ATTACHMENT 1

SUPPLEMENTAL REVISION TO PROPOSED

TECHNICAL SPECIFICATION CHANGE

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

a. In accordance with the frequency specified in Table 4.8.2 on a STAGGERED TEST BASIS by:

1. Verifying the fuel level in the day tank.

2. Verifying the fuel level in the fuel storage tank.

3. Verifying the fuel transfer pump can be started and transfers fuel from the storage system to the day tank.

4. Verifying the diesel generator can start and gradually accelerate to synchronous speed (900 rpm) with generator voltage and frequency at 4160±420 volts and 60±1.2 Hz. Subsequently, verifying the generator is synchronized, gradually loaded to ~~greater than or equal to 2700~~ 2500 to 2600 kw* and operates for greater than or equal to 60 minutes. (This test should be performed in accordance with the diesel manufacturer's recommendations for routine surveillance testing, including performance of an engine prelube and any other starting warmup procedure prior to the test.)

5. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.

b. At least once per 92 days by verifying that a sample of diesel fuel from the fuel storage tank obtained as a DRAIN Sample in accordance with ASTM-D270-65, is within the acceptable limits specified in Table 1 of ASTM D975-74 when checked for viscosity, water and sediment.

c. At least once per 184 days the diesel generator shall be started from ambient conditions and accelerated to at least 900 rpm in less than or equal to 10 seconds. The generator voltage and frequency shall be 4160±420 volts and 60±1.2 Hz within 10 seconds after the start signal. The generator should be manually sychronized to its appropriate emergency bus, loaded to ~~greater than or equal to 2750~~ 2500 to 2600 kw* in less than or equal to 60 seconds, and operate for greater than or equal to 60 minutes. The diesel generator shall be started for this test by using one of the following signals with startup on each signal verified on a staggered test basis.

a) Simulated loss of offsite power by itself.
b) Simulated loss of offsite power in conjunction with an ESF actuation test signal.
c) An ESF actuation test signal by itself.

*The error band is meant as guidance to avoid routine overloading of the diesel. Loads in excess of the band for special testing at the direction of the manufacturer or a momentary variation in the load due to changing bus loads shall not invalidate the test.

SURVEILLANCE REQUIREMENTS (Continued)

c) Verifying that all diesel generator trips, except engine overspeed, generator differential and breaker overcurrent are automatically bypassed upon loss of voltage on the emergency bus and/or a safety injection actuation signal.

7. Verifying the diesel generator operates for at least 24 hours. During the first 2 hours of this test, the diesel generator shall be loaded to ~~greater than or equal to 3025~~ 2800 to 2900 kw* and during the remaining 22 hours of this test, the diesel generator shall be loaded to ~~greater than or equal to 2750~~ 2500 to 2600 kw.* Within 5 minutes after completing this 24-hour test, perform Specification 4.8.1.1.2.d.4.

8. Verifying that the auto-connected loads to each diesel generator do not exceed the 2000 hour rating of 3000 kw.

9. Verifying the diesel generator's capability to:

   a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power.
   b) Transfer its loads to the offsite power source, and
   c) Proceed through its shutdown sequence.

10. Verifying that the following diesel generator lockout features prevent diesel generator starting only when required:

    a) Remote Local Selection Switch
    b) Emergency Stop Switch

e. At least once per 10 years or after any modifications which could affect diesel generator interdependence by starting both diesel generators simultaneously, during shutdown, and verifying that both diesel generators accelerate to at least 900 rpm in less than or equal to 10 seconds.

4.8.1.1.3 Each diesel generator 125-volt battery bank and charger shall be demonstrated OPERABLE:

a. At least once per 7 days by verifying that:

1. The electrolyte level of each pilot cell is between the minimum and maximum level indication marks,

2. The pilot cell specific gravity, corrected to 77°F and full electrolyte level, is greater than or equal to 1.200,

3. The pilot cell voltage is greater than or equal to 2.08 volts, and

*The error band is meant as guidance to avoid routine overloading of the diesel. Loads in excess of the band for special testing at the direction of the manufacturer or a momentary variation in the load due to changing bus loads shall not invalidate the test.

ATTACHMENT 2

DISCUSSION OF SUPPLEMENTAL

REVISION

DISCUSSION OF SUPPLEMENTAL REVISION

Background

North Anna Unit 2 Emergency Diesel Generators (EDG) have experienced several engine failures for which the root cause(s) have not yet been identified. Unit 1 has recently experienced a similiar engine failure. Of the several items considered as contributors to these failures, maximum electrical loading has recently been included for consideration as a potential cause. The present Unit 2 Technical Specifications require that the EDG be loaded to greater than or equal to 2750 kw(or 3025 kw in the case of the eighteen month overload test). 2750 kw is the continuous (8000 hr) load rating of the EDG. At loadings greater than 2750 kw, the time of operation between required maintenance periods is greatly reduced. The North Anna EDG's are rated by the manufacturer as follows:

- 8000 hours at 2750 kw
- 2000 hours at 3000 kw
- 168 hours at 3100 kw
- 4 hours at 3150 kw
- 30 minutes at 3300 kw

Operation of the EDG beyond these rated values requires subsequent maintenance and inspection similar to that summarized in Table 8 under 8760 hours of continuous operation.

Evaluation:

Proposed Surveillance Requirements 4.8.1.1.2.a.4, 4.8.1.1.2.c, and 4.8.1.1.2.d.7 have been modified to specify error bands in electrically loading the EDG in lieu of the present requirement to load the EDG "greater than or equal to" a given value. For continuous load rating, the value specified is 2550 ± 50 kw. For overload testing, the value specified is 2850 ± 50 kw.

Basis:

In a meeting on January 23, 1985, the manufacturer, Colt Industries, verbally indicated that several of the recent Unit 2 diesel engine failures are symptomatic of severe thermal transients and/or overloading. With the recent failure of the Unit 1H diesel engine, consideration has been given to the possibility of EDG overload as a contributing cause to engine degradation or as a failure mode. We note accordingly that the present Unit 2 technical specifications require loading to greater than or equal to the continuous duty rating of 2750 kw. As specified, this requirement has the potential for routine overloading of the EDG during surveillance testing.

By requiring loading "greater than or equal to" in the technical specification, the EDG could routinely be loaded above the

continuous rating of 2750 kw to ensure compliance. Operator records are not totally conclusive in terms of past practice in that EDG load during surveillance testing has often been simply denoted as "greater than 2750". In as much as departures from normal loading are noted in operator records (e.g. "2800", "2900",etc.), it has been assumed that "greater than 2750" represents loading between 2750 and 2800 kw consistent with meter marking. Specifying an upper limit would eliminate the concern of an open-ended loading requirement.

More importantly, instrument error and other reading inaccuracies are not accounted for in this reading. Based on an approximate 5% instrument loop span error, ± 200kw error may be introduced to the operator reading. See Enclosure (1). This potentially can result in routine overloads during normal surveillance testing. If routine testing is actually performed at levels significantly above 2750 kw and instrument error is adverse, the time until required maintenance would be reduced and yet not be realized by operations or maintenance personnel. This is easily seen in the 2 hour overload test at 3025 kw. Conservatively adding 200 kw instrument error results in a 3225 kw load which has an operational rating under four hours. In such a case, the surveillance test would actually be degrading EDG availability and reliability.

