U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Report No. 50-255/89007(DRS)

Docket No. 50-255 License No. DPR-20

Licensee: Consumers Power Company
212 West Michigan Avenue
Jackson, MI 49201

Facility Name: Palisades Nuclear Generating Plant

Inspection At: Palisades Site, Covert, Michigan and Corporate Offices, Jackson, Michigan

Inspection Conducted: Palisades Site April 3-7 and 17-21, 1989
Corporate Offices April 6-7 and 17-20, 1989
Region III Offices April 24 to May 5, 1989

Inspectors: Rolf A. Westberg
Rolf A. Westberg, Team Leader — 6/22/89 Date

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Ronald N. Gardner, Chief
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6/27/89
Date

Inspection Summary:

Inspection on April 3 through May 5, 1989 (Report No. 50-255/89007(DRS)):

Areas Inspected: Routine announced inspection by Regional based inspectors of: actions on previously identified items (92702); design control (37700, 37702, 37051, and 37828); onsite followup of written reports of non-routine events (92700); and inservice testing of pumps and valves (73756).

Results: Of the four areas inspected, no violations or deviations were identified in two areas. Three violations were identified in the remaining areas. The first violation pertains to multiple examples of inadequate design control (Paragraphs 4.b.(2)(a) 3, (a) 4, (b) 3, (e), (f), (i), and (j); and 5.a,b,d, and e). The second violation pertains to examples of failure to verify the size of socket fillet welds (Paragraphs 4.b.(2)(a) 4 and 5.f). The third violation pertains to exceeding a Technical Specification (Paragraph 5.c).

The inspection disclosed the following weaknesses:

- Facility Change packages contain undocumented engineering judgements
- Numerous examples of inadequate design verification
- Review of ten Specification Changes and nine Facility Changes produced 19 examples of inadequate design control
- Drafting errors found during review of Facility Change Packages
- Field personnel made unauthorized design changes
- Use of "codes of convenience"

The inspection noted the following strengths:

- Design procedures are good
- Improved performance in the pump and valve area
- Electrical DBDs are good

DETAILS

1. Persons Contacted

Consumers Power Company (CPCo)

*R. D. Orosz, Engineering and Maintenance Manager
*J. G. Lewis, Technical Director
*W. E. Garrity, Engineering Manager, Energy Supply Service
*#K. E. Osborne, Projects Superintendent
*R. M. Brzezinski, I&C Superintendent
*D. VandeWalle, Configuration Control Manager
*#D. J. Malone, Licensing Analyst
*T. J. Palmisano, Systems Engineering Superintendent
*J. O. Alderink, Staff Engineer
*K. A. Toner, Engineering Supervisor
*R. E. McCald, Planning and Administrative Director
*R. M. Hamm, Staff Engineer
*R. P. Margol, QA Administrator
*G. C. Withrow, Engineering Superintendent, Big Rock Point
*J. Pomaranski, Energy Supply Services
*W. L. Lomis, Projects Superintendent
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#D. S. Riat, Project Engineer
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Nuclear Regulatory Commission (NRC)

#R. Cooper, Engineering Branch Chief, Division of Reactor Safety
*B. L. Burgess, Chief, Projects Section 2A
*R. N. Gardner, Chief, Plant Systems Section
#D. Danielson, Chief, Materials and Processes Section
*E. R. Swanson, Senior Resident Inspector
*J. K. Heller, Resident Inspector

*Denotes personnel who attended the exit interview on April 21, 1989 at the Palisades site.

#Denotes personnel who attended the working meeting and final exit interview on May 5, 1989, at Region III offices.

2. Actions on Previously Identified Items (92701, 92702)

   a. (Open) Open Item (255/88020-03): The licensee advised that the two 100A breakers of concern serving a #2AWG cable circuit (21 Amp load) are to be replaced during the next outage anticipated to be May 1989. The work orders have been issued. Pending verification of the completed work, this item remains open.

b. <u>(Open) Open Item (255/88020-05)</u>: This issue concerned high pressure air compressor motor currents. The licensee advised that the recurring compressor motor overcurrent problem has been resolved by installing a smaller diameter drive pulley, thus reducing the load on the motor and consequently motor current. The motor is now reported to run within its service factor but for a longer period of time for each compressor cycle. The inspector noted that while the foregoing solves the motor overcurrent problem, it is not evident from the documentation provided that the longer running time is compatible with the maximum demand on the compressed air system. Pending verification of the above concern, this item will remain open.

3. <u>Configuration Control Project</u>

a. <u>Scope</u>

This portion of the team inspection focused on the progress of the Configuration Control Project (CCP). The Palisades Plant CCP is a multi-disciplinary project which is intended to produce a set of design documents that accurately reflects the plant's current configuration. The design documents will be used to ensure that all future modifications utilize up-to-date design information.

The project is broken into five distinct phases of work. These phases are:

(1) Engineering and Vendor Drawing Verification
(2) Design Basis Reconstitution for Selected Systems
(3) System Functional Testing
(4) Safety System Design Confirmation
(5) Q-list Data Base Update and Validation

At this point in the project, only the drawing verification and design basis reconstitution tasks have been initiated. The inspector looked at only the design basis reconstitution task.

b. <u>Summary</u>

Consumer Power's approach to design basis reconstitution consists of consolidating supporting information for licensing bases in a single document. The resulting Design Basis Document (DBD) contains references to lengthy calculations and analyses, such as seismic considerations, rather than reproducing detailed calculations. This document is intended to provide a single source of reference to identify critical design parameters and locate supporting information. This document will be maintained "as-configured."

Draft DBDs have been issued for the Component Cooling Water (CCW), 2400 Vac, and 480 Vac systems. Draft DBDs have also been issued for four non safety-related electrical systems. DBDs for High Pressure Safety Injection (HPSI), Low Pressure Safety Injection (LPSI), and Service Water (SW) are currently under development. The HPSI and LPSI DBDs are being prepared by a contractor, while Consumers Power is drafting the SW DBD.

c. Strengths

The electrical system DBDs are well-organized and provide useful information in a concise format utilizing tables and appendices to separate data into usable blocks. A technical review of closed out discrepancy reports showed that conflicting or missing data is being investigated to an adequate technical level on a timely basis. In fact, several deviation reports have resulted from design deficiencies identified during the reconstitution.

A detailed review of component information given in the CCW DBD showed that the information accurately reflected design information (with a few exceptions), and that original supporting design basis documents were easily retrieved. Data which did not correspond to original documents are identified in Section 3.f of this report.

d. Weaknesses

The CCW DBD is the only mechanical system for which a DBD has been completed. The inspector reviewed a draft of the CCW DBD which had not been signed off for technical review. The document contains a great deal of information on the CCW system, but was very poorly organized and difficult to use.

One of the sub-tasks under the DBD reconstitution is the development of thermal-hydraulic (T/H) models. A CPCo developed code, FLOWNET, was selected to model the systems. Models have been developed for the SW, CCW, HPSI, and LPSI systems. The HPSI and LPSI models are currently being benchmarked. Of concern is the fact that the T/H models are being developed prior to finalization of the DBD, and may not reflect the final DBD. Since the CCW DBD contains many discrepancies which have not been resolved, the inspector was unable to assess the accuracy of the CCW model. In addition, the CCW FLOWNET model is not finalized, since sufficient data was not available for complete benchmarking. The DBD did not indicate the correct status of this model.

e. Conclusions

The inspector was very satisfied with the level of effort Consumers Power is putting into this phase of the project. Design documents are being researched to an appropriate level of detail, and discrepancy reports are routinely created. However, the content and format of the Design Basis Documents varied greatly between electrical and mechanical systems. The inspector identified several strengths of the safety-related electrical DBD which could be applied to the mechanical DBDs to make them more usable and less confusing.

At this point in the CCP, there is insufficient material to assess the adequacy of efforts to reconstitute missing design basis information for mechanical systems. Further evaluation of the Configuration Control Project at Palisades is recommended in a later phase of the design basis reconstitution task. Use of results from the Safety System Design Confirmation task, which has not been initiated, should also be evaluated.

f. Detailed Findings

(1) Strengths of the electrical DBDs which could be applied to the mechanical DBDs are identified as follows:

- Electrical standards are clearly identified in a separate table in the inputs for future electrical modifications. Mechanical CCW design standards are buried in the text and are not easily identified.

- Mechanical system descriptions and operating information are very brief and contain lengthy verbiage, which could be summarized in tables.

- Electrical DBDs describe the present system description through tabular data. History and logic information is located in an appendix. Mechanical CCW DBD contains system and component histories which obscure the present design basis.

- Equipment data given in the appendices of electrical DBDs identifies and supports applicable Technical Specification (TS) and FSAR information. The CCW system flow rates given for some components do not match FSAR values. Discrepancy reports were not issued for these items.

- Interfacing equipment is located in a single section of the electrical system DBDs. The CCW system contains supporting systems in three different sections of the document in varying degrees of detail.

- Electrical information is easily located through the Table of Contents. References to other sections of the document within the text are minimal. The CCW DBD contains numerous references to other sections of the document which could be eliminated if better organized.

- In electrical system DBDs, all text is factual and concise, or contains short references to a discrepancy report. The CCW DBD uses terms such as "apparently", "appears to", or "in the author's opinion" in reference to design points, which are vague and misleading.

- For electrical DBDs, discrepancies between information given in design documents and missing design basis information is being aggressively pursued. Numerous items have been closed out. When missing information cannot be located, the appropriate design basis information for current use is given to resolve the report. The number of discrepancy reports generated by the CCW DBD reconstitution greatly exceeds the number generated by the electrical system DBD, and the resolution process has just started.

- Both electrical and mechanical DBDs should contain discrepancy report numbers in the discrepancy list to facilitate tracking.

(2) Discrepancies found between information given in the Component Cooling Water DBD and original design documents include the following:

- The long-term shutdown heat load is given as 46.39 MBTU/hr on page 38 of the DBD. The correct value is 46.13, as given in Engineering Analysis PAL-86-083K-01. The correct value appears in Table 3-1, page 10 of the DBD.

- Values given in Table 3-1 do not agree with values in the FSAR. For example, the Primary Cooling Pump Shutdown Cooling Flow is given as 360 gpm in the DBD, but is 180 gpm in the FSAR. The document gives some basis for the change, but a discrepancy report was not issued. Shutdown cooling flow for the charging pumps is 22 gpm in the FSAR, but 32 gpm was used in the DBD. Some basis is given in the text on page 48, but is deemed inadequate. Finally, accident flow upon SIS for the Reactor Shield Cooling HX is listed as 126 gpm and 0.20 MBTU/hr while the FSAR does not require flow during shutdown. No basis is given for the change.

- No basis is given for the change in Primary Coolant Pump flow requirement from 50 gpm to 90 gpm on page 46 of the DBD.

