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Licensee: Virginia Electric and Power Company
Glen Allen, VA 23060

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Facility Name: Surry 1 and 2

Inspection Conducted: February 26 - March 2; March 12-16 and 26-30, 1990

Inspectors: ______________________ 17 May 1990
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SUMMARY

Scope:

This special, announced inspection consisted of an in-depth team inspection of the maintenance program and its implementation. NRC Temporary Instruction 2515/97 issued September 22, 1989, was used as guidance for this inspection.

Results:

Overall, the maintenance program and its implementation were judged to be marginally SATISFACTORY with a strong potential for improvement. The more significant areas of strength and weakness are highlighted in the Executive Summary, with details provided in the report. one violation was identified: "Failure to Follow Procedures for Maintenance" - paragraph numbers 2.e., 2.h., 3.b., 3.i., and 3.k. One unresolved item was identified: "EDG Day Tank Fuel Transfer Line Analysis" paragraph 2.f.

EXECUTIVE SUMMARY

This NRC maintenance team inspection rated the Surry maintenance program and its implementation marginally satisfactory with a strong potential for improvement. The satisfactory rating indicates adequate development and implementation of the important elements of a maintenance program, with the areas of weakness being approximately offset by strengths in other areas.

The inspection was conducted by an eight-man team using inspection guidance provided in NRC Temporary Instruction 2515/97. A principal feature of this instruction is a maintenance inspection logic tree used to collate and present the maintenance inspection findings.

The tree prepared by the NRC from inspection of Surry maintenance is presented as Appendix 3 to this report. It depicts the ratings determined for individual maintenance elements and the overall satisfactory rating. The ratings are discussed in report Section 4.

The team identified the following significant strengths and weaknesses:

<u>Significant Strengths</u>

- System engineers support to craft activities
- The MOVATS testing program
- The procedure upgrade program and the positive effect the program has on procedures
- The training program and facilities

<u>Significant Weaknesses</u>

- Poor material condition of the Containment Air System
- Poor material condition of the Heating, Ventilating and Air Conditioning System
- Poor allocation of resources
- No effective prioritization program
- The current Post Maintenance Test Program is inadequately defined
- Control of maintenance backlog is ineffective

One violation was identified during the maintenance inspection. It involved several examples of failure to follow procedures for maintenance.

One unresolved item was identified relating to the analysis of the day tank transfer line for the Emergency Diesel Generator.

1. INTRODUCTION

This inspection was conducted to assess the effectiveness of maintenance at Surry Nuclear Plant utilizing guidance given in NRC Temporary Instruction 2515/97. It was performed by a eight-man team during February and March 1990.

The inspection findings and conclusions are described in report Sections 2 through 4. Section 2, Inspection Details, describes the conduct of the inspection and the findings obtained. Section 3, Issues, describes the more outstanding issues identified during the inspection. Section 4, Evaluation of Plant Maintenance, summarizes all of the findings and logic which culminates in the overall rating of maintenance effectiveness at Surry. A special maintenance inspection logic tree developed for the NRC was utilized to collate findings for the rating process. It is discussed in Section 4 and presented in Appendix 3.

The last section of the report, Sections 5 describes the exit interview held with the licensee following the inspection.

2. INSPECTION DETAILS

This inspection was performance based and included:

* General equipment condition and housekeeping in the various equipment spaces were examined and evaluated. Pumps, valves (including operators), piping, supports and foundations were inspected for general condition and cleanliness, leaks (water, oil, and grease), rust/preservation, lubrication, dirt/trash, etc. Switchgear, relays, printed circuit control boards,circuit breakers, switches,lights, batteries and chargers, inverters, motor starters, wiring, connections and cables were inspected for general condition and cleanliness, terminations, corrosion, lifted leads, spare wires, boric acid, and missing parts.

* In-process maintenance work activities. Work performance, procedure compliance, proper documentation, cleanliness and housekeeping, material control, system control (tag-out, LCO, etc.), tool control, Post Maintenance Testing (PMT) requirements, and personnel qualification, as applicable to the specific work, were evaluated.

* Maintenance work histories for selected systems were examined by reviewing a brief description of the 100 newest completed WOs. Selected open and completed WOs for each system were examined in detail for technical adequacy to include nature of trouble, work description, PMT, completeness, readability, and legibility.

* Health physics in its relation to maintenance

The inspection findings for systems, health physics and for miscellaneous maintenance work observed are described below. All findings of importance to the evaluation are included in Section 4.

2.a. SAFETY INJECTION (SI) SYSTEM

Background

The function of the SI system is to provide adequate emergency cooling to the reactor core in the event of a LOCA or high energy line break. Depending on the accident scenario this is accomplished with the passive accumulators, the low head SI pumps, the high head (charging) pumps, and associated piping and valves.

Inspection

The inspection included walkdown of the majority of both unit 1 and 2 SI systems outside the containments, and examination of 17 completed WOs related to the SI system.

In addition, the team observed the following maintenance work activities related to the SI system:

Maintenance Work Document ID	Description of Activity Observed
WO 496754	Repair of oil leaks on Charging Pump 01-CH-P-1B
WO 640335	Repair of oil leaks on Charging Pump 01-CH-P-1B
WO 680651	PM (Vibrational Analysis) on Low Head SI Pump 1-SI-P-1B

The team evaluated the following general maintenance areas while inspecting the SI system: Post Maintenance Testing (PMT); QA/QC Involvement in the Maintenance process; Predictive Maintenance (including a sample of vibrational and oil analysis data for Low Head SI Pumps 1A and 2A); and Control of Vendor Manuals.

Findings

The inspections, observations, and record reviews revealed the following:

In general, material condition and housekeeping were good with the exception of some poor conditions, as detailed below. Although these conditions indicated a need for improvement in some areas, they were minor compared with the generally good condition of other areas observed.

There were five areas where the unit 2 SI piping configuration does not agree with flow diagram 11548-FM-089A, Sheet 2. In addition, there was a temporary support installed for valve 2-SI-MOV-2885C. These problems had been identified by the licensee during a walkdown inspection in November-December, 1989, but no corrective action had been initiated as of the close of this inspection. The failure to initiate corrective action for this known condition and the licensee identified drawing errors indicate a weakness in taking timely corrective action discussed further in section 3.e.

In addition to the above discrepancies the team found that Sheet 3 of drawing 11548-FM-089A, shows a union in line 3"-SI-347-1503 which does not exist (Drawing Change Request 90-1364 issued after identification by the NRC). Also, sheet 1 of the drawing indicates that valve 1-SI-69 and 2-SI-69 are locked closed (It appears this is another drawing error since procedures do not require that these valves be locked). Drawing Change Requests 90-1259 and 90-1363 were issued after identification of this problem by the NRC. Although the above drawing discrepancies including the five discrepancies identified by the licensee, do not affect plant or system operability, they are an indication of configuration control problems discussed further in section 3.b.

Several instances of missing fasteners or screws were identified. Examples: handwheel nut on valve 2-SI-51, pump 2-SI-P-1A electrical junction box cover screws, bolt on motor inspection plate for valve 2-SI-MOV-2890A, upper limit switch junction box cover screws for valve 2-SI-TV-202B, motor cover plate screws for valve 1-SI-MOV-1869B, junction box cover screws for valve 1-TV-RM-100A, and junction box cover screws for valve 1-TV-CC-105C.

Pressure gauge 1-SI-PI-1942 was overdue for calibration - sticker indicated a due date of 10/27/89. Investigation revealed that this gauge is not in the calibration program since it is used only on rare occasion for testing Accumulator Discharge Check Valves (see Operating Procedure 1-OP-7.1.1) and is calibrated on an as needed basis. However, there is nothing in the operations procedure to ensure that the gauge is calibrated when used.

For valve 1-SI-MOV-1090C, body to bonnet fastener washers were corroded (excessive rust) and the fasteners and bonnet flange were coated with what appeared to be floor wax. The system engineer indicated that the fasteners (including washers) had been evaluated by engineering (EWR 89-198) and were considered to be acceptable.

A number of valves/components appeared to be leaking and no deficiency tags were found. Examples: valves 1-SI-RV-1845B (WR 542552 issued and probably will be scheduled to work next outage), 1-SI-193 (per system Engineer, minor leak identified on 1/13/89, no repair required), 1-SI-233, and 1-SI-150 (existing WR 637554); pressure gauge 1-SI-PI-100; and flow element 1-SI-FE-1940. This indicates a weakness in the deficiency identification and tagging program and is discussed further in section 3.d.

Many SI valves and components were bagged or wrapped in poly, but were not tagged. It was not clear whether these components had leaks. Further discussions with the licensee health physics (HP) personnel revealed that the bags were a result of the licensee's leak reduction and contamination control programs. Some might be to control small leaks, while others were to prevent spread of contamination from items such as motor operated valve (MOV) valve stems. At the time of the inspection, HP was tracking 688 primary sources of contamination. Forty-three new sources were identified in February, 1990 and only one was repaired in February. No significant improvement has been made since June, 1989, when the number was 679. This indicates a weakness in taking timely corrective action and is discussed further in section 3.e.

A number of instances of loose flex conduit connectors or broken flex conduit were identified. Examples - valve 1-TV-RM-100A, valve 2-SI-TV-202B, valve 1-SI-MOV-1869B, valve 1-TV-CC-105C, valve 1-TV-VG-109B and valve 2-SI-SOV-202A1.

A few instances of loose spare parts were identified. Examples - 1" pipe cap on valve 1-SI-102A, 3" pipe tee in contaminated area at pump 1-SI-P-1C, 1" pipe cap and 2 small nuts in unistrut at pump 2-SI-P-1B and 1" pipe cap on valve 1-SI-MOV-1890B.

Flow orifice 1-SI-FE-1941 was installed backwards. This had been identified by the licensee and justified as being acceptable until the next outage.

The base and fasteners of a Containment Spray (CS) pipe support (upstream of valves 1-CS-101C and 101D) was excessively rusty.

Many areas were identified where care had not been exercised in protecting piping and components during painting, resulting in a generally sloppy appearance and many areas of paint on stainless steel pipe. Examples - large contaminated areas in units 1 and 2 auxiliary building basements and contaminated areas in the 1-SI-P-1A pump cubicle.

One small diameter pipe clamp (near valve 2-SI-36) was not attached to the pipe (licensee identified - WR 675422 written, not yet submitted) and another was missing (near valve 1-SI-MOV-1869B).

A very thick deposit of some unknown substance covered the packing leak-off, drain piping at valves 1-SI-MOV-1867C and D.

PG (Primary Grade Water) pipe at pump 1-SI-P-1A was not capped.

Oil was standing on the flange of pumps 1-SI-P-1A and 2-SI-P-1A. Also Pump 2-SI-P-1A had an upper seal leak with heavy boron buildup (identified by licensee - WR 675427 written but not issued) and excessive grease at lower motor bearing.

The handwheel for valve 2-SI-425 was laying on the floor (work order 085615 issued to replace valve for other reasons).

Two pressure gauges ("A" RCP CC return line and "C" RCP CC supply line) located above valve 2-SI-MOV-2869B were missing glasses.

Areas of insulation were missing near valves 2-CC-210A and 2-TV-BD-200B.

Although housekeeping was generally good, poor conditions were noted in contaminated areas in the charging pump cubicles and the auxiliary building basements of both units. Example - 2C Charging Pump platform was very oily, loose rags, pen, tape, spare parts, and insulation on lube oil piping was badly deteriorated. The licensee pointed out that they were aware of the areas in the auxiliary building and had plans to further decrease the contaminated areas and improve housekeeping.

As a result of the above inspections, the following new WRs were issued: 641171, 641175, 641174, 641173, 641179, 641178, 641170, and 641167. During the inspection, the team found that a number of work requests had been written, but not submitted, by the SI System Engineer during the late 1989 system walkdown. This and the above noted deficiency tagging problems are discussed further in paragraph 3.d.

Review of completed Work Orders revealed that in general, instructions for performing work lack detail and are not always followed (examples - WO 083101 limit switch replaced, WO did not specify to replace; MOVATS testing performed on many MOV WOs without WO specifying to run test). In addition the "Description of Work Performed" block is often sketchy and lacks detail. In some cases this block contains instructions by the foreman rather than description of the work performed. These Work Order weaknesses appear to be a partial result of the Work Order procedure, which lacks details relative to responsibilities and a block-by-block description of Work Order generation and performance. Weaknesses in completed Work Orders are discussed further in paragraph Nos 3.g and 3.s.

Weaknesses were identified in the Post Maintenance Test program and are discussed in section 3.h

In general, QA/QC was adequately integrated into the maintenance process. The two most recent audits, S89-25 and S89-06 were reviewed; although rather limited in scope, the audits identified good findings. It was noted that while the program requires only biennial audits in the maintenance area the time between audits appears to be offset by the work of the QA performance group (who are presently performing monthly evaluations of maintenance), and the surveillances being performed by QC. QA Performance Evaluation Reports 90-01-01.00 and 90-02-03.00 were reviewed. It appears these evaluations are well planned and executed and are producing excellent results.

The team noted a problem with timeliness of corrective action relative to QA audit finding S87-22-03. This is discussed further in section 3.e.

In general,the predictive maintenance program, consisting of "state of the art" vibrational and oil analysis, was considered a strength in the licensee's program. However, the following weaknesses were identified in the current program. 1) The predictive maintenance procedure, section 5.1 of the Maintenance Policies and Procedures Manual, is outdated and does not reflect the current site practice of integrating the ASME Section XI vibration testing of Section XI pumps into the predictive analysis program. In addition, the procedure does not cover the equipment that is currently being used. 2) Although the program does not yet include Thermography, the licensee plans to add Thermography to the program. In addition, a draft of a new program, procedure MDAP-0009, has been written and is being reviewed. The new program should further improve the program and correct the weaknesses identified above.

Based on interviews with maintenance personnel and observation of work, technicians, mechanics, and foreman appeared to be well qualified and performed their tasks in a professional manner. There appeared to be a good philosophy of working and adhering to work documents and procedures. During plant tours and observations of work, the team noted an attitude of following all requirements such as safety and HP requirements.

The program for vendor manual control was well documented and a spot check of vendor manuals showed good control.

In general, the system engineering organization appeared to be well qualified, intimately involved in the maintenance process, and familiar with their systems - a definite strength for the maintenance program.

2.b AUXILIARY FEEDWATER (AFW) SYSTEM

Background

The AFW is designed to provide feedwater to the steam generators when main feedwater is not available.

The AFW system consists of two electric motor-driven and one turbine-driven pumps, per unit, taking suction from a condensate storage tank. The AFW system is provided with complete sensor and control instrumentation to enable the system to automatically respond to a loss of steam generator inventory.

Inspection

To evaluate maintenance of the AFW system in Units 1 and 2, the team conducted walkdown inspections, examined selected documents, witnessed three periodic tests performed on the Terry turbines in Units 1 & 2, and conducted interviews with cognizant licensee personnel. The walkdown inspections focussed on general equipment condition, housekeeping, and proper identification of the equipment. Documents which were reviewed included PM procedures and vendor manuals for equipment in the AFW system, completed periodic tests (PTs), Work Orders (WOs) and licensee's evaluation of NRC Information Notice (IN) 88-67.

Findings

The housekeeping in the general area was good. Maintenance and periodic tests were routinely performed on the equipment. The team identified a problem related to verifying the operability of the Terry turbine automatic overspeed trip mechanism. This matter is discussed further in paragraph 3i.

The inspection team determined that three industry/NRC initiatives related to MOVs, check valves larger than 2", and check valves in air systems affected the AFW System.

There are two MOVs in the FWS of each unit. During the review of the adequacy of the MOVs, the calculated values of the maximum target thrust was determined to be less than the minimum values for the motor operators for all four valves. Adequate justification was provided for continued operation. The valve operators are scheduled to be replaced with Limitorque type motor operators with larger target thrust values during the next refueling outage for each unit.

A check valve is installed in each of the three inlet pipes supplying steam to the Terry turbine auxiliary feedwater pump through a common header. These check valves have not been previously included in the IST program; these valves can only be inspected on disassembly and cannot be tested. The licensee's current check valve program requires the disassembly and inspection at least one check valve per unit, per refueling outage.

Also, each unit has check valves installed in the instrument air system to supply air to the ASCO type SOVs to open the Terry turbine steam inlet valves. Depending on their location, the check valves either protect the integrity of the Instrument Air System or the Nitrogen backup system. These check valves are scheduled to be leak tested during the next refueling outage. The team observed a pressure gage on the Nitrogen backup air cylinder to indicate that the Nitrogen pressure was less than instrument air pressure as is required to prevent the Nitrogen from entering the instrument air system. However, there was no requirement to calibrate this pressure gage to ensure an accurate Nitrogen pressure indication.

2.c COMPRESSED AIR (CA) SYSTEM

Background

The compressed air system (CAS) is divided into three subsystems: the instrument air (IA), the service air (SA), and containment instrument air systems. The IA and containment IA systems are designed to provide reliable, dry, oil-free air for pneumatic controls and valves outside and inside containment, respectively. Major components in the CAS include rotary screw, positive displacement, and liquid seal ring compressors, air driers, backup accumulators, and check valves required to maintain integrity of backup accumulators. All piping in the CAS is stainless steel and/or copper.

Inspection

Most major components and many end-use devices outside containment were included in the walkdown inspection of the CAS. In general, material condition was adequate, with some exceptions. The licensee's response to NRC Generic Letter (GL) 88-14 "Instrument Air System Supply System Problems Affecting Safety-Related Equipment" was also reviewed. Pursuant to this review, the team examined records of licensee air quality checks and selected corrective maintenance records to determine the extent of maintenance work performed as a result of air quality.

Findings

Overall, IA quality outside containment was very good; the licensee has recently replaced inefficient refrigeration air driers with twin-tower dessicant units. Hydrocarbon and dewpoint measurements were well within specification; however, particulates were typically 5 microns, and the licensee is aiming for 3 microns, per Instrument Society of America (ISA) specification ISA-S7.3. The team found, however, that spare discharge filters and dessicant for the new air dryers were not stocked in the warehouse at the time of the inspection, but have been ordered. Other spare parts, such as regulators, fittings, and valves were properly stored, and retrievable.

The team found numerous examples of end-use devices, many of which vibrate during normal operation, connected to IA root valves by lengths of small-diameter copper tubing. This was considered significant by the team and is discussed further in section 3.c.

In contrast with the IA quality outside containment, containment IA quality was poor and is discussed further in Section 3.c.

The team found that the licensee has not tested the check valves which ensure availability of backup accumulators required for safe shutdown and accident mitigation. These check valves were recently added to the licensee's inservice test (IST) program and will be tested at the next refueling outage. This issue is also discussed in paragraph 3.c.

2.d 480 AND 4160 VOLT AC DISTRIBUTION SYSTEMS

Background

The purpose of the 4160 VAC distribution system is to provide station and emergency (safety-related only) power to large motors (300 horse power (hp) or greater) and to the 480 VAC distribution system using 4160/480 V transformers. This power is provided to non-safety related (NSR) power generation loads and to safety-related (SR) equipment. The emergency power is provided by three 4160 VAC SR diesel generators.

The 480 VAC distribution systems provides power to SR and NSR loads such as battery chargers, motors less than 300 hp, motor control centers (MCCs) and to the 240 V and 120 VAC distribution systems using 480/240 V and 480/120 V transformers.

Inspection

The walkdown inspections were performed for both the power generation and safety-related 480 V and 4160 V AC distribution systems in both Units 1 and 2. The majority of the power generation panels, MCCs, and switchgear was inspected; all the cubicles in the safety-related 480 VAC MCC were inspected; and the majority of the 4160 VAC safety-related switchgear panels were examined, including all the emergency diesel generator electrical panels.

