2. Browns Ferry Nuclear Plant (BFN)

Browns Ferry implements the requirements of the OQAM and DPM by its station standard practice directives BF 10.3, "Corrective Action Program," and BF 10.7, "Handling of Nonconformance Reports (NCRs)." NSRS reviewed these documents and their related referenced documents to the criteria specified in J above as they related to water quality control. From the review conducted, NSRS concluded that:

a. The plant QA unit has been ineffective in determining the adequacy of the plant chemistry program. Since April 1981 no deficiencies were identified even though NRC and INPO indentified inadequacies in the program.

b. The plant Chemical Unit should use the existing system or devise a system to assure out-of-compliance conditions are promptly identified and corrected.

BF 10.3 specifies that Corrective Action Reports (CARs) are intended for identifying conditions adverse to quality which are not handled by one of BFNs other systems for identifying problems such as trouble reports (TRs) etc. NSRS review identified three cases where out-of-compliance conditions were noted, however, documentation of the condition for correction and recurrence control was not afforded by one of these identifying systems. These cases included:

(1) In Spetember 1981 NRC identified that there was a lack of quality assurance program requirements in the BFN area of radiological effluent monitoring (RG 4.15). Because BFN stated the NCO was preparing a QA/QC water quality manual (DPM N79E2) which would implement the criteria of RG 4.15 (due to be issued at that time in November 1981) and since the adequacy of the document could not be determined until its issuance, NRC identified the item as unresolved instead of a noncompliance. In October 1981 section III of the DPM was issued to comply with the RG 4.15 requirements; however, since BFN had no corrective action requirement documented, the DPM provisions were not implemented.

(2) During the NSRS review in August 1982, it was identified that Ge(Li) detector resolutions had exceeded the limits specified in section 1200 of the RLM by a significant amount in May 1982. Though plant chemical unit personnel had also noted the discrepancy in May 1982, no technical evaluation was conducted of the poor detector resolutions, and the equipment was allowed to be used to perform safety-related analyses in a potentially defective state.

(3) During NSRS review of reactor building closed cooling water (RBCCW) system sodium nitrite concentration log for the period July 2, 1982 through July 20, 1982, it was observed that on July 12, 1982 the concentration had dropped to 85 ppm (normal range 500-600 ppm). The log indicated two pounds of nitrite had been added but no analysis was performed to ensure that concentration was brought back up to within specification. The next sample taken was one week later back on the normal sample frequency schedule. No out-of-compliance condition report was documented to investigate why this condition resulted and how recurrence could be precluded.

NSRS indicated to plant management that the use of the CAR system should be emphasized for use by the plant staff or for the plant chemistry unit to develop their own out-of-limit or equipment malfunction condition notification sheet to document conditions brought to the attention of the chemical unit supervision and the technical reasoning for its allowance or acceptability. This notification document should be similar to the one used by WBN. (See V.F.4 below.)

3. Sequoyah Nuclear Plant (SQN)

SQN implements the requirements of the OQAM and DPM by its station procedures SQA-118, "Handling of Nonconformance Reports," AI-12, "Adverse Conditions and Corrective Actions," and AI-13, "Nonconforming Items." NSRS reviewed these documents and their related reference documents to the criteria specified in V.F above as they related to water quality controls. From that review NSRS concluded that:

a. Increased emphasis should be afforded to the CARs written and assigned to the SQN Chemical Unit for resolution. NSRS review of SQN corrective action reports for the period September 1980-August 1982 identified the following concerns.

(1) CAR No. 7-81-41, report date August 7, 1981 identified the following adverse conditions. "The radioactive byproduct material control program was not being maintained per the requirements of SQ E2." NSRS review of this CAR identified that it was still open (over one year old).

(2) CAR No. 12e-82-33, Report Date May 28, 1982 involved an adverse condition with the M&TE program. From NSRS review of the SQN chemical laboratory M&TE during this review, the problems identified in the CAR were still present. One extension had already been afforded by the plant QA Unit to the Chemical

Unit. The conditions should be acted upon promptly to close out this adverse condition.

(3) CAR No. 21-82-41, Report Date July 7, 1982, classified as a "significant" condition adverse to quality involved a possible high concentration of oxygen and hydrogen in the waste gas decay tanks. The statement of adverse condition was not clear as to whether the instrumentation was reading high or that action was not taken because the grab sample results were found low (meaning the gauge was in an out-of-specification condition). Prompt action should be taken on the basis of a high reading because of NRC:OIE bulletins that have been issued dealing with similar conditions which ultimately ended with explosions in the waste decay tanks. This item was still on the active list as of August 16, 1982.

(4) CAR Nos. 10-81-30, 10-81-31, and 10-81-32 dated March 25, 1981 involving radiochemistry calibration procedures and records had all been closed; however, for a less than adequate basis as determined by NSRS. The "cause" of these adverse conditions involving missed voltage plateau determinations, etc., was identified by the Engineering Section as to the ambiquity of the QA inspector's understanding of the procedures reviewed. The Engineering Section demonstrated that though certain aspects of the calibration procedure requirements had been missed, subsequent checks showed the equipment operational and therefore was operational during the missed period. NSRS considers this methodology of blaming the inspector and absolving the Chemical Unit not appropriate to get to the root cause of the deficiencies, that being, "failure to follow procedures" or "failure to provide adequate procedures," "failure to implement procedures," etc. It should also be pointed out that the corrective action for these deficiencies required revision of the affected procedures.

From review of these CARs and others it appears the Chemical Unit may not be taking prompt corrective action to resolve identified deficiencies cited against it. The CARs also indicate that there is a definite problem with the implementation of the procedures governing the Chemical Unit's M&TE activities. NSRS identified to plant management that the Chemical Unit needs to pay detailed attention to audit/ survey findings and CARs identified against it to correct conditions adverse to quality. In addition, SQN should develop and use an "out-of-limit notification form" similar to the one used by WBN. (See V.F.4)

4. Watts Bar Nuclear Plant (WBN)

WBN implements the requirements of the OQAM and DPM specified in V.F.1 by its station procedures WB 1.2, "Adverse Conditions and Corrective Action," and AI-2.8.3, "Nonconformance 10CFR50.55(e) and Affected Organizations." NSRS reviewed these documents and their related reference documents to the criteria specified as they related to water quality control. From the review conducted, NSRS concluded that:

a. The WBN system of identifying out-of-limit conditions should be formalized.

In order to document TI-27 out-of-limit conditions which require specific corrective actions to be taken or notifications to the chemical engineer when certain out-of-specification limits are reached, WBN has devised a "Notification of Out-of-Limit Condition" form. The form, as is presently used is an informal mechanism for the radiochemical laboratory analysts to communicate conditions which require management attention and action, and to identify and document the action taken to restore the parameter back within its specification range.

The system appears adequate to document and track internally identified problems. They system also takes the burden off the radiochemical laboratory analysts to resolve these conditions and places it with the chemical engineers.

The informal system should be formalized and extended to cover equipment malfunctions. These notification sheets should be for internal control and use and retained for a period commensurate with the severity of the condition. The sheet should be routed back to the originator for his awareness of corrective action taken.

G. Special Chemistry Considerations

Appendix B to 10CFR50 requires that an operator of nuclear plants establish program measures to ensure that persons and organizations conducting activities affecting the safety-related functions of the CSSC should perform all those actions necessary to provide adequate confidence that the CSSC will perform satisfactorily in service. Such activities include typical activities, such as operation, maintenance, repairing, cleaning, inspection, testing, modification, etc.

NSRS chose several specialized areas involving nonaqueous chemistry considerations for review:

1. Diesel Fuel Oil Quality (Receipt and Storage)
2. Cleanup of Residue from Plant Fires
3. Cleanliness of Components and Piping Systems

These areas are important to nuclear safety because of the crucial functions (emergency electrical generation, pressure integrity of critical piping systems, and crud control) that might be compromised by improper practices. It was intended that the review assess adequacy on the basis of typical activities listed above. The administrative and technical bases of the area are discussed below.

1. Diesel Fuel Oil Quality (Receipt and Storage)

The principal regulatory guidance providing requirements for diesel fuel oil quality was found in Regulatory Guide 1.137, "Fuel Oil Systems for Standby Diesel Generators." This regulatory guide (RG) incorporated portions of ANSI N195-1976 by reference. Although nonbinding in itself, RG 1.137 was largely echoed in the technical specifications and FSARs of the reviewed plants. The WBN FSAR committed to RG 1.137. Mandatory surveillance requirements were imposed on TVA in the plant technical specifications, and TVA had committed to various additional requirements in the FSARs.

Program requirements for fuel oil quality had been defined in DPMs N78M7, "Fuel Oil Quality and System Leak Checking Requirements for Standby Diesel Generators," and N78E1, "Diesel Fuel Oil Supply and Storage Systems - Micro-organism Control."

This area was reviewed to determine whether program objectives had been established and were being implemented. Elements that were reviewed included the following:

Management Controls

A determination of whether adequate policy objectives had been established in the technical specifications, FSAR, and DPM and whether these objectives had been properly translated into detailed directives and procedures for implementation as to specifications, surveillance/action requirements, and analytical and sampling procedures.

Implementation

A determination of whether sample and analysis requirements had been implemented as directed by management controls.

Corrective Action

A determination of whether questionable or unacceptable results were being recognized and resolved efficiently.

a. Division of Nuclear Power Central Office (NCO)

The NSRS review of NCO responsibilities for fuel oil quality was concerned with management controls and implementation. The review consisted of discussions with NCO supervisory personnel (Chemical Engineering Section and Rotating and Stationary Equipment Groups) and examination of data and correspondence. Procurement requirements were not included in this review.

(1) Management Controls

Management's technical objectives were drafted and communicated to the nuclear plants and central laboratory via DPMs N78M7 and N78E1.

DPM N78M7

NCO had coordinated a recent revision of DPM N78M7 to standardize the analyses performed for the nuclear plants by the central laboratory. It was confirmed from discussions and correspondence that management policies were being communicated with appropriate feedback from the plants and central lab.

NSRS felt that additional management guidance should be stated in DPM N78M7 for the following concerns:

(a) Analysis of "outside" storage tank contents should be performed periodically. NSRS believes that condensate/water could contaminate the tanks either from dew forming on the insides of partially filled tanks or from water delivered in fuel; sediment could build up from sludge (microbe action) or receipt of contaminated fuel. Thus failure to analyze the storage tanks periodically could compromise diesel operability. The diesel seven-day storage tanks are especially susceptible to transfer of contaminated or degraded fuel because the transfer suction from an "outside" storage tank is located at the bottom of a storage tank directly over a sump which cannot be drained of contamination (except at BFN). Several diesels could be put out or service from one adverse incident. For example, three of four seven-day tanks had been refilled at one site within a two-day period from an outside storage tank that was being tested only for accumulation of condensate. If a breakdown in fuel quality had occurred over time within that tank, loss of diesel availability could have resulted.

(b) NSRS noted that analyses of one-day tanks were self-imposed at SQN, but not at WBN and BFN. Adverse results noted at SQN for one-day tanks indicated that analysis of the contents of one-day tanks could be beneficial. However, since unnecessary analyses severely tax the central laboratory facilities, and since the SQN results may have been caused from sampling techniques or from biocide interference with the analysis, the need for analysis of one-day tank contents should be evaluated carefully with appropriate follow-up action taken.