4. <u>Verification of Design (37700, 37702, 37051, and 37828)</u>

a. <u>Inspection Scope</u>

This five-week special team inspection of the design control program reviewed the following areas: verification of design assumptions, verification of design input and documentation, review of design calculations and methodology; compliance with codes and standards; and validity of associated 10 CFR 50.59 reviews.

In addition to document reviews and interviews, limited walkdowns and verification of as-built conditions were accomplished.

The engineering areas reviewed during this inspection were mechanical, electrical, civil/structural, instrument/control, welding, thermal/hydraulic, and computer codes.

b. <u>Detailed Inspection Findings</u>

(1) <u>General</u>

The licensee's modification program for the Palisades plant is described by Procedures No. NODS-P08, "Control of Modifications," No. 9.02, "Facility Change-Major", No. 9.03, "Facility Change-Minor," and No. 9.04, "Specification Change." The inspector reviewed these documents and found them acceptable.

In order to assess the acceptability of design changes at the Palisades plant, nine facility changes and ten specification changes completed from October 1987 to the present were selected at random for review.

(2) Review of Facility Change (FC) Packages

(a) FC-789: Installation of New Bypass Low Flow Rate CVs in Parallel with Existing Auxiliary Feedwater Flow Control Valves

This modification added two 1 1/2 inch bypass control valves around the existing 4 inch control valves on the P-8C auxiliary feedwater pump. The modification was required to provide better flow control characteristics during low flow conditions. The inspector reviewed the following documentation associated with this change with regard to NRC requirements and licensee commitments:

1 EA-FC-789-02, "Seismic Qualification Requirements for FIC-0736A and FIC-0737A Replacement," Revision 2, September 1, 1988.

No deficiencies or concerns were noted.

2 EA-FC-789-04, "EI 0736 and EI 0737 Converter Support, Component Cooling Room X8400 and X8401 Conduit Supports, West Safeguards Room," Revision 0, August 2, 1988.

The following deficiencies or concerns were noted:

- For conduit support details 9, 10, 11, 12, 13, and 14, the calculations stopped at the attachment weld to the embedded steel. There was no discussion regarding the adequacy of the embedded steel due to the additional loads from the supports. During subsequent discussions, the analyst stated that since the loads were relatively small and the embedded steel had such a large capacity, no evaluation was required. The inspector concurred with this conclusion; however, this is considered as an example of a weakness, in that it is an undocumented engineering judgement.

- Engineering Design Change (EDC) No. 789-1 eliminated conduit support detail 13 and revised the locations of conduit support details 9, 10, 11, 12, and 14. Although this change affected calculation EA-FC-789-04, the calculation was never revised to indicate that a design change had been made. During discussions with the licensee, it was indicated that the signature of the technical reviewer for the EDC was verification that the change would not invalidate the original calculation. However, the calculation now consisted of the original analysis with an indeterminate number of EDCs that had to be included with it. Since the EDC form does not list calculations as potentially affected design documents, it was uncertain whether the technical reviewer had considered the effects on the original analysis. In any case, there was no basis given with the EDC to justify why it would not affect the original analysis. On this basis, it is considered as another example of a weakness, in that it is an undocumented engineering judgement.

3 EA-FC-789-07, "Seismic Analysis of Auxiliary Feedwater Control ESSR 88714," Revision 1, August 24, 1988.

The following discrepancies were noted in the finite element piping analysis model:

- The location of new support H224 was analyzed at 6" from the 45° elbow. The piping drawing (M101 Sheet 5113) used to install the support specified a dimension of 1'-7 1/2" from the elbow. This difference was not noted in the calculation.

- The length of pipe between model nodes 6276 and 6282 was analyzed as 5'-10" long. The installation drawing specifies 5'-6" long. This difference was not noted in the calculation.

- The length of pipe between model nodes 6288 and 6290 was analyzed as 1'-11" long. The installation drawing specifies 2'-2" long. This difference was not noted in the calculation.

- Several additional dimensional discrepancies on the new bypass piping were also noted between the analysis and installation drawing. These discrepancies ranged from 1" to 2 1/4" and were considered minor by the inspector. However, none of these discrepancies were noted in the calculation.

The above discrepancies are considered examples of a violation of 10 CFR 50, Appendix B, Criterion III in that the licensee failed to correctly translate the design into the drawing (255/89007-01a).

- For the south bypass loop, the Young's Modulus was specified as 27.4 E6 psi instead of 27.9 E6 psi. This is equivalent to analyzing this portion of pipe with properties at 300° instead of 70°. This discrepancy was not noted in the analysis.

- The location of the center of gravity (CG) for the new bypass valves was analyzed at 19" from the pipe centerline. The location specified on the vendor drawing was 22". This represents a 15% increase in the moment arm which was not noted in the calculation.

In addition to the above noted discrepancies for modelling the bypass piping, other discrepancies were noted in the model of the original auxiliary feedwater piping. The inspector could not determine whether these discrepancies were inherent in the original data or whether they occurred during the transcription of the original model into the current piping analysis. However, notes in the piping model stated the following:

- "Bechtel analysis is a bit off from ISO here"
- "Bechtel has modeled elbows only with SIFs. Elbows are used here"
- "Review ISO for pipe schedule change"

These notes led the inspector to question the validity of the assumption made in the calculation concerning the correctness of the original input data.

The additional discrepancies in the model of the auxiliary feedwater piping were as follows:

- For flow element FE-0736, the weight of 192 lbs was modeled at node 211 instead of node 205. Although this was only a 4 1/2" error on a 6" pipe, the flange pair was analytically modeled with the weight concentrated at one edge instead of at the middle of the flanges.
- For Valve MO-0754, the 460 lb weight was modeled at the centerline of the pipe at node 267. The weight should have been specified at the valve CG at node 268, 18" out from the pipe centerline.
- The horizontal response spectra used in the analysis was inconsistent with the spectra given in Specification C-175. The spectra used was lower and not as broad as those given in the Specification.
- Piping between the nodes 252 and 253 was modeled as 4", schedule 40, instead of 6", schedule 80.

The above discrepancies are further examples of violation of 10 CFR 50, Appendix B, Criterion III in that the licensee failed to correctly translate the design into the drawing (255/89007-01b).

The licensee committed to rerun the piping analysis in order to reconcile differences. At the same time, accurate as-built dimensions were obtained from the field for inclusion in this reanalysis effort. Based on the revised analysis, the licensee concluded that the installation was within the FSAR stress allowables and was acceptable.

The inspector concurred with the licensee's conclusions, but had the following comments pertaining to this revised analysis.

First, in the revised analysis, the stress intensification factors (SIFs) were specified as 1.0 for socket welded fittings. Based on FSAR statements, the original Code of construction was modified to incorporate the 0.75-times-the-SIF factor, which is consistent with later editions of the Code. By applying this to the 1.3 SIF for socket welds, the resulting SIF will be 1.0. However, by specifying the SIF at 1.0 in the analysis instead of 1.3, the licensee erroneously reduced the SIF for secondary as well as primary stresses. This is inconsistent with their FSAR requirements and therefore the thermal stresses given in the reanalysis are in error by 30%. This error will not result in an overstressed situation, but is still an error.

Second, even though the FSAR specifies the inclusion of the 0.75-times-the-SIF factor, the licensee selectively chose to ignore the fact that the later piping codes also increased the socket welded fitting SIF from 1.3 to 2.1. Use of "codes of convenience" is a programmatic weakness and a poor judgement relative to fundamental engineering principles.

Third, even though the analytical model had been revised and rechecked, the pipe schedule flange weight and Young's Modulus deficiencies previously noted were still not detected by the licensee. In addition, Support H225 was analyzed at a location of 9" instead of 6.69" from the elbow as shown on the as-built drawing. Although these errors are minor in nature and are not considered safety significant, they are indicative of weaknesses in the licensee's design verification process.

As an additional comment, the inspector noted that the computer generated isometric plot of the system, as required by Specification M-195, was of very poor quality. Nodal point designations and pipe routing lines were interposed to the extent that the plot was extremely confusing and of very little value.

4 Consumers Power Company Drawing M101 sheet 5113, Revision 0, "Piping Isometric, Auxiliary Feedwater Control Valve CV-0736A and CV-0737A Bypass Piping."

The following deficiencies were noted:

- The size of the fillet weld was determined by the requirements of welding specification WPS-11.21, Revision 2; however, for the socket welded fittings, the size of the fillet weld was not specified on this drawing.

- In reviewing the Repair Inspection Checklist (RIC) for the welds in question, the weld size specified is 1 1/2". This is misleading in that this is the size of the pipe and not the size of the fillet weld. In order for the welder to determine size of the fillet weld, the pipe wall thickness must be obtained and a calculation of 1.09 times the wall thickness must be performed. Although this is a relatively simple calculation, it is a design function and as such must be controlled. Currently, there is no documentation to demonstrate that this design activity was performed properly. In addition, there are no controls in place to check and verify this design activity.

  Failure to provide design control measures to correctly translate the fillet weld design size into the drawing is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01c).

- A secondary aspect, associated with the socket welds, pertains to the quality control (QC) inspection of the completed fillet welds. The RIC forms have a column for "QC Verification" but for the socket welds in question, the size of the fillet welds was not inspected by QC. Line No. 16 of the RIC form, which specifies the weld, size, gap, and type of joint was marked "NA" (not applicable) for all the welds in question under the QC Verification column.

- Although all of the welds received a Nondestructive Testing (NDT) Visual Examination (VT), it is not clear if the size of the weld was verified during these examinations. Since the size of the socket fillet welds was not specified on the drawing, nor noted on the RIC form, the NDT examiner would have had to determine the required size in the same manner as previously described for the welder. No notation of size nor record of the size calculation was available in the documentation provided with the NDT-VT data. In addition, the VT report did not list fillet weld gauges under "Visual Aids Used" giving further indication that the size of the welds was not checked.

As a point of clarification, it should be noted that the VT performed on the socket fillet welds was in accordance with American Welding Society (AWS) D1.1 requirements. This is a structural welding code and allows portions of fillet welds to be undersized by 1/16". This is inconsistent with the requirement of ANSI B31.1, Power Piping Code which specifies minimum fillet weld sizes. If the size of the socket fillet welds was verified by the stated VT examination, it cannot be assured that the weld meets the ANSI B31.1 Code requirements.

Failure to verify conformance of the size of the socket fillet weld with the documented welding procedure is a violation of 10 CFR 50, Appendix B, Criterion X (255/89007-02a).

