U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-423/85-54

Docket No. 50-423

License No. CPPR-113

Licensee: Northeast Nuclear Energy Company

P.O. Box 270

Hartford, Connecticut 06101

Facility Name: Millstone Nuclear Power Station, Unit 3

Inspection At: Waterford, Connecticut

Inspection Conducted: September 9-20, 1985

Inspectors: K. A. Manoly, Lead Reactor Engineer — 10/17/85 date

S. D. Reynolds, Jr., Lead Reactor Engineer — 10/17/85 date

F. P. Paulitz, Reactor Engineer — 10/17/85 date

M. J. Schaeffer, Reactor Engineer — 10/17/85 date

Other Accompanying Inspectors: R. M. Campbell, NDE Technician
R. W. Winters, Reactor Engineer
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Approved by: J. T. Wiggins, Chief, Materials and Processes Section, DRS — 10/17/85 date

Inspection Summary: Inspection during September 9-20, 1985 (Report 50-423/85-54)

Areas Inspected: As-built inspection of piping, ducting, supports, electrical power, instrumentation and controls of selected safety-related systems by seven region-based inspectors and a supervisor. The inspection covered the following systems: charging, quench spray, recirculation spray, residual heat removal, control room emergency ventilation, control room pressurization and ac/dc power distribution. Additionally, the licensee's structural steel re-verification program and licensee actions on previous NRC inspection items were reviewed. The inspection involved 375 man-hours.

Results: No violations were identified. The inspectors determined that the systems selected were constructed substantially in conformance to their FSAR descriptions. However, two concerns were identified regarding the design capacity of the control room pressurization system air storage bottles and the quality of workmanship for their installation.

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DETAILS

1. Scope and Purpose of the Inspection

This as-built team inspection was conducted by region-based reactor engineers to verify that selected systems were constructed substantially in conformance to the description contained in the Final Safety Analysis Report (FSAR) and in NRC's Safety Evaluation Report (SER) and to verify that the systems selected met their functional requirements. The inspection included examination of fluid systems, HVAC systems, ac and dc power systems and instrumentation and controls systems. In general, the systems selected were determined based on the results of the Millstone 3, plant-specific Probabilistic Safety Study. Extensive system walkdowns were performed, during which independent dimensional measurements were made. Various project specifications, operating procedures and design calculations were reviewed. Further, independent calculations and a field test of instrumentation cable terminations were performed.

2.0 Persons Contacted

Stone & Webster Engineering Company (SWEC)

*R. Rudis, EA Program Manager
*J. LaMarca, Electrical Engineer
*M. Scanlon, Lead Engineer
*J. Knechting, Assistant Project Engineer
W. Vos, Senior Engineer FQC
*M. Matthews, Assistant Superintendent, FQC
R. Ackley, Project Engineer
J. Capozzoli, Jr., Supervisor, Construction Services
G. Price, Facilities Equipment Specialist
R. Smith, N-5 Program
G. Turner, Resident QC Manager

Northeast Nuclear Energy Company (NUSCO/NNECo)

*R. McGuinness, Licensing Supervisor
*K. Gray, Jr., CQA Staff Assistant
*V. Papadopoli, CQA Supervisor
*P. Quinlan, Project Engineer
*L. Nadeau, Assistant Project Engineer
*M. Hess, Plant Engineer
*J. Crockett, MP3 Superintendent
G. Olsen, I&C Engineer
S. Orefice, Project Engineer
B. Nichols, Project Engineer
M. Pearson, Operations Assistant

U.S. Nuclear Regulatory Commission (USNRC)

*T. Rebelowski, Senior Resident Inspector
R. Summers, Project Engineer

*Denotes individuals present at exit meeting.

Throughout the course of the inspection other licensee and SWEC engineers and technical personnel were also contacted.

3.0 Mechanical Systems

3.1 General

The scope of inspection in the area of mechanical systems covered piping, the heating, ventilation and air-conditioning (HVAC) system and their respective supports. The specific systems which were inspected in the piping area included:

- Quench Spray System
- Recirculation Spray System
- Residual Heat Removal System
- Charging/High-Head Safety Injection System

The inspection in the HVAC area focused on the Control Room Habitability Systems.

The objective of this inspection was to verify, by sampling review, that the above systems were designed and fabricated such that they were capable of performing their intended functions as specified in the Final Safety Analysis Report (FSAR) and whether the as-built configurations were in conformance with the FSAR, the SER and system specifications and drawings.

3.2 Piping Systems

The inspection in this area included piping components, equipment and supports. A review of the licensing documents was performed to insure that, for those selected systems, FSAR commitments were correctly translated into specification procedures and drawings. A cross review was also performed of the Piping and Instrumentation Diagrams (P&ID's) and support detail drawings to verify their consistency and agreement with the as-built installations. The verification was performed either by visual inspection or by independent measurements on accessible components and supports.

The criteria used for the assessment of piping components and supports were those described in the installation specifications for these components. The inspection attributes included verification of the following:

- linear and angular measurements related to piping runs and support locations;
- branch connection types and locations;
- fittings types and locations;
- piping bend and elbow radii;
- support mark numbers, functions, and locations;
- proper flow direction marks on valves;
- correct sequential location of valves on piping runs; and,
- proper identification and orientation of valves and Limitorque operators.

The inspection attributes for equipment (pumps, heat exchangers, etc.) included verification of the following:

- manufacturer specification and purchase orders;
- name plate data consistency with FSAR requirements and manufacturer's data (capacity, type, rated head, horse power); and,
- heat exchanger component class (tube side and shell side).

The inspection attributes for pipe supports included verification of the following:

- as-built configuration against support detail drawing (BZ series) including dimensions of members;
- connection to the proper structure;
- sizes and quality of welds on hangers, including welded attachments to piping;
- baseplate dimensions and location of structural attachment to baseplates;
- baseplate bolt (concrete expansion or Richmond insert) tightness, edge distance and the bolt mark identification for Hilti bolts;

- restraint bleed holes open and free of foreign material;
- load setting of spring hangers;
- grouting of floor mounted baseplates and gap sizes for wall mounted plates; and,
- pipe routing and support locations such that movements of piping due to vibration, thermal expansion, etc., would not likely cause contact with other pipes, supports, equipment or components.

3.2.1 Quench Spray System (QSS)

The QSS is one of two containment heat removal systems. Its function is to remove heat from the containment atmosphere to limit, reduce, and maintain at acceptably low levels the containment pressure and temperature following a LOCA or secondary system pipe rupture.

The QSS consists of two redundant 100% capacity trains, each containing a quench spray pump, a chemical injection system, and riser pipes leading to two common 360° quench spray headers.

Accessible segments of train "A" of the QSS were selected for purpose of as-built verification during this inspection. The walkdown of piping components and supports was conducted from the outlet of the Refueling Water Storage Tank (RWST), to the quench spray pump (3QSS*P3A) at elevation 21'-6" in the Engineering Safety Features (ESF) building, to the containment building where the riser piping leads to the spray headers. Detailed inspection was conducted on the accessible portions of the system which are located primarily in the ESF building and at the lower portion of the riser piping in the containment building.

At the time of the inspection, the entire segment of piping, from the containment penetration up to and including the spray headers, had a completed ASME N-5 data report certification. The piping segment in the ESF building was not yet certified. Detailed documentation of the piping components and supports inspected in this system is provided in Attachment 2A to this report.

3.2.2 Recirculation Spray System (RSS)

The RSS is the second of the containment heat removal systems. It is designed to further enhance the depressurization of the containment and to maintain at subatmospheric pressure in the long term. The RSS consists of two parallel, redundant 100% capacity trains, each containing two containment recirculation pumps with dedicated heat exchangers, and riser piping leading to two common 360° recirculation spray headers. The four redundant 50% capacity recirculation spray subsystems take suction from the containment sump; the recirculation spray water flows through recirculation coolers where it is cooled by the service water. The rated flow for each recirculation pump is about 3000 gpm.

The status of the RSS piping completion was similar to that of the QSS. At the time of the inspection, the ASME N-5 data report certification was complete for the entire piping portion inside the containment.

Accessible segments of train "B" of the RSS piping were selected for the purpose of as-built verification during this inspection. The walkdown was conducted from the ESF building penetration at elevation (-) 32'-3", where the system takes suction from the containment sump, to the recirculation pump (P1B), to the containment recirculation cooler (E1B) inside the ESF building, and to the containment penetration where the riser piping leads to the spray headers.

Detailed documentation of the piping components, equipment, and supports inspected in this system is provided in Attachment 2B to this report.

3.2.3 Residual Heat Removal System (RHS)

A walkdown verification of a piping segment in the RHS system inside the ESF building, at elevation 21'-6", was conducted during this inspection. Though verification of piping installations in this system was not planned as part of the piping as-built verification; nevertheless, it was performed to provide a detailed verification of an accessible piping segment (PLI No. C.1-RHS-4) which had a completed ASME N-5 certification.

Details of the piping components and supports verified during this walkdown are provided in Attachment 2C to this report.

3.2.4 Charging/High Head Safety Injection System

This system is part of the ECCS and provides high pressure borated water from the refueling water storage tank (RWST) through the charging pumps to the reactor coolant cold legs.

The system utilizes redundant charging pumps discharging to a single line to the cold legs. The walkdown included the accessible portions of the system from the RWST to the reactor coolant cold legs utilizing the applicable piping location isometric drawings (PLI's). Detailed inspections were made of ten supports of various configurations. Charging pump name plate data was verified to be in accordance with FSAR requirements. Detailed documentation of the piping components, equipment and supports inspected is provided in Attachment 2D to this report.

3.2.5 Findings

The inspectors concluded that general workmanship in this area was good. However, as a result of the as-built verification of the piping systems, the following specific findings were noted for which licensee corrective actions were in progress at the end of the inspection:

1. Some information was found to be either missing or incorrect on PLI drawings for the QSS, RSS and RHS systems. The types of information included orientation of piping restraints; reference angles between piping and equipment; and piping bend radii. The inspector determined that this information had either been incorrectly recorded during licensee walkdowns or had yet to be added to the PLI's because of in-process E&DCR's. None of the missing information was deemed to have a significant effect on the adequacy of the piping installation or on the licensee's stress reconciliation effort.

2. Some of the measurements shown on PLI drawings differed slightly from those measured by the as-built inspection team. Examples of these differences are shown in Attachment 2. In no case did the dimensional discrepancies exceed the limits of the construction criteria for the systems. Further, though the difference in measurements exceeded the accuracy limits for the PLI walkdown program (Specification M968), the inspector deemed the magnitude of deviations to have been inconsequential. The inspector noted that the limits contained in M968 were very conservative with regard to the impact of dimensional tolerance deviations on actual piping stress levels and support loads.

3. The flow direction marking was found to be missing on check valve No. 3QSS*V4. The licensee indicated that this observation was identified during SWEC's PLI walkdown of isometric drawing No. CI-QSS-25. This item was also noted on QC inspection report IR-P5A03827 and was subsequently resolved by N&D 13271 which required a UT examination of the subject valve and the similar valve on the "B" train. The examination revealed that both valves were installed in the correct orientation.

