fillet welded to embedded steel. The free-standing cabinet contains several electrical devices, e.g., capacitors, diodes, resistors, potentiometers, etc. A battery charger cabinet is installed within 1/4" from the static power source cabinet INV-1 and no connection between the two cabinets was observed during the inspection. The power line conditioner and maintenance bypass system are contained in two other cabinets (ID 3VBA*XRC-1 and 3VBA*SW-1, respectively).

The equipment qualification is based upon testing of a similar unit and documented in Elgar report no. 80244, dated 12-2-82. The TRS envelop the RRS over the entire frequency range. During the first two OBE tests the door came open. The door was reclosed and the cabinet was retested with 5 OBE and 1 SSE biaxial random multifrequency inputs. No other anomaly was reported.

Based upon our site inspection of the equipment and documentation review, we conclude that the following comment should be resolved for seismic qualification of the equipment:

1. The applicant should investigate the possible dynamic interaction between the installed inverter and the adjacent charger cabinet, and demonstrate applicability of the existing qualification documents to the installed condition.

# Reactor Coolant Pump

The Reactor Coolant Pump (RCP) is in a coolant loop between the reactor and the steam generator. The loop is comprised of a hot leg which connects the reactor with the steam generator, a crossover leg which connects the steam generator with the RCP and a cold leg which completes the loop between the RCP and the reactor. The RCP circulates large volumes of water around this loop.

The Reactor Coolant Pump is qualified by analysis. The analysis is described in the report "Northeast Utilities, Millstone Nuclear Power Station #3, Model 93A-1 Pressure Boundary Summary Report" dated February 1985.

Generic seismic and LOCA loads are used as conservative estimates of the design of the Model 93A-1 pump. Steps were taken to ensure that the generic analysis produced loads that were equal to or exceeded the loads at many locations. The generic motor model was taken as the heaviest of the model 93A-1 motors. The pump casing model was based upon the heavier of the two pump casings used with the Model 93A-1 pumps. The lateral loads were multiplied by a factor of 1.25 to account for variations permitted in the turning process. In addition, the vertical loads were multiplied by a factor of 2.50 to account for modeling differences in the motor thrust bearing.

In the specific case of Millstone 3, all loads except two were lower than the generic loads. The exceptions were the vertical forces due to deadweight and pressure. The net effect of this difference was investigated using a worst case evaluation of load combinations of P + DW + T + OBE. In these calculations, the stress in the critical areas results in a stress for the generic case which is much worse than the stress for the plant specific case. All stresses are less than the allowables.

The support stiffness matrix was calculated by Stone and Webster from the design drawings. The support characteristics of Millstone 3, as designed, are within the generic support stiffness required by Westinghouse. The as-installed stiffness matrix is currently under evaluation.

It is concluded that the design of the Reactor Coolant Pump qualifies it seismically for use at the Millstone 3 location continyent upon future confirmation by the applicant that the as-installed stiffness matrix is acceptable.

Safety Injection Pump Assembly
(3SIH*P)

This Safety Injection Pump Assumbly consists of an 11-stage centrifugal pump (supplied by Pacific pumps) and a 450hp electric motor (by Westinghouse) mounted on a common base plate. The base plate is connected to the concrete floor by means of eighteen 1" diameter bolts at elevation 21'-6" of the engineered safety features building. The purpose of the pump is to provide flow during safety injection phase. There are two such units in the safety injection system portion of the ECCS. The overall weight of the inspected pump is 13,260 lbs with base dimensions of 190" x 42.5".

The design specifications covering the assembly are described in Spec. 952 481, Rev. 1 (NEU class 2 pumps) and in Spec. 952 349, Rev. 2 (NEU aux. pump motors). The pump is designed per ASME Section III requirements and the motor is designed according to NEMA MG1 part 20 requirements. The documents show that the seismic qualification of this component is approached by a combination of testing and analysis.

The motor component is qualified by similarity. A generic unit with similar dynamic characteristics is shown to be qualified by test in Report No. 76F6083U, "Seismic Qualification Report for Safety Injection Pump Motors for Seabrook Station Units I and II", dated 3-29-77 and issued by Westinghouse Corporation. Generic loading (for both SSE and OBE) higher than the Millstone Unit 3 specific values were applied in three directions and the lowest natural frequency observed was in excess of 49 Hz. During the SSE test, the maximum deflection of the motor components did not cause interference nor excessive misalignment. In the same report an additional static analysis was performed on the motor using computer code ME 9032. The critical stator core weld stress and the shaft shear stress were confirmed to be less than the corresponding allowable values. The same applies to the lateral displacement at the coupled end of the motor shaft.

