UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos. 50-259/88-04, 50-260/88-04, 50-296/88-04

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos. 50-259, 50-260, and 50-296

License Nos. DPR-33, DPR-52, and DPR-68

Facility Name: Browns Ferry Nuclear Plant

Inspection Conducted: February 1-29, 1988

Inspectors: A. H. Johnson for — 3/14/88
G. L. Paulk, Senior Resident Inspector — Date Signed

A. H. Johnson for — 3/14/88
C. R. Brooks, Resident Inspector — Date Signed

A. H. Johnson for — 3/14/88
E. F. Christnot, Resident Inspector — Date Signed

A. H. Johnson for — 3/14/88
W. C. Bearden, Resident Inspector — Date Signed

A. H. Johnson — 3/14/88
A. H. Johnson, Project Engineer — Date Signed

Approved by: A. J. Ignatonis — 3/22/88
A. J. Ignatonis, Section Chief, — Date Signed
Inspection Programs
TVA Projects Division

SUMMARY

Scope: This routine inspection was in the areas of operational safety, maintenance observation, surveillance testing observation, reportable occurrences, previous enforcement action, restart test program, employee concerns, design controls and quality surveillance report reviews.

Results: Two violations were identified: (1) two examples of inadequate procedures or failure to follow procedures for QA records preparation and workplan control, (2) failure to correctly translate the design basis into specifications and drawings.

REPORT DETAILS

1. Licensee Employees Contacted:

C. C. Mason, Senior Manager, Operations Center
H. G. Pomrehn, Site Director
*J. G. Walker, Plant Manager
P. J. Speidel, Project Engineer
*J. D. Martin, Assistant to the Plant Manager
*R. M. McKeon, Operations Superintendent
J. S. Olsen, Superintendent - Units 1 and 3
T. F. Ziegler, Superintendent - Maintenance
*D. C. Mims, Manager - Technical Services Supervisor
J. G. Turner, Manager - Site Quality Assurance
M. J. May, Manager - Site Licensing
*J. A. Savage, Compliance Supervisor
A. W. Sorrell, Site Radiological Control Superintendent
R. M. Tuttle, Site Security Manager
*L. E. Retzer, Fire Protection Supervisor
*H. J. Kuhnert, Office of Nuclear Power, Site Representative

Other licensee employees contacted included licensed reactor operators, auxiliary operators, craftsmen, technicians, public safety officers, quality assurance, design and engineering personnel.

*Attended exit interview

2. Exit Interview (30703)

The inspection scope and findings were summarized on February 26 and March 4, 1988 with the Plant Manager and Superintendents, and other members of his staff. New items identified:

a. Violation (259,260,296/88-04-02) Two examples for failure to follow procedures for QA records preparation and work plan control, paragraphs 5.a and 11.

b. Violation (259,260,296/88-04-03) Failure to correctly translate design requirements into drawings, paragraph 11.

c. Unresolved Item *(259,260,296/88-04-01) A problem with security administrative controls and documentation for out of service equipment, paragraph 5.a.

d. Inspector Followup Item (259,260,296/88-04-04) Single failure criteria involving emergency core cooling systems. Identified as part of restart test program.

*An Unresolved Item is a matter about which more information is required to determine whether it is acceptable or may involve a violation or deviation.

e. Inspector Followup Item (259,260,296/88-04-05) Diesel Generator field breaker sizing and excessive heat in DG panel. Identified as part of restart test program.

f. Inspector Followup Item (259,260,296/88-04-06) Filter capacitors missing from battery charger B.

The licensee acknowledged the findings and took no exceptions. The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspectors during this inspection.

Commissioners Carr and Bernthal made visits to the site during this report period. General discussions were held with TVA management and NRC staff.

3. Licensee Action on Previous Enforcement Matters (92702)

(CLOSED) Violation (259,260,296/84-15-08) This violation resulted from inspector review of plant drawings. The violation stated that Revision 2 to TVA drawing 47W847-10 was found in the Technical Support Center (TSC). However, the current revision at that time should have been Revision 3.

The out-of-date drawing was removed and the current revision of drawing 47W847-10 placed in the TSC. All Drawing Control Center issue clerks have been cautioned concerning the need for absolute accuracy in the drawing filing process. Additionally, the licensee is involved in an ongoing process of review and improvement of plant drawings including replacement of existing drawings with Configuration Control Drawings (CCDs).

The licensee has addressed the inspectors concern as stated in the original inspection report and corrective action should be adequate to preclude recurrence. This violation is closed.

4. Followup of Open Inspection Items (92701)

(CLOSED) Inspector Follow-Up Item (259/87-14-01) This item resulted from an inspector followup of an event which occurred during the performance of the monthly surveillance test on the 3 ED Diesel Generator (DG). Failure of the C phase fuse contacts in the DG exciter potential transformer circuitry resulted in initiation of Standby Gas Treatment, refueling zone isolation, control room emergency ventilation, Unit 3 half-scram, and primary containment isolation. The cause of the failure was the line side of the fuse stab for the C phase becoming worn making little or no contact. This condition resulted in arcing across the contacts, subsequent cable damage and phase-to-phase fault. Numerous components, wiring and cabinet structures were damaged and the DG was secured and made inoperable.