The team observed portions of the various types of preventive maintenance (PM) and corrective maintenance (CM) electrical work activities described below:

Component ID	Type CM or PM	Work Activity
02-CW-PMP-2A	CM	Assembly of rebuilt motor
02-CP-PMO-15C	CM	Motor bearing replacement & test
01-CR-CRN-8	PM	Inspection & test of trolley hoist
01-AS-PMD-1A	CM	Pump motor leads reconnect
01-EE-P-100	PM	Calibration of level switch
01-EE-P-101	PM	Calibration of level switch
01-B1-RCDR-SDE	CM	Troubleshooting recorder inputs
02-W-PMO-1B	PM	Inspection, lubrication, and service of pump motor
01-HS-PMO-3B	PM	Inspection, lubrication, and service of pump motor
01-BB-REL-PRRXB	CM	Replacement of relay
02-EPL-BKR-1B1	CM	Troubleshoot and return breaker to service

The team examined, in detail, 36 completed work orders, and in addition, reviewed post maintenance testing on another 23 work orders for switchgear sent to an outside vendor for refurbishment.

The team reviewed 32 electrical CM and PM procedures. Eleven procedures were for the emergency diesel generators. Eleven (9 PMs & 2 CMs) were for MCCs, circuit breakers, and switchgear. Three of these procedures were proposed, but not approved. The other procedures were for various types of CM and PM tasks for motors, time relays, batteries, battery chargers, cable terminations, and electrical calibrations.

Findings

The walkdown inspections, observations, discussions with licensee personnel, and document (work orders and procedures) reviews revealed the following:

In general, the material condition and housekeeping for the SR 480V and 4160V and the NSR 4160V AC MCCs and switchgear panels were in good condition with the following exceptions:

- In the majority of the SR 4160 V panels, spare wires were not properly identified and capped (taped back). In several instances the tape was loose or there was exposed bare copper. In four panels, Unit 1 - 15J10 and 15J11 and Unit 2 - 25J3 and 25J11, the wrong type of tape was used. This orange and purple plastic tape was extremely loose. The licensee took corrective action to fix these problems.

- In the NSR 480 V MCCs, the cubicles were dirty. In NSR MCCs 2C2-1-53 and 1G1-1-1C numerous lifted leads were not identified or capped.

° In the circulating water (CW) building, both batteries had loose power connections at the positive and negative terminals. These batteries provide the 125 VDC control power for the CW 4160 VAC pump motors switchgear. The licensee had identified these conditions but did not take corrective action until the team questioned the safety of the loose terminals.

After the completion of the 480 VAC walkdown inspection, the team reviewed the PM program for motor starters in the SR 480V MCCs. The PM requirements for inspection and testing of MCC thermal overload devices, motor starters (contactors) and molded case circuit breakers (MCCBs) specified in procedure EPL-MCC-E/R1 were deferred (cancelled) for the last two scheduled periods due to lack of manpower. Licensee personnel stated the deferrals were approved by the Site Nuclear Operations Committee. The licensee also stated that EPL-MCC-E/R1 will be replaced with an upgraded procedure, and the associated components will be placed in the PM program and the required PMS will not be deferred due to lack of manpower. During the review of VPAP-0806, Power Circuit Breaker and Switchgear Program, the team determined that MCCBs were not included. The licensee stated that MCCBs will be included for the next outage. SR MCCBs will be tested on a five year basis and NSR MCCBs on a ten year schedule. With the inclusion of the molded case circuit breakers, the team considered the new Power Circuit Breaker Program would be very good.

During the observation of work activities, the team found the electrical maintenance personnel were knowledgeable and performed their work in a satisfactory manner. The foreman verified that electricians are task qualified to perform the assigned work. However, the team observed the foreman and electricians spend considerable time performing planning duties instead of working in the field. This subject is further discussed as a issue in Sections 3.g and 3.r.

From the review of the electrical maintenance procedures, the team identified several weaknesses. The licensee agreed to upgrade the procedures to specify specific tolerances, test equipment, and disallow marking "N/A" (not required) in the functional testing procedural step when operators are not available. In addition, the licensee agreed to include the vendors recommendations for motor starters (contactors) in PM procedures. The team found the electrical maintenance procedures, for safety-related equipment, had sufficient QC hold points which is considered a strength.

During the review of completed work orders, the team identified the following problems:

- Work instructions are not adequately detailed
- PMT is not specified (See Section 3.h)
- Functional testing is not adequately specified
- The craft do not specify in adequate detail the work performed and problems identified in their "Work Performed" write up
- Craft foremen are required to provide additional planning since the work orders are very brief

Summary of Electrical Maintenance

Strengths

- Personnel are knowledgeable of work and perform their duties in a satisfactory manner.
- Work is task oriented requiring craft to be qualified for each task.
- Personnel use initiative to perform work and functional testing even when not specifically specified in work order [This refers to PMT for switchgear sent to outside vendor for refurbishment]
- Personnel have a good attitude in the performance of their duties and try to do things correctly

Weaknesses

- *Craft and foremen spend too much time in shop
- *Foremen have added burden of doing supplemental planning
- Electrical maintenance procedures need to be upgraded
- The size of the staff is marginal considering additional temporary duty assignments and training
- *The work backlog is excessive and not being reduced
- PM have been cancelled due to lack of manpower

*Note: These items are weaknesses for performing electrical maintenance, but not necessarily the fault of the Maintenance Department. The small planning staff and poor coordination with operations together with lack of adherence to the schedule work plan contribute significantly to less effective electrical maintenance.

The team inspected the training program and facilities and found it to be quite satisfactory with one exception. The licensee has not completed obtaining and installing all the necessary laboratory equipment to support classroom training as planned.

Observations

The team observed the close working relationship of the Maintenance Department with the various system engineers. The team also had discussions with operations personnel who considered the system engineers as an asset to the plant. The team also observed that the station engineering management has a policy of walking down a different system with each system engineer on a weekly basis. The team considered this type of management involvement and the system engineer as a strength.

2.e. 120 VOLT AC BUS AND 125 VOLT DC SYSTEMS

Background

The function of the 120 volt AC and DC systems are to provide reliable, uninterruptable vital power to instrumentation and control systems and components during all modes of plant operation. Each system includes two independent trains of distribution panels and associated cabling while two independent station batteries for each Unit provided emergency power to the vital AC busses through a combination of uninterruptable power supply/battery charger static devices on loss of normal AC distribution.

Inspection

The walkdown inspection included the majority of the Unit 1 distribution system and panels and the station batteries were also inspected.

The team observed the following maintenance activities related to the AC and DC distribution systems, and observed selected work activities of the I&C technicians.

WO # 88416	Search for grounds on 1B DC Bus
WO # 89582	Correct indication on Emergency Boration Line
1-PT-28.8	Power Range Nuclear Inst. Calibration
Cal-630	Rescaling of Power Range Drawer
1-PT-8.1	Reactor Protection System Logic (Periodic Test)
2-PT-8.5	Consequence Limiting Safeguards Logic (Hi-Hi Train, Periodic Test)

The team also reviewed numerous work orders for accuracy and completeness as detailed below.

Findings

System walkdowns:

Each of the station's four vital batteries had been recently replaced. Cells that were in acceptable material condition from the replaced vital batteries were utilized to make up a new "black battery" for each unit. Critical loads, such as the main turbine generator shutdown lube oil system, were removed from the "station" battery load, and transferred to the black battery load list. Installation of this modification was perceived as a licensee strength in that the modification significantly improved the station battery performance due to load reduction. Deficient conditions were noted as follows:

- o Design Change Package 8532 (U-1) was not installed in accordance with specifications. Problems such as ungrounded cable conduit, loose intercell connector bolts, and loose bolts in the cell platform were noted. These conditions indicated a weakness in the control of electrical work practices and is discussed further in Section 3.o.

- o Cell 52, Vital Battery 2A, was noted to have a low electrolyte level (the top of the meniscus was below the low level line, but above the cell plates).

- o Cell 51, Vital Battery 2B, was noted to have a thermometer left sitting in cell. The thermometer was held captive in a rubber stopper, but the rubber stopper was simply resting in a cell lid cavity, i.e., cell over-pressure (from gas) would not have been directed through the cell flame arrester.

- o Cells 4 and 56, Unit 2 black battery, had significant verdigris growth on the terminals and intercell connectors. Cells 5 and 11 had significant chemical deposition on the flame arresters.

During the walkdown of the 125 volt DC (vital) and 120 volt AC (vital) distribution systems, several items of concern to the team were noted.

In general the material condition and housekeeping of low voltage distribution panels were marginally adequate. Poor conditions and practices noted during the walkdown are detailed below.

- o Most distribution panels contained schedules of breaker assignments that were in error due to informal changes, such as hand-written corrections, strike-overs, and white-outs. When components listed on the schedules were compared to the applicable drawing (e.g., D.C. distribution panel 1-2 against Loading Table Bus Distribution Panels DC 1-1 and DC 1-2, dwg #11448-FE-11AE), it was noted that several errors existed.

- o Not all wires were labeled and/or labeled correctly (e.g., Vital Bus 1-IIIA, breaker #6 feeder cable was labeled 1VBS15-B; the wiring diagram and loading table drawing called for the cable to be labeled 1VBS15. Vital Bus 1-IA, breaker #3 cable feed to Process Rack 3, was not labeled as cable 1VSB44). Spares were frequently not labeled and/or not properly terminated (125 volt DC Panel 1-2).

  - Not all breakers were labeled (e.g., breaker #13, DC panel 1- 2).

  - Not all distribution panels were labeled on the outside to permit ready identification (e.g., main 125 volt DC distribution panel 1B).

  - Breaker amperage capacity installed in the distribution panels was frequently different than plan/drawing requirements. This was considered a weakness in the licensee's configuration control program and is discussed further in Section 3.b.

  - Vital AC and DC distribution panels, and 480 volt and 4160 volt breaker test panels (fed from vital DC), were very dirty, and contained trash, including loose metallic material. Cable terminations at feeder breakers in the vital panels were occasionally improper, e.g., not all wires captured under breaker clamp device, insulation cut back too far, wires splayed in individual feed cables, and bend radius too sharp. Material conditions of panels were deficient, including e.g., missing knockout plugs, improper hold-down fasteners, and detached hold-downs for panel wireways. These conditions indicated a weakness in the control of electrical work practices and is discussed further in Section 3.o.

The system engineer accompanying the craft and inspection team took prompt and substantive corrective action to correct the discrepancies noted, including the preparation of work requests, station deviation reports, and drawing change requests. The effective support to the craft, detailed system knowledge and expertise, and high motivation of the system engineers was perceived by the team to be a licensee strength.

Review of Work Orders revealed the following discrepancies.:

Work Order 78160, dated 13 June 1989, required, "Clean & Remove Trash" from the Safety Related (SR) 125 Volt DC Distribution Cabinet 1A (Mark #01-EPD-BC-1A-1). The work actually performed included the disconnecting and removal of eight ventilation fans from the cabinet. The team was of the opinion that the scope of work in the work order should have specifically addressed the subject of fan removal with a specific work step authorizing the removal; a specific step should also have verified the operability of the fans (PMT) after electrical reconnection.

Work Order 86936, dated 20 October 1989, required, "1. Troubleshoot/Repair" and "2. Verify Operability" of a ground indication on the SR battery bus (125 Volt DC Distribution Cabinet 2B, Mark #02-EPD-B-2B). Work actually performed indicated that, "Found under voltage relay J Box half full of water near lighting PNL 2T1. Need to replace relay and wire lugs. 10/28/89." A further entry stated, "Replaced relay and lugs. Verified operability and returned to service. There is still no ground on the DC bus at this time. 10/28/89"

- The undervoltage relay replaced was not identified in the work order. Purchase order or requisition documentation for the relay was not included with the work order.

- Since the relay did not appear to correct the ground, replacement of the relay was clearly outside the scope of the work order. A work order revision was not issued to change the scope of work.

- The Mark # for the relay was not listed in the work order, thus no effective material history was generated as a result of this maintenance activity.

- No indication of what was accomplished to "Verify operability" was included in the work order, thus the adequacy of the "PMT" was questionable.

- No root cause evaluation was indicated as performed to determine why a relay J Box was half filled with water, or if the fundamental problem (water source) had been corrected to prevent recurrence of the failure.

Work Order 62675, dated 16 March 1988, required the replacement of motor bearings on #2 Rod Control MG Set, Mark # 02-EPD-M-MG-2.

- The work instructions of the work order were very sketchy, but did reference the procedure EMP-C-EPL-117 regarding corrective maintenance on the MG set. This procedure was unused during the work activity for reasons unknown and not listed in the work order. A superseding procedure EMP-C-EPCR-08, dtd. 4 Dec. 1986, Rod Drive Synchronous Alternators, accompanied the work order and was the document used for the work performed without formal revision of the original work order.

  The scope of work in the work order was to "replace motor bearings". The actual work accomplished included motor and alternator bearing replacements, with no revision to the work order.

- M&TE used during the repair procedure were not properly listed on the work order or in the procedure.

- Although pre-work vibration analysis accomplished under WO #62597 indicated that the motor to generator coupling "had badly damaged teeth and coupling grease had turned to powder.", WO # 62675 did not reflect that the motor coupling had been replaced or repaired. Steps at paragraph 5.17 of procedure EMP-C-EPCR-08 simply installed the shaft coupling with no indication of what was actually accomplished.

- WO #62597 (vibration analysis) indicated the machine as safety related (SR), while WO #62675 indicated the machine as non safety related (NSR). The machine was NSR.

Work Order #66468, dated 16 June 1988, was prepared to "1. Troubleshoot and Repair" and "2. Verify operability." of a grounded condition on both DC battery busses when containment DC lighting leads were landed. The leads had been lifted and tagged when the condition occurred.

- The work order Mark # was listed as 01-EPD-BKR-14. The actual grounds were detected in the 1-ERC1 Panel, breakers 6 and 8 feeds. The Mark # was not changed.

- The scope of work increased significantly after troubleshooting, but no modifications were made to the work order, i.e.,

  - 8 breakers were replaced in (presumably) the 1-ERC1 Panel,
  - 2 light fixtures were replaced in the B lighting loop, 3 fixtures in the C loop, and an unknown number in the A loop,

- lights in the "RCP cubes" were also repaired,

- A work order "Repair or Replacement Follower" specifically required, "Verify any leads lifted to isolate ground are landed with proper polarity in accordance with applicable design drawings. Functionally test circuit after landing." No evidence was included with the work package that any of the lifted leads had been properly landed in accordance with the work instruction.

Work Order #74377, dtd 8 December 1988, required "1. Troubleshoot & Repair." (and "2. Verify ground is cleared.") of Ckt. #2 in the DC Distribution Panel 1 - 2, Mark # 01-EPD-BKR-43, the supply to SI "B" accumulator solenoid operated valves (SOVs). The electricians assigned to perform the task prepared their own work instructions, including the requirement for tagout, notwithstanding the inadequate work order received from planning. The "work instructions" prepared by the electricians comprehensively addressed all steps expected by the team; the instructions also referenced the subsequent Work Request # submitted after the craft identified the problem SOV.

- The work order was stamped, "Determined to be minor maintenance per SUADM-M-16", thus a "procedure" was not required. Contrary to this work order stamp, work order preparation instructions specifically listed maintenance requiring equipment tagouts as not qualifying as "minor maintenance." Thus this work order should not have been stamped "minor maintenance."

- The drawings listed by planning for performing the work were "FE-1G, -10A, and 11AE". The craft had to use drawing "FE3BK" to perform the work.

- The work instructions prepared by the craft that recorded the work accomplished were perceived by the team as a job well done.

Work Order #86476, dtd 7 October 1989, required the electrical craft to, "1. Troubleshoot and repair breaker.", Reactor Trip Breaker "B" Normal, Mark #01-RP-BKR-BNORM. The problem was reported as the breaker not appearing to be closed while the I&C craft were performing periodic reactor protection system tests (PT - 8.1).

- "PROCEDURE NOT REQUIRED" was conspicuously stamped on the work order, notwithstanding the work scope authorizing "troubleshoot" and "repair" of the breaker.

- The work accomplished reflected that the breaker was racked out, manually closed, continuity checked satisfactory on all three phases (no work performed), and the breaker was racked in. PT - 8.1 was continued and presumably performed without further difficulty. No further evaluation or deviation reporting was reflected by the work order.

- The work was performed on 8 October 1989. The "Equipment Returned to Service" date was listed as 6 December 1989, after the plant had returned to full power. This equipment should have been "returned to service" before power operations.

Based upon the above types of examples noted by the team in its review of closed work orders, the team concluded that work order instructions prepared during the planning phase of maintenance activities lacked adequate detail. (Also see section 3.g.)

Review of maintenance in progress - I&C Group

The Instrumentation and Control (I&C) group, re-organized into the Maintenance Department in late 1989, was responsible for the planning, scheduling, calibration and maintenance of plant installed, primary and secondary, instrumentation and controls, and the measuring and test equipment (M&TE) program. Organizational and assignment of responsibilities procedures such as SUADM-ADM-47, dtd 18 September 1989, Operation of the Instrument Department, had not been revised to reflect the re-organization. There was no visible evidence of effective integration of the I&C group with the Maintenance Department since the group was fundamentally doing business as before, e.g., work order planning was performed at the craft level.

Staffing of the I&C group was noted to be a "numbers" problem, i.e., thirty five technicians were authorized (no break-down between trainees and technicians), but only twenty were actually staffed. Of a large group of about fifteen contractors retained in late 1989, only two remained due to factors related to the permissible overtime they could work. Only thirteen of twenty staff were "technician" grade, the balance were "trainees" in the apprentice program. As a consequence, I&C supervision expressed concern that although they were currently maintaining reasonable control over I&C backlog, any further increase in maintenance activities could not be adequately supported by staff on-hand.

I&C Supervisors stated that their attempts at hiring had been halting at best; resumes received through the personnel department were frequently aged to the point that calls to prospective hirees found them unavailable. Further, from point of interview to an offer of employment (while background checks and clearances were obtained) was also a long enough period to result in the same answer on calling potential hirees. Staffing was noted to be potential problem in several areas, e.g., not 100% shift coverage, one person operating entire calibration program, and ineffective work order planning.

Turnover, to the credit of the licensee, was noted to be a relatively low number of approximately two per year. Supervision was not advised of the loss mechanism, although it was understood that termination interviews were conducted. The team noted that the I&C group had the lowest level of maintenance backlog of approximately 500 work orders of the three major craft.

The team was concerned about the level of planning performed in preparation of work orders. As discussed in Section 3.g., planning for the I&C group was performed at the craft level. Work Orders, in general, included work instructions of the form, "Investigate and repair". For example, WO #89582, dated 5 March 1990, was written to "Correct Indication" on the emergency boration line flow indicator (Mark #01-CH-FT-1110). The job steps stated, "Invest/ Correct Indication", although the actual steps required were: determining the installed flow converter was faulty; obtaining and bench calibrating a new converter; removing installed device (rad area) and installing new calibrated device; and setting zero and span adjustments in place with a calibration device. The craft accomplished the preparation of "work instructions" to support the work order by revising an existing calibration procedure 1-CAL-311, Boric Acid Bypass Flow (Emergency Borate Flow) F-1-110, dated 3 October 1988. The revision of the existing procedure was accomplished in accordance with appropriate procedures. This methodology was noted to be the normal method of preparing I&C work order instructions on several occasions during the inspection. It was also noted to be extremely cumbersome because calibration procedures and periodic test procedures rarely fit the maintenance activities. This methodology also resulted in work orders that had no overall coordinated sequence of steps. Interviews with the craft indicated that they thought they could not extract portions of approved procedures or technical manuals to prepare supplemental work instructions. SUADM-ADM-47, dtd 18 September 1989, Operation of the Instrument Department, supported this perception at paragraph 4.3.8.1 concerning preparation of work orders, "Identify work procedures that are required. Pay particular attention and identify if the procedure will need to be deviated and/or pre-approval is required." Based upon the above observations, it was the team's opinion that program and implementation improvement was required in the area of preparation of I&C supplemental instructions for work orders.

Clearance Program and Implementation Improvements Required:

The team reviewed the clearance log for both units to determine if adequate clearances were being set to maintain equipment control and provide safety to the maintenance technicians as well as the equipment itself.