The document package also includes Report No. WCAP-8687, supplement 2-A02A, Revision 2, "Equipment Qualification Test Report - Westinghouse EMD - Motor Insulation", dated March 1983, prepared by Westinghouse Power Engineering Division. In this report, the environmental testing and seismic and vibration aging of the non-metallic parts of the motor are documented and shown to be qualified for 5 years.

The qualification of the JHF - Pacific Pump (by analysis) is documented in report number K-436, "Design Calculations for WNES", dated 3-31-77, prepared by Pacific Pumps Company and reviewed by Westinghouse Corp. (PED). Since the pump, base and all appurtenances have fundamental frequencies greater than 35 Hz, a static analysis is acceptable for purposes of computing critical stresses and deflections. The pump model was subjected to SSE loading levels of 3 g in one horizontal and 2 g in the vertical direction in lieu of three axis accelerations of 2.1/2.1/2.1 g. Critical stresses and deflections due to SSE and other operating loadings (dead weight, operating pressure and nozzle) were found to be acceptable. The calculations presented in the report also confirm that there is sufficient bolting (in the as-built condition) to keep the base plate and mounted equipment in place during plant specific seismic events.

An additional "operability test" of the pump is documented in the report "Operability Report for the Pacific Pumps - Centrifugal Charging/Safety Injection 11-stage Pump", prepared by Westinghouse Corp. and dated July 19, 1984. A 16' x 16' aluminum shaker table was used to impart to the pump the required force and motion simulating a stipulated seismic event. Special fixtures were fabricated to simulate the piping field loads imposed on the suction and discharge nozzles. The TRS in each test run envelops the RRS over the frequency range of interest (1-33 Hz). Seismic tests were performed with the pump operational and also with the pump starting during the strong motion part of the simulated earthquake. No pump damage was observed and operability is confirmed.

During the audit of the documents, a question was raised concerning the critical torsional frequency of the assembly as compared to the motor's operational speed. The documents presented for the qualification do not address this issue. NEU personnel felt that the critical frequency is higher than the maximum operational speed. However, this needs to be documented and made part of the qualification package.

Based on the results of the motor's dynamic and aging tests, pump analysis and pump operability tests, this equipment can be considered to be seismically qualified if it can be shown that the critical torsional frequency is higher than the maximum operational speed of the motor.

Charging Pump Hydraulic Isolation Valve
(3CHS*MV)

The charging pump discharge isolation valve is part of the chemical and volume control system. In case of high energy line break, the valve closes and isolates the chemical and volume control system. There are three such units in the safety system. The inspected assembly is located in the auxiliary building at elevation 27'-6". It consists of a 4" Westinghouse valve operated by a Limitorque motor. It measures approximately 44.8"x31" and has a total weight of 642 lbs. The valve is butt welded into the piping system with the stem located in the vertical position above the horizontal pipeline. The assembly is designed per Westinghouse Spec. 952174, revision 4, and the efforts performed to assure its seismic qualification include a combination of testing and analysis.

The operability test of the valve is documented in report No. 4995, "Operability Test Report of Westinghouse Nuclear Gate Valves", issued by the Electro Mechanical Division of Westinghouse Corp., and dated January 28, 1977. The tests described in the report indicate that the valve will successfully operate while experiencing seismic inertia loads (in two planes, parallel and perpendicular to the pipe run) of up to 4.5 g's and pipe pressure of up to 3/4 the materials yield strength. However, the seismic inertia loads were applied at a level coinciding with the interface between the motor and the valve stem rather than through the center of gravity of the motor. Although there is some conservatism in the g-value of the applied seismic loading, NEU personnel should demonstrate that the valve was adequately deflected during the operability tests.

The qualification of the motor is discussed in report No. WCAP - 8687, supplement 2 - 404A, revision 2, "Equipment Qualification Test Report - Limitorque Motor Operator - Environmental and Seismic Testing", prepared by Westinghouse Corp., and dated March, 1982. A resonance search by single axis sinusoidal sweep test was performed. Excitations of magnitude of 5 g's were applied at frequencies of 2-35 Hz (one sweep with operator open, one closed). No resonant frequencies in the seismic band width (5-35 Hz) in three mutually perpendicular axes were detected. During the OBE and SSE tests, no evidence was observed of any mechanical damage, deterioration, interference with proper operation and false operating of electrical contacts.