The licensee subsequently issued LER 87-08 which identified this failure and outlined the following corrective action:

- Inspection of Control Cabinets of remaining 7 DGs

- All 4160 volt potential transformer fuse contacts in plant to be inspected

- Maintenance procedures to be revised to require inspection and maintenance of all 4160 volt fuse contacts on regular basis

- Based on the results of an engineering evaluation which determined that these fuses were unnecessary, the fuse and spring finger contacts will be bypassed on all 8 DGs

The licensee's failure evaluation and assessment of generic ramifications associated with this event are adequate. This item is being closed and the implementation of the above corrective action will be tracked as part of the followup on LER 87-08. This item is closed.

(CLOSED) Unresolved Item (259,260,296/87-30-02) CREV Inoperable Due To Excessive Flow. This item was opened when the inspector noted that the licensee's original LER 87-14 was not adequate i.e., did not explain the problem with Control Room Emergency Ventilation or discuss safety consequences. Also missing were dates and times the equipment was inoperable.

Subsequent to this finding LER 259/87-14 Rev. 1 was issued. The inspector reviewed the newer revision to the LER and found it adequate, addressing the inspector concerns. Additionally, the inspector reviewed the licensee's evaluation of effects on 10 CFR 50 Appendix A, accident exposure limits which would have resulted from reduced filter efficiency. The LER will remain open pending further review by the staff; however, the inspector determined that the licensees evaluation was adequate for the purpose of closing this item. This item is closed.

5. Operational Safety (71707, 71710)

The inspectors were kept informed of the overall plant status and any significant safety matters related to plant operations. Daily discussions were held with plant management and various members of the plant operating staff.

The inspectors made routine visits to the control rooms when an inspector was on site. Observations included instrument readings, setpoints and recordings; status of operating systems; status and alignments of emergency standby systems; onsite and offsite emergency power sources available for automatic operation; purpose of temporary tags on equipment controls and switches; annunciator alarm status; adherence to procedures; adherence to limiting conditions for operations; nuclear instruments

operable; temporary alterations in effect; daily journals and logs; stack monitor recorder traces; and control room manning. This inspection activity also included numerous informal discussions with operators and their supervisors.

General plant tours were conducted on at least a weekly basis. Portions of the turbine building, each reactor building and outside areas were visited. Observations included valve positions and system alignment; snubber and hanger conditions; containment isolation alignments; instrument readings; housekeeping; proper power supply and breaker; alignments; radiation area controls; tag controls on equipment; work activities in progress; and radiation protection controls. Informal discussions were held with selected plant personnel in their functional areas during these tours.

In the course of the monthly activities, the inspectors included a review of the licensee's physical security program. The performance of various shifts of the security force was observed in the conduct of daily activities to include; protected and vital areas access controls, searching of personnel, packages and vehicles, badge issuance and retrieval, escorting of visitors, patrols and compensatory posts. In addition, the inspectors observed protected area lighting, protected and vital areas barrier integrity.

a. Security Concerns

During a routine tour on February 15, 1988, the inspector interviewed the secondary alarm station (SAS) watchstander regarding the operability of his closed-circuit television (CCTV) display screens. The screen for a certain camera was blank but no maintenance request (MR) sticker or deficiency tag was hung. The watchstander was unable to determine why the camera was out of service so he contacted the Central Alarm System (CAS). CAS personnel knew that the camera was out of service but they did not know which program controlled the work activity or when the camera could be expected to be available. The inspector was able to trace the work to Engineering Change Notice (ECN) 286 and Workplan 0017-86. Work started in July 1987, and the camera had been out of service since December 1987. The workplan had been bogged down with problems for some time and had recently been put on complete hold until a coordinating activity was completed. This was expected to keep the camera out of service until about June 1988. The inspector learned from the modification engineer that the camera could be restored to an operable status by simple tasks requiring only a few man-hours of work. After being asked for a re-evaluation of the situation, the licensee immediately implemented the necessary work and returned the camera to service on February 19, 1988. In following up on this activity the inspector categorized and reported his concerns to plant management as follows:

(1) There was a lack of aggressive action to restore security equipment to service. Equipment out of service necessitates some compensatory action. The number of compensatory measures on-site are excessive and each additional one adds to the overall vulnerability of the facility. This was a finding by the Regulatory Effectiveness Review (RER).

(2) There was a lack of understanding by some on shift security personnel of the status of security equipment. Although appropriate compensatory measures were in effect for the camera, at least one individual thought the camera was in service, one individual thought the camera could be turned on if needed and others didn't know the status of the camera at all.

(3) There was a lack of attention to detail in completing the programmatic paperwork associated with removal of security equipment from service. Individuals requesting removal of security equipment from service or degradation of a security barrier are required to fill out Form BF-117 as described in Standard Practice 11.5, Removal of Security Equipment From Service. A portion of this form is used to document any applicable compensatory measures and an approval signature is required from the security shift supervisor along with the time and date approval is given. The BF-117 form for removal of a certain camera did not have the required compensatory measures indicated nor was any signature obtained. This was also the case for approximately half of the active BF-117 forms reviewed. Another abuse of the form was the expected duration block. This block was listed as indefinite for the camera re-wiring work and several other jobs in progress as well.