4. The spectacle flange, 3QSS*FLS-1A, was found to be installed with a blank in the direction of flow on the QSS piping inside the containment. Upon notifying the licensee of this findings, the spectacle flanges were added to the station system operating procedure OP3309-1 and OP3309-2 for the Quench Spray System. According to the procedure, the spectacle flanges would be part of the valve line-up sheets for the QSS system. The licensee further indicated that an evaluation was being performed to identify other spectacle flanges in safety related piping systems for their inclusion in the applicable valve line-up procedures.

No violations were identified in this area.

3.3 Control Room Habitability HVAC Systems

3.3.1 Scope

The inspection of the control room habitability HVAC systems consisted of a walkdown examination of ducts, filters, valves, dampers, fans, supports and components in the control room normal and emergency HVAC systems and in the control room pressurization system. Accessible areas from the air inlet on the control building roof, through the inlet tornado dampers and the normal ventilation path to control room, and, through the emergency path through the filters to the control room were examined. The walkdown continued from the control room exhaust back through the tornado dampers to the roof. Inspection was made of the "A" train of redundant subsystems except where there was much greater accessibility to identical components in the "B" train.

The inspector also verified that the outside air isolation valves were manually operable from within the control room envelope, as described in the FSAR and SER, in the event normal remote operation was not possible.

Further, a review was made of the FSAR and SER to insure that licensing commitments were properly translated into procedures, specifications and drawings. The P&ID drawings were utilized for the walkdown along with specific SWEC duct support detail drawings for verification of as-built configurations.

3.3.2 Inspection Criteria

The criteria utilized for inspection of the duct work, components, and supports was as described in the applicable installation specifications listed in Attachment 1. The specific inspection attributes for the walkdown included verification of the following:

Duct Inspection

- proper size and location of duct work;
- lack of excessive sheet metal deformation;
- acceptable weld profiles;
- proper location and installation of flow, radiation and chlorine sensing devices;
- completeness of bolted flange connections;
- access door location and operation;
- cleanliness of inside duct surfaces; and,
- proper installation of turning vanes.

Damper, valve and fan inspection

- acceptable weld profiles;
- marking and tagging;
- location as required by EB drawings; and,
- installation of supplemental hardware such as air operated valves solenoids, limit switches, etc.

Supports

- location and completeness for all supports;
- dimensions, weld sizes and weld profiles;
- proper marking and tagging; and,
- proper attachment to embedment plates.

Air Tank Storage System Inspection

- location and orientation of air bottles and associated piping;
- marking and tagging of system components;
- air tank pressure indication hardware;
- flow direction of valves; and
- installation details in the air tank support system

3.3.3 Findings

3.3.3.1 Findings Relative to Supports Ducts, Piping and Components in the HVAC System

The inspectors concluded that general field workmanship was good. The walkdown inspection verified the adequacy of the system installation with a few minor observations.

Visual inspection showed that not all shaft attachments (e.g. for limit switches, damper operator, weights, etc.) were welded to the shaft. The inspector questioned the ability of the installation to withstand seismic loads. Further review of detail drawings and discussions with the licensee showed that the non-welded seismic attachments had full-drilled hole/pin type connections which were sufficient to meet seismic requirements.

Debris from insulation was found on the turning vanes at the air conditioner exhaust/control room inlet duct work. The licensee demonstrated that an inspection for debris would be made prior to system startup.

Poor weld quality of the intermittent GMAW-S structural fillet welds on the outside of vendor supplied filter train "A" led the inspectors to question the quality of the critical inside seal welds. The licensee removed covers to permit visual inspection of these important seal welds. The inspector visually examined the accessible seal welds and reviewed the penetrant inspection records for these welds. These welds were subsequently determined to be fully acceptable.

3.3.3.2 Finding Relative to the Control Room Pressurization System

The inspector reviewed, in detail, the control room pressurization system. This system is designed to provide air to maintain a positive pressure in the control room during the first hour after the start of a loss of coolant accident. The air is stored in two redundant trains of pressurized air bottles (4 in train A and 5 in train B). The system, including the air bottle supports, was not initially classified as Seismic Category 1, but was engineered considering the effects of seismic loads. Review of the FSAR and the Millstone 3 SER indicated that the licensee had subsequently committed to reclassify the system as Seismic Category 1 and initiated E&DCR T-R-02761 on January 16, 1985 to effect this system upgrade. The E&DCR addressed those tests and inspections necessary to categorize the system as Seismic Category 1 and Quality Assurance Class I. The FSAR and SER indicated that the air bottles were designed to ASME Section VIII requirements and the piping and valves to ANSI B31.1 criteria; these facts were verified based on review of field markings and of drawings.

The 9 air storage bottles were found to be installed in 3 vertical groups of 3 horizontally mounted bottles. The air storage bottle support system consisted of an encircling box-like modular mounting frame placed on an 8" x 6" L shaped structural angle acting as a cantilever at each end of each bottle. The L sections were attached to steel embedment plates with 3/8" all around fillet welds. Each mounting frame was to be bolted to two welded studs on the embedment plate and also to two locations on its cantilever beam.

Review of SWEC Drawing 12179-EX-233A-1 for the air bottle support system showed the SWEC design of the embedment plate and attached cantilever support beams. The licensee stated that the fabrication of the embedment plates by Thames Valley Steel (TVS) was in accordance with SWEC specification C993 which covers embedments fabricated to AWS D1.1 and QA Category I requirements. The encircling box mounting frame and the air storage bottles were purchased from U.S. Steel as commercial catalogue items with a requirement that the air bottles be "U" stamped as required by ASME SC VIII. The air storage bottle details were shown on US Steel drawing 4X14773 which indicated the required ASME Code data. The mounting frame details were shown on US Steel drawing 4MP1679 which indicated that the frame was designed and built to commercial standards and not specifically to ASME, AISC or AWS D1.1 requirements. The material utilized for the frame was AISI 1020 hot rolled bar stock (which nominally meets the requirements of A36 for the thickness utilized). The licensee's approach to upgrading the pressurized air storage tank supports was to analyze the design of the mounting frame, the mounting frame attachment to angle supports, the angle support welds to embedment plates and the concrete embedments, invoking seismic and structural design code rules. This was shown in SWEC calculation number 357. The inspector reviewed this calculation and determined that it did, in fact, account for seismic loading conditions.

In technical discussions with SWEC and the licensee, the inspector questioned what actions were being taken to insure that a source of oil free air would be provided to recharge air storage tanks and to insure that the air delivered to the control room during system actuation would be of sufficiently low dew point to preclude line freezing on depressurization of the tanks. The licensee indicated that the system operating procedure was being revised to cover the air quality and moisture content concerns.

Visual inspection of the air storage tank system indicated that the flow arrows on manual valves V682, V683, and V690 in the charging line of the air storage tanks appeared opposite to the assumed flow direction. Further review and discussions with the licensee showed that the valves were purposely installed in this orientation to achieve greater leak tightness for the air storage tank system.

Additionally, relating to the air bottle support system the inspector found that;

- portions of the angle to embedment plate welds were not observable due to coverage of these welds by the mounting frames or (in three cases) by concrete
- two apparent undersized fillet welds on the bolt ear to ring attachment were found;
- bolts were missing at several bolted connections of the mounting frame to the support angle;

- washers were missing from a number of bolted connections; and,
- the nut was missing from the top embedment plate stud to mounting frame attachment on tank BHVC-TKIA.

Also, based on a review of E&DCR T-R-02761 the inspector noted that a 100% visual inspection of the air storage tank mounting frames and supports was required but had not yet been conducted. However, the acceptance criteria for this inspection appeared to require more definition.

Because of the deficiencies identified in the air storage tank installation and because the licensee's QC inspection was not completed, the inspector could not verify that the installation would meet Seismic Category 1 requirements. Therefore, the acceptability of the system installation is considered unresolved pending:

- the licensee's correction of the installation deficiencies noted above;
- the licensee's establishment of adequate acceptance criteria for the QC inspection of the installation; and,
- completion of the QC inspection (50-423/85-54-01).

3.3.4 Review of Design Calculations Regarding the Control Room Pressurization System

The inspector independently calculated the capacity of the control room pressurization system to determine if one of the two redundant subsystems could maintain the control room envelope at 1/8 in wg pressure for 1 hour in the face of a 230 cfm outleakage rate. The A train was selected for consideration because it has one less air bottle train than the other train. The details of this calculation are shown in Calculation No. 1 attached to this report. The calculation relied on data provided by: 1) the licensee for control room envelope free volume (226612 ft^3) and for the volume of air in each of the nine tanks (23.27 ft^3); 2) Section 6.4 of the SER for the 230 cfm leakrate; and 3) Technical Specification 4.7.7.2 for the minimum control room air pressure.

The results of the calculation did not clearly demonstrate that the four air bottle train could perform the system's intended function; therefore full redundancy between the two subsystems was not shown. The inspector then requested and reviewed SWEC calculation P(B)-0990, revision D, which considered the capability of the redundant system train. The results of P(B)-0990 indicated that 4 air bottles were sufficient to handle 54 minutes of outleakage from the control room.

The inspector discussed the results of the above calculations with representatives of SWEC and the licensee. The inspector was informed by SWEC that the control room leak rate was currently projected to be on the order of 120 cfm (instead of 230 cfm) based on additional analysis. With this lower leak rate, the four bottle train would be expected to provide more than 60 minutes of service. Further, the licensee informed the inspector that the results of an actual leak rate measurement which would be performed during the preoperational test program would serve as the basis for judging the adequacy of the system design.

In response to the concerns the inspector identified in this area, the licensee also provided an internal memorandum dated September 19, 1985 which indicated that the 230 cfm leak rate specification was no longer applicable and had been removed from the FSAR prior to revision 13. The inspector commented that the NRC SER still mentioned the 230 cfm limit and that the licensee should clarify the need for a leak rate limit with NRR.

The inspector informed the licensee that the adequacy of the design of the control room pressurization system would be considered unresolved pending: (1) clarification by the licensee of the control room envelope's design leak rate requirement and agreement from NRR in this leak rate; (2) the licensee's completion of the control room envelope leak rate test; and, (3) the licensee's subsequent analysis of the actual leak rate to verify system operability. (50-423/85-54-02)

4.0 Electrical Systems

4.1 General

The objective of this phase of the inspection was to examine the installation of selected portions of the Class 1E ac and dc power systems and to verify the as-built conditions agreed with FSAR and SER descriptions and project specification requirements. The portion of the ac system selected for inspection were those associated with the A quench spray and charging pumps. In the dc area, aspects of the batteries, battery chargers, inverters and the DC distribution system were examined.

4.2 AC Power Systems

4.2.1 Cabling, Raceway and Separation

The inspector conducted a field walkdown of the power feeds from 4160V emergency switchgear 3ENS*SWG-A bus 34C to the motors of quench spray pump 3QSS*P3A and charging pump 3CHS*P3A. The inspector observed workmanship and the as-built conditions of the cable, conduit and cable trays, noting in particular the following attributes:

- cable and raceway identification and proper color coding;

- electrical separation between redundant trains and class IE and non-class IE cables and raceway;
- raceway hardware properly installed;
- cable tie downs where appropriate; and
- general conditions such as cleanliness.

The governing specification for acceptance in this area was the E350 specification.

4.2.2 Findings

The inspector determined that the identification of cabling and trays was as required by the specification. The color of the cable (orange) corresponded to the correct channel designation. The inspector also noted appropriate tray grounding throughout the runs and verified that the cable routing agreed with the computer generated cable pull tickets. Several instances were noted of dirt and debris in open ventilated trays, however the inspector judged the cleanliness of the trays to be consistent with what would be expected during the current phase of construction. In fact, the inspector noted that, for those portions of the trays that had covers installed, the trays had been cleaned prior to the cover installation.