In order to ensure that the EDG is not routinely overloaded for surveillance testing, the proposed revision specifies a loading which accounts for instrument error by lowering the specified loading to ensure the upper value does not exceed the continuous or the overload rating. Additionally, the proposed technical specification takes into account operational control capabilities and human factors characteristics of the meter by providing a ± 50 kw operating band consistent with the 100 kw meter graduation. It is believed by Virginia Power and concurred with by the manufacturer, that this approach to EDG loading adequately confirms EDG capability to perform as specified without the resultant potential for degrading diesel engine availability and reliability by virtue of the surveillance test.

For the 2750 kw continuous load rating, the proposed specified load is determined as follows:

1) upper limit = 2750 - 200 kw
   = 2550 kw

2) applying an operational band of ± 50 kw results in a control band of 2500 - 2600 kw which matches the 100 kw graduations on the meter

The resultant span in actual load may then be from 2300 to 2800 kw, which corresponds to 83.6 to 101.8% of the 2750 kw continuous rating.

For the 3025 kw overload test, the proposed specified load is determined as follows:

1) upper limit = 3025 kw - 200 kw
   = 2825 kw

2) applying an operational band of ± 50 kw results in a control band of 2775 - 2875 which is not well human factored with the 100 kw meter graduations. Accordingly, 25 kw is added to account for human factors in reading the meter. The control band becomes 2800 - 2900 kw.

The resultant span in actual load may then be from 2600 to 3100 kw, which corresponds 94.5 to 112.7% of the 2750 kw continuous rating.

We note that the application of an operating band is meant as guidance to avoid routine overloading of the diesel engine during surveillance testing. Although the load will be monitored visually on the kw meter, a momentary variation of bus loads may result in an associated momentary deviation of the operating band. Likewise, special testing at the direction of the manufacturer may require loading in excess of that specified by the surveillance requirement. In either event, it is not the intent of this change request to so limit the operating range as to result in frequent invalidation of tests due to anticipated momentary variations in load or special testing at higher loads. Such a consequence would be counterproductive in that it would result in additional EDG starts. Rather than just maintain a lower limit, as in the existing Technical Specification, we propose the concept of a control band as an operating target with the additional flexability referenced by asterisk to acount for anticipated operational conditions and events.

50.59 and Significant Hazards Review

Pursuant to 10 CFR 50.59, we have reviewed the proposed supplemental Technical Specification change and have concluded that no unreviewed safety question exists: (i) the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased. Specifying an upper limit in electrical loading which addresses instrument error and EDG rated output limitations with the manufacturer's recommendations is intended to enhance diesel reliability by avoiding inadvertant severe test conditions which can lead to premature failures. In this respect, the supplemental change should serve to enhance overall safety; (ii) the possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. The proposed change only affects EDG loading surveillance practices and has no actual impact on any accident analysis; (iii) the margin of safety as defined in the basis for any Technical Specification is not reduced. The change in the loading requirement does not affect the capability of the EDG to

perform its function. Rather, the purpose of the change is to increase overall diesel reliability. Likewise, pursuant to 10CFR50.92, we conclude that the proposed supplemental change involves no significant hazards considerations.

Conclusion

The proposed supplemental change in EDG loading is consistent with the previously submitted exigent request in that it attempts to redress immediate diesel engine reliability concerns identified as a result of the failures experienced on Unit 2. As noted in the original submittal, these changes do not represent a final optimization of testing requirements, however, we believe they will provide positive improvements to diesel generator reliability. Following implementation and experience through our reliability improvement program, we intend to reassess the related specifications for both units and propose specifications which programatically address EDG reliability.

INSTRUMENT ERROR

Instrument error is not accounted for in the present loading requirements of the North Anna Unit 2 Emergency Diesel Generators Technical Specifications. The proposed loading requirements account for 5% total instrument, calibration and reading inaccuracy. The following discussion provides the bases for the 5% error value.

The current transformers (CT) and potential transformers (PT) that provide the transformed line current and voltage for the KW transducer introduces an error into the instrument circuit which is effected by the difference in the actual windings ratio (true ratio) and the nameplate ratio and the magnitude of the load (burden) connected to the secondary windings of these transformers. A winding ratio test is performed prior to operation of all CTs and PTs to determine the transformers true ratio. Although the test results for the subject transformers are not yet available, typical results for this test on comparable replacement devices indicate that the true ratio can be expected to be within 1% to 2% of the nameplate value. Based on this experience for similar grade devices and in lieu of the actual error, a winding ratio error of ±1.5% is assumed to be both reasonable and consistent with common practice for replacement devices. This equates to a ratio correction factor (RCF) of 1.015.

At generator loads up to 3025 kw the effect of CT secondary load or burden has a small effect on CT accuracy. A calculation using actual relay, transducer, and meter burdens and a typical CT excitation curve indicates that an error of .3% is reasonable for this effect. With this additional error the RCF for the CTs is 1.018.

The kw transducer receives input from the CTs and PTs and the resultant RCF for use with the transducer is the product of the two RCFs, or $RCF_{ct} \times RCF_{pt}$ = 1.018 x 1.015 = 1.033. The percent error introduced by the CTs and PTs is 3.3%.

Although the subject kw transducer error is not readily available, the manufacturer's catalog data specifies this error to be ± .2%. Likewise, the kw meter is specified by manufacturer information to have an error of ± 1.5% of full scale.

Using the above information for the CT, PT, kw transducer and kw meter error the instrument circuit error is determined to be as follows:

$$\text{Instrument Error} = \sqrt{(3.3)^2 + (0.2)^2 + (1.5)^2} = 3.63\%$$

An additional error of ± 1.0% is assumed for instrumentation calibration drift and another 0.595% accounts for error in reading the kw meter due to parallax. (The operator is assumed to be able to read the generator kw load to within ±25kw, which yields a reading error of 0.595% of span.)

The calculated total circuit error is the sum of these three components Instrument, Calibration, and Reading error.

Total Circuit Error = 3.63 + 1.00 + 0.595 = 5.23%

Based on a 4200 kw meter span, this correlates to 220 kw. Correspondingly, a relative value of ±200 kw was chosen for calculating the surveillance requirement loading limits. The use of a relative value for this calculation is reasonable since based on human factors considerations, the error value will be adjusted to match actual meter graduations. Refer to Attachment 2.

ATTACHMENT 3

CLARIFICATIONS TO VIRGINIA

POWER LETTER NO. SERIAL 85-029

DATED FEBRUARY 1, 1985

Clarifications To Virginia Power Letter, Serial No. 85-029, Dated February 1, 1985

Virginia Power letter, Serial No. 85-29, dated February 1, 1985, requested changes in Unit 2 Technical Specification 3/4.8.1 on A.C. Power Sources. This request was as a result of several recent failures on Unit 2 Emergency Diesel Generators (EDG). Preliminary investigations of the failures identified several aspects of routine surveillance testing which appear to either contribute to engine degradation or accelerate the time to failure. The following clarifications to the original submittal are meant to augment or update the previous "Discussion of Proposed Changes" and do not alter the conclusions previously reached.