(4) There was a lack of feedback to the security shift supervisor when jobs were completed which required removal of a security device from service or partial degradation of a security feature. This resulted in several BF-117 forms being maintained in an active status long after completion of the job. As an example, the BF-117 form for the opening of a vital area was initiated by the project engineer for the recirculation system safe-end replacement job. Authorization was requested for the duration of the safe-end replacement; however, this job had been finished for about nine months.

(5) An attitude existed among security shift personnel such that they "lived with" a recurring equipment deficiency as opposed to pursuing a permanent repair. There was an additional attitude among the maintenance personnel responsible for security equipment such that they failed to believe a problem existed. The inspector witnessed such a problem on a camera on

February 15, 1988. The picture gradually lost focus until the picture was lost and replaced by a pattern of bars for a brief period of time and then the picture returned. This cycle repeated itself several times while the inspector was interviewing the SAS watchstander. The SAS watch was completely unaware of why the camera performed in that manner. Watchstanders in the CAS; however, were very familiar with the problem and indicated that it was a common problem among some specific cameras not restricted to just a certain camera. It was termed "crow-barring" and was apparently caused by a problem with the automatic iris adjustment. Maintenance personnel were initially unfamiliar with a description of the problem and after a short period of evaluation concluded that the problem only exhibited itself during certain times of the day. This explanation was rejected by the inspector since the problem was witnessed on an overcast day in the morning. The inspector requested a further evaluation of the problem.

It should be noted that throughout this review, appropriate compensatory measures were being maintained when required. The problem was with the administrative controls and documentation which were established in order to assure appropriate control was maintained. The number and characterization of findings in this area indicate a definite potential for an actual breakdown in compensatory measures to occur. These findings will be tracked as an Unresolved Item (259,260,296/88-04-01) for failure to adhere to security procedures pending a followup inspection by Region II Security Inspectors.

One additional problem outside the security organizations responsibility was noted during this review. The workplan control form (Form BF-62) for workplan WP0017-86, Cable Pull and Camera Support for Permanent Power Installation, was not properly completed. Step IV.B required a check on whether any plant equipment is to be removed from service by the workplan and Step XI required the Shift Engineer to give permission to take any equipment out of service. The workplan did not specify that the security CCTV's would be taken out of service nor was the shift engineer's permission obtained. This deficiency was discussed with the plant management and modifications representatives as an example of a violation for failure to adhere to procedures (259,260,296/88-04-02).

b. Operator Logs

The quality of Reactor Operator logs was discussed with plant management personnel on February 19, 1988. The need for continuing oversight by operations supervisors was stressed. Some logs continue to have legibility problems and even logs that are legible are sometimes unintrepretable even by personnel with a good understanding

of plant equipment, programs, and procedures. Entries are made which identify a procedure in progress by number without stating the title of the procedure so that proper documentation of the activity is made. Many abbreviations, acronyms and initialisms are used without a list of such approved shortcuts. Carbon copies are maintained in the control room logbook while original sheets are routed for review. All of these factors make it difficult to interpret activities performed during the shift without asking for a line-by-line interpretation by the operator on-shift. Another recurring deficiency was the use of a temporary "scratch pads" by the unit operators. Contemporaneous log entries are not made at the time of an occurrence. Operators make entries on a temporary scratch pad during the shift and then at some point prior to shift turnover transfer these entries into the official log. This process lends itself to potential abuse in that a temptation exists that embarrassing or sensitive entries may not be transferred to the legal logbook. Guidance as contained in Standard Practice 12.24, Conduct of Operations, was found to be confusing. In one portion the Standard Practice reads:

> "Logs are legal records and shall be kept in a neat, legible manner. All entries shall be made at the time indicated on the log. If any log readings are missed, the reason shall be stated on the log. Write-overs, white-out, or erasures shall not be allowed on any station logs. Mistakes shall be crossed out with a single line, initialed and dated by the person maintaining the log. All log entries, as well as other documentation, signatures and initials shall be made in black ink only. All log entries (Shift Engineer, Unit Operator or Radwaste Logs) must be written clearly, precisely and completely. The log books are an official record and as such all entries should be thought out as to understanding of an event and future readability by others. The records of events must be documented to the fullest extent".

Another section of the Standard Practice; however, reads:

> "Log Books, Charts, Turnover Sheets, etc. are official records and mirror the conduct of the operations at Browns Ferry. They must be maintained in a professional manner. Continuity of log entries, specifically systems logged out of service and entries identifying problems, must be maintained. To this end, operators are encouraged to maintain "scratch pads" to maintain records of out-of-service equipment and eturn to service for subsequent entry into the logs. The scratch pads may be destroyed after use. Formal logs are to be maintained as up to date as practical during the shift."