While inspecting for electrical separation, the inspector noted instances along the run of cables where the required separation had not been met between 1E and non-1E trays, (i.e. separations were found less than 3 feet horizontal and 5 feet vertical). In addition, the required barriers/-wrapping were not yet installed. Similar conditions were also noted to exist between other trays in the same locations. In response to a concern for the above condition raised by the inspector, representatives of SWEC discussed its program for assuring proper electrical separation. The program was described in NEAM 128 and implemented through FCP 355. The program involved engineering walkdowns and drawing reviews, on a per building basis, which would identify separation problems and track the correction of these problems. The program was intended to resolve the separation problems prior to building turnover. The inspector concluded that the program appeared sound and capable of achieving its desired results. The inspector also noted a program status which indicated that the walkdowns and reviews in the areas in which the majority of the separation problems identified by the inspector (i.e., in the Control Building and cable tunnel) had not yet been completed.

To verify the implementation of the program, the inspector examined two additional areas where the separation program had been completed; the Emergency Diesel Generator building and the Intake Structure. Based on the results of the review of these areas, the inspector concluded that the program was being implemented satisfactorily.

The inspector had no further questions.

4.2.3 Calculation of Available Voltage at Selected Loads

The inspector selected the train A quench spray pump and charging pump as representative safety loads to determine that the voltage available at these motors would be adequate for motor starting and running under the worst case normal voltage conditions. In conducting this evaluation the inspector reviewed the following:

- cables type, size, length and impedance;
- circuit breakers type, size and ratings;
- pump motors size, starting and running currents; and,
- worst case voltage conditions at the emergency busses.

The inspector reviewed those Stone and Webster calculations and voltage profile studies which were used as a basis for the design and protective relay settings. The inspector found that the voltage profile study and changes made in equipment relay safety settings, and operating procedures provided assurance that cable size and rating and the voltage at the emergency switchboard 34C and 34D were sufficient to start and operate the quench spray and charging pumps under all rated and degraded voltage conditions projected.

The inspector also conducted a walkdown of the 4160 volt power cable runs from the emergency switchboard to the train A quench spray and charging pumps to verify approximate cable length, pull routing, cable type and size, marking, support and spacing.

No discrepancies were discovered.

Using handbook cable impedance, the inspector performed the independent voltage calculation shown in Calculation 2 to determine the voltage drops from the emergency switchboards to the train A quench spray and charging pumps. Cable impedances, motor starting and running currents, and the calculated voltage drops were found to be consistent with the data used by SWEC in the design. No discrepancies were discovered.

4.3 DC Power System

The inspector verified that the direct current distribution system was in conformance with FSAR and SER commitments. Verification included checks to show that the Class 1E dc power system installation had met the electrical independence and separation requirements between redundant trains and channels.

4.3.1 Batteries, Battery Chargers, Inverters, and DC Distribution

The inspector examined the four Class 1E batteries, 3BYS*BAT-1, 3BYS*BAT-2, 3BYS*BAT-3, and 3BYS*BAT-4, verifying that:

- they were procured in accordance with E259;
- the battery interconnecting linkages were clean and free of corrosion, and the terminals were coated with no-oxide lubricant;
- they were installed in locked rooms and the keys to the rooms were controlled in accordance with approved administrative procedures;
- the rooms were well illuminated and the lighting system consisted of explosion proof fixtures;
- the room ventilation system appeared to be operating properly;
- the rooms were identified in accordance with the approved engineering drawings; and,
- each room was monitored by an operable H_2 detection module.

The inspector found that each battery room was very clean. The lead-calcium cell jars were found to have been wiped down, making electrolyte level easily visible. The battery racks were mounted in accordance with approved engineering drawings. The racks were painted and the inspector could see no signs of pitting or corrosion from electrolyte spillage. In addition, the inspector reviewed the weekly battery surveillance procedures and assured that the batteries were being maintained in accordance with these procedures. No violations were identified during the tour of the battery rooms and during the review of the surveillance procedures.

The inspector examined battery chargers 3BYS*CHGR-1, 3BYS*CHGR-2, 3BYS*CHGR-3 and 3BYS*CHGR-4, including two spare chargers, 3BYS*CHGR-7 and 3BYS*CHGR-8. These battery chargers receive power from the correct 480 VAC motor control centers and maintain their batteries on a constant float charge.

Static inverters 3VBA*INV-1, 3VBA*INV-2, 3VBA*INV-3, and 3VBA*INV-4, were also observed and were found to be powered from 125 VDC distribution switchboards 3BYS*PNL-1, 3BYS*PNL-2, 3BYS*PNL-3 and 3BYS*PNL-4, as required, and to be supplying power to the correct four 120 VAC vital bus panels.

The battery chargers, static inverters and dc distribution switchboards were examined by the inspector for the following attributes:

- equipment procurement in accordance with specifications E260, E622 and E262;
- proper color coding and identification;
- proper functioning of the filtration and ventilation system;
- proper calibration labels on ammeters, voltmeters and frequency meters;
- sizing of circuit breakers, relays and switches in accordance with approved engineering drawings;
- correct size and type and proper termination of field run and vendor furnished power, control, and instrumentation cables;
- evidence of leaky capacitors or dirty printed circuit boards; and,
- cable minimum bend radius not exceeded.

Of the attributes inspected, the inspector found no problems. The workmanship was found to be of high quality and field run and vendor cables were found properly terminated in accordance with E350. Circuit breakers were sized in accordance with the approved engineering drawings.

No violations were identified.

4.3.2 Battery Alarms and Instrumentation

The inspector verified that the following alarms and indicating instruments would function in accordance with the description provided in section 8.3.2.2 of the SER:

- Battery Float Charge (Ammeter);
- Battery Circuit Output Current (Ammeter);
- DC Bus Voltage (Voltmeter);
- Battery Discharge (Alarm;)
- DC Bus Overvoltage (Alarm;)
- Battery Disconnect Open (Alarm;)
- Battery Charger Disconnect Open (Alarm;) and,
- Battery Charger Failure (Alarm).

The inspector additionally verified that procedures were in place to direct the control room operators' response to annunciating alarms.

The alarm circuitry was verified by the inspector to be consistent with SWEC drawings EE-1BB-9, EE-1BC-8 and ESK-7VZ.

No violations were identified.

4.3.3 Cable Routing and Separation

The inspector randomly selected a number of cables associated with the dc power distribution system and physically verified that the routing, color coding, cable size, type, separation, and routing were in accordance with the cable schedule EC-1, dated August 29, 1985. The cables selected and the associated routing were:

Cable No.	From	To
3BYSNOL604	3BYS*BAT-1	3BYS*BAT-1
3BYSNOL602	3BYS*BAT-1	3BYS*PNL-1
3BYSNOL610	3BYS*CHGR-1	3BYS*PNL-1
3BYSNOL611	3BYS*CHGR-1	3BYS*PNL-1
3BYSNOL630	3BYS*PNL-1	3VBA*INV-1

The orange train cables listed above were found to be routed in accordance with the associated cable pull tickets and were found properly terminated. Separation, both between the raceways and inside of equipment, was maintained as stated in the FSAR.

No violations were identified.

5.0 Instrumentation and Control

5.1 Scope

Selected safety instrumentation and control systems were inspected for conformance with applicable regulatory requirements and with the licensee FSAR commitments. Visual observations of the installed systems were made to confirm that they were designed and installed in accordance with the licensee design and construction documents.

The safety instrumentation and control systems selected for this inspection were as follows:

- Reactor Coolant System Pressurizer Pressure Instrument Loop 3RCS*PT445, Channel 1 (low pressure input to the two of four logic for safety injection);

- Containment Pressure Instrument Loop 3LMS*PT936, Channel 2 (high-1 input to the two of three logic for safety injection);

- Containment Pressure Instrument Loop 3LMS*PT937, Channel 1 (high-3 input to the two of four logic for containment depressurization and phase B isolation);

- Radiation Detection Instrument Loop 3HVC*RIY16A and B (high radiation input to one of one logic for control building isolation)

- Chlorine Detection Instrument Loop 3HVC-AIT17A and B (high chlorine input to one of one logic for control building isolation)

- High Head Safety Injection System controls including charging pump 3CHS*P3A, refueling water storage tank supply to charging pumps valve 3CHS*LCV112D, and charging to cold leg injection block valve 3SIH*MV 8801A;

- Quench Spray System controls including Quench Spray Pump 3QSS*P3A Quench Spray Pump Isolation Valve 3QSS*MOV34A

- Control Room Isolation control including control room ventilation inlet air isolation valves 3HVC*AOV25 and 3HVC*AOV26, control room ventilation outlet air isolation valves 3HVC*AOV22 and 3HVC*AOV23, control room ventilation outlet air isolation valve 3HVC*AOV20 and 3HVC*AOV21 and 3HVC*AOD27A and 3HVC*AOD27B; and

- Control Room Pressurization Controls including air storage tank outlet valves 3HVC*SOV74A and 3HVC*SOV74B.

5.2 Criteria

5.2.1 Instruments and Impulse Lines

The visual inspection during the walkdown of the instrument and impulse lines included checks for the following technical requirements:

- tubing and fitting cleanliness was level "C" per Spec. 2280.000-691;

- tubing and instrument identification was as required;

- minimum slope, bend radius and separation requirements were maintained;

- tubing defects and damage were within allowable levels;

- instrument lines connected to process fluids equal to or greater than 200 degrees F had no bends within six inches of the source piping;

- instrument line isolation valves were located outside of the shield wall; and

- tubing restraints (guides) and anchors were located in accordance with the drawing dimensions and no tubing was located in walkways.

5.2.2 Cable, Cable Termination and Raceway

The visual inspection during the walkdown of the cables, cable terminations and raceway included checks for the following technical requirements:

- safety related instrument and control cables were identified at each terminating end and at each 15 feet;

- there was no visual damage to the cables;

- the conductors were connected to the terminal point and terminal block as shown on the wiring diagram;

- the conductor terminations were made in accordance with the licensee visual acceptance criteria;

- the cables were supported in the vertical direction by Kellem's grips;

- redundant cables and raceways were separated as specified in Appendix C of Specification for Electrical Installation E350.

- raceways were identified as required; and

- cables were installed in their respective raceways in accordance with the cable schedule.

5.2.3 Controls

The elementary diagrams and field installations were reviewed to check for the following technical requirements:

- redundant components were properly identified;

- the functional requirements for the controls were achieved;

- resetting of a protective system actuation, at the system level, would not cause a component action;

- there was a system bypass status alarm;

- the valve motor thermal overload protection was bypassed by an accident signal; and

- the valve torque switch was bypassed for ninety percent travel in the safe direction.

5.3 Documentation

The documents reviewed during this inspection are listed in Attachment 1. In addition, the applicable outstanding Engineering and Design Change Reports were reviewed.

5.4 Visual Inspection Details

The inspector performed the walkdown of the following safety systems and components using the visual criteria listed in paragraph 5.2.

5.4.1 Instrument Impulse Lines

5.4.1.1 Reactor Coolant Pressure SIS Input

The reactor coolant pressurizer pressure instrument impulse line, 3RCS*LT459-H(ZR), was visually inspected from the pressurizer process piping to instrument 3RPS*PT445.