Unit 1 Diesel Failure

On February 1, 1985, Unit 1 experienced a diesel engine failure similar to the diesel engine failures recently experienced on Unit 2. Table 1 provides a chronological summary of this "1H" diesel engine failure.

During August, 1984, the "1H" EDG was inadvertantly overloaded to 3600 kw, which is in excess of the continuous rating for the EDG. Under the direction of the manufacturers, the diesel generator set was inspected for damage. Inspection of the diesel engine included the upper crank main and thrust bearings; vertical drive gear faces; No. 5 and No. 11 upper rod bearings, piston pins and bushings, tolerances were measured on all rod bearings. The results of these inspections indicated little or no wear and all measured parts were within tolerance. A subsequent surveillance test was successfully performed on the EDG concurrent with vibration measurements. Based on these results, no further inspections were recommended by the manufacturer.

In light of the previous overload condition, Colt Industries has verbally indicated that the recent "1H" diesel engine failure is most likely related to the previous overload condition. Overloading, as a failure mode, may have commonality between Unit 1 and Unit 2 diesel engine failures as identified in this supplemental change request. However, this "1H" diesel engine failure is attributed to an isolated and severe overload which is a non-routine event. The Unit 2 diesel engine failures occurred during or following routine testing. Based on this difference, we believe the "1H" diesel engine failure to be unrelated to the Unit 2 diesel engine failures. As a consequence, the hypothesized dichotomy of diesel engine failure experience between Unit 1 and Unit 2 as characterized in our original submittal and attributed in part to the differences in surveillance testing remains unaltered.

Definition of Failure

In the original submittal, Unit 1 EDG failure experience was variously characterized in contrast to Unit 2 experience as "has not experienced similar failures", "has experienced no failures to date", and "experienced no diesel failures". Considering the definition of "valid failure" as used in Regulatory Guide 1.108, clarification of the terminology used in the original submittal is warranted.

It was our intent in the original submittal to contrast engine failure experience between Unit 1 and Unit 2. Accordingly, the characterizations of "no similar failures" or "no diesel failures" were meant to represent a lack of catastrophic engine-related failures such as cracked cylinder liners, scored pistons, or broken piston rings (i.e. failures which constitute engine damage). Correspondingly, these characterizations are not meant to exclude the possibility that "valid failures" per Regulatory Guide 1.108 have occurred for Unit 1, only that such failures are not engine damage related. As identified in NUREG-CR-2989 (Reliability of Emergency AC Power Systems at Nuclear Power Plants), Unit 1 failures have previously ocurred. None of these failures to our knowledge have resulted in engine-related damage, except for the most recent failure of the "1H" EDG.

Emergency Diesel Generator History

Tables 2 and 3 are provided to summarize significant events experienced during testing or maintenance of the Unit 1 and 2 EDGs subsequent to receipt of the respective plant operating license. The events identified represent operational problems or EDG trips, but are not necessarily valid failures per Regulatory Guide 1.108. These tables are based on a review of EDG-related events in LER's, maintenance histories, and NUREG-CR-2989. The tables consist of events which have subjectively been determined to be significant in characterizing existing diesel generator reliability but do not include every incident in which the EDG may have been declared inoperable per the Technical Specification.

As noted above, to our knowledge no previous operational event on Unit 1, except the most recent "1H" diesel failure, has resulted in major engine damage. The only similar previous events on Unit 1 are high crankcase pressure trips. (See Table 2) In as much as these trips did not result in any engine failure and the trip function itself is overridden in an emergency demand situation, previous Unit 1 EDG experiences are of limited significance to the proposed changes submitted in the original request. None of these previous events alters the comparison or conclusion in the original submittal regarding diesel engine failure experience between Unit 1 and Unit 2.

Table 3 summarizes Unit 2 EDG operational problems or trips, including the recent 2H and 2J EDG events in December, 1984, which

resulted in engine damage. Beyond similar high crankcase pressure trips, the only other failure resulting in engine damage occurred on the "2J" EDG in June, 1983. The root cause of this failure was never definitively determined although the manufacturer postulated the failures were indicative of continued overloading in excess of the continuous rating. As Tables 4, 5, 6, and 7 document for the last two years of recorded operation, the EDGs were not routinely or intentionly overloaded during surveillance testing. In addition, the proposed modification to the surveillance requirements made by this submittal will account for instrument error which will thereby mitigate the potential for routine or inadvertant overloading of the diesel due to the existing technical specification requirements.

Table 4, 5, 6, and 7 provide a summary of EDG starts for 1983 and 1984. This data was compiled from a combination of completed maintenance, operation, and periodic test procedures, diesel generator log books, and control room operator logs. Although this is a more complete compilation of starts than was available for the original submittal, this information should be considered representative rather than complete and definitive. Identified starts for this time period are as follows:

"1H" EDG - 83 starts	"2H" EDG - 138 starts
"1J" EDG - 76 starts	"2J" EDG - 118 starts
Total Unit 1 - 159 starts	Total Unit 2 - 256 starts

In this two year period, the Unit 2 EDGs have experienced approximately 60% more starts than Unit 1 EDGs. In a revision to the original submittal, of those Unit 2 starts which are presently identified, approximately 38% are due to surveillance testing, 29% to maintenance, 27% to operability testing, 3% to unintentional or spurious automatic starts, and 3% remaining unclassified. The relative changes in percentages from that noted in the original submittal reflect the accounting of the more recent accelerated testing following the Unit 2 diesel failures in December, 1984.

Slow Start Surveillance Test Procedure

In both the technical specification change request (Surveillance Requirement 4.8.1.1.2.a) and the corresponding basis accelerating to synchronous speed and loading the EDG is referred to as a gradual process. The basis refers to these actions as "gradual ramping". In actuality, acceleration to synchronous speed is a two-step process. The diesel rapidly accelerates to approximately 450 RPM and then is "gradual ramped" to 900 RPM over a one to two minute period. In as much as the proposed procedure specifies discrete loads during "gradual ramping", the loading process is more accurately characterized as "staircasing".

During a special test of the EDG on February 13, 1985, to verify the acceptability of the proposed procedure, the EDG was accelerated to and held at several discrete speeds to obtain various test data. At

one of these hold points, the diesel was thought to abnormally vibrate. Colt Industries has been contacted to identify whether the diesel has any critical speeds which must be avoided to prevent engine damage. Colt has stated that the diesel generator has no harmful critical speeds between 450 and 900 RPM. Refer to Attachment 4 for additional information.

Existing Maintenance Program

A summary of the existing diesel maintenance program is provided in Table 8. This program has been revised subsequent to the recent failures experienced on Unit 2 EDGs. As identified in Attachment 4, maintenance criteria and practices will be reviewed as part of the proposed reliability improvement program. Additionally, twelve maintenance personnel have been sent to the manufacturer's facility for training since the recent Unit 2 EDG failures. This training includes one week of diesel engine theory and one week of "hands on" engine tear down and repair.

TABLE 1
NORTH ANNA POWER STATION UNIT 1
SUMMARY OF "1H" DIESEL FAILURE

2/1/85- "1H" diesel trips at end of 1 hr surveillance test concurrent with localized external flame up (flashing) in No. 1 cylinder vicinity. Trip due to high crankcase pressure. Diesel declared inoperable.