(c) The DPM should state how in practice WBN and SQN are to satisfy surveillance requirement 4.8.1.1.2.c, to obtain an analysis from new fuel oil prior to addition to the seven-day tanks. The plants' intent was to meet the technical specifications by verifying the acceptability of all fuel received into a designated tank prior to transfer to other tanks. If this interpretation is to be made, the analyses recommended in (a) above should be enforced via DPM requirement and a strong warning should be included in site procedures to indicate that transfer of unanalyzed new oil to the seven-day tanks would constitute a violation of technical specification.

DPM N78E1

This DPM provided clear general guidance. NSRS had two concerns as follow:

(a) Both WBN and BFN reported that the authorized microbe test kits were unreliable. WBN was evaluating an alternative test kit. The NCO needs to identify and authorize a suitable test kit.

(b) Clarification may be needed if biocide addition is determined to interfere with analysis of fuel oil for insolubles. It may be necessary for plants to meter in biocides or to minimize their use by stringent control to eliminate water/condensate from storage tanks.

Miscellaneous Controls

NSRS believes that NUC PR would benefit by establishing management controls to address the following concerns:

(a) Performance of Field Reviews

NSRS found that NCO personnel were prevented by NCO policy from reviewing plant practices and results in the field. NSRS believes that NCO personnel should conduct periodic reviews to detect inadequacies and inconsistencies such as the following in site implementation:

- One plant neither tested for microbes nor added biocide to fuel oil. Two other plants added biocide by differing methods (one by metered flow, one by batch addition). The vendor of the biocide recommends that it be metered into the fuel oil.
- One plant was performing no onsite analyses prior to accepting fuel oil into reserve storage.
- One plant did not hold fuel in a reserve tank till fully analyzed.

(b) Certification of Central Laboratory Services

NSRS found that while comfortable with time-tested results, neither the plant staffs nor NCO were cognizant of the quality conditions under which fuel oil analyses were performed. The NCO should ensure that (1) an adequate quality assurance program for nuclear plant support is in place at the central laboratory and (2) that confirmation of an adequate laboratory quality program is relayed periodically to each applicable plant.

(c) Diesel Fuel Oil Tank Inspections

NSRS found the following inconsistencies with the diesel fuel oil tank inspection programs.

BFN - No periodic tank inspection program existed for outside or seven-day storage tanks.

SQN - Technical specifications required a cleanup once per ten years of safety-related tanks.

WBN - Site was preparing a basis to request exemption from a strict requirement for tank cleanups on a 10-year interval.

NCO - The Stationary Equipment Group had identified a need for an inspection of fuel oil storage tanks.

NSRS recommends that NUC PR evaluate needs and establish a DPM policy to be augmented by technical specifications as necessary to make the requirements consistent between plants. Both the safety-related (one day and seven day) and nonsafety-related (outside storage) tanks should be included in this program.

(2) Implementation

Implementation of NCO-requested support was considered by NSRS to be good. For example, NCO had taken action to resolve several problems encountered at SQN [Memorandum from W. H. Kinsey to W. T. Cottle dated September 3, 1982, "Receipt of Fuel Oil and Process of Samples," (L24 810904 087)] to add a contract clause to hold up fuel receipts until onsite analyses could be conducted, and to successfully warn a fuel contractor against continued delivery of deficienct fuel oil. Incidental problems at BLN and BFN were being addressed in a timely manner by NCO personnel during this review.

The Rotating Equipment Group provided technically qualified support including the following measures:

- Review of industry experience through review of branch routing (correspondence), industry periodicals, and NOMIS (recently cancelled).
- Contacts with vendor representatives.
- Review of analytical results from the central lab.
- Consultation with a state lab and TVA's central lab.
- Membership in the Joint Committee on Petroleum Quality.

The Rotating Equipment Group and Chemical Engineering Section personnel were cooperating on resolution of fuel oil problems handled by the NCO.

b. Browns Ferry Nuclear Plant

NSRS reviewed the BFN program for fuel oil quality in regard to management controls, implementation, and

corrective action. The review included discussions with applicable personnel, examination of procedures and data, and observation of sample and analysis techniques. The site program was appraised chiefly against requirements of the technical specifications (SR 4.9.A.1.e) and DPMs N78M7 and N78E1.

(1) Management Controls

NSRS found that BFN's management controls were adequate with the following exceptions:

(a) SI 4.9.A.1.e specified acceptance criteria based on ASTM D975-74 whereas SR 4.9.A.1.e required analysis to "the latest revision to ASTM D975."

(NOTE: By a review of data for 1981-82, it was determined that no unsatisfactory fuel had been accepted. NSRS was told that the site was taking prompt action to correct the SI procedure.)

(b) Several sampling procedures in the radiochemical lab manual (RLM) contained discrepancies such as invalid valve numbers or failure to restore a system to standby readiness following sample activities. These deficiencies were identified to site personnel as part of a concern that the RLM should be brought up-to-date.

(c) Provisions should be made to sample and analyze fuel of additional DGs installed onsite, such as the diesel-driven fire pump, security DG, and diesel-driven dewatering pump.

NSRS noted a number of deficiencies in the plant's practices that should be evaluated during improvement of the fuel oil program:

- Surveillance requirement 4.9.A.1.e required analysis per "the latest revision" of ASTM D975. Both the nuclear plants and central laboratory would benefit from a change to the SR that standardized BFN to the same ASTM standards as used for SQN and WBN or at least fixed on one specific edition of the standard.

- The contents of fuel outside oil storage tanks were not being sampled periodically (refer to NCO section for details.)

- Fuel from storage tanks were being sampled for condensate lines and sump drains. Seven-day tanks were being sampled using a weighted sample line. NSRS believes that water-sensitive paste on a dipstick should be employed to detect water to the very bottom of the tank. (At BFN a pipe plug should be helpful on the outside storage tank cap for ease of access with a dipstick.)

- BFN should provide additional protection for the emergency DGs by establishing a "receipt/reserve" system for the two storage tanks. Such a system is in place at both SQN and WBN to prevent the contamination of more than one tankload of fuel oil (as well as to satisfy a technical specification requirement). Fuel oil receipts would be added to and retained in a designated ("receipt") tank till cleared by lab analyses. Only cleared oil would be transferred into the second (reserve) tank. Auxiliary boiler feed pumps would take suction from the receipt tank. Such a system would provide the following benefits:

  - Quarantine fuel oil until all its qualities had been verified.

  - Provide a reserve of clean fuel oil for the seven-day tanks. Since the reserve (clean) tank could be filled via the auxiliary boiler feed pump suction line, sediment, sludge, or water buildup from contaminated fuel, bacterial action, or condensation would be less likely to be transferred from the receipt to the reserve tank.

  - The need for additional storage precautions has been underscored by the following incidents: (1) Tankers were not being sampled properly. (2) Even though some unsatisfactory fuel had been detected and rejected on other occasions, the site had accepted fuel in 1981 that exceeded limits for flash-point (one tanker in February 1981) and viscosity and distillation point (three tankers in August 1981).

- The site should evaluate a policy for the following concerns:

  - Whether biocide addition is necessary when microbe tests are not performed.

  - Whether biocide should be metered rather than batch added into fuel during receipt.

(2) Implementation

NSRS observed activities and reviewed documentation to determine whether program requirements were being implemented adequately. Documentation of implementing activities was verified to be in good order. NSRS noted that sample results from both the outside storage tanks (sampled 3/81 and 9/81) and the seven-day tanks (sampled in 1981 and 1982) contained detectable levels of dirt (up to .02-.03 by volume percent; limit = .05 v/o max). NSRS noted this condition as a basis for consideration in establishing tank inspection and cleaning requirements for fuel storage tanks at all plants (addressed in NCO comments).

From discussions and observations, NSRS concluded that implementation of fuel oil quality practices was adequate with exceptions as follows:

(a) Fuel oil samples were not being obtained from the bottoms of delivery trucks, where water and sludge should be expected to concentrate.

(b) A glass flask and millipore vacuum pump were being utilized in the portable apparatus used to obtain condensate samples from the seven-day tanks. Both glass and carbon vane pumps should be evaluated against safety considerations. NSRS recommends use of a dipstick with water-sensitive paste to assure a sample to the absolute bottom of a tank.

(c) It appeared that an unauthorized backup valve had been installed in lieu of a pipe plug on the one-day tank drains. An approved modification should be provided.

(d) The plant was neither sampling for microbes nor adding biocide to incoming fuel deliveries. Both WBN and BFN reported that the approved boron sample kits were unreliable. Sometimes the kits already indicated contamination upon receipt. BFN stated that boron kits were not currently obtainable (through late 1982)

despite vigorous efforts to obtain them. A plant supervisor stated that in his opinion microbe sampling and the addition of biocide were unnecessary since the condensate sampling program consistently showed no water in the site's fuel tanks. Nevertheless, due to the possibility of condensate formation on inside tank surfaces and the chance of receiving water-contaminated fuel, NSRS recommends that BFN obtain a reliable method to test for microbes (see NCO comments above).

(e) The plant's method for detecting the accumulation of condensate or sediment in fuel tanks was deficient. A centrifuge water and sediment test conducted with a cone-shaped centrifuge tube per ASTM method D1976 would be far more effective than the current practice of allowing a 30-minute settling period before attempting to inspect the contents of a semi-opaque polyethylene bottle.

(3) Corrective Action

From a review of documented data, NSRS concluded that corrective action had been conducted very well with regard to recognized deficiencies regarding fuel quality. Twice in 1981 the fuel storage tanks were sampled promptly to determine the effect of contaminated fuel receipts on tank contents. The procedure for flashpoint testing had been revised and the CLAs were made aware of the cause and correct procedure to avoid recurrence of a flashpoint deficiency. The plant had also requested revision to upgrade DPM requirements to provide a generic fix to that problem.

c. Sequoyah Nuclear Plant (SQN)

The SQN program for fuel oil quality was reviewed with regard to management controls, implementation, and corrective action. The review included discussions with applicable personnel and examination of procedures and data. Implementing activities were discussed but not observed, due to time limitations. The site program was appraised chiefly against requirements of the technical specifications (SR 4.8.1.1.2) and DPMs N78M7 and N78E1.

(1) Management Controls

Management controls at SQN were adequate with some exceptions. While a comprehensive control document (such as a standard practice) did not exist,

requirements for periodic analyses had been consolidated in excellent fashion into SI-116, "Quarterly Chemistry Requirements on Diesel Generator Fuel Oil." However, conditional requirements were not as well covered administratively (or in practice, as discussed below).

