ACCELERATED DOCUMENT DISTRIBUTION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9307140183 DOC.DATE: 93/07/06 NOTARIZED: NO DOCKET #
FACIL:50-269 Oconee Nuclear Station, Unit 1, Duke Power Co. 05000269
50-270 Oconee Nuclear Station, Unit 2, Duke Power Co. 05000270
50-287 Oconee Nuclear Station, Unit 3, Duke Power Co. 05000287
AUTH.NAME AUTHOR AFFILIATION
HAMPTON,J.W. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

SUBJECT: Responds to NRC 930507 ltr containing findings in EDSFI Repts 50-269/93-02,50-270/93-02 & 50-287/93-02.Corrective actions:detailed single failure analysis of Keowee governor sys will be performed & procedures will be upgraded.

DISTRIBUTION CODE: IE01D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 29
TITLE: General (50 Dkt)-Insp Rept/Notice of Violation Response

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD2-3 PD	1	1	WIENS,L	1	1
INTERNAL:	ACRS	2	2	AEOD/DEIB	1	1
	AEOD/DSP/ROAB	1	1	AEOD/DSP/TPAB	1	1
	AEOD/TTC	1	1	DEDRO	1	1
	NRR/DORS/OEAB	1	1	NRR/DRCH/HHFB	1	1
	NRR/DRIL/RPEB	1	1	NRR/DRSS/PEPB	1	1
	NRR/PMAS/ILPB1	1	1	NRR/PMAS/ILPB2	1	1
	NUDOCS-ABSTRACT	1	1	OE DIR	1	1
	OGC/HDS2	1	1	REG FILE 02	1	1
	RES/HFB	1	1	RGN2 FILE 01	1	1
EXTERNAL:	EG&G/BRYCE,J.H.	1	1	NRC PDR	1	1
	NSIC	1	1			

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 504-2065) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

TOTAL NUMBER OF COPIES REQUIRED: LTTR 24 ENCL 24

R I D S / A D D S R I D S / A D D S

Duke Power Company
Oconee Nuclear Site
P.O. Box 1439
Seneca, SC 29679

J. W. Hampton
Vice President
(803)885-3499 Office
(803)885-3564 Fax

DUKE POWER

July 6, 1993

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Site
Docket Nos. 50-269, -270, -287
Inspection Report 50-269, -270, -287/93-02
Reply to Findings

Dear Sir:

By letter dated May 7, 1993 the NRC issued Electrical Distribution System Functional Inspection Report No. 50-269/93-02, 50-270/93-02, and 50-287/93-02. Within this report, six findings were designated as requiring a sixty day response.

As requested in the inspection report, I am submitting a written response to the findings identified within.

Very truly yours,

J. W. Hampton

cc: Mr. S. D. Ebneter, Regional Administrator
U. S. Nuclear Regulatory Commission, Region II

Mr. L. A. Wiens, Project Manager
Office of Nuclear Reactor Regulation

Mr. P. E. Harmon
Senior Resident Inspector
Oconee Nuclear Site

IE01
1/1

FINDING 1: LACK OF INTEGRATED TEST OF EMERGENCY POWER SOURCE FOR OCONEE AND LACK OF TEST TO DEMONSTRATE DESIGN CAPABILITY.

a. **The switchyard isolation (relay 94) of the EGTPS had never been tested. The switchyard isolate complete feature had not been tested. (para. 2.3.1)**

Response to finding 1-a:

As mentioned during the audit, a test for the switchyard isolation relays and the switchyard isolate complete was scheduled for the Oconee Unit 2 refueling outage (RFO). These relays (94) were tested on May 22, 1993 by procedure PT/0/A/0610/022. One channel of the switchyard isolation relays (94) was energized through the Degraded Grid Protection System and proper alignment of the switchyard breakers was verified. This procedure will be performed again using the second channel of switchyard isolation relays during the upcoming Oconee Unit 1 RFO, currently scheduled for the second quarter of 1994. Both channels of the switchyard isolate complete feature were energized through the switchyard breaker auxiliary contacts and closure of the Keowee overhead breaker was verified.

b. **The overhead path from Keowee to the switchyard has never been tested. (para. 3.3.1)**

Response to finding 1-b:

As mentioned during the audit, a test for the Keowee overhead path was scheduled for the Oconee Unit 2 RFO. The overhead path from Keowee through the switchyard to Oconee loads was tested on May 22, 1993 by procedure PT/0/A/0610/022. The Keowee unit aligned to the overhead path was placed in service generating to the grid. A degraded grid problem concurrent with an ES actuation was simulated causing the Yellow bus to isolate from the Duke System. The Keowee unit generating to the grid performed a load rejection and six seconds later reconnected to the overhead path as designed. Simultaneously, PCB 9 opened and four seconds later closed, as designed, to connect Keowee to the Yellow bus and energize transformers CT1, CT2, and CT3. A Reactor Coolant Pump Motor (approximately 9MVA steady state, 47MVA inrush) was started to demonstrate that Keowee could accept block load through the overhead path. The LOCA loads for an Oconee unit are approximately 7MVA steady state, 33MVA inrush.

c. **Keowee Hydro Emergency Start (PT/0/A/0620/016) test procedure does not test the units in the method that UFSAR Section 8.3.1.1.1 indicates that the unit is loaded. (para. 3.4.2.1)**

Response to finding 1-c:

Section 8.3.1.1.1 of the FSAR states, "Each unit's voltage regulator is equipped with a volts-per-cycle limiting feature which permits it to accept full emergency power load as it accelerates from zero to full speed within 23 seconds...". Procedure PT/0/A/0620/016, performed annually, verifies that both Keowee units reach rated speed and voltage within 23 seconds unloaded. Information relative to the Keowee unit's ability to accept load as it accelerates from zero to rated speed within 23 seconds was provided subsequent to the exit as stated in para. 3.4.2.1 of the inspection report. The information provided was periodic test procedure PT/0/A/0610/01J prior to 1987. Keowee Emergency Start was initiated and a Keowee unit was loaded with approximately 2MVA steady state load after 11 seconds, and accelerated to full speed and voltage within 23 seconds. This test demonstrated that the Keowee units can accept a load and accelerate to rated speed and voltage within the time specified in the FSAR. To acquire loads equivalent to full emergency power loads during a test is not practical because it would require removing significant safety systems from service.

d. **The composite of the present Keowee tests do not bound the design requirements. (para. 3.4.2.1)**

Response to finding 1-d:

During a design basis event the Keowee Hydro Units are required to perform as follows:

1. a. If shutdown, accelerate to rated voltage and speed within 23 seconds.
   b. If running, reject load and separate from the grid.

2. Align to their designated power path (overhead or underground).

3. Accept block loading of 1 Oconee unit's LOCA loads and 2 Oconee units' hot shutdown loads.

The ability of the Keowee units to accept block loading (approximately 2MVA steady state) and accelerate to rated speed and voltage within 23 seconds after starting was demonstrated prior to January 1, 1987 by procedure PT/0/A/0610/01J (see response to finding 1-c). The ability of the Keowee units to accelerate to rated speed and voltage within 23 seconds after starting is demonstrated annually by procedure PT/0/A/0620/016.

Response to finding 1-d: (continued)

The ability of a Keowee unit to reject load and separate from the grid, if generating, has been demonstrated every RFO since January 1, 1992 by procedure PT/0/A/0610/01J.

The ability of a Keowee unit to reconnect to the overhead path 4 - 6 seconds after grid separation was demonstrated by procedure PT/0/A/0610/22 on May 22, 1993. Prior to May 22, 1993, periodic circuit continuity checks, periodic calibration tests and post modification tests were credited as the method of operability verification of this portion of the system.

The ability of the Keowee units to properly align to the underground power path is demonstrated every RFO by procedure PT/0/A/0610/01J.

The ability of the Keowee units to accept block loads equal to or greater than emergency power loads is demonstrated annually by procedure PT/0/A/0620/016. Greater than 22 MW is loaded to each Keowee generator from the system grid at a maximum rate. This loading exceeds the maximum steady state emergency loading requirement. Additionally, since the audit, procedure PT/0/A/0610/022 was performed where a Reactor Coolant Pump Motor was successfully block loaded onto a Keowee Unit. Data taken during this test shows the loading to be approximately 9MVA steady state and 47MVA inrush. This exceeds the maximum emergency block loading associated with one LOCA unit.

Testing of the Keowee Hydro Station to perform its function as the Oconee On-site Emergency Power Source adequately bounds its design requirements.

FINDING 2: ANALYSIS, STUDY, OR CALCULATIONS NOT COMPLETE OR NOT PERFORMED.

a. The calculation OSC-2059 may not have taken the worst bounding condition when determining the voltage on the 4160V and lower voltage safety busses. (para. 2.3.2)

Response to finding 2-a:

Five concerns relative to this finding were mentioned. However, as noted in the EDSFI report, the team concluded that the results were acceptable due to the fact that the end results would only be off 2-5% (para. 2.6.2).