- An additional aspect was associated with the size of socket fillet welds. The inspector noted that the current design practice used by the licensee is inconsistent with the original Code of construction. The current practice utilizes later editions of B31.1 Code which specify the 1.09 times the nominal piping wall thickness. The original Code of construction required 1.25 times the nominal wall thickness. From a technical standpoint the current practice is acceptable; however, this inconsistency has not been delineated by the licensee in the FSAR. Pending revision of the FSAR, this item is considered open (255/89007-04).

- A further concern associated with the piping installation drawing pertains to the attachment weld for a bypass piping fitting onto the existing run pipe. For this situation, the drawing did not specify the type of joint nor the weld reinforcement required. However, the specified fitting is a "Weldolet" and as such has an existing weld prep on it and requires no additional design work. Also, the size of the fillet weld cover is specified in the welding procedure for this type of full penetration branch line connection. The problem arose during the review of the RIC forms for the four branch connection welds. Although these are full penetration single bevel groove welds, with fillet weld reinforcement, the RIC form labels these welds as "F.W." indicating a fillet weld. For Gap Thickness, the RIC form specifies "NA" which would be appropriate for a fillet weld but not for a full penetration weld. Since this attachment must be a full penetration weld, there was no documentation available to assure that the proper penetration had been achieved using the specified fillet weld. Additional review by the inspector of the NDT Examination Reports revealed another deficiency. According to liquid penetrant (PT) examination report sheet No. MKV-01, welds No. 2 and No. 13 on line EBC-3-1 1/2 did not receive a PT examination as required by Technical Specification M-152(Q) "Field Fabrication and Installation of ASME Section XI Piping Modification in a Nuclear Power Plant," Revision 14, September 30, 1986, Paragraph 9.1.1. Pending verification that all four branch attachment welds are full penetration welds and resolution of the PT deficiencies, this is considered an Unresolved Item (255/89007-05).

5 Consumers Power Company Drawing M-207, Sheet 7, "Piping and Instrumentation Diagram Auxiliary Feedwater System," Revision 10, December 19, 1988.

This drawing was revised to incorporate the changes in the piping and alarms for FC-789. The inspector's review of the drawing disclosed that the pipe size for both bypass lines was erroneously indicated as 1/2 inch piping. The pipe size should have been 1 1/2 inch. The pipe was verified to be 1 1/2 inch; therefore, no safety significance was attributed to this occurrence.

None of the discrepancies noted above were safety significant or impacted equipment operability.

(b) FC-722: Backup Nitrogen Supply to ESS and SWS Valve Operator Air Supply

This modification added five separate nitrogen supply stations in order to provide a backup supply to 11 air operated control valves. In the event of a total loss or deterioration of the normal air supply, the backup nitrogen supply will provide the necessary flow and pressure to operate the valves for the required period of time. The inspector reviewed the following documentation associated with this change with regard to NRC requirements and licensee commitments:

1 EA-FC 722-02, "Sizing of N_2 Distribution Lines and Cylinders," December 15, 1986.

No adverse comments were noted during the inspection.

2 EA-FC 722-03, "Support Details for Cylinder Mounting."

Sheet 18 of calculation EA-FC 722-03 contained a sketch showing a typical mounting bracket for restraining the nitrogen cylinder against the walls. View A-A showed a 5/8 inch diameter threaded rod attached to an angle iron with a 1/4 inch fillet weld. This weld is impossible to make. Field inspection by the inspector found that the installed weld was a flair bevel with a fillet weld cover. While this is more conservative, in that additional weld metal was added, this is considered a weakness since the engineer specified an inappropriate weld. In addition, the field did not reject the erroneous design information and instead implemented their own interpretation of the information. Although a conservative and appropriate interpretation was made, the practice of field personnel making unauthorized design changes is not a good practice and is considered a weakness.

3 EA-FC-722-10, "N_2 Backup Test Evaluation for Station 5," February 27, 1987.

The calculation stated that the nitrogen usage rate was 32.5 psig ΔP/hour based on the test results from functional test T-FC 722-501-01. However, the test results failed to account for the post test calibration shift of 5 psig for one of the pressure gauges. By incorporating this additional factor, the usage rate is increased to 33.75 psig ΔP/hr.

Using the above rate in the calculation reduces the "Actual Operating Period" from 10.3 days to 9.93 days. This is below the assumed acceptance limit given in the original calculation. No safety significance was attributed to this occurrence; however, the instrument accuracy requirements specified in the test procedure were inadequate as noted below.

- Procedure No. T-FC 722-501, "CV Air Supply - N_2 Backup Performance Test," Revision 0, February 6, 1987.

  Under Special Tools/Equipment, a 0-3000 psig pressure gauge is called for. The accuracy specified is ±2% minimum. This equates to a ±60 psig accuracy. The acceptance criteria for three of the four nitrogen stations ranged from 24 psig to 68 psig over the four hour span of the performance test.

  Failure to delineate appropriate acceptance criteria is a further example of violation of 10 CFR 50, Appendix B, Criterion III Design Control (255/89007-01q).

Additional reviews by the inspector disclosed that the pressure gauges actually used had a specified accuracy of ±1%. In addition, pretest and post test calibration data indicated that the actual accuracy was closer to ±0.1%. Based on this information, the performance test results were considered adequate by the inspector.

- EA-T-FC722-501-01, "Calculation of Acceptance Criteria for Modification Test Procedure T-FC-722-501," January 13, 1987.

  On page 2 of the calculation, it states that the total volume of gas contained in the nitrogen bottles at 2000 psig is 209 scf. This value is incorrect in that it is the usable cylinder volume as given in Calculation EA-FC 722-02. The actual volume is approximately 228 scf. By using the incorrect value, the calculated acceptance criteria for pressure drops were higher and, therefore, were non conservative.

  Failure to provide design control measures to correctly translate the usable cylinder volume from the calculation to the test procedure is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01d).

  Evaluation of the above error by the inspector indicated that the effect would be a reduction in acceptable delta P by several psig. A review of the test results found that except for cylinder station 5 this would not cause any significant problem. For station 5, the acceptable nitrogen usage was exceeded during the test. The test results were reviewed by the inspector during the review of Calculation EA-FC 722-10. This review, which was discussed previously in this report, concluded that the error in the calculation had no safety significance.

4 Consumers Power Drawing M-208, Sheet 1B, "Piping and Instrument Diagram Service Water System," Revision 9.

  This drawing had been previously revised to incorporate the changes made by FC-722. For line 1/2"-JDD-16 the Backup Nitrogen Station was given as "1A." This is incorrect and should instead be given as "3B." Although no safety significance was attributed to this drafting error, a potential exists for making an incorrect decision concerning the nitrogen backup system.

None of the above noted discrepancies were safety significant or impacted equipment operability.

(c) FC-789: Auxiliary Feedwater Flow Control Modifications (Structural)

Prior to the modification, the auxiliary feedwater flow control valves were not capable of controlling flow at a rate low enough to allow continuous auxiliary feedwater flow to the steam generators during startup and hot shutdown conditions.

This modification installed 1 1/2" bypass control valves around the existing 4" auxiliary feedwater flow control valves located in the west safeguards room. The new valves are capable of controlling low flow rates to both steam generators from motor driven auxiliary feedwater pump P-8c. The inspector reviewed the modification package and the documentation related to the modification including Engineering Analysis FC-789-08, Revision 3, dated October 10, 1988, and design drawings C-271, Revision 1 and C-274, Revision 5. The inspector identified the following concerns:

- Support Nos. EB-10-H224 and EB-10-H225 were attached to the existing whip restraints. The inspector noted that the design sketch specified a 3/16" fillet weld between the steel column and the baseplate. The baseplate was identified as one inch thick based on sheet 13 and sheet 19 of engineering analysis FC-789-08. In accordance with American Institute of Steel Construction (AISC), Code as implemented by the licensee, the minimum size of fillet weld for the one inch baseplate shall be 5/16". Since the 3/16" fillet welds were field measured, such welds therefore did not meet the AISC Code requirements. Further, drawing No. C-274, Revision 5, dated January 20, 1983, was reviewed. It was found that as many as 16 of these Type III whip restraints were installed.

- For Type III restraints the size of the structural members was not specified other than in Item 4 of the drawing notes, which specified all wide flange shapes as W 6 x 20, unless noted. However, the field measurements revealed that W 8 structural steel shapes were installed. There was no documentation to demonstrate that the specified size could be replaced with a different size.

- For Type III, V and XV restraints the sizes of the baseplates, welds, and the anchor bolts were not specified other than a note in the Type I restraint drawing details. This note stated "typical connection to concrete unless noted." The Type I restraint detail provided sizes for the welds, baseplates and the anchor bolts. The weld size between the structural members and the baseplates was 5/16" fillet. The size for the baseplates was 13" x 1" x 1'-1". However, the baseplates from the field measurement for the Type III restraints were 10" x 1" x 1'-2", and the fillet weld from the field measurement was 3/16". There was no documentation to show that the existing baseplates and the existing fillet welds satisfied the intent of the original design.

The preceding items were discussed in detail during the May 5, 1989 working meeting and resolved. The inspector had no further concerns.

(d) FC-731: Reg. Guide 1.97 Transmitters (I&C)

These transmitters are used to provide indication of plant variables that are required by the control room operating personnel during an accident situation. The inspector reviewed the pressurizer level instrument calculation (EA-FC-731-01) and the loop power supply calculation (7906-E/I-008). The calculations were acceptable.

(e) FC-756: HPSI Pump Miniflow Bypass Modification

This modification provided greater flow capability for the High Pressure Safety Injection (HPSI) pump performance tests. The minimum flow recirculation piping from the discharge of both HPSI pumps has been modified by the addition of a manual bypass around the existing restriction orifices. The inspector reviewed documentation associated with this modification including piping stress analyses and the support evaluations for the affected systems. The inspector identified the following concerns:

- Bechtel's stress isometric drawing 03378, sheet 4 of 5, Revision 1, and drawing SP-FSK-M193, Revision 4, showed a dimension of 29 7/8 inches between pump 66A and the elbow. The as-built dimension is 13 1/2 inches. Both (ADLPIPE, Inc.) ADL's and Bechtel's stress analyses used 29 7/8 inches. This dimensional discrepancy was not documented during the NRC IEB 79-14 program, nor was it corrected in Bechtel's and ADL's stress analyses. Further, this discrepancy is in conflict with the assumptions contained in analysis No. CS-ESSR 87-144 that purportedly demonstrated that the Bechtel drawings are correct. The inspector also noted that the input data used in the modification portion of the piping system was inconsistent with as-built drawing No. 03378, sheet 4 of 5, Revision 2, as noted below:

Node Point	Input in ADL Stress Analysis	As-Built Drawing Dimension
3100-3580	9.24"	14"
3050-3520	11.64"	14"
3110-3050	23.04"	21"
3515-3590	20.64"	21"

The licensee reviewer was not aware of the above dimensional discrepancies. Failure to correctly translate the design into the drawings is considered a further example of violation of 10 CFR 50, Criterion III (255/89007-01e).