2/1-2/85-Following extinguishment of flame up with dry chemical, diesel inspected. Trip appeared to be spurious w/subsequent overspeed trip indication cause unknown. Diesel retested successfully and declared operable.

2/2/85- Post-operation check identifies jacket cooling head tank empty-refilled w/50 gallons.

2/4/85- Head tank observed empty again. Diesel inspected. Water leak observed. Diesel declared inoperable. Repairs initiated include:

.No 3 Cylinder Liner Cracked/Scored-Replaced
.No 3 Upper Piston - Scored - Replaced
.No 3 Upper Piston Pin Bushing - Abnormal wear observed - Replaced
.Three Main Bearings and one connecting rod bearing exhibit wear (pitting) but are within tolerance - replaced

2/7/85- "1H" diesel repaired and returned to service

TABLE 2
NORTH ANNA POWER STATION UNIT 1
EMERGENCY DIESEL GENERATOR
SIGNIFICANT TESTING AND MAINTENANCE EVENTS

EDG	DATE	PROBLEM	CORRECTIVE ACTION
1H	2-16-79	Failure to reach 900 RPM in 10 sec.	Check out-second attempt successful
1H	7-2-79	Spurious trip	Check out-cause unknown
1H	9-26-79	Trip after 30 sec.	Check out-air accumulation in fuel filter due to prior maintenance-second attempt successful
1H	2-2-80	Trip due to high crankcase pressure	Pressure Switch Setpoint Change
1H	2-15-80	Overspeed Trip	Check out-oil booster servomotor not bleeding off fast enough
1H	2-23-80	Overspeed Trip	Check out-reset speed control
1H	3-2-80	Overspeed Trip	Check out
1H	3-6-80	Overspeed Trip	Replace Oil Booster Servomotor and Reset Governor Settings
1H	3-10-80	Trip due to high crankcase pressure	Check out
1H	3-11-80	Trip due to high crankcase pressure	Pressure Setpoint Change (air ejector orifice size changed 4/3/80)
1H	4-3-80	Overspeed Trip	Replaced governor booster servomotor, hydraulic assembly and EGA Controller
1H	4-29-84	Voltage regulation problems	Replaced regulator card - diode overheating

1H	5-29-84	Trip on high jacket coolant temperature	Temperature switch recalibrated
1H	8-7-84	EDG inadvertently overloaded to 3600 kw	Check out in accordance with vendor recommendations
1H	2-1-85	Trip on high crankcase pressure and overspeed; coolant leaks	Engine Repair #3 cylinder liner cracked and upper piston scored; three main bearings and one connecting rod bearing worn
1J	10-30-79	Upper crankshaft thrust bearing found "flashed" during refueling PM	Replaced thrust bearing
1J	7-14-82	Main bearing #6 and connecting rod bearing #6 found "flashed" during outage PM	Replaced bearings
1J	11-14-84	Spurious trip of output breaker. EDG did not trip.	Check out

TABLE 3
NORTH ANNA POWER STATION UNIT NO. 2
EMERGENCY DIESEL GENERATOR
SIGNIFICANT TESTING AND MAINTENANCE EVENTS

EDG	DATE	PROBLEM	CORRECTIVE ACTION
2H	8-9-80	Insufficient Information	replaced governor with rebuilt unit
2H	10-12-80	Insufficient Information	replaced booster servomotor on governor (formerly 1H unit)
2H	9-6-81	Insufficient Information	replaced defective spring in governor
2H	3-8-82	Failure to restart during blackout/SI functional - deficient test procedure	procedures changed to preclude air start during fuel admission time delay
2H	7-4-83	High jacket coolant temperature due to low lube oil level	added lube oil
2H	10-19-84	High jacket coolant temperature;	calibrated temperature switches
2H	10-19-84	High crankcase pressure	air start valve gasket replaced
2H	10-22-84	High crankcase pressure	cleaned lube oil strainer
2H	11-2-84	High crankcase pressure	cleaned crankcase ejector-diesel additionally instrumented for next start. Crankcase pressure switch found defective and replaced 12/2/84.
2H	12-3-84	Failure to reach 900 RPM in 10 sec.	successfully started second attempt; air start system maintenance performed 12/7
2H	12-9-84	High crankcase pressure	major engine repairs #10 lower piston rings broken

2H	12-13-84	Water jacket pump and motor-seal leaking; bearings failed	replaced seal and motor
2H	2-25-85	Generator Failed to reach proper voltage in 10 sec.	voltage regulator/ linear reactor was replaced
2J	3-9-81	Insufficient Information	installed rebuilt governor; replaced servomotor
2J	3-12-82	Generator fails to maintain proper voltage (high)	replaced voltage regulator
2J	3-23-82	Lower main bearing #14 was found to be scored	bearing replaced and oil line repaired
2J	10-20-82	Field failed to flash	replaced latch trip coil
2J	4-2-83	High crankcase pressure	check out
2J	5-30-83	High crankcase pressure	check out
2J	6-13-83	High jacket coolant temperature	setpoint adjusted
2J	6-14-83	High crankcase pressure	coolant leaks repaired #3 cylinder liner and upper piston replaced
2J	12-7-84	High crankcase pressure	major engine repairs #2 and #3 upper pistons replaced; #11 cylinder liner and upper piston replaced
2J	1-13-85	High crankcase pressure	#4 upper and lower piston replaced; piston rings showed abnormal wear

TABLE 4

NORTH ANNA POWER STATION UNIT 1

1H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1-2-83	2750-3000	2:00	surveillance	
1-22-83	2750	2:18	maintenance	operability test after maintenance following battery replacement
2-2-83	2800	2:10	surveillance	
3-2-83	2800	2:00	surveillance	
4-3-83	2750	2:00	maintenance	operability test after maintenance on Air Start solenoid valve
4-2-83	2800	2:19	surveillance	
4-15-83	2800	2:05	maintenance	prove operability after maintenance
4-16-83	2750	2:00	operability	1J EDG out for maintenance
4-16-83	2750	2:02	operability	1J EDG out for maintenance
4-17-83	-	-	operability	insufficient detailed information
5-2-83	2800	2:06	surveillance	
5-16-83	-	-	operability	insufficient detailed information
5-16-83	2750	2:22	operability	
5-17-83	-	-	-	insufficient detailed information
6-1-83	0	0	maintenance	trouble shooting
6-3-83	0	0	maintenance	trouble shooting
6-3-83	2800	2:02	maintenance	prove operability following maintenance
6-4-84	2750	2:13	surveillance	
7-2-83	2900	2:04	surveillance	
8-2-83	2800	2:03	surveillance	
8-16-83	0	0	operability	

TABLE 4 (Continued)

NORTH ANNA POWER STATION UNIT 1

1H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
8-16-83	2750	2:16	operability	
9-2-83	2750	2:05	surveillance	
10-2-83	2750	2:06	surveillance	
10-8-83	2750	2:00	-	
10-15-83	2800	2:01	maintenance	
11-2-83	2800	2:00	surveillance	
12-2-83	2800	2:02	surveillance	

TABLE 4 (Continued)

NORTH ANNA POWER STATION UNIT 1

1H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1-3-84	2800	2:08	surveillance	
2-2-84	2800	2:01	surveillance	
3-2-84	2750	2:01	surveillance	
4-2-84	2750	2:05	surveillance	
4-2-84	-	-	operability	insufficient detailed information
4-17-84	2600	2:11	-	insufficient detailed information
4-27-84	-	-	operability	insufficient detailed information
4-28-84	-	-	operability	insufficient detailed information
4-28-84	-	-	operability	insufficient detailed information
4-28-84	0	0	maintenance	diesel started to mix glycol
5-2-84	2900	2:02	surveillance	
5-29-84	-	-	surveillance	diesel trip on high jacket coolant temperature, temperature switch setpoint had drifted
6-21-84	0	0	maintenance	diesel started for Tech. Rep.
6-22-84	0	0	maintenance	diesel started for Tech. Rep.
6-22-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.