The valve body is qualified by analysis and the procedure is outlined in report No. 5888, "Stress Report for Westinghouse Classs 1 Nuclear Valves", prepared by Westinghouse Corporation and dated November 29, 1982. Since the least natural frequency is determined to be in excess of 144 Hz, a static analysis is performed. The valve bonnet is modeled as 3D solid and a computer program WECAN is used for its analysis. Hand calculations are used to compute the critical stress and deflection in the rest of the valve assembly (modeled as a beam). Under the imposed seismic and operating loads, the critical stress in the bonnet is computed to be less than the code allowable and the maximum deflection of the yoke section has adequate margin of safety.

Based upon our review of the various reports presented during the site visit and field installation, we have concluded that this equipment can be considered to be seismically qualified pending confirmation of the operability of the valve by proper use of static deflection test method.

# 7300 Process Protection System Cabinets

The 7300 Process Protection System (PPS) cabinets contain signal conditioning devices, such as, print circuit cards, power supply, breakers, termination panels, etc. for monitoring pressurizer water level and pressure, containment presure, reactor coolant flow and temperature from various safety-related sensors. There are two 3-bay cabinets and two 2-bay cabinets in the plant. Westinghouse supplied the cabinets per their specification number 952501.

A site inspection was conducted on the equipment. All four units are locted at elevation 47'-6" of the control building. The base frames of the cabinets are fillet welded to floor steel. Top corners of the cabinets are attached to adjacent cabinets with bolts and shim plates.

A generic seismic qualification of the equipment is documented in Westinghouse report WCAP-8687, Suppl. 2-E13A, Rev. 1, July 1981. The seismic testing was performed with phase-coherent, multi-axis, multi-frequency inputs. The 3-bay cabinet exhibited fundamental natural frequencies of 10 Hz in the side-to-side direction and 7 Hz in the front-to-rear direction. The corresponding frequencies for the 2-bay cabinet were 5-5.5 Hz and 6-6.5 Hz. No anomalies were reported. The auditable link for the plant-specific equipment is provided in Westinghouse document EQAL-NEU, Rev.1, June 1984.

Based upon our review of the available documents and the site inspection, we conclude that the following comments should be resolved for seismic qualification of the equipment:

1. Investigate dynamic interaction between the PPS cabinets and adjacent cabinets, and demonstrate adequacy of connections between the two.

2. Confirm implementation of Westinghouse's recommendation for field modification of some relays (W NEUM-10583).

3. Some of the qualification documents were draft copies. Westinghouse should confirm their final release.

4. Some devices are qualified for 5 years and need replacement. No document was presented during the audit to demonstrate inclusion of this requirement in the maintenance manual. This shold be resolved for an overall qualification of the equipment.

# Nuclear Instrumentation System Console

The nuclear instrumentation system (NIS) console is a class 1E equipment. It provides alarm functions, secondary control function of indicating reactor status during start-up and overpower trip protection. The console contains various electrical assemblies e.g., source range, power range, intermediate range, flux deviation and miscellaneous control and indication, audio count rate channel, scaler-timer, component and rate circuit, etc. The four-bay console measure about 88.5" wide x 30" deep x 91.31" high and weighs approximately 3 kips. The unit is located at 47"-6" elevation of the control building and mounted on the floor with plug and fillet welds. The console is supplied by Westinghouse per their specification number 952732 and drawing number 6055D66.

A site inspection was conducted on the equipment identified by the NU engineer. There was no ID, tag or model number marked on it to identify the equipment.

Westinghouse presented two separate test reports to qualify the equipment. Report WCAP-7821, Supp. 1 and 2, dated December 1971, documents single axis sine beat testing of a similar two-bay console. The specimen exhibited 5.0-7.7 Hz fundamental natural frequencies in both horizontal directions. The building floor response spectra also show peak accelerations in the same frequency range. The test specimen was subjected to 5 sine beats at each test frequency in the front-to-back, side-to-side and vertical directions. A failure of the drawer latch mechanism was detected during the test. Subsequently the latch mechanism was redesigned. According to Westinghouse engineers, this modification was provided to Millstone, Unit 3 equipment.

The second document presented by Westinghouse was WCAP-8830, dated October 1976. This report documents phase-coherent multi-axis multi-frequency testing of a similar one-bay console. It was reported that the test specimen withstood one low level test, but suffered extensive structural damage caused by an erroneous input signal to the shaker system prior to a high level test.

Based upon our review of the documents presented and interpretation provided during the audit, and our site inspection, we conclude that the following comments should be resolved for seismic qualification of the equipment:

1. Some devices (e.g., audio count rate channel, scaler-timer, component and rate circuit) were not included in the test specimen. Per Westinghouse, these devices are not required to perform class 1E functions. However, no document was produced to support this statement. Therefore, the applicant should provide documents to confirm that the unqualified devices contained in the class 1E console are non-class 1E.