(a) Fuel oil was not always analyzed prior to acceptance. This was contrary to DPM N78M7. While samples were being obtained for follow-up analysis by the central laboratory, neither a flashpoint nor a condensate-and-sediment test was being performed onsite as required by DPM N78M7. NSRS was told that onsite testing had been abandoned due to truck drivers' protests of delays. However, it was determined at the NCO that a change in contract had been issued on August 6, 1981 to permit holdup of fuel deliveries for up to 30 minutes to permit onsite analyses (memorandum from K. N. Passeur to James Corry dated December 2, 1981, "Invitation C3-586108"). Plant policy was intended to quarantine fuel deliveries in a specified outside storage tank until central lab results had been obtained. While acknowledging this to be a defensible practice, NSRS noted that on at least one occasion, SQN had transferred fuel from the reserve tank prior to learning that a (mildly) deficient delivery had been made [Memorandum from E. L. Whaley to Dan L. Paul dated December 1, 1982, "Meeting to Discuss Standardization of Fuel Oil Specification/ Analysis for Standby Diesel Generators - All Nuclear Plants," (L29 811201 801)]. NSRS strongly recommends implementation of the DPM requirement in the SQN program.

(b) Although SQN met the intent of surveillance requirement 4.8.1.1.2.c by analyzing fuel delivered into storage (as opposed to performing analyses of stored fuel immediately prior to transfer to the seven-day tank), the condition of fuel maintained in the outside storage tanks was not being determined. Although quarterly condensate checks of the outside storage tanks are being performed, NSRS believes that the close proximity of the diesel transfer suction to the tank bottom (where water and sludge would accumulate) and the possiblity that buildup of sludge would not be detected by condensate checks are grounds for recommending periodic analysis of storage tank contents. NSRS noted that 3 of

the 4 seven-day tanks were topped off on one occasion at SQN. This recommendation is an enhancement that would increase the degree of compliance with SR 4.7.1.1.2.c and could promote diesel and plant availability. Thus, the contents of outside fuel oil tanks should be analyzed periodically.

(c) This relates to a recommendation made to the NCO (see V.G.1.a.(1)-DPM N78E1, item (b) above). An analysis dated March 25, 1982 reported that "a biocide-like material" had been found in a fuel sample from 1B-B seven-day storage tank. "Insolubles" found in recent fuel samples may be related to biocide in the fuel. Biocide has been shown to be a constituent in sludge removed from tanks at WBN. Since addition of biocides may be a mixed blessing (suppression of bacterial action at a cost of increased sludge and perhaps interferences with lab analyses), NSRS recommends that NUC PR take action to resolve this matter.

(2) Implementation

Implementing activities were evaluated from review of data and discussions from the central laboratory (for offsite fuel analyses). Implementation seemed generally adequate. For example, lab reports and fuel receipts were found to match, and SI and SOI data were found in generally good condition. From discussions, it appeared that sampling methods were being properly applied by RCL personnel. NSRS verified that diesel strainer inspections and filter replacements were being controlled by procedures. NSRS noted the following concern:

(a) For the one-day tanks the site had approved SI-116 data indicating levels of insolubles up to 11.5 mg/ 100 ml--considerably in excess of the technical specification limit (2 mg/ 100 ml) allowed on seven-day tanks. While NSRS found that follow-up action had been taken promptly for insolubles identified in September 1981 and March 1982, the site had accepted documentation of insolubles in the one-day tanks that exceeded the technical specifications limits for the seven-day tank.

Since the indication of insolubles found in 1982 may be caused by biocide interference with the analysis procedure, by concentration

due to the tank drain configuration, or may otherwise be symptomatic of a more significant problem, NSRS recommends that NUC PR evaluate and document a basis for resolving indications of insolubles in the one-day tanks. Expedited action to resolve this matter could be highly beneficial to future diesel generator availability in light of technical specification limits on seven-day tanks.

(3) Corrective Action

Corrective action was evaluated on the basis of follow up to deficiencies identified in correspondence (1977-1982) and data (1981-82) files. NSRS concluded that corrective action had been generally reasonable and appropriate. SQN had initiated prompt and effective follow up for several recent incidents regarding fuel, such as delayed analyses and indication of insolubles in one-day fuel tanks (SI-116 dated March 10, 1982). NSRS found follow-up data for the latter incident in the CLS laboratory's file but not in the plant file.

d. Watts Bar Nuclear Plant (WBN)

The WBN program for fuel oil quality was reviewed with regard to management controls and implementation. Corrective action could not be evaluated due to limited data.

The review included discussions with applicable personnel, a walkthrough of sample and analysis facilities, and examination of procedures and data. Implementing activities were not observed due to time constraints, but were discussed with several staff members. The site program was appraised chiefly against requirements of the (proposed) technical specifications, DPMs N78M7 and N78E1, and the FSAR.

(1) Management Controls

Management controls at WBN were adequate , but some weaknesses were identified. The plant staff had developed to an exceptional degree controls to define and control fuel oil storage and handling activities. Comprehensive requirements had been detailed in a standard practice, five section instruction letters, and various SOIs, TIs, and SIs. The following conclusions were drawn:

(a) The WBN program contained well-defined acceptance criteria and action statements for fuel oil activities. The system of procedures was comprehensive and generally adequate with exceptions as follows:

- No SIs had been issued to satisfy the requirements of SRs 4.8.1.1.2.b and 4.8.1.1.2.f.1 of proposed technical specifications dated December 1, 1981. However, a procedure was being prepared in draft form for SR 4.8.1.1.2.f.1. The status of procedural preparation for SR 4.8.1.1.2.b was undetermined. However, appendix B of SOI 82.1G provided partial fulfillment of that SR.

- SI 8.6 contained no provision for analysis of insolubles as required by the proposed SR 4.8.1.1.2.c dated December 1, 1981.

- WBN was performing quarterly onsite analyses for fuel oil stored in the outside storage tanks. This exceeded current requirements. However, NSRS has advocated this practice for SQN and BFN (see earlier portions of this section). WBN should evaluate whether an additional analysis for insolubles should be conducted periodically to add assurance that oil stored in the "outside" storage tanks meets the technical specifications requirements for diesel service.

- WBN added biocide to all fuel deliveries and metered flow into deliveries to outside storage tanks. The site also performed microbe tests on all fuel tanks quarterly. This exceeded requirements and provided a conservatism for fuel protection that NSRS has recommended in this report for BFN and SQN.

- WBN provided for no analysis of one-day tank contents. This policy should be evaluated against experience at SQN (repeated indications of insolubles).

(b) The RCL worksheets should be updated to better identify sampling requirements. This is an enhancement proposal. Noting that the monthly worksheet (appendix B of RSL C14) contained little more than a subject with

signoff and remarks, NSRS recommends that the Chemical Unit revise the worksheet to cross-reference data sheets and clarify sample requirements. For example, sheet 3 of the worksheet could be improved as follows:

- Clarify that fuel oil analyses are performed onsite at quarterly intervals. The worksheet appears to direct that monthly samples be sent for analysis to the central laboratory.

- Provide references to worksheets TI-37.81.2 (microbes) and SI 8.6 (analytical parameters) in the remarks section.

  A good example of a comprehensive worksheet may be seen in the weekly and monthly worksheets (part 1400) of the BFN RLM. These worksheets identify sample point, log sheet (data sheet), procedures, frequencies, and limits as applicable for analyses.

(2) Implementation

Implementing activities were evaluated from review of data, a walkthrough of facilities, and discussions with plant personnel. Implementation seemed generally adequate except as follows:

(a) A reliable test kit is needed to test for microbes in diesel fuel tanks. NSRS noted that an unused comparator bottle showed evidence of contamination. WBN's staff stated that chemical unit personnel were working with a vendor and the NCO to obtain a more reliable test method.

(b) Several problems with documentation and sample performance were found in the fuel oil-related worksheets TI-37.18 (series). These were identified to the plant staff for resolution.

e. Central Laboratory

The central laboratory's program for fuel oil analyses was reviewed with regard to management controls, implementation, and corrective action. The review included discussions with applicable personnel, a walkthrough of facilities, and examination of test data. Implementing

activities were discussed but not observed in detail. The analysis program was appraised chiefly against requirements of DPM N78M7 and plant surveillance requirements.

(1) Management Controls

Management controls for fuel oil analyses were very informal at the central laboratory. Assignment of responsibility had been made verbally and through job descriptions. Analyses were being conducted in accordance with federal specification VV-F-800B or ASTM specifications as directed by DPM N78M7 or site data sheets, respectively. Due to the expertise of the staff and the evident participation and knowledge of the lead chemist in industry and internal TVA fuel testing developments, NSRS was satisfied that fuel analysis controls were in existence. However, a written QA program for safety-related analyses should be developed to delineate minimum controls, implementation, and documentation requirements.

(2) Implementation

Implementing activities were judged fully adequate. NSRS noted indications of good communication and awareness of plantsite and NCO concerns. From discussions of analysis techniques and results, it was apparent that the lab was performing effectively. Current problems that had been identified for resolution related to (a) the need for consistent requirements for all sites and (b) an excessive workload aggravated by the recent addition of insolubles to fuel oil test requirements for fuel analyses and the appearance of insolubles in recent SQN fuel samples. These concerns have been addressed elsewhere in this section of the report.

From a sampling of laboratory records for November 1981 and March 1982, NSRS determined that the central laboratory had been responsive to the DPM requirement for reporting of analysis results within 14 working days of receipt by the laboratory.

2. Cleanup of Residue from Plant Fires

Program requirements for cleanup of residue from plant fires had been defined for NUC PR in DPM N75M3, "Cleaning Procedure for Residue from Plant Fire." This area was reviewed with regard to management controls and implementation at the plantsite. NSRS was concerned whether significant latent hazards might exist from undetected residues from plant fires. Findings were as follows:

a. Division of Nuclear Power Central Office (NCO)

All three sites had expressed concern that the DPM should define thresholds to limit post-fire survey requirements to relevant situations. NSRS was comfortable with the discretion shown at SQN and WBN in applying DPM requirements. However, as a technicality, the DPM was not being complied with as written (conduct surveys after all fires). NSRS recommends revision of DPM N75M3 to define thresholds for implementation of post-fire survey requirements.

b. Browns Ferry Nuclear Plant (BFN)

Management controls formerly consisted of three maintenance instructions which had been cancelled or were obsolete. The existence of the DPM was not known to the Safety Engineer and no responsibility for implementing surveys had been assigned.

NSRS determined that post-fire surveys had been conducted in at least one or two instances of 43 fires reported in 1981-82, as directed by the plant superintendent. However, data was found only for a torus fire which had occurred on July 7, 1982 or July 8, 1982. Residues had not been checked for the following fires, which might have had significant after effects:

7-22-82	Fire in IM shop (mineral oil)
12-13-81	Fire in torus (wood under a slag pan)
12-8-81	Fire in torus (cardboard box).
9-24-81	Fire in communications room (I&C inverter power supply.
8-22-81	Fire in torus (electrical cables, welding leads, oxygen and acetylene hoses, and trash).
7-31-81	Fire in torus (electrical cables).

NSRS recommends that BFN establish and implement controls to provide for surveys and cleanup of fire residues in plant practices in accordance with division directives.

c. Sequoyah Nuclear Plant (SQN)

While DPM N75M3 had not been implemented into plant management controls, the safety engineer was aware of the DPM requirement. Chloride surveys had been per-

formed following the two signficant fires which had occurred in 1981. Results of the surveys and cleanup were well documented. Due to concern that the DPM requirements may be overlooked at some future date, NSRS recommends that SQN establish controls to implement the requirements of DPM N75M3 in plant practice.

d. Watts Bar Nuclear Plant (WBN)

DPM requirements had been implemented in detail into standard practice WB 1.6 with clear delegation of responsibilities within the plant staff. The Results Engineering Section was well aware of the survey requirements and had performed and documented thoroughly a survey following the one significant fire that had occurred in 1981-82.