Response to finding 2-a: (continued)

One concern mentioned was the fact of having only one input file for both the short circuit and voltage dip calculations. This file models the unit specific auxiliary power system. The use of one input file is acceptable since the load input data is based on manufacturer's data or actual test data and the cable lengths modeled are the actual lengths based on cable routing sheets and plant inspections.

A second concern mentioned was that the computer program might not adequately formulate the transformer tap position, nor the pre-fault voltage on the bus. This concern will be addressed in the next revision of the specific calculation. The Unit 1 calculation, OSC-2059, is scheduled first with an expected approval date of December 31, 1993.

Another concern noted that when determining the total loads on transformers the calculations used 75°C cable temperature, constant motor efficiency and power factor at full load and only one 230 kV system impedance. As noted during the audit, changing cable temperature from 75°C to either 25°C or 90°C would not invalidate the results. A cable temperature of 75°C is very much in line with cable temperatures in the plant, therefore, this value is acceptable. Constant motor efficiency, power factor and 230 kV system impedance will be addressed during the next scheduled revision to each unit's voltage and load study calculation. The Unit 1 calculation, OSC-2059, is scheduled first with an expected approval date of December 31, 1993.

b. No analysis or test to verify that the rapid transfer (transfer of power to MFBs) timing was correct. (para. 2.5)

Response to finding 2-b:

The transfer scheme was tested during original unit start-up testing. Since then, Oconee has 20 years of satisfactory operating experience with the present transfer scheme. This circuit has been challenged with each unit trip. As mentioned during the audit, an analysis to document the transfer adequacy is currently scheduled to be completed by June 30, 1994.

c. Licensee did not have a transient voltage study for the 4 kV safety load groups when they are supplied from Lee gas turbine or from Central substation. (para. 2.6.1)

Response to finding 2-c:

A transient analysis for the loads when fed from either Lee or Central does exist and was used in each specific calculation study. A tool to dynamically model the source was not available when the calculation was performed.

Response to finding 2-c: (continued)

Although this was highlighted as a concern, the team concluded, as mentioned in the EDSFI report, that Lee Combustion Turbine Generator would supply adequate voltage to the standby busses to meet load voltage requirements (para. 4.1.1). Also, the team mentioned that no concerns were noted relative to voltage adequacy when fed from Central switchyard (para. 4.1.2).

Duke Power is currently certifying a computer program, CYME, capable of dynamically modeling generating sources. Once completed, the Lee calculation will be revised to include the transient response of the source with the present transient response of the loads. The revisions are scheduled to be completed by December 30, 1994.

As noted during the audit, the source impedance seen by transformer CT5 is lower than the source impedance seen by CT4. Therefore, for the same steady state voltage, if the transient voltage to Oconee loads is adequate when supplied from CT4 then it is better when supplied from CT5. The calculation supporting voltage adequacy from Central switchyard will be revised to document this by December 30, 1994.

d. **No study had been conducted to review control cable length and the size of the fuses being used to protect such circuits. (para. 2.7.3)**

Response to finding 2-d:

Calculations for the switchyard, plant, and Keowee dc are either complete or presently being performed. These analyses use actual cable lengths based on cable routing sheets or inspections and evaluated circuit adequacy to the individual component level. Recent modifications in the "E", "S", and "SK" breaker control circuits are a result of these ongoing analyses.

The specific circuit addressed in the report is associated with the Degraded Grid Protection System. Faults within this circuit loop, regardless of position, would cause this logic to go to its dropped-out (safe) state and provide status alarms and indication that would alert the control room operator to the problem. Therefore, no action is planned for the fuses associated with this circuit.

During their next scheduled revision, each unit's voltage and load study calculation will address the adequacy of fuse sizes in MCC control circuits during transients and steady state conditions. The Unit 1 calculation, OSC-2059, is scheduled first with an expected approval date of December 31, 1993.

e. **KC-0073, Auxiliary Power System Voltage Level, Rev 1, 3/9/92, voltage analysis of the Keowee 600V auxiliaries was considered incomplete. The maximum and minimum expected voltages should have been determined for the evaluation. (para. 3.2.4.4)**

Response to finding 2-e:

The Keowee AC auxiliary power system is a simple auxiliary power system. Each unit has its own load center and two motor control centers. The load of the system (ie. both units) is less than 350 KVA. Power cable runs from the source to the equipment are relatively short. The referenced calculation provides a base line of the voltage profile when supplied from each unit specific transformer and the backup CX transformer. As noted in the EDSFI report, no operability concerns exist relative to the Keowee 600V auxiliary power system (para. 3.2.4.4). Furthermore, as mentioned during the audit, calculation KC-UNIT-1-2-0095 is being performed to further address Keowee auxiliary power system voltage adequacy. This calculation is scheduled to be completed by October 30, 1993.

f. **Analysis to support the fact that Keowee auxiliaries will not be degraded due to overvoltages or overfrequency conditions when being supplied from one Keowee unit. (para. 3.2.4.4.)**

Response to finding 2-f:

While Keowee supplies power to Oconee's emergency loads it also supplies power to its own auxiliaries. No credible single failure exists that will cause a Keowee unit to produce overvoltage. Therefore, overvoltage is not a concern for the Keowee auxiliaries when being supplied from a Keowee unit. Not withstanding the above, failures that would cause overvoltage would only impact the auxiliaries of that Keowee unit since only one unit's auxiliaries can be normally fed from its associated unit based on current dedicated alignment.

As with the regulator, no credible single failure exists that will cause a Keowee unit to produce sustained overfrequency. Similar to the above, failures that would cause overfrequency would only impact the auxiliaries of that Keowee unit since only one unit's auxiliaries can be normally fed from its associated unit based on current dedicated alignment. Frequency transient effects on Keowee auxiliaries are being documented. This documentation is scheduled to be completed by March 30, 1994.

g. **Identify the full scope and complete individual voltage component calculations for Keowee. (para. 3.2.4.4)**

Response to finding 2-g:

As part of the Design Basis Documentation (DBD) effort, available documentation of system design basis of plant systems and supporting analyses are researched. Design basis efforts have generally identified certain analyses that were not documented. The Keowee dc DBD is scheduled to be completed by December 31, 1993. As noted during the audit, calculations are being performed to analyze circuits down to the component level. Completion of these revisions is scheduled for December 31, 1993.

h. **No analysis to support the assumption that Oconee safety loads could properly perform during an overfrequency transient lasting 40-50 seconds. (para. 3.3.3)**

Response to finding 2-h:

Several Keowee load rejection tests at various load levels were performed. The data obtained is being used to document the adequacy for frequency response of safety loads following a Keowee load rejection. The analysis is scheduled to be completed by March 30, 1994.

i. **Several calculations were not complete for the SSF. (para. 5.1)**

Response to finding 2-i:

As noted in the system DBD and during the audit, voltage adequacy of the SSF electrical system when supplied from the SSF diesel generator poses no operability concerns. Documentation exists, OSC-0931, showing voltage adequacy of the SSF when supplied from a degraded 230 Kv switchyard. Since the SSF diesel generator is controlled to maintain 4160V on the 4160V bus, the above mentioned calculation is a bounding case. As mentioned in the EDSFI report, an analysis to formally document voltage adequacy for the SSF diesel generator is scheduled to be completed by December 30, 1994.

Although a formal fault study analysis for the SSF is not complete, the system design is adequate. The following reasons support this conclusion: 1) The electrical equipment is the same as equipment purchased for the plant, thus they have the same fault duty ratings, 2) The fault currents would be less within the SSF electrical system than faults within the Oconee units electrical system because of voltage drops through the cables, and 3) The SSF diesel generator is a

Response to finding 2-i: (continued)

smaller source of fault current than plant fault sources. As mentioned in the EDSFI report, this item is an open item from the DBD and is scheduled to be completed by December 30, 1994.

j. To support calculation OSC-4458 for the Switchyard 125 VDC power a more rigorous test of the minimum required pickup voltage may be needed. (para. 6.3.2)

Response to finding 2-j:

Calculation OSC-4458 calculates the 230 kV switchyard DC system voltage to the component level. Adequacy of voltage under worst case voltage conditions to each system component was documented based on manufacturer's information. The voltage at the majority of the components was within the manufacturer's supplied test data. Only one case had voltages significantly lower than supplied manufacturer's test voltage. This worst case example is the voltage to Cutler Hammer Type M relays used in the switchyard PCB trip circuits on Startup Transformer Lockout. The worst case voltage calculated is 71.5 Vdc. Prior to the EDSFI audit, a test report from Cutler Hammer was used as justification for adequacy of voltage. The test involved testing several Cutler Hammer Type M relays by the manufacturer to voltages below our minimum required value. Since the EDSFI audit, a third party supplier for this type relay tests these relays to pick up at voltages as low as 70 Vdc (58% of rated voltage). As part of our dedicated supplier requirements, the operating specifications of the equipment are reproducible and verified.