Section 4.1 of the Nuclear Quality Assurance Manual, Part III contains the licensee's requirements for permanent QA records. Paragraph 6.1 states that written instructions that cover QA records preparation shall include requirements to ensure that QA records are complete, legible, and in black ink or other permanent medium. An exception is allowed to the permanent medium requirement which allows some documents to be prepared in a nonpermanent medium. The document must be converted to a permanent medium prior to final approval and the nonpermanent document must remain under the control and responsibility of the supervisor who gives final approval of the document. Standard Practice 12.24 does not contain any control measures over the nonpermanent scratch-pad. This is a violation of 10 CFR 50 Appendix B, Criterion V for failure to have an adequate procedure for preparation of operating logs (259,260,296/88-04-02).

c. Posting of Notices and Information to Workers

The inspector verified posting of information as required by the Nuclear Regulatory Commission was met in accordance with 10 CFR 19, 10 CFR 20, and 10 CFR 21. The Browns Ferry Site Director Standard Practice 2.3 delineates posting requirements as specified in the Code of Federal Regulations.

The following deficiencies were noted:

(1) The Notice to Employees (Attachment 1) of SDSP 2.3 references employees to use of the Nuclear Safety Review Staff (NSRS) for employee concerns not able to be handled through line management. This attachment should be updated since the NSRS no longer exists.

(2) The annual summary of work injuries and illnesses was not posted by February 1 as required by SDSP 2.3. Additionally errors exist on the location where posted column of SDSP 2.3 in that new areas for posting have been selected without updating the procedure.

(3) Documents required for posting by the 10 CFR 19, 20, and 21 cannot be examined at the location given in SDSP 2.3. Corrections to the procedure should be made to correct these location errors.

Upon notification by the inspector the licensee took corrective action to address these deficiencies.

d. The inspectors audited a training course conducted by Westinghouse for Operations Department personnel entitled "Conduct of Operations". The goal of the class was to increase awareness of the importance of

conducting Browns Ferry Station operations in an attentive, diligent and conscientious manner. The concept of professionalism was discussed throughout the session. Events in other industries including airlines, railroads, shipping and chemical plants were assessed and operator errors which contributed to those events were discussed. The Chernobyl event was discussed in detail. Barrier analysis was used to analyze these events with emphasis on operator performance in event mitigation. The course was very well received by the attendees and was considered to be outstanding.

6. Maintenance Observation (62703)

Plant maintenance activities of selected safety-related systems and components were observed/reviewed to ascertain that they were conducted in accordance with requirements. The following items were considered during this review: the limiting conditions for operations were met; activities were accomplished using approved procedures; functional testing and/or calibrations were performed prior to returning components or system to service; quality control records were maintained; activities were accomplished by qualified personnel; parts and materials used were properly certified; proper tagout clearance procedures were adhered to; Technical Specification adherence; and radiological controls were implemented as required.

Maintenance requests were reviewed to determine status of outstanding jobs and to assure that priority was assigned to safety-related equipment maintenance which might affect plant safety. The inspectors observed the below listed maintenance activities during this report period:

a. RHRSW Coupling Replacements

b. 3A Diesel Generator Yearly Inspection

In response to an inspector concern raised at an NRC daily management meeting on February 7, 1986, the licensee has completed an inspection and evaluation of a structural crack noted in the plant off-gas stack. TVA engineers conducted a physical/visual survey of the off-gas stack's exterior and all accessible interior surfaces. The survey of the exterior surfaces (from the base to the first platform, first platform to the second platform and so on), was conducted on December 11, 1987, and the accessible interior surfaces on December 14, 1987. The results/findings of this survey are documented in BFEPC1 Calculation No. CD-Q0066-871856, showing all surface cracks visually identified and located in plans and developed elevations of the stack.

TVA's conclusion was that the cracks are not evidence of a structural defect. The cracks are minimum (mostly hairline) in size, no concrete spalling and no stain found in cracks to signify rusting of rebars. It

was TVA's judgement that the most probable cause of these surface cracks would be the temperature variation that the stack has been exposed to since construction. Browns Ferry Engineering Project considers this effort complete and the subject closed/dispositioned.

No violations or deviations were observed in this area.

7. Surveillance Testing Observation (61726)

The inspectors observed and/or reviewed the below listed surveillance procedures. The inspection consisted of a review of the procedures for technical adequacy, conformance to technical specifications, verification of test instrument calibration, observation on the conduct of the test, removal from service and return to service of the system, a review of test data, limiting condition for operation met, testing accomplished by qualified personnel, and that the surveillance was completed at the required frequency.

During a review of Surveillance Instruction 4.7.F.3 for the SI upgrade program, the licensee noticed that the corresponding technical specification (4.7.F.2.6) required cold DOP for in-place leak testing of HEPA filters. It was thought that the test method in use since 1976 was a hot DOP test. As a result the licensee declared the Standby Gas Treatment System inoperable as well as the Primary Containment Purge and Control Room Emergency Ventilation Systems which have similar testing requirements. After further review the licensee now considers its test method to comply with the cold DOP test requirement but no explicit definition of a hot versus cold DOP test can be found. System operability was reinstated. To avoid a future misunderstanding, the licensee intends to submit a technical specification change to clarify the required testing method.