The team noted that the 480 volt feeder breaker for the U-1 Water Chiller for the Air Conditioning Unit (switch gear 1B2-12B) was red tagged with two red tags (red tag #1246755 was associated with clearance #62476; red tag #1246062 was associated with clearance 2059274). The "Remarks" block of the red tag was annotated "OFF/OFF" on tag #1246755, and "OFF/ON" on tag #1246062. The team learned that the two positions referred to the proper tagged position listed first, and the restoration position listed second. The listing of these positions on the tags has been implemented by persons responsible for hanging tags, but was not required nor described by SUADM-O-13 (dtd 1 Feb. 90), Operations Department - Operation, Maintenance, and Tagging. Only the Tagging Record Form (#888.6A/7A) required the tagged and restoration positions to be listed in accordance with SUADM-O-13. It was the team's opinion that the listing of two different restoration positions for the same equipment was an implementation weakness in the clearance methodology.

The team noted that a large number (91) of station deviation reports (DRs) had been generated during 1989 related to tagged out components, including:

- o 34 DRs for improperly tagged components
- o 12 DRs for missing (abused) tags
- o 15 DRs involved breakers out of position
- o 22 DRs involved valves found out of position
- o 9 DRs involved wrong components tagged

The team perceived this as a very large number that potentially affected personnel safety. Interviews with Operations personnel indicated that a large portion of the problems were noted during the termination of outages, where devices had been mis-positioned for reasons unknown. The team noted that paragraph 5.11.3, SUADM-O-13 specifically waived performance of the quarterly tagout audit (field check of tags) during outages, and that only an Administrative Review of the log was performed prior to startup. Manpower was stated as one of the limiting factors in not performing field audits during outages, even though there was a high probability for error during the intensely active maintenance period. It was the team's opinion, based on the large number of tagout discrepancies, especially associated with outages, that the field audits should not be waived to provide reasonable assurance that components tagged for long periods of time would be periodically checked in their proper position.

The team reviewed the tagout log to determine if program requirements were being adhered to. Many very old tagouts were in an active status, with no apparent action currently underway to correct the condition. (See section 3.m.) Unit #1 tagout #59551 was an Operations tagout on the chilled water (CD) system. It was noted that tag number 863558 was listed as partially cleared on a Tagout Partial Clearance form Figure 11; the Tagging Record Block 11 (Tag Removed) for the tag was not properly signed. Tag number 801005 was listed as removed on the Tagging Record, Block 11; the tag was not authorized for partial clearance on the appropriate Tagout Partial Clearance form.

Procedural Weaknesses Identified During Periodic Testing:

The team observed the performance of Periodic Test 1-PT-8.1 (Rev. 1), Reactor Protection System Logic (For Normal Operations), on U-1. The test ensured the continued proper operability of the reactor trip portion of the reactor protection system. Several strengths of the I&C technicians were noted during the testing, including a good pre-job briefing that addressed previous "lessons learned", good procedural adherence, good command and control of the evolution by the team leader, and good communications between the three, two man groups of technicians performing the test.

Several procedural inadequacies were also noted as follows. The craft technicians were confused about the extent of completion of an Engineering Work Request (EWR) affecting Extraction Steam Motor Operated Valves (MOVs), and therefore convinced the Shift Supervisor (S/S) to unnecessarily de-energize the breaker to an Extraction Steam valve (MOV ES-100A) as a part of establishing initial conditions. Although the procedure did not address the subject, the lead I&C technician, based on his understanding of the EWR, requested the S/S to de-energize the MOV to prevent an inadvertent actuation of the valve during the logic testing. In fact, the EWR had only been partially completed on U-2, and then was canceled; the EWR had no applicability to Unit 1 testing. It was the team's opinion that the procedure should be unit-specific to the extent that a subject affecting only one unit should be addressed in each unit procedure.

Precautions and Limitations paragraph 4.2 stated, "Bypass breakers will only be closed long enough to perform required testing on associated trains." The team perceived this wording as vague when compared to the requirements of Technical Specifications (TS), Table 3.7-1, Action Statement 11. which stated, "..... one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.1 ....". It was the team's opinion that the TS requirements should be included in the Precautions and Limitations, and that clock times should be entered at paragraphs 5.15 and 5.68 (time breaker closed/opened) to assure specific awareness and compliance with TS requirements. The technicians demonstrated such awareness.

During performance of the procedure (at Step 5.83), a relay failure occurred (promptly detected by the technicians by smell). No provision had been provided in the procedure (or any higher tier procedure) for "backing out" of the sequence safely, thus a one-time change was executed to back out and restore the plant to safe conditions. It was during this failure that the use of a "For Reference Only" drawing occurred as discussed below. The failure occurred relatively early in performance of the procedure, thus adequate time was available to permit the time- consuming procedural change, and not violate the two-hour requirement addressed above. It was the team's opinion that instrument test procedures could be enhanced by consideration of the situation of plant restoration if a system failure occurred, especially for time sensitive procedures such as this.

A "For Reference Only" drawing (as opposed to a controlled drawing), Drawing 113E244, Reactor Protection System, was used by the technicians and their supervisor for troubleshooting and procedure revision preparation, and operational considerations by the Shift Supervisor to establish safe plant conditions, without assuring the drawing was correct by comparison to a controlled drawing. The drawing was a logic wiring diagram for the reactor protection circuitry. The team perceived the use of uncontrolled drawings in this manner as an implementation weakness since plant modifications could have been made that would not have necessarily been recorded on the uncontrolled drawing. The use of the "For Reference Only" drawing was in violation of the licensee's procedure for use of station drawings, SUADM-ADM-11, dated 29 Nov. 1989, Station Drawing Revision and Distribution, which stated at paragraph 4.7, "Individuals using drawings or aperture cards shall be responsible for ensuring that the item used is the latest revision." This failure to follow procedure is an example of violation 50-280,281/90-07-01.

Revision 1-16-90 to 1-PT-8.1 was a permanent change executed on 7 February 1990 (added a cautionary note to the procedure that had been omitted at the last procedure update). The team noted that the included 10 CFR 50.59 Screening Checklist on the Procedure Action Request (Form No. 730682) was not completed correctly; i.e., the form required the listing of Sections of the UFSAR that had been reviewed in performing the 50.59 evaluation, but none were listed. The team perceived this failure to follow procedure as an implementation weakness in executing procedure changes.

2.f EMERGENCY DIESEL GENERATOR (EDG) SYSTEM

Background

The purpose of the emergency diesel generator (EDG) system is to provide a dependable source of onsite power capable of automatically starting and supplying electrical power to loads necessary for safe shut down and maintenance of safe shutdown conditions under all design basis conditions. Major equipment and auxiliary systems included in the system walkdown were three 20 cylinder diesel engines, generators, starting air systems, engine cooling, fuel system, lubricating oil, and governors.

Inspection

The walkdown inspection included the majority of the above systems. In addition, the team witnessed monthly performance tests of an EDG, an engine-driven compressor in the starting air system, the replacement of a starting air system compressor, and reviewed closed and open work orders. The team also reviewed selected PM procedures for EDG components against vendor manual requirements for EDG system equipment.

Findings

At the time of the inspection, the team found that the licensee did not have documentation verifying that the EDG fuel oil transfer lines (approximately two inches OD) were seismically qualified. These lines are installed between the day tanks and the EDGs. In addition, the team found one of the in-line flex hoses replaced with a rigid section of pipe. The licensee could neither adequately determine the reason the flex hose was replaced nor provide documentation which controlled or recorded the work involved. These flex hoses serve to isolate the day tanks and associated piping from vibration while the EDG is running. During the inspection, the licensee performed a seismic evaluation of the fuel lines and concluded that the existing configuration was acceptable. However, the licensee plans to add supports, and replace the rigid section of pipe with braided hose. Need for further NRC review of the calculations involved (SEQ-1517) will be identified as unresolved item 50-280/90-07-02 "EDG Day Tank Fuel Transfer Line Analysis."

Material condition of equipment in the EDG spaces was, in general good, with exceptions noted below. Several problems associated with a work order are also listed below.

The team found a significant air leak at an air fitting on the pressure switch which controls the motor-driven air compressor of the engine and motor-driven compressor set in the air start system for EDG 3. A WO was written to correct the problem.

The team observed work activity on WO 93103 for replacement of an air compressor (one of six being replaced). The compressors were being replaced because of moisture-induced deterioration of valves, and unavailability of replacement valves. Since there were no air driers or coalescing filters at the discharge of the air compressors, the new compressors are subject to the same damage as those which were replaced. Details of this issue are discussed in paragraphs 3.c and 3.f

In addition, on WO 93103, the team found that the vendor technical manual for the compressor specified light oil or anti-seize compound for thread lubricant, with 20 percent reduction in applied torque if anti-seize is used. The work package, however, only specified the threads be "lubricated". The craft applied anti-seize to the threads without questioning what type of lubricant to use, and proceeded to torque the fasteners to the values indicated on the work order. The specified torque values were based on the use of anti-seize, however, had the craft used light oil and the torque values furnished with the work order the fasteners would have been undertorqued.

The team noted that a valve which admits air to two air starting motors on one of two trains in the air start system was not functioning properly. The licensee indicated the root cause was due to poor air quality. This issue is discussed in paragraph 3.c.

Local indications and remote sensors for vital EDG system conditions, such as engine temperature, and starting air system pressure were not calibrated. The remote sensors provide input which triggers the "Diesel Trouble" control room annunciators. The result is all sources of EDG system condition may not be accurate. This issue is discussed in paragraph 3.1.

2.g HEATING VENTILATING AND AIR CONDITIONING (HVAC) SYSTEM

The functions of the HVAC system is to provide for contamination control by ensuring that air is not recirculated in areas of potential contamination, and provide adequate seasonal ventilation and/or temperature control in occupied machinery spaces including the control and relay room area. The system consists of ductwork, fans, filters, dampers and associated controls.

Inspection

The team performed a walkdown inspection of the subject system in such areas as the auxiliary building, mechanical equipment rooms -1, -2 and -3, control room, and emergency switch gear room.

A selected sample of (20) completed work orders and the following Engineering Work Requests (EWRs) were reviewed.

EWR	Title
89-540	Evaluate VS Pressure Switch Calibration, Units 1 and 2
90-078	Evaluate VS MCR Chiller Existing Capabilities (E4A, B, C) Surry 1 and 2
89-687	Evaluate VS Fan Duct (1-VS-F-2, 12A and -12B)
87-170	Repair of Containment Recirculation Fan (2-VS-F-1A)
89-336	Evaluate VS Repairs for Startup, Units 1 and 2

The team observed maintenance work in progress on three nonsafety-related chillers listed below:

Component	Work Order	Activity Description
01-CD-REF-1A	089694	Weld Repair Tube Sheet and Gasket Seating Surface and Recoax
02-CD-REF-1	089693	Overhaul Compressor and Rod-Out Tubes
01-CD-REF-1B	089691	Overhaul Compressor and Rod-Out Tubes

Findings

The above inspections, observations, interviews and record/document reviews revealed the following:

Rather than focussing on permanent repairs on the HVAC system, the licensee is performing temporary fixes which include making extensive use of Foster's Duct Sealant and red duct tape to plug holes and leaks in the ductwork throughout the system. The team observed an unusually large number of work request tags on the vast majority of rotating components i.e., fan motors, sheaves, dampers, actuators, metering devices, fan belts, etc. By-and-large, the reason for these tags was for components requiring corrective maintenance or replacement.

Under the current licensee program, work requests are evaluated, and based on their merit they are either rejected or accepted. If accepted, they are assigned a work order number and a priority number. According to figures provided by the licensee there are presently approximately 220 outstanding job orders for the VS waiting disposition. In addition, there are 15 others, also outstanding, waiting on parts non-traceable to equipment manufacturers.

All of the above work orders have been assigned a priority ranging from number 1 through 3 as required by SUADM-M-11, Attachment 2. By this procedure, any work order given a priority range of 1 through 3 must have the work begin from 48 hours up to a maximum of 4 weeks, for priority 3.

Because of the this observation, the team has determined that this procedural requirement is not being enforced since the scheduled start date on all of the above and many other WRs has passed without work initiation. This failure to comply by established procedural requirements is considered a programmatic weakness. This matter is discussed further in Section 3.m.

2.h MISCELLANEOUS MAINTENANCE ACTIVITIES

Inspection

The team observed the below indicated maintenance work activities related to other systems:

Maintenance Work Work Document ID	Description of Activity Observed
WO 067521 & EWR 86448	Alignment of Condensate Polishing (CP) Pump 02-CP-P-15C
WO 93028	Alignment of CP Pump 02-CP-P-430
JN 087715	Preventative Maintenance

WO - Work Order EWR - Engineering Work Request JN - Job Number

Findings

The above inspection/observations revealed the following:

During observation of pump 02-OP-P-430 alignment using WO 93028, the team noted that the only instruction on the WO was "Align Pump" with no reference to any procedure, vendor manual, or other document. Maintenance personnel stated that this was in the "skill of the craft" and no procedures were needed. Further review revealed that a detailed procedure was available for pump alignment using the dial indicator method. The procedure had numerous sign-off steps, acceptance criteria, and the job had been started using the procedure. However, after the job started, the decision was made by the craft to use the optical alignment method. Since no procedure was available for this equipment, the vendor manual for the equipment was used. When questioned by the inspector, the foreman stated that based on training, they knew what the acceptance criteria were and therefore did not need a procedure. The team questioned the Mechanical Maintenance planner and supervisor responsible for the WO and the response was that the WO probably should have referenced the vendor manual for the alignment. However, they further indicated that they were busy trying to keep up with the more important jobs and did not have adequate resources to do detailed planning of non-safety-related jobs and had to depend on the "skill of the craft." This is an example of weaknesses in planning and adequate resources discussed further in sections 3.f. and 3.g.

In general, maintenance mechanics, technicians, foremen and supervision appeared to be well qualified, knowledgeable, and work was performed in a professional manner.

In review of activities related to erosion/corrosion heater drain pipe failure, the team found that the licensee has a well defined program for inspection of pipe for erosion/corrosion thinning. The program is defined in Engineering Standard SDT-GN-0033 which was in response to NRC Generic Letter 89-08 and was implemented January 1, 1990. Prior to that date, procedure SUADM-M-33 defined the program. The pipe section that failed (at the discharge from flow control throttling valve LCV-122B) was not in the program, however, the elbow next to the pipe section was in the program. There had been no reason to suspect the pipe section prior to the failure. Although the similar pipe section in Unit 2 had been replaced with CR-MO steel, the replacement was a convenience replacement while replacing the elbow and not because of excessive thinning. The licensee's actions and planned actions after the pipe failure appeared to be conservative and aggressive. Similar piping at the discharge throttling valves for the other Unit 1 train and both trains on Unit 1 were inspected for thinning. The other Unit 1 train had significant thinning and required pipe replacement. Piping in both Unit 2 trains was acceptable. The licensee was compiling a list of all throttling valve configurations in the systems covered by the program. This list was to be examined for other similar piping that should be inspected.

The team also reviewed several completed work orders (WOs) related to work performed on Motor Operated Valves (MOVs), replacement of electric solenoid operated valves (SOVs) to extend the longevity of the qualified lives, and replacement of components in NAMCO type limit switches, also to extend the longevity of the qualified lives. Problems related to incomplete summary descriptions on the cover sheet, partially complete information on the model/serial numbers, and using the wrong illustration were identified. These findings are discussed further in paragraph 3s.

The team noted an example of failure to follow procedures associated with installation of radiation monitor RM-SW-107 which involved failure to complete sign-off steps in sequence; i.e., precondition step 2.4 was not signed off even though work had proceeded to installation step 4.18. This constituted a nonconformance to upper tier procedure STD-GN-0001 which mandates that sign-off steps be completed in sequence barring specific notes to the contrary. The licensee initiated DR S1-90-321 to begin corrective action.

2.i HEALTH PHYSICS

The team determined that the HP group was included in the planning and scheduling of maintenance activities through representation at all daily planning and briefing meetings. Interviews with maintenance and HP personnel indicated that good lines of communication existed between the groups.

In addition to the licensee's general employee training for radiological protection, the licensee had provided most maintenance workers advanced radiation worker training. The training provides maintenance workers with additional instruction and practice in radiological survey and work practices. The graduates are allowed to perform limited radiological monitoring functions at their work sites as directed by health physics personnel. The majority of maintenance workers interviewed believed that the training had helped them understand how radiological protection activities could be integrated into the maintenance activities. The advanced radiation worker training had been provided to about 60 percent of the maintenance staff and the licensee planned to provide the training to all maintenance personnel.

Maintenance workers reported that the licensee's on-going decontamination program was very beneficial to the maintenance process. Workers reported that ready access to non-contaminated areas, that were contaminated in previous years, had improved maintenance efficiency. Workers reported that there was more effort by maintenance personnel to keep systems and components from leaking contaminated fluids and that housekeeping during and following maintenance activities was an important element of their job. The licensee's area of contaminated floor spaces has steadily declined in recent years. The licensee's floor area contaminated in 1989 declined from 20,500 square feet (ft2) in January to 14,500 ft2 in December. The licensee's goal for 1990 was to reduce the area contaminated to 11,500 by December, 1990.

The licensee's collective personnel exposures were 792 and 420 person-rem per unit in 1988 and 1989. The licensee's collective personnel exposure goal for 1990 was 303 person-rem per unit. In interviews with maintenance workers the team determined that worker awareness of ALARA goals and objectives were high. The interviewed maintenance workers could adequately describe methods for keeping collective radiation exposures ALARA and knew their lifetime, quarterly, and annual radiological exposures. Workers reported that ALARA activities were strongly supported by management. The licensee strengthened its ALARA program during 1989 providing additional resources and management attention to implement various source term reductions and ALARA program initiatives. To increase facility staff involvement in the ALARA program, various departments, including maintenance, were required to develop and implement department action plans to minimize personnel dose. Worker awareness of the ALARA program was a program strength.

3. ISSUES

3.a. SUITABILITY ANALYSIS FOR REPLACEMENTS

American Society For Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV) Code Section XI, Paragraph IWA 7220 requires the Owner to conduct an evaluation of the suitability of replacements, prior to authorizing the installation of those replacements. This requirement is implemented, by the licensee in Procedure SUADM-M-08, dated February 27,1990, "ASME Section XI Repairs and Replacement Programs" The licensee informed the team that SUADM-M-08 is applicable to pressure retaining components and their supports only (items covered by ASME B & PV Code Subsections IWB, IWC, IWD, and IWF). The licensee's program does not address the IWA 7220 suitability analysis requirements for non pressure retaining replacement parts, such as bearings, bushings, springs, stems, disks and shafts (items covered by ASME B & PV Code Subsections IWP and IWV). The licensee was unable to provide a single example where there was objective quality evidence attesting to the fact that a responsible individual had made a conscious decision that replacements "in kind", of non pressure retaining parts for Section XI components, were suitable for the intended service.

The team concluded that a weakness exists in the licensee's program related to the implementation of the suitability analysis requirements of ASME B & PV Code Paragraph IWA 7220 for non pressure retaining components and for the documentation of suitability analysis for all first time replacements "in kind."

3.b. DOCUMENT CONTROL/CONFIGURATION MANAGEMENT SYSTEM FOR MAINTENANCE

Drawing Revisions Not Issued Following Plant Modifications

During walkdowns of the 120 volt AC and DC vital and semi-vital distribution system, the team noted several occasions where breaker amperage capacity listed on drawings differed from the installed breakers as follows.

- o Drawings 11448-FE-11AE (Rev. 3), Loading Table Bus Dist. Panels DC 1-1 & DC 1-2, and 11448-FE-18J, Wiring Details, Misc CKTS, Sheet 2, reflected all breakers as being 15 ampere capacity. The installed breakers were 20 amp.

- o Drawing 11448-FE-11AA (Rev. 7), Loading Table, Vital Bus Distribution, Panels 1-1, 1-III, reflected feeder breakers 16 and 19 to be 15 amp and 30 amp respectively. The actual breaker sizes installed were 20 and 15 amp respectively.

- o Drawing 11448-FE-11AC (Rev. 6), Loading Table Semi-Vital Bus Distribution Panel 1SVB1, reflected breakers 32 and 33 as 20 amp and 30 amp respectively. The installed breakers were 50 amp and 20 amp respectively.