FINDING 3: EXAMPLES OF INADEQUATE CONTROL OF DRAWINGS AND SETPOINT DOCUMENT.

a. Inaccuracies were noted in the recently developed Keowee mechanical support systems flow diagrams. Drawings of the Keowee air systems were not available. This was acknowledged as PIP 0-093-0197. (para. 3.2.2)

Response to finding 3-a:

The minor flow diagram deficiencies will be corrected under the editorial change process by September 30, 1993. These deficiencies are being tracked by PIP's 0-093-0102 and 0160, not 0197 as noted in paragraph 3.2.2 of the EDSFI report. The proper PIP numbers were identified in EDSFI RFI No.'s 21, 74, 75 and 76. The safety related portions of the Keowee governor air systems are shown on flow diagrams KFD 104A-1.1 and 2.1.

Response to finding 3-a: (continued)

Another concern was noted to be an example of Finding 3 in EDSFI Report paragraph 3.6.3 which was not mentioned in Appendix A of the report. This concern pertains to the Operational Experience Review. This review has been identified as part of Design Study ONDS-0258. The review is in three major stages. The first stage was the compilation of a broad ranging list of compliance items that may have application to Keowee. This stage was completed in December 1992. The second stage is a detailed review of the items on the list to determine applicability to Keowee. If an item is found to apply to Keowee, a review of the actions taken for that item will determine if Keowee was included in the response. The results of the second stage review will be a list of compliance items that are applicable for Keowee but no response has been given. This will be completed by July 15, 1993. The third stage of this review will involve the determination of action plans for each of the missed items. This stage is planned to be completed by January 31, 1994.

b. A controlled document for the setpoints at Keowee (except for electrical relay settings) was not available. (para 3.3.4.3)

Response to finding 3-b:

As detailed in paragraph 3.3.4.3 of the EDSFI report, the setpoints at Keowee ARE controlled via drawings, procedures, and personnel experience. The finding concerned only the fact that the procedural control and use of the Oconee Alarm and Setpoint Document at Keowee had not been implemented in the same manner as the rest of the site. No concerns were identified relative to equipment operability as a result of setpoint problems. For the example cited in the report, the setpoint was correct but did not agree with all controlling documents. The testing done of the Emergency Power System and at Keowee has also not uncovered any setpoint problems.

As part of the Oconee Nuclear Station Emergency Power Plan, a comprehensive effort to identify equipment and associated procedures at Keowee is underway. An integral part of this plan is to identify and verify instruments with setpoints and add these to the Oconee Alarm and Setpoint Document. Due to uncertainties of the total amount of equipment and setpoints that will have to be addressed, possible programmatic problems requiring documentation changes, and the lack of structured equipment database information available, a completion date of June 1, 1995 is considered appropriate.

FINDING 4: AREAS WHERE ADDITIONAL LICENSEE ACTIONS ARE WARRANTED TO COMPLETE CORRECTIVE ACTIONS.

a. The response of the Keowee governor system to postulated failures (ie., loss of oil level) was not fully analyzed or understood. (para. 3.2.4.1)

Response to finding 4-a:

A detailed single failure analysis will be performed for the Keowee governor system. This analysis will fully document the conclusions previously identified in the Memo to File dated January 15, 1993 and will include the postulated failure mechanism identified from the October 1992 event. This analysis will be completed by September 30, 1993. The postulated failure concerns the loss of governor control following extended loss of auxiliary AC power. To enhance the governor's availability, a modification is planned to change one of the governor oil pumps to DC power. This will greatly increase the amount of time that a Keowee unit can run without auxiliary AC power. This modification (52955) is presently scheduled for November, 1995 (Innage 61).

b. Implementation of the setpoint revision to the Loss of Field relay at Keowee had not been implemented. (para. 3.2.4.1)

Response to finding 4-b:

The need to implement the setpoint change was identified in March, 1991 and documented in Station Problem Report (SPR) 3426. At that time it was determined that the setpoint change was NOT tied to the operability of the equipment but was an enhancement to the equipment's operating characteristics. The SPR was activated for implementation in July, 1992 and assigned to Component Engineering for resolution under the minor modification process. This minor modification was evaluated by Component Engineering and scheduled for implementation in the last quarter of 1993. All of this activity predated the EDSFI finding. The setpoint change will be implemented by October 1, 1993.

FINDING 5: KEOWEE ENGINEERING ANALYSES WERE NOT SUFFICIENTLY COMPREHENSIVE AND SPECIFIC VALUES HAD NOT BEEN ESTABLISHED THAT WOULD BOUND DESIGN CRITERIA.

a. The licensee did not consider all credible failure modes for the Keowee governor control system and voltage regulator. (para. 3.2.4.1)

Response to finding 5-a:

Appropriate single failure criteria has been applied in evaluating the Keowee voltage regulator and governor.

As noted during the audit (RFI-083), calculation OSC-4995 documents that no credible single failure exists that would render the regulator inoperable. This analysis includes an evaluation of the volts/hertz limiter, as discussed in detail during the audit, but is not limited to this feature.

As with the regulator, no credible single failure exists that would render the governor inoperable. A detailed single failure analysis will be performed for the Keowee governor system. This analysis will formally document the conclusions previously identified in the Memo to File dated January 15, 1993 and will include the postulated failure mechanism identified from the October 1992 event. The analysis will be completed by September 30, 1993.

b. The basis for bypassing Keowee trip functions during emergency start of the unit was not fully analyzed or documented. (para. 3.2.4.2)

Response to finding 5-b:

Keowee Hydro is designed to provide emergency power to Oconee Nuclear Station. When operating as Oconee's emergency on-site power source certain protective devices are bypassed. The devices bypassed are those which are important under normal operating conditions, but not needed to protect the unit during an emergency. These devices protect the unit from failures that, if not attended to, would degrade the unit. Also, the presence of out of normal operation of these bypassed devices would not cause a catastrophic failure of the unit, but would still give alarm indication. Some of the protection devices bypassed would require multiple failures to actually provide a lockout signal, but the mis-operation of the protective device would shut the unit down. Therefore these are bypassed. As discussed during the audit, calculation OSC-5096 addresses Keowee single failures and protective trips and documents that the present configuration is adequate. Although adequate, a more optimal system may be obtainable. PIP 0-093-0081, initiated on January 21, 1993, addresses this issue and requested a design study to further examine the issue. The scheduled completion date is March 30, 1994.

c. The effect of frequency of the electric power supplied by Keowee to ECCS pump motors had not been fully evaluated. (para. 3.4.1)

d. Acceptable voltage and frequency limitations for Keowee electrical auxiliaries and the emergency power system should be defined. Additionally, acceptable recovery times from voltage and frequency excursions should also be identified. (para 3.4.1)

Response to findings 5-c and 5-d:

Since items 3 and 4 are similar, the response to these concerns are being combined. The response to RFI No. 03 and 039 provided during the audit addressed these concerns. See Attachment I for details.

Furthermore, with the aid of new dynamically modeling tools and new test results, calculation OSC-2444 will be revised, during the next scheduled revision, to utilize the full modeling capability presently available and document the information shared during the audit. The next revision is scheduled for December 30, 1995.

FINDING 6: DESIGN FEATURES AND MECHANICAL COMPONENTS AT KEOWEE WERE IDENTIFIED THAT WERE NOT BEING TESTED.

a. The team identified several components involved in the operating of the Keowee units during an emergency start which were not being tested. (para. 3.4.2.4)

Response to finding 6-a:

All of the components listed by the team will be tested as described below. Most components are challenged during normal generation to the grid and confidence in the proper operation of these components is high. Those that are not normally challenged are tested, but without quantitative measures. Procedures will be developed with specific acceptance criteria to ensure our confidence in these devices is justified.

PIP 0-093-0167 was written on level switches in the oil systems affecting operability of the Keowee units under emergency start conditions not being calibrated by procedure. Procedures have been written for these switches and testing will be completed by December 31, 1993. The PIP has been closed.

Response to finding 6-a: (continued)

PIP 0-093-0195 was written for pressure switch 63F on the CO2 system. MP/0/A/2000/059 and 060 are being revised to reference new procedures IP/1/A/0400/023 and IP/2/A/0400/023. A minor modification for a test tee and valve will be required. The procedure, minor modification and test will be completed by September 1, 1993.