8. Quality Surveillance Report Reviews (40704)

The licensee program of quality surveillance survey results was reviewed by the inspector to assure proper review adequacy, quality assurance program satisfactorily implemented, and quality control program surveys conducted in accordance with procedures. The following quality surveillance section results were reviewed:

a. Restart Test Program - QBF-S-88-0074

b. Power Stores Package Searches - QBF-S-88-0057

c. Quality Requirements for 1/4 inch and smaller OD tubing - QBF-S-88-0032

d. Purchase Orders/Specifications-QBF-S-88-0086

e. Grouting and Dry - Packing of Base Plate and Joints - QBF-S--99-0063

f. Radiological Emergency Plan Training: Operations Support Center Staff - QBF-S-88-0063

g. NRC Commitment Verification - QBF-S-88-0067

h. NRC Bulletin 79-14 Phase II Walkdown-QBF-S-88-0076

i. Condenser Tube Pullout - QBF-S-88-0058

The surveys reviewed were thorough and noted significant deficiencies that required correction. The surveys adequately addressed the QA and programmatic requirements. No concerns were noted.

9. Reportable Occurrences (90712, 92700)

The below listed licensee events reports (LERs) were reviewed to determine if the information provided met NRC requirements. The determination included: adequacy of event description, verification of compliance with technical specifications and regulatory requirements, corrective action taken, existence of potential generic problems, reporting requirements satisfied, and the relative safety significance of each event. The following licensee event reports are closed:

LER No.	Date	Event
259/84-23 Rev. 1	5/18/84	Primary Containment Isolation System Initiation
259/85-49 and Rev. 1	6/23/85	Inoperability of Diesel Generators Because of Seismically Unqualified Battery Racks
259/87-01 and Rev. 1	1/28/87	Personnel Errors Cause Fire Watch Violations
259/87-12 and Rev. 1	5/6/87	Inadequate Maintenance Procedure Cause Breaker Failure to Close and Engineered Safety Actuation
259/87-23	8/26/87	Personnel Error Results in Unrepresentative Radiological Release Assessment Data

LER No.	Date	Event
259/87-29	11/5/87	Personnel Error in Writing Equipment Tag-Out Clearance Results in Actuations of Engineered Safety Features
296/87-04	10/13/87	Diesel Generator 3EB Start Due to Personnel Error During Maintenance
296/87-05	10/19/87	Unplanned Diesel Generator Start Due to Relay Failure
296/87-06	11/24/87	Unplanned Engineering Safety Features Actuations Due to Relay Failure and Personnel Error During Corrective Maintenance

During replacement of a failed relay (LER 259/84-23) an adjacent wire came loose and caused primary containment isolation system isolations on Unit 2. The wire had been incorrectly terminated. The wiring on Units 2 and 3 were inspected and Unit 3 was found to have similar problems. The incorrect termination on Unit 3 was determined to be the result of two field changes. The wiring was corrected through engineering change notice P5135 and workplan 3048-84.

During a post maintenance review of a maintenance request to repair the diesel generator battery rack studs (LER 259/85-49) it was determined the wrong stud material was used during the 1976 and 1980 installation of studs for the new battery racks. All the diesel generator battery rack studs were replaced with certified studs and seismic qualification was restored by workplan 1224-85 and 3054-85.

A fire watch was not posted (LER 259/87-01) in the area of the diesel generator building when portions of a fire protection system was isolated and an individual (fire watch) reported to the wrong cable spreading room. The plant fire protection unit developed a listing of areas requiring fire watches and the reasons for them. The listing will be routinely updated and maintained in the shift engineer's office. A fire protection engineer has been placed on the call out list.

During transfer of a shutdown bus to its alternate power supply, the alternate power supply failed to close the breaker, causing the engineered safety feature actuation (LER 259/87-12). An inspection of the breaker found grease and dirt buildup on the control cell linkage which prevented

proper breaker operation. The control cell linkages on the four kilovolt plant breakers were inspected and cleaned. Procedure BF EMI-7, Maintenance of Medium and Low Voltage Switchgear was revised to include cleaning of suspect parts.

The composite portion for the month of August 1987, was inadvertently disposed of which resulted in an unrepresentative quarterly sample for radiological release assessment data for the third quarter of 1987 (LER 259/87-23). The surveillance instruction was revised to emphasize labelling and storage of samples.

A fuse was removed from a panel in order to deenergize a primary containment isolation valve modifications activities which resulted in engineered safety features actuations (LER 259/87-29). The switching necessary to electrically isolate the valve was inadequate during preparation of the clearance. The individuals involved were cautioned and a critique of the incident was reviewed by operations personnel.

On November 24, 1987, control room personnel observed the B train of the CREV system to be running from an auto start signal (LER 259/87-30). Investigation by electrical maintenance personnel revealed that a burned electrical relay caused the auto start. The relay coil was assessed as an end-of-life failure failure and was replaced.

During the performance of maintenance on the 3EB diesel generator an electrician accidently shorted the auto start relay, while connecting an oscilloscope, which caused an auto start (LER 296/87-04). The personnel involved were critiqued on the event and all electrical technicians reviewed and signed the critique on November 30, 1987.

After completing a degraded logic test on a 4160 volt shutdown board the 3D diesel generator received an auto start signal (LER 296/87-05) an investigation revealed two failed voltage relays that caused the auto start signal which were monitoring the shutdown board. The failed relays were replaced and the logic test was rerun.

On November 22, 1987, the Unit 3 inboard containment isolation valves were automatically closed due to a failed relay coil in the primary containment isolation system. On November 24, 1987, during replacement of the failed relay coil the electrical jumper used was inadvertently dislodged by maintenance personnel (LER 296/87-06). Corrective maintenance was completed and the systems were returned to normal.