TABLE 4 (Continued)

NORTH ANNA POWER STATION UNIT 1

1H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	0	0	maintenance	diesel started for Tech. Rep.
6-23-84	2000	0:40	maintenance	diesel started for Tech. Rep.
6-26-84	0	0	maintenance	diesel started for Tech. Rep.
6-26-84	0	0	maintenance	diesel started for Tech. Rep.
6-26-84	2800	2:20	surveillance	
6-28-84	2750	1:01	maintenance	diesel started for Tech. Spec.
7-2-84	2800	2:00	surveillance	
7-6-84	2750	0:06	-	insufficient detailed information
8-7-84	3600*	0:20	-	* during installation of design change, diesel unknowingly overloaded due to error in design modification. Actual time estimated at 3600 kw overload condition for both events of 8/7 and 8/8 is eleven minutes based on a reconstruction of the events.
8-7-84	2775	1:07	-	insufficient detailed information
8-8-84	3600*	0:04	-	
8-8-84	2750	1:00	-	insufficient detailed information
8-12-84	2750	2:15	surveillance	
8-15-84	2750	2:15	maintenance	

TABLE 4 (Continued)

NORTH ANNA POWER STATION UNIT 1

1H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
8-17-84	2750	0:52	surveillance	started for SI/Blackout test
8-18-84	2800	2:32	-	insufficient detailed information
9-4-84	2900	2:11	surveillance	
9-12-84	0	0	surveillance	
10-2-84	2900	2:00	surveillance	
10-17-84	2800	2:01	-	insufficient detailed information
10-18-84	2700	2:04	-	insufficient detailed information
10-29-84	2700	2:02	-	insufficient detailed information
11-2-84	2775	2:10	surveillance	
11-7-84	0	0	maintenance	diesel started to mix glycol
11-7-84	2700	2:06	maintenance	operability test after maintenance
11-14-84	2800	2:04	operability	
12-4-84	2800	2:18	surveillance	

TABLE 5

NORTH ANNA POWER STATION UNIT 1

1J EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1-17-83	2800	2:01	surveillance	
2-12-83	2750-3000	2:01	maintenance	operability test after maintenance
2-16-83	2800	2:05	surveillance	
3-16-83	2800	2:05	surveillance	
3-24-83	-	-	maintenance	insufficient detailed information - testing during design change
3-24-83	-	6:17	-	insufficient detailed information
4-2-83	0	0	operability	1H EDG out for maintenance
4-3-83	-	0:47	operability	1H EDG out for maintenance
4-3-83	0	0	operability	1H EDG out for maintenance
4-3-83	-	2:03	operability	1H EDG out for maintenance
4-4-83	-	-	operability	1H EDG out for maintenance
4-14-83	-	-	operability	1H EDG out for maintenance
4-14-83	-	2:00	operability	1H EDG out for maintenance
4-17-83	2750-3000	2:01	operability	1H EDG out for maintenance
5-17-83	0	0	maintenance	diesel started to vent governor, field was not flashed
5-17-83	2750	2:15	maintenance	operability test after maintenance
6-1-83	0	0	operability	1H EDG out for maintenance
6-1-83	-	0:34	operability	1H EDG out for maintenance
6-1-83	0	0	operability	1H EDG out for maintenance

TABLE 5 (Continued)

NORTH ANNA POWER STATION UNIT 1

1J EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
6-2-83	-	2:13	operability	1H EDG out for maintenance
6-2-83	0	0	operability	1H EDG out for maintenance
6-2-83	2750	0:39	operability	1H EDG out for maintenance
6-3-83	0	0	operability	1H EDG out for maintenance
6-3-83	-	2:16	operability	1H EDG out for maintenance
6-3-83	-	-	operability	1H EDG out for maintenance
6-16-83	2750-3000	2:03	surveillance	
7-16-83	2750	2:03	surveillance	
8-16-83	2750	2:05	surveillance	
9-2-83	0	0	operability	1H EDG out for maintenance
9-8-83	0	0	-	inadvertent start
9-16-83	2750	0:13	maintenance	trouble shooting
9-16-83	2800	2:14	surveillance	surveillance/operability test after maintenance
10-8-83	2650	2:02	-	insufficient detailed information
10-12-83	2775	2:01	-	insufficient detailed information
10-16-83	2900	2:03	surveillance	
10-17-83	2700	1:05	-	inadvertent start
11-16-83	2775	2:12	surveillance	
12-2-83	-	-	operability	insufficient detailed information
12-16-83	2775	2:00	surveillance	

TABLE 5 (Continued)

NORTH ANNA POWER STATION UNIT NO. 1

1J EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1-16-84	2750	2:00	surveillance	
2-16-84	2750	2:02	surveillance	
3-16-84	2800	2:08	surveillance	
3-20-84	2750	1:01	operability	
4-2-84	0	0	-	insufficient detailed information
4-16-84	2750	2:20	surveillance	
4-16-84	-	-	maintenance	insufficient detailed information
4-16-84	2750	3:31	-	insufficient detailed information
4-17-84	-	-	maintenance	insufficient detailed information
4-17-84	2850	2:01	operability	
4-27-84	0	0	-	insufficient detailed information
4-28-84	2750	2:00	operability	1H EDG out for maintenance
5-16-84	2775	2:00	surveillance	
5-31-84	2800	2:17	-	insufficient detailed information
6-13-84	-	-	-	Auto start on bus undervoltage signal
6-13-84	0	0	-	insufficient detailed information
6-13-84	0	0	-	insufficient detailed information
6-14-84	2800	2:01	surveillance	
7-6-84	2800	2:13	-	insufficient detailed information
7-9-84	1500	0:40	-	insufficient detailed information

TABLE 5 (Continued)

NORTH ANNA POWER STATION UNIT NO. 1

1J EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
7-16-84	2800	2:13	surveillance	
8-16-84	2750	2:02	surveillance	SI/Blackout test
8-18-84	2800	2:03	surveillance	
9-5-84	2800	2:34	-	insufficient detailed information
9-16-84	2800	2:14	surveillance	
10-10-84	2800	2:00	surveillance	
10-16-84	2800	2:00	surveillance	
10-17-84	-	-	maintenance	
10-30-84	2750	2:17	maintenance	operability test after DCP81-05
11-7-84	0	0	-	insufficient detailed information
11-7-84	-	-	maintenance	
11-8-84	-	-	maintenance	insufficient detailed information
11-8-84	2800	2:02	maintenance	operability test after repair of two oil leaks
11-14-84	2800	1:08	surveillance	diesel output breaker tripped opened
11-14-84	2800	0:13	maintenance	diesel started for trouble shooting
11-14-84	2750	2:19	surveillance	
12-15-84	2750-3000	2:11	surveillance	