3. Cleanliness of Components and Piping Systems

This area was reviewed in regard to practices such as mechanical and chemical cleaning, flushing, layup, decontamination, and retention of pipe specimens.

Program requirements for cleanliness of components and piping systems had been defined in the following DPMs.

DPM No.	Subject
N73E5	Cleanliness Criteria for Plant Components and Piping Systems
N80E5	Decontamination of Maintenance Materials and Removed Plant Components
N73E2	Chemical Cleaning or Decontamination Procedure
N79E2 (part VI)*	Nuclear Plant Water Quality Manual (Layup Practices)
N73E1	Specification Standards of Material Commonly Associated with Maintenance Which May Come in Contact with Reactor Coolant
N73M2	Process Specifications for Welding, Heat Treatment, and Allied Field Operations
N79M3	Foreign Objects in the Primary Coolant System
N75E6	Retaining Pipe Specimens and Crud Samples for Future Reference

*Not issued

NSRS reviewed whether significant underlying hazards to safety-related plant components and piping might be incurred from weaknesses in cleanliness and decontamination practices employed in the operating plants. Findings were as follow:

a. Division of Nuclear Power Central Office (NCO)

Questions from site evaluations and review of division practices were discussed with applicable NCO personnel. The DPMs identified above comprised a comprehensive framework for control of cleanliness during outages, maintenance, and modifications for monitoring of contamination on critically important components and piping systems. However, NSRS concluded generally that the NCO needed to provide improved program criteria and to verify the implementation of such requirements by an acceptable method.

(1) Program Controls

The scope of program controls (see DPM list above) was adequate. However, the following deficiencies were noted:

(a) DPM N73E5 was too general and incomplete. Based on requirements of construction specification G-39, "Cleaning During Fabrication of Fluid Handling Components," and ANSI N45.2.1-83, "Cleaning of Fluid Systems and Associated Components During Construction Phase of Nuclear Power Plants," which are for fabrication standards, the DPM lacked practical guidance for implementation of cleanliness criteria--especially in regard to the condition of pipes and components opened up but not affected directly by maintenance activities.

The DPM lacked criteria for maintaining cleanliness during work activities such as repairs or modifications and failed to specify means for mechanical cleaning. Also, the acceptance criteria for systems under control of NUC PR were ambiguous in several respects. Comments from site personnel (see sections concerning BFN, SQN, and WBN below) indicated that specific criteria should be provided for the degraded conditions including general corrosion, tuberculation, and fouling that were being found on occasion (especially in raw water pipes). DPM criteria did not address inspection or flush requirements in follow up to work activities involving use of

special materials, processes, or conditions such as cutting on vertical pipes. The DPM also failed to identify specific considerations for flush boundaries or practical alternatives where a process path could not be utilized. NSRS recommends that the NCO address this concern by evaluating field concerns and incorporating as applicable the contents of standard practice BF 3.10, "Cleanliness of Piping Systems" and WBN's QCT 4.36, "General Procedures for Preoperational Cleaning and Flushing of Fluid Handling Systems and Components." (NOTE: Revision R0, not R1, should be evaluated for applicability.)

(b) Part VI (layup practices for large components and/or piping systems) of DPM N79E2 had not been issued. While NSRS found that each plantsite had addressed layup of critically sensitive components, no comprehensive programs were in effect.

(c) Training and certification criteria need to be established for inspection of pipe cleanliness and conditions. NSRS understands that action has been started to remedy this concern prior to NSRS' review. Training requirements had not been established in the QC Inspector Training Manual for piping cleanliness inspectors. (See BFN and SQN below for additional details.)

The other DPM's listed above were judged to be acceptable. DPM N80E5 appeared to have responsibilities and requirements set forth in exceptionally clear and usable form.

(2) Implementation

Parts of the implementation activities in the NCO were determined to be very good. Findings were as follow:

(a) The Metallurgical Analyses Section was strongly involved in numerous piping condition problems and was conducting industry experience review in its area of expertise. Areas of recent involvement were large bore pipe corrosion, eddy-current testing of BFN's RHR heat exchangers, WBN's steam generator modifications, integration of industry experience into ISI programs, examination for pitting in stagnant raw water pipes, and development of a grid inspection program for raw water pipes.

(b) Field data and discussions with NCO personnel showed that the NCO was not appropriately involved in plant problems in several areas. There did not seem to be adequate involvement in the problems experienced at the site in applying the cleaning and inspection requirements of DPM N73E5 to practical situations. The NCO was not aware of lack of site action in regard to DPM N75E6 (Retention of Specimens) and was involved in flush and decontamination activities only on an on-call basis. NSRS was concerned from these examples that NCO activities were removed too far from field applications to provide overview of performance and upgrading of program requirements based on adverse field experience. NCO should evaluate this concern and correct the conditions cited above.

b. Browns Ferry Nuclear Plant (BFN)

NSRS reviewed program controls such as standard practices and plant procedures and conducted discussions with applicable personnel. Plant program and implementation were judged adequate but weaknesses were identified as follows:

(1) Program Controls

(a) Standard Practice BF 3.10, "Cleanliness of Piping Systems," contained considerable guidance not made available in DPM N73E5. However, the cleanliness criteria of DPM N73E5 had not been incorporated directly into the plant practices or procedures. In practice, inspection results were being documented to the following (typical) statement:

"Verification that piping is clean per BF 3.10, class (A, B, C, D, or E)."

This practice failed to document specific results of inspections or tests (such as visual, swipe, flush, etc.) and forced cleanliness inspectors to refer not to BF 3.10, but to excerpts from DPM N73E5 in the field. Thus, too much interpretation and too little documentation was being effected on the job. NSRS recommends that BFN evaluate the forms in WBN's TI-27, part III (appendices A through E) for use in stating inspection criteria and utility in documenting cleanliness inspection results.

(b) Field services personnel stated that inspection problems were occurring due to conflicting criteria in use--that is, field services was preparing components per construction specificatoin G-29 (welding and NDE) while QA inspectors were employing inspection criteria from DPM N73E5. This was causing rework or hassle that field services personnel considered excessive. NSRS recommends that the site evaluate and take steps to remedy this conflict.

(2) Implementation

(a) The inspection criteria of DPM N73E5 fail to address the condition of piping system components. Faced with corrosion on a large scale, such as flaking, tuberculation, etc., the QC staff had ruled that all visible surfaces of piping interiors would be cleaned to permit verification that pitting, cracking, etc., was not being obscured during cleanliness inspections. The QC supervisor had attempted usuccessfully to obtain clarification of the DPM from the Chemical Engineering Group. Lacking criteria, the QA section was requiring what appeared to be excessive, but conservative action. The plant chemical unit supervisor was determining acceptability of piping conditions when requested to do so. However, as with QA, this was being done in the absence of NCO (DPM) guidance. NSRS believes the DPM should contain explicit criteria for pipe condition (see NCO comments for further discussion).

(b) The training program for QC inspectors had consisted of a lecture by the site QC supervisor to his inspectors, who were issued an excerpt taken from DPM N73E5 when called on to perform piping cleanliness inspection. A division-approved QC inspector certification program is needed, as discussed in comments on the NCO above.

(c) BFN had no practice or procedure for, and was not conducting, a program to retain archive samples from pipes and components for the purposes described in DPM N75E6. NSRS recommends that the site resolve this deficiency.

c. Sequoyah Nuclear Plant (SQN)

NSRS reviewed program controls and discussed implementing activities with applicable personnel in maintenance, field services, and QA sections. The forms provided in AI-26 for control of foreign materials appeared to be very complete and useful. Plant programs and implementation were judged good except as follows:

(1) Program Controls

No concerns were identified.

(2) Implementation

(a) SQN's QC inspectors were required to complete classroom and on-the-job training prior to certification for piping cleanliness inspections. An inspector was also required to be certified as a mechanical inspector and as a Level II inspector in MT or PT. SQN expected that certification in VT inspections would be substituted for the MT or PT requirement at a later time (pending transfer of VT certification from ANSI N45.2.6 to ASNT-TC-1A). NSRS considered the SQN program to be reasonable under the circumstances. However, a division-approved certification program is needed, as discussed in NCO comments above.

d. Watts Bar Nuclear Plant (WBN)

NSRS reviewed program controls and discussed implementing activities with applicable personnel. The program had been prepared in detail and was judged adequate except as follows:

(1) Program Controls

QA personnel stated that the inspection criteria for DPM N73E2 were applicable primarily to newly fabricated pipe and were stated too broadly to be applied to pipes that had been in service. As at BFN, this problem relates to condition of components, which needs to be addressed in the DPM.

(2) Implementation

Not observed.

H. Raw Water Treatment Practices

Several specialized areas were selected for review of raw water treatment practices. Selections were based on importance to nuclear safety and included the following operational problems:

°Bio-fouling (clam, slime, and sponge infestation
°Radiation monitoring of raw water effluents

Discussion

Nuclear safety concern in the area of raw water treatment has been heightened recently by adverse incidents addressed in OIE Bulletin 81-03, "Flow Blockage of Cooling Water to Safety System Components by Corbicula Sp (Asiatic Clam) and Mytilus Sp. (Mussel)." The NRC identified blockage of coolant flow to safety-related systems as one of the two abnormal occurrences in the U.S. nuclear industry in 1981 in its 27th "Report to Congress on Abnormal Occurrences." That report cited six instances occurring between September 1980 and January 1982 in which the function of safety-related components had been severely degraded by bio-fouling, siltation, and corrosion effects. Problems with each of these effects have received much attention in TVA because of recent similar experiences with our nuclear plant systems.

This safety review was limited to control measures and results applied to nuclear safety-related raw water systems (ERCW and FPS at SQN and WBN; RHRSW, EECW, and FPS at BFN) and did not address environmental limits except for radiation monitoring in raw water effluents.

General administrative requirements found in Appendix B to 10CFR50 require that an operator of a nuclear plant establish program measures to ensure that persons and organizations conducting activities affecting the safety-related functions of the CSSC should perform all those actions necessary to provide adequate confidence that the CSSC will perform satisfactorily in service. This review was conducted to determine whether program objectives had been established and were being implemented effectively.

Review Basis

The following aspects of NUC PR's program for raw water treatment were evaluated:

Management Controls - A determination of whether adequate policy objectives have been established in the technical specifications, FSAR, and DPM and whether these objectives have been properly translated into detailed directives and procedures for implementation as to specifications, surveillance/action requirements, and analytical and sampling procedures.

Implementation - A determination of whether (1) activities have been conducted in accordance with management controls, (2) the technical bases of the program are adequate, and (3) results bear out the soundness of the program.

Independent Review - A determination of whether adequate review and follow up is performed by independent safety and quality assurance audit groups.

1. Measures for Control of Biofouling

TVA has committed to technical requirements for control of biofouling in the technical specifications, FSARs, and regulatory correspondence as follows:

Plant	Technical Specification	FSAR	OIE Bulletin 81-03
BFN	4.11.A.1.f and Environmental TS*	NA	Response dated 5/26/81
SQN	4.7.11.1.c and Environmental TS*	9.2.2.6	Response dated 5/26/81
WBN	(Presumed same as SQN)	9.2.1.6 9.2.8.1	Response dated 7/21/81

*The Environmental Technical Specifications (ETS) references limits prescribed in the NPDES permit.