- The as-built sketch for the modification near pump 66A was sent from the site to the engineering office for review. The inspector noted that this sketch contained a dimensional error. The 2'-6 1/2" dimension was incorrectly marked on the sketch. This dimension was off by nine inches.

  Failure to correctly translate the design into the drawing is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01f).

- Pipe support drawings DC1-H198.1 and DC1-H196.2 contained in support calculation No. 03378 were reviewed. The inspector found that one drawing showed fillet welds at the structural joints but no weld sizes were specified. The other drawing showed a 3/16 inch fillet weld with a note "assumed." As a result, the design bases of the welds were not adequately translated into the drawings.

  Failure to correctly translate the design into the drawing is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01g).

None of the above noted discrepancies were safety significant or impacted equipment operability.

(f) FC-731: Regulatory Guide 1.97 Transmitter Replacement (Structural)

This facility change was generated to upgrade the HPSI and LPSI flow indication instrument loops to meet the Category 2 requirements of Regulatory Guide 1.97. The safety-related instruments were installed on instrument racks which were attached to the containment wall through fillet welds and bent plates. The inspector reviewed documentation associated with this FC package including a final design calculation filed with the package which was identified as calculation No. 7906-CS-03, Revision 9, dated December 9, 1987.

The objective of the calculation was to evaluate the structural adequacy of the instruments mounted to the instrument racks and the attachment of the instrument racks to the containment wall. The inspector identified the following discrepancies in the calculation:

- The analysis criteria shown on page 3 require the CG of the instruments/equipment to be considered in the seismic stress calculations. A review of the rack support bent plate on page 27 found that the CG of the instruments was not considered in the seismic stress calculations. As a result, the forces and moments at the rack support attachment were inadequately calculated.

Failure to adequately check and verify that the analysis was performed correctly is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01h).

- The calculated bending stress "fbx" shown on page 27 was in error. The 5,645 psi should be 5,976 psi. The checker did not identify this calculational error.

  Failure to adequately verify and check this calculation is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01i).

- The torsional moment "Mz" was not included in the stress calculation, even though the moment was obvious because of eccentricity of the load acting on the supporting bent plate. Further, there was no documentation to show that the existing 3/16" fillet welds used to attach the instrument racks to the containment wall were evaluated in accordance with the forces and moments derived from the supporting bent plate stress calculations. Consequently, there was no assurance that the connections between the instrument racks and the containment wall were able to withstand the seismic loads. These items were discussed in detail during the May 5, 1989 working meeting and resolved. The inspector had no further questions.

- The new loads on the rack after modification were greater than the existing loads prior to modification. However, the existing loads were still used in the rack support seismic stress calculations. No justifications were noted in the calculations. This is an example of an undocumented engineering judgement and is considered an example of a program weakness.

None of the above noted discrepancies were safety significant or impacted equipment operability.

(g) FC 732: Containment Hydrogen Monitors-Containment Isolation Valve Logic

The licensee determined that the containment hydrogen monitor isolation valve logic was not single failure proof. FSAR Section 6.7, "Containment Isolation System," requires that control circuits which actuate automatic isolation valves arranged in a series configuration are to be completely separate, ensuring that no single failure will compromise the integrity of the containment isolation system. The licensee modified the logic to provide containment isolation on either a left or right channel containment isolation signal.

The inspector reviewed the modification wiring changes, post modification testing, and surveillance testing. The following drawings were reviewed:

- 950SB9*M201, SH. 42, Sub Panels for Vertical Section C13L (C13-4), Revision 40
- 950SB9*M201, SH. 43, Sub Panel for Vertical Section C13R (C13-5), Revision 43
- 950SB9*M201, SH. 88, C11A Control Panel Section R1 Subpanels J & K Detail Wiring, Revision 10
- 950SB9*M201, SH. 96, C11A Control Panel Section R5 Subpanels A & B Detail Wiring, Revision 11
- E-916, SH. 1, Schematic Diagram Containment Hydrogen Isolation Valves, Revision 7
- E-916, SH. 2, Schematic Diagram Containment Hydrogen Isolation Valves, Revision 7

The inspector identified two drawing errors. Schematic diagram E-916, SH. 2, had the two left channel logic relay's identification switched (SP-7 and SR-7) and relay 5R-6 contacts (11/12) should be (5/6). Schematic diagram E-916, SH. 1, should be changed to include the voltage dropping resistors to the valve position lights. The field wiring was installed correctly as per the wiring diagrams. The drawing errors did not impact testing or operability. The licensee corrected the drawings prior to the end of the inspection. The inspector reviewed the corrections and found them to be acceptable.

The inspector also reviewed the post modification and surveillance tests. The tests were technically accurate and provided sufficient test overlap to ensure the complete system was tested.

(h) FC-567: Core Cooling Instrumentation (I&C)

The Inadequate Core Cooling Instrumentation (ICCI) was added to comply with NUREG-0737, Item II.F.2. The inspector reviewed those portions of the modification that involved the subcooled margin monitor and the Reactor Vessel Level Monitoring System (RVLMS). The engineering, installation, and testing of the above equipment appeared to be acceptable.

(i) FC-567: Core Cooling Instrumentation Modification (Electrical)

NUREG-0737 and USNRC Generic Letter No. 82-28 require the installation of an instrumentation system for the detection of inadequate cooling of the reactor core. In order to comply with this requirement, the licensee upgraded the existing subcooled margin monitor pressure transmitters, upgraded core-exit thermocouple signals and installed a reactor vessel level monitoring system. The addition of the latter has resulted in the increase of 600 VA electrical load on each of preferred AC (120V, Class 1E) busses Y10 and Y20. This increased loading on these two busses also increased the loading on the associated DC to AC inverters, bypass regulator and DC systems. The preferred AC system, including the inverters, and the DC system are considered safety-related or Class 1E.

The inspector observed that the licensee performed calculations to analyze the impact of the increased loading on the preferred AC bus supply breakers, cabling to the preferred busses from their respective inverters and on the DC batteries; however, no calculations or analyses were evident which addressed the impact on the inverters, bypass regulator or the DC system battery chargers. This resulted in a concern for the capability and capacity of these Class 1E systems to perform their safety-related functions.

The inspector concluded that the licensee had failed to employ adequate design controls during the design stage of the facility change in that the full impact of the increased loading was not analyzed. In response to the inspector's concern, the licensee verified the present loading on the respective inverters and battery chargers which includes the increase resulting from the instrumentation additions. The two battery charger output currents were reported to be 93 amps and 100 amps. The chargers have a nameplate rating of 200 amps. The inverter output currents were reported as 22 amps and 34 amps.

These current readings are equivalent to 2640 VA and 4080 VA at 120 volts output. Emergency loading anticipated for busses Y10 and Y20 as stated on Page 3 of Design Basis Document, "Instr. AC Sys-DBD, Rev. C-1," dated December 17, 1988, is 850 VA and 1289 VA. The inverters are each rated at 6kVA output. The bypass regulator is rated at 5kVA, but will be shed during a Design Basis Event (DBE) and will not be subjected to the emergency load. Thus, the licensee feels that the devices are not overloaded and will perform their intended functions.

The inspector concurs that based on the licensee's reported inverter and battery charger outputs, plus the anticipated emergency loading, per the Design Basis document, the inverters, bypass regulator and battery chargers will not be overloaded. However, failure to employ adequate design controls which would have included analyses of all impacted components is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01j).

None of the above noted discrepancies were safety significant or impacted equipment operability.

(j) FC-760-2: Control Room Emergency Lighting

This facility change was performed to provide additional emergency lighting in the Control Room. The lighting additions were identified and evaluated as part of the licensee's Control Room Design Review performed as required by Generic Letter No. 82-33, Supplement 1 to NUREG-0737. The modification added two self-contained (battery operated with a battery charger) units and two DC lighting fixtures to the existing emergency lighting systems in the Control Room.

During the review of the facility change documentation, the following items of concern were identified:

- Engineering analysis EA-FC-760-2-001 was performed to analyze the mounting of the lighting fixtures to be installed. Section V of this document, referring to the DC lighting fixtures, states in part "Assume the lighting fixture is rigid . . . ." This assumption is not justified in the analysis document and, in fact, the fixture (McMasters-Carr Lampholder, Cat. No. 1700K12) employs a swivel joint. The lighting fixtures are not safety-related, but mounting is considered critical since they are in the Control Room and failure could endanger personnel or safety-related devices.

- The engineering analysis contains a figure showing that the lighting fixture mounting has an implied critical dimension that requires verification upon installation. Evidence could not be found in the documentation that the dimension had been verified.

- Surveillance Procedure AE-5A was developed to verify operability of the self-contained emergency lighting units. The procedure addresses battery float voltage and duration of illumination. Acceptance criteria is 7.0 $\pm$ 0.1 volts and eight hours of lamp operation. Test Test frequency is every 24 months. In contrast to this, the vendor literature in the document package recommended monthly checks of the electrolyte level, specific gravity and indicator light operation.

In response to the second concern, the inspector and the licensee measured the lighting fixture critical dimension in the Control Room and determined the fixture mountings were acceptable.

With regard to the third concern, the licensee advised the inspector that a request has been issued to include the vendor recommended checks in their "Periodic and Predetermined Activity Control" (PPAC) Program with a frequency of every six months. Justification for not following the vendor recommended test frequency was not given.

The inspector concluded that the first concern regarding the unverified assumption in EA-FC-760-2-001 is a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01k).

None of the above noted discrepancies were safety significant or impacted equipment operability.

(k) <u>FC-799: Offsite Power Reliability Improvement</u>

This facility change was performed to provide power to the cooling tower busses from the unit's generator output. To accomplish this, the high voltage side of existing spare Station Power Transformer 1-3 was connected directly, without a circuit breaker, to the 345 KV side of the station's main transformer. The low voltage side was connected via bus supply circuit breakers to cooling tower 4160V busses 1F and 1G. Alternate feeds to these two busses remained on Startup Transformers 1-1 and 1-3, respectively. Both fast automatic and fast manual transfer schemes have been provided for busses 1F and 1G between one transformer source and the other. Fast transfer is an open circuit or dead bus transfer without intentional time delay.

In addition to the above, the switchyard batteries (which were close to end-of-life), and switchyard battery chargers were relocated and replaced. A portion of a fire wall between the station power transformers and startup transformers was to be razed and a new wall erected. The fire wall work has been deleted from this facility change.

Revision 7 to Chapter 8 of the plant's FSAR was issued in line with this facility change. This revision states: "Station Power Transformer 1-3 can be reconnected in place of Startup Transformer 1-2 within three days to provide full replacement of the failed startup transformer."