TABLE 6

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1/2	2750	2:08	surveillance	
1/17	2800	2:01	surveillance	
1/31	>2750	2:04	surveillance	
2/14	>2750	2:01	surveillance	
2/22	>2750	1:01	operability	2J EDG out for maintenance
2/22	2750	2:00	operability	2J EDG out for maintenance
2/28	2800	2:01	surveillance	
3/14	2750	2:07	surveillance	
3/28	>2750	2:09	surveillance	
4/2	>2750	2:07	automatic	S.I. signal - diesel manually paralleled with offsite grid and loaded
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
4/17	0	0	maintenance	adjust governor; overspeed test; fix fuel injector leaks
4/17	2800	1:45	maintenance	verify governor & turbo charger operability
4/17	2850	1:00	maintenance	coolant changeout
4/17	>2750	2:01	maintenance	operability test following maintenance
4/18	2800	2:08	surveillance	
4/25	2850	2:06	surveillance	
5/9	>2750	2:16	surveillance	
5/11	-	-	operability	insufficient detailed information
5/12	2800	2:11	surveillance	
5/16	3025 & 2750	25:24	surveillance	18 month-Blackout Test (3025 kw for 2 hours)
5/17	2750	1:05	surveillance	
5/17	950	0:36	surveillance	simulated Blackout
5/17	2750	1:05	surveillance	
5/18	1325	0:12	surveillance	
5/18	1900	0:42	surveillance	Blackout w/simulated SI
5/18	2800	2:06	surveillance	
5/19	>2750	2:20	surveillance	SI functional test
5/23	2800	2:22	surveillance	
5/23	>2750	2:00	automatic	SI signal - diesel manually paralleled with offsite grid and loaded

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
5/30	2800	2:06	surveillance	
6/6	>2750	2:06	surveillance	
6/13	2650	1:04	operability	
6/13	2700	1:00	operability	
6/14	2750	1:00	operability	
6/14	2500	1:02	operability	
6/14	2750	1:01	operability	
6/15	2750	1:03	operability	
6/15	-	-	operability	
6/15	2250	1:00	operability	
6/15	2600	1:00	operability	
6/16	2700	1:12	operability	
6/16	2500	1:01	operability	
6/16	2700	1:00	operability	
6/17	2700	1:04	operability	
6/21	2750	2:05	surveillance	
7/4	2750	0:27	surveillance	pen recorder was out of calibration-test invalidated, retest required
7/4	2750	1:58	surveillance	diesel trip on high coolant temperature apparently caused by low lube oil level
7/4	2800	2:05	surveillance	
7/18	2750	2:17	surveillance	
8/1	2750	2:07	surveillance	
8/15	2750	2:00	surveillance	

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
8/26	2750	1:02	operability	
8/26	2750	1:03	maintenance	diesel started to check voltage regulator
8/26	2750	1:03	maintenance	diesel started to check voltage regulator
8/29	2750	2:01	surveillance	
9/12	2750	1:01	surveillance	pen recorder failed - test invalidated, retest required
9/12	2750	2:02	surveillance	
9/19	2750	2:03	operability	
9/26	2750	1:01	surveillance	
10/3	2750	2:02	surveillance	
10/16	2800	1:00	operability	
10/16	2800	2:01	operability	
10/17	2800	1:44	operability	
10/17	2800	2:02	operability	
10/17	2750	1:01	operability	
10/18	2800	2:13	operability	
11/2	2323	2:05	operability	
11/3	2040	1:13	operability	
12/3	2750	2:05	surveillance	
12/16	2750	1:01	surveillance	
12/16	2750	1:45	operability	
12/16	2750	1:03	operability	
12/17	2800	1:04	operability	
12/17	2800	1:05	operability	

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1/3	2850	2:05	surveillance	
2/3	2750	2:01	surveillance	
3/2	2800	2:02	surveillance	
4/1	0	0	spurious	UV circuit breaker inadvertently opened causing a diesel auto start signal
4/5	0	0	maintenance	started diesel to test new governor
4/5	0	0	maintenance	started diesel to test new governor
4/5	0	0	maintenance	
4/5	2800	2:01	maintenance	operability test after maintenance
5/3	2800	2:09	surveillance	
5/9	0	0	maintenance	diesel ran to mix coolant after changeout
5/9	0	0	maintenance	diesel ran to mix coolant after changeout
5/9	0	0	maintenance	diesel ran to circulate coolant for chemistry sample
5/9	2800	2:00	maintenance	operability test after maintenance
5/16	2820	2:00	operability	
5/16	0	0	operability	pen recorder malfunctioned - test invalidated, retest required
5/16	2750	1:02	operability	
5/16	2800	0:33	operability	
5/17	2800	1:02	operability	
5/17	2800	1:22	operability	
5/17	2800	1:03	operability	

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
5/18	2750	2:00	operability	
6/2	2800	2:02	surveillance	
6/13	2750	1:11	operability	
7/2	2800	2:06	surveillance	
8/4	2750	2:18	surveillance	
9/2	2750	2:04	surveillance	
10/4	2750	0:40	operability	
10/7	2800	2:01	maintenance	operability test after coolant changeout
10/19	3025	1:13	surveillance	Diesel trip on jacket cooling high temperature; temperature switch was recalibrated
10/19	-	-	maintenance	diesel trip on high crankcase pressure; air start valve gasket replaced
10/21	3025 & 2750	14:00	surveillance	24 hour test (2 hours at 3025 kw) - diesel trips on high crankcase pressure (10/22)
10/22	2750	-	maintenance	trouble shoot high crankcase pressure; lube oil strainer cleaned
10/23	3025 & 2800	24:01	surveillance	24 hour test completed (2 hours at 3025 kw)
10/27	2800	2:01	surveillance	diesel had positive crankcase pressure
11/2	-	0:20	surveillance	diesel trip on high crankcase pressure, crankcase ejector was cleaned
11/2	2800	2:00	surveillance	
12/2	2750	2:03	surveillance	

TABLE 6 (Continued)

NORTH ANNA POWER STATION UNIT 2

2H EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
12/3	2800	2:03	surveillance	
12/3	0	0	surveillance	diesel failed to come up to rated speed in 10 seconds
12/6	2800	1:01	operability	
12/7	2750	1:04	operability	
12/8	2750	1:01	operability	
12/8	2800	1:02	operability	
12/8	2750	1:01	operability	
12/9	2750	0:10	operability	diesel trip on high crankcase pressure
12/9	1200	:09	automatic	degraded bus voltage
12/10	0	0	maintenance	
12/11	0	0	maintenance	
12/11	1000	0:45	maintenance	
12/11	2800	1:02	maintenance	operability test after maintenance
12/13	0	0	maintenance	
12/13	2750	1:01	maintenance	
12/20	0	0	surveillance	six pen recorder failed to operate
12/20	0	0	surveillance	six pen recorder failed to operate
12/20	2800	1:10	surveillance	
12/27	2750	1:03	surveillance	