Procedures on instruments and electrical equipment have begun to be upgraded. This will be a continuous process. MP/0/A/2001/002, Inspection and Maintenance of Keowee ACBs and Associated Disconnects and Bus, was just completed for this year, including inspection of the check valves on the air accumulators and testing of the two air pressure switches. MP/0/A/2001/002 will be revised by June 1, 1994 for the next inspection to include specific guidance on check valve inspection and air pressure switch testing.

b. Testing was not being performed on safety related mechanical components (ie., coolers and pumps). (para. 3.4.2.4)

Response to finding 6-b:

The proposed program changes for inclusion of Keowee equipment in the Inservice Testing (IST) program have been issued for review and comment by affected parties. Full implementation is targeted for December 31, 1993. This will include procedure development, modifications required, and initial testing. The additional testing will be integrated with current testing to qualify the successful results currently obtained.

Although cooler maintenance is performed, the coolers are not in a formalized maintenance program. Cooler testing will be addressed considering the guidance provided under GL 89-13 and current cooler maintenance performed. Maintenance revisions will be made as deemed necessary, although current disassembly and inspection procedures may well be appropriate. Target completion for this program is March 1, 1994.

Valves 1OG-7 and 2OG-7 are specifically referenced in the audit. These valves should not be in the IST program because they are part of the governor 'skid'. It has not been typical for Duke Power to include skid equipment in the IST program. The valves should not be on the active valve list since they are considered a piece of the governor component. In addition, these valves are float valves. There is no criteria in ASME Section XI for testing these valves. It is agreed that a test should be performed to verify valve operation and qualify the successful performance of the valves. This test will be added to MP/1/A/2200/3 and MP/2/A/2200/3, which are performed annually. The test will be written, reviewed, and approved by December 31, 1993.

Response to finding 6-b: (continued)

The ACB air tank check valves were specifically mentioned in the audit. These valves should not be in the IST program because they are part of the ACB 'skid'. The current testing of these valves is considered appropriate by this audit and this testing will continue. Procedural weaknesses are being addressed. The ACBs are scheduled for replacement by NSM-52890, currently scheduled for implementation in the 3rd quarter of 1994. This makes extensive program changes unwarranted. The new breakers currently being proposed are of the stored energy or spring type actuation, thus eliminating the current air requirements.

ATTACHMENT I

FINDING 5 - Items c & d

Supplemental Information

Oconee EDSFI

RFI No. 03 and 039 - Follow Up

Initiator: Bill Raughley

Title/Subject: Keowee Generator Terminal Voltage

Response by: Sokha Chhak/ Todd Grant /Jay Bryan, 2/25/93

As stated in the earlier response to the subject RFI, CYME program was used to perform a preliminary transient analysis to support OSC 2444. The attached Figures 1 through 10 are the summary of the CYME results for both the LOOP and LOOP/LOCA cases. The analysis assumes Keowee to be at steady state prior to Emergency Loading. For the scenario involving Keowee unit coming up to speed, Emergency loads will be accepted by Keowee at voltage and frequency below rated values, but in constant ratio due the volt/Hz feature. Generator voltage and frequency are expected to be approximately 70% (using test data indicating Keowee full start time of 18 seconds). This values could be higher or lower depending on Keowee starting time (23 seconds maximum committed in the FSAR), but no less than 50% due to the setting of the EPSL undervoltage relays. For this loading condition motors should be able to accelerate as normal because the low voltage condition is also accompanied by a low frequency. Contactors will pick up when sufficient voltage is available.

After the first response to the subject RFI, several meetings had taken place with the initiator to discuss concerns that are related to the results of the CYME study.

Concerns brought out by the initiator during the meetings are:

1. Contactor operations during transient dips and fuse adequacy during prolonged inrush.

2. Motor acceleration.

3. Motor protective devices.

4. Effects on low voltage motors supporting large motors, if exist.

5. Effects on process flows when pump motors are operating at frequency slightly below 57 Hz.

6. Effects of under-frequency condition on contactors, chargers.

Responses to the above concerns are as follows:

1. When a LOCA unit is connected to the Keowee unit while the generator is not at rated voltage and frequency, see Attachments 1 and 2 for the response. Fuse analysis was included in the previous response to the subject RFI.

2. In the previous response, motor acceleration times were included. For the case where the LOCA unit is connected to the Keowee unit while the generator is still coming up to speed, the conclusion is still valid because of the volt/hertz theory.

3. Analyses of motor protective devices were given in the previous response.

4. There is no low voltage motor required to support large safety motors.

5. For three unit LOOP, the frequency drops to 56Hz and remains below 57Hz for approximately 15 seconds, see Fig. 2. This will result in some reduction in process flow . However, it was determined that for a LOOP condition, process flow rate is not critical.

For the LOCA/LOOP condition, when the two loop units are connected to Keowee, the frequency drops to 56.5 Hz and remains below 57 Hz for approximately 10 seconds (see Fig 6). This will result some reduction in process flow. The critical process is the LPI system. B&W analysis requires that 90% of the required flow must be obtained within 48 seconds. This 90% represents 90% flow of one LPI pump. In a LOCA event, two LPI pump motors will be started and run. It is judged that the system frequency of 56.5Hz for 10 seconds will not cause two LPI pumps to produce flow less than the analyzed flow rate. Since this low frequency condition occurs during the time that two other LOOP units are being loaded to Keowee(due to a single failure of the overhead path), other failures need not be postulated and therefore the two LPI pumps should always be available.

6. For contactors see Attachments 1 and 2. Based on discussions with the charger manufacturer, when the frequency drops below 57 Hz the DC output may be lost, but the charger will not be damaged. The DC output will be present again when the frequency becomes greater than 57Hz. Momentary loss of charger output is merely an extension of the transfer time, in which input power to the charger is lost anyway. Batteries are sized to provide adequate dc control power for one hour without chargers.

Form 00184 (R4-88)

DUKE POWER COMPANY

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE 3 UNIT LOOP.

