TENNESSEE VALLEY AUTHORITY
NUCLEAR POWER

OPERATIONAL READINESS REVIEW
PHASE TWO REPORT
BROWNS FERRY UNIT TWO

OPERATIONAL READINESS REVIEW TEAM

MARCH 9, 1990

TVA 64 (OS-9-65) (OP-WP-5-85)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : O. D. Kingsley, Senior Vice President, Nuclear Power, LP 6N 38A-C

FROM : Operational Readiness Review Team, Browns Ferry Nuclear Plant

DATE : March 9, 1990

SUBJECT: BROWNS FERRY NUCLEAR PLANT UNIT 2 (BFN-2), OPERATIONAL READINESS REVIEW REPORT

The Operational Readiness Review (ORR) team was formed at your direction on May 1, 1989. As requested, the team conducted a two phase assessment of the qualification and motivation of personnel at BFN Unit 2 and the availability of necessary supporting resources for the safe and reliable testing, operation, and maintenance of Unit 2 for startup. This initial phase was completed and an interim report issued on June 9, 1989. The second phase was planned to be conducted by the team closer to restart when the effectiveness of the numerous actions underway by BFN could be more completely assessed.

The second ORR review was conducted over a four week period, beginning February 5, 1990, using methods similar to previous ORR reviews. The eight members of the team provided a broad base of nuclear plant operating and management experience. Seven of the eight team members were on the initial BFN ORR team. Numerous plant observations were conducted, simulator training was observed and interviews were held with many key personnel. These interviews and observations, together with the associated document reviews, provided sufficient basis for the concerns identified in the report of this second phase review, which is attached.

The ORR team recognizes the limitations under which this review was conducted relative to the status of ongoing major plant modifications and the absence of fuel from the reactor. However, by having made a similar review in May 1989, the team was able to judge the progress in overall readiness. The ORR Team concludes that with the programmatic control systems in place and subject to satisfactory resolution of identified and emergent items, BFN can safely resume Unit 2 nuclear operations.

The team does recommend that a short, independent review of operations and work control, including integration of the planned automated maintenance system, be performed after fuel load and when startup training is nearing completion. Such a review will provide for a final assessment of the effectiveness of those improvement activities which cannot be fully evaluated in the current environment.

O. D. Kingsley
March 9, 1990

BROWNS FERRY NUCLEAR PLANT UNIT 2 (BFN-2), OPERATIONAL READINESS REVIEW (ORR) REPORT

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ORR:GMF
Attachment

TENNESSEE VALLEY AUTHORITY

NUCLEAR POWER

REPORT OF

OPERATIONAL READINESS REVIEW

PHASE TWO

BROWNS FERRY UNIT TWO

OPERATIONAL READINESS REVIEW TEAM

March 9, 1990

OPERATIONAL READINESS REVIEW REPORT

TABLE OF CONTENTS

SUMMARY

Synopsis:

The Operational Readiness Review (ORR) Team was formed by the Senior Vice President, Nuclear Power, to assess, prior to restart, the qualification and motivation of personnel at the Browns Ferry Nuclear Plant (BFN) and the availability of necessary supporting resources for the safe and reliable testing, operations, and maintenance of unit 2. The review was to be performed in two phases: the first, a bounding review and the second, to make a final assessment of readiness.

The ORR Team interim (phase one) findings were contained in a report dated June 9, 1989 which was forwarded to the Senior Vice President, Nuclear Power, by memorandum dated June 9, 1989.

The phase two ORR Team findings are presented in this report. Comments where appropriate are included on the BFN response to the Senior Vice President, Nuclear Power, on the June 1989 ORR Team interim report. In addition, Appendix A to the report provides minor additional notes on the BFN response.

The ORR Team observed both areas of improvement and areas of concern. The concerns are detailed in this report. The more significant improvements and areas of concern are summarized below.

Areas of Improvement

- Management direction and control continue to improve including increasing visibility at the working level where attitudes and morale are generally better.
- The continuing efforts to improve the area of operations is apparent. Programmatic controls are generally in place and are resulting in improvements.
- Radiological controls continue to be satisfactory to support startup.
- As low as reasonably achievable (ALARA) awareness training has been instituted and is in progress.
- Chemistry programs are in place to support restart. Installation of on-line chemistry monitoring equipment was nearing completion.
- The plant is nearing online use of a new work control program, "MPAC," which should improve capabilities for maintenance planning.
- Operators are receptive to the applicability of lessons learned from other TVA plants and nuclear industry events.
- Investigations of abnormal events have improved.

Significant Concerns

- Inconsistencies existed in achieving the standards of performance expected by senior site and plant management.
- The plant shutdown and cooldown procedures may place undue burden on operators to avoid an inadvertent criticality.
- Some preventive maintenance activities have been deferred without adequate technical justification.
- Technical issues were not always pursued aggressively in sufficient depth.
- Quality of procedures, although improved, was still hindering proper work completion and efficient performance.
- Rigorous attention to operational details was sometimes lacking.
- Full advantage was not being obtained from simulator training to ensure operator readiness for restart.
- Training effectiveness has been impacted by poor communications among line organizations and the training organization.
- Maintenance planning and work practices need continuing attention to achieve the performance standards that BFN management expects.
- Occupational Safety practices and conditions need significant improvement to achieve industry standards.

ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
ASOS	Assistant Shift Operating Supervisor
AUO	Assistant Unit Operator
BFN	Browns Ferry Nuclear Plant
BWR	Boiling Water Reactor
CI	Chemistry Instruction
CSSC	Critical Systems, Structures and Components
ECP	Estimated Critical Position
GE	General Electric Company
GOI	General Operating Instruction
HCU	Hydraulic Control Unit
HPCI	High Pressure Coolant Injection
INPO	Institute of Nuclear Power Operations
MMI	Mechanical Maintenance Instruction
MR	Maintenance Request
N/A	Not Applicable
NE	Nuclear Engineering
NRC	Nuclear Regulatory Commission
ORR	Operational Readiness Review
OSHA	Occupational Safety and Health Administration
OSIL	Operations Section Instruction Letter
PM	Preventive Maintenance
PMT	Post Maintenance Testing
RHR	Residual Heat Removal
RVWL	Reactor Vessel Water Level
SDSP	Site Directors Standard Practice
SI	Surveillance Instruction
SIL	Service Information Letter
SOS	Shift Operating Supervisor
TVA	Tennessee Valley Authority
UO	Unit Operator

A. Inconsistent Attainment of Expected Standards of Excellence

1. Concern

Inconsistencies existed in the degree to which high standards of excellence were being achieved.

2. Basis

a. Some shift turnover meetings were conducted very well with clear, loud announcements and with participation encouraged. Others, while covering the required subjects, did so in such a pro forma, low key manner that a clear understanding of material presented was not assured.

b. Performance of personnel in the Shift Operations Supervisor (SOS) and Assistant Shift Operations Supervisor (ASOS) positions during the simulator exercises indicated widely varying standards. More detail is provided in another concern (Item # F) on Simulator Training within this report. In general, those not assigned regular shift positions were less rigorous than the regularly assigned crew.

c. Standards maintained in the Operations Support Center showed considerable variation. In some instances, review was minimal, e.g., the requirements for tagging were determined largely from the response of the maintenance personnel involved; Maintenance Requests (MRs) were closed without apparent review of Post Maintenance Testing (PMT). In other cases, review of work scope, tagging, and possible impact on the plant were thorough prior to authorizing work.

d. Considerable variation was noted in the quality of instruction in classroom training periods. While only a few classes were monitored, performance varied from excellent preparation and presentation to a mediocre grasp of the subject and routine following of the lesson plan. In one instance, the instructor was so unfamiliar with the subject that he could not answer trainees' questions.

e. Response by members of management to industrial safety concerns, in one case, was the statement "we don't come under [Occupational Safety and Health Administration] OSHA," as opposed to others expressing concern for providing a safe worker environment.

f. The Operations Management Observation check program requires two observations per week by non-shift operations managers. Only one had been performed in the past three months. Most of the observations required of on-shift managers (SOS/ASOS) have been performed. While many of the observations performed included meaningful comments, some appeared superficial.

2. Basis (cont'd)

g. During maintenance on a reactor feedwater turbine, internal parts were left uncovered and disassembled parts were scattered on the floor. On the other hand, the High Pressure Coolant Injection (HPCI) pump turbine, which was left in a disassembled state while awaiting parts delivery, had all exposed parts wrapped and protected.

h. While the dictate to follow procedures was well known and followed generally, there were still instances of non-compliance.

i. During observation of a Radiological Emergency Planning Training Drill, the team noted training benefit was only obtained when the Plant Manager was present. He was the only manager or drill observer present who provided constructive criticism and coaching. When the Plant Manager left the control room, overall performance declined (e.g., communications, command and control) and criticism/coaching was not given.

B. SHUTDOWN FROM POWER OPERATIONS TO COLD SHUTDOWN

1. Concern

The plant procedure for unit shutdown and cooldown places the unit in a condition requiring very careful operator action to ensure the reactor remains shutdown during plant cooldown. Industry experience indicates that events distracting the operators during such a shutdown could result in an inadvertent criticality.

2. Basis

a. The procedure for plant shutdown/cooldown (GOI-100-12A) has been revised to eliminate a reactor scram from about 30 percent power as the normal means of plant shutdown. This change was made to reduce the number of scrams and associated transients.

b. The procedure requires normal shutdown by fully inserting all control rods per a rod program which requires notch insertion of many rods. Cooldown, up to 90°F/hr, is permitted to start as soon as the reactor is subcritical. A precaution is included to coordinate the cooldown with rod insertion to prevent inadvertent criticality.

c. The Institute of Nuclear Power Operations (INPO) has identified an incident at a Boiling Water Reactor (BWR) in which an inadvertent criticality occurred while conducting such a shutdown. INPO noted the difficulty in balancing the effects of rod insertion, heat removal, decay heat generation and xenon poisoning in this condition.

d. Adequate training of operators for such a shutdown may be difficult as INPO noted that the simulator for the plant discussed above could not duplicate the event. The current BFN restart training program does not include simulator training for such a shutdown.

e. The plant shutdown/cooldown sequence should provide adequate margin against inadvertent criticality without undue operator burden. Startup simulator training should address this evolution.

C. Resolution of Industry Issues

1. Concern

Evaluation of industry-wide technical issues for applicability to BFN, in some instances, had not been conducted in sufficient depth.