During the review of the facility change documentation, the following items of concern were identified:

- Station power transformer 1-3 is a 22.5/25/2 - 11/25/12.6 - 11/25/12/6 MVA, 55 C/65 C unit having an impedance of

9.3% (H to X, Y) while the startup transformer 1-2 that it would replace is a 9.5/10.6 MVA 55 C/65 C unit having an impedance of 10.84% (H to X). Thus, if Station Power Transformer 1-3 was reconnected to the 2400V system, a higher 345KV system contribution to a 2400V system fault would be anticipated. It is not evident that this impact on the 2400V system's fault withstand capability has been evaluated for this increased fault duty. The increased fault duty that would be imposed on the 2400V system by reconnecting Station Power Transformer 1-3 to serve the 2400V busses requires evaluation. Also, prior to placing this transformer in this service a 10 CFR 50.59 review is required.

- The logic for the fast automatic transfer scheme does not include a synchro-check feature, thus an out of phase transfer is possible. The inspector considers this an observation worthy of licensee review and reevaluation since induction motors and their driven loads upon out of phase transfers can be subjected to severe transient torques that may exceed design stresses. ANSI Standard C50.41, Section 15, recommends that to limit the possibility of damaging the motor or driven equipment, or both, the power supply be designed so that the resultant vectorial volts per hertz between the motor residual volts per hertz and the incoming source volts per hertz at the instant the transfer or reclosing is completed does not exceed 1.33 per unit volts per hertz on the motor rated voltage and frequency bases. Fast transfer between sources that are in-phase have been accepted as limiting the resultant vectorial volts to 1.33 per unit.

  A review by the licensee failed to indicate that the provisions of Section 15 of ANSI C50.41 or reference to its intent were included in the procurement documentation for the cooling tower pump and fan motors. Since the cooling tower pumps have shafts in excess of 20 feet and thus are likely to be more fragile than typical close-coupled motor load systems, this potentially increases the risk of shaft failure even if the voltage difference is small enough to protect the motor.

  The licensee was unaware of any study made to evaluate or determine the magnitude of the resultant vectorial volts per hertz between motor residuals and incoming supply.

  The fast manual transfer scheme for transfer of cooling tower busses 1F and 1G is supervised by a manual synchro-check circuit. However, the fast automatic transfer scheme has no synchro-check feature to block transfer in the event the sources involved are out of phase.

The inspector recognizes the fact that under all planned 345KV system operating conditions the power sources involved in bus transfers at Palisades will by procedure be in-phase and thus no extreme motor/load transients should result. However, switchyard alignment is understood by the inspector to be under the control of the transmission system dispatcher, rather than the nuclear plant operator and the nuclear plant operator could be unaware of any phase differences. The possibility exists that the two sources could be electrically separated and a phase difference exist such that a bus transfer damaging transient could result.

None of the above noted discrepancies were safety significant or impacted equipment operability.

5. Specification Changes (SCs)

Specification change packages are used to document minor specification changes to existing plant equipment. The SC process is applied to changes to the specifications or setpoints of installed plant equipment resulting from modifications made by the equipment vendor, material substitutions and/or technical or code requirements needed to support maintenance activities or minor equipment modifications required to improve equipment/system reliability or efficiency. The SCs were reviewed to ensure that changes to the plant were accomplished according to NRC requirements, applicable codes, standards, and Consumers Power Company (CPCo) procedures. The following SC packages were reviewed:

- SC 86-145 — Modify RGEM Controllers - FC 2330 and FC 2346
- SC 87-067 — SIRW Tank High Temperature Alarm Setpoint Change TIA 0328 and TIA 0332.
- SC 87-069 — Replace SIRW Level Transmitter - LT 0331
- SC 87-090 — Change SW Leak Detection (Containment Air Coolers) Flow Setpoint From 75 gpm to 300 gpm - FS 0885.
- SC 87-163 — Upgrade FW Flow Transmitters - FT 0701 and FT 0703.
- SC 87-285 — Setpoint Change for Startup Ex-Core Detector HV Removal.
- SC 87-344 — Low Temperature Over Pressure (LTOP) Setpoint Change - TS 0115 and TS 0125.
- SC 88-102 — Replace Containment Pressure Transmitter - PT 1812.
- SC 88-069 — Upgrade SI Tank Pressure Transmitters - PT 0363, PT 0367, PT 0369 and PT 0371.

The following paragraphs address those SC packages that will require additional licensee action:

a. SC 87-090 changed the Service Water (SW) leak detection (Technical Specification Table 4.1.3.13) setpoint from 75 gpm to 300 gpm. Engineering analysis No. EA-SC-87-090-1 stated that engineering judgement was the basis for the 75 gpm setpoint. The 300 gpm setpoint was selected based on the total inaccuracies of the instrumentation loop times the full scale flow of the flow transmitters. The EA and SC did not provide any justification to support what size of SW containment air cooler piping break could be detected by the leak detection instruments. The operator response for annunciator window EK-1347, "Containment Air Coolers Service Water Leak," was to close the inlet valve to each containment air cooler and check for leakage. The operators may isolate the containment air coolers in response to an alarm setpoint that was not adequately verified or checked to meet the design intent of the SW leak detection system. Failure to apply design control measures for verifying or checking the adequacy of the SW leak detection setpoint change is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-011).

b. SC 87-163 upgraded FW flow transmitters FT-0701 and FT-0703 to Rosemount units. The supply voltage requirements for a 1151 DP transmitter is 12 Vdc to 45 Vdc (4 mA to 20 mA current loop). The transmitter will operate within this voltage range as a function of load resistance. The load resistance for the FW flow transmitters is approximately 300 ohms. The nominal supply voltage requirement for the transmitter as determined from the Rosemount functional specifications was approximately 19 Vdc.

   The licensee installed a zener diode in the series current loop to lower the transmitter operating voltage. The inspector reviewed the SC and determined the licensee did not provide any design criteria for the zener diode. In addition, the licensee did not state the power supply voltage nor did they measure the zener and transmitter operating voltages following completion of the SC. At the request of the inspector, the licensee measured the power supply, zener, and transmitter voltages for FW flow transmitter FT 701. In addition, the licensee also included FT 0702 (steam flow), and PT 0702 (steam flow pressure compensation) loop voltages. The following voltage measurements (Vdc) were made:

Equipment No.	Transmitter	Zener	Power Supply
FT 0701	18.8	22.2	44.3
FT 0702	18.2	23.8	42
PT 0702	17.62	23.88	41.5

   From the above results, it appears the zeners were performing their intended function. The licensee indicated a total of 26 Rosemount transmitters have been installed with zeners in the series current loop.

The FW flow inputs are discussed in the FSAR in Sections 7.5 and 10.2.3.3 relating to FW Regulating Systems and Section 7.2.3.2 which relates to FW flow instrumentation that provide input to the secondary plant heat balance calculation. The initial safety evaluation addressed the transmitter replacement and was revised to include the addition of the zener. However, the safety evaluation did not address the failure mechanism of the zener (shorting) and whether its failure would increase the probability of a malfunction of the FW flow loop.

The voltage measurements indicate that if the zener did short, the maximum voltage dropped across the transmitter would be less than 45 Vdc which should not increase the probability of a FW flow loop malfunction. However, failure to apply design control measures for verifying or checking the adequacy of the zener design is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01m); and the failure to delineate appropriate acceptance criteria to demonstrate the zener was performing its design function is also considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01r).

c. SC 87-344 changed the Low Temperature Over Pressure (LTOP) setpoints for Temperature Switch 0115 and Temperature Switch 0125. The Primary Coolant System (PCS) over pressure protection system receives pressure and temperature information and acts to minimize the possibility of overpressurizing the PCS at reduced temperatures by relieving through the power operated relief valves (PORVs). The inspector discussed the LTOP system with the licensee on April 6, 1989. The licensee provided the inspector with electrical schematics and the surveillance procedures which were used to adjust the pressure and temperature setpoints. The surveillance procedures were reviewed in parallel by the licensee and the inspector. The licensee identified on April 10, 1989, that the LTOP pressure setpoint calibration tolerances would permit the setpoint to be left without adjustment above the Technical Specification (TS) allowable value. The procedures involved are the following:

- MO-27A Functional Check for PCS Overpressure Protection System Setpoint 310 PSIA - Cold Shutdown/Heatup
- MO-27B Functional Check of Overpressure Protection System Setpoint 575 PSIA - Plant Heatup
- MO-27C Functional Check of PCS Overpressure Protection System Setpoint 310 PSIA - During Cooldown
- MO-27D Functional Check of PCS Overpressure Protection System Setpoint 575 PSIA - Plant Operating

The inspector completed the in-office review of the above procedures on April 13, 1989. The inspector independently came to the same conclusions as the licensee and notified the licensee by FAX on April 13, 1989.

The inspector reviewed past performances of MO-27B and MO-27C. This identified that on at least 17 occasions, the LTOP pressure setpoints were left adjusted above the TS allowable value. These are examples of violation of TS 3.1.8.1.a and TS 3.1.8.1.b (255/89007-03).

The LTOP protection is required to meet 10 CFR 50, Appendix G - Fracture Toughness Requirements during heatup and cooldown of the reactor vessel. The most nonconservative as-left setpoint permitted its associated PORV to lift 4.13 psia above the TS setpoint. The smallest pressure margin (25 psia) available is at a heatup/cooldown temperature rate of 50°F (MO-27, Basis Document). The maximum pressure instrument loop error is 14.06 psia. Since 4.13 psia plus 14.96 psia is less than the pressure margin of 25 psia, the plant was being operated within its Appendix G limits.

d. SC 88-069 upgraded Safety Injection (SI) tank pressure transmitters, PT 0363, PT 0367, PT 0369, and PT 0371 to Rosemount units. This upgrade is similar to SC 87-163. The pressure channel is described in FSAR Section 6.1.8.b. The FSAR states in part, "the pressure of each safety injection tank is indicated in the main control room." The analog pressure loop also provides high and low pressure alarms. Redundant high and low pressure alarms are also provided by pressure switches (bistable devices). Operations uses the pressure loop indicators (PIA 0363, PIA 0367, PIA 0369, and PIA 0371) to fulfill SI tank TS 3.3.1.b requirement that the SI tanks are pressurized to at least 200 psig. The surveillance is performed according to TS Table 4.1.2 by verifying the pressure indication is between the alarm setpoints. The SI tank pressure loop is further described on FSAR Figure No. 6-1 SH.1, "Piping and Instrument Diagram Safety Injection, Containment Spray and Shutdown Cooling System." Even though the specific power supplies for the pressure loops were not identified on Figure No. 6-1, SH. 1, changes in the power supply output voltage could affect the operability and reliability of the pressure loop. The Safety Review performed by the licensee stated SC 88-069 did not involve a change to the facility as described in the FSAR.