By DNC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

KEOWEE GENERATOR VOLTAGE, FREQ

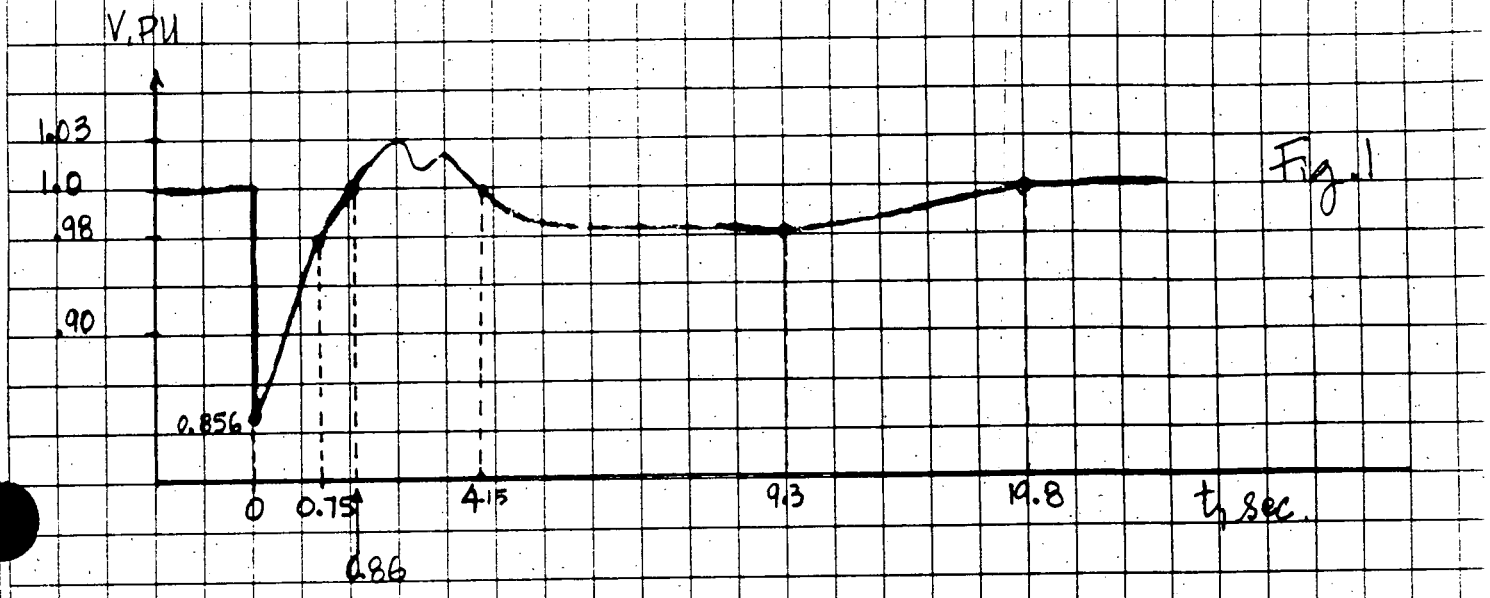

Fig. 1

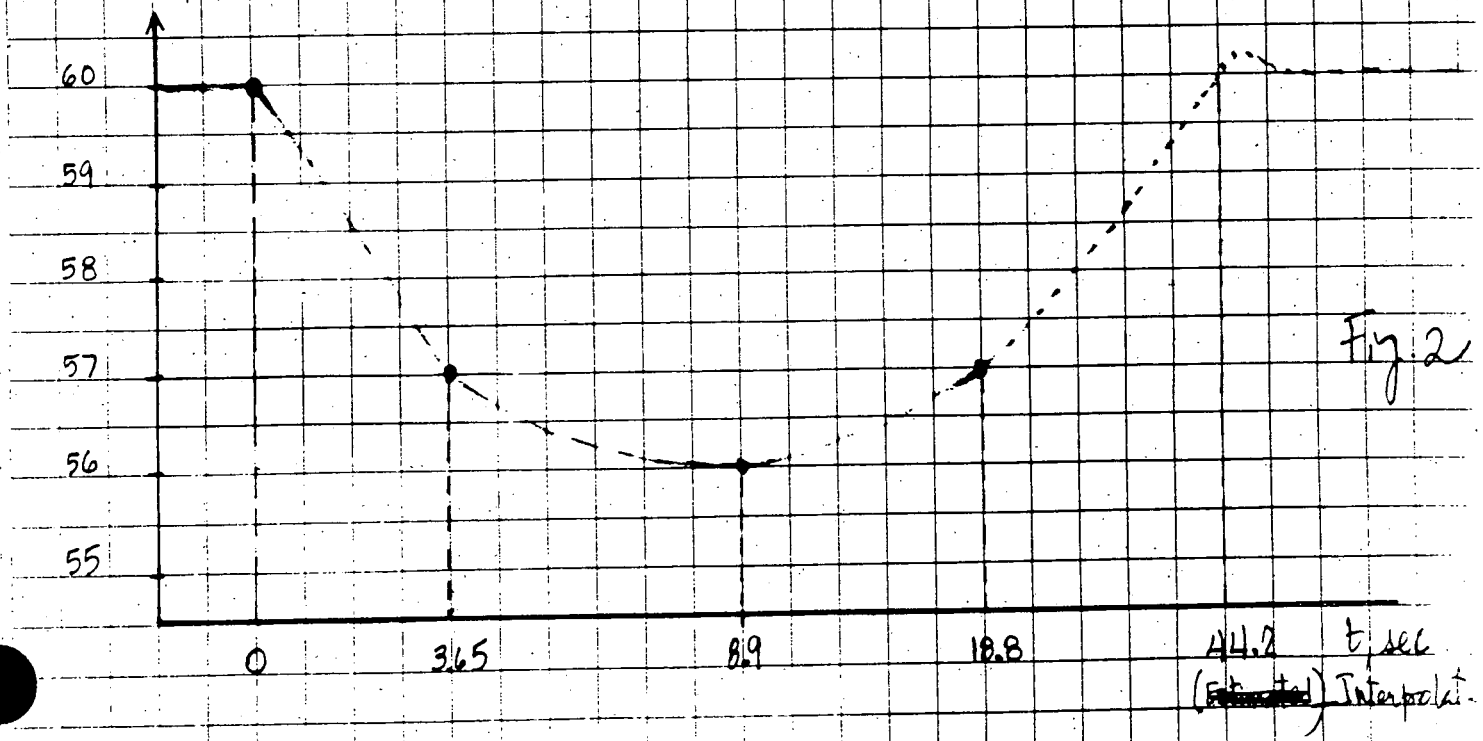

Fig. 2

DUKE POWER COMPANY

Form 00184 (R4-88)

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE

3-UNIT LOOP By SMC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

4 KV 1TC, 2TC, 3TC
1TD, 2TD, 3TD
1TE, 2TE, 3TE
} West end.

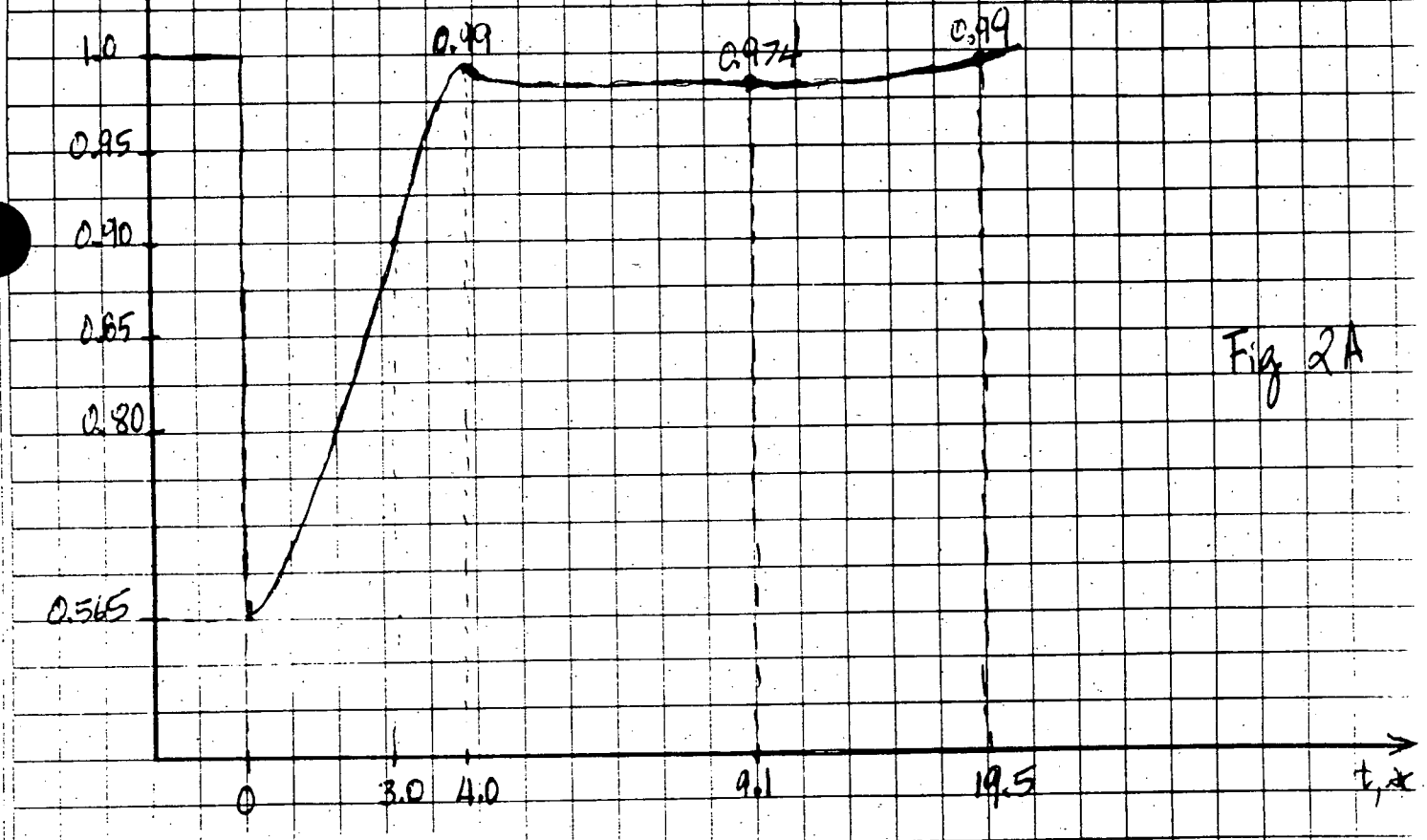

Fig 2A

DUKE POWER COMPANY

Form 00184 (R4-88)

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE

3 ϕ - LOOP By ONC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

660V 1XS1, 1XS2, 1XS3, 1XSF
2XS1, 2XS2, 2XS3, 2XSF
3XS1, 3XS2, 3XS3, 3XSF } (Worst one)