2. Basis

The ORR Team endorses the use of generic approaches to issues developed by owners groups, and other organizations as part of a systematic evaluation of technical issues. However, the following examples indicated that BFN may be too willing to accept generic solutions without independent challenge and critical review:

a. The Nuclear Regulatory Commission (NRC) IE Bulletin 88-04, Potential Safety-Related Pump Loss, requested licensees to investigate and correct, as applicable, two miniflow design concerns. The first concern involved the potential for the dead-heading of one or more pumps in safety-related systems that have a miniflow line common to two or more pumps or other piping configurations that do not preclude pump-to-pump interaction during miniflow operation. The second concerned the adequacy of the installed miniflow capacity for a single pump in operation. The original BFN evaluation of these concerns appeared limited. Specifically:

(1) For the Residual Heat Removal (RHR) and Core Spray pumps, the TVA response indicated that adverse pump-to-pump interactions would not be expected. This conclusion was apparently based on a generic review by General Electric Company (GE). However, as evidenced by differences in susceptibility to this problem between the two Sequoyah Nuclear Plant units due to individual pump flow characteristics, site specific evaluations appear necessary. Unit specific calculations were not on file and the ORR Team could not confirm their existence.

(2) The bulletin also required licensees to evaluate the adequacy of the minimum pump flow during miniflow operation. The bulletin indicated that miniflow lines have traditionally been designed for 5 percent to 15 percent of pump design flow and that some pump manufacturers now are advising that pumps should have minimum flow capacities of 25 percent or more for extended operation to protect against hydraulic instability or impeller recirculation problems. For BFN, RHR and Core Spray miniflows of about 6 percent and 10 percent respectively were calculated. The file did not contain vendor agreement with the acceptability of these flowrates and the time spent in the miniflow mode.

The ORR Team noted that simultaneously and independently, the BFN Nuclear Experience Review group had requested a reevaluation of the BFN response to the bulletin in the light of the Sequoyah experience.

2. Basis (cont'd)

b. Questions concerning the conservatism of the plant shutdown/cooldown procedure are discussed in another concern (Item # B) within this report. These questions arose from review of an industry event, reported by INPO, in which an BWR experienced an inadvertent criticality using a similar procedure. The TVA review of this nuclear experience item was limited to the minimum required to address the specific deficiencies initially reported by INPO at the other utility (i.e., training on the procedure, definition of control room responsibilities, simulator fidelity).

Initiative was not taken to question the prudence of using a shutdown/cooldown sequence which could place undue burden on the operators. The review of simulator fidelity also appeared limited to assessing the ability to simulate a positive reactivity addition, rather than verifying the ability to simulate actual plant response during such an event.

D. Aggressive In-Depth Pursuit of Technical Issues

1. Concern

Technical issues had not always been evaluated in sufficient depth or aggressively pursued to completion.

2. Basis

a. The June 1989 ORR Report previously identified a concern that vendor recommendations were not implemented in a timely manner. An example given was GE Service Information Letter (SIL) 419, a "Category 1" SIL issued in August 1985 (A Category 1 is defined by GE as an item "that could have an early impact on BWR plant availability, reliability, or safe operation"). This SIL recommends the inspection of certain one-inch Hancock gate valves in the Hydraulic Control Units (HCU). BFN intends to perform the inspection prior to restart. The work was scheduled to be performed concurrently with the scram diaphragm replacement. Work on the west bank HCU's was started on August 28, 1989, but no inspections of the subject valves had been made to February 1990. The ORR Team was told the inspections were being postponed to be performed while working the east bank, because of lack of parts. Implementation of this SIL has been delayed for over four years. Continued failure to aggressively pursue this potential safety-related issue could impact restart schedules, especially if inspection results increase the scope beyond that currently anticipated.

b. Incident investigation report 89-93, Low Scram Pilot Air Header Pressure Scram on 12/3/89 caused by a failed solder connection, described a failure (separation) of an one-half inch solder joint. The report noted that maintenance history revealed nine previous "broken" connections associated with the control air system at Browns Ferry. While the investigation report appeared thorough, a discussion with a cognizant metallurgist indicated that the joint solder wetted area appeared to have complete bond. Metallurgical and chemical analyses of the solder and piping were not done to determine if the flux, solder constituents or any impurities in the bonding may have contributed to the failure. A more thorough analysis may have indicated the cause of this recurring failure.

c. Although the NRC IE Bulletin 88-04 concerned safety-related pumps (see item C. of this report), it is not apparent that a review of Balance of Plant systems where dual pump operation is possible has been made or an evaluation of miniflow adequacy has been made or planned.

d. In a memorandum on May 25, 1989, the ORR Team provided detailed comments that resulted from performing a partial simulator validation of the startup procedure, 2-GOI-100C. Among other comments, the ORR Team identified a conflict in the plant conditions at which the Immediate Range and Average Power Range

d. cont'd

Monitors overlap is verified per a Surveillance Instruction (SI). (The GOI and SI specified inconsistent power levels.) The ORR Team also noted that resolution of this conflict must consider the need to assure proper average power range monitor function prior to entering a mode in which intermediate range monitor scram functions are defeated. This comment has yet to be resolved. The conflict still exists and training is being conducted despite the disparity.

E. Line Organization/Training Interface

1. Concern

Training effectiveness was being impacted by deficiencies in the communication among line organizations and training, and the lack of timely support for training activities.