2. Compliance with the requirement of 1SSE test preceded by 5 OBE tests was not demonstrated during the audit. The applicant should satisfy this requirement of IEEE std 344-1975.

3. An auditable link between the qualification documents and the installed equipment should be established by marking appropriate ID or tag number on the installed equipment.

# Reactor Trip Switchgear

The reactor trip switchgear is a class 1E floor-mounted free-standing two-bay cabinet. The unit is located at elevation 45'-6" in the auxiliary building. The switchgear provides reactor trip function by tripping the control rods. The equipment mesures 73-1/4" x 42-1/8" x 92" high and weighs approximately 3,400 lbs. The cabinet in its two compartments contains electrical devices, such as, fuses, relays, buses, switches, etc. The switchgear is supplied by Westinghouse per their specification 952080 for model no. DS-416.

The switchgear marked 3RPS*SWG-1 was inspected at the site during the audit. The equipment is fillet welded to the embedded steel. A non-category I Westinghouse cabinet is installed close to the switchgear maintaining approximately 1/2" gap between the two.

The equipment is qualified by phase-coherent multi-frequency tests. The test results are documented in Westinghouse reports WCAP-8687, Supp. 2-E20B, Rev. 1, dated July 1981 and WCAP-8687, Supp. 2-E62A, Rev. 0, December 1984. The switchgear exhibited fundamental natural frequencies of 5-7 Hz in the side-to-side direction and 10-12.5 Hz in the front-to-rear direction. No relay chatter or other anomaly was reported.

Based upon our site inspection and documents review, we conclude that the following comments should be resolved for seismic qualification of the reactor trip switchgear:

1. Confirm implementation of Westinghouse's recommendation for field modification of the shunt trip attachment (W NEUM-10564).

2. Investigate the possible dynamic interaction between the switchgear and the adjacent non-category I Westinghouse cabinet, and demonstrate applicability of the existing qualification documents to the installed condition.

3. Per available qualification documents, some devices are qualified for 5 years and need replacement. No document was presented during the audit to demonstrate inclusion of this requirement in the maintenance program. This should be resolved for an overall qualification of the equipment.