TABLE 7

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1/10	2800	2:20	surveillance	
1/24	>2750	2:22	surveillance	
2/7	2750	2:01	surveillance	
2/8	>2750	2:10	surveillance	
2/22	2775	2:02	surveillance	
3/7	2900	2:02	surveillance	
3/21	2750	2:06	surveillance	
4/2	-	-	Autostart	diesel trip on high crankcase pressure, cause was not determined
4/3	2800	2:01	surveillance	
4/3	2800	2:15	maintenance	operability test following maintenance
4/7	2750	1:08	maintenance	
4/8	2300	10:22	maintenance	C reserve station service transformer out of service
4/17	-	-	operability	maintenance on 2H EDG
4/18	2750	1:03	maintenance	to observe voltage regulator
5/10	2950	6:19	maintenance	started for Tech. Rep.
5/11	3000	0:22	maintenance	started to troubleshoot
5/12	2750	2:14	surveillance	
5/16	>2750	26:18	-	
5/17	1100	0:21	-	
5/18	1900	0:10	-	
5/18	>2750	2:44	-	
5/18	2750	2:07	-	

TABLE 7 (Continued)

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
5/19	2250	2:19	-	
5/19	2750	2:40	Auto-start	bus undervoltage
5/23	2750	2:00	Auto-start	SI signal
5/30	-	-	surveillance	diesel trip on high crankcase pressure, cause was not determined
5/30	2800	0:18	surveillance	diesel shutdown due to small fire on exhaust manifold
5/30	2800	2:04	surveillance	
6/13	2750	0:59	surveillance	diesel trip on high jacket coolant temperature. Setpoint found low by 15 degrees
6/14	0	0	maintenance	diesel trip on high crankcase pressure
6/14	0	0	maintenance	diesel trip on high crankcase pressure
6/19	3000	3:46	operability	
6/19	0	0	maintenance	started to adjust governor
6/19	0	0	maintenance	started to adjust governor
6/19	0	0	maintenance	started to adjust governor
6/19	0	0	maintenance	started to adjust governor
6/20	2900	2:02	surveillance	
6/27	2850	2:00	surveillance	
7/4	2600	1:05	operability	2H EDG removed for maintenance
7/4	-	-	operability	insufficient detailed information-2H EDG removed for maintenance
7/8	2750	0:19	surveillance	voltage response test

TABLE 7 (Continued)

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1983

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
7/8	2600	2:03	surveillance	voltage response test
7/11	2800	2:02	surveillance	
7/25	2750	2:01	surveillance	
8/8	2750	2:01	surveillance	
8/22	2750	2:03	surveillance	
8/26	2750	1:03	maintenance	trouble shoot voltage regulator
8/26	2750	1:03	maintenance	trouble shoot voltage regulator
8/26	2750	2:02	maintenance	operability start after maintenance
9/5	2800	2:06	surveillance	
9/19	2780	1:00	operability	
9/19	2750	2:00	operability	
10/17	0	0	maintenance	
10/17	0	0	maintenance	
10/18	2750	2:02	operability	
11/2	2750	1:00	operability	
11/2	2800	2:07	operability	
11/2	2750	1:01	operability	
11/3	2275	1:01	operability	
11/17	2750	2:02	surveillance	
12/3	2750	1:03	operability	
12/17	0	0	maintenance	
12/17	2800	2:04	operability	

TABLE 7 (Continued)

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
1/17	2750	2:00	surveillance	
2/16	2800	2:11	surveillance	
3/16	2800	2:01	surveillance	
3/31	1900	1:03	surveillance	simulated ESF actuation with loss of offsite power
3/31	2750	2:09	-	offsite power was unavailable
4/6	2750	1:28	surveillance	
4/16	2800	2:00	surveillance	
5/8	2750	1:02	operability	2H EDG out for maintenance
5/9	2800	2:00	operability	
5/9	2850	2:02	operability	
5/14	2800	2:03	operability	operability check prior to deenergizing 500KV bus #2
5/14	2750	2:01	operability	2H EDG out for maintenance
5/18	0	0	maintenance	diesel started to mix coolant
5/18	0	0	maintenance	diesel started to mix coolant
5/18	2750	2:30	maintenance	operability test after maintenance
6/4	2750	2:01	surveillance	
6/13	2750	1:25	Autostart	loss of F transfer bus
6/16	2750	2:01	surveillance	
7/16	2800	2:03	surveillance	
9/9	2800	0:16	maintenance	

TABLE 7 (Continued)

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
9/9	2750	0:13	maintenance	
9/9	2800	0:22	maintenance	
9/10	2775	2:15	maintenance	operability test after maintenance
9/17	0	0	maintenance	
9/17	2750	2:05	surveillance	
10/11	2800	2:01	surveillance	
10/15	1500	2:13	operability	operability test after design change
10/19	3025	30:49	surveillance	24 hour test
10/21	2750	2:02	surveillance	diesel test after SI/Blackout test
11/2	2800	2:01	operability	
11/16	0	0	maintenance	
11/16	2750	2:06	surveillance	
12/7	0	0	operability	2H EDG out of service for preventive maintenance to trouble shoot high crankcase pressure
12/7	2800	2:00	operability	
12/7	2800	1:03	operability	diesel trip on high crankcase pressure
12/10	0	0	maintenance	diesel started for Tech. Rep.
12/10	0	0	maintenance	diesel started for Tech. Rep.
12/10	0	0	maintenance	diesel started for Tech. Rep.
12/10	0	0	maintenance	diesel started for Tech. Rep.
12/10	0	0	maintenance	diesel started for Tech. Rep.
12/10	0	0	maintenance	diesel started for Tech. Rep.

TABLE 7 (Continued)

NORTH ANNA POWER STATION UNIT 2

2J EMERGENCY DIESEL GENERATOR TESTS - 1984

DATE	LOAD(kw)	DURATION (Hrs:Mins)	REASON	COMMENTS
12/10	700-2750	12:00	maintenance	
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	troubleshooting for reason of positive crankcase pressure
12/11	0	0	maintenance	
12/11	0	0	maintenance	
12/17	2800	1:15	surveillance	
12/23	2800	1:21	surveillance	
12/30	2800	1:04	surveillance	

TABLE 8

NORTH ANNA POWER STATION

SUMMARY OF DIESEL MAINTENANCE PROGRAM

Interval	
Semi-Annual	Clean lube oil strainer Change fuel oil duplex filter element Replace lube oil filters Clean fuel oil pump suction strainers Clean lube oil "Y" strainer Clean starting air supply strainers Change oil in Woodward Governor Sample engine lube oil Inspect air filter Service cooling fan drive Clean fuel oil pump duplex strainers Clean fuel oil day tank foot valve strainer
Annual	Overhaul Governor Booster Servo Motor Clean Pre-lube Pump "Y" strainer
Refueling	MMP-P-EG-4, Refueling Outage Inspection. 1. Inspect fuel oil pump seal for leakage. 2. Inspect injection racks and linkage for freedom, cleanliness, proper assembly and lubrication. 3. Inspect vertical drive coupling springs, bolts and nuts. 4. Inspect governor for freedom, cleanliness, and proper lubrication and ensure that the lock nut is tight. 5. Visually inspect lube oil system for leaks. 6. Inspect lube oil strainer and clean as required. Check for metal particles. 7. Inspect fuel oil filters for signs of leakage and replace filter elements. 8. Inspect torsional dampers. Check weights for freedom and visually check for wear. 9. Visually inspect governor drive and check for excessive play in shaft. 10. Visually inspect fuel oil pump and water pump drive. 11. Check alignment of engine and driven equipment and check coupling bolts for tightness. 12. Record crank strain of lower crank shaft on cylinders number 11 and 12. 13. Check air filters and replace (clean as required). 14. Visually inspect fan at top of diesel housing for freedom, cleanliness, oil leaks and proper lubrication.