2. Basis

a. A decision to eliminate the use of Keff vs rod position curves from the startup procedure and to implement the use of criticality limit guidelines was not communicated to Training.

b. Training and Operations plans for the incorporation of the interim Safety Parameter Display System into the simulator were inconsistent.

c. Revised reactor vessel water level curves needed to support training on the modified system had not been prepared by Nuclear Engineering (NE). The training is in progress. Senior NE management was not aware of the critical need for this information.

d. Resolution of some rod worth minimizer parameters was not completed in time to support initiation of startup training.

e. Late completion of numerous Technical Specification changes required prior to restart may impact the ability to adequately cover these in training. Training had not been informed of the planned changes which would permit advanced preparation of training information.

f. Sequoyah has initiated training on proper Technical Specification usage. The need for this training had not been evaluated for Browns Ferry.

g. The decision on completion of modifications which would impact operations and training (e.g., source range scrams) had not been reached or clearly communicated to Training.

h. Instances were noted of inadequate communication of expectations to training by line management, and of reluctance by Training management to bring issues of inadequate support to appropriate line management attention.

F. Simulator Training

1. Concern

Full advantage was not being obtained from simulator training to ensure operator readiness for startup and to reinforce the requisite standards for conduct of operations.

2. Basis

During observations of several requalification simulator training exercises using the plant startup procedure, the ORR Team noted the following:

a. In some cases, requisite control room formality was not maintained. For example, instructors and operators were involved in conversations not related to the evolutions in progress.

b. Instances of inadequate communications were observed including imprecise orders and alarms/conditions being announced in too low a voice to be clearly heard.

c. Operating practices required in the control room were not consistently enforced (e.g., obtaining SOS and Reactor Engineer signatures authorizing use of rod pull sheets, logging unusual events).

d. Opportunities to establish preferred operating practices were not used effectively. For example, the method and number of verifications of individual rod positions was left to the discretion of each unit operator.

e. Thorough critiques were not always held at the end of each simulator session.

f. The training may not fully reflect intended procedures to be used for actual startup. For example, instructors noted that a modification to incorporate source range scrams might be performed before startup, and the procedure required use of Keff vs rod position curves which were not planned to be used during actual startup.

g. Simulator hardware/software deficiencies detract from training effectiveness. For example:

(1) The core map printout frequently printed incorrect rod positions requiring resolution.

(2) Frequent (several times per minute) source range period alarms were received which instructors and operators stated to be unlike the plant. In some cases, the alarm continued distracting personnel from the startup procedure; in others, it was silenced.

2. Basis (cont'd)

(3) In one instance, a rod position anomaly was corrected without investigation, apparently because it was assumed to be a simulator malfunction.

h. In some cases, instructors did not adequately cover lessons learned or actively participate in the training evolution.

i. Both Operations and Training management expressed concern that simulator performance might regress following the recent successful completion of requalification examinations. However, neither group was proactive in preventing this from occurring. No management personnel were present during the first startup training conducted on February 19, 1990.

G. Attention to Operational Details

1. Concern

Rigorous attention to operational details was sometimes lacking.

2. Basis

1. During a required de-energization of a 480-volt shutdown board:

   a. No notification was given to the refueling crew although the action caused all area radiation monitors to alarm on the refuel floor.

   b. Power was lost to two effluent monitors because the back-up supply was previously tagged out.

2. One breaker was noted removed from the 480-volt common board without the proper record in the Configuration Control Log. This condition had apparently existed for over two months.

3. Assistant Unit Operators (AUOs) did not note several maintenance items for which MRs needed to be prepared.

4. Unit Operators (UOs) and AUOs did not always take action to correct inoperable indicating lights.

5. Communications were not always at the expected standard. This was particularly noted in phone calls from outside to the Control Room and during a radiological emergency drill.

6. Examples of improper logs, communications deficiencies and inattention to operation were noted during simulator training. These are discussed in more detail in another concern (Item # 2) within this report.

7. On two occasions, AUOs used an uncontrolled, copied page of a procedure to perform an evolution.

8. The 480-volt boards 2A and 2B for turbine building ventilation are not on the rounds sheet, although an AUO observed did check them. These should be on the rounds sheet.

9. An AUO found two valves mispositioned when he started to perform a screen backwash procedure. He notified the control room properly before repositioning the valves, but did not log the condition.

10. A Hold Order tag was noted still attached to a breaker which had been removed from the switchboard for repair.

2. Basis (cont'd)

11. A team member noticed a roll of tape resting on the top of a Core Spray Pump room sump pump so that it interfered with the float level detector. When the roll of tape was removed, the level indicator visibly moved. A similar observation was made during a tour with an AUO in the RHR/HPCI pump room where a grease gun was adrift with the potential for interfering with the sump level device.

12. Some floor drains were not routinely cleaned of debris or checked so they could perform their function In some cases, these were adjacent to a sample station or in spaces was a radioactive spill would be worsened by a plugged drain.

    (1) There was no screen in a floor drain outside the east end of the control bay. This drain had been a factor in a reportable discharge sample to the State last November.

    (2) The drain by the issue station for personnel protection clothing on the 565-foot level of the Turbine Building did not drain properly when water from another drain system backed up in the area.

H. Preventive Maintenance

1. Concern

Some Preventive Maintenance (PM) activities have been deferred and removed from the overdue list without adequate technical justification.

2. Basis

a. The June 1989 ORR report detailed a concern with the large number of backlogged PM items. Maintenance management stated that, in addition to increasing PM performance, one of the methods for reducing the backlog of outstanding PM activities (greater than 25 percent overdue) was deferral based on operational or technical assessments. The integrity of a deferral process is essential to ensure that the PM program remains credible.