Audit Equipment Table

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| BOP-1 | CES*MCB-MB3 | Main Control Boards. A half-U-Shaped monitoring benchboard. | The control boards are used to monitor and control the safe operation and shutdown of the plant. | 1. The analysis report used for demonstration of structural integrity of the control boards structure did not establish the adequacy of connecting blots and weld.<br>2. The installed control boards did not have any ID, tag or model number marked on them. | Pending | Open | |
| BOP-2 | 3ENS*SWGA | 4.16 KV Emergency Switchgear. | This switchgear supplies power to all emergency auxiliary loads, such as the 480 V load center and MCC and associated loads. | 1. The original test repoits from Wyle Labs and from G.E. were not available during the audit.<br>2. It was not demonstrated during the audit whether there was sufficient clearance between the top point of the switchgear and buss | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| BOP-2 (cont'd) | | | | duct to avoid interference. | | | |
| BOP-3 | 3FWA*P1 | Motor-driven SG Auxiliary Feedwater Pump. | It provides cooling for the core during an emergency reactor shutdown and containment isolation. | | | Qualified | |
| BOP-4 | 3CES*PNLBE10 | Isolator Cabinet. | Performs the electrical isolation function required by R.G. 1.75 which states tht an electrical fault condition from non-class 1E equipment should be isolated from class 1E circuits. | | | Qualified | |
| BOP-5 | 3HVR*MOD72B | Motor-operated Damper. Duct mounted and supported at the wall. | Damper is used for ventilation during fuel handling. | The present solder joint capacitor clip in the actuator must be replaced by a seismically qualified alternative device. | Pending | Open | |
| BOP-6 | 3LMS*MOV40A | 1-1/2" Globe Valve Assembly (with a system of structurally restraining members). | Assembly monitors containment leakage rate. | 1. The finite element analysis in the qualification report does not address the as-built supporting | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| BOP-6 (cont'd) | | | | conditions of the valve. 2. Qualification of the structural supporting system was not demonstrated. | Pending | Open | |
| BOP-7 | 3SCV*PNL24P | 120/240 VAC Single Phase 3-wire Distribution Panels. | Provides power to safety related equipment in the auxiliary building such as compartment heater in MCC and limit switches for motor operated valves. | Simularity between the installed equipment and the tested specimen was not established. | Pending | Open | |
| BOP-8 | 3RHS*MV8702C | RHS Inlet Isolation Valve (12"). | The function of the valve is to isolate the low power RHS system from the high pressure RCS system during power operation. | Operability test by static deflection was not adequately demonstrated. | Pending | Open | |
| BOP-9 | 3RPS*PNLESCA | Emergency Generating Load Sequencer Cabinet. | This cabinet will be used for loss of offsite power in general. The EGLS will automatically perform the functions of load shedding and load blocking. | | | Qualified | Qualification is contingent upon removal of the adjacent monitor cabinet by 2 inches. |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| BOP-10 | 3RHS*PNLAS | Auxiliary Shutdown Panel. | Provides the back-up for the main control board reactor shutdown contols. | Field inspection revealed two loose bolts in connecting adjacent panels and one bolt missing. However, at the time of inspection, field quality control did not complete final inspection. Q.C. procedures should pick up on items such as this. | | Qualified | |
| BOP-11 | 3SCV*XD10 | Transformer. A box-shaped wall-mounted equipment. | This transformer provides power supply to maintain the proper environment in MCC's and to control circuitry of HVAC dampers, one hydrogen recombiner, hydrogen recombiner valves and a radiation monitoring microprocessor. | The qualification documentation package as presented did not include the support analysis report and the equipment similarity report (Square D No. 8116900). | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| BOP-12 | 3VBA*INV-1 | Static Inverter. A floor-mounted free-standing cabinet. | The inverter converts emergency battery power to 120 AC and supplies power to control and instrumentation for the Plant Protection Systems. | The proximity of the installed inverter to an adjacent cabinet and the possible dynamic interaction between the two cabinets were not addressed in the qualification documents. | Pending | Open | |
| NSSS-1 | 3RCS*P | Reactor Coolant Pump. | Supplies reactor coolant water. | The as-installed stiffness matrix was not available at the time of audit. S&W designed the support structure for the RCP on the basis of design drawings. This is being re-evaluated according to the as-built condition. | Pending | Open | |
| NSSS-2 | 3SIH*P | Safety Injection Pump Assembly. | The assembly is required to provide flow during safety injection phase. | Torsional frequency of assembly needs to be computed and compared to motor's operational speed. | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| NSSS-3 | 3CHS*MV | Charging Pump. Discharge Isolation Valve (4"). | In case of high energy line break, the valve closes and isolates the chemical and volume control system. | Operability test by static deflection was not adequately demonstrated. | Pending | Open | |
| NSSS-4 | 3RPS*RAKSET | 7300 Process Protection System (PPS) 3-bay and 2-bay floor-mounted cabinets. | The cabinets contain signal conditioning equipment for monitoring pressurizer water level and pressure, containment pressure, reactor coolant flow and temperature from various safety-related sensors. | 1. The connections between the PPS cabinents and the adjacent cabinents were not addressed in the available qualification documents.<br>2. The implementation of Westinghouse's recommendation for field modifications of some relays (W NEUM - 10583) was not confirmed.<br>3. Some of the qualification documents were draft copies. Westinghouse will confirm their final release.<br>4. Per available qualification documents, some devices | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| NSSS-4 (cont'd) | | | | are qualified for 5 years and need replacement. No document was presented during the audit to demonstrate inclusion of this requirement in the maintenance program. | | | |
| NSSS-5 | 3RPS*RAKNIS | Nuclear Instrumention System (NIS) console. A floor-mounted free-standing four-bay cabinet. | The NIS console provides alarm function, secondary control function of indicating reactor status during start-up, power operation and overpower trip protection. | 1. Some devices were not qualified for class 1E functions. Per Westinghouse, these devices are not required to perform Class 1E function. However, no document was presented to support this statement.<br>2. Meeting the requirement of 1SSE test preceded by 5 OBE tests was not demonstrated during the audit.<br>3. The installed console did not have any ID, tag or model number marked on it. | Pending | Open | |

Audit Equipment Table (Cont'd)

| SQRT ID No. | Applicant ID No. | Equipment Name and Description | Safety Function | Findings | Resolution | Status | Remarks |
|---|---|---|---|---|---|---|---|
| NSSS-6 | 3RPS*SWG1 | Reactor Trip Switchgear. A floor-mounted free-standing two-bay cabinet. | The switchgear provides reactor trip function by tripping the control rods. | 1. The implementation of Westinghouse's recommendation for field modifications of the shunt trip attachment (W NEUM -10564) was not confirmed.<br>2. The proximity of the installed switchgear to an adjacent non-category I cabinet and the possible dynamic interaction between the two cabinets were not addressed in the qualification documents.<br>3. Per available qualification documents, some devices are qualified for 5 years and need replacement. No document was presented during the audit to demonstrate inclusion of this requirement in the maintenance program. | Pending | Open | |