The following licensee event reports were reviewed and remain open pending further review:

LER No.	DATE	EVENT
259/85-51	9/25/85	Deteriorated Cable in Reactor Protection System

LER No.	DATE	EVENT
296/83-47 and Rev. 1	7/30/83	Seal Flow Through RHR Seal Cooler Less Than Required Minimum Flow Rate
296/86-08	9/5/86	Shorted Generator Coil Reduces RHR Capability

No violations or deviations were observed in this area.

10. Employee Concerns (Allegation)

The inspector reviewed an employee concern involving soldering identified as employee concern ECP-87-BF-B97-01. This concern was initially identified by a TVA instrument technician assigned to the Browns Ferry (BFN) Instrument Shop and a copy of the concern was sent to the Region II office in June 1987. The specific concern involved soldering performed by a vendor on solid state electronic cards used in the neutron monitoring system which initiates scrams and rod blocks. The inspector was informed by BFN personnel that the electronic cards were received from General Electric (GE) on site for a modification (mod) and the mod was installed in 1983. Under a seven (7) power microscope the inspector observed an electronic card similar to the cards used for the mod. The soldering contacts on the pins of chips and operation amplifiers (Op Amps) appeared contaminated, i.e. poor pre-soldering clearing and/or post soldering cleaning, and discontinuing, i.e. sometimes referred to as "cold solder joints", where there are gaps between the pins and the solder. The technician informed the inspector that these problems were identified on nine of eleven Thermo Trip Cards and on nine of nine Direct Currect (DC) amplifier cards, all used in Unit 2. The technician also stated that the I&C shop personnel were making repairs to the Thermo Trip Cards and DC amplifier cards in the I&C shop until they were instructed to return all cards to power stores. The employee concerns representative indicated that the soldering specification may or may not have been stipulated in the procurement process used for the modification. The employee referenced several military specifications as possible soldering standards. This item will remain open and tracked as an allegation.

11. Design Control (37702)

On January 27, 1988, the licensee made a non-emergency report per 10 CFR 50.72 for an unanalyzed condition outside the design basis of the plant. The finding concerned the seismic qualification of Emergency Equipment Cooling Water (EECW) and Residual Heat Removal Service Water (RHRSW) buried piping where the piping exits and enters building structures. Appendix C, Section C.2.1 of the FSAR describes this feature as follows.

Class I buried piping, at penetrations into secondary containment and at entry points into the intake structure, is protected from differential

movement of the soil and structure by a guard box and flexible joints. The guard box is supported by, and moves with, the soil. One open end butts against, but is not connected to, the building. Large pipes which may be overstressed by the differential movement of the structure and the soil-bearing end of the guard box are provided with two flexible couplings. One coupling is located near the structure and one near the soil-bearing end of the guard box. The guard pipe provides adequate clearance to permit one joint to move with the structure and one with the soil, without contacting the pipe.

Analyses of seismically-induced soil motions on Class I buried piping were made, and the seismic stresses were determined to be small. Therefore, differential movement at support points, at containment penetrations, and at entry points into other structures is the primary concern in designing buried piping at the Browns Ferry Nuclear Plant.

In October 1986, the licensee discovered that the function of some of the flexible (Dresser) couplings had been defeated at some time in the past. Tie-rod harnesses were installed across the couplings on the B RHRSW and EECW piping at the intake structure. These harnesses were apparently installed in order to provide additional axial support for the coupling. Since no drawings could be found which showed the harnesses, the Division of Nuclear Engineering (DNE) was asked to evaluate the as-found condition and provide the necessary design information in order to repair some of the tie-rods which were found damaged. DNE responded that the harnesses were not required and could either be repaired or removed at the option of the plant maintenance organization.

About a year later, during preparation for a hydrostatic test in June 1987, similar damage was found on tie-rods and lugs on harnesses on the A RHRSW couplings. The tie-rods were removed from these couplings prior to the hydrostatic test. Later, while the system was being brought up to hydrostatic test pressure, the coupling failed due to the excessive axial load at about normal system pressure. This failure was aided by the fact that a hanger (M-30) near the coupling had been previously removed. It was later determined that this M-30 hanger was underdesigned for the expected axial loading during a seismic event.

In December 1987, a Condition Adverse to Quality Report (CAQR-871126) was written which concluded that the original design intent as stated in the FSAR had been defeated by the use of harnesses which did not preserve the required flexibility of the Dresser coupling. As a result of the rigid connection, relative movement between the building and buried piping as would occur during a seismic event, would produce loads far greater than the components were designed to withstand. A loss of both the EECW and RHRSW systems could occur during a seismic event. One problem with this CAQR noted by the inspector was that the check on potential affect on operability of the nuclear plant was marked "no". Justification for this

conclusion was contained on the CAQR continuation sheet which simply stated that it hao been determined that the adverse condition would not prevent EECW/RHRSW from performing as designed; therefore, operability was not affected. This was contradictory with the CAQR paragraphs.