5.4.1.2 Containment Pressure SIS Input

The containment pressure impulse line, 3LMS-750-27-Z(A-1), was visually inspected from inside the containment through penetration number 13 to the auxiliary building, then through Containment Isolation Valve, 3LMS*MOV40A(AO), to instrument 3LMS*PT937(AR).

5.4.1.3 Containment Pressure, Containment Depressurization and Containment Isolation Input

The containment pressure impulse line, 3LMS*750-28-2(B-), was visually inspected from the containment through penetration number 68 to the auxiliary building, then through Containment Isolation Valve, 3LMS*MOV40B(BP), to instrument 3LMS*PT936(BW).

5.4.2 Instrument Cables

5.4.2.1 Reactor Coolant Pressure SIS Input

The reactor coolant pressurizer pressure instrument cable, 3RCSIRX821, was visually inspected from instrument 3RPS*PT445 through the electrical raceways to the electrical penetration inside the containment. This circuit was continued by cable 3RCSIRX820 from the electrical penetration, outside the containment, through the electrical raceways to the Reactor Protection Cabinet, 3RPS*RAKSET 1, which is located outside of the control room.

5.4.2.2 Containment Pressure SIS Input

The containment pressure instrument cable, 3LMSRX800, was visually inspected from instrument 3LMS*PT937 through the electrical raceways to the Reactor Protection Cabinet 3RPS*RAKSET 1.

5.4.2.3 Containment Pressure Containment Depressurization and Containment Isolation Input

The containment pressure instrument cable, 3LMSWX800, was visually inspected from instrument 3LMS*PT936 through the electrical raceway to the Reactor Protection Cabinet, 3RPS*RAKSET 2, which is also located outside of the control room.

5.4.3 Control Cables

5.4.3.1 Charging Pump

The charging pump 3CHS*P3A control cable, 3CES30C101, was visually inspected from the control and indication devices that were located on the main control board, 3CES*MCB-MB3, through the electrical raceways to termination cabinet, 3CES*TB-MB30, located outside of the control room. The circuit continued from the termination cabinet with control cable, 3CHSAOC350, through the electrical raceway to switchgear 3ENS*SWG-A, located at the lower level of the control building. The circuit continued from the switchgear with control cable 3CHSAOC351, through the electrical raceways, to the Diesel Generator Sequence Panel, 3RPS*PNL - ESCA, located next to the control room.

5.4.3.2 Charging Pump Suction Valve

The charging pump suction valve 3CHS*LCV112D control cable, 3CES30104, was visually inspected from the control and indication devices that were located on main control board, 3CES*MCB-MB3, through the electrical raceways to termination cabinet 3CES*TB-MB30. The circuit continued from the termination cabinet with control cable 3CHSDOC004 through the electrical raceways to the transfer panel, 3CES*PNL TSA, located in the switchgear room. The circuit continued from the transfer panel with control cable, 3CHSDOC001, through the electrical raceways to the motor control center, 3EHS*MMC-3A1, which was also located in the switchgear room.

5.4.3.3 Safety Injection Valve

The charging to cold leg injection block valve, 3SIH*MV 8801A, control cable, 3CES30C109, was visually inspected from the control and indication devices located on main control board 3CES*MCB-MB3 through the electrical raceways to termination cabinet 3CES*TB-MB30. The circuit continued from the termination cabinet with control cable 3SIHAOCO31 through the raceway to motor control center 3EHS*MCC3A1. The circuit also continued from the termination cabinet with control cable 3SIHAOCO32 through the electrical raceways to Solid State Protection Panel 3PRSRAKOTA1, located next to the control room.

5.4.4 Equipment

The following equipment was visually inspected to confirm their location, identification, and to verify the condition of instruments or control cables entering the electrical raceway system:

- control building air storage tank outlet valves 3HVS*SOV74A&B;
- control building radiation detectors 3HVC*RIY16A&B;
- Control building chlorine detectors 3HVC-AIT17A&B; and,
- Control room inlet air isolation valves 3HVC*AOV25&26.

5.5 Findings

The inspector found that the state of workmanship in the area was generally good and that the instrumentation and control systems inspected conformed to the criteria of paragraph 5.2 with the following exceptions:

- The pitch of the containment pressure impulse line 3LMS*PT937 starting three and one half inches from valve *V41(A-) to restraint guide EK-514004 H001, 6-G-2 was in the downward direction instead of in the upward direction.
- There were eleven auxiliary and time delay relays located in reactor protection system auxiliary panel, 3RPS*RAKOTXA, which were not identified and one time delay relay 69X-circuit 3HVCA24(-0), was identified incorrectly. Similar conditions of devices not identified were also found to exist in panel 3RPS*RAXOTXB.

In response to these findings, the licensee has agreed to correct the slope of impulse line 3LMS*PT937 and to evaluate the need to more clearly identify all components in panels 3RPS*RAKOTXA & B.

Regarding the Control Room HVAC system, the inspector found that the chlorine detection probes had not yet been inserted into the control room air inlet piping. However, the inspector verified that provisions had been made in the piping for these probes. The licensee stated that the reason these probes were not inserted, at this time, was the material used in the probes was effective only for six weeks. These probes would be inserted prior to making the system operable.

The inspector also confirmed that the licensee had revised the Control Building Isolation System control logic to appropriately address the concern, identified in the SER section 7.3.3.8, that the radiation, chlorine and containment pressure actuation inputs be capable of being reset individually without affecting the operability of the other actuation signals.

No violations were observed during this inspection.

5.6 Independent Verification

At the request of the inspector, the licensee conducted a wire termination tensile strength test in accordance with the minimum requirements specified in UL-486. The test was witnessed by the inspector. The conductor terminations tested were for wire sizes 16, 14, 12 and 10 AWG. The terminations were made by the licensee such that they met the established visual acceptance criteria. The terminations for each wire size included acceptable terminations with the rear crimp set at each of the three settings available on the crimping tool. Also, two terminations were made for each wire size which would have been rejected using the licensee's visual criteria; these also had the back crimp set at three different settings. A total of 36 wire terminations were thus tested. Each termination exceeded the UL-486 tensile strength requirement by at least twenty five percent without failure.

6.0 Civil/Structural

6.1 General

The scope of inspection in the civil/structural area focused on the as-built load verification program for Category I structural steel. The licensee's program for this activity was undertaken to verify, through sampling inspection and evaluation, the adequacy of the original structural steel design and its conformance to the FSAR requirements. This verification process, when completed, would also determine whether the estimated "envelope" loads used for the original design of Category I structural steel were sufficient to account for the final support loads resulting from piping, equipment, HVAC, conduit, cable trays, and other miscellaneous attachments.

The objective of the inspection of this activity was to provide an assessment of the licensee's program by evaluation of the following:

- the adequacy of the licensee's sampling plan and its implementation in providing a representative sample of Category I structural steel framing with varied load characteristics.
- the accuracy of the data transmittals containing building steel attachment locations and corresponding loads.
- the approach for the analysis and its conformance to the acceptance criteria established.

To achieve this objective, the inspector performed a review of the various procedures utilized in providing the technical direction, the basis for the sampling inspection, the structural design criteria being implemented and the draft technical report provided after the completion of the first phase of evaluation. These procedures and criteria are identified in Attachment 1 to this report.

In addition to the review of documents, the inspector met with cognizant licensee engineers and contractors who are involved in carrying out this program. Further, the inspector performed a sampling verification of the two major activities performed by the licensee's contractors. The verification involved the walkdown of building steel samples and a review of the design evaluation effort provided for the qualification of these selected samples.

6.2 Building Steel Verification Program

The licensee program for carrying out this effort has been based on a sampling evaluation of Category I structural steel framings from five areas which were selected to provide a representative sample with varied load characteristics. The evaluation included member and connection stresses.

The criteria utilized by the licensee for the sampling plan have been outlined in SWEC's procedure QAD-7.11. The sample consisted of a total of 243 beams and 25 columns from a total plant population of approximately 6700 category I structural steel members. The sample selection was intended to be biased towards the worst-case configurations, with regard to density of loading and type of attachments. The acceptance criteria for the sampling plan were related to the number of samples which fail the evaluation. If the results indicated six or more rejections, then the sample was considered as failing.

The samples were selected from the following areas:

- Engineered Safety Features Building (Elevation 21'-6");
- Main Steam Valve Building (Elevation 61' - 10");
- Engineered Safety Features Building (Elevation 24' - 6");
- Control Building (Elevation 47' - 6"); and,
- Containment Structure (Annulus Pipe Rack).

The collection of data required for performing the steel verification was the responsibility of SWEC. This involved the walkdown of the selected samples for the identification of support attachments to building steel and the development of current loads induced by these attachments.

The verification effort involved in this activity has been performed by Teledyne Engineering. The criteria used for performing the evaluation were provided in SWEC's procedure for structural design in addition to the AISC manual of steel construction and the AISC procedure for torsional analysis of steel members.

Phase I of the sample evaluation was a screening operation based on the use of the following assumptions:

- use of a single envelope of worst case loads to account for all load combinations;
- use of an allowable stress of 1.0S for envelope loads including SSE;
- use of bounding analysis for groups of identical connections;
- use of absolute sum of resultant stresses from dynamic loads induced by attachment on a member;
- use of absolute sum of resultant stresses from attachment loads other than seismic; and,
- increase of the "significant loads" by a factor of 1.15 to account for minor loads from non-significant attachments.

The significant attachments included the following:

- large bore piping systems;
- cable tray supports;
- duct supports;
- eccentrically-loaded small bore piping and instrumentation supports; and
- ASME small bore piping supports.

The non-significant attachments included the following:

- direct attachments of non-ASME small bore, conduit and instrument lines;
- nonseismic standard supports for small bore piping; and,
- conduit, small bore and instrumentation supports determined as non-significant by engineering judgement.

Phase II of the evaluation was performed on those elements which did not pass the first level screening review. In this phase, the evaluation was based on more detailed analysis and less conservative assumptions.

The NRC inspection of this activity involved the selection of two members from each of the five areas evaluated, which were determined to be stressed close to or at allowable stresses. A detailed walkdown inspection was conducted to verify the data transmittals for those selected members. Finally, a review of the sample evaluation was performed to determine the adequacy of the attachment load magnitudes and application in addition to the analysis performed. Documentation of the structural steel samples reviewed during the inspection is provided in attachment 2F to this report.

6.3 Findings

As a result of the inspector's review of the licensee's structural steel verification program, the following findings were identified and discussed with licensee and SWEC representatives:

1. The licensee's data collection was based on information regarding attachment locations and loads transmitted to building steel which was current when the effort took place. The inspector identified attachments which were either not considered in the Teledyne analysis or were recently added to structural steel members. These attachments were identified in the following locations:

   - the control building (Area 4), beam No. S20AG4;
   - the ESF building (Area 2), beam No. T7G2G1;
   - the ESF building (Area 1), beam No. T2G20K;
   - The ESF building (Area 1), beam No. T4G30H.

   Though the evaluation of these members in the Teledyne report had utilized conservative assumptions, the evaluation had found these members to be stressed near or at the allowable limits. The inspector concluded that further verification would be required to insure the design adequacy of these and other members to which support attachments had been installed after the completion of data collection effort by SWEC.