Based on the large number of the above types of errors noted during the walkdowns, the licensee initiated a check of all 120 volt AC and DC vital and semi-vital panel breaker installations against all affected drawings, and noted numerous errors (randomly dispersed within 16 additional drawings) of similar nature i.e. labeling and fuse sizes in other panels and their drawings. During the time of the inspection, it could not be determined why the errors occurred. The majority of incorrect drawings were considered to have occurred following plant modifications; e.g., occurred as a result of performing a work order to correct a tripping breaker. In any case, drawings were not properly updated in accordance with plant procedure (as it now exists) SUADM-ADM-11, dtd. 29 November 1989, Station Drawing Revision and Distribution, which required drawing revisions be issued when plant modifications were made or when as- built conditions different than drawings were discovered. The licensee verified that the proper sized breakers and cables were installed in accordance with modification requirements. A total of eleven drawings required correction. The licensee advised the inspection team that a program existed for drawing changes upon completion of field design changes; based on the examples noted by the team, it was concluded that the program for control of drawing changes had not been effectively implemented. This failure to follow procedure is an example of violation 50-280,281/90-07-01.

Vendor Supplied Information Not Incorporated in Plant Documents in Accordance with Procedure

The team was concerned that vendor supplied information that necessitated changes to plant procedures and documents was not being properly processed and incorporated into station requirements. The team reviewed a specific example of vendor supplied information to determine if the licensee's process for handling of vendor information was being properly incorporated.

Limitorque Corporation published Maintenance Update 89 - 1 in December 1989. This important bulletin addressed several maintenance topics applicable to Limitorque actuators, such as:

- o actuator pinion gear fit-up, orientation, and location
- o gear to shaft key material, fit-up, and retention (staking)
- o set screw spot drilling and retention (lockwiring/staking).

Although this bulletin had been received by both corporate and site personnel responsible for the Motor Operated Valve (MOV) maintenance program, the team noted that:

- o MOV maintenance procedures had not been updated to reflect the requirements of the bulletin,
- o the TSC library, controlled document Vendor File and Vendor Manual did not contain the bulletin or any reference to its contents, and
- o the licensee's Commitment Tracking System (CTS) did not contain reference to the contents of the bulletin.

The team was able to determine that a memorandum had been prepared by the station MOV Coordinator that called the attention of Maintenance Engineering to the contents of the bulletin, but no further action had been taken. The team determined that neither corporate nor site personnel directly associated with the MOV program were aware of their responsibilities for processing vendor supplied information such as the Limitorque Bulletin.

Station requirements for processing vendor supplied information were found in SUADM-ADM-31, Vendor Interface / Control of Vendor Documents, dated 5 Dec. 1985, at paragraph 8.0, Vendor Supplied Information, which stated,

8.1.1 "All technical correspondence from any vendor ... shall be reviewed by the appropriate department. Each Department Head is responsible for insuring that any of this correspondence received in his department is forwarded promptly to the Supervisor Records Management.

8.1.2 If it is determined that corrective actions are necessary the item shall be placed on the Commitment Tracking System.

8.1.3 If the completed item causes a change to the Vendor Manual or to the Vendor File, the attached form "Vendor's Manual/File Revision" (Attachment 3) shall be completed by the Licensing Coordinator and forwarded to the TSC Library for a controlled distribution and filing ...." The team noted that Attachment 3 was the checklist that would cause, among other items, required revisions to station procedures to be implemented.

Based upon the above example, the team concluded that the program for control and incorporation of vendor supplied information was not being effectively implemented in accordance with required station procedures. This failure to follow procedure is an example of violation 50-280,281/90-07-01 and is discussed further in section 3.k.

3.c. AIR SYSTEMS

The team found numerous examples of end-use devices which vibrate during normal operation and are connected to stationary IA root valves by lengths of small-diameter copper tubing. This was considered significant in light of much industry experience with trips and transients due to vibration-induced air line failures, including a trip at Surry's sister plant, North Anna (February, 1989) in which an IA line on a feedwater regulating valve failed due to vibration; a steam generator tube plug failure and tube rupture were associated with this large transient.

Compressed air is supplied to containment by four (two per unit) rotary water seal ring compressors which take a suction on the containment (typically 99 percent relative humidity at 118 degrees F.) then discharge into refrigeration air driers. These air driers are not capable of attaining dew points of less than 35 degrees, even under optimum conditions. The licensee's response of February, 1989, to NRC GL-88-14 committed to conformance with ISA S7.3 which states, in part, that at no time shall IA dewpoint exceed 35 degrees.

An annual PM procedure, IA-C-M/A2, written in 1985, covers the containment IA air compressors and discharge air filters, inside the refrigeration air driers at the discharge of the air compressors. The team found that the most recent performance of this PM procedure for the refrigeration air driers was in mid-1989, by a contract maintenance firm. At that time, the contractor indicated that two of the discharge filters were so rotted and corroded they could not be left in place; discharge air from these air driers to containment IA loads was not being filtered at the time of the inspection. The remaining two filters were dirty, however, they were left in place because spare filters were not on hand. This was still the case at the time of the inspection, per cognizant licensee personnel. Further, the team found that the only time prior to 1989, this procedure was ever performed was January, 1987 during which time, the steps for inspection of the discharge filters was checked off as "Not Applicable". There are no other records, per the licensee, that these filters were ever changed since installation of the air driers, or about 7 years. In addition, the team reviewed station deviation reports (DRs) relating to water found in end-use devices and high dewpoints in the containment IA system. These DRs document water squirting from solenoid operated valves, flow gauges full of water, and dewpoint readings greater than 60 degrees F, among other things. Interviews with station personnel also indicated that air regulators at end-use devices were typically full of water when blown down during outage PM work. The lack of attention and timely commitment of resources by management towards needed upgrades in the containment IA system, despite documentation of numerous problems, as well as the general material condition of the containment IA system was considered a weakness in the licensee's maintenance program.

The team found that check valves which ensure operability of backup accumulators for air-operated valves required for safe-shutdown were not in the licensee's inservice test (IST) program. These check valves were added to the program late in 1989, and are scheduled for testing, however, the failure to recognize the requirement for inclusion of these valves in the IST program was considered a weakness by the team.

In the EDG air start system, the licensee experienced chronic problems with leaking check valves and compressors which have required frequent in-head valve replacement; these valves are no longer available for this vintage of compressor. Recently, the licensee replaced all six discharge check valves, and has been in the process of replacing all six compressors under various engineering work requests (EWRs). These problems were primarily due to poor air quality, per licensee correspondence, and cognizant licensee personnel. Degradation of the air compressors and the check valves was due to accumulation of water on top of the check valves, and passage of the water into the air compressors. The adequacy of the EDG air start system was also addressed in a type 2 request for engineering and construction assistance, dated June 30, 1989, in which station engineering personnel identified two concerns which were: the absence of a program for monitoring or controlling EDG starting air quality, and the high likelihood that the air start receivers (18 total, 20 cubic feet per tank) are full of rust and scale from years of wet service.

The team then witnessed the routine blowdown of the air start system for EDG 1, and a significant quantity of water was discharged. Also note, that the licensee recently removed over 20 pounds of rust from inside the service air receiver in the turbine building. Air quality in the EDG air start system can also affect the performance of the solenoid operated valves which admit air to the air starting motors. Sluggish performance of one of these valves was documented in August, 1989, for EDG 2 in which the licensee produced traces of engine RPM versus time. Cognizant licensee personnel indicated to the team that the valve's degraded condition was primarily due to poor air quality. To alleviate these problems, and improve reliability of the diesel air start system, station engineering personnel recommended installation of air driers and filters, the goal being conformance with ISA S7.3. The licensee's response to the problems cited above so far has been a lack of commitment to long term corrective action, with more emphasis on short-term solutions with respect to the material condition of the EDG air start system. This was considered a weakness in the licensee's maintenance program.

3.d. DEFICIENCY IDENTIFICATION AND TAGGING

During walkdown inspections and observation of work, the team evaluated the licensee's program for deficiency identification and tagging. The following problems were identified with the program:

During walkdown of the SI system, a number of small leaks and minor deficiencies that had not been identified by the licensee were identified (see section 2.a for details). In addition, many deficiencies identified in the walkdown had been identified by the licensee during their walkdown in late 1989. However, deficiency tags written by the system engineer had not been hung nor had WRs been submitted.

A number of deficiencies were identified that had been previously identified by the licensee, WRs had been issued, yet the deficiencies had not been tagged or the tags had been removed. Health Physics (HP) personnel responsible for identifying leaks and sources of contamination estimated that 10% of the tags they hang get torn off or removed for some reason before the corrective work is accomplished.

During the SI system walkdown by the team (in the first week of the inspection) deficiencies identified in systems other than the SI system had not been tagged or WRs initiated by the close of the inspection. The SI system engineer, who accompanied the team on the walkdown inspection, did not feel obligated to tag the deficiencies in other systems.

Inconsistencies in tagging known deficiencies detracts from the overall process of identifying deficiencies and initiating corrective action in that people are less likely to initiate a tag since they cannot be sure whether a problem has already been identified and corrective action initiated. The above problems appear to be the result of a weak procedure for identification and tagging of deficiencies. The procedure (SUADM-M-11) does not clearly specify that anyone identifying a deficiency is responsible for initiating a WR card (tag). In addition, the word "should" is used throughout the procedure, detracting from the effectiveness of the procedure. Procedures could be strengthened by requiring that all personnel who are in the plant on a regular basis routinely take WR cards with them and tag any deficiency noted.

3.e. TIMELINESS OF CORRECTIVE ACTION

During the inspection, a number of cases were identified where actions to correct known problems were not taken in a timely manner. These items, discussed in detail in this section or other sections of the report,are summarized as follows:

In late 1989, the licensee performed a walkdown of the SI system and identified a number of areas where the piping configuration was not like the drawing. Five areas where the Unit 2 SI piping configuration did not agree with flow diagram 11548-FM-089A, Sheet 2 were identified. By the end of the inspection, a drawing change request still had not been issued to correct the drawings. Although the configuration problems do not affect plant or system operability, corrective action has been slow. Also, a temporary support was found installed for valve 2-SI-MOV-2885C in the same late 1989 walkdown. As of the close of this inspection, an Engineering Work Request (EWR) had not been issued to evaluate the support. The above problems indicates weakness in taking timely corrective action for known drawing errors and deficient conditions.

During the review, the team found that adequate corrective action had not been completed for QA audit finding S87-22-03 issued in October, 1987. The finding identified numerous discrepancies in completed WOs (the team also found problems with completed WOs - see section 3.s). This audit finding relative to adequate corrective action by maintenance to improve the quality of WOs has been escalated by QA to step 2 (August 15, 1989) of a 3 step escalation process. This is another example of problems with timeliness of corrective action.

HP was tracking 688 primary sources of contamination. Forty-three new sources were identified in February, 1990, and only one was fixed indicating lack of attention to the problem.

Necessary modifications to the radiation monitoring system, such as elimination of high background readings in monitor locations, has existed for years - see section 3.f.

The need to replace containment instrument air filters was identified in mid-1989. The filters still have not been replaced (see section 3.c).

Necessary modifications to the HVAC system have existed for years - see section 3.f.

3.f ALLOCATION OF RESOURCES

In an effort to determine the root-cause for delays in corrective maintenance, the team interviewed cognizant engineers, foremen and craft. From these interviews, the team has ascertained that there are several contributing factors responsible for this lack of maintenance and the resulting HVAC system degradation. These are as follows:

1. The licensee's resources are committed on a priority basis, first on those systems which are important to nuclear safety, second, on systems necessary for power generation and third, on balance of plant systems/noncritical to safety. Because most of the HVAC system is nonsafety-related, manpower dedicated for system maintenance is limited to a crew of four, with no allowance for overtime. System maintenance is for the most part, limited to the safety-related section of the system and its associated components. Management's support for maintenance on the balance of the system is very limited and, not program driven i.e., a component operates until it breaks down. When it (component) no longer functions, it is tagged out and repaired or replaced depending on availability of funds, parts and/or manpower.

2. The team ascertained that the licensee maintains little or no inventory of replacement parts i.e., fan belts, sheaves, motors for quick maintenance/repairs are not on hand. Therefore, simple off the shelf replacement parts are purchased through a cumbersome procurement system which treats all replacements as though they are safety-related causing long delays and extended down time.

Other examples of system degradation and the licensee's failure to respond in a positive manner are as follows:

- On July 31, 1989, the station experienced an ESF actuation at a time when the ventilation system VS was being aligned, i.e., repositioning of the HVAC dampers, for testing purposes. An engineering work request EWR 89-540, was issued to investigate the root cause of the problem and report the findings to management. A review of the subject reports entitled, Systems Engineers Review of Ventilation ESF Actuation Surry Power Station, dated August 23, 1989, identified the root-cause as VS leakage and actuator blow-by combined with reduced Instrument Air Header pressure. The reports stated that actions in progress taken to correct the problem included: Service all actuators to eliminate blow-by, walkdown system to identify and repair all air leaks, verify pressure switch settings for compliance with design requirements. The team determined that as of March 29, 1990, no substantive corrective action(s) had been taken on subject actuators and sixteen related dampers. This was attributed in part, to a lack of replacement parts for reasons discussed earlier. A detailed walkdown of the system to identify and repair all leaks has not been performed, hence the system continues to leak at a rate of approximately 47 cubic feet per minute and lastly, pressure switch verification setting is only partially completed.

- Also, by document review, i.e. EWR 87-170, 3/12/87, 87-170A, 5/8/87 and 89-336 with Field Changes A-Y dated 5/19/89 through 2/14/90, and through discussions held with cognizant personnel, the team has determined that the containment air cooling recirculation and air cooling control rod drive mechanism (CRDM), systems in both units are worn-out and unable to function as originally designed. These documents show that as of May 1987 fans, dampers, louvers, actuators and linkages in the containments recirculation system were no longer able to function as designed and required extensive structural/welding repairs or replacement. Bids for replacement were solicited in December 1987 but the licensee rejected the two responses submitted for consideration. More recently the licensee issued station commitments CTS 89-7836-001, 89-7460-001 to replace the containment recirculation fans and dampers by June 4, 1992.

  In reference to EWR 89-336, the team ascertained that the air cooling CRDM, system is in a similar degraded condition in that doors, dampers, linkage brackets, louvers, fans and even some of the ductwork no longer function as designed in that it required 22 field changed to the subject EWR to help remedy existing field conditions. For example, certain dampers had to be either blocked or wired open for continued operation, ductwork from fan 1-VS-F-4B to the main duct trunk line required extensive structural/welding repairs, control rod vent shroud cooler access cover seats required extensive repairs, damper linkage brackets on control rod shroud cooling fans 2-VS-F-60A, -60C and -60D were found broken and were wired open for continued operation. Similar temporary fixes were imposed for the dampers on recirculating fan 1-VS-F-1B. These conditions help to demonstrate further the systems degradation, resulting from inadequate maintenance and a lack of the necessary resources to keep the system functioning as designed.

During review of annual calibration data for various detectors in the radiation monitoring system (RMS), the team noted that Procedure No. CAL-001, dated 17 Aug. 1989, Log Ratemeter Scintillation Detector Source Calibration, Initial Conditions paragraph 3.3 required, "Background/process count rate must be at least one decade below the calculated calibration source count rate." A review of the latest calibration data performed for RM-CC-105 and 106 (Component Cooling Water [effluent] A & B respectively) in January and February 1990 respectively showed the background counts to be approximately 1.1 E+5 cpm, and the calibration source strength to be about 7.0 E+4 cpm. That is, the background was higher than the source strength, opposite that of the initial conditions requirements. Based on interviews with the craft, the team learned that this condition had existed for several years, and that on each occasion of performing the procedure, a procedure deviation was prepared to permit omitting the paragraph 3.3 initial condition requirement. The problem was described as being caused by contaminated sediment on the walls of the CC piping; thus the monitors were not observing actual fluid activity levels.

The team noted that a Technical Report (No. NE-697, Rev. 0), entitled "Changing RM-CC-105/106 to Off-line Monitors, Type 1 Final Report, Surry Power Station" was issued in March 1989, and recommended the off-line monitoring system as the most practical and only solution expected to work. A Request for Engineering and Construction Assistance (Type 3) was initiated by the station on 14 July 1989, with a required start date of 1 September 1989 and required completion date of 1 June 1990. Capital Project Type 3 IR-6369 was issued on 1 August for "Replacement of CC Radiation Monitors".

Since much of the RMS was not operating in accordance with UFSAR commitments, a special SNSOC Radiation Monitor Subcommittee had been reviewing the overall status of the Surry RMS for the past several months. In their report of 9 March 1990, endorsed by SNSOC on 15 March 1990, a "Long Term Action Item" (#3) was listed as:

"3. A Type 3 study will be initiated for replacement of RM-CC-105, 106 if necessary.

a. Track progress of CC task team. If fixed background is found to be significant, proceed with Type 3 IR 6369 (on hold) to replace monitors. -ENG/NSS" No information was provided about the "on-hold" status of the plant modification.

The team perceived the above lack of substantive action as an inappropriate, continued delay in performing required plant modifications. An appropriate engineering study had been completed, and there was no evidence that any conditions had significantly changed during the past year. Therefore, it appeared to the team that it was time to get on with correcting the problem, rather than continuing to study the problem ad infinitum. In addition to the monitoring problems caused by the high background, the team was concerned about the mentality that continued deviations of procedures tended to foster in the craft - i.e., simply revise the procedure if it is not possible to perform in accordance with the procedure. It was the team's opinion that adequate resource commitment should be made by management to avoid forcing craft personnel into deviating procedures because equipment was not functioning according to design.

Other long-standing problems with permanent solutions proposed but not yet implemented due to lack of resource allocations are associated with the EDG air start system and containment IA system.

Six compressors were being replaced on the EDG air start system. These compressors required constant maintenance and eventual replacement due to moisture backflow (past in-line check valves) during compressor idle stage and resultant rusting valves. The proposed permanent solution to the problem (addition of air dryers and filters at the compressors' discharge) was deleted from the 1990 station budget.

Containment IA was known to be below industry standards by the licensee for many months. Problems include lack of filters, high-dewpoints and water in end-use devices. Solutions and needed repairs have been proposed. However, no improvements or repairs had been completed at the end of this inspection.

The above problems indicate a significant weakness in the allocation of resources and in addition in the timeliness of corrective action for known problems.

3.g JOB PLANNING

Supplemental Work Instructions Accompanying Work Orders Were Frequently Inadequate

The team reviewed two types of procedures in use by the licensee: formal procedures that were used on a repetitive basis to perform recurring maintenance activities, and "supplemental work instructions" that were prepared as a part of the planning process for unique maintenance activities. "Procedures" are discussed in Section 3.n of this report. The latter "instructions", considered by the team to have the force of procedures in implementation, were reviewed as a part of the planning process, since they should typically be prepared during the planning phase of Work Order preparation.

The team noted that approximately two-thirds of all work orders reviewed utilized work instructions that had the intent and complexity of "investigate and repair". Review of these types of work orders led the team to the conclusion that many functions such as utilization of proper procedures, technical manuals, and performance of appropriate post maintenance testing (PMT), may not have been accomplished. For maintenance activities observed by the team, it was noted that "planning" typically occurred at the craft level, when the assigned craft was ready to go into the field to accomplish the work. "Investigate and repair" activities accomplished just that, i.e., no revision to the details or scope of work in the work order was accomplished after "investigating", prior to proceeding with the "repair". In an effort to determine the reasons for observed implementation problems, the team focused on the planning and work order preparation program.

SUADM-M-12, dtd 20 April 1989, Work Order Planning, was the governing document for the preparation of Work Orders by the planning department. This procedure was noted to be weak because details of an acceptable program were absent from the procedure.

- The procedure did not contain a reference list, thus such references as ANSI N18.7 - 1976, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants, and INPO 85-038, Guidelines for Conduct of Maintenance at Nuclear Power Stations (Nov. '85) were not included. Station procedures necessary for the implementation of work orders, such as clearances, housekeeping, system cleanness, rigging, and calibration, were also not included.