The SC package did not provide any design criteria for the zener diode and did not provide the power supply output voltage that is required to correctly design for the appropriate zener voltage. The following zeners were installed:

• Loop PT 0363	10 Vdc
• Loop PT 0367	15 Vdc
• Loop PT 0369	15 Vdc
• Loop PT 0371	10 Vdc

The licensee successfully calibrated each pressure loop following the zener and transmitter installation. The licensee did not verify the power supply, zener, and transmitter voltage at any time before or after declaring the SI tank pressure channels operable. The licensee obtained the voltage measurements at the request of the inspector. The following voltage measurements (Vdc) were made:

Equipment No.	Transmitter	Zener	Power Supply
PT 0363	57.62	9.63	74.85
PT 0367	51 (calculated)	14.91	73.14
PT 0369	52.40	15.13	74.47
PT 0371	57.34	9.53	75.16

As can be seen from the above measurements, the transmitters were being operated outside their nominal operating range (14 Vdc to 45 Vdc).

The inspector discussed the operation of a Rosemount transmitter at a voltage greater than 45 Vdc with the manufacturer. The manufacturer indicated that the transmitter would continue to operate above 45 Vdc; however, the manufacturer did not have any data to support how long the transmitter would reliably operate above 45 Vdc. It appears that as the voltage at the transmitter increases, transmitter degradation will begin. This effectively decreases the transmitter life and reliability. A further concern of the inspector is the failure mode of the zener (shorted) that could go undetected and result in the transmitter having to withstand the additional zener voltage without malfunctioning.

The inspector reviewed the SI tank pressure loop power supply manual. The Foxboro Model 610A power supply is designed to furnish power to a single electronic transmitter. The nominal DC output voltage is 80 volts. The manual also states that the output load resistance must be 600 ohms +10; -20 percent. The SC package did not determine the load resistance. The manual provided detailed instructions to sum the input resistances of all the receivers in the loop (excluding the transmitter) and to adjust the load adjustment dial on the power supply to the difference between the loop resistance and 600 ohms.

The Rosemount 1151 GP transmitter performance specifications state that the "power supply effect" is less than 0.005% per volt. The inspector was concerned that in this case, a higher voltage zener will have to be used to lower the transmitter voltage (typically around 20 Vdc). For instance, if a 40 Vdc zener was selected and it failed (shorted), the transmitter voltage could increase to 60 Vdc. This could add an additional 0.2% error into the high and low setpoint calculation developed for Procedure No. RI-15A, "Safety Injection Tank Pressure Channel Calibration." Prior to the inspection, the licensee had no plans to monitor the zener voltages on a routine basis. During the inspection, the licensee indicated they were looking into the feasibility of measuring the zener voltages on a periodic basis to ensure the zeners were performing their design functions.

Failure to apply design control measures for verifying or checking the adequacy of the zener design is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01n); the failure to verify and check the design by considering the affects of increased load resistance on the power supply is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01o); and the failure to delineate appropriate acceptance criteria to demonstrate the zener was performing its design function and acceptance criteria to properly adjust the power supply load adjustment resistor are considered further examples of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01s).

Procedure No. 3.07, "Safety Evaluations," was written to provide the guidance on determining the need for and proper completion of a Safety Evaluation. The SI Tank pressure channel is discussed in the FSAR text and appears on FSAR Figure No. 6-1, SH. 1. 10 CFR 50.59, "Changes, Tests and Experiments," requires that a Safety Evaluation be performed for changes to the facility as described in the FSAR. The pressure channel power supply is not explicitly described in the FSAR; however, the power supply and changes thereto will have a direct operability affect on the pressure channel. The licensee answered question No. Two of the Safety Review, "Does the item involve a change to the facility as described in the FSAR?", as "no". Consequently, a safety evaluation was not performed. The addition of the zener diode created a different failure mode (shorted). A shorted zener diode in this application will not alter the current flowing in the instrument loop. The loop will remain intact with the additional zener voltage being applied to the transmitter. This configuration reduces the reliability of equipment identified as important to safety by operating the transmitter outside its normal supply voltage range. As a result, the likelihood of the transmitter to malfunction increases. This also creates a different failure mode, one that could fail the transmitter as a result of excessive supply voltage. The inspector recognizes that 10 CFR 50.59 only requires safety evaluations for determinations of the existence of unreviewed safety questions for equipment described in the FSAR. In the above case, the description of the subject equipment in the FSAR was not explicit. Nevertheless, since the modification that installed the zener diode introduced a different equipment failure mode, a potential effect on equipment operability now exists. Thus, the licensee should be sensitive to this type of problem when engaging in future modifications.

This item has minor safety significance. Redundant pressure switches were operable and could have alerted the operator on an abnormal SI tank high or low pressure condition.

e. SC 88-102 upgraded containment pressure transmitter PT 1812 to a Rosemount unit. The pressure loop provides indication only and is not required to be operable for any type of analyzed event. The SC package did not perform a seismic evaluation for the new transmitter mounting arrangement. The transmitter is connected to a Class X penetration (Number 17) as described in FSAR Section 6.7.2.1.8. The NRC position (RG 1.29, "Seismic Design Classification") is that systems affecting primary and secondary reactor containment whose failures during a Safe Shutdown Earthquake (SSE) could result in the release of radioactive materials should have their design requirements extended to the first seismic restraint beyond the defined boundaries (primary containment). Those portions of structures, systems, or components that form interfaces between Seismic Category I and non-Seismic Category I features should be designed to Seismic Category I requirements. In this case, the manual instrument isolation valve is always open which extends the primary containment boundary to the transmitter. Failure to apply design control measures for verifying or checking the seismic capability of the transmitter mounting is considered a further example of violation of 10 CFR 50, Appendix B, Criterion III (255/89007-01p).

In summary, the inspector was concerned that modifications being made under the SC process have not consistently received an adequate level of engineering attention, as illustrated by the above examples.

f. SC-89-72 (Deviation Report D-PAL-89-043)

This deviation report documented the undersized fillet welds on socket welded fittings for SC-89-72. This specification change was necessary to provide an interim solution to primary coolant system leakage from cold leg drain valves. The change required the installation of a new length of two inch schedule 160 pipe with a socket welded cap on each of the four loop drains. Inspection of all eight socket fillet welds indicated that none of them met the Code required size of 3/8 inch.

During the inspector's review of the deviation report, there were several concerns that apparently were not addressed. First, although the corrective actions appear to recognize that the current RIC form does not give the welder sufficient information (specifically the size of the fillet weld), there was no recognition that QC did not and was not required to verify the size of the fillet weld. The undersized condition was not discovered until the authorized inspector (AI) pointed it out to the licensee. All of the welds had been reviewed and approved by the licensee's program and yet the size had never been verified. This is considered another example of violation of 10 CFR 50, Appendix B, Criterion X, in that the size of the socket fillet welds was not verified (255/89007-02b).

The second concern pertains to the generic aspect of the problem. The licensee appeared to recognize the programmatic weakness which contributed to the problem by revising the RIC form to include the specific weld size. However, there appeared to be no corrective actions directed toward reviewing previously made socket fillet welds for compliance with Code requirements. Based on the added complication that the sizes of fillet welds in general apparently have not been verified under the licensee's program, reviews of past work may not be necessarily limited to socket welded fittings. Pending a review of the licensee's justification as to why additional inspection of previous fillet welds is not required, this is considered an Unresolved Item (255/89007-06).

Out of ten SC packages reviewed, ten examples of inadequate design control were identified. This is considered a program weakness.

6. Inservice Testing (IST) of Pumps and Valves (73756)

This portion of the inspection was based on Consumers Power Company IST program for Palisades Station including submittals dated December 28, 1988, for the pump program and April 21, 1988, for the valve program.

The inspectors found that the licensee's IST program had not yet been approved by NRC. Therefore, the licensee's programs were reviewed to determine whether the programs and relief requests were consistent with methods acceptable to NRC, and whether compliance with ASME code Section XI, Subsections IWP and IWV was achieved to the extent practical.

a. Administrative Controls

Inservice testing of pumps and valves is controlled by the licensee to ensure that the appropriate testing is performed at the proper interval, that it is performed in accordance with approved procedures by qualified personnel using appropriate instruments, that the results are accurately recorded, properly analyzed, correctly stored and that trends of test results are monitored to predict and preclude failure of the tested component.

(1) Administrative procedures are generated by the Inservice Inspection Section and then reviewed and approved by the Procedure Review Committee and Engineering Maintenance.

(2) Technical procedures covering the performance of IST are generated by the Inservice Inspection Section with the concurrence of Operations. They are then reviewed and approved by Quality Assurance, Procedure Review Committee and Engineering Maintenance.

(3) Scheduling of inservice testing of pumps and valves is performed by the Technical Specification Surveillance Program Coordinator. Twice each month the coordinator interrogates the computer tabulation of equipment and test requirements and, through use of the Periodic Preplanned Activity Control System (PPACS), generates a list of equipment which is to be tested, the tests which are to be performed, and the time at which the test must be completed. Based on the information provided by the computer, the coordinator prepares the Technical Specification Surveillance Procedure, which provides the technical information from the computer and a practical translation of the time period within which the work should be performed. Operations performs the work within the time "window" in the schedule. When a pump or valve fails to meet its IST acceptance criteria, Operations immediately declares the component inoperable. When the test is completed, the test data are transmitted to the Inservice Inspection (ISI) Section for analysis. If any of the data is in the "Alert" range the ISI Section initiates an order for increased surveillance of the component. The inspectors confirmed the increased inspection frequency imposed on equipment in the "Alert" range by review of the Technical Specifications Surveillance Procedure.

The IST Section records the pump and valve data and adds it to the "Parameter Manager", a computer program used in their trending and forecasting program. The licensee demonstrated a significant commitment to this system. Personnel who use it are convinced of its value.

b. Training

Training of Inservice Testing personnel is accomplished through the Training Coordinator. The Training Coordinator maintains records of the contents of training classes provided by all training facilities, and the records of the personnel who have taken the training.

Generic skills are provided by the Muskegon Skills Center, which is a Consumers Power facility. Here the basic skills required of all power plant employees is provided, with hands-on training provided on operating loops containing representative pumps and valves.

Plant specific skills, including work on valve operators, is provided at the South Haven Training Center.

Dedicated valve maintenance personnel receive more intensive training through specialized contractors such as Chesterton (Packing), Fisher Valve (Control Valves), Farris (Relief Valves), Anchor-Darling (Valves), and Limitorque (Valve Operators). The use of the dedicated valve maintenance personnel is credited with materially reducing valve maintenance rework . Also contributing to that improvement was a more widespread training program to familiarize engineers and management with the more important facets of valve maintenance. Similar specialized training was provided for pump maintenance personnel through McNally Rotating Equipment but the effect of that training was not monitored.