These commitments consist of various mechanical and chemical control measures (such as screening, straining, flushing, mechanical cleaning, and injection of biocides) to prevent or control the effects of clams, slime, sponges, or other agents (such as silt and corrosion effects) on safety-related raw water components. The technical bases for chemical control measures have been developed from experience and research efforts by TVA. The minimum concentration for chemical controls has been established by TVA's research efforts and reported in two documents (report by L. B. Goss, et al, "Control Studies on Corbicula for Steam-Electrical Engerating Plants," presented at the First International Corbicula Symposium, Ft. Worth, Texas, October 13-15, 1979 and a memorandum to H. J. Green from M. D. High dated October 19, 1982, "Toxicity of Chlorine to Freshwater Sponges Found in the Vicinity of Browns Ferry Nuclear Plant"). The findings of these reports are being employed at the nuclear plants within environmental safety limits prescribed by the NPDES permit, which is referenced in the environmental technical specifications.

TVA's program for control of bio-fouling mechanisms consists of prevention and control. All but very small organisms are screened or strained from raw water at the plant intake or

system suctions. Organisms which pass through the strainers and establish themselves in the raw water system are controlled by injection of biocide or by periodic flushing and mechanical cleaning. Research and experience have shown that larva clams, slime, and sponge infestation can be controlled by injection of chlorine to obtain a total residual chlorine level in the range of 0.3-0.4 ppm in 96-108 hours at water temperatures in the range of 77-82 degrees Fahrenheit. Such controls will cause a very high mortality rate without causing a sudden release of dead organisms which could block flow through downstream heat exchangers. Research and recent experience have shown that chlorine controls can be very effective if applied twice a year, at the beginning and close of the clam spawning period, during which raw water temperatures exceed 62-65 degrees Fahrenheit.

a. Division of Nuclear Power Central Office (NCO)

The NCO program for raw water treatment was reviewed in regard to management controls and implementation. The review included evaluation of DPM's, correspondence, and reports, plus discussions with applicable NCO personnel. The following determinations were made:

(1) The NCO had issued a comprehensive structure of DPMs to define criteria (DPMs N77A13 and N75M6) and analytical techniques (DPM N78E2) to implement a satisfactory chlorination program at each nuclear plant. The controls were considered to be very good.

(2) While the NCO was providing technical support for the chlorination activities to the plants in several ways, it was not providing a periodic onsite review to detect and emphasize the need to resolve implementation deficiencies at the plants. This was particularly significant at SQN, which experienced serious asiatic clam infestation in a containment spray heat exchanger in 1982, long after a satisfactory chlorination program should have been in service per technical specification and FSAR commitments.

It was noted that the NCO had provided support to BFN by contracting for research into susceptibility of fresh water sponges to chlorine and by researching and providing revised chlorination limits to WBN to prevent recurrence of releases in excess of NPDES permit limits. NCO engineering sections were providing support or participating in all of the significant raw water system problems identified by onsite portions of this review, including pitting and general corrosion, bio-fouling, and siltation.

b. Browns Ferry Nuclear Plant (BFN)

The BFN program for raw water treatment was reviewed in regard to management controls and implementation. The review included evaluation of plant practices, procedures, and results plus discussions with applicable personnel and a walk-through of chlorination sample facilities. The following determinations were made:

(1) Although no standard practice had been developed to assign responsibilities and define plant program criteria, the system of procedures, including SIs, MMIs, OIs, and RLM instructions was in good order.

(2) From review of results and a walk-through with station personnel, it was determined that raw water chlorination activities were well understood and implemented satisfactorily. Chemical unit personnel had taken measures to rotate bleed points among the FPS header branches to ensure an orderly and complete distribution of chlorine during the 21-day chlorination period. Results from fire header flushes had shown little if any evidence of recent clam infestation. Overall implementation was considered to be very good.

c. Sequoyah Nuclear Plant (SQN)

The SQN program for raw water treatment was reviewed in regard to management controls and implementation. The review included evaluation of plant practices, procedures, and results, plus a discussion with the cognizant chemical engineer. The following determinations were made:

(1) Although no standard practice has been developed to assign responsibilities and define the plant's program criteria, the plant staff was implementing a chlorination program. Draft surveillance instructions were in preparation to provide procedures for chlorination for the RCW/RSW, ERCW, and CCW systems. NSRS did not locate an operating procedure for operation of the sodium hypochloride facility or injection into raw water streams. SQN should issue approved operating and surveillance procedures for the chlorination of raw water sytems as soon as practicable.

(2) From review and discussion of test results, it was determined that raw water chlorination needs were well understood by the cognizant engineer. SQN had been chlorinating the raw water systems practically continuously from late April through

August but had not achieved the desired chlorine residuals on any consistent basis. Although measured residuals were improving with time, they were well below acceptance criteria. Plant personnel cited equipment problems as the chief contributor to this problem. As of August, the initial flush of the fire protection system with chlorinated water was in progress but had not been completed. As clam infestations were found in two containment spray heat exchangers in March 1982 and the plant has experienced an inability to obtain or maintain chlorine residuals at desired levels in safety-related systems, SQN's chlorination program is considered inadequate--SQN should obtain the aid of the CEG and increase efforts to resolve equipment or other factors that have inhibited acceptable chlorination results.

d. Watts Bar Nuclear Plant (WBN)

The WBN program for raw water treatment was reviewed in regard to management controls and implementation. The review included evaluation of plant practices, procedures, and results, plus a walk-through of facilities and discussions with the cognizant chemical engineer. The following determinations were made:

(1) WBN's standard practice and system of procedures had been developed and issued in excellent order.

(2) The plant staff had been chlorinating raw water systems for approximately five years with the result that no live clams and few clam shells had been found during flush and inspection activities. The plant staff had taken effective action to resolve injection equipment problems and to obtain modified chlorination limits for an ERCW outage which had adversely affected control of chlorine residuals in releases to the reservior. Results indicated that desired residuals were being maintained during flushing of the fire protection systems.

I. Chemical Measuring and Test Equipment (M&TE)

Criteria XII of Appendix B of 10CFR50, Requires that "Measures shall be established to assure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specified periods to maintain accuracy within necessary limits." For the purposes of this review chemical M&TE were perceived by NSRS to be those devices that are used to measure safety-related parameters that are not classified as installed process instrumentation.

To comply with the NRC regulatory requirements specified in Appendix B of 10CFR50, TVA has formulated a Quality Assurance Program for Station Operation as described in section 17.2 of the Topical Report, TVA-TR75-1A, R5. Section 17.2.12, "Control of Measuring and Test Equipment," specifies the following requirements which are considered applicable to NUC PR's chemical M&TE program:

- M&TE shall be controlled in accordance with written procedures or instructions.
- Procedures or instructions for calibrating and controlling M&TE shall include identification of the test equipment, calibration techniques, calibration frequencies, maintenance control, and storage requirements.
- Each item of M&TE shall be assigned a specific interval for recalibration. Historical records which contain sufficient experience data for evaluating calibration intervals shall be maintained.
- Unique identification shall be provided for each item of test equipment.
- Traceability shall be provided for reference standards to national standards with periodic validation.
- Records shall be maintained which indicate the complete status of each item of test equipment, including its maintenance history, calibration results, abnormalities, and last and future calibration dates.
- Controls shall be provided for the purchase requirements and acceptance tests for new or replacement test equipment.
- M&TE shall be calibrated against a working standard having a tolerance not greater than 1/4 the specified tolerance of the M&TE.
- The reference standards used to calibrate the working standards shall have a closer tolerance than that of the working standard.
- M&TE found out-of-calibration shall be conspiciously tagged, segreated, and an investigation shall be initiated to determine the validity of previous measurements and any necessary corrective action to be taken.
- Each organization shall be responsible for assuring that test equipment used by that organization has been properly calibrated and documented.

The Office of Powe- has implemented the requirments of Criterion XII, Appendix B of 10CFR50 and section 17.2.12 of the Topical

Report through the Office of Power Quality Assurance Manual, OP-QAP-12.1, "Control of Measuring and Test Equipment."

1. Division of Nuclear Power Central Office (NCO)

The NUC PR quality assurance program to complement the POWER QA program for M&TE described above is delineated through Part III, Section 3.1, "Control of Measuring and Test Equipment," of the N-OQAM.

The evaluation conducted at NCO involved the following:

- A review of the existing M&TE control program to determine if the key requirements are specified in the OPQAM have been included in the N-OQAM. It was not the purpose of this section of the review to evaluate the entire adequacy of the NUC PR M&TE program.

- Discussions with CEG personnel to determine if a program had been established by that group to assess the degree of implementation of the chemical M&TE control program at the nuclear facilities and at CLS.

The NSRS review at the NCO concluded the following:

a. The key requirements as specified in the OPQAM have been included in part III, section 3.1 of the N-OQAM.

b. No program has been established by the CEG to assess the degree of implementation of the M&TE program at each of the nuclear facilities or CLS. CEG and the chemical units at each plant accept the CLS activities (procurement, testing, calibration, and repair) at face value and apparently have made very little effort to ensure that the requirements of the OP-OQAM and the N-OQAM are being implemented at CLS for chemical M&TE. In addition, it appears that nuclear counting equipment is not considered as M&TE at BFN. The scope of OP-QAP-12.1 states in part that the requirements of that procedure apply to M&TE used in monitoring the CSSC and equipment necessary to assure that operations are conducted within technical specification limits. The scope of part III, section 3.1 of the N-OQAM states in part that the procedure establishes a calibration program to control and verify the accuracy of M&TE used to ensure CSSC are in conformance with prescribed technical requirements. As nuclear counting equipment is used routinely to determine safety-related parameters to assure compliance with facility technical specifications (i.e., dose equivalent iodine 131, radionuclide content in plant effluents, etc), the scope of the OPQAM and the N-OQAM procedures are applicable to nuclear counting equipment and no formal exception has been taken. Any M&TE (including nuclear counting

equipment) calibrated and operated by the chemical units at the nuclear facilities should be calibrated and operated in accordance with the requirements of part III, section 3.1 of the N-OQAM.

In summary, there are no specific requirements for CEG personnel to periodically assess the degree of implementation at each facility. However, the requirements are somewhat generic for all facilities and unique for the nuclear counting equipment. The "General Requirements" of part III, section 3.1 of the N-OQAM require that the M&TE program shall provide for the ready detection of inaccuracies and nonconformance with requirements for timely and effective corrective action. Periodic assessments of program implementation should identify developing problems and prescribe corrective actions as well as providing feedback for program improvement that can be shared by all of the nuclear facilities. These assessments should be in the form of direct review by CEG or review or involvement in the QA audit process.

2. Browns Ferry Nuclear Plant (BFN)

The BFN M&TE program is delineated by Standard Practice BF 17.5, "Control of Measuring and Test Equipment." This document requires that "all sections having M&TE must establish a program following BF 17.5 requirements." The Chemical Unit program to comply with BF 17.5 requirements is defined by Radiochemical Laboratory Manual Procedure 757, "Procedure for the Internal Control of Measuring and Test Equipment (MTE) Assigned to the Chemical Unit."