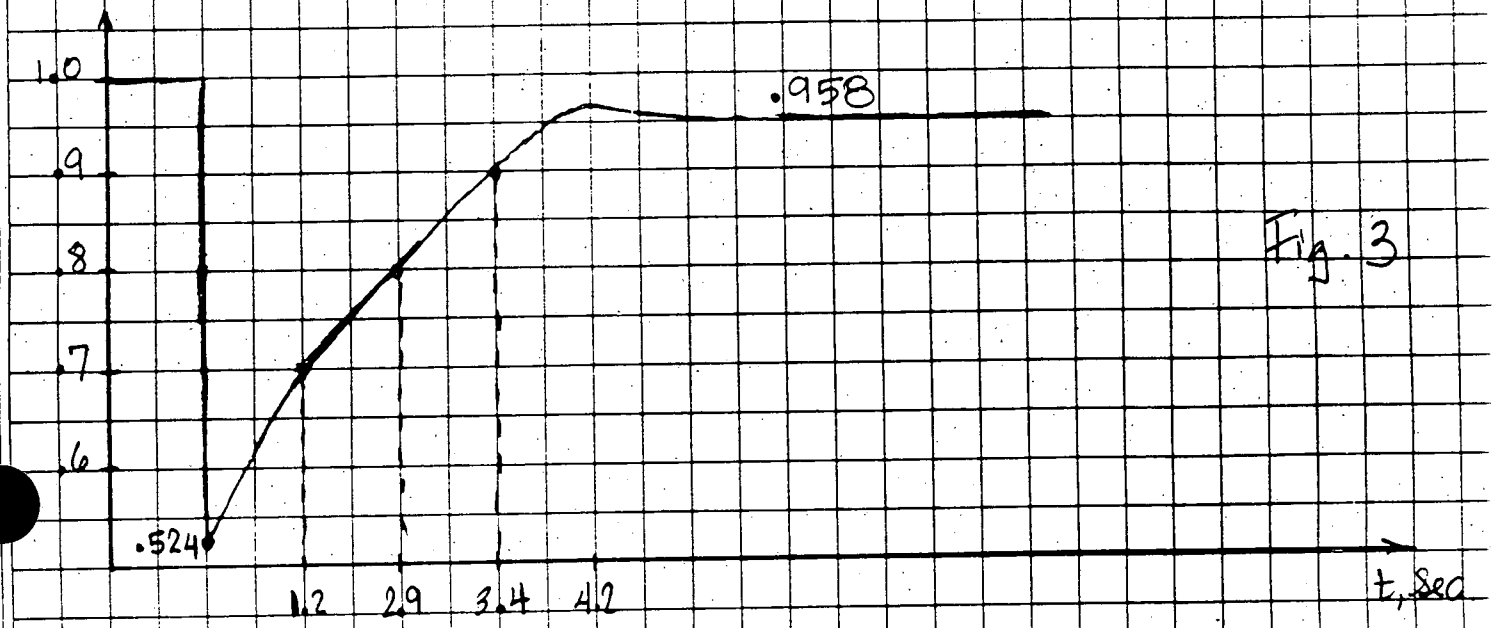

Fig. 3

208V 1XS1, 1XS2, 1XS3, 1XSF
2XS1, 2XS2, 2XS3, 2XSF
3XS1, 3XS2, 3XS3, 3XSF } (Worst one)

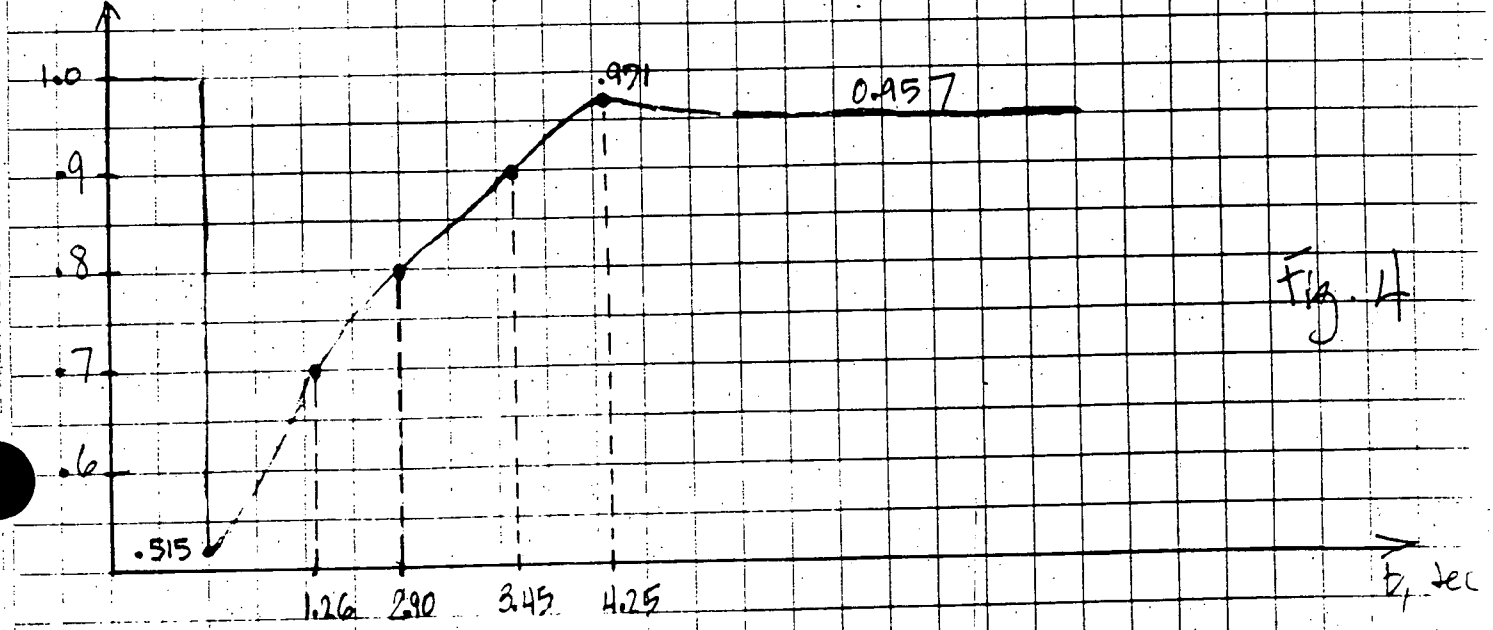

Fig. 4

DUKE POWER COMPANY

Form 00184 (R4-88)

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE
LOCA / LOOP

By SNC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

KEOWEE GENERATOR VOLTAGE & FREQ.