Training records for all personnel are kept on the Employee Information System Computer program. In addition, each Mechanical Maintenance foreman has a copy of a Training Matrix Notebook which provides him with an outline of each employee's training. Further guidance in assuring that properly qualified personnel are used on the job is provided by the individual work order, which contains a mandatory section on skill levels and training required to perform the work. Additional special training is provided by the foreman who completely reviews each job to be done with the personnel involved before any work is initiated. In this way the workers are familiar with the full extent of the work to be done before they begin the job.

c. Calibration

Records of instruments used in the IST program to measure test parameters in the IST program were maintained in a data base and scheduled for calibration by Instrumentation and Control at the licensee's Jackson Headquarters. Calibration of instruments such as stopwatches and vibration measuring equipment was done at the Jackson office, whereas calibration of instruments for flow or pressure gauges was done onsite in accordance with the plant's Instruments and Controls Computer Program schedule.

The inspector reviewed the calibration data associated with various gauges used in the performance of testing of the Service Water and Boric Acid Pumps. Additionally, calibration data was reviewed for charging flow instrumentation and a TK-80 vibration analyzer. The TK-80 vibration analyzer, ID No. 8428-00694, was calibrated on a yearly frequency to a tolerance of ± 5 percent, in accordance with the Code requirements. The flow and pressure gauges and the flow transmitter calibration data reviewed by the inspector were calibrated within ± 2 percent and as low as ± 0.5 percent for flow indicator FI-1347, which is used during the performance of the Service Water Pump test.

The inspector reviewed the instrument storage and calibration controls provided for IST equipment and noted no problems. These controls were adequate to ensure the required accuracy for the IST program.

d. <u>Pump Program Implementation</u>

The licensee's pump IST program implementation was inspected to verify compliance with Appendix B of 10 CFR 50; 10 CFR Part 50.55a(g); and subsection IWP of Section XI of the ASME Code (1983 Edition with Addenda through Summer 1983). The inspection included a review of administrative controls, selected surveillance procedures, test results, and documentation.

(1) <u>Program/Relief Requests</u>

The inspector reviewed the licensee's controlling procedure governing the conduct of IST, including associated relief requests.

Due to the fact that approval of the licensee's program had not yet been granted, the inspector evaluated the program and requests to determine the extent to which compliance with code requirements was achieved. To the extent practical, the licensee was meeting the code requirements. However, some concerns were noted and are detailed below:

- Two relief requests in the licensee's program were intended to provide relief from the requirements of Table IWP-3100-2, "Allowable Ranges of Test Quantities," when the instrumentation used by the licensee to perform IST, although calibrated within the requirements of Table IWP-4110-1, "Acceptable Instrument Accuracy," allowed the test results to fall outside of an allowable range, into either the "Alert" or "Required Action" range. This was a nonconservative approach to be used by the licensee in the event that increased testing, due to test failures, was required due to Code allowable inaccuracies of the measuring and test equipment. This was not an acceptable practice and the inspector discussed this with the licensee. Blanket relief was not the intent of the licensee and instrumentation used for IST purposes is within the accuracy limits specified in Table IWP-4110-1. Modifications to systems with inaccurate gauges were initiated by the licensee, and the licensee stated that these relief requests would be withdrawn.
- The method of vibration analysis used by the licensee was displacement. The inspector noted that other techniques

such as vibration analysis using velocity measurements allows a more comprehensive analysis of the pump condition. The licensee stated that they were reviewing this technique.

During the conduct of this inspection, NRC issued Generic Letter (GL) No. 89-04, "Guidance on Developing Acceptable Inservice Testing Programs", dated April 3, 1989. Many of the issues noted above will be addressed by the licensee in their response to the GL. It is the licensee's intent to delete the majority of relief requests contained in the program, which will require the modifications as mentioned above.

(2) Completed Surveillance Review

The inspector reviewed several procedures to ensure that Code requirements were met and to evaluate the effectiveness of the program.

The following surveillance packages were reviewed:

- Procedure No. MO-38, Revision 2, dated November 7, 1988, "Auxiliary Feedwater System Pumps, Inservice Test Procedure," performed on March 13, 1989.
- Procedure No. QO-19, Revision 3, dated October 20, 1988, "Inservice Test Procedure - High Pressure Safety Injection Pumps and ESS Check Valve Operability Test," performed March 8, 1989.
- Procedure No. QO-20, Revision 2, dated July 6, 1988, "Inservice Test Procedure - Low Pressure Safety Injection Pumps," performed January 11, 1989.
- Procedure No. QO-18, Revision 3, dated October 7, 1988, "Inservice Test Procedure - Concentrated Boric Acid Pumps," performed October 29, 1988, November 4, 1988, and March 8, 1989.
- Special Test Procedure T-235, Revision 0, dated March 14, 1987, "Concentrated Boric Acid Pumps **P-56A and **P-56B Performance," performed March 14, 1987.

One administrative problem was noted in Procedure No. MO-38. Step 3.6.1.b allowed for a vibration instrument accuracy of ± 10 percent, which is outside of the allowable accuracy range specified in the Code. The instrument used during the surveillance was calibrated within the Code specified accuracy range and all of these type of vibration monitoring instruments were calibrated to ± 5 percent accuracy as allowed by the Code. A procedure change was issued by the licensee on April 7, 1989, to revise the allowable accuracy from ± 10 percent to ± 5 percent accuracy. No other problems were noted.

The licensee recently completed a modification on the HPSI system, which allowed tests to be run at substantial flow conditions. No problems were noted with Procedure No. QO-19.

The LPSI system pumps, tested in surveillance Procedure No. QO-20, currently do not have a configuration that allows for tests to be conducted at or near design flow conditions. However, the licensee has developed preliminary plans to address this problem. These plans are to install appropriate flow and pressure gauges in current system piping or modify the configuration to add a recirculation loop that would allow for substantial flow testing. This action will also be addressed by the licensee as part of the response to GL 89-04.

The inspector noted one discrepancy during the review of the surveillances performed using Procedure No. QO-18. As part of an IST pump inspection, reference values are to be established to compare the measured values obtained during subsequent tests to allow for comparison in order to determine the pump hydraulic condition. The values are to be measured after either the reference flow rate or differential pressure is established, as required by the Code. The licensee does not have the instrumentation in the line used to test the Boric Acid pumps to measure flow rate or differential pressure, and therefore could not establish the appropriate reference for testing. A relief request was submitted to the NRC; however, the inspector noted that this was unacceptable.

The licensee tested these pumps at design flows and pressures in 1987, and the pumps performed acceptably. In addition, the licensee noted that the reference values need to be established to fully evaluate the hydraulic condition of the pump. It is the intent of the planned modifications to install the appropriate means to conduct this type of testing.

The inspector noted that this condition existed only for the Boric Acid and Component Cooling Water pumps (for which similar actions are being taken) and is not a concern for other pumps.

(3) Test Observation

The inspector witnessed the performance of inservice testing of the Service Water Pumps. The licensee uses Operations personnel to perform all aspects of the testing, including the pump vibration measurement. Vibration data was obtained using calibrated equipment. The points used for measurement were clearly marked on the pump. Reference flow was established in the recently installed bypass header, installed to facilitate the pump testing. However, the flow gauge used, FI-1347, was difficult to read, in that it swung approximately $\pm$ 300 gpm from the desired average flow.

A deviation report was issued when the licensee discovered this condition during a previous surveillance and initiated action to have the situation corrected by June 1989.

The work was done in a professional manner and the Operations staff was knowledgeable. No other problems were noted.

h. Valve Program Implementation

The licensee's valve IST program implementation was inspected to verify compliance with Appendix B of 10 CFR 50, 10 CFR Part 50.55a(g); and subsection IWV of Section XI of the ASME Code (1983 Edition with Addenda through Summer 1983). The inspection included a review of administrative controls, selected surveillance procedures, test results, and documentation.

(1) Program/Relief Requests

As previously indicated, approval of the licensee's program had not yet been granted, so the inspectors evaluated the program and the related relief requests with respect to the guidance available in ASME Section XI and Generic Letter 89-04. Several anomalies were observed.

(a) Relief Request No. 2 proposed, as an alternative to full flow testing of check valves, the partial stroke exercise during hot shutdowns and disassembly and verification of freedom of disk motion on a five year basis. That is, two valves would be inspected every five years and all four would be inspected in each ten year interval.

This request conflicts with the NRC position on "Alternative to Full Flow Testing of Check Valves" indicated in Attachment 1 to Generic Letter 89-04, which states "Extension of the valve disassembly/inspection interval from that allowed by the Code (Quarterly or cold shutdown frequency) to longer than once every six years is a substantial change which may not be justified by the valve failure rate data for all valve groupings." The attachment lists three prerequisites for reducing inspection frequency based on valve inspection experience.

The licensee indicated that the alternative proposal in the relief request would be abandoned and that testing would be modified to reflect the intent of Generic Letter 89-04.

(b) The inservice testing of plant valves, Procedure EM-09-02 Revision 12, dated April 21, 1988 (The IST Program), included two valve lists: Attachment 1: Valves tested by P&ID and Attachment 2: Valve Reference List in alpha numeric order. These valve lists contained erroneous data:

- References to Relief Request (RR)-11 should be to RR-10

- References to RR-13 should be to RR-12

- References to Drawing Coordinates are incorrect.

For example:

CV-0884 on M208 1A should be G-3 instead of D-6
CV-0885 on M208 1A should be F-3 instead of D-5

Trending records reflect similar anomalous references, which are probably the result of revisions in the number of relief requests and in the redrawing of some P&IDs.

(c) The program for IST states, in paragraph 5.2.4.C, "Valve leakrate testing other than containment isolation valves shall be performed in accordance with IWV-3420. EM-09-02 Revision 12 has no valves meeting this requirement." However, NRC's "Order For Modification of License Concerning Primary Coolant System Pressure Isolation Valves" dated April 2, 1981, included revised Technical Specification pages 4-17 and 4-19. Page 4-17 included the following information:

> Technical Specification paragraph number 4.3.h.: Periodic leakage testing (a), (b) on each check valve listed in Table 4.3.1 shall be accomplished prior to returning to the Power Operation Condition after every time the plant has been placed in the Refueling Shutdown Condition, or the Cold Shutdown Condition for more than 72 hours if such testing has not been accomplished within the previous 9 months, and prior to returning the check valves to service after maintenance, repair or replacement work is performed on the valves.

The licensee has confirmed that all necessary tests were performed on Pressure Isolation Valves even though the tests were not included in the Inservice Testing Program. Test results for the leak testing of these valves after each refueling shutdown and cold shutdown were located and were reviewed by the inspector.