The evaluations conducted at BFN involved a comparison of the Chemical Unit M&TE progrm as defined in RLM 757 against the requirements of BF 17.5.

The NSRS review at BFN concluded the following:

a. The chemical M&TE program as described in RLM 757 was not well defined and only addressed the BF 17.5 requirements in a general manner. No provisions had been made in the program for the M&TE calibrated by the local Chemical Unit personnel (including nuclear counting equipment). The Chemical Unit should develop a detailed documented program delineating the requirements of standard practice BF 17.5 and including controls for the M&TE calibrated by the plant chemical units. The following conditions noted during the review of this area support this finding (not all inclusive):

   - General Requirement 6.2.1 of OP-QAP-12.1 requires in part that organizations responsible for control of M&TE shall prepare and maintain procedures

which define in detail their plan for complying with applicable requirements; the assignment of responsiblities for accomplishing these activities; a listing of individual instruments to be controlled, and their calibration frequencies. The implication from this requirement is that control of M&TE is an important quality function and warrants detailed instructions and close control. Contrary to this requirement, RLM 757 is very general in nature and does not include controls for calibration and corrective actions for important chemical M&TE such as turbidimeters, atomic absorption units, analytical balances, flash point testers, flow rotometers used in effluent analyses, and nuclear counting equipment.

- Part III, section 3.1 of the N-OQAM requires in part that activities involving unacceptable M&TE subsequent to its previous acceptable calibration shall be investigated and necessary corrective actions shall be executed. The results of investigations and corrective actions associated with unacceptable equipment shall be presented in a report to the responsible section supervisor for review. This report is to be a QA record and maintained in the history file for the M&TE. Attachment 1, "Measuring and Test Equipment Deficiency," of BF 17.5 satisfies this requirement for equipment found out of calibration or tolerance by the CLS. However, the intent of the requirement is prompt investigation and action to determine if a condition exists that may adversely affect plant operation or endanger the health and safety of the general public. No requirements exist in the plant documents (BF 17.5 and RLM 757) for this type of action for equipment calibrated by the Chemical Unit. A breakdown of control in this area is identified in section V.D.2 of this report. A gamma ray spectrometer system was possibly defective and no attempt was made to evaluate the data generated by the instrument during the defective time frame.

- The "Report of Calibration" issued by the CLS contains significant information required by BF 17.5 to be maintained as quality assurance records for a retention period of six years. These records are not addressed in RLM 757. Some of the information required by BF 17.5 is recorded in a M&TE log book maintained in the radiochemical laboratory. However, the logbook is not classified as being maintained as a quality assurance record.

- BF 17.5 requires that M&TE and reference standards found outside acceptable limits will be identified, separated, and tagged with an out-of-limit calibration item tag, form TVA 7830. No mention of reference standards on form TVA 7830 is made in RLM 757.

- Shipping instructions specified in BF 17.5 are not addressed in RLM 757.

- The chemical M&TE program is not PORC reviewed or approved.

NSRS recognizes that all Chemical Unit personnel are trained in the proper control of M&TE by General Employee Training Course (GET)-12 and that periodic retraining is required. However, this training is not a recognized substitute for a well documented and defined program for control of chemical M&TE. NSRS recommends that BFN perform (or request NCO to perform) a thorough Chemical Unit M&TE control program evaluation and take those corrective actions that may be necessary to satisfy the requirements as specified in the applicable controlling documents. The documented program should be PORC reviewed and approved.

3. Sequoyah Nuclear Plant (SQN)

The SQN chemical M&TE program is delineated by the following plant documents:

- Administrative Instruction (AI)-31, "Control of Measuring and Test Equipment"

- Technical Instruction (TI)-20, "Chemical Laboratory Test Equipment Calibration Program"

- Technical Instruction (TI)-49, "Radiological Chemical Laboratory Test Equipment Program"

- Administrative Instruction (AI)-13, "Nonconforming Items"

- Results Maintenance (I) Section Instruction Letter No. A64, "Control and Use of Measuring and Test Equipment"

- Engineering Section Instruction Letter (ES SIL) C10, "Routine Laboratory Schedules and Actions for Out-of-Limit Conditions

The evaluation conducted at SQN involved a comparison of the chemical M&TE program as described in those documents listed above to determine if the requirements of the N-OQAM had been implemented. In addition, actual implementation of the requirements of the SQN documents was evaluated.

The evaluation conducted at SQN concluded the following:

a. The key requirements of part III, section 3.1 of the N-OQAM have been included in plant documents. TI-20 provides for the calibration and control of chemical laboratory M&TE excluding the counting room equipment. It controls both the M&TE calibrated by CLS and by the plant Chemical Unit. The nuclear counting equipment is considered as M&TE at SQN. The program for calibration and control of this equipment is defined in TI-49. The instructions for nonconforming M&TE are provided by AI-13. ES SIL-C10 provides a schedule for preformance checks that are required for chemical M&TE. A list of chemical M&TE (not including nuclear counting equipment) is maintained as an attachment to RS&M(I) A64 for convenience of updating without PORC approval.

   The Chemical Unit staff at SQN was unfamiliar with the program used by CLS to procure, test, calibrate, and maintain chemical M&TE. They had not determined if an approved program was used by CLS for these functions.

   The Chemical Unit personnel receive training in the use and control of M&TE by GET-12. Periodic retraining is required.

b. The station documents that delineate the Chemical Unit M&TE program do not address the program as it is being implemented. During the implementation review of the documented chemical M&TE control program, the following conditions were noted:

   - Gamma ray spectrometer systems that had been calibrated by POTC were being used to perform safety-related analyses. This mode of calibration is not reflected in TI-49. The POTC had calibration procedures for this type of equipment but they had not received upper tier review and approval at POTC or at SQN.

     In addition, POTC did not have an approved quality assurance program. It would therefore be difficult for SQN to prove that these detectors had been calibrated using approved procedures by qualified individuals.

   - Attachment A of RS&M(I) A 64 is outdated and contains no schedule of calibration or accuracy information. Examples of M&TE in use but not included in attachment A are as follows (not all inclusive):

Bausch and Lomb Spectrophotometer TVA No. 511205
Hach Turbidimeter TVA No. 490067
Fisher Tetrator

- The Radiochemical Laboratory Analysts are performing the performance checks scheduled in ENSIL C10. However, they are using procedures in TI-20 that were written for equipment no longer in use.

- The M&TE being operationally checked by procedures in TI-49 is not being nonconformed in accordance with AI-13 and TI-49.

In conclusion, it appears that the implementation of the chemical M&TE program at SQN has diverged from the procedures that afford administrative controls. Corrective action should be taken to enhance compliance with administrative controls.

4. Watts Bar Nuclear Plant (WBN)

The WBN chemical M&TE program is delineated by the following plant documents:

- Technical Instruction (TI)-10, "Calibration Program for Measuring and Test Equipment"

- Technical Instruction (TI)-20, "Chemical Laboratory Counting Equipment Standardization Methods"

- Engineering Section Instruction Letter (ENSL) 67, "Calibration Schedule for Chemical Section M&TE Equipment"

- Engineering Section Instruction Letter (ENSL) C8, "Chemical Laboratory Equipment Standardization Program"

The evaluation conducted at WBN involved a comparison of the chemical M&TE program as described in those documents listed above to determine if the requirements of the N-OQAM had been implemented. In addition, actual implementation of the requirements of the WBN documents were evaluated.

The NSRS evaluation conducted at WBN concluded the following:

a. The key requirements of part III, section 3.1 of the N-OQAM, have been included in plant documents. TI-10 establishes the requirements for a calibration program to control M&TE used by the Chemical Unit of the Engineering Section along with the plant sections. Procedures for calibrating and controlling nuclear counting instruments are containued in TI-20. A listing of

chemical M&TE, the respective calibration schedule, and accuracy information is contained in ENSL C7. A schedule for standardizing chemical M&TE is contained in ENSL C8.

b. The Chemical Unit personnel receive training in the use and control of M&TE by GET-12. Periodic retraining is required.

c. The plant QA organization had a formal periodic survey program to audit the chemical M&TE program. Two surveys had been performed by the onsite QA survey group. It appears that the Chemical Unit took prompt corrective actions on the survey findings. The program appears to have improved as a result of the survey.

d. The Chemical Unit management and supervisory personnel should develop an internal review program to periodically determine the degree and acceptability of implementation of M&TE requirements. This conclusion is supported by the following conditions noted during the review:

- Section V.A.1 of TI-10 requires that the calibrated accuracy expected for each item of M&TE calibrated by CLS be provided by the plant. Accuracy information is included in attachment B of ENSL C7. However, the plant staff was unaware of the origin of this information, as no references are given, whether the information is correct, and if the CLS has been supplied with this information by the plant as required by TI-10.

- Section V.A.1 of TI-10 requires that the Engineering Section maintain the schedule of assigned M&TE per ENSL C7. Attachment B of ENSL C7 requires that the Orion PH meter, TVA ID No. 434535, be calibrated every 26 weeks. This instrument was observed as being calibrated on a frequency of every 52 weeks.

- The plant staff was not aware of the acceptability of the program used by CLS to procure, test, calibrate, and repair the Chemical Unit M&TE. They had not determined if the M&TE was being calibrated by the use of adequate and approved procedures by qualified personnel using adequate standards.

5. <u>Power Operations Training Center (POTC)</u>

The POTC chemical M&TE program is delineated by section 500, "Instrument Calibration Procedures," of the Radiochemical Laboratory Manual.

The evaluation conducted at POTC involved a comparison of section 500 of the RLM to determine if the requirement of the N-OQAM had been implemented.

The NSRS evaluation conducted at POTC concluded the following:

a. Section 500 of the RLM only provides calibration procedures for specific nuclear counting equipment. However, these procedures receive no upper tier review or approval.

b. The POTC Chemical Unit should develop and implement an M&TE program to comply with the requirements of section 3.1, part III of the N-OQAM, for the POTC equipment used in safety-related analyses and to provide applicable controls over activities involving calibration of nuclear plant equipment. This conclusion is supported by the following facts:

   - The POTC Standard Practice TCS 10 states the following: "The radiochemical laboratory at the Power Operations Training Center (POTC) has equipment and facilities similar to radiochemical laboratories at nuclear power plants. The POTC lab is therefore capable of performing most of the chemical and radiochemical analyses required at the plants. In emergency situations, especially those in which the Sequoyah Nuclear Plant lab is inaccessible, the POTC lab serves as a backup facility and will support any analyses necessary for the determination of the nature and extent of the emergency, the status of the plant, and recovery from the emergency." The OQAM defines M&TE as "Devices or systems used to calibrate, measure, gauge, test, inspect, or control in order to acquire research, development, test or operational data to determine compliance with design specifications or other technical requirements." The related equipment at POTC (including nuclear counting equipment) should be controlled by an M&TE program as the requirements are applicable anytime the POTC laboratory is performing quality or safety-related support for the nuclear plants.

   - The POTC is currently planning to purchase, calibrate, and repair nuclear counting equipment for the nuclear plants. These functions must be controlled by an acceptable M&TE program in addition to complying with requirements of RG 4.15.