- Section 2.0, Work Order Planning addressed the subject of providing details to accomplish work with the following:

  "2.3 The planner will check the work order for completeness, clarity and accuracy and add any additional required information." Since this instruction appeared to apply to the original Work Request, the team observed that details listed in the Work Order were usually no more than what had appeared in the Work Request.

"2.4 The planner will plan the job and estimate resources required.

2.4.6 Work procedures required will be identified and obtained."

For most Work Orders reviewed by the team, it was noted that the "originator" of the Work Request performed the "job planning/procedure writing" in his preparation of the document that identified the problem, i.e., the work request. For maintenance activities that were observed and reviewed by the team during the inspection, the work request would state, "Item X is failed. Troubleshoot and repair." This was translated to the Work Order, and in most cases became the "procedure" for repair of the component. In general, no amplifying "procedural steps" or supplemental work instructions were prepared except for complex repair activities. "Planning" was performed at the craft level, at the time the repair activity was started.

Many maintenance activities were not addressed by a pre-prepared procedure, thus it was frequently necessary and appropriate to provide supplemental work instructions in the Work Order. If procedures were available, work instructions should be prepared to sequence the work, or direct the use of sections of pre- approved maintenance procedures or technical manuals. In cases where pre-approved procedures were available and accompanied the Work Order, the team observed the use of one or two pages of the procedure that was forty or fifty pages in length - the unused pages were marked "N/A'" as not appropriate to the Work Order being performed.

o No approval process for the content of the Work Order or the adequacy of the planning process was included in the SUADM-M-12 procedure. Craft concurrence was not included in the process. Quality review of the work orders was not specified. No check lists of necessary work order attributes were available to assist the planners in preparing comprehensive work orders.

o Paragraph 2.4.1 stated, "Required plant status and initial equipment conditions will be identified." No further details were provided in the SUADM-M-12 procedure about preparatory steps for the setting of clearances, establishing necessary plant conditions, or other meaning the paragraph may have had.

- Guidance on special considerations was not included in the procedure. As examples, safety considerations such as confined space or fire protection work permits were omitted from the planning procedure. "Interfaces with other crafts or departments will be identified and necessary work requests submitted." was the extent of consideration given to items such as RWPs, scaffolding, and special chemical requirements. No guidance on the extent or level of detail of work instructions was provided, i.e., word by word instructions for some types of activity, but limited guidance, "skill-of-the-craft" for other activities. Guidance concerning pre-planning walkdowns of the expected maintenance activity was not included.

Based upon the above types of inadequacies in the work order planning and preparation instructions, the team concluded that the work order planning program needs significant improvements.

During interviews with the craft and planning department personnel, the team learned that "planners" did not function as a centralized group responsible for preparation of detailed work instructions. Planners were forced to function as schedulers and material procurement personnel. By craft, the following was determined to be the planner staffing strength:

	Electrical	I&C	Mechanical
Staff	1	2	9
Contractor	2		4
On loan from craft resources	2		1

The planning department staffing did not permit the detailed work instruction preparation that was typical of the industry, and the burden of this segment of the planning effort defaulted to the craft. Since the craft felt they knew what they were going to do, pre-job details were frequently not added to the work orders for the electrical and mechanical crafts. I&C technicians generally attempted to revise existing procedures to "make them fit" the intended maintenance activity.

Based on the extent of the observed problems with the procedure governing the maintenance planning effort, the inadequacy of work control documents, and the sparse planning staff, the team concluded that the program for preparation of maintenance authorization documents was a significant weakness.

3.h. POST MAINTENANCE TESTING (PMT) PROGRAM WEAKNESSES

The PMT program is governed by the following two procedures:

SUADM-M-27, Revision 1, Requirements for A Post Maintenance Testing Follower

SUADM-M-47, Revision 0, Post-Maintenance Test/Verification program

The following problems were identified with the program:

The current PMT program, procedure M-27, is very limited for equipment other than ASME Section XI equipment. The procedure was written to cover Section XI testing and has been revised to cover other safety-related equipment and, on a very limited basis, non-safety-related equipment. However, the procedure is primarily a Section XI procedure and provides very little detail for other equipment, e.g., electrical. Although, the PMT Follower is used for all safety-related WRs, the lack of procedural detail results in inconsistences in specifying PMT for equipment other than Section XI.

Personnel responsible for specifying PMT on the Follower have experience primarily in Section XI testing and are not qualified to specify testing in other areas such as electrical. Again, this results in inconsistences in specifying test requirements. On some WRs reviewed, the PMT follower indicated that engineering was contacted for the required PMT. However, without procedural guidance, desired results cannot be assured.

In the electrical and I&C areas, the PMT Follower is attached to the work order. The electrical and I&C sections stated that they are only required to perform the PMT specified on the Follower. The planners stated they are not responsible for PMT. Fortunately, most of the electrical and I&C procedures have sufficient testing and calibration requirements that are equivalent to PMT. However, two weaknesses were identified. One item is that when switchgear is sent to an outside vendor for refurbishment, PMT was not adequately specified. Another item is that the maintenance procedural step for functional testing can be marked "NA" (not required) if Operations is not available to perform the step. The licensee stated that the procedures will be revised disallowing NA'd steps for functional testing by Operations. The licensee stated that temporary corrective action will be immediately implemented by requiring that qualified electrical system engineers will specify all PMT on the Followers until the new program is in place. The team considered these responses by the licensee as acceptable.

Based on previous assessments (INPO and Licensee), the weaknesses in the PMT program had been recognized and corrective actions initiated. In October, 1989, a task team was assigned to develop a new PMT program. At the time of the inspection, a new comprehensive PMT was under development. The program is detailed in procedure M-47 and consists of a series of matrices for each component under the program. At the time of the inspection, the only matrix that had been issued was for the Auxiliary Feedwater Pumps. The scope of equipment to be included in the program was still being developed. By the close of the inspection, the scope had been defined and was to include all equipment on the mechanical and electrical "Q" list (approximately 15,000 items). Licensee personnel indicated that tentative plans are to have matrices completed for ISI/TS (Inservice Inspection/Tech Spec) items in 1990, safety-related items in 1991, and BOP (balance of plant) items in 1992. To date, matrices have been developed for a significant portion of all ISI/TS check valves, motor operated valves (MOVs), and safety-related 4160v and 480v breakers. However, none of these matrices have been through the review process and added to the procedure.

3.i. TESTING OF AUXILIARY FEEDWATER TURBINE

The auxiliary steam turbine-driven pump unit consists of a Terry turbine coupled to an Ingersol (Ingersol/Dresser) pump equipped with a Woodward governor and a trip throttle valve manufactured by Gimpel Machine Works Incorporated (Gimpel), Philadelphia, Pennsylvania. Industry wide problems including overspeed trip failures were encountered with the Terry turbine and IN 88-67 described two instances where the Terry turbines failed to trip on overspeed. INPO issued at least three SOERs on this subject. Major maintenance was performed on the Terry turbines installed at Surry Units 1 and 2 during 1988 (WO 58211) and 1986 (WO 41408), respectively. Attachment 8 to WO 58211 indicates that the Terry turbine overspeed trip was set at 6280 rpm and verified to trip at the set point. WO 41408 records did not indicate that the overspeed trip mechanism operated. The Terry Corporation, the manufacturer of the Terry turbine, in Instruction Section 7 of the Instruction Manual states in part, "It is most important that every overspeed device and trip mechanism be tested regularly, preferably once monthly. This will insure that the tripping mechanism is operating freely. The test can be made manually or by overspeeding the Unit. The mechanism, when tripped, should respond instantly and reduce the speed of the Unit, or hold it from overspeeding with the throttle valve wide open. Record trip set point and date of initiation. Verification of proper functioning and setting of the overspeed trip device during initial startup is mandatory. This should be accomplished with the turbine disconnected from the driven equipment." The licensee did not translate the vendor recommendations into a procedure to conduct an overspeed trip testing of the turbine.

The team reviewed the action taken by licensee relative to IN 88-67 entitled, "PWR Auxiliary Feedwater Pump Turbine Overspeed Trip Failure." Station Commitment Assignment/Response Form (SCARF) 88-6067-003, which was initiated to track the actions relative to IN 88-67 stated that the Woodward governors would be replaced for Units 1 and 2 during the next refueling outages. It also stated that the Terry turbine for Units 1 and 2 were overhauled in 1988 and 1986, respectively, during which the tappet balls were replaced and overspeed tests were performed. In view of the recent overhaul and subsequent overspeed trip test, the SCARF requested an extension of time to develop a procedure to conduct an overspeed trip test with the new governor. The licensee was unable to produce any records to substantiate the statement in the SCARF that the overspeed trip test was conducted on the Unit 2 Terry turbine.

The Industry Operating Experience Review (IOER) Committee reviewed the "Testing of Steam Turbine/Pump Overspeed Trip Devices" and provided a recommended action plan. The document referenced:

(INPO) SOER 8113: Current Loss of High Pressure Core Cooling Systems.

(INPO) SOER 86-13: Reliability of PWR Auxiliary Feedwater Systems.

(INPO) SEN 55: Failure of Woodward Governors results in Auxiliary Feedwater Pump Turbine Overspeed Trip Failure.

NRC IN 88-67: PWR Auxiliary Feedwater Pump Turbine Overspeed Trip Failure.

NRC Case Study Report AEOD/C602: Operational Experience Involving Turbine Overspeed Trip, dated August 1986.

The action plan for Surry stated three concerns and outlined the actions to be taken for each concern. However, the team determined that attributes such as the following were not considered:

- Recommendations of the manufacturer of the Terry turbine
- Research of the overhaul and maintenance records to determine if overspeed trip tests were indeed performed.
- Engineering evaluation to determine the consequences of operating the Terry turbines without knowing if overspeed trip device fails to operate and overpressurizes the piping downstream of the turbine.
- The frequency at which the overspeed test should be performed considering attributes such as, the vendors recommendation to test the overspeed trip mechanism monthly, the complexity of uncoupling the pump before the test, the fact that the Terry turbine is operated infrequently, and that there are no pressure relieving devices downstream of the AFW turbine.

IN 88-67 dated August 27, 1988, described a failure of the AFW pump turbine overspeed mechanism in July 1988 at the San Onofre Station. A failure of the overspeed trip mechanism occurred at the Ranch Seco Station during January 1989 during which the AFW System was pressurized. The team determined that contrary to paragraph 6.2.1 of Procedure VPAP-0504, research and evaluation of the Vendor Technical Manuals was not performed and the recommendations of the vendor to test the overtrip mechanism was not incorporated in a suitable procedure.

Station requirements for processing vendor supplied information were found in SUADM-ADM-31, Vendor Interface / Control of Vendor Documents, dated 5 Dec. 1985, at paragraph Nos. 8.0, 8.1.1, 8.1.2,and 8.1.3 (see section 3.b)

Based upon the above example, the team concluded that the program for control and incorporation of vendor supplied information was not being effectively implemented in accordance with required station procedures. This failure to follow procedure is an example of violation 50-280,281/90-07-01.

3.j. PERSONNEL SECURITY TRAINING

Training in security access control was noted to be lax in at least one case by the inspection team. One maintenance technician was observed to "tail-gate" another technician into the Emergency Switchgear and Relay Room. Confusion between the concept of "accountability" and "controlled accessibility" appeared to be the cause of the problem. The licensee agreed to take appropriate action in the matter.

3.k. CONTROL AND CALIBRATION OF MEASURING AND TEST EQUIPMENT (M&TE)

Procedure SUADM-M-39 (dtd 13 Dec. 1988), Control of Measuring and Test Equipment, established the facility M&TE program. The procedure detailed the issue, recall, storage, and segregation of special, limited-use, or expired M&TE. The procedure also provided instructions for placing damaged equipment out-of- service, and for resolution of out-of-tolerance equipment used in the field. Although the calibration laboratory was small, it was found to be clean and organized, and adequate in its function.

Each piece of equipment was assigned a unique "SQC" number by which the equipment's calibration and use history was tracked. All tracking and recall was performed manually on cards associated with the equipment by the SQC number. No formal "check-out" system was employed by the licensee for pieces of M&TE under control of the I&C and Operations group; two way traceability on equipment used in quality work was maintained by, 1) recording the equipment and its SQC number on the work order itself, and 2) recording the date and procedure that the M&TE was used on a Test Equipment Record card (Form # MTM06) attached to the equipment itself (instructions for use of the MTM06 form were not included in the SUADM-M-39 procedure, but appeared to be properly implemented). Electrical and mechanical craft similarly maintained storage of limited M&TE under their control, but most electrical and mechanical items were checked in and out of tool issue points. Recall of M&TE approaching the calibration due date was controlled by manual review of history cards segregated into month-due categories. The M&TE technician generated a Certification Due Notice, and forwarded it to the cognizant supervisor having possession of the instrument.

Although the program appeared fundamentally adequate, several areas of concern were noted by the team. A high level of responsibility was placed on the various disciplines for proper control and handling of M&TE due to the decentralized control of the equipment. All disciplines except Operations readily complied with requirements of SUADM-M-39 related to use, storage, and recall. The team concluded that many of the following types of problems were the result of no single point of contact in the Operations department taking responsibility for the program.

Several areas of procedural non-compliance in M&TE control were noted in the Operations department. For example, Section 8.0 of SUADM-M-39 addressed the subject of storage of M&TE, including segregation, environment, and handling. M&TE under the control of Operations was stored in two lockers behind the control room adjacent to an air-conditioning unit. The lockers included all kinds of paraphernalia, including some very heavy test gear such as connecting piping, discarded radios and their associated chargers, etc. The lockers were in total disarray, thus storage conditions could have (and had) damaged or disrupted calibration of the instruments. As an example, an Eagle Eye Flow Meter (3 - 9,000 GPM range) had a calibration sticker reflecting calibration of 08/22/89, and due date of 8/90 (SQC #3708). The meter face had been broken out of the meter for a long period of time, but reflected a last used date of 2/18/90 on the Test Equipment Record Card (i.e., the equipment had not been removed from the system). The test for which the equipment was used was illegible, and the card was not annotated with the SQC # of its associated equipment (Card loose in the meter container). Two 1,500 - 4,500 GPM flow meters were also stored in the locker, one with a broken meter face. Neither meter was calibrated because the calibration facility did not possess equipment accurate enough for the 2" H2O range of the meter.

Two pressure gages were also found in the locker. One 0 - 5000 PSIG pressure gage was "tested" 12/17/87 (not in M&TE system), and one 0 - 1000 gage was "calibrated" 1/29/90, and "due" 2/29/90 (i.e., past due - # SQC 3655).

Two dual stage (0 - 4,000, 0 - 400 PSIG), pressure regulators were also found in the locker that were used to perform containment penetration leakage tests. These regulators were un- tested and un-calibrated. Paragraph 6.2 of SUADM-M-39 specifically required all M&TE to be calibrated prior to use on safety-related systems, but specifically excepted devices that were continuously monitored during use with other certified equipment (in this case, the regulators were used with high accuracy, Heise gages). In that instance, paragraph 6.2 required application of a "No Calibration Required" sticker to certify the acceptable use of the device with other calibrated devices. Similar situations were noted with several power supplies in use by I&C technicians. In all cases (regulators, power supplies) observed by the team, "No Calibration Required" stickers were not affixed to the devices which was contrary to procedural requirements.

Improper storage conditions were also noted by the team for laboratory type, six foot high, roll around instrument racks that were under the cognizance of the I&C group, not Operations. To meet seismic restraint requirements, the licensee had "temporarily" (Summer of 1989) wrapped a large chain around the upper cabinets in the rack. The upper cabinets included power supplies, counters, digital voltmeters, etc. The chain was then wrapped around an adjacent stanchion to keep the entire assembly from damaging adjacent reactor protection instrument racks. This storage method was perceived by the team as a poor practice since a bump into the rack resulted in the chain wrenching on the instrument cabinets. The licensee should correct this condition of improper storage storage of M&TE.

The team reviewed instrument history sheets and recall lists, and noted that several instruments under the control of Operations were overdue for calibration for several years (e.g., SQC # 3653 - 3/87, 3589 - 10/88, 3566 - 10/88, 3562 - 7/85, 3544 - 6/86). Several Notice(s) of Instrument Restriction had been generated because the device(s) had gone beyond their certification due date; there was no evidence that compliance with paragraph 7.5 of SUADM-M-39 had occurred regarding application of Certification Overdue stickers, and return of restriction notice copies to the calibration facility. The team was especially concerned that the inventory of required test equipment to support the plant was being "lost" due to such events as breakage and contamination, but not being recognized due to lack of control of calibration status. The team perceived this lack of control as a significant implementation weakness.

The above examples in addition to those discussed in sections 2.e, 3.b and 3.i indicate, that the licensee failed to follow procedures for maintenance. This will be identified as violation 50-280,281/90-07-01 :"Failure To Follow Maintenance Procedures".

In exploring potential "loss" mechanisms of test equipment, the team learned that the licensee has no facility for calibration or comparison checking of contaminated equipment. If an M&TE device becomes contaminated (Heise gages were a good example), the device was simply stored, and used in contaminated applications only, until the expiration of its normal calibration period. At this time, the device was permanently retired, with no check of accuracy before retirement. Thus compliance with paragraph 7.6 of SUADM-M-39 regarding evaluation of out-of- calibration conditions when a device was presented for calibration was not possible. The licensee advised the team that the situation of contaminating an instrument had not occurred for a long period of time.

The team noted areas of strengths and concerns for devices requiring off-site calibration due to cal lab limitations. For example, the qualified vendors list was up-to-date, and a sample check of devices recently sent "out" for calibration showed the items to have been sent to a qualified vendor. The team noted an effort on the part of the instrument technician to anticipate the lead time required to obtain authorization to send devices off-site but also noted a few cases where the device was over-looked until due/past due. However, on occasion, the attempts to anticipate calibration requirements were thwarted by extremely variable processing time (months) on purchase orders to requisition the calibration service. The net result was several items of M&TE were out of calibration before required vendor support could be authorized and obtained. Multiple pieces of the same equipment prevented this from becoming a significant problem.

Related to sending equipment off-site, the team noted that infrequently, quality control personnel performing receipt inspection of returned M&TE would erroneously retain and/or separate an instrument's pedigree papers from its associated device. Again, this was not a significant problem because ultimately, the papers could be traced and recovered. However, the situation was of concern to the team because the licensee currently utilized only one technician to manage the calibration program, and manage and operate the calibration laboratory. No persons-in-training were assigned to the laboratory. It was the team's opinion that a program improvement in this area should be considered by the licensee.

Another team concern was related to availability of M&TE device accuracy to the technicians performing maintenance activities. This was of concern to the team because procedures in use by technicians were noted to cover the entire spectrum of required accuracies and required instruments to support the procedure.

For example:

(1) Procedure 1-PT-2.1A, dated 17 July 1987, Reactor Coolant Wide Range Temperature (T-1-410), stated at Initial Conditions paragraph 3.4, "Insure that the test equipment to be used has adequate precision and range to measure the desired parameter and has been calibrated against standards traceable ...".

(2) Procedure Cal-001, dated 17 August 1989, Log Ratemeter Scintillation Detector Source Calibration, stated at Initial Conditions paragraph 3.6, "The following test equipment or equivalent is available, calibrated and meets accuracy requirements as specified.

3.6.1 Frequency counter or Scaler Timer.
3.6.2 Digital multimeter."

No accuracy requirements were specified.

(3) Procedure Cal-044, dated January 12, 1990, stated at Initial Conditions paragraph 3.2, "The following test equipment or equivalent is available and calibrated.

3.2.1 Function generator, HP 3310A.
3.2.2 Pulse generator, Rutherford B16.
3.2.3 Digital multimeter, Fluke 8110A.
......"

The team observed that the first two examples relied on the technicians to perform instrument acceptability determinations, and did not provide accuracy values for the instruments that could be used in the performance of the procedure. The team concluded that preparation of "upgraded procedures" was tending towards overcoming inadequacies in accuracy requirements versus accuracy of instruments available. It was the team's opinion that as an interim methodology, the licensee should consider making readily available to the craft all M&TE instrument accuracies such that if accuracy criterion are specified by a procedure, the craft will be able to readily determine acceptability of instruments in use.