The Licensee indicated that the current procedures already reflect the intent of Position 8 of Generic Letter (GL) 89-04. A sample of surveillance procedures was reviewed to confirm this statement. Several of the procedures did not provide clear guidance in this area. Paragraph 6.2 of procedure QO-05 Revision 30, for example, indicates that corrective action shall be as specified in Palisades Administrative Procedure No. 9.23. The corrective action in that document provides a definition of LCO initiation time that does not meet the intent of Position 8. It also includes guidance for continued use of equipment not meeting test acceptance criteria that does not conform to the intent of Position 8. Similarly, Paragraph 6.0 of Procedure QO-21, Revision 4, does not require that pumps or valves which fail to meet acceptance criteria be declared inoperable.

4.e.(3) Stroke Time Reduction Resulting From Limit Switch Shift

Experience with previous licensee programs disclosed a problem which occurs when limit switches are repositioned for optimum torque switch bypass. When the limit switch controlling torque switch bypass also controls the position indicating light, there is a potential for losing control of stroke timing.

Ideally, the limit switches for position indicating lights should be adjusted to operate near to the open and closed positions. The limit switch for the torque switch bypass is commonly set as high as 20 percent off the closed position. When the same rotor and the valve operator is used to operate both switches, there is a conflict in objectives. The problem can be resolved on a four rotor limit switch operator by shifting the lights to the other rotor on the closed end of travel. However, on a two rotor operator, there is no simple resolution to the problem. When the rotor is fixed at 20 percent off the closed position an error is automatically introduced into the normal stroke timing procedure. Ordinarily, stroke timing is performed from the Control Room and the timing covers the interval between the initiation of the switch (in this case, the "close" switch) and the operation of the light at the "close" end of the stroke. If the light operates 20 percent before the end of the stroke, the timing stops 20 percent before the end of the stroke. Thus a stroke time that violates the "required action" acceptance standard by up to 20 percent would be acceptable in this system. As a consequence, the stroke timing would fail to comply with the requirements of IWV-3413(b), in that stroke timing would not be measured within 10 seconds or 10 percent of the specified limiting stroke time.

The licensee recognized the potentially detrimental aspects of this condition when adjusting switches in response to IEB 85-03. Two rotor MOV's which required additional switches to permit separate control of position indication lights and torque bypass switches were replaced by four rotor MOV's to facilitate this change and prevent the conflicting requirements. The licensee indicated that all limit switches for position indication lights are now located near the extremes of stroke travel and provide an accurate and effective means for measuring stroke time.

j. Discussion of the IST Program

The anomalies cited in the IST program and its relief requests are not identified as violations because the program and relief requests were not previously approved by the NRC. Had these documents been reviewed, these anomalies would have been identified and corrected before the documents were returned. In effect, the current review has performed a similar (although more superficial) function. It provides minimal guidance to the licensee in revising the program to conform to the guidelines of Generic Letter 89-04.

The licensee has demonstrated a commendable attitude toward improving performance in the areas of pumps and valves. The training previously described represents only one facet of their approach to this area. Another is the Valve Improvement Program, which sought to improve valve performance through improvements in packing selection and application, project coordination, tool application, and training of dedicated groups. That program resulted in the following results:

- Reduced valve maintenance rework from over 10 percent to under 1 percent.
- Tripled the number of valves that could be repaired in one year.
- Essentially eliminated packing leaks on repacked valves.

The success of the program is attributed to the application of innovative approaches and to the cooperation of all levels of management to achieve the desired end results.

7. Onsite Followup of Written Reports of Non-Routine Events (92700)

(Closed) LER 255/88021: Potential for the loss of the Service Water (SW) pumps. Since February 5, 1987, the plant has experienced several unexplained service water pump trips. The licensee determined in November 1988 that the cause of the spurious tripping was the result of the high dropout (HDO) overcurrent relay not resetting during high SW load conditions. The load increases were initiating the time over current (TOC) relay and along with the unreset HDO relay would trip the pump.

The licensee backfiled the SW pump impellers in late 1986. This increased the SW pump capacity sufficiently to increase and maintain the motor running current above the HDO relay reset point. The backfiling increased the pump horsepower requirements from 350 Hp to approximately 375 Hp. The motor is rated at 350 Hp and has a service factor of 1.15. The motor may be reliably operated to 402.5 Hp (assuming no losses).

Motor insulation systems are susceptible to heat buildup. The SW motor has a Class B insulation system. According to ANSI Standard C50.41-1982," American National Standard For Polyphase Induction Motors for Power Generating Stations," the temperature rise of a Class B insulation system is acceptable provided the temperature-rise does not exceed 90°C as determined by the resistance method of temperature determination. The licensee determined the temperature-rise (resistance method) was 85.86°C and at a motor efficiency of 92% would produce 375.07 Hp. As a result of the above, the licensee considers the motors qualified for their intended use. The inspector reviewed internal CPCo correspondence KAS 01-87, dated January 7, 1987. The correspondence stated that "The Plant should be advised to proceed with their plans to replace the pumps and motors with those of greater capacity as they intended. While this is not necessitated by current conditions, it would be prudent for the long term." ANSI Standard C50.41-1982 in Section 9.3.2, "Temperature-Rise," supports the above statement. The Standard states that, "Operation at the temperature-rise values given in Table 2 for a 1.15 service-factor load causes the motor insulation to age thermally at approximately twice the rate that occurs at the temperature-rise values given in Table 1 for a motor with a 1.0 service-factor load; that is, operating one hour at specified 1.15 service-factor temperature-rise values is approximately equivalent to operating two hours at the temperature-rise values specified for a motor with a 1.0 service-factor."

The inspector reviewed the operator's response to Annunciator Number 37, "Service Water Pump P-7B Overload/Trip." The response was "Check relays if pump tripped. If pump did not trip, then overload relay caused alarm in this case, monitor motor current and if possible, reduce service water loads. Pump will trip if current reaches 114 to 126 amps." Onshift personnel indicated they would not operate the pump with the alarm present. They would immediately start the standby pump or equalize the flow between the running pumps to reduce the motor current. The inspector reviewed the SW pump's operating history for the summer of 1988. The following current readings (Amps) were obtained from the 'B' shift (day shift):

Date	SW Pump A	SW Pump B	SW Pump C	Date	SW Pump A	SW Pump B	SW Pump C
6/1	X	82	83	7/21	X	81	83
6/7	X	81	82	8/1	77	78	79
6/14	79	83	X	8/4	86	87	86
6/21	83	86	X	8/8	87	88	79
6/28	80	80	83	8/9	81	82	75
7/7	X	83	84	8/15	81	83	76
7/14	X	86	86				

X Denotes pump not running

None of the pumps was operated near their 1.15 service-factor current of 96 Amps. The inspector advised the licensee to continue to closely monitor the SW motor currents and take appropriate measures to ensure the motors are being operated at less than 96 Amps. The inspector had no further concerns on this item at this time.

8. Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the inspector, and which involves some action on the part of the NRC or licensee or both. An open item disclosed during this inspection is discussed in Paragraph 4.b.(2)(a) 4.

9. Unresolved Items

An unresolved item is a matter about which more information is required in order to ascertain whether it is an acceptable item, an open item, a deviation, or a violation. Unresolved items disclosed during this inspection are discussed in Paragraphs 4.b.(2)(a) 4 and 5.f.

10. Exit Meetings

The inspectors met with licensee representatives (denoted in Paragraph 1) on April 21 and May 5, 1989 to discuss the scope and findings of the inspection. In addition, the inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.

ATTACHMENT A: PERSONNEL CONTACTED

CPCo

R. M. Brzezinski	Instrument and Control (I&C)
R. J. Corbett	Project Engineer
D. D. Crabtree	System Engineer
G. J. Daggett	System Engineer
T. C. Duffy	Reactor Engineer
M. A. Ferens	I&C
E. Feury	Training
R. M. Hamm	Project Engineer
L. H. Keller	Staff Engineer
D. M. Kennedy	I&C
J. A. Meincke	Reactor Engineer
M. T. Nordin	Supervisor, Electrical Systems
M. D. Paschke	Project Engineer
D. T. Perry	Staff Engineer
U. R. Peterson	I&C
W. L. Roberts	Project Engineer
R. L. Scudder	Training
G. W. Sleeper	Project Engineer
T. J. Swiecicki	I&C
D. Vandewalle	CCP Manager
R. S. Westerhof	I&C

CPCo Jackson

G. J. Brock	Senior Engineer
Y. F. Chan	Staff Engineer
R. T. DesJardins	Staff Engineer
G. W. Foster	Senior Engineer
B. L. Harshe	Staff Engineer
P. Papaioannou	Staff Engineer
R. Pienkos	Senior Engineer
D. J. Radzwion	Senior Engineer
R. C. Schmid	Engineer (Contract)
K. A. Stevens	Staff Engineer
J. L. Topper	Staff Engineer
M. R. Wade	Section Head, Projects Engineering and Construction
G. A. Washburn	Engineer (Contract)
K. Yeaber	Staff Engineer

Bechtel

M. Mau	Engineer

ATTACHMENT B: FACILITY CHANGE REVIEW

Modification	Type	Description
FC-567	Major	Core Cooling Instrumentation
FC-722	Minor	Nitrogen Backup Supply to Several Valves
FC-731	Major	Reg. Guide 1.97 Transmitters
FC-732	Minor	Containment Hydrogen Monitors Containment Isolation Valve Logic
FC-756	Minor	HPSI Pump Recirculation Path Miniflow Orifice Bypass Valves
FC-760-02	Minor	Control Room Emergency Lighting
FC-789	Minor	Installation of New Bypass Low Flow Rate CV's in Parallel With Existing AFW Control Valves
FC-799	Major	Offsite Power Phase I - Repowering of Cooling Towers via the Installation/Hookup of Station Power Transformer 1-3
FC-811	Minor	Installation of SW Pump Instrumentation Phase I

ATTACHMENT C: PROCEDURE REVIEW

Procedure No.	Title	Revision
NODS-P08	Control of Modifications	18
3.07	Safety Evaluation	2
9.01	Request for Plant Modification	4
9.02	Facility Change - Major	5
9.03	Facility Change - Minor	5
9.04	Specification Changes	5
9.05	Modification Procedures and Construction Work Packages	6
9.11	Engineering Analysis	2
9.30	Q-List	5
13.01	Identification and Tracking of CCP Discrepancies	0
8303-501	Function Check Test-345 KV Switchyard Battery Chargers	0
8303-502	Preoperational Test - 4160V Busses 1F and 1G Breakers	0
AE-5	Basis Document for DC Lighting Test - Turbine, Auxiliary, Feedwater Purity and Service Buildings	1
AE-5A	Basis Document for Emergency Lighting Unit Duration Test and Circuit Adjustments	0
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