A listing of 82 PM activities was provided to the ORR Team by the PM manager. This list was typical of PM items that had been categorized as "Not Performed" and that had been removed from the PM schedule and rescheduled to a later date. These items are no longer considered to be overdue and are not tracked as such.

A comment section was provided for each PM task on the list. A review of these comments revealed that approximately 20 percent of these "Not Performed" items had questionable justifications for deferral. The following are typical of the statements found under the comment sections: (Note that the ORR Team did not review any additional backup documentation that may have been contained in Plant Records.)

- "Not Tech Justified"

- "Deferral Not Approved"

- "Procedure Does Not fit Work"

- "No Manpower"

Further discussions with PM program personnel revealed that these items should not have been removed from the overdue list until they had received the appropriate technical justification for deferral in accordance with the requirements of the Site Directors Standard Practice (SDSP) 6.3, "Preventive Maintenance Scheduling and Tracking." If the task does not meet those requirements, it should be tracked as overdue.

b. One specific PM that the ORR Team noted had not been performed since 1985 was a task for monitoring flow blockage in the unit two RHR Service Water System. This activity has a periodicity of one month. A Systems Engineer indicated that performance of this task was part of the responses to NRC Generic Letter 89-13 and INPO Significant Operational Event Report 84-01. This system was in service during 1989 when fuel was installed in the unit 2 reactor, and could have been performed during that period.

I. Maintenance Work Practices

1. Concern

Observations in the area of maintenance work practices indicated that continued attention is required to achieve high standards of performance.

2. Basis

a. Rigging for disassembly of a complex horizontally mounted 18-inch valve was performed using a direct lift from the hook of the Turbine Building crane. (This was a craft decision; no procedural guidance was provided.) The use of a chain fall and sling from the crane hook would have allowed for finer control and alignment and is a standard maintenance rigging practice.

b. Inspection of the removed body to bonnet gasket from the valve discussed above showed evidence of uneven compression of the gasket although there was no evidence of steam leakage. The procedure contained in the work package for reassembly provided no specifications for alignment or bolt torquing sequence. Further investigation pointed to the conclusion that the bonnet was most likely misaligned during a previous reassembly and that the misalignment took up the load on the gasket. Although a detailed print of the valve was provided as part of the work package, it was not present at the worksite.

c. During maintenance on a reactor feedwater turbine, internal parts were left uncovered and disassembled parts were scattered on the floor. On the other hand, the HPCI pump turbine, which was left in a disassembled state while awaiting parts delivery, had all exposed parts wrapped and protected.

d. A maintenance crew, marked as Not Applicable (N/A) a step in a procedure which called for vacuuming equipment because they could not obtain a vacuum cleaner.

e. A work crew was observed torquing baseplate bolts. In this case, the bolts were overtorqued, then were backed off to obtain the correct torque. The foreman indicated that he saw no problem with overtorquing bolts as long as the final torque obtained was correct.

f. An electrician was observed wearing a metal watch while working in an energized panel.

g. Although the work package required performance of a procedure and the work package permitted no options for partial completion, a maintenance crew performed only certain sections of the procedure based on oral directions from an engineer.

2. Basis (cont'd)

h. One maintenance work package called for the replacement of valve packing. The PMT called for a stroke test and leak test. During repacking it was determined that the valve stem was damaged and another MR was initiated to replace the stem. The stroking was performed for the first MR and the leak test requirement was deleted since it would be covered by the second MR for the valve stem. (It could not be determined who changed the requirements.) Unfortunately, the PMT for the second MR referenced the PMT covered under the first MR for the valve packing. This results in no PMT for valve leakage being performed even though the valve was completely disassembled.

i. The work instruction for one MR required that the packing be adjusted on a valve. If that did not work, the work crew was instructed to replace the entire valve, since no parts were available. The completed work section stated that the valve bonnet had been replaced with no further explanation or change to the work instructions.

j. During observation of a job to replace bearings in a pump, the foreman stated, when questioned by a team member, that he would have removed one of the shields from a double shielded bearing. The work instruction required that the double shielded bearing be replaced, but did not authorize the bearing modification.

k. Cleaning steps in a preventive maintenance procedure had been completed when a team member pointed out considerable dirt and grease in the bedplate (fire hazard). The crew at that point cleaned the bedplate.

l. Two instances were observed of maintenance work packages which had been worked up to three weeks beyond the expiration date of the controlled procedure copies in the package.

m. The exhaust motor and fan for a shutdown board battery room were removed for repair. The exhaust duct was left open in a manner that greatly reduced the effectiveness of the battery room exhaust ventilation. The condition was corrected only after a second MR was processed to close the duct opening.

J. Maintenance Planning

1. Concern

Observations by ORR Team members indicated that continued attention in the area of planning skills is required to achieve high standards of performance.

2. Basis

a. One non-Critical System, Structures and Components (non-CSSC) work package for a valve packing adjustment described the method to adjust the packing in great detail. However, the planner also referenced section 8 of Mechanical Maintenance Instruction (MMI-51), "Maintenance of CSSC/Non-CSSC Valves and Flanges," as part of the work instruction. For the work activity described, MMI-51 is superfluous information. Further, while the PMT specified a leak test, there was no requirement for ensuring that the stem would move after the packing was adjusted.

b. One package for a non-CSSC pump required the replacement of a mechanical seal. The package contained the following deficiencies:

(1) In the package, the planner referenced two different mechanical seals with a note that the craftsman determine which was correct.

(2) A Plant Manager's Instruction 6.2 "Skill of the Craft," authorization was used to allow the craftsmen to perform the repair with no formal instruction other than a generic vendor manual.

(3) In addition to replacing the mechanical seal, the work instruction told the craftsmen to check the pump shaft and bearings for damage and replace parts "as necessary."

(4) Parts information that was provided as part of the package contained data for every major pump part including shaft, wear rings, impeller, etc.

(5) There were no alignment measurements or acceptance criteria for coupling adjustment even though the coupling would be removed to replace the seal.

(6) Retest requirements specified only a leak test on the seal. In the event that pump internals were replaced, there was no requirement for additional PMT to ensure that the pump produced design flow.

c. One Instrument MR involved the leak of glycerine from a gauge face. The work instructions said to troubleshoot, tighten the fitting, repair as necessary, and recalibrate, as required. The MR required a return of the package for replanning only if welding was necessary for repair. However, this gauge was installed in a thermal well and replacement is accomplished by unscrewing the gauge; no welding is required.

2. Basis (cont'd)

d. Another Instrument MR gave the mechanic blanket authorization to trouble shoot, repair, and replace parts as necessary and to then determine the necessary PMT.

e. One work package was for the repair of a cable which was pulled too far from a conduit. The work instruction referenced a procedure for the repair of flexible conduit. This procedure did not address how to repair the cable.

f. For one work activity, unnecessary work was specified. The craftsmen were required to disassemble a small pump to determine if the proper bearings were installed. This bearing information could have been determined from the previous lubrication PM data sheet which listed the vendor part number for the bearings. This information was also listed on the label plate of the pump.

g. Operations personnel indicated that electrical planners are inexperienced and do not apparently understand the scope of work since some requests for tagouts are incompatible with work to be performed.

h. On one work activity, workers stopped the job because the component label plate differed from the MR. In addition, the component was wired differently than indicated in the work package.

i. The team noted that although some of the October 1989 responses to the June 1989 ORR Report have been implemented, the following items are still outstanding:

(1) The revision to SDSP 7.6, "Maintenance Request and Tracking," has not been implemented.

(2) Engineers have not been assigned to senior planning positions.

(3) Planners still do not review completed work packages.

(4) Planners are not proactively involved in work packages that they have prepared, once the package is in progress.

(5) Planners are still not required to mark appropriate sections of the procedure as N/A when preparing work packages.

j. While work package feedback sheets are being routinely returned from the field, a random sampling of these feedbacks revealed no significant comments regarding work package content or quality.

K. Procedure Quality

1. Concern

Deficiencies in procedures have detracted from the ability of plant personnel to conduct maintenance and operations efficiently. In some instances, procedure deficiencies have increased the potential for errors and have resulted in non-compliance.

2. Basis

a. Some maintenance procedures have a sequence of steps which require maintenance crews to have at least four separate discussions with operations personnel prior to starting the work. Two discussions are required with the Unit Operator, one with the Shift Support Supervisor (or the SOS) and one with the SOS. This is inefficient and unnecessary to safely control the work. In fact, the team observed the sequence of these steps being violated to expedite commencing work. This violation contributed, at least in part, to a maintenance crew starting a job without signing off the prerequisites as required.

b. MMI-51 was deficient in numerous aspects and needs to be replaced with a series of procedures more specific to valve type and manufacturer. This is recognized by the Maintenance Procedures Manager.

c. The June 1989 ORR Report stated that some signature steps in procedures were not clear as to what was meant to be accomplished by signing the step. The BFN response of October 1989 stated a checklist for verifying procedures in SDSP 7.4 "Procedure Review" requires that signature steps meet basic requirements. The team considers this checklist (item 56 in the checklist refers to signatures) is not satisfactory. It does not convey, adequately, the need to assess the meaning, clarity, preciseness and lack of ambiguity of signatures. Further, the BFN response did not discuss a separate procedure validation checklist in SDSP 7.4 which does not have any item that specifically addresses signature steps.

d. Electrical Preventive Instruction, EPI-0-000-MOT 201, required certain motor double shielded bearings to be replaced but does not specify an allowed replacement. A work package which included this EPI for work on an air-wash pump motor did not provide this information either.

e. A procedure to check radiological control air sampler flow referred to an appendix for the proper hose, but the appendix did not specify the size. The team observed a 1/4-inch hose being stretched over a 3/8-inch connector.

2. Basis (cont'd)

f. A mechanical maintenance procedure for alignment of a diesel generator lube oil circulation pump to motor specified a minimum torque value for motor feet-to-foundation bolts. This is poor wording since "minimum" would allow any value over that, however great, to be acceptable.

g. A procedure for calibration of a water level indicator for a condensate pot off a HPCI turbine supply line did not adequately specify the adapters and test fixtures needed to perform the calibration. For example, no sketches of the fixtures were included.

h. An SI.4.8.B.2 on effluent monitoring that covers refueling floor continuous air monitors listed locations for three of the continuous air monitors incorrectly.

i. Another concern (Item # L) within this report discusses problems with chemistry procedures. Concern for excessive signatures and initials in procedures is covered in item # M of this report.

j. Procedures in varying degree did not meet the specific procedure style and writers guides in Plant Managers instructions. Moreover, these style and writers guides generally did not reflect the most up-to-date guidelines on procedure preparation in TVA Nuclear Power Standards, e.g., human factor elements. Thus, these guidelines were not being reflected [illegible] EN procedures as major revisions, rewrites, or new proced[illegible] identified and prepared.

L. Chemical Sampling and Analysis Procedures

1. Concern

Chemistry procedures, especially Surveillance Instructions, are cumbersome, and do not consistently support the objective of gathering required information using proper control and documentation methods while practicing ALARA.

2. Basis

During phase one of the ORR, a concern was expressed that Chemistry Analysts did not consistently demonstrate high standards of performance in sampling and analysis. As observed during this phase of the ORR, the methodology and technique of sampling and analysis had improved, but the procedures in use were not fully supportive of this objective. In several cases observed, the procedures were detracting from the task of obtaining samples and data in a manner consistent with good practice and ALARA.

a. To support the requirements of the Technical Specifications, many routine samples and analyses have been shifted into the Surveillance Program and are being conducted as SIs.

b. SI documents are more complex and greatly increase the required analyst documentation of the details of the sample or analysis, compared to Chemistry Instructions (CI) used for the same activity when not requiring to meet the Technical Specifications. Instances existed where different procedures were used on different occasions for the same sample. An example was the requirement to sample reactor coolant every 96 hours by the SI, but it was done daily per the CI, using a less complex procedure.

c. The CI program and its results fall under the quality program of the Chemistry Department and, therefore, have credibility. Thus, the extra administration of the SI contributes nothing to the overall quality of the final product.

d. The requirements imposed by some new SIs often detract from ALARA concepts because they require more time, mostly administrative, in radiological areas. To perform the task and properly make signoffs, the analyst is forced to spend more time in the radiation field and make more entries into contaminated areas, therefore contributing to radiological waste while increasing opportunity to spread contamination.

e. Analysts comments about streamlining the SIs and making them more "user friendly" during the validation process have been countered with "it doesn't meet the writers guides." It would appear that the writers guides should have the same objectives to obtain the sample or conduct the analysis properly. This item is discussed in more detail in another concern (Item # K), within this report.

2. Basis (cont'd)

f. Under observation of an ORR Team member, an SI for sampling Fuel Pool water took 75 minutes to perform. Records of previous performance of this sampling showed it had routinely been done in a much shorter period of time.

g. SI steps were noted to be written without complete regard for the user. For example, temperature corrections on conductivity measurements were sequenced in the procedure while drawing the sample. However, those corrections were not made at the sample sink, but back at the laboratory.

h. Some SI step sequencing and logic were not well thought out; for example, one procedure required a 100 ml sample flush of the same stream before each of three separate determinations were made. The extra flushes were not technically necessary.

i. Much discussion was occurring regarding the need for and value of obtaining Operations concurrence, permission, or signature for the SI performance. Here again, the writers guide appeared to be inflexible, without proper regard for what Operations really needed.

M. Signatures/Initials in Procedures

1. Concern

The excessive use of signatures and initials throughout procedures can detract from the importance of verifications required to ensure safety and quality. The efficiency of work can also be impacted.

2. Basis

a. Excessive signatures and initials create an atmosphere in which they mean little. Reserving them for the more important steps enhances the attention that will be paid to assure the proper action is taken.

b. The reactor operator controlling rod withdrawal during startup in accordance with procedure 2-SI-4.3.B.1a-1, Control Rod Coupling Integrity Check-Al Startup, is required to stop after each rod motion to initial and time the action. In some cases, this is for a single notch motion. While the team recognized that rod coupling and rod sequence actions must be positively ensured, the requirement for the operator to give his attention to initials and time entries in the procedures to this extent distract him from his instruments.

If the operator's signature and time are deemed necessary, Operations should consider rehearsing this procedure at the simulator and working out the optimum use of a second UO, perhaps to the extent of revising the procedure to provide for the second UO to verify and sign off for the steps.

c. Another concern (Item # L) within this report discusses excessive signatures in chemistry procedures that make the procedures inefficient and increase radiation exposure.

d. Many initials appear to be used simply to track status of the work rather more than to certify that a key action has been completed properly. The need to constantly sign-off work or operations steps may actually detract from proper performance particularly in radiological contamination areas.

N. General Employee Training

1. Concern

Some documentation issued for General Employee Training check-in information was out of date, inaccurate, and did not convey a sense of professionalism.

2. Basis

a. The quality of the reproduced material in the handouts was often poor and presented an unprofessional image. In several cases, they were obviously copies of copies. Several were badly misaligned with logos, etc., running off the paper.

b. Plant Notice 9, dated March 13, 1985, referred to Standard Practices BF-19-11 and BF-2-3. BF-19-11 was superseded by SDSP-32.2 on January 10, 1988, and BF-2-3 was superseded by SDSP 2.11 on February 20, 1986. Since these treated the issue of procedure adherence, the notice would be expected to demonstrate attention to detail. Further, the procedures adherence message conveyed by the notice was considered by the ORR Team to be incomplete.

c. Plant Notice Number 4, dated February 27, 1984, implied an exception to the eating, smoking, and chewing in regulated areas. This subject was also included in an "All employees memorandum," dated December 17, 1987, which also included redundant and out-of-date information.

d. The personnel contamination monitoring memorandum of July 7, 1983, was not representative of current practices.

e. Discussions of these findings with various members of the Radiological Controls Department showed that they did not review the material, except as users when they renew their personal qualification.