2. SWEC's data transmittals reviewed by the inspector did not identify whether all support attachment loads were provided for transmittal to Teledyne or whether only those considered significant were provided. Further, the Teledyne draft report did not clearly identify the basis for qualification of all members evaluated (i.e. whether the qualification was based on consideration of all attachments loads or on the basis of significant attachments with the 15% increase to account for non-significant attachments)

3. The detailed analysis performed by Teledyne for the evaluation of those control building beams (Area 4) selected by the inspector was not available for review.

4. The licensee's acceptance criteria for the sampling plan did not identify the statistical confidence level which would have been achieved based on the comparison of the number of samples considered failures to the total sample size and the total population.

   Based on the above four items, acceptability of the licensee's structural steel verification program is considered unresolved pending the licensee's evaluation and NRC review (423/85-54-03).

7.0 <u>Follow-up on Outstanding Inspection Findings</u>

7.1 <u>(Closed) Unresolved Item (423/83-17-01)</u>

This item was concerned with the generic approach to the analysis of piping systems which was based on nominal values of piping fitting thickness. When this item was reviewed in inspection No. 50-423/85-32, the licensee had agreed to provide the results of the evaluation of the diesel generator exhaust piping for NRC review.

The inspector reviewed the results of the licensee's evaluation of the piping system. Computer analyses were performed utilizing wall thicknesses of elbows of 1.5, 2.0 and 3.0 times the nominal value to quantify the effect of heavy wall fittings on the exhaust piping stresses.

The effect was determined to be insignificant due to the overall flexibility of the piping system and the presence of expansion joints. Thus, the thermal loading did not have any noticeable effect on the qualification of this piping system.

The licensee response was considered sufficient to close this unresolved item.

7.2 <u>(Closed) Unresolved Item (423/84-04-10)</u>

This item was related to the lack of specific evaluation for local stresses at web attachments of structural steel introduced by piping or conduit hanger supports. The inspector reviewed the generic procedure developed by SWEC for the evaluation of web attachments (Calculation No. 12179-SEO-58.01 and S80.2). The development of the generic approach was based on finite element analysis utilizing various sizes and locations of attachments to webs of structural steel w-shapes. The evaluation addressed out-of-plane normal attachment loads and bending moments acting on webs.

Implementation of the above procedure in the evaluation of support attachments to w-shapes started in October 1984. Since the evaluation of all category 1 piping and tubing supports had started in April 1984, in conjunction with the stress reconciliation effort, the inspector conducted a review of sample evaluation packages which were performed prior to the issuance of Calculations S80.1 and 80.2. Evaluation of local stresses induced by web attachments was based on engineering judgement. The methodology utilized in the evaluation was based on considering an effective width of w-shape webs to be equal to the smaller of 25tw (tw = web thickness) or twice the attachment width. This methodology was considered conservative. The licensee's response was considered adequate to close this unresolved item.

8.0 Unresolved Items

Unresolved items are matters about which more information is necessary to determine whether they constitute violations or deviations or are acceptable. Unresolved items are discussed in paragraphs 3.3.3, 3.3.4 and 6.2.

9.0 Attachments and Calculations

Attachment No. 1 is a list of specific documents reviewed.

Attachment No. 2 is a list of specific piping components and supports examined during the course of this inspection.

Calculation No. 1 is an independent NRC calculation to determine if the control room air pressurization system capacity was in accordance with FSAR, SER and Technical Specification requirements.

Calculation No. 2 is an NRC independent calculation to determine that the voltage drops between the power sources and the quench spray and charging pumps were within allowable limits.

10. Exit Interview

The inspectors met with the licensee representatives denoted in paragraph 1 at the conclusion of the inspection. The inspector summarized the scope and findings of the inspection and the need for licensee attention to address those issues remaining unresolved. No written material was given to the licensee during the course of this inspection.

Documents Reviewed

High Pressure Safety Injection System

Document	Number	Type
Field Fabrication & Erection of Power Piping	2280-000-968	Specification
Chemical and Volume Control	12179-FSK-26-2J	Flow Diagrams
High Pressure Safety Injection	12179-FSK-27-2A	Flow Diagrams
Low Pressure Safety Injection	12179-EM-112C-3	Piping Diagram
High Pressure Safety Injeciton	12179-EM-113A-3	Piping Diagram
Safety Injection System	12179-CI-SIL-152A	Piping Isometrics
"	12179-CI-CHS-504	"
"	12179-CI-CHS-30	"
Safety Injection System	12179-CI-CHS-33	Piping Isometrics
"	12179-CI-CHS-507	"
"	12179-CI-SIH-4	"
Safety Injection System	12179-CI-SIH-3	Piping Isometrics
"	12179-CI-SIH-501	"
Safety Injection System	12179-CP-407023	Piping Isometrics
"	12179-CI-SIH-141A	"
"	12179-CP-407310	"
Safety Injection System	12179-CP-408046	Piping Isometrics
"	BZ-74B-135-1	Piping Details
"	BZ-74B-133-2	"
Safety Injection System	BZ-74B-11-5	"
"	BZ-74B-127-4	"
"	BZ-74B-155-2	Piping Details
"	BZ-74B-153-4	"
Safety Injection System	BZ-74B-10-4	"
"	BZ-74B-147-2	"
"	BZ-74B-184-5	Piping Details
Safety Injection System	BZ-74B-13-2	"

Documents Reviewed

Quench Spray System

Document	Number	Type
Quench Spray & Hydrogen Recombiner	12179-EM-115A-3	P&IC
Drilled in Expansion Type Concrete Anchors	2199.142-924	Specification
Field Fabrication & Erection of Piping	2280.000 - 968	Specification
Quench Spray Pumps	2214.602 - 040	Specification
Quench Spray System	12179-CI-QSS-1	Piping Isometrics
"	12179-CI-QSS-6	"
"	12179-CI-QSS-2	"
Quench Spray System	12179-CI-QSS-25	Piping Isometrics
"	BZ-79B-40-3	Piping Details
"	BZ-79B-42	"
Quench Spray System	BZ-79B-42-2	Piping Details
"	BZ-79B-225-4	"
"	BZ-79B-41	"
Quench Spray System	BZ-79B-39-3	Piping Details
"	BZ-79A-43-1	"
"	BZ-79B-39	"
Quench Spray System	BZ-79B-69-3	Piping Details
	BZ-79B-37-4	
Control Drawing	12179.CI-KHS-4	Piping Isometric

Documents Reviewed

Containment Recirculation Spray System

Document	Number	Type
Field Fabrication & Erection of Power Piping:	2280.000.968	Specification
Containment Recirculation Pumps	2214.802-044	Specification
Containment Recirculation Coolers	2214.803-020	Specification
Control Drawings	12179-CI-RSS-16T	Piping Isometrics
"	12179-CI-RSS-21	" "
"	12179-CI-RSS-4	" "
Control Drawings	12179-RSS-502B	Piping Details
"	BZ-79B-112-2	" "

Documents Reviewed

Control Room Emergency Ventilation System

Document	Number	Type
HVAC System	2170-430-M565 R-8	Specification
HVAC/DUCT Fabrication	12179-132C	Specification
Emergency Ventilation System	12179-EB-39C-13	P&ID
"	12179-EB-39D-15	"
"	12179-EM-151B-3	"
Emergency Ventilation System	12179-EM-151A-3	P&ID
"	12179-EB-392-11	"
"	12179-EB-39M-9	"
Emergency Ventilation	12179-EB-39J-9	P&ID
"	12179-FSK-22-9A	Flow Diagrams
	12179-FSK-22-9B-R-11	"
Emergency Ventilation	12179-FSK-22-9G-R-7	Flow Diagrams
Control Room Emergency Pressurization System	P(B) - 0990 Rev. 0	Calculation
Unit 3 Control Room Doses Due to Inleakage of Containment & ESF Leakage from Unit 3 LOCA	UR (B) 262 - 2	Calculation
Toxic Chemical Analysis; Control Room Pressurization: Chlorine	ENVR-W264 Rev. 0	Calculation
Support for Air Storage Bottles 3 HVC TKIA thru 1H, 1J	#357	Calculation

Documents Reviewed

AC & DC DISTRIBUTION SYSTEM

Document	Number	Type
Voltage Profile Calculation	#132 E	Calculation
Switchgear Circuit Breaker M-26	GEH-1802	GE Procedure
Control Storage Batteries	E259 Rev. 1	Specification
Static Battery Chargers	E260 Rev. 2	Specification
DC Distribution Panelboards & Panels	E262 Rev. 1	Specification
Static switches, Inverters & Regulating Transformers - Single phase	E622 Rev. 1	Specification
Station Battery Surveillance Testing	SP 3712 N Draft B	Specification
Digital Isolator Circuits O & P	12179-ESK-7VZ	Drawing
One Line Diagram for 125 VDC/ 125 VAC Distrib. System	12179-EE-1BA-10 Rev. 10	Drawing
One line Diagram for Battery 301A-1/301A-2	12179-EF-1BB-9 Rev. 9	Drawing
One line Diagram for Battery 301B-1/301B-2	12179-EE-1BC-8 Rev. 8	Drawing
SWEC Separation Project Procedure	NEAM 128 Rev. 2	Procedure
SWEC Field Const. Procedure Physical Separation for Elect. Cable & Raceway	#355 Rev. 1	Procedure

Documents Reviewed

Instrumentation and Controls

Document	Number	Type
Electrical Installation	2400.000-350 Rev. 8	Specification
Instrumentation Installation Piping, and Tubing	2472.800-943 Rev. 10	"
Aux Relay Rack Panel 3 RPS Rakotax		
	12179-EE-25CL-2 Rev. 2	Front View
	12179-ESK-4YA-1 SH1 R3	Outline
	12179-ESK-4YA-2 SH2 R3	Outline
	12179-ESK-4YA-3 SH3 R7	Material List
	12179-ESK-4YA-4 SH4 R7	Material List
	12179-ESK-4YA-5 SH5 R2	Material List
Loop Diagram	3 RCS-445 12179-FSK 25-1E Rev. 9	Pressurizer Pressure
Loop Diagram	3 LMS-937 12179-FSK-33-1 Rev. 6	Containment Pressure
Loop Diagram	3 LMS-936 12179-FSK-33-1 Rev. 1	Containment Pressure
Instr. Loop Calibration Report (LCR)	3 RCS-455A Rev. 1	Pressurizer Pressure
	3 LMS-937 Rev. 1	Containment Pressure
	3 LMS-936 Rev. 1	Containment Pressure
Pressurizer Pressure	3 RCS LT459(ZR)	Isometric Drawings
	3 RCS PT455(ZR)	" "
Containment Structure	12179-EK-501176, Rev. 3	Isometric Drawings
" "	12179-EK-501178, Rev. 2	" "
" "	12179-EK-501097 Sheet 1 Rev. 2	" "
Containment Structure	12179-EK-501097 Sheet 2 Rev. 4	Isometric Drawings
Containment Pressure	3LMS*PT937 (AR)	Isometric Drawings
Auxiliary Building	12179-EK-514004 Rev. 2	Isometric Drawings