3.1. DEFINITION OF MAINTENANCE REQUIREMENTS

The team reviewed instruments and control devices to determine if adequate calibration activities were being accomplished on control room indications that operators would use to implement normal, off-normal, and emergency operating procedures. The team examined three categories of devices: 1) those that fulfilled Technical Specification requirements, 2) those that fulfilled regulatory guidance or operating procedure requirements, and 3) those that provided personnel and/or equipment safety functions. The team learned that instruments in the first category (some safety-related) were subjected to formal, proceduralized Periodic Tests (PTs) that accomplished instrument calibrations and checks consistent with Technical Specification (TS) requirements. A sample check of the PT index, that listed the applicable PT procedure number, the related TS table requirement, and the frequency, showed that all instruments were properly addressed. An informal checklist was in use by the licensee that distributed the many calibrations (by month) over an 18-month cycle. The team concluded that, based on the sampling conducted, an adequate periodic calibration program for TS required instruments had been implemented. It was noted, however, that periodic calibrations were in the beginning stages of integration with the station preventive maintenance program.

In the second category of instruments, the team selected as a sample base, Reg. Guide 1.97 instruments and learned that these instruments were equally well addressed in periodic calibrations as the Technical Specification required instruments. However, of concern to the team was the fact that a Reg. Guide 1.97 instrument did not have a formally approved procedure for accomplishing appropriate calibrations. For example, Unit 1 pressurizer relief tank (PRT) temperature (T-1-471) was calibrated using a (apparently startup) procedure that was not dated and not approved. The last calibration performed using the informal procedure was September 1989. The team noted, however, that Procedure Number 2-Cal-333 had been approved for the Unit 2 PRT temperature device on 11 March 1986. Several other U-1 devices had no currently approved calibration procedure, such as:

- o Containment Vacuum Pump Discharge Flow (F-CV-150)
- o Throttle Pressure (P-MS-102)
- o SW Flow to Control Room Chillers (PDI-SW-130A, B, C)
- o SW Flow to Component Cooling Heat Exchangers (PDI-SW-132A, B, C, D)

These instruments were non-safety, but used by control room operators to implement operational procedures.

The last category or group of instruments the team was particularly concerned about were instruments that provided control room operators direct indication of the integrity of operating safety-related equipment, e.g., the EDGs. Several local alarm windows at the EDG local control panel were actuated by pressure and temperature switches, such as:

Oil Pressure (low)	20 psig (engine speed 125 - 870 rpm) 44 psig (engine speed above 870 rpm)
Crankcase Pressure (high)	1 - 1.7" H20
Cooling Water Press. (low)	20 psig
Starting Air Press. (low)	165 psig
Engine Temperature (high)	190 deg. F.

Fuel and lube oil parameters were also monitored. These devices, in addition to local alarms, provided contacts in a supervisory alarm circuit for the main control room annunciator 1J-H7, "EDG #1 Trouble" (similar for all diesels). Control room personnel initiated off-normal response procedures on receipt of the alarm(s). None of the pressure or temperature devices that initiated alarms were included in a periodic test/calibration program. In addition, the team noted that local reading instruments, e.g., the many pressure gages on the air start receivers, were similarly not included in any periodic test or calibration program. Thus an auxiliary operator, when dispatched to the EDG local panel on receipt of a control room alarm, could not be assured of valid indication for engine parameters. The lack of periodic calibration of critical engine instrumentation was perceived by the team as a program and implementation weakness. The team noted, however, that another important system, instrument air, did have many of its pressure control switches (e.g., those associated with the compressor operation) in a periodic test/calibration program. Coverage was found to be system dependent. The licensee did not have an instrument list, thus covered instruments were not able to be readily determined. The licensee advised the team that the "PM Upgrade Program" would address this problem on a system by system basis as the program analysis is completed during the next several years. It was the team's opinion that the I&C group should provide Operations with a list of those instruments providing direct or indirect indication (alarms) to the control room of system integrity. Operations should evaluate those instruments that are not calibrated for potential safety of equipment impact such that a decision on the necessity for the instruments to be calibrated can be made in a more timely manner. The team concluded that the PM Upgrade Program when implemented as described should tend to correct currently observed problems.

3.m. PRIORITIZATION AND BACKLOG CONTROLS

The team reviewed the licensee's records, schedules, interviewed maintenance department personnel, and attended planning and scheduling meetings to determine the effectiveness of the licensee's prioritization scheme, and the extent and control of the maintenance backlog. Specific areas examined included prioritization, deferred preventive and corrective maintenance, and measurements of past and current backlog.

During their review of work orders, the team observed numerous high priority work orders that were very old:

WO #	Priority	WO Approval Date
076790	1	89/01/12
077997	1	89/02/03
086587	1	89/10/10
088023	1	89/11/17

The team reviewed the program for work order prioritization to determine the adequacy of the program, and whether it was being properly implemented. Procedure SUADM-M-11, dtd. 14 April 1989, Work Request System, was the governing procedure for assignment of corrective maintenance (CM) priorities. (Preventive maintenance activities were always assigned Priority 1; this issue is discussed below.) Paragraph 3.2.1 stated, "The OMC completes Blocks 10 - 12, Blocks 14 - 20, reviews the WRC for accuracy and completeness." The Operations Maintenance Coordinator (OMC) was the SRO-qualified person making the prioritization decision for entry in Block 11 of the Work Request Card (WRC). Attachment 2, Work Request Card Completion, provided the guidance for priorities as follows:

Priority 1	Urgent work, scheduled to start in 24 - 48 hrs.
Priority 2	Priority work, scheduled to start one week after approval
Priority 3	Used to build a backlog of work, ordinarily scheduled to start 4 weeks after approval
Priority 4	Work to be done at time specified by originator, such as outage
Priority 5	Priority work done during a trip
Priority 6	Work on equipment without a redundant system - treated as priority as it could cause a shutdown
Priority 7	Work on equipment that could cause a shutdown if the redundant system failed.

The team noted in practice that only priorities 1 - 4 were used in work orders. The team also noted what was considered a significant program weakness in the above prioritization scheme:

- o The scheme did not consider Technical Specification (TS) LCO limitations
- o The scheme did not consider safety of personnel
- o The scheme did not consider safety of equipment
- o The scheme did not consider impact on unit generation capacity, etc.

The team discussed the above considerations, both the written program and team's opinion of an adequate scheme, with the station personnel responsible for prioritization assignment and learned the following. Priorities 1 - 3 were assigned based on consideration of Technical Specifications, safety of equipment and personnel, and unit generation capacity. Equipment redundancy, extent of degradation, and assessment of risk of challenge to safety systems were considered in the priority assignment. As discussed below, the team also learned that high priorities were conservatively assigned in an attempt to overcome production sluggishness caused by other factors. Priority 4 appeared to be the only priority that was assigned in accordance with the program requirements - i.e., a Priority 4 Work Order was planned for a normal outage. It was the team's opinion that the current program for priority assignment constituted a weakness, however, the manner in which the ineffective program was being circumvented and implemented was adequate.

The team learned that once a priority had been assigned to a work order, limitations on WPTS access and system difficulties made the change of the priority very difficult. This was considered a program weakness because several aged, Priority 1 work orders were being carried in the system that were not actually high priority any longer. For example, WO # 088023 required the fabrication and installation of missing generator shroud bolts on #3 EDG.

It was a Priority 1 work order when written because the shroud was rubbing on the engine to generator shaft; now that the shroud was temporarily, correctly positioned by temporary bolts, it was appropriate to change the work order to a lesser priority. The priority revision had not been made because the change was too difficult. It was the team's opinion that a program change should be made so that assigned priorities have meaning.

In the area of preventive maintenance deferrals, the team noted that the corporate reported performance indicators for 1989 averaged approximately 1.1%, closely approximating the licensee's goal. "Deferral" was defined as the percentage of PM during the monthly period not completed within the assigned grace period (1X periodicity for EQ, 1.25X periodicity for non-EQ). During the team's review of individual deferral approval sheets, the team noted that the actual deferral rate was much higher during 1989, somewhere approximating 15 - 20% average for the year (as high as 43% in June 1989). The discrepancy between "reported" and actual deferrals related to the method of record keeping - only if a PM activity were scheduled, then not completed, did the PM become a reported "deferral". The team concluded that this method of record keeping constituted a poor practice in that it did not give a clear picture of the amount of deferred preventive maintenance that contributed to a high backlog. Changes in record keeping and aggressive attention to completion of PMs have recently been initiated that should cause reported "deferrals" to track actual deferred preventive maintenance. Actual deferred PMs for February 1990 were approximately 1%.

A review of recently deferred PMs showed that some very important PMs were being deferred for illogical reasons. For example, PM EE-EDG-M/A1, Emergency Diesel 1 Year Service and Inspection, stated the "Reason for Deferral" as, "Parts" although the PM was not new. Engineering review of the deferral had rejected "parts" as not being technically justifiable. PM EE-C-M/M1, a Monthly Compressor Check of the EDG air start compressor (Mark # 01-EG1-C-QX1), stated the reason for deferral as, "PM missed due to parts - new PM". Again, engineering review of the deferral had rejected "parts" as not being a technically justifiable reason, and noted that the PM was the same as the quarterly scheduled PM since 1987. Manpower was also frequently listed as a reason for deferral. It was the team's opinion that parts unavailability and lack of manpower for long-standing PMs constituted poor planning. The PM Deferral Review Sheet did not provide for listing the last time the PM activity was accomplished, i.e., how far beyond end-of-grace, although that information was available in the WPTS by performing a special report run-off. If a PM activity was indefinitely deferred, it was simply noted as "missed" at its next due date in the WPTS to permit clearing the previously generated work order number from the system. The team also noted that all PMs were assigned a priority of 1. This tended to defeat the purpose of a prioritization scheme, and prevented effective management of backlogged work. It was the team's opinion that a significant program improvement would accrue from a two-fold scheme that related PM priority to importance of operation to the plant and importance of operation to the component itself.

For each deferred PM, the discipline supervisor was required to review the deferral, then engineering reviewed and approved/ rejected the deferral. The responsible superintendent (e.g., maintenance) reviewed and approved all deferrals; SNSOC approval was required for all EQ PM deferrals. It was the team's opinion that a program improvement would accrue from an increasing level of management review of deferred PMs for increasing amounts of time beyond end-of-grace period.

The licensee's program for backlog control was largely not proceduralized. Passing mention of backlog control was made in procedure SUADM-M-14, Work Order Scheduling, dtd 19 Dec. 1989, para. 2.3, that stated, "A preliminary POD will be established to reflect carry-over work, new work scheduled from the backlog schedule, and new work scheduled as a result of station needs." Backlog control was observed to be a de-centralized function of the craft schedulers reminding the craft foreman of outstanding work orders, and the need to continue to work off backlog as "filler" items when manpower permitted. The centralized planning and scheduling function dealt primarily with the high priority work items on a day-to-day basis. The above type of backlog control was largely a function of planning, i.e., craft-level planning for the I&C shop, shared craft-level and centralized planning for the electrical craft, and mostly centralized planning for the mechanical craft. In addition to craft "lists" of backlog items, the Operations Department had recently begun preparing prioritized lists (watch station basis weekly) of plant equipment that required increased operator action because of equipment faulty operation. For example, numerous work orders were outstanding on service water temperature control valves (Mark #s SW-TCV-108/208); since their operation was unreliable, operator action was routinely required to monitor and adjust. These lists of approximately 200 items affecting all crafts were used to help set craft work priorities.

Even though the control of backlog was not proceduralized, management tracked and was acutely aware of backlog through performance indicators. A review of the performance indicators showed an overall increasing trend of outage and non-outage backlog from June 1989 (when data was first available) to the present. As of 28 March 1990, the total outstanding work items numbered 4727, which included corrective maintenance (CM) work orders, PMs, and EWRs. By the end of 1989, the average age of non-outage CM had increased from approximately 200 to 300 days, but then dropped back to about 200 days in January 1990. The total non-outage CM at the end of March 1990 was 2027 items broken down as follows by craft and readiness to work:

	Mech	Elect	I&C	Weld	Labor	Const.	Other
In planning	447	374	183	59	7	16	698
Working	71	65	62	3	12	29	1

In addition to the above, approximately 500 PM activities were performed each month for the three major crafts as follows:

Mech	Elect	I&C
240	200	60

Approximately 50 of the 2,000 CM items were recorded as Priority 1 work items. Each of these work items was reviewed by the team with the licensee for its safety impact on the operational status of the plant. As discussed above concerning work order prioritization, Priority 1 was applied to work orders in a very conservative manner. That is, only approximately five of the fifty work orders were actually high priority. The balance of the work orders were being treated as high priority because of their long term, potential impact on equipment or on generating capability if further, significant degradation occurred. The five work orders were receiving detailed attention consistent with their impact on plant operation. The team's review of other lesser priority, outstanding work orders showed many of them to be 100's of days old. In a related issue, the team reviewed the open clearance (equipment tag-out) records and noted the following figures:

	Number of Tagging Reports	Days Active Ave	Days Active Maximum
Unit 1	146	215	1,598
Unit 2	72	148	1,013

The team noted that there was a direct correlation between very aged equipment clearances and work orders, i.e., most of the old clearances continued to exist due to incomplete very old work orders.

The licensee advised the team that recent efforts at increasing the coordination between the craft and the support interfaces were having a positive effect in stopping the increasing trend. As noted in Section 3.r of this report, it was the team's opinion that substantive action should be taken by the licensee to improve the effectiveness of coordination and improve the support interfaces to positively reverse the adverse trend of backlog.

3.n. PROVIDE MAINTENANCE PROCEDURES

The team reviewed procedures as a part of work observed in progress, and as a part of work packages already accomplished. Comments on procedures generated as a result of observation of the work in progress are discussed in Section 2.h. Comments derived from review of work packages are included below.

Procedure ECM-1503-1, Rev. 1, MOV Motor Repair and Replacement, provided instructions for replacement and repair of MOV motors. This procedure was approved for use on 15 June 1989, and represented the "upgraded" format. This procedure was also one of those in the licensee's special MOV program and therefore received special scrutiny during its preparation phase.

The team carefully reviewed this procedure to determine the adequacy of the licensee's maintenance procedure upgrade program. Split responsibility between the electrical and mechanical craft existed in the MOV actuators - the electrical craft were responsible for the actuator motor, and limit and torque switches. The mechanical craft had responsibility for the balance of the actuator. Notwithstanding the special attention that the procedure had received, the team noted the following areas for improvement.

Although portions of this procedure addressed many electrical operations that had to be performed with the valve energized, paragraph 4.0 Precautions and Limitations only listed "None". Paragraph 6.2.8 included a Caution that stated, "Possible equipment damage. Incorrect pinion gear installation may not be detected in testing.", and then required, "Install pinion gear IAW Attachment 1." Attachment 1 was found to be an elementary drawing of the pinion gear configuration (gear shoulder related to the motor), with no detailed information concerning the gear key (when applicable), set screw, nor lockwire. A review of the Limitorque Instruction and Maintenance Manual (SMBI-180D), SMB-0 to SMB-4 & SMB-4T, Reassembly, determined that Step 5. required, "When reinstalling the motor pinion, pc #40, insure it is a tight fit on the motor shaft (preferably a light press fit). Note that the SMB-0 motor pinion is installed with the set screw lockwire between the gear teeth and the motor flange. On the SMB-1 through 4, the gear teeth are between the set screw/lockwire and the flange." Limitorque drawing 08-408-0001-4 showed the gear configuration and the lockwire installation, but was not included in the subject procedure.

It was the team's opinion that inadequate detail was included in the upgraded procedure in that the procedure did not include the fundamental repair information of the Limitorque maintenance manual. Since the repair manuals or portions thereof were not noted to accompany work orders, and the above information could not necessarily be relied on to be skill of the craft, it was also the team's opinion that such information should be included in the appropriate procedure.

Similar increased attention to detail was required in mechanical MOV procedures. As an example, procedure MMP-C-MOV-178, dtd 20 September 1988, Removal and Overhaul of Limitorque Model SMB-000 through SMB-00 and SB-00, was used to overhaul an SMB-00 type operator (WO 565294, Charging Pump to Regen Hx Stop Valve, MK #02-CH-2289A). Page 36 of the procedure included in the work order contained an illustration of the disassembly of a SMB-000 shaft (vs SMB-00), and the part numbers identified in the illustration were specific only to the SMB-000 operator. Additionally, the part nomenclature and assembly sequence was different from the SMB-00 operator. Although the procedure was revised on 21 October 1988 (during the performance of the maintenance), the illustration of the SMB-000 actuator remained unchanged on page 37. Both revisions of the procedure were used in WO 565294 to perform the actuator overhaul, including replacement of the hypoid gear which was most affected by the procedure error.

The above procedural problems were perceived by the team to be examples of weaknesses in the procedure preparation program.

3.o CONTROL OF ELECTRICAL WORK PRACTICES

Electrical work practices:

Design Change Packages 8532 and 8534 (U-1 and U-2 respectively) installed new station batteries (vital 120 volt DC power distribution system). The team noted during system walkdown inspections that several conditions in the batteries were not consistent with installation specifications. For example, vital batteries 1A and 1B each required two conduit installations for intercell cabling between battery halves. Neither cable conduit was grounded in either battery. The team reviewed NUS-2030, Specification for Electrical Installation for Surry Units 1 & 2, Category Safety Related, and noted that at paragraph 6.9, "Metal conduit systems shall be grounded by copper cable connections to the ground grid, grounded cable tray system, or to building steel using tinned copper lugs."

Vital battery 1A, cell 30 to 31 intercell connector, exhibited two 1/4" terminal bolts that did not not appear to have been properly tightened. The lockwasher under the nut was not compressed (1/32" gap) against the Belleville washer.

The support platform (battery rack) for vital battery 1A was noted to have two loose bolts (lockwasher not compressed and locking) on the end piece at cell 18. The same condition was observed at cell 43.

Based upon the above observations, the team concluded that electrical work practices and control, and the attendant quality control inspections, were an implementation weakness and required strengthening. In each of the above cases, the licensee immediately initiated the appropriate station deviation report and work request to correct the adverse condition.

Material conditions of panels:

During system walkdown inspections of 120 volt AC and DC vital panels, the inspection team noted occasions of dirty panels and poor material conditions as follows.

While observing troubleshooting for ground faults in the vital 125 volt DC distribution system, the team noted that the U-1 480 volt and 4160 volt Breaker Test Panels (fed from 120 volt vital DC via cable 1B63) contained significant amounts of trash and dirt. Numerous parts bags, several screws, cut tie wraps, and cut wire ends were found in the 480 volt test panel. The insulation on one wire run was badly frayed, not tie-wrapped, and not properly stood off the panel frame to prevent chaffing on the door edge (after repositioning the wire run, the ground improved significantly). One of two hinge pins in the panel door was missing.

An un-numbered "Rod Control Signal Circuit" connection box, immediately adjacent to the U-1 480 volt Breaker Test Panel, was missing one of four cover screws in the gasketed cover plate, thus the box was not properly sealed against moisture intrusion (immediately corrected).

U-1 125 volt DC distribution panel 1B was extremely dirty and contained cut tie wraps, discarded danger tag pieces, and numerous pieces of conduit Sealant. Several improper nuts were used (acorn type nuts apparently lost) to hold the cover panel captive. Panel 1-2 (125 volt DC fed from 1B) was also dirty, containing screws, cut cable ties, tape, cut wires, and a case (panel) nipple on top of the panel.

Similar conditions were observed in the 120 volt AC vital panels. Vital Bus Distribution Panels 1-IA and 1-IIIA were found dusty (from concrete), dirty with metal shavings from drilling, and contained cut tie wraps and wire ends. In addition to dirt, Vital Bus 1-1 contained numerous pieces of excess expandable foam (fire barrier material) in the panel bottom. Panel 1-1 was also missing two knockout plugs (one top, one side); Semi-Vital Bus Dist Panel 1SVB1 was missing a knockout plug from the panel top.