The subsequent red-phone report was prompted by maintenance and technical support personnel review of the preliminary design change to the Dresser coupling. The design was so radically different from the previous design that a question of operability of the original design and as-found condition was raised. A high level management review team was assembled to evaluate the ramifications of the findings and immediate work was started to cut out eight of the Dresser couplings and replace them with rigid welds. Although an in-depth analysis is still underway by the licensee, the following deficiencies are currently known:

(1) Hanger M-30 which provides the only axial restraint for the couplings in question was significantly underdesigned and could not withstand the thrust load. An analysis determined that the hanger would bend and deflect out of position during a seismic event. This would allow the coupling (without the tie-rod harness) to spring apart and fail the pressure boundary of the coupling.

(2) The original design function of the Dresser coupling was defeated at some point by the installation of tie-rod harnesses. No design analysis was performed to justify this modification. The harnesses were probably installed in 1973 time frame in order to maintain the coupling integrity during water hammer events which were common at that time. A recent analysis showed that the harnesses were underdesigned for the required load.

(3) The design evaluation of the as-found condition of the couplings in October 1986 was erroneous. This evaluation, contained in a memorandum from S. R. Lawson to R. H. Wall dated 10/30/86, concluded that the M-30 hanger provided the necessary axial restraint that the Dresser coupling lacked and therefore the tie-rod harnesses could be eliminated.

The safety significance of these findings are still under evaluation by the licensee. At a minimum, a seismic event would have resulted in a degradation of the RHRSW and EECW available due to a loss of the coupling integrity. At the most, a complete loss of the Ultimate Heat Sink (UHS) would have resulted. This is a violation of the Design Control requirements of 10 CFR 50, Appendix B (259,260,296/88-04-03). Although the problem was identified by the licensee it is considered a self-disclosing violation in that a failure of the coupling had to occur during a hydrostatic test to force full reconciliation of the deficiency. The opportunity existed in October of 1986 to fully evaluate the problem but a perfunctory analysis failed to correct the design deficiency.

During a review of the documentation associated with this problem the inspector noted that delinquent reviews were performed on the hydrostatic test data on the RHRSW system. SI 3.3.13.A.2, ASME Section XI Hydrostatic Pressure Testing of the RHRSW System Buried Piping, which was performed on July 30, 1987, did not pass the acceptance criteria due to the failed Dresser coupling. The Shift Engineer did not review the data to determine if an LCO was violated until November 25, 1987. The results were not reviewed by the Mechanical Engineer until November 30, 1987, and the Cognizant Engineer did not review the data until February 18, 1988. For the next trial of SI 3.3.13.A.2 performed on October 31, 1987, most of the reviews were more timely; however, the data sheet did not specify that the acceptance criteria was not satisfied nor was the Shift Engineer's signature obtained to document that a review for an LCO violation had occurred. These deficiencies were discussed with plant management as further problems with attention to detail and meticulous compliance with procedures. Similar examples of nine delinquent reviews had been identified by the licensee and documented in CAQR 880102.

12. Restart Test Program

a. Restart Testing Status

The inspector attended RTP status meetings, reviewed RTP test procedures, observed RTP tests and associated tests performances, and reviewed selected RTP test results. The following specific RTP activities and associated activities were monitored during this reporting period:

(1) RTP-002, Condensate, The system was released for testing by the Joint Test Group on February 23. A special test (ST-99 Condensate Demineralizer) is in progress which involves the condensate polishers clean and precoat sequence and is being conducted under the chemistry departments responsibility.

(2) RTP-023, Residual Heat Removal Service Water (RHRSW), The system is being impacted by the header outages due to the Dresser couplings. Several Maintenance Requests, Hold Orders and Design Change Notices are outstanding as well as hydrostatic tests completions.

(3) RTP-024, Raw Cooling Water (RCW), The system is being restrained somewhat by repairs required to 2A and 2B RCW pumps, time delay relays and various system valves. The system is also impacted by the Emergency Equipment Cooling Water (System 067) header outages.

(4) RTP-030, Diesel Generator and Reactor Building Ventilation (DG & RX BLDG VENT.), Section 5.1, DG Building Ventilation Flow

Verification Units 1,2, & 3 was performed during this reporting period; however, initial review of data indicates a possible retest of some of the twenty-six fans involved in this section of the test may be required.

(5) RTP-031, Control Building Heating Ventilation and Air Conditioning (Cont. Bldg HVAC), The actual restart test procedure is still in the draft stage. However, primary activities are in process which includes repairs to a tear in ductwork and the installation of ductwork, conduit and cable seals. Both of these are being worked partly under Engineering Change Notices 0031A and P0647 respectively. Restart test procedure performance is scheduled to start on March 29.

(6) RTP-057-4, 480 Volt Distribution System (480 V Dist.), The system is closely related to system 82 standby Diesel Generators (DG) in that load shedding verification is performed in conjunction with DG load acceptance test. Logic function tests are performed to plant procedures such as SMI-1-48SD.

(7) RTP-057-5 4.16 KV Distribution System (4 KV DIST.), The system is also closely related to the DGs and has been identified as system necessary to support Loss of Power/Loss of Coolant Accident (LOP/LOCA). A schedule for the performance of procedures (Logic functions, etc.) indicates that the 4.16 KV shutdown boards will be completed prior to the associated DG Low Acceptance test. Plans are in place to perform a battery discharge (ampere hour) test when the 4.16 KV Shutdown Board 3EB is out of service for functional testing and maintenance.