Documents Reviewed

Instrumentation and Controls

Document	Number	Type
Containment Pressure	3LMS*PT 936 (BW)	Isometric Drawings
Containment Pressure	3LMS*PT 24A (BP)	Isometric Drawings
Auxiliary Building	12179-EK-514003 Rev. 2	Isometric Drawings
Containment Structure	12179-EK-1C Sh 3 Rev. 7	Instrument Piping Drawings
Containment Vacuum & Leakage Monitoring	12179-EK-14 Rev. 4	Instrument Piping Drawings
Multiple Instru. Liquid Service Inst. below Tap Pressure above 150 PSI	12179-SK-16P-71 Rev. 5	Instrumentation Design
Pressure Instruments - Air or Dry Gas Inst Above Tap 150 PSI or below	12179-16P-65 Rev. 5	Instrumentation Design
Control Switch Contact Diagram 4.16 KV	12179-ESK-3E Rev. 11	Elementary Diagram
Charging Pump 3CHS*P3A	12179-ESK-5CS Rev. 10	Elementary Diagram
4.16 KV Quench Spray	12179-ESK-5DG Rev. 10	Elementary Diagram
Pump 3QSS*P3A	12179-ESK-6LS Rev. 7	" "
480VMC Quench Spray Isolation Valve 3QSS*MOV34A		
480 VMC Charging Pump to Reactor Cold Leg Isolation Valve 3SIH*8801A	12179-ESK-6MV Rev. 6	Elementary Diagram
480 VMC Refueling Water Storage Tank to Charging Pump Valve 3CHS*LCV 112D	12179-ESK-6PM Rev. 7	Elementary Diagram
Control Bldg. Isolation (Train A) SH1	12179-ESK-7TA Rev. 8	Elementary Diagram
Control Bldg. Isolation (Train A) Sh2	12179-ESK-7TB Rev. 7	Elementary Diagram

Documents Reviewed

Instrumentation and Controls

Document	Number	Type
Control Bldg. Isolation (Train B) Sh1	12179-ESK-7TC Rev. 8	Elementary Diagram
Control Bldg. Isolation (Train B) Sh2	12179-ESK-7TD Rev. 7	Elementary Diagram
Control Room Outlet Air Isolation Valves 3HVC* AOV20&21	12179-ESK-7PB Rev. 6	Elementary Diagram
Control Room Outlet Air Isolation Valves 3HVC* AOV 22&23	12179-ESK-7PC Rev. 6	Elementary Diagram
Control Room Outlet Air Isolation Valves 3HVC* AOV 25&26	12179-ESK-7PD Rev. 6	Elementary Diagram
Control Room Makeup Air Damper 3HCV*AOD 27A & 27B	12179-ESK-7PK Rev. 5	Elementary Diagram
Air Storage Outlet Valves 3HVC*SOV74A & 74B	12179-ESK-7PL Rev. 5	Elementary Diagram
Reactor Trip Breaker 3RPS*ACB-RTA	12179-ESK-11A Rev. 7	Elementary Diagram
Main Control Board 3CES*MCB-MB3	12179-EE-3AGK Rev. 3	Wiring Diagrams
Termination Cabinet 3 CES*TB-MB30	12179-EE-3DZ Rev. 6	Wiring Diagrams
Termination Cabinet 3 CES*TM-MB20	12179-EE-3DR Rev. 6	Wiring Diagrams
Process CAB Prot Set 1	12179-EE-3HA Rev. 4	Wiring Diagrams
Process CAB Prot Set 2	12179-EE-3HB Rev. 3	Wiring Diagrams
Eng Safeguard Seg Panel 3 RPS PNL ESCA SH 1	12179-EE-3TM Rev. 10	Wiring Diagrams

Documents Reviewed

Instrumentation and Controls

Document	Number	Type
Transfer Switch PNL 3CES PNL TSA SH7	12179-EE-3UG Rev. 2	Wiring Diagrams
Emergency Switchgear A SH7	12179-EE-8BG Rev. 11	Wiring Diagrams
480V MC 3EHS*ACC-3A1	12179-EE-9FE Rev. 4	Wiring Diagrams
Cable Schedule EC-1 Issue 87	12179-EE-59A	Wiring Diagrams

Documents Reviewed

Structural Steel Verification Program

Document	Number	Type
Sampling Inspection (Generic Procedure)	QAD-7.11	Quality Assurance Directive
Steel Load Verification	NETM 57, Rev. 0	Technical Procedure
Steel Load Verification	TR-6288-1 (Draft)	Technical Report
Structural Design Criteria	NETM-34, Rev. 1	Design Criteria
AISC Torsional Analysis of Steel Members	AISC Journal, 2nd 1982/Vol. 19, No. 2	Technical Paper
Web Attachment Generic	12179-SEϕ-580.2	Generic Calculations
Torsional Analysis of Steel Members for Allowable Moments with 1&2 Stiffener Plates	12179-SEϕ-580.3	Generic Calculations
Local Stress Check on W12X40 Due to 3-CCP-1-PSR-034	12179-SEϕ-BZ-107C.17	Design Calculations
Local Stress Check of W24X55 Due to CP379707-H003	12179-SEϕ-BZ-79R.8	Design Calculations
Local Stress Check of W24X94 & W36X230 for 3-MSS-5-PSSP423	12179-SEϕ-BZ-2D.1	Design Calculations
Local Stress Check of W36X194 for 3-MSS-5-PSSP424	12179-SEϕ-BZ-2D.2	Design Calculations
Local Stress Check on W8X20 for 3-CCP-1-PSST 136	12179-SEϕ-BZ-107B.4	Design Calculation
Local Stress Check on a W14X211 from 3-CDS-1-PSA-138	12179-SEϕ-BZ-107B.7	Design Calculation

Documents Reviewed

Structural Steel Verification Program

Document	Number	Type
Local Stress Check on W18X77 and W18X85 from 3-CCP-1-PSST 156	12179-SEϕ-BZ-107C.4	Design Calculation
Local Stress Check on W8X20 for 3-CCP-1-PSST 136	12179-SEϕ-BZ-107B.4	Design Calculation
Local Stress Check on a W14X211 from 3-CDS-1-PSA 138	12179-SEϕ-BZ-107B.7	Design Calculation
Local Stress Check on W27X84 & W27X94 Due to 3-CDS-1-PSA 270	12179-SEϕ-BZ-107C.9	Design Calculation

ATTACHMENT 2A

QUENCH SPRAY SYSTEM

LOOP A

ITEM	ID No.	PLI No.	DWG No.	Comments
Valve	3QSS*V42	C.I.-QSS-1		
Valve	3QSS*V933	C.I.-QSS-1		
Support Strut	PSST 074/ PSST 180	C.I.-QSS-1		1' 5½" dimension should be 5 ½" between these supports. Drafting error - IR P5A02426
Valve	3QSS*V945	C.I.-QSS-1		
Support Strut	PSST 081	C.I.-QSS-1		
Support Strut	PSST 075	C.I.-QSS-1	BZ-79B-225-2	Detailed Inspection
Support	PSR 076	C.I.-QSS-1	BZ-79B-39	Detailed Inspection
Support	PSR 077	C.I.-QSS-1	BZ-79B-40-3	Detailed Inspection
Support	PSST 078	C.I.-QSS-1		Should be 1'- 1½" upstream of trunion. Drawing to be changed IR P5A02426
Support	PSR 079	C.I.-QSS-1	BZ-79B-41	Detailed Inspection
Support	PSSH 080	C.I.-QSS-1		Drawing dimension from elbow is 1'-8 1/8". Should be 1'-10". Drawing to be changed IR P5A02426
Valve	3QSS*V51	C.I.-QSS-1		
Valve	3QSS*V2	C.I.-QSS-6		
Support	PSST 115	C.I.-QSS-6	BZ-79B-69-3	Detailed inspection

ATTACHMENT 2A

QUENCH SPRAY SYSTEM

LOOP A

ITEM	ID No.	PLI No.	DWG No.	Comments
Support	PSR 116	C.I.-QSS-6		
Support	PSR 117	C.I.-QSS-6		
Valve	3QSS*V951	C.I.-QSS-2		
Valve	MOV*34A	C.I.-QSS-2		
Support	PSST 083	C.I.-QSS-2	BZ-79B-42	Detailed Inspection
Valve	3QSS*V950	C.I.-QSS-25		
Check Valve	3QSS*V4	C.I.-QSS-25		No flow direction indicated on valve. Correct installation was verified by ultrasonic test N&D 13,271
Valve	3QSS*V975	C.I.-QSS-25		
Support	PSR 030	C.I.-QSS-25		
Flange	FLS1A	C.I.-QSS-25		Blank part of spectacle flange in system. To be removed during system line up. per OP3309-1, -2.
Support	PSR 031	C.I.-QSS-25		
Support	PSR 032	C.I.-QSS-25	BZ-79A-38-3	Detailed Inspection
Support	PSR 033	C.I.-QSS-25		
Support	PSR 073	C.I.-QSS-1	BZ-79B-37-4	Detailed Inspection
Support	PSA 034	C.I.-QSS-25		
Support	PSR 035	C.I.-QSS-25		

ATTACHMENT 2A

QUENCH SPRAY SYSTEM

LOOP A

ITEM	ID No.	PLI No.	DWG No.	Comments
Support	PSR 036	C.I.-QSS-25	BZ-79A-42-2	Detailed Inspection
Support	PSR 037	C.I.-QSS-25	BZ-79A-43-1	Detailed Inspection
Support	PSR 038	C.I.-QSS-25	BZ-79A-42-2	Detailed Inspection

Attachment 2B

Containment Recirculation System

Loop P B

ITEM	ID No.	PLI No.	DWG No.	Comments
Valve	V27	C.I.-RSS-16T		
Support	PSR 167A	C.I.-RSS-21T		Direction of restraint not on drawing
Support	PSR 167	C.I.-RSS-21T		
Support	PSST 166	C.I.-RSS-21T		
Support	PSR 165	C.I.-RSS-21T		
Support	PSST 164	C.I.-RSS-21T		
Support	PSR 163	C.I.-RSS-21T		
Support	PSSH 161	C.I.-RSS-21	BZ-79B-112-2	Detailed Inspection
Support	PSR 158	C.I.-RSS-21	BZ-79B-109-2	Detailed Inspection
Support	PSST 160	C.I.-RSS-21	BZ-79B-111-2	Detailed Inspection. Direction of restraint not on drawing
Support	PSSP 416	C.I.-RSS-21	BZ-79B-141-3	Detailed Inspection
Support	PSA 012	C.I.-RSS-502B		
Support	PSR 013	C.I.-RSS-502B	BZ-79A-19-1	Detailed Inspection
Support	PSR 014	C.I.-RSS-502B		
Support	PSR 015	C.I.-RSS-502B		

Attachment 2C

Residual Heat Removal System

ITEM	ID No.	PLI No.	DWG No.	Comments
Support	PSR 024	C.I.-RHS-4		
Support	PSR 023	C.I.-RHS-4		
Valve	V4	C.I.-RHS-4		Dimension from valve to downstream elbow taken to outside of pipe not center line of elbow.
Support	PSR 009	C.I.-RHS-4		
Support	PSSH 010	C.I.-RHS-4		
Support	PSSP 450	C.I.-RHS-4		
Support	PSR 011	C.I.-RHS-4		
Support	PSSH 012	C.I.-RHS-4		
Support	PSST 022	C.I.-RHS-4		
Support	PSR 064	C.I.-RHS-4		
Support	PSR 066	C.I.-RHS-4		
Valve	V966	C.I.-RHS-4		