Refueling (continued)	15. Inspect designated air start check valves. 16. Test Amot valves. 17. Inspect lower drives and timing gears. 18. Check operation of injection nozzles, opening pressure and inspect for leakage. 19. Examine timing chain and check tension. 20. Check fuel injection timing. 21. Perform 50 psi water pressure test on engine block and inspect cylinder liners for internal and external leaks. 22. Inspect the pistons, rings, air and exhaust ports and cylinder liner thru the ports, also check for accumulation of oil in the air receivers. Inspect the turbo protector screen and clean as required. Install new exhaust and air manifold gaskets. 23. Remove blower inspection cover, inspect impellers and check clearances. 24. Check the main and connecting rod bearings for discoloration and evidence of blistering or distortion. Inspect the gap in the main bearing split and the gap between the main bearing shell and main bearing cap. A .002" feeler gauge should not enter either of these gaps. 25. Check crank alignment and crankshaft end float. 26. Check balance of engine using vibration meter. 27. Measure generator air gaps. 28. Inspect internals of lube oil cooler. 29. Inspect overall exterior of diesel for cleanliness. 30. With engine running, vent mechanical governor. 31. Check overspeed trip setpoint by overspeeding engine.
4320 hrs.*	1. Perform MMP-P-EG-4, Refueling Outage Inspection. 2. Inspect govenor, air start distributor and pump drives. 3. Check crankcase oil separator drain tube. 4. Check the flexible pump drive gear. 5. Clean the air inlet ports. 6. Clean the exhaust ports. 7. Turbo charge - clean air impeller and diffuser. 8. Inspect fuel oil relief valve.
8760 hrs.*	1. Clean fuel oil day tank foot valve strainer. 2. Clean crankcase oil separator. 3. Disassemble, clean and service the air start check valves. 4. Disassemble camshaft bearings and check wear. 5. Disassemble and inspect the fuel oil, lube oil and water pumps. 6. Check torsional damper pins and bushings for wear. 7. Remove upper and lower pistons, disassemble and check wear.

*hours of continuous operation

ATTACHMENT 4

PROPOSED DIESEL RELIABILITY

IMPROVEMENT PROGRAM

Proposed Diesel Reliability Improvement Program

A program to improve and maintain the overall reliability of the emergency diesel generators (EDG) will be implemented at North Anna Power Station. Although the reliability improvement program has not been completely finalized and is likely to evolve with experience, we propose to implement this program as currently outlined concurrently with implementation of the proposed technical specifications. Specific components of this program as presently configured are as follows:

1) Monitoring Surveillance Program - The diesel engine manufacturer, Colt Industries, has recommended the recording of engine performance parameters for trend analysis as part of routine surveillance testing. By trending engine performance parameters, it is hoped to predict and prevent failures before they occur as well as identifying root causes for the recently observed diesel engine failures. The program as presently specified includes monitoring and trending the following parameters during surveillance testing:

   i) lube oil header pressure,
   ii) lube oil temperatures, and
   iii) crankcase vacuum

   The following item will be recorded before and after each test:

   iv) lube oil level-record any additions

   In addition, lube oil and the lube oil strainer and filter will be inspected, sampled, and/or analyzed for wear products and chemistry quarterly.

   In a recently received letter dated February 27, 1985, Colt Industries proposed a monitoring and trending program specifying thirty-seven measurements during routine surveillance testing. This recommendation will be reviewed as part of the monitoring surveillance program to determine the parameters to be added to the program. Draft ANSI Standard OM-16, Inservice Testing of Diesel Drives In Nuclear Power Stations, will also be reviewed to determine if additional parameters should routinely be monitored, trended, and analyzed as part of this program. We expect that both of these reviews will be completed by May, 1985. Although the proposed monitoring surveillance program has not been finalized and is likely to evolve with experience, we propose to implement this program as outlined above concurrently with implementation of proposed technical specifications.

2) Discrete Frequency Spectra Analysis - The use of Discrete Frequency Spectra analysis of the EDG's for predictive analysis and preventative maintenance indication was initiated in June 1984. This program is in the developmental stages at North

Anna Power Station. Spectra have been obtained, but reduction of the data into component signatures has not been completed. The use of acoustical analysis is concurrently being investigated for possible application. Based on preliminary program results, an evaluation will be made later in 1985 to determine the extent and continued application, if any, of this effort to the diesel reliability program.

3) Evaluation of Past and Present Practices - An evaluation of past and present diesel maintenance records and operating history will be performed by an independent third party consultant. This evaluation will attempt to identify areas for improving maintenance and operating practices and also to determine the probable root cause(s) of previous diesel engine component failures. As part of this evaluation, the existing maintenance procedures will be reviewed to ensure compliance with the current guidance provided in the EDG technical manuals. Virginia Power has recently contracted Trident Engineering as consultants for this program. This third party evaluation will begin in March, 1985.

4) Slow Start Surveillance Testing Procedure Training - Operations personnel will be trained on the proposed procedures for testing resulting from the Technical Specification change request. This training is in progress and is expected to be complete by March 14, 1985.

As discussed in Attachment 3, engine vibration was noted during the special EDG test on February 13, 1985. Although Colt Industries has stated that the diesel generator has no harmful critical speeds between 450 and 900 RPM, the proposed slow start procedure will be modified to caution the operator to observe for any excessive engine vibration and to quickly pass through such speed if vibration is noted. In addition, the proposed procedures will be revised to alert operations personnel that during the slow start test of the EDG, the EDG being tested is technically inoperable per the Technical Specification. This condition will exist for up to several minutes at the start of the proposed procedure as a result of local control during ramping up to synchronous speed.

5) Japanese Experience - As part of our technical exchange program with the Japan Atomic Power Company, we have requested and intend to review the technical specifications, test procedures, and other related maintenance information associated with the exemplary EDG reliability experienced by the Japanese. A limited amount of information has already been exchanged. We anticipate a more detailed exchange and review to occur late in 1985.

6) Nuclear Guidelines For Diesel Operation - The technical manuals, maintenance criteria, and procedures will be reviewed to ensure that they reflect plant specific standby diesel application. Colt Industries has been contacted in this regard and a follow up meeting to outline this effort is planned in

April, 1985. At that time, a schedule for implementation will be determined.

7) Maintenance Training - As discussed in Attachment 3, training of maintenance personnel at the manufacturer's facility will continue on a routine basis. This training will include both theory and "hands on" application. The next class of twelve personnel is tentatively planned for August, 1985. In addition, Colt Industries will be sending a representative in April, 1985, to provide a three day training course for electricians.