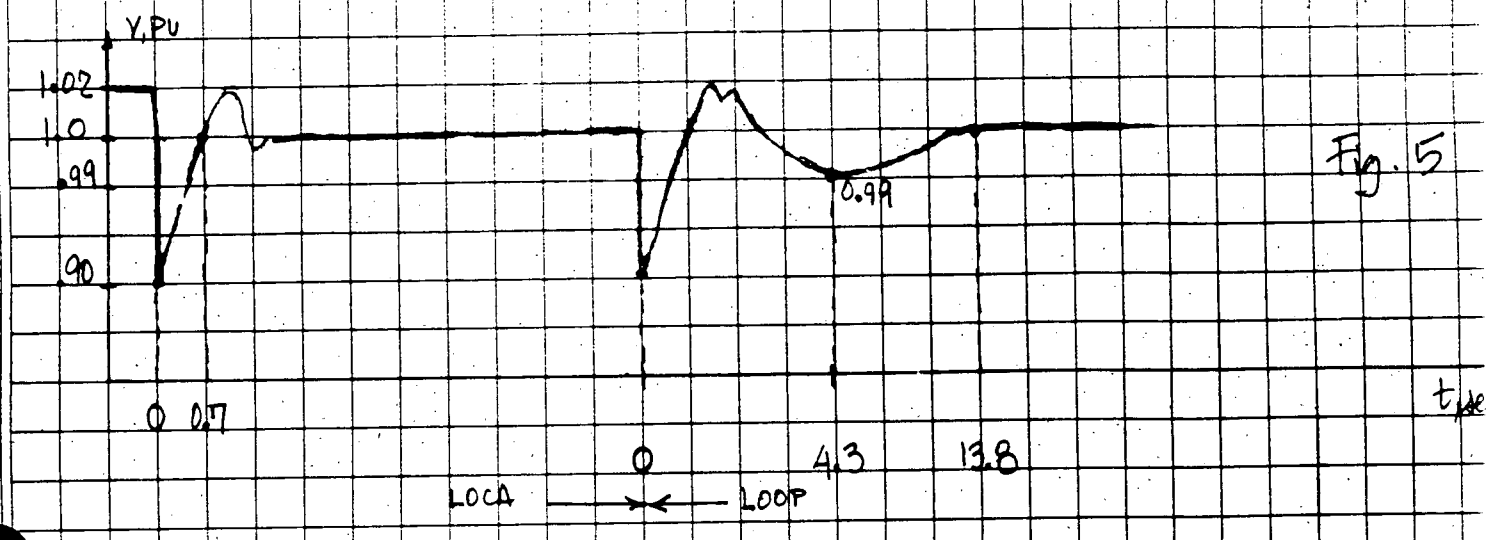

Fig. 5

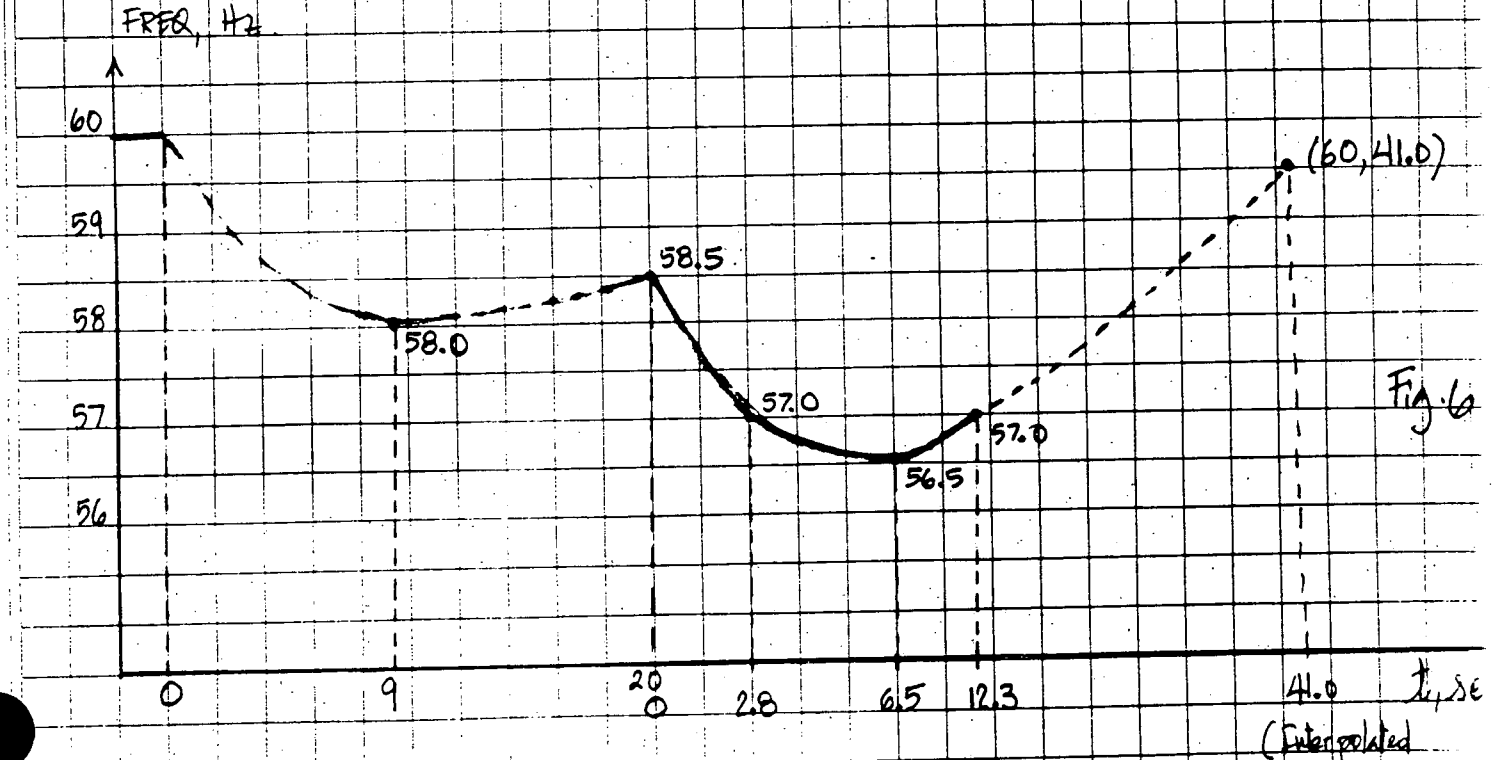

Fig. 6

Form 00184 (R4-88)

DUKE POWER COMPANY

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE

LOOP / LOCA By SNC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

ΔKV 1TC, 2TC, 3TC
1TD, 2TD, 3TD
1TE, 2TD, 3TE
} Worst Case.

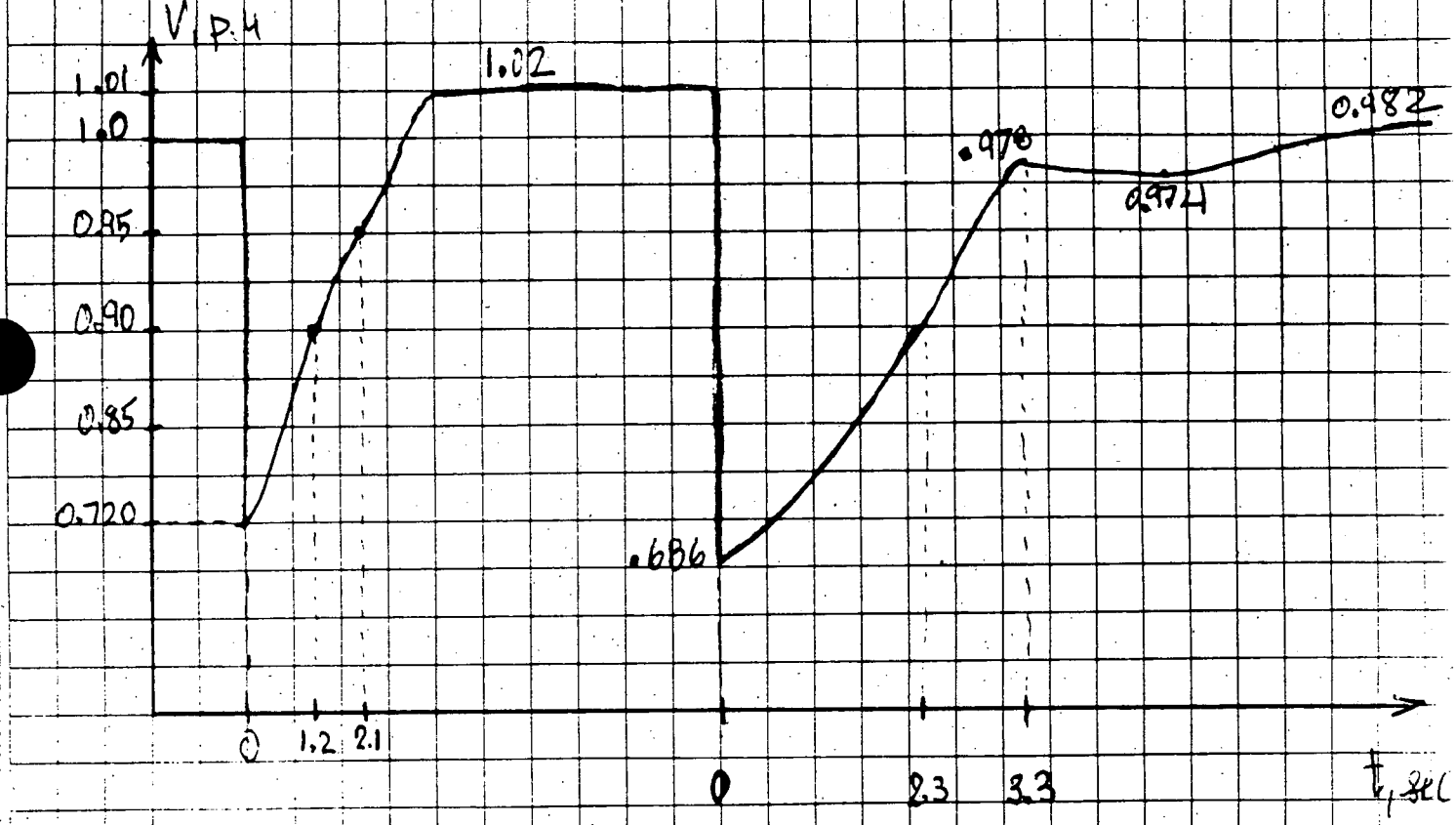

Fig 6.A

Form 00184 (R4-88)

DUKE POWER COMPANY

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE

LOCA/LOOP By SNC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

600V 1XS1, 1XS2, 1XS3, 1XSF (worst one)