Attachment 2D

Charging/High Head Safety Injection System

Item	ID No.	P&ID	DWG No.	Comments
Valve	3SIL-V1	C.I.-SIL-152A		
Valve	V709 MV8468A	C.I.-CHS-504		
Support	PSR 320	C.I.-CHS-504	BZ-74B-135-1	Detailed Inspection
Valve	V43	C.I.-CHS-504		
Support	PSST 340	C.I.-CHS-504	BZ-74B-155-2	Detailed Inspection
Support	PSST 332	C.I.-CHS-504	BZ-74B-147-2	Detailed Inspection
Support	PSST 319	C.I.-CHS-504		
Support	PSST 318	C.I.-CHS-504	BZ-74B-133-2	Detailed Inspection
Support	PSSH-338	C.I.-CHS-30	BZ-74B-153-4	Detailed Inspection
Support	PSR 339	C.I.-CHS-30		
Valve	V276	C.I.-CHS-30		
Support	PSSP 465	C.I.-CHS-30		
Support	PSSH 010	C.I.-CHS-33	BZ-74B-184-5	Detailed Inspection
Valve	V46	C.I.-CHS-33		
Valve	V272	C.I.-CHS-33		
Support	PSSP 400	C.I.-CHS-33		
Support	PSR 011	C.I.-CHS-33	BZ-74B-11-5	Detailed Inspection

Attachment 2D

Charging/High Head Safety Injection System

Item	ID No.	P&ID	DWG No.	Comments
Support	PSSH 116	C.I.-CHS-33		
Support	PSR 009	C.I.-CHS-33	BZ-74B-10-4	Detailed Inspection
Support	PSR 011	C.I.-CHS-507		
Valve	V51	C.I.-CHS-507		
Valve	MV8438A V702	C.I.-CHS-507		
Support	PSR 013	C.I.-CHS-507	BZ-74B-13-2	Detailed Inspection
Valve	V285	C.I.-CHS-507		
Valve	MV 8438C	C.I.-CHS-507		
Support	PSA 312	C.I.-CHS-507	BZ-74B-127-4	Detailed Inspection
Support	PSR 109	C.I.-SIH-4		
Support	PSA 108	C.I.-SIH-4		
Valve	V53	C.I.-SIH-4		
Valve	V54	C.I.-SIH-4		
Support	PSR 624	C.I.-SIH-4		
Support	PSR 014	C.I.-SIH-3		
Valve	MV8801A	C.I.-SIH-3		
Support	PSR 014	C.I.-SIH-3		
Valve	V4 MM8801B	C.I.-SIH-3		
Support	PSR 015	C.I.-SIH-3		

Attachment 2D

Charging/High Head Safety Injection System

Item	ID No.	P&ID	DWG No.	Comments
Valve	V834/V835	C.I.-SIH-3		
Valve	V905/V906	C.I.-SIH-3		
Support	PSR 017	C.I.-SIH-3		
Support	PSR 018	C.I.-SIH-3		
Valve	V903/V904	C.I.-SIH-3		
Valve	V990	C.I.-SIH-501		
Valve	V883	C.I.-SIH-501		
Check Valve	V5	C.I.-SIH-501		
Valve	V898	C.I.-SIH-501		
Supports	PSSP 905 PSR 333	C.I.-SIH-501		
Support	VPSIR 1100	C.I.-SIH-501		
Support	PSR 648	C.I.-SIH-501		
Valve	V887	C.I.-SIH-501		
Support	PSR 334	C.I.-SIH-501		
Valve	V68	CP 407023		
Valve	V67	CP 407023		
Valve	V6	CP 407023		
Support	PSR 647	CP 407023		
Support	PSR 339	CP 407023		
Support	PSR 340	C.I.-SIH-141A		
Support	PSST 531	CP 407310		

Attachment 2D

Charging/High Head Safety Injection System

Item	ID No.	P&ID	DWG No.	Comments
Support	PSR 532	CP 407310		
Support	PSR 533	CP 407310		
Support	PSR 534	CP 407310		
Support	PSR 535	CP 407310		
Support	PSSP 162 PSSP 165	CP 408046		
Support	PSR 1112	CP 408046		
Check Valve	V29	CP 408046		
Support	PSSP 1109	CP 408046		
Support	PSSP 1110	CP 408046		
Support	PSST 161	CP 408046		

Attachment 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Damper	1134	12179-EM-151B-2		
Switch	FS 116B	"		
Damper	1135	"		
Fan	FN 6	12179-EM-151B-2		
Damper	DMPT 7A	"		
Damper	DMPT 7B	"		
Valve	V75 (AOV 21)	12179-EM-151B-2		
Valve	V74 (AOV 20)	"		
Support	DSA 391	12179-EB-39C-13		
Support	DSR 341	"		
Support	DSR-393	"		
Support	DSA-394	12179-EB-39C-13		
Support	DSA-219	"		
Damper	DMPF-15	"		
Support	DSR-238	12179-EB-39C-13		
Support	DSA-237	"		
Support	DSA-255	"		
Damper	DMP-90	12179-EB-39C-13		
Support	DSA-195	"		

Attachment 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Support	DSA-151	"		
Support	DSR-194	12179-EB-39C-13		
Support	DSR-196	"		
Support	DSR-152	"		
Support	DSA-276	12179-EB-39C-13		
Support	DSA-277	"		
Support	DSA-103	"		
Support	DSA-102	12179-EB-39C-13		
Support	DSA-257	"		
Support	DSA-258	"		
Support	DSA-267	12179-EB-39C-13		
Support	DSA-266	"		
Support	DSA-274	"		
Support	DSA-083	12179-EB-39C-13		
Support	DSA-084	"		
Support	DSR-100	"		
Support	DSR-099	12179-EB-39C-13		
Support	DSA-083	"		
Support	DSA-082	"		
Damper	DMP-83	12179-EB-39C-13		

Attachment 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Damper	DMP-86	12179-EB-39C-13		
Damper	DMP-87	"		
Damper	DMP-88	"		
Damper	DMP-89	12179-EB-39C-13		
Switch	RE 16A	12179-EB-39L-11		
Switch	RE 16B	12179-EB-39L-11		
Valve	AOV-25	12179-EB-39D-15		
Valve	AOV-26	"		
Damper	DMPT 5A	"		
Damper	DMPT 5B	12179-EB-39D-15		
Support	PSA 003	"		
Support	DSA 933	"	BZ 539G-58-3	Detailed Inspection
Support	DSA 932	12179-EB-39D-15	BZ 539G-58-3	Detailed Inspection
Support	DSA 828	"		
Support	DSA 827	"		
Support	DSA 824	12179-EB-39D-15		
Support	DSA 823	"		
Support	DSA 822	"		
Support	DSA 821	12179-EB-39D-15		

Attachment 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Support	DSA 826	"		
Support	DSA 951	"		
Support	DSA 950	"		
Valve	AOD 134	12179-EB-39D-13		
Fan	FN 4	"		
Support	DSR-872	12179-EB-39D-13		
Support	DSR-701	"		
Support	DSR-704	"		
Support	DSA-705	12179-EB-39D-13		
Support	DSA-703	"		
Support	DSR-706	"		
Support	DSA-707	12179-EB-39D-13		
Damper	DMPT 7A	"		
Damper	DMPT 7B	"		
Fan	FN 6	12179-EB-39D-13		
Valve	AOV 20	"		
Support	PSA 003	"		
Fan	FN 1A	12179-EB-39D-13		
Fan	FN 1B	"		
Support	DSA-851	"	BZ-539G-83-2	Detailed Inspection
Support	DSR-852	12179-EB-39D-13		

Attachment 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Support	DSR-853	12179-EB-39D-13		
Support	DSR-846	"		
Support	DSA-870	"		
Support	DSA-847	12179-EB-39D-13		
Support	DSA-848	"		
Support	DSR-849	"		
Support	DSA-865	12179-EB-39D-13		
Support	DSA-868	"		
Support	DSR-867	"		
Support	DSA-872	12179-EB-39D-13		
Support	DSA-878	"		
Support	DSA-874	"		
Damper	DMP 4A	12179-EB-39D-13		
Damper	DMP 4B	"		
Damper	DMP 15	"		
Damper	DMP 16	12179-EB-39D-13		
Support	DSA 946	"		
Support	DSA 947	"		

ATTACHMENT 2E

Control Room Emergency

Ventilation System

Item	ID No.	P&ID	DWG No.	Comments
Support	DSA 882	12179-EB-39C-13		
"	DSA 885	"		
"	DSA 879	"	BZ-539G-68-3	Detailed Inspection
Support	DSR 875	12179-EB-39C-13		
"	DSA 876	"		
"	DSA 880	"	BZ-539G-68-3	Detailed Inspection
Air Tank Pressurization Units	3HVC-TKIA thru 3HVC-TKIJ	12179-EB-39J-9 "		
Fan	FN 1A	12179-EB-39M-9		
Damper	DMP 28	"		
"	DMPB 6A	"		
"	DMP 27	12179-EB-39M-9		
Fan Damper	DMP 25	"		
Switch	FS 38A	12179-EB-39M-9		
Support	DSA 001	12179-EB-39C-13	BZ-539D-5-3	Detailed Inspection
Support	DSR 002	"	"	" "
Support	DSA 003	12179-EB-39C-13	BZ-539D-5-3	Detailed Inspection
Support	DSR 010	"	BZ-539D-7-5	" "
Support	DSA 011	12179-EB-39C-13	BZ-539D-8-2	Detailed Inspection
Air Storage Tank Mounting Frames			4MP1679 4X14773 R-3	Vendor Drawing/- Detail Inspection
Filter Train "A"		12179-EM-151A-3		
Filter Train "B"		12179-EM-151A-3		
Valve	V682	12179-EB-39J-9		Detailed Inspection
"	V683	"		"
Valve	V689	12179-EB-39J-9		Detailed Inspection
"	V690	"		"
Air Bottle Mounting Frames		12179-EX-233A-1		Detailed Inspection

ATTACHMENT 2F

Sampling Verification of Category I Standard Steel

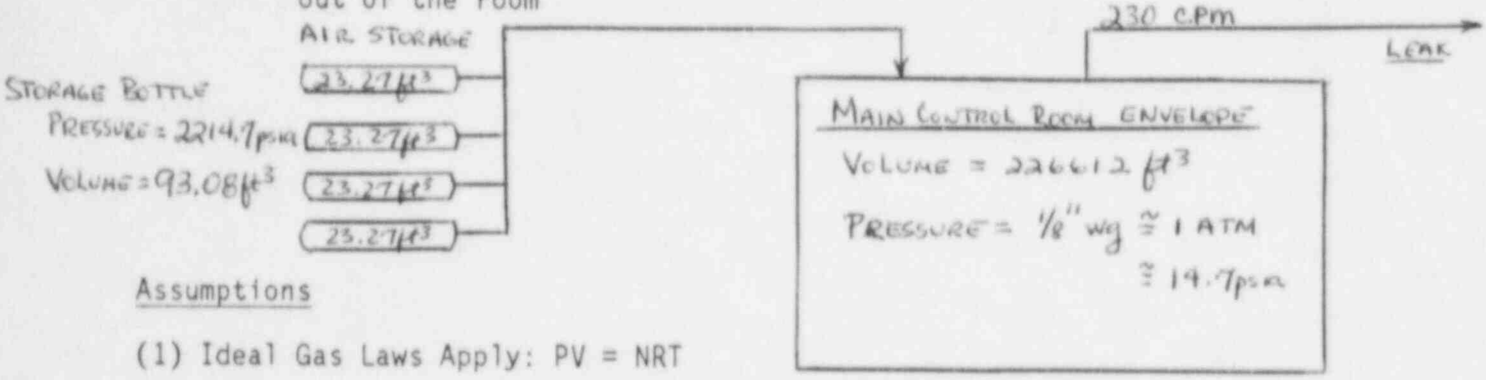
Area #	Location	Elevation	Member No.	Member Size or ID
1	ESF Bldg.	21' - 6"	T2G2øK	W24 x 131
1	" "	21' - 6"	T4G3øH	W24 x 131
2	ESF Bldg.	24' - 6"	T7G2G1	W12 x 45
2	" "	24' - 6"	S11T7øE	W8 x 31
3	M.S.V.Bldg.	61' - 0"	T3G1øG	W12 x 30
3	" "	61' - 0"	G10GøEJ	W30 x 173
4	Control Bldg.	47' - 6"	S40AG4	W24 x 68
4	" "	47' - 6"	S20AG4	W24 x 68
5	Contnmt. Bldg. (Annulus Rack)	(-) 4' - 5"	427	Rack No. 2J
5	Contnmt. Bldg. (Annulus Rack)	(-) 1' - 5"	631	Rack No. 19

Calculation 1

Calculation for Verification of Control Room Pressurization System

Purpose: To verify that four (4) bottles of compressed air in the control room pressurization system will provide air to keep the control room pressurized for about one (1) hour.