(8) RTP-057-7, 250 VOLT DC Shutdown Board Battery Chargers (250 VDC S/D Batt.), The system has received upper management attention through the Restart Operations Center (War Room) and every effort is being made to complete the RTP no later than March 6. The major hold ups for the test has been a lack of material (filter capacitors) and craft support.

(9) RTP-065, Standby Gas Treatment (SGTS), The system is under test not only to support LOP/LOCA, but also to establish secondary containment for the fuel reconstitution. Several dampers have not satisfied the time to close test specification, but also some dampers have been disabled by linkages and motors removed and did not function when initiation signals were present.

(10) RTP-067, Emergency Equipment Cooling Water (EECW), The system is affected by the Dresser coupling issue due to header outages to remove selected couplings. Preparations were being made to hydrostatic test the system once the couplings were removed and replaced by welds.

(11) RTP-070, Reactor Building Closed Cooling Water (RBCCW), The system is in the pre-test stage with ASME Section 11, Hydrostatic tests in progress and Mechanical Testing group is performing 10 CFR 50, Appendix "J" tests, i.e, local leak rate tests. The system is scheduled for restart test release the first week of March, 1988.

(12) RTP-075, Core Spray (CS), The system has successfully tested section 5.7, Local Operation of 2A, 2B, 2C and 2D core spray pumps. Several ECNs, MRs and Surveillance Instruction updates are being processed to support completion of the test.

(13) RTP-082, Standby Diesel Generators (STDBY DG), Several load acceptance tests on the eight (8) DGs have been performed. Two of Unit 3 DGs require degraded voltage tests and are scheduled to be performed during the monthly SIs. Additional special testing involving the DGs speed governors and voltage regulators are scheduled for March, 1988. This special test will involve direct vendor input with DNE supplying the test methodology. The RTP will be revised to reflect this test.

b. Design Deficiencies Identified By RTP

(1) Systems 57-3, 250 Volt DC Distribution and 57-4, 480 Volt AC Distribution

During a review of subsystem 280, Battery Boards and subsystem 231, 480 Volt AC shutdown boards by a system engineer in January of 1987, in preparation for the restart test the following was discovered:

(a) The loss of 250 Volt DC Battery Board #1 would cause a loss of 480 V load shed logic signals to 480 V shutdown boards 1A & 1B.

(b) The loss of Battery Board #1 would cause a loss of Safety Divison II core spray logic.

The above condition was determined by the licensee as a breach in single failure criteria and documented by CAQR's. This item is identified as an Inspector Followup Item (259,260,296/88-04-04).

(2) System 82, Diesel Generators (DGs)

The DGs are designed for 3050 KW for 1/2 hour, 2950 KW for seven (7) days and 2850 KW indefinite. The RTP calls for a 24 hour fuel consumption run with the first 2 hours @ 2950 KW and the

next 22 hours @ 2850 KW. During the fuel consumption run the field breaker for the generator tripped shortly after the test was started while the DG was @ 2950 KW. This has been attributed to the following:

(a) The field amperage is undersized @ 100 amps and a DCN No. 3532 has been issued to upgrade the capacity to 125 amps.

(b) The control cabinets where the breakers are located have too high of an internal temperature and a DCN No. 3531 has been issued to add ventilation louvers to the cabinets. This item is identified as an Inspector Followup Item (259,260,296/88-04-05).

(3) System 32, Control Air System

During the test of drywell control air suction valves FCV-32-62 & 63, the cylinder operated valves failed to close on loss of power to the solenoid valve and upon loss of control air as required by the Safety Design Basis contained in the FSAR. This item was previously identified in NRC Report (259,260,296/87--33).

(4) System 57-7, 250 Volt DC Shutdown Batteries

The filter capacitors in the battery charges did not pass the ripple voltage tests. All capacitors are being changed and as of the end of this reporting period, Charger A has new capacitors, successfully passed the ripple voltage test and is back in service. The restart test and system engineering personnel shifted to Charger B for the next ripple test. However, when maintenance removed the cover of the B Charger the filter capacitors were missing. This item is identified as an Inspector Followup Item (259,260,296/88-04-06).

c. Deficiencies Identified By RTP That Are Under Review

(1) System 82, Diesel Generators (DGs)

The RTP requirement is that a seven (7) day supply of diesel fuel oil be available for three (3) DGs. The fuel oil transfer pump that may be called upon is supplied from a 1E source; however, it must be primed from service air, which is not a system important to safety.

(2) System 82, Diesel Generators (DG)

During the paralleling of the Unit 1/2 DGs with the Unit 3 DGs the KVAR sharing was not present. It was initially determined that this may be a wiring error; however, further evaluation is ongoing.

(3) System 65, Standby Gas Treatment (SBGT)

During the performance of an ANSI required test the phase to phase current readings for the relative humidity heater were greater than the 5 percent relationship required by the ANSI Standard. N510-1975, Section 14.2.3.

(4) System 23, Sump Level Switches

The RHR service water building sump level switches cannot be adjusted to meet the high level pump start requirement and the requirement has no band.