Based upon the above observed material conditions, the team concluded that the licensee's program and implementation for control of housekeeping during electrical maintenance in 120 volt AC and DC panels constituted a program weakness.

Improper terminations:

In addition to the adverse material conditions observed, the team noted several instances of improper terminations as follows. The U-1 480 volt Breaker Test Panel (fed from vital 120 volt DC) had two wires in one wire run with lugs bent over more than 90 degrees of crimp angle. U-1 125 volt DC distribution panel 1-2 had several unlabeled spares that were not correctly terminated (bent over, loose wrap of electrician's tape). Several examples were noted of excessive insulation cut back at the breaker feed cable (1/4" vice required 1/32") and not all wire strands captured under breaker terminating clamp (e.g., 125 volt vital DC panel 1-2, breakers 11 & 15, and 120 volt vital AC panel 1-IIIA, breakers 3 & 5). Excessive insulation cut-back in 125 volt vital DC panel 1B had permitted the wire strands on one feed cable to splay apart, potentially permitting strand breakage. Although the team recognized that some of the above conditions may have existed since the plant was constructed, there were also occasions of modifications that could have permitted correction of the deficient conditions. Current practices were clearly defined by the requirements of NUS-2030, Specification for Electrical Installation for Surry Units 1 & 2, Category Safety Related in Section 5, that addressed termination requirements. Based upon the above adverse conditions, the team concluded that the licensee's program and implementation for control of standard practices during electrical maintenance in 120 volt AC and DC panels constituted a program weakness.

3.p. PERFORMANCE OF MAINTENANCE TRENDING

The team noted that the primary vehicle for reporting conditions adverse to quality was the Station Deviation Report. Procedure SUADM-LR-13, dtd 29 Dec. 1989, Station Deviation Reports, provided detailed instructions for initiating and processing Deviation Reports. The team noted that the system was applicable to both safety related (SR) and non-safety related (NSR) components, systems, materials and services. The team's review of program criteria and actual deviation reports (DRs) indicated that the threshold upon which station personnel based their decision to prepare deviation reports was low. During 1989, approximately 4,000 reports were initiated and evaluated. Root Cause Evaluations (RCE) were initiated based upon the significance of the deviation report.

The licensee had recently implemented the Component Failure Evaluation (CFE) Program (SUADM-M-48, dated 29 December 1989) as a direct adjunct to the station deviation reporting system. A station deviation would normally set the CFE program into motion for all SR component failures (except MOVs which were handled separately under the MOV program). NSR component failures were evaluated under the CFE program when directed by management. The CFE program was designed to perform evaluations that did not require the extensive degree of investigation necessary in the RCE program.

Since the CFE program had just been initiated, approximately twenty evaluations had been completed. The evaluations were comprehensive, and appeared to provide an adequate basis upon which a meaningful trending program of component failures could be based.

Trending of station deviations has become more effective during the latter half of 1989 with increased attention and staffing by the responsible station group. Monthly trend reports on station deviations have been issued that depict major categories, such as procedure errors, personnel errors, EDGs, pumps, and valves. The level of detail in the trend graphs required interested parties to review specific categories of deviations to formulate plans of action. Each monthly report also focused on the details of a particular category; e.g., the December 1989 report, published in February 1990, focused on types of personnel errors for the whole 1989. In the maintenance area, 187 deviations were written, of which:

- 54 DRs involved valve maintenance
- 37 DRs involved pump maintenance
- 57 DRs involved procedures not processed correctly
- 82 DRs involved inadequate maintenance (e.g., wrong part, wiring not per specification, not correctly installed)

Insufficient data history had been collected to permit trending of the above types of data, although the licensee was moving in that direction. Programs had been implemented on a case basis in response to the initial DR(s) to correct the above types of problems - trending of the data could be used as a tool to determine program effectiveness.

Based upon the above observations, the team concluded that the licensee had implemented an adequate program for trending of maintenance problems. Continued data collection and evaluation was required to determine the program's effectiveness.

3.q. TOOL AND EQUIPMENT CONTROL

The team found three tool issue points in use; the primary tool issue point was in the upper level of the condensate polishing building, and the contaminated tool issue point (Auxiliary Tool Room) was located on the 45' level of the Auxiliary Building. A third issue point was located outside the power block, and was used as a construction issue point.

Tool inventory control was adequately coordinated between the issue points. Cognizant division supervisors were responsible for notifying the tool room of tool requirements. The team observed evidence of supervisors properly forecasting tool requirements for forthcoming maintenance activities. Positive inventory control resulted in approximately one or two demands per day for devices that were not available at the issue point. A strength worthy of note was the issue room's control of special tools and devices. On each occasion of acquiring, through manufacture or purchase, an unusual device or tool for a special application, a photograph has been taken of the device, and its special storage location annotated on the photograph. Positive control of these devices has been maintained, and workers seeking special tools simply have to "thumb through" the book of photos until the desired device was located.

Rotating tools such as air grinders and electric drills were on a comprehensive preventive maintenance program that included items such as lubrication checks and ground fault checks. Evidence of the checks having been done was attached to the tool. The team noted that slings, cables, chain falls, etc. were also subjected to periodic testing; distinctive colored tape was used to mark the device when next due for test. A unique serial number for each device was also attached by tag that permitted test tracking. One nylon sling was noted by the team to be in a ready-to-issue bin with no evidence of having been properly tested.

Electrical and mechanical M&TE devices were found stored in a segregated area. Positive control of issue and return was maintained, and included tracking of the work order on which the M&TE device was used. No effort was made by the licensee to assure proper calibration of any returned device unless problems were reported by the user. A complete engineering evaluation was performed for the situation of a device failing calibration when tested at its normal cycle. The team noted several micrometer adjustment type torque wrenches that were stored in ready to issue bins at high torque values. The licensee advised the team that manufacturer recommendations required setting the wrenches at 20% of full scale, but these requirements had not been incorporated in procedures governing operation of the tool room, in torque wrench calibration procedures, nor posted in conspicuous locations where wrenches were stored. Manufacturer's recommendations concerning exercising torque wrenches prior to calibration were also not included in procedures. Based on the above observations, the team concluded that although the overall program for tool issue and control was adequate, several program and implementation improvements should be considered.

3.r. SUPPORT INTERFACES

One of the most detrimental conditions concerning the performance of maintenance is the lack of coordination between the support interfaces. Maintenance support interface problems are predominately with the following departments: Planning, Scheduling, and Operations. In addition, the material control for parts is an area that significantly contributes to the Maintenance Department's backlog. In these areas, the team did not find fault with any individuals or managers. The personnel were cooperative with each other and recognized the limitations of the programs within the plant.

Planning

The team concluded that the Planning Department was not capable of performing all planning functions independently because it was not adequately staffed. Consequently maintenance personnel, foreman and craft, have the added burden of supporting planning. For example, there is one permanent electrical planner, one or two contractors, and two borrowed electricians to perform all electrical planning. The permanent electrical planner spends considerable time coordinating with scheduling and at the plan of the day (POD) meetings. Since maintenance personnel support detail planning, this contributes to the problems of maintenance. Maintenance personnel are required to interface more and are not performing their primary function of doing corrective and preventive maintenance. In addition, the team does not consider the Maintenance Department adequately staffed to perform their main function, reduce the backlog, do detail planning, and provide craft to the Planning Department. Other planning issues are discussed in Section 3.g. and 3.m.

Scheduling

The team did not identify any specific problems with the Scheduling Department or the schedule. However, it was recognized that the "plant wide single train method" is not used for scheduling. The plant wide single train method is: only work on equipment in a specific single train is scheduled for a specific time period (day, etc.). No other work in the other train(s) is allowed. Since the licensee does not use the single train method, Operations has more of a burden in controlling and approving work.

The main problem is schedule adherence. The Scheduling Department provides 30, seven, four, and one day schedules. Every day there is a POD meeting for the next day's scheduled work. During the periods when the team was onsite, approximately 40 percent of the POD scheduled work was actually started or performed. The licensee's statistics for POD effectiveness is as follows:

Month	Department	Percent Effectiveness
Dec.	I&C	14%
Dec.	Electrical	64%
Jan.	I&C	22%
Jan.	Electrical	68%

Month	Department	Percent Effectiveness
Jan.	Mechanical	61%
Feb.	I&C	55%
Feb.	Electrical	74%
Feb.	Mechanical	41%

Maintenance personnel stated that they were frustrated with the large number of last minute cancellations of work already scheduled and approved at the POD. During the inspection period, the team did not find any evidence that this situation would be corrected.

Operations

The Operations Department is responsible for approving maintenance activities. Through observation and discussions with maintenance personnel, the team identified the method used to implement this approval as the major "bottleneck" in the coordination of planning and scheduling maintenance. A shift supervisor located in the control room annex reviews and approves work activities that have already been scheduled during the POD. Included in these duties are reviewing and approving revisions to work orders and procedures. These duties of the shift supervisor are necessary for safe plant operation. However, the method and time of implementation was found to be inefficient. The plant work schedule for maintenance craft is from 7:00 a.m. to 3:30 p.m. daily except for a skeleton staff on back shifts. Operations, including the shift supervisor, isolate themselves during the period of 7:00-8:30 a.m. and 11:00 a.m to 1:00 p.m. daily. During this "quiet time" (3-1/2 hours) daily, all maintenance activities requiring support and/or approval from Operation before proceeding is placed on hold. During the 7:00-8:30 a.m. "quiet time," POD scheduled items may be "deferred" and maintenance is not made aware of this until after 8:30 a.m. The same holds true for the 11:00 a.m.- 1:00 p.m. "quiet time" period. Operations has assigned a SRO representative to coordinate with planning and scheduling (POD). This SRO interface does not appear to function very well since the shift supervisor at the control room annex can override the POD.

Discussions were held with Operations concerning the coordination problems already discussed. Operations is aware of these problems, wants to correct them, and plans to assign more licensed operators to each shift as soon as they become available (late 1990).

Conclusion

The team concluded that coordination problems between the departments must be resolved for the licensee to implement an effective maintenance program and reduce the large backlog. Material control problems have been previously identified by the NRC and INPO in other reports. The team was told that lack of spare parts continues to be a significant problem area.

3.s. LICENSEE REVIEW OF COMPLETED WORK RECORDS

To evaluate the licensee's review of completed work documents the team examined four completed WOs, evaluated the QA review process and reviewed the the procedure for the QA review.

The team reviewed four completed WOs (79205-01-CH-MOV-12750, 535128-02-CH-MOV-2275A, 83923-02-SI-MOV-2867C, 65954-01-RS-MOV-155B and 72503-02-CH-MOV-2289A) related to the work performed on Motor Operators.

WO 72503 documents the work activities performed on 92-CH-MO-2289 (charging pump to regenerative heat exchanger stop valve). Work performed was documented on Procedures MMP-C-MOV-178 dated September 20, 1988 and October 21, 1988. One of items replaced was the "Hypoid Gear." The Hypoid Gear is listed as part number 12 in the Limitorque vendor manual for SMB00. However, the above procedures, on page 36, illustrated the assembly of SMP000 of drive shaft and, therefore, the replacement of the Hypoid Gear was not adequately captured in the records. The cognizant maintenance support engineer gave sufficient explanation to the inspection team and produced evidence to support that the Hypoid Gear was in fact replaced and the completed WO inadequately documents the replacement. QA reviewed this WO and determined it complete and acceptable.

The team reviewed the completed WOs related to the replacements of solenoid operated valves (SOVs) to extend the longevity of the qualified lives of the equipment. The useful life of the SOVs were calculated to be 42 years taking into consideration the environment (temperature and radiation) in which it (the SOV) is located. The following packages were reviewed: WO 71612; WO 71613; WO 71564; and WO 71567.

WO 71612: Replaced the 02-MS-SOV202A - In Attachment 7, the WO# was left blank. The serial number of the replaced valve is documented as 77826T-2. The same number is documented on Page 12. This may be erroneous, because the team observed that this was the serial number of the SOV installed on 02-MS-SOV-202B during the performance of periodic testing of the Auxiliary feedwater turbine on March 16, 1990. Copies of Attachment 7 are circulated to corporate and other management officials to denote the completion of EQ related work.

WO-71613: Replaced the 02-MS-SOV-202B. On Page 12 of the WO and in Attachment 7, the serial number of the SOV is indicated as 778262t-1. The team observed that the serial number on the SOV was 778262t-2 during the observation of the periodic test of the Auxiliary Feedwater Turbine on March 14, 1990.

WO 71564: Replaced the 02-CC-SOV-205A. On Attachment 7 of model number of the SOV was not documented.

WO 71567: Replaced the 02-CC-SOV-205C. On Attachment 7 of the Model number of the SOV was not documented. A comment on the cover sheet stated that the actual stroke of the valve is 1/8" longer than the design. EWR will be written. However, a EWR number was not identified.

The team reviewed three completed WOs documenting the work performed on NAMCO type limit switches to extend the longevity of the qualified lives. WOs 02-MS-2S2-201A, -201B, -ZS1-201C documented the work performed on the limit switches on the mainsteam trip containment isolation valves. No adverse findings were identified in this area other than the observations in the following paragraphs.

Evaluation of the QA Review of WOs

QA reviews 20% of the completed WOs utilizing procedure QADI 35C, Revision 4, dated February 1, 1990. The rest are stamped "Noted" and filed. This review is in addition to QC in-process verifications. Review of this procedure including Attachment 6.1 indicates that QA is not required to scrutinize a completed WO to ascertain if it is technically complete in all respects. The team discussed with the QA Manager and his staff the above findings. The QA Manager was responsive to the team concerns that technically incomplete and incorrect WOs may be erroneously accepted as acceptable documents. The QA Manager assured the inspection team that he will consider implementing the following measures:

- Develop an adequate checklist which will reflect the salient steps verified.

- Provide sufficient input to the "Procedure" writing group to retain only the relevant information in a given procedure which is applicable to the specific work being performed

- Train QA reviewers to review the first few completed WOs prior to resorting to sample reviews.

- Examination of QA Procedure for the QA Review.

The team reviewed several completed WOs including those identified in above paragraph in this section and observed the following weaknesses:

- The procedures contained more general "nice to have" than specific "need to have" information, thus making the WO more voluminous.

- The description of the work performed (on the cover sheet) did not adequately describe the accomplishment.

- If cable splicing was required, the WO should document that the cables were crimped, bolted or terminated. The engineers should determine the size of the conductors and specify the connection method.

- If replacing a SOV, the WO should state if the existing CONAX connector was retained, or a new CONAX connector was used.

- Attachment 7 for SOV WOs are used by licensee management to demonstrate that EQ is current. As such, the information on Attachment 7 should be complete and accurate.

- Procedures MMP-C-MOV-178, dated September 8, 1988 and October 21, 1988, used to reflect work performed on SMP00 type Limitorque operators should have a note on pages 3b and 37, respectively, to indicate that the illustration (SMP000) provided on those pages were incorrect.

- The summary in WOs for limit switch (LS) related activities should precisely state if the LS was replaced or if only the gasket covers were replaced. The exact torque valve to which the bolts (screws) were torqued to should be stated.

4. Evaluation of Maintenance

Summary Rating of Maintenance Process

Program: SATISFACTORY

Implementation: SATISFACTORY

The evaluation completed by the NRC team rated both the Surry maintenance program and its implementation SATISFACTORY

The Surry maintenance rating was obtained by collating and assessing the maintenance team inspection findings in a special maintenance inspection logic tree. The tree completed for Surry maintenance inspection is depicted in Appendix 3. The tree divides maintenance evaluation into three "parts" (I, II, and III). The parts are divided into eight "areas" (1.0 through 8.0) and the areas into individual maintenance topics or "elements" (1.1, 1.2, 2.1, etc.). Based on their inspection findings (negative and positive), the team established ratings for most of the elements. Subsequently, area ratings were determined based on associated element ratings; part ratings based on the associated area ratings; and, finally, a total maintenance rating was determined from the ratings for the parts. The team did not weight all findings or ratings equally.

Four rating categories were used and a color was assigned to each to aide in displaying the ratings on the maintenance inspection tree. The rating categories were as follows:

"Good" Performance (Green)	-	Overall, better than adequate, shows more than minimal effort; can have a few minor areas that need improvement
"Satisfactory" or "Adequate" Performance (Yellow)	-	Adequate, weaknesses approximately offset by strengths
"Poor" Performance (Red)		Inadequate or missing
(Blue)	-	Not evaluated or Insufficient Information to Evaluate

Each part, area and element, as well as overall maintenance, is represented by a block on the tree. Most of the blocks are split into two parts with the upper portion representing program or process and the lower half representing implementation. The exception is for the part I blocks which are not considered to have separate programs or implementation.

The parts and areas of the maintenance inspection tree are described below. The inspection findings that contributed to the ratings are also given. Individual element ratings are not described but are shown in Appendix 3.

4.a. Overall Plant Performance Related to Maintenance (Tree Part I)

Rating: Satisfactory

This part of the tree is an overall assessment and rating of maintenance through direct measures: Its rating was based on the SATISFACTORY rating determined for "direct" measures below.

4.a(1) Direct Measures (Tree Area 1.0)

Rating: SATISFACTORY

The direct measures used to assess this area are the plant historic data (tree element 1.1) on the performance of the operating units and observations of housekeeping and material conditions observed in walkdown inspections (element 1.2).

Historical Data Related to Maintenance

The team examined historical data for licensee's maintenance and maintenance-related activities. The data covered the period from the beginning of 1989 to present, plus some 5 year trends. The data reviewed was included in the Virginia Power Nuclear Performance documents issued on a monthly basis. The data reviewed does not provide a totally accurate picture of the plants today since both units returned to service from extended outages in the period (Unit 1 - 7/89 and Unit 2 - 11/89). The results are mixed (some good and some poor). The equivalent availability was poor at the beginning of 1989 and good at the end of 1989 and to date in 1990 with a declining 5 year trend. The forced outage rate was poor for 1989 and good to date for 1990 with an upward 5 year trend. The number of unplanned reactor trips was good to date for 1990 with a mixed (declining for Unit 1 and upward for Unit 2) 5 year trend. The number of ESF actuations was mixed (good for Unit 2 and poor for Unit 1) for 1989 and good for both units to date for 1990. Radiation exposure was poor for 1989 and good for the beginning of 1990 with an improving 5 year trend. The corrective maintenance backlog was excessively high for 1989 and appeared to continue trending upward for the beginning of 1990. In review of licensee reports, i.e., LERs and reactor trip reports, for indicators such a unplanned trips and ESF actuations, there was no conclusive evidence indicating maintenance problems contributing to the events.

The findings of the team's evaluation of the historical data and the walkdown inspections consisted of numerous minor discrepancies. Examples are noted in Section 2.a,b,c,etc. above. On the basis of the number and significance of the discrepancies observed the team rated the area SATISFACTORY

4.b Management Support of Maintenance (Tree Part II)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This part of the tree is an assessment and rating of areas of the tree which represent management's support of maintenance through their commitment and involvement, organization and administration, and provision of technical support for the maintenance process.