Method: The final pressure in the control room will be calculated assuming minimum air pressure in the bottles and the design basis leakrate out of the room



Assumptions

(1) Ideal Gas Laws Apply: PV = NRT

(2) Adiabatic Expansion: RT = constant

(3) Assume final air bottle pressure = final Main Control Room (MCR) pressure

Calculations

Total Amount of Air initially in the bottles and in the MCR = Total Amount finally in bottles and MCR + Total Leakage.

$$(N\ bottles + N\ control\ room)_i = (N\ bottles + N\ control\ room)_f + N\ leak$$

$$(P\ bottles_i\ \ V\ bottles) + (Pcr_i\ Vcr) = (P\ bottles_f\ \ V\ bottles) + (Pcr_f\ Vcr) + (Pleak\ \ Vleak)$$

$$Pcr_f = \frac{(2214.7)\ (93.08) + (14.7)\ (226612) - 14.7\ (13800)}{(93.08 + 226612)}$$

= 14.7 psia

Where:
N bottles = Amount of Air in bottles
N control room = Amount of Air in MCR
N leak = Amount of Air which leaked out of MCR
P bottles = Pressure in the air bottles
V bottles = Volume of the air bottles
PCR = Pressure in the control room
VCR = Volume of the control room envelope
Pleak/Vleak = Pressure/Volume of the air leakage
i = initial
f = final

Alternately, assume the volume in the air flash must be able to makeup exactly for that air volume lost due to leakage. Therefore, assuming 2200 psig initially in the bottles and completely loss-less piping:

N flasks = N leakage

$$\frac{P_B i\ V_B}{RT} = \frac{(P\ leakage\ V\ leakage)}{RT}$$

Where: Nflasks = Amount of air in the air bottles

Nleakage = Amount of air leakage

P_B/V_B = Pressure/Volume of bottles

Pleakage/Vleakage = Pressure/Volume of leak

$(2214.7)\ (4)\ (23.27) = (14.7)\ (230\ ft^3/min.\ x\ 60\ min/hr)\ (x\ hrs)$

$$x = \frac{(2214.7)\ (4)\ (23.27)}{(14.7)\ (230)\ (60)}\ hr$$

= 1.016 hr

Licensee analysis, using more realistic assumptions which considered air losses in the piping system, indicated the available time was 54 minutes. Therefore, it is not clear that the system will satisfy design requirements.

For Five Bottles:

$$Pcr_f = \frac{(2214.7)\ (116.35) + (14.7)\ (226612) - 14.7\ (13800)}{(116.35 + 226612)}$$

$= 14.9^+$ psia ≈ .2 psig OK

Or:

$$xhr = \frac{P_B i\ V_B}{(Pleakage)\ (Vleakage)\ (60\ min/hr)}$$

$$= \frac{(2214.7)\ (5)\ (23.27)}{(14.7)\ (230)\ (60)}$$

= 1.27 hr OK

Calculation 2

Voltage at Motor Terminal of QSS and Charging Pump

<u>Querch Pump</u>

Pump Data: 4KV, 500 hp, 0.88pf (running), 93% efficient, 1775 rpm; 66 amperes full load running current; 396 amperes locked rotor current, 0.31pf (locked rotor)

Power Cable: 4/0 stranded aluminium 905 feet long
Impendance From General Electric Wire and Cable Selection and Technical Guide, Table 73 and 78

$R = 0.08361$ ohms per 1000 ft and 25°C

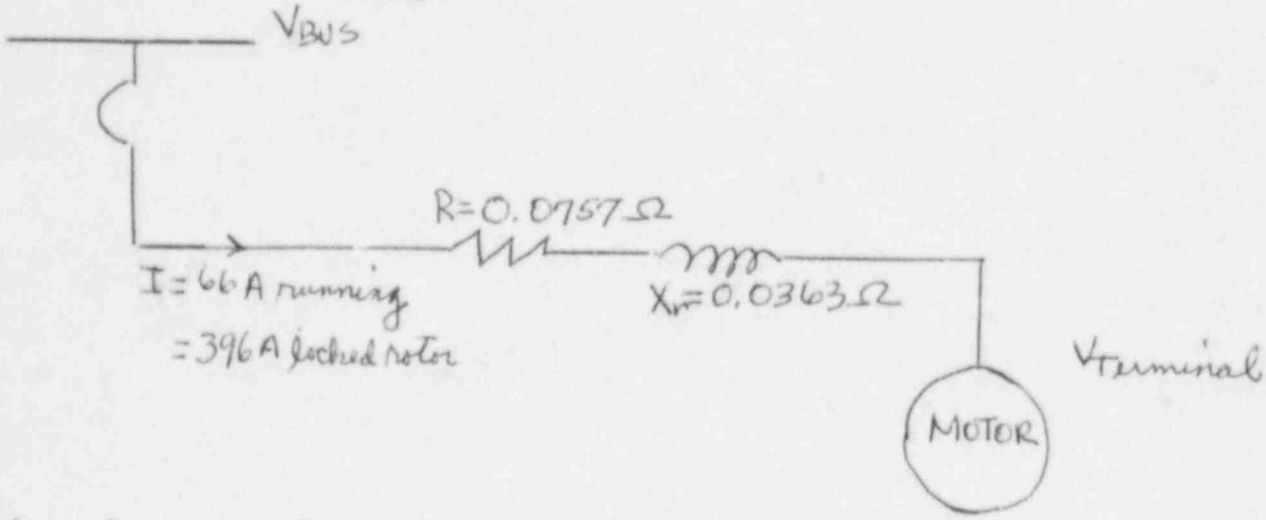
$= 0.08361 \times \frac{905}{1000}$ 0.0757 ohms

$Xr = 0.0411$ ohms per 1000 ft at 60 Hz (Worst Case)

$= 0.0411 \times \frac{905}{1000}$ 0.0363 ohms

$Z = \text{sqrt}\ (R^2 + Xr^2)$

$= 0.084$



Voltage Drops: Running $V = IZ = (66)\ (0.084) = 5.54V$ = about 6V

Locked Rotor $V = IZ = (396)\ (0.084) = 33.26V$ = about 34V

Voltage at Motor Terminals

Nominal 4160 - 6 volts drop running = 4154 running

4160 - 34 volts drop starting = 4126 starting

Degraded Grid 3900 - 6 volt drop running = 3894 running

3900 - 84 volts drop starting = 3866 starting

The voltage drops shown above do not appear excessive for motor starting or running.

Charging Pump

Pump Data: 4KV, 600 hp, 91% efficiency, 76 amperes full load running, 0.91pf; 518 amperes locked rotor current, 0.28 pf, 1774 rpm.

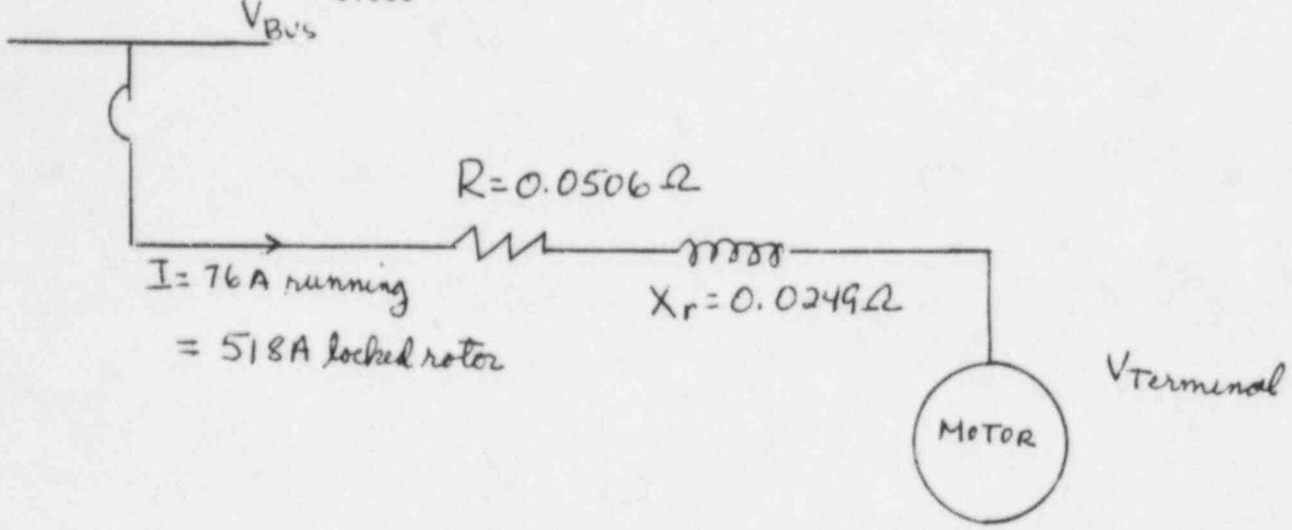
Power Cable: 4/0 Stranded Aluminium, 605 feet long

Impendance From General Electric Wire and Cable Selection and Technical Guide, Tables 73 and 78

$$R = 0.08361 \times \frac{605}{1000} = 0.0506 \text{ ohms}$$

$$Xr = 0.0411 \times \frac{605}{1000} = 0.0249 \text{ ohms}$$

$$Z = \text{sqrt}\,(R^2 + Xr^2)$$
$$= 0.056$$



Voltage Drops: Running $V = IZ = (76)\ (.056) = 5$ volts

Locked Rotor $V = IZ = (518)\ (.056) = 29$ volts

Voltage at Motor Terminals:

Nominal 4160 - 5 volts drop = 4155 volts running

4160 - 29 volts drop = 4131 volts starting

Degraded Grid 3900 - 5 volts drop = 3895 volts running

3900 - 30 volts drop = 3870 volts starting

The voltage drops shown above do not appear excessive for motor starting or running.