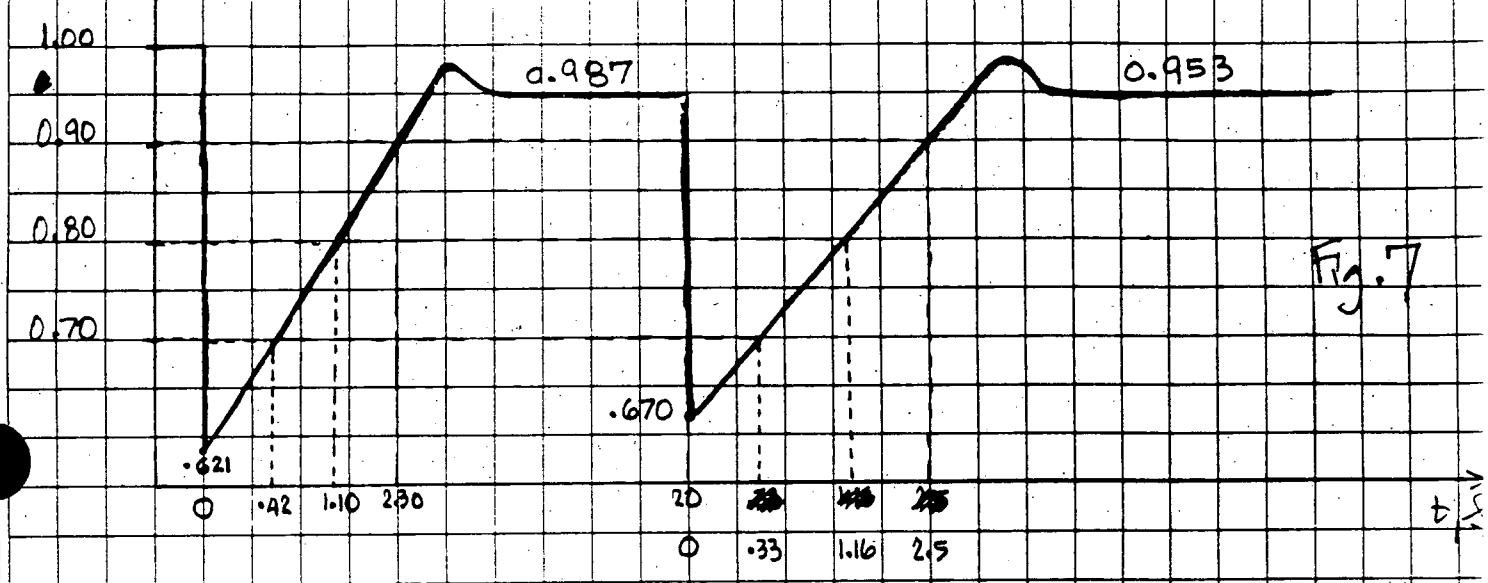

Fig. 7

600V 1XS1, 1XS2, 1XS3, 1XSF (Worst one)

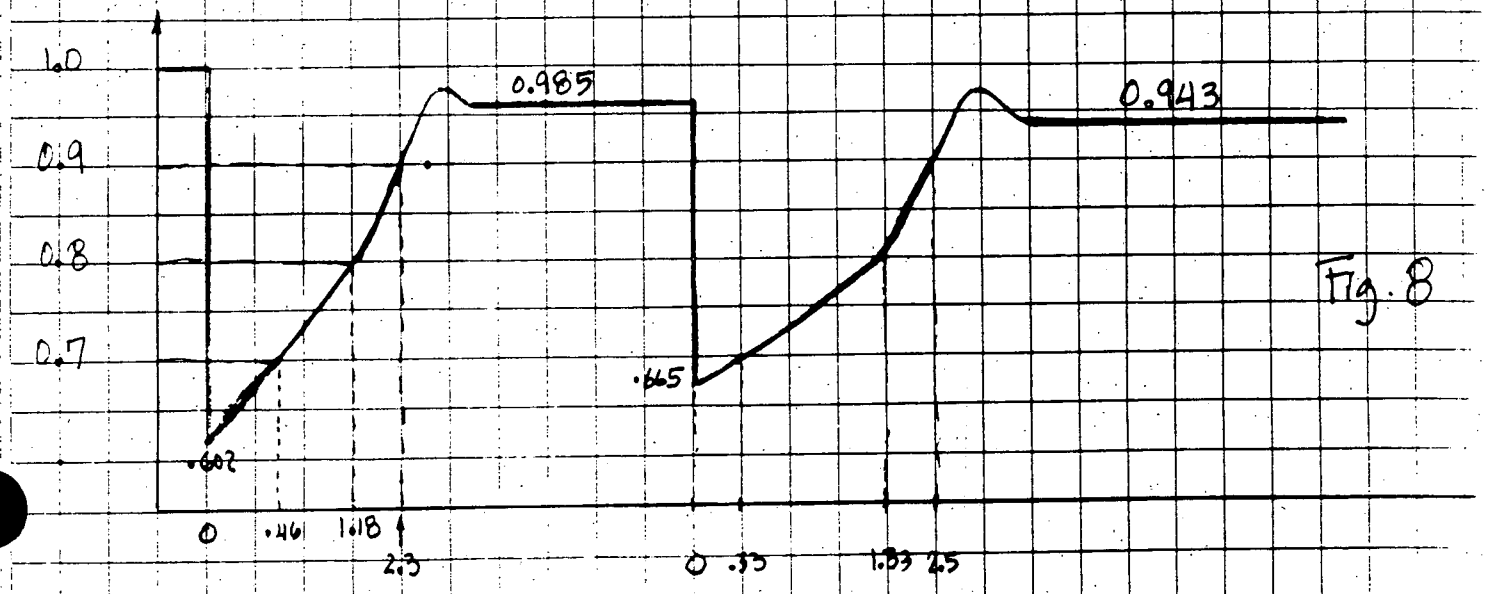

Fig. 8

Form 00184 (R4-88)

DUKE POWER COMPANY

Station _____ Unit _____ Rev. _____ File No. _____ Sheet _____ Of _____

Subject KEOWEE

LOCA/LOOP By SNC Date 2/25/93

Prob No. _____ Checked By _____ Date _____

600V 2XS1, 2XS2, 2XS3, 2XSF, 3XS1, 3XS2, 3XS3, 3XSF (Worst one)

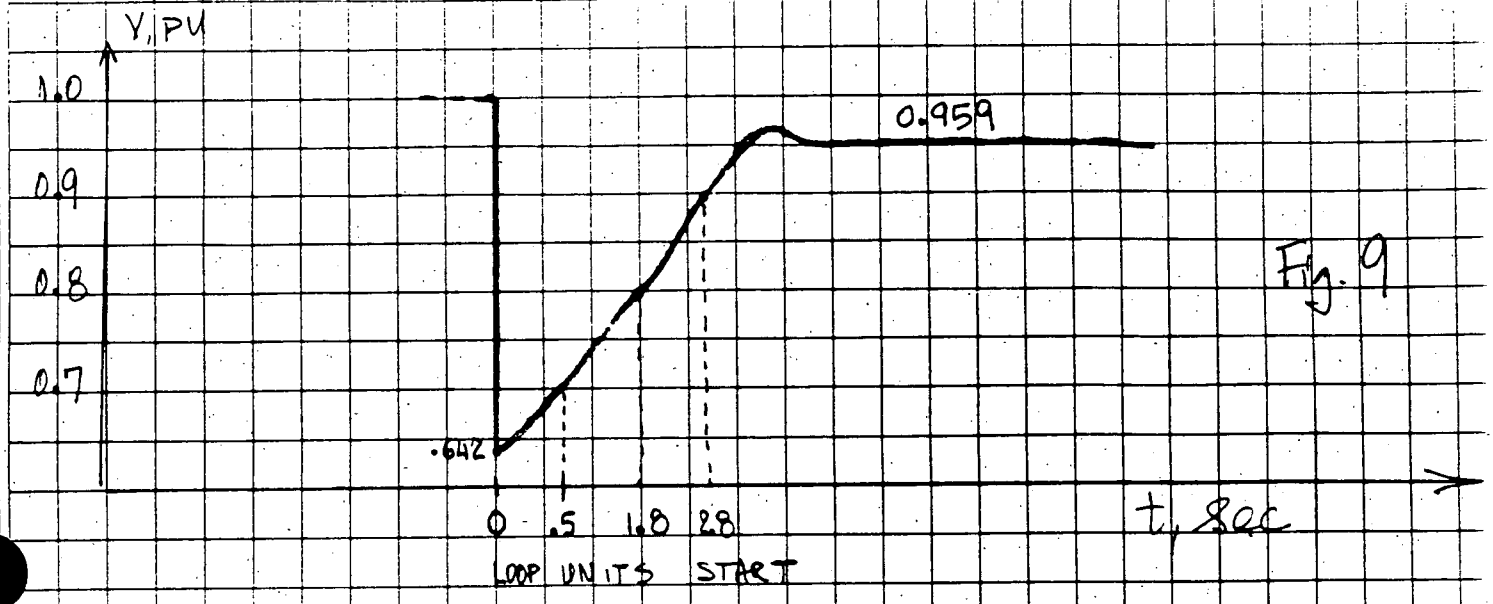

Fig. 9

208V 2XS1, 2XS2, 2XS3, 2XSF, 3XS1, 3XS2, 3XS3, 3XSF (Worst one)