4.b(1) Management Commitment and Involvement (Tree Area 2.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area consists of upper management's direct encouragement and promotion of improvements in maintenance. The rating of the program and implementation was based on the following findings of strengths and weaknesses:

The STRENGTHS noted in this area included:

- Management commitment to industry initiatives is good
- MOV program is good,
- System engineer program very strong (2.e)
- Manager of engineering performed weekly walkdowns with a system engineer (2.d)

The WEAKNESSES noted in this area included:

- Problems identified in NRC Information Notices and industry communications not available to working level people
- Goal achievement not good (performance indicators)
- Recognition and response to adverse performance indicators slow
- Response to QA findings not always timely (2.c & 3.e)

Observations in this area included:

- Reliability centered maintenance program not embraced
- Self assessment performed late '89
- Plant participating in EPRI plant aging program
- Plant PM upgrade program
- Procedure Upgrade Program
- MOV program upgrades
- Training Program is INPO accredited

4.b(2) Management Organization and Administration (Tree Area 3.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area consists of management's support of and involvement in the control of maintenance through developing and implementing a maintenance plan setting goals and policies; allocating resources, defining maintenance requirements, monitoring performance, providing document control and determining the need for improvements to plant material condition. Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- Instructors from NTD required in plant
- Supervisory span of control is good (2.a & 2.h)
- NO sacrifices of safety are made to meet production goals

- Predictive maintenance, oil and vibration analysis is good (2.a)
- Post maintenance debriefs addressed possible additional requirements
- Post maintenance debriefs for I&C group effective in identifying problems and carrying forward to subsequent maintenance.(2.e)
- Verbatim compliance by I&C technicians absolute - many changes had to be initiated to make procedures fit the tasks. (2.e)
- Corporate driving force in replacing SOVs to maintain EQ currency, and causing existing MOV re-inspection

The WEAKNESSES noted in this area included:

- Some systems such as IA and HVAC are not goal oriented for required system improvements - evidenced by lack of commitment (3.f)
- No visible evidence of special maintenance department goals and objectives.
- Elect/Mech planning does not have adequate staffing, planning a function of the craft (2.e, 3.g, 3.r)
- Maintenance manpower inadequate (especial HVAC) (3.f)
- Periods of no shift coverage by I&C - call in (2.e)
- Maintenance often delayed due to non-availability of material (3.r)
- Corrective maintenance backlog trend is upward (3.m)
- Maintenance often delayed, not supported, due to "quiet time" in control room (3.r)
- I&C manning not able to support full implementation of PM program
- Current PMT program very limited for equipment other than ASME Section XI (3.h)
- Procedure for Predictive Maintenance is outdated (2.a)
- Some electrical PMs deferred due to lack of manpower (2.d)
- Appropriate Vendor PMT not accomplished (3.i)
- Vendor tech manual requirements not implemented (AFW, motor starters PMs, containment instrument air dryer filter) (2.d & 3.c)
- PM program for HVAC limited (2.g & 3.f)
- PM program for instruments other than Tech Spec required items was not prepared or performed (e.g., EDG safety functions for alarm in CR, pressure gage on N2 back-up to IA for AFW MS inlet FCV (3.1)
- Persons specifying electrical PMT are not qualified (3.h)
- Persons specifying electrical PMT inconsistently require varying PMT (or none at all) for the same equipment. (3.h)
- ASME requirements related to check valve performance have not been incorporated in IST program (MS to AFW & IA)
- PM deferral rate for '89 was not correctly counted to provide representative information. (3.m)
- Drawings not updated following plant modifications (3.b)
- Drawings not equal to plant as-built (2.a & 3.b)
- "For ref only" drawings used in Trouble Shooting, preparation of procedure revisions, and plant operations decisions (Rx protection system relay failure). (2.e)
- 2 occasions of Procedure Action Request (procedure change) not completed accurately (1 time fully signed off/1 time error detected by Shift Sup prior to implementation). (3.b)

- Mods to plant procedures and equipment are not considered in a timely manner (3.f &3.1)
- Procedure for preparation and completion of Work Orders does not contain adequate detail.(3.g)
- Resistance to dedicating adequate funds to replace/adequately repair system components (use band-aid repairs too frequently) (3.f)
- OPs (operations) control of maintenance shifts work priorities too easily

Observations in this area included:

- Maintenance plan has been prepared and in effect
- The utility has been forced to utilize contractor support for maintenance dept and system eng support because of inability to maintain permanent staff
- Thermography predictive analysis program not initiated
- PM program undergoing Task Force review
- Source documents that could change maintenance requirements are problematically covered.
- Trend INPO performance indicators
- Evaluating each SR work order for root cause problems (Component Failure Evaluation Program - CFE), initiated Jan 90. Should be an effective program.
- Bi-annual review of maintenance procedures was accomplished (occasionally not effective, inst. cal proc)
- Computer based (WPTS) document control system is used for work orders.
- 1,7,30 day look ahead attempting to coordinate dept activities.

4.b(3) Technical Support (Tree Area 4.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses the various elements of technical support that are needed for maintenance to function effectively (e.g., engineering support, health physics, QC, risk assessment, etc.). Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- Close liaison existed between system eng and craft.(2.d & 2.e)
- Internal/corp. communication channel provided timely exchange of info
- Strong involvement from system engineers in their respective systems (2.a & 2.e)

- EQ program well supported by corporate and engineering
- MOV/Check valves/PM programs good eng support
- Procurement and maintenance engineering must approve each part procurement action.
- Elect procedures include many hold points for QC sign-off (2.d)
- Performance inspections by QA people (Quality Performance Group) effectively augmented the maintenance process
- Worker awareness of ALARA concerns was high
- Advanced Rad Worker quals for QMT workers provided the ability to perform work that otherwise would have required continuous HP coverage
- Recovery of contaminated areas strong program
- HP aggressive in identification of sources of contamination
- Craft exhibited strong safety consciousness.
- Overall HP program continues to improve
- Licensing group was strong
- Commitment tracking system was good

The WEAKNESSES noted in this area included:

- Communications between craft (maint. dept.) and operations were not optimum for completion of scheduled maintenance activities. (3.m)
- Risk assessment was not considered in prioritization of work orders, however at the implementation level, consideration was given to safety risk for not accomplishing work. (3.m)
- QC procedure for review of completed work order packages is inadequate
- Generic letter commitment on Instrument Air poorly handled

Observations in this area included:

- Current PMT program is written exclusive of most tests for non-ASME Section XI equipment.(3.h)
- PM program for HVAC limited
- PMT not well defined (3.h)
- Persons specifying electrical PMT are not qualified (3.h)
- Engineering has not caused all PM requirements to be identified (e.g., I&C) (3.1)
- Many contractors to support engineering
- System engineers located outside PA
- Engineering analysis via Component Failure Analysis initiated Jan '90.
- QMT members provided a high degree of quality control awareness, but quality control was frequently exercised by peers.
- QC notified at start of all SR work orders
- Guidance available for when QC inspection required.
- Audit of maintenance dept on bi-annual basis

4.c. Maintenance Implementation (Tree Part III)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This part of the tree is an assessment and rating of the work, organizational, hardware and personnel controls necessary to proper implementation of maintenance.

4.c(1) Work Control (Tree Area 5.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses assessment of important elements of work control through evaluation of maintenance in progress, work order control, planning, scheduling, prioritizing, etc. Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- Good technician skills, knowledge, and abilities (2.e)
- Good command and control of Periodic Test evolutions (2.d & 2.e)
- Craft complied with procedures, and were attentive to necessity for Procedural PARs
- All craft assured task qualification proper prior to job start (2d)
- Equipment history was readily available/accessible in the WPTS system for post '84 events
- Upgrade program for procedures was generally effective in improving procedures when compared to pre-upgrade
- PMT on periodic tests conducted by the Ops group were good.

The WEAKNESSES noted in this area included:

- Clearance program could be improved in tagged position/restoration position
- Coordination with OPs for work accomplishment was poor (3.r.)
- Completed work orders for replacing SOVs to maintain EQ exhibited errors, omissions and were cumbersome
- Work orders occasionally lacked detail, relied heavily on skill of the craft. (2.a, 2.d & 2.e)
- Definition of special tools, special equipment, special people quals was a function of procedural adequacy, not the work orders. (3.k., 3.g., 3.n.

- Mech/Elect/I&C planning did not have resources to perform detailed planning - left up to the craft (2.e & 3.g)
- I&C planning not integrated with the maintenance dept. - work order inst were prepared by revising existing alignment procedures. (2.e)
- Work instructions associated with the work package were in general very limited for E and M craft disciplines.
- Programmatic prioritization scheme was time to complete dependent, not safety of people, safety of equipment, or Tech Spec related. However, implementation of priorities appeared to take the above types of considerations into account. Notwithstanding, many high priority work orders were years old. Bottom line - no effective prioritization scheme in effect.
- Provision for modification of work item prioritization difficult once assigned in WPTS, thus assigned priority may have been in error, but not corrected (3.m)
- Risk assessment was not considered in prioritization. (3.m)
- Numerous Priority 1 work items were very old - driven by the program (3.m.)
- Backlog of CM work orders has continued to increase in all categories, and therefore backlog control must be ineffective (3.m)
- Backlog CM average age is very old (3.m.)
- Deferred PMs only recently brought under control (2.d)
- Many (old) procedures did not specify required test equipment, or tolerances, or acceptance criteria, or special tools.
- Maint procedures (WO instructions) for replacing SOVs and MOV related work were voluminous and cumbersome - not tailored to the specific application and contained errors.
- AFW turbine driven pump PT referenced the wrong Tech Spec requirements (wrong para.)
- Several fundamental instrument alignment procedures had not been initially prepared and approved (PRT Temperature).(3.1)
- Elect. Procedures frequently asked Ops to perform a step - if not possible, N/A the step, (2.d)
- I&C PT procedures did not adequately establish I/Cs, reference Tech Specs, nor provide for exiting procedure in event of equipment failure (2.e)
- Procedure for preparation and completion of Work Orders does not contain adequate detail. (3.q)
- Elect PMT was cancelled due to lack of manpower and the PMT was not carried forward as overdue (2.d)
- Current PMT program very limited for equip other than ASME Section XI (3.h)
- Persons specifying electrical PMT are not qualified (2.d & 3.h)
- Persons specifying electrical PMT inconsistently require varying PMT (or none at all) for the same equipment.(2.d & 3.h)
- QC review of completed work orders were not effective in that the reviews focused only on detecting missing information, not incorrect information. In some cases, WOs with incomplete information were not detected.(2.e)
- Incomplete and erroneous work orders on EQ SOV replacements
- Work accomplished lacked adequate description (2.d)

Observations in this area included:

- Foreman on the job presence good
- Craft were attentive to resolution of problems encountered, but resolution took inordinate amounts of time
- Lifted lead/jumper program and implementation adequate.
- Clear provisions for accomplishing emergency work
- WPTS computer system provides adequate equip history for items of less than 5 years age.
- Licensee had to go to off-site facilities for documents related to ASME Code vessels (i.e, State of Virginia)
- Coordinated scheduling of functionally related equipments is not effectively performed for all disciplines.
- 1, 7, and 30 day look aheads attempt to perform Work Order coordination
- Procedural upgrade program was improving quality of formal maintenance procedures.
- Numerous, minor administrative documentation errors in Work Orders were detected that were not of safety significance.

4.c(2) Plant Maintenance Organization
(Tree Area 6.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses the processes used by the maintenance organization to control, support and direct maintenance activities. Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- All craft and foreman demonstrated good job skills (2.a, 2.d & 2.e)
- Procedural adherence was good (2.e)
- Unanticipated work problems promptly resulted in work stoppage, and resolution initiated. (2.e)
- Contractors in I&C area were required to meet same qualification requirements as Surry people, including JPMs to perform plant work.
- Contractors were under direct supervision and control of Surry supervisors.
- Contractors were required to operate under all applicable Surry procedures.
- Work request program was an easy, efficient means for any plant person to identify and report deficient conditions, and was effectively used by most plant personnel.
- Station Deviation reporting system had a low threshold for reporting of deviant conditions. Review process provided for substantive evaluations. (3.p)
- System engineers were a visible support to the craft.(2.e)

The WEAKNESSES noted in this area included:

- 120 v AC, 125 v DC vital panels contained trash, exhibited adverse material conditions, and had improper cable terminations. (2.e & 3.o)
- Vital station batteries exhibited some poor electrical work practices after mods. (2.d, 2.e & 3.o)
- PM program for HVAC limited (2.g)
- NSR 480 v panels contained excessive dirt and trash. (3.o)
- Electrical foreman required to perform work order planning, thus reducing job site supervision and ability to initiate productive effort. (2.d)
- Deficiencies such as leaks and missing fasteners not identified by licensee. (2.a & 3.d)
- Deficiencies identified, but not tagged. (2.a & 3.d)
- Tagging procedure is weak because of non-definitive requirements (3.d)
- Operations support of work order initiation/commencement was inefficient for at least three hours per day, including from 1100 - 1300. (3.r)
- Coordination with OPs for work accomplishment was poor (3.r)
- Operations group did not support all attributes of the M&TE program. (3.k)

Observations in this area included:

- Contractors were utilized as system engineers.
- Necessary clearances and work qualifications were not effectively planned
- I&C contractors met few job qualification requirements, therefore they were on site for several months before they became an effective contribution to the I&C group - matter of fact, they were a burden (e.g., escort requirements)
- Program is in its infancy for most maintenance trending programs (3.p)
- CFE program initiated in Jan 1990 (3.p)

4.c(3) Maintenance Facilities, Equipment and Material Controls (Tree Area 7.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses the plant maintenance facilities, equipment and material controls with regard to the part they play in supporting the maintenance process. Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- I&C, Mechanical supervision co-located with the craft.
- Procedures, technical manuals, and M&TE were co-located with the I&C craft
- Individual, lockable work space was provided for each I&C technician.

- The M&TE lab was located in the I&C spaces - was clean and well maintained, well organized, but small. (3.k)
- NTD laboratory facilities very effective, but not all planned equipment installed.
- Material storage was observed as a strength

The WEAKNESSES noted in this area included:

- Material control program was informally implemented by checklist.
- Increased material usage scrutiny (material dedication program) caused excessive delays in initiating maintenance activities, e.g., HVAC. (2.g & 3.f)
- Material procurement system was extremely cumbersome.
- Inventory of spare parts in some cases (HVAC) was zero. (3.f)
- Licensee unable to perform calibration of contaminated M&TE. (3.k)
- Storage and recall program/implementation very weak for Ops. (3.k)
- Range and characteristics of M&TE not readily available to technicians (problem because the procedures do not contain required instruments, and the techs have to perform the evaluation). (3.n)
- Test instrument racks secured by large chains to meet seismic restraint requirements could damage delicate instrumentation. (3.k)

Observations in this area included:

- Welding and machine shop areas were found to be small.
- Welding of consequence was farmed out to contract personnel.
- Mechanical hot shop not available, temporary tents set up for that kind of work.
- Tracking of M&TE used documented in work orders.
- Many items of M&TE had a record accompanying the device showing its use. (OPS and I&C)
- Evaluation program in place for M&TE failing calibration.
- M&TE Entire program run manually by one person with no trainee.

4.c(4) Personnel Control (Tree Area 8.0)

Rating:

Program: GOOD

Implementation: SATISFACTORY

This area encompasses staffing controls (personnel policies, turnover minimization, shift coverage, etc.), training, testing and qualification and the overall current status of personnel (actual turnover rate, extent of personnel trained and qualified, drug problems, etc.). Its rating was based on the following strengths and weaknesses:

The STRENGTHS noted in this area included:

- Range and span of control of supervision was good.(2.a & 2.e)
- Crews are maintained stable (roll together on watch)
- Training program INPO accredited.
- Strong apprentice training program.
- Strong feedback program on training effectiveness.
- Required quarterly hours for instructors in plant was high.
- Apprentice motivation was high to complete training steps (increase in pay, peer approval).

The WEAKNESSES noted in this area included:

- I&C tech coverage not available 24hrs/day (2.e)
- Staff not at full complement for I&C and electrical (2.e)
- Backlog is high for mechanical and electrical (2.d & 3.m)
- Many craft members pulled for Temporary Assignment (2.d)
- I&C not totally integrated with the Maint Dept (2.e)
- Craft not always in compliance with security measures (tailgating). (3.j)

Observations in this area included:

- Craft foreman could readily (and did) determine individual qualification status for craft assignment to particular job tasks. (2.d)
- Use of contractors in the I&C area to cover staff shortfall was partially effective.
- 10% of I&C production time was devoted to recurrent training.
- Qualification process included oral, written, and performance examinations.

5. Exit Interview

The inspection scope and results were summarized on April 12, 1990, with those persons indicated in Appendix 1. The team leader described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

(Open) Violation 50-280,281/90-07-01: "Failure to Follow Procedures for Maintenance" paragraphs 2.e., 3.b., 3.i., and 3.k.

(Open) Unresolved item 50-280,281/90-07-02: "EDG Day Tank Fuel Transfer Line Analysis" paragraph 2.f.

APPENDIX 1

PERSONS CONTACTED

Licensee Employees

* R. Allen, Operations Maintenance Coordinator
* R. Benthall, Supervisor Licensing
* M. Boling, Asst. Plant Manager North Anna
* D. Christian, Asst. Plant Manager for Operations and Maintenance
* J. Downs, Power Planning
* D. Erickson, RP Superintendent
* A. Friednman, Superintendant of Nuclear Training
* E. Grecheck, Asst Plant Manager for Licensing
* R. Gwaltney, Superintendent of Maintenance
  M. Hadduck, Supervisor Electrical Maintenance
* D. Hanson, Supervisor of Maintanance Support
* E. Harrell, Vice President for Nuclear Operations
* D. Hart, Supervisor QA
* M. Kansler, Station Manager Surry
* A. Keagy, Superintendent Materials
* H. Miller, Director Maintenance Support - Corporate
* F. Mone, Planning
* R. Saunders, Manager Licensing
* R. Scanlan, Licensing Engineer
* E. Smith, Manager QA
  D. Snoddy, Supervisor Mechanical Maintenance
* R. Thornsberry, Planning
* G. Tompson, Suprervisor Maintenance Engineering
* J. Winebrenner, Supervisor Procurement Engineering
* F. Wolking, Nuclear Operations Support

NRC Personnel

* W. Holland, Senior Resident Inspector
* C. Julian, Chief Engineering Branch
* S. Tingen, Resident Inspector

* Attended Exit Interview on April 12, 1990

APPENDIX 2

ACRONYMS AND INITIALISMS

ADM	Administration
AEOD	Analysis and Evaluation of Operational Data
AFW	Auxiliary Feedwater
ALARA	As low as Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
B & PV	Boiler and Pressure Vessel
BKR	Breaker
cal	Calibration
CAS	Compressed Air System
CD	Chilled Water System
CFE	Component Failure Evaluation
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CP	Condensate Polishing
cpm	Counts Per Minute
CRDM	Control Rod Drive System
CS	Containment Spray System
CTS	Commitment Tracking System
CW	Circulating Water System
deg	Degree
dept	Department
DPR	Demonstration Power Reactor
DR	Deviation Report
EDG	Emergency Diesel Generator
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
ESF	Engineered Safety Feature
EWR	Engineering Work Request
GL	Generic Letter
GPM	Gallons Per Minute
HP	Health Physics
hp	Horse Power
hrs	Hours
HVAC	Heating Ventilating and Air Conditioning
Hx	Heat Exchanger
IA	Instrument Air
IAW	In Accordance With
I&C	Instrumentation and Control
IN	Information Notice
INPO	Institute for Nuclear Power Production
ISA	Instrument Society of America
ISI	Inservice Inspection
IST	Inservice Testing
JN	Job Number
LCO	Limiting Condition for Operation
LER	Licensee Event Report
LOCA	Loss of Coolant Accident
LS	Limit Switch

M&TE	Measure and Test Equipment
MCC	Motor Control Center
MCCB	Molded Case Circuit Breaker
MG	Motor Generator
MOV	Motor Operated Valve
NA	Not Applicable
NSR	Non Safety Related
OMC	Operations Maintenance Coordinator
P.E.	Professional Engineer
PM	Preventive Maintenance
PMT	Post Maintenance Testing
POD	Plan of the Day
PRT	Pressurizer Relief Tank
PT	Performance Test
PW	Primary Water
PWR	Pressurized Water Reactor
QA	Quality Assurance
QC	Quality Control
QMT	Quality Maintenance Team
rad	Radiation
RCP	Reactor Coolant Pump
RMS	Radiation Monitoring System
rpm	Revolution per Minute
Rx	Reactor
SCARF	Station Commitment Assignment/Response Form
SI	Safety Injection System
SOV	Solenoid Operated Valve
SR	Safety-Related
SRO	Senior Reactor Operator
S/S	Shift Supervisor
TS	Technical Specification
TSC	Technical Support Center
VAC	Volts Alternating Current
VDC	Volts Direct Current
WO	Work Order
WPTS	Work Planning and Tracking System
WR	Work Request
WRC	Work Request Card

APPENDIX 3 (MONOCHROME)
SURRY
REPORT NOS. 50-280,281/90-07