6. Central Laboratory Services (CLS)

The CLS M&TE program is delineated by the following documents:

- Laboratory Instruction Letter Nos. 1 through 5.
- TVA Office of Power, Maintenance Coordination Staff Quality Program Procedure No. 1.0
- Central Laboratories Procedure Nos. 101, 102, 201, 202, 203, 204, 205, 206, and 208.

The evaluation conducted at CLS involved the following:

- A review of the CLS M&TE program as defined in the documents described above to determine if the program delineates the requirments of OP-QAP-12.1.
- A review of calibration records of chemical M&TE identified by NSRS as being in use at the nuclear plants.
- A review of training records of those personnel that had calibrated the chemical M&TE previously discussed.
- A tour and inspection of the M&TE repair and calibration facility.

The NSRS evaluation conducted at CLS concluded the following:

a. The requirements of OP-QAP-12.1 are delineated in those documents above.

b. Calibration records are being maintained as required by the N-OQAM.

c. The training records for those personnel associated with the calibration of the referenced chemical M&TE appeared in order. Training of those personnel is discussed further in section VIII.A.6 of this report.

d. An evaluation should be performed to determine the contamination hazard potential of M&TE used by the nuclear plants and returned to CLS for repair and calibration.

   Some of the M&TE used at the nuclear facilities has a high degree of potential of being contaminated on the inside surfaces and sample chambers. Radioactive fluids are placed in sample chambers during the course of analyses. These fluids leak or are spilled on the inside surfaces of these sample chambers. In some cases M&TE equipped with cooling fans is used inside regulated and contamination zones. It is somewhat impractical to expect that all of the inside surfaces will be contamination free when received at CLS from the plants. In addition, it is impractical to disassemble the equipment at the plantsite to allow for an

extensive contamination survey by health physics personnel. NSRS recommends that the CLS be equipped with radioactive detection equipment and those personnel repairing and calibrating M&TE trained in proper use of the equipment. Frequent surveys should be made in the course of repair work. In addition, CLS should arrange for periodic health physics surveys of the applicable work areas.

In summary, it appears that CLS is calibrating and controlling M&TE in accordance with approved procedures. They have developed and are implementing a formal QA program for M&TE control. The CLS is staffed with a full time QA manager who is well qualified and actively involved in the M&TE program. In addition, the work areas inspected reflected a professional attitude. It should be noted that the NSRS review at CLS was not an indepth review as to the acceptability of the M&TE program. Due to the importance of the M&TE program (program affects every nuclear facility), the OQA organization should perform a detailed audit to establish the degree of its acceptability.

VI. LIST OF PERSONNEL CONTACTED

A. Division of Nuclear Power Central Offic·

Name	Organization/Job Title	Attended Entrance Meeting	Contacted During Review	Attended Exit Meeting
D. L. Paul	NUC PR/NMB, Mechanical Branch Staff Specialist	X	X	X
J. M. Pleva	NUC PR/CEG, Chemical Engineering Section Supervisor	X	X	X
E. L. Whaley	NUC PR/CEG, Chemical Engineer		X	
D. S. Hixson	NUC PR/CEG, Chemical Engineer		X	
F. E. Hartwig	NUC PR/CEG, Chemical Engineer		X	
D. P. Wilson	NUC PR/CEG, Chemical Engineer		X	
P. L. Whitt	NUC PR/CEG, Chemical Engineer		X	
J. L. Maholtra	NUC PR/CEG, Chemical Engineer		X	
M. L. Rollins	NUC PR/CEG, Chemistry Section Supervisor		X	X
L. Reardon	NUC PR/CEG, Chemist		X	
M. E. Koss	NUC PR/CEG, Metallurgical Engineer		X	
J. Corry	NUC PR/REG, Mechanical Engineer		X	
E. F. Harwell	NUC PR/Chemical Engineering Group Supervisor		X	X
+T. D. Knight	NUC PR/Reactor Engineering Branch Chief		X	X
T. F. Ziegler	NUC PR/Nuclear Maintenance Branch Chief		X	
R. C. Parker	NUC PR/Quality Assurance & Compliance Group Supervisor			X
W. E. Andrews	NUC PR/Quality Engineering & Compliance			X
E. K. Sliger	NUC PR/Radiation & Environmental Protection Supervisor		X	
D. F. Goetcheus	NUC PR/CEG, Metallurgical Analysis Section Supervisor		X	
J. T. Dills	NUC PR/REP, Chemical Engineer		X	
T. R. Woods	NUC PR/Metallurgical Engineer		X	

+Senior representative at September 10, 1982 exit meeting.

B. Browns Ferry Nuclear Plant

Name	Organization/Job Title	Attended Entrance Meeting	Contacted During Review	Attended Exit Meeting
+J. R. Bynum	Assistant Plant Superintendent		X	$X^{1,2}$
R. Tibi	Compliance Engineer			X^{2}
K. Morkin	Chemical Engineer		X	X^{2}
T. Sharpe	Chemist		X	$X^{1,2}$
A. L. Clement	Chemical Unit Supervisor	X	X	$X^{1,2}$
W. G. Tays	Radiochemical Laboratory Supervisor		X	X^{2}
J. R. Clark	Chemical Engineer		X	$X^{1,2}$
W. C. Thomison	Engineering Section Supervisor	X	X	$X^{1,2}$
K. Richards	Radiochemical Laboratory, Shift Supervisor		X	
D. McDaniel	Radiochemical Laboratory, Shift Supervisor		X	
L. Parvin	Plant QA, QC Supervisor		X	
D. Barker	Plant QA, Survey Coordinator		X	
J. Raglin	Plant QA, QC Engineer		X	
J. M. Pleva	NUC PR/CEG, Chemical Engineering Section Supervisor		X	
F. E. Hartwig	NUC PR/CEG, Chemical Engineer		X	
J. D. Bryan	Radiochemical Laboratory Analyst		X	
R. Cole	OPQA Coordinator		X	
xG. T. Jones	Plant Superintendent			X^{2}
T. L. Chinn	Compliance Supervisor		X	
R. J. Childers	Administrative Services Supervisor		X	
W. Roberts	Compliance Engineer		X	
C. Rozear	Compliance Engineer		X	
E. Balch	Document Control		X	
R. G. Metke	Staff Specialist		X	
N. Fulmur	Assistant Storeroom Supervisor		X	
D. W. Nix	NUC PR/CEG, Chemist		X	
M. Davis	Training Officer		X	
E. May	Material Control Clerk		X	
J. Pyron	Supply Officer		X	
L. Jones	Plant QA Supervisor		X	
J. R. Phifer	Safety Supervisor		X	
T. Keckeisen	Fire Protection Engineer		X	
R. Thigpen	Material Maintenance, General Foreman		X	
A. D. Grigsby	Radiochemical Laboratory Analyst		X	
J. S. Black	Radiochemical Laboratory Analyst		X	
J. Crowell	Field Services Engineer		X	
B. Carrigan	Field Services Engineer		X	
P. Crabb	Work Plan Coordinator		X	
J. Walker	Mechanical Maintenance Engineer		X	
J. Watson	Mechanical Maintenance Engineer		X	
M. W. Haney	Mechanical Maintenance Supervisor		X	

[1] Present at exit meeting July 23, 1982.
[2] Present at exit meeting August 6, 1982
+ Senior station representative at July 23, 1982 exit meeting.
x Senior station representative at August 6, 1982 exit meeting.

C. Sequoyah Nuclear Plant

Name	Organization/Job Title	Attended Entrance Meeging	Contacted During Review	Attended Exit Meeting
A. M. Carver	Compliance Engineer	X		X
N. Lehberson	Plant QA Staff Engineer			X
R. W. Fortenberry	Engineering Section Supervisor	X	X	X
J. L. Taylor	Chemical Unit Supervisor		X	X
+M. R. Harding	Compliance Supervisor	X	X	X
P. Johnson	Radiochemical Laboratory Shift Supervisor		X	
W. L. Williams	Chemical Engineer		X	
J. B. Mullenix	Chemist		X	
J. W. Proffitt	Chemical Engineer		X	
J. D. Pierce	Radiochemical Laboratory Supervisor		X	
H. L. Harris	Radiochemical Laboratory Analyst Trainee		X	
J. A. Parker	Radiochemical Laboratory Analyst Trainee		X	
W. A. Wright	Radiochemical Laboratory Analyst Trainee		X	
C. R. Wilhoite	Radiochemical Laboratory Shift Supervisor		X	
D. Amos	Chemical Engineer		X	
V. L. Varner	Administrative Services Clerk-Steno		X	
B. H. Ervin	Training Officer Clerk-Steno		X	
W. E. McKnight	Management Services Supervisor		X	
R. J. Kitts	Health Physics Supervisor		X	
T. Lones	Radiochemical Laboratory Shift Supervisor		X	
C. Stulz	Plant QA, QA Engineer		X	
J. Anderson	Plant QA, QC Supervisor		X	
C. E. Bosley	Radiochemical Laboratory Shift Supervisor			
P. MacLaren	Radiochemical Laboratory Analyst		X	
C. Brannon	Power Storeroom Supervisor		X	
C. Morrison	Assistant Power Storeroom Supervisor		X	
T. Moody	Power Storeroom Clerk		X	
J. McPherson	Supervisor, Mechanical Test Unit		X	
D. McAmy	Mechanical Engineer		X	
J. Robinson	Field Services Supervisor		X	
D. Love	Mechanical Engineer		X	
P. Hitchcock	Mechanical Engineer		X	
K. McDonald	Chemical Engineer		X	
E. Craig	Safety Supervisor		X	

+ Senior station representative at September 3, 1982 exit meeting.

D. Watts Bar Nuclear Plant

Name	Organization/Job Title	Attended Entrance Meeting	Contacted During Review	Attended Exit Meeting
F. K. Heacker	Chemical Unit Supervisor		X	X
D. R. Matthews	Chemical Engineer		X	
S. O. Casteel	Chemical Engineer		X	
M. E. King	Chemical Engineer		X	
H. Waddle	Radiochemical Laboratory Shift Supervisor		X	
J. J. Erpenbach	Assistant Engineering Section Supervisor	X	X	X
W. H. Nall	Radiochemical Laboratory Supervisor		X	
G. Curtis	Quality Assurance Supervisor		X	
H. Pope	Quality Control Supervisor		X	
K. R. King	Radiochemical Laboratory Shift Supervisor		X	
D. F. Bailey	Management Services Supervisor		X	
W. L. Byrd	Compliance Supervisor	X	X	X
J. Englehart	Compliance Engineer			X
+R. L. Lewis	Assistant Plant Superintendent			X
W. T. Cottle	Plant Superintendent	X		
B. D. Varga	Plant Training Officer		X	
C. H. Whittemore	OPQA Coordinator		X	
J. T. Kirkpatrick	Field Services Electircal Engineer		X	
J. L. Collins	Mechanical Maintenance Supervisor		X	
S. Jenkins	Power Stores Supervisor		X	
R. C. Manley	Plant Services Unit Supervisor		X	

+ Senior station representative at August 27, 1982 exit meeting.