O. Occupational Safety

1. Concern

Industrial safety practices and conditions need significant improvement to assure a consistently safe working environment.

2. Basis

a. When workmen struck a door frame in the reactor building with a load of metal scaffolding, an electrical arc was struck between the metal pipe and the door frame. Follow-up of the event was routine, instead of that expected for an electrical shock hazard.

b. Means of egress were not consistently marked in BFN buildings as required by OSHA 1910.37(g). That regulation requires that access to exits shall be marked by readily visible signs with arrows indicating the direction of travel to reach the nearest exit.

c. Tripping hazards were noted in walkways in the Turbine Buildings, Reactor Buildings, and Control Bay. These were typically obstructions reaching into the walkways caused by material, parts, and tools.

d. Improperly secured welding leads, hoses, and cords were common on walkways and on stairs. These represented both tripping and slipping hazards.

e. Tripping hazards, holes, and uneven surfaces existed in areas outside the buildings and immediately alongside roads where no sidewalks are provided.

f. The barriers around a new section of sidewalk and fire system valve installation southeast of the West Portal were so placed as to present a tripping hazard for pedestrian traffic.

g. On two occasions observed, persons pushing large, heavy wheeled carts were not observant of the safety of persons in the path of the vehicle. On both occasions, "near misses" occurred.

h. The reverse motion warning device was not operational on several vehicles, including a fork lift, a vendor's large garbage truck, and a large dump truck (# 25) used on site.

i. Many persons with no eye protection were observed entering and leaving the west doors of the machine shop which is clearly posted as an "eye protection required" area.

j. Workmen were observed standing within touching distance of the buckets and arms of backhoes during digging. Machine operators were observed on numerous occasions to move filled buckets over other workmen.

2. Basis (cont'd)

k. Scaffolding toe boards were not always installed as required. After pointing one case out to the safety department (concerning work on a steam valve to a feedwater pump), the Safety Department shut down several jobs to correct the scaffolding.

l. Two persons on a Plant Manager weekly tour stated that "we don't come under OSHA." The ORR Team noted that the TVA Safety Manual includes much of the OSHA regulations.

m. Two persons were observed riding in the back of a moving van with open doors. One was seated on a box near the back of the van and the other was seated on the rear of the van floor with his legs out the back of the van--his feet were resting on the power tailgate.

n. Motor vehicles appeared to occasionally exceed site speed limits, especially inside the protected area. This was especially hazardous where no sidewalks were provided for pedestrian traffic.

o. A workman was observed stepping on a scaffolding handrail made of 2' x 4' lumber. The handrail broke under his weight.

p. An electrician was observed wearing a metal watch while working in an energized panel.

q. Although part of the control building was posted as a "safety glasses required" area, this requirement was routinely ignored.

r. Safety chains at the head of heavily used vertical fixed ladders were often left unhooked. Several were unhooked in low use areas. One was noted with a broken catch on the hook and another was held in place with a single strand of wire.

s. The power lead to a portable welding machine was noted to be stretched tight by the position of the machine.

APPENDIX A

ORR TEAM COMMENTS ON BFN PLANT
FINAL RESPONSE DATED OCTOBER 11, 1989 TO INTERIM REPORT OF THE
OPERATIONAL READINESS REVIEW OF BROWNS FERRY UNIT 2

NOTE:

A status of actions from the October BFN response to the June 1989 ORR Report was provided in the form of a TROI computer printout (Action Status Report) to the ORR team the week of 29 January 1989.

Comments:

1. Section II.A. of the June ORR Report noted that Operator Aids in the Control Room were not in the simulator. The Action Status Report indicated this had been corrected. The team noted operator aids in the simulator that were not in the Control Room.

2. The Action Status Report listed two items in the response to Section III.A. of the June ORR Report as complete which were not complete. One was issuance of a TVA Nuclear Power Standard on "Conduct of Operations." The other was an action to revise a drawing which was reported as complete when a drawing change request was sent to Nuclear Engineering.

3. Section III.A. of the June ORR Report noted that an Operations Section Instruction Letter (OSIL) contained operational information that would more appropriately be placed in a higher tier document. The October Response indicated that the specific OSIL and others had been incorporated into higher tier documents. The team noted that another group of documents, Operations Memos, in some cases, contained operational information (e.g., electrical system lineup requirements) which should be reviewed for incorporation into higher tier documents.

4. Section VI.C. of the June ORR Report discussed estimated critical position (ECP) calculations and recommends taking advantage of ECP predictions during approach to criticality. The October Response did not agree. However, the team found that the Reactor Engineering Group was planning to require minimum and maximum rod sequence pull steps below and above which the evolution would be stopped and an assessment made (i.e., if criticality is achieved before the lower limit or if it is not achieved by the upper limit).

5. Section VI.D. of the June ORR Report discussed Reactor Vessel Water Level (RVWL) instrumentation. The October Response discussed some actions to be taken based on the then unit 2 reactor vessel fuel loaded condition. The team noted now that the fuel has been unloaded, Technical Support is planning to do some additional testing of the RVWL instruments while the fuel is out. Further, Technical Support obtained a recommendation from the General Electric Resident Engineer to check the newly installed reference leg piping for thermal expansion during the Power Ascension Program. These additional steps should help ensure the operability of the RVWL instrumentation.