E. Power Operations Training Center

Name	Organization/Job Title	Attended Entrance Meeting	Contacted During Review	Attende Exit Meeting
H. Martin	Health Physics/Chemistry Training Unit Supervisor		X	X
W. T. Reid	Laboratory Unit Supervisor	X	X	X
M. S. Collins	Management Services Section Supervisor			X
A. Haynes	Clerk-Stenographer			X
+W. F. Popp	Nuclear Training Branch Assistant Chief	X		X
L. H. Sain	Engineering Training Section Supervisor			X
J. Mays	Radiochemical Laboratory Analyst Trainee		X	
B. H. Williamson	Radiochemical Laboratory Analyst		X	
M. O. Walters	Engineering Training Section, Instructor Training Supervisor		X	

+ Senior representatior at August 3, 1982 exit meeting.

F. Central Laboratory Services

Name	Organization/Job Title	Attended Entrance Meeting	Contacted During Review	Attended Exit Meeting
R. Cliffort	Document Control Supervisor		X	
R. Camp	Property and Supply Officer		X	
F. Watson	Management Services Supervisor		X	
G. A. Ericson	QA/QC Section Supervisor		X	X
D. Besnell	Power Stores Supervisor		X	
D. Axley	Measurements Laboratory Lead Technician		X	
J. Rose	Chemical Laboratory Section Supervisor	X	X	X
R. Taylor	Chemist		X	
+H. A. Taff	Central Laboratory Services Chief			X

+ Senior representative at September 16, 1982 exit meeting.

G. NSRB/OPQA/NUC PR Steam Generator Task Force (SGTF)

Name	Organization/Job Title	+Contacted
C. E. Chmielewski	NSRB/Sequoyah Full Time Member	X
T. M. Galbreth	NSRB/Browns Ferry Full Time Member	X
B. F. Roberts	NSRB/Executive Secretary	X
R. L. Moore	OPQA/Support Audits Supervisor	X
G. W. Killian	OPQA/Plant Program Supervisor	X
D. L. Paul	SGTF/NMB, Mechanical Branch Staff Specialist	X
T. F. Ziegler	SGTF/Nuclear Maintenance Branch	X

+ No formal exit meetings were conducted at these organizations; however, preliminary findings were discussed at the respective organizational offices on September 16, 1982.

VII. DOCUMENTS REVIEWED (REFERENCES)

NOTE: Revisions to controlled documents made after September 1, 1982 were not considered in this review except as identified below.

A. TVA Documents

1. Corporate

a. Topical Report, TVA-TR75-1A, R5, "Quality Assurance Program Description"

b. IPM - Interdivisional Quality Assurance Procedures Manual for Nuclear Power Plants

c. Organizational Bulletin I, Management Services

d. Organizational Bulletin I, Power

e. TVA Radiological Emergency Plan

B. Codes, Standards, and Regulations

1. Regulatory Requirements/Information

a. 10CFR20 - Standards for Protection Against Radiation

b. 10CFR50 - Domestic Licensing of Production and Utilization Facilities, including:

(1) Appendix A - General Design Criteria for Nuclear Power Plants

(2) Appendix B - Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants

(3) Appendix I - Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Is Reasonably Achievable" for Radioactive Material in Light-Water Cooled Nuclear Power Reactor Effluents

c. 10CFR51 - Licensing and Regulatory Policy and Procedures for Environmental Protection

d. 10CFR100 - Reactor Site Criteria

e. OIE Bulletin 81-03 - Flow Blockage of Cooling Water to Safety System Components by Coricula (Asiatic Clam) and Mytilus (mussel) [A02 810413 015]

f. OIE Bulletin 82-02 - Degradation of Threaded Fastners in the Reactor Coolant Pressure Boundary of PWR Plants

g. OIE Information Notice 81-27 - Flammable Gas Mixtures in the Waste Gas Decay Tanks in PWR Plants

h. OIE Information Notice 81-21 - Potential Loss of Direct Access to Ultimate Heat Sink

i. OIE Information Notice 82-14 - TMI-1 Steam Generator/ Reactor Coolant System Chemistry/Corrosion Problem

j. OIE Information Notice 82-32 - Contamination of Reactor Coolant System by Organic Cleaning Solvents

k. OIE Circular 81-09 - Containment Effluent Water That Bypasses Radioactivity Monitor

l. NPDES Permit No. A110022080, "Authorization to Discharge Under the National Pollutant Discharge Elemination System" BFN

m. NPDES Permit No. TN00264504, "Authorization to Discharge Under the National Pollutant Discharge Elimination System," SQN

n. NPDES Permit No. TN0020168, "Authorization to Discharge Under the National Pollutant Discharge Elimination System," WBN

o. USNRC Region II, Office of Inspection and Enforcement Inspection Reports for BFN and SQN: January 1980, August 1982

2. Regulatory Guides

a. RG 1.8 - Personnel Selection and Training, R1, May 1977

b. RG 1.21 - Measuring, Evaluating, and Reporting Radioactivity in Solid Waste and Release of Radioactivity in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants, R1, June 1974

c. RG 1.28 - Quality Assurance Program Requirements (Design and Construction), R2, February 1979

d. RG 1.30 - Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment, R0, August 1972

e. RG. 1.33 - Quality Assurance Program Requirements, R2, February 1978

f. RG 1.37 - Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants, R1, September 1977

g. RG 1.38 - Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants, R2, May 1977

h. RG 1.39 - Housekeeping Requirements for Water-Cooled Nuclear Power Plants, R2, September 1977

i. RG 1.56 - Maintenance of Water Purity in Boiling Water Reactors, R1, July 1978

j. RG 1.58 - Qualification of Nuclear Power Inspection, Examination, and Testing Personnel, R0, August 1973

k. RG 1.64 - Quality Assurance Requirements for the Design of Nuclear Power Plants, R2, July 1976

l. RG 1.78 - Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release, R0, June 1974

m. RG 1.83 - Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes, R1, July 1975

n. RG 1.88 - Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records, R2, October 1976

o. RG 1.112 - Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water Cooled Power Reactors, R0, May 1977

p. RG 1.123 - Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants, R1, July 1977

q. RG 1.137 - Fuel Oil Systems for Standby Diesel Generators, R1, October 1979

r. RG 1.144 - Auditing of Quality Assurance Programs for Nuclear Power Plants, R1, September 1980

s. RG 4.15 - Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, R1, February 1979

t. RG 8.8 - Information Relevant to Ensuring that Occupational Exposures at Nuclear Power Stations Will be as Low as Reasonably Achievable, R3, June 1978

u. RG 8.10 - Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable (Nuclear Power Reactors), R1, May 1977

3. <u>American National Standards Institute (ANSI) Standards</u>

a. ANSI N18.1-1971 - Selection and Training of Nuclear Power Plant Personnel

b. ANSI N18.7-1976 - Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants

c. ANSI N45.2-1971 - Quality Assurance Program Requirements for Nuclear Power Plants

d. ANSI N45.2.1-1973 - Cleaning of Fluid Systems and Associated Components for Nuclear Power Plants

e. ANSI N45.2.2-1972 - Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants (During the Construction Phase)

f. ANSI N45.2.3-1973 - Housekeeping During the Construction Phase of Nuclear Power Plants

g. ANSI N45.2.4-1972, IEEE Standard Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations

h. ANSI/ASME N45.2.6-1973 - Qualifications of Inspection, Examination, and Testing Personnel for Nuclear Power Plants

i. ANSI N45.2.9-1974 - Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants

j. ANSI N45.2.11-1974 - Quality Assurance Requirements for the Design of Nuclear Power Plants

k. ANSI/ASME N45.2.12-1977 - Requirements for Auditing of Quality Assurance Program for Nuclear Power Plants

l. ANSI N45.2.13-1976 - Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants

m. ANSI N195-1976 - Fuel Oil Supply Systems for Emergency Diesel Generators

4. <u>American Society for Testing and Materials (ASTM) Standards/Federal Specifications</u>

a. ASTM, "Annual Book of ASTM Standards"

- Part 23, "Petroleum Products and Lubircants (I) D56-D1660," 1981
- Part 24, "Petroleum Products and Lubricants (II) D1661-12896," 1981
- Part 25, "Petroleum Products and Lubricants (III) D2896-latest; Aerospace Materails, Catalysts
- Part 29, "Paint - Fatty Oils and Acids, Solvents, Miscellaneous; Aromatic Hydrocarbons; Naval Stores," 1981
- Part 31, "Water," 1974, 1975, 1977, 1981

b. VV-F-800B, "Federal Specification for Diesel Fuel Oil"

c. Mil-STD-767C(SH), "Cleaning and Cleanliness Control Requirements for Special Purpose Equipment," October 1973

5. Office of Power

a. Power Nuclear Safety Review Procedures Manual

b. NSRB Charter, Revision 8

c. Office of Power Quality Assurance Manual (OPQAM)

(1) OP-QAP-2.2, "Quality Assurance Training," R1, December 21, 1978

(2) OP-QAP-3.1, "Modification Control," R0

(3) OP-QAP-4.1, "Procurement Document Control," R2, August 27, 1979

(4) OP-QAP-5.2, "Instructions, Procedures, and Drawings," R0, February 15, 1979

(5) OP-QAP-7.1, "Control of Purchased Material, Equipment, and Services," R0, July 7, 1976

(6) OP-QAP-8.1, "Identification and Control of Materials, Parts, and Components," R0, September 15, 1976

(7) OP-QAP 12.1, "Control of Measuring and Test Equipment," R1, January 17, 1980

(8) OP-QAP-13.1, "Handling, Shipping, and Storage," R0, November 3, 1976

(9) OP-QAP-15.1, Nonconforming Materials, Parts, or Components," R0, November 3, 1976

(10) OP-QAP-16.1, "Corrective Action," R0, January 20, 1977

(11) OP-QAP-17.1, "Quality Assurance Records," R0, November 3, 1976

(12) OP-QAP-18.1, "Audits," R3, March 26, 1981

d. Selected service reviews and personnel history data - Forms TVA 9890, 9880, and 3031

e. Selected from TVA 1453, "Individual Participation in an Educational Activity"

f. Selected Personnel Job Descriptions

g. Central Laboratory Instruction Letters

(1) No. 1 - Instructions for Handling Procedures for Repairing and Testing Portable Test Equipment

(2) No. 2 - Instructions for Implementing Environmental Control Lab Procedure 202, Section VI-7

(3) No. 3 - Instrument Limitations Caution - Stickers

(4) No. 4 - Instructions for Calibration Multi-range Instruments

(5) No. 5 - Instruction for Assigning Identification Numbers to Expendable Equipment Requiring QA Documentation

h. TVA Office of Power Maintenance Coordination Staff Quality Program Procedure No. 1.0 - Performance and Quality Management

i. Central Laboratories Procedures

(1) No. 101.1 - Central Laboratories Service Organization

(2) No. 102 - Calibration Personnel Qualification

(3) No. 201 - Lab Standard Instrument Recall and Calibration Intervals

(4) No. 202 - Measuring and Test Equipment Control

(5) No. 203 - General Instrument Calibration Procedure and Standard Statements

(6) No. 204, Nuclear Instrument Processing

(7) No. 205 - Document Control

(8) No. 206 - Collection, Storage, and Maintenance of Nuclear Calibration Reports

(9) No. 207 - Disposition of Out of Tolerance Laboratory Standards

(10) Section 600 - "Chemical" - Central Laboratories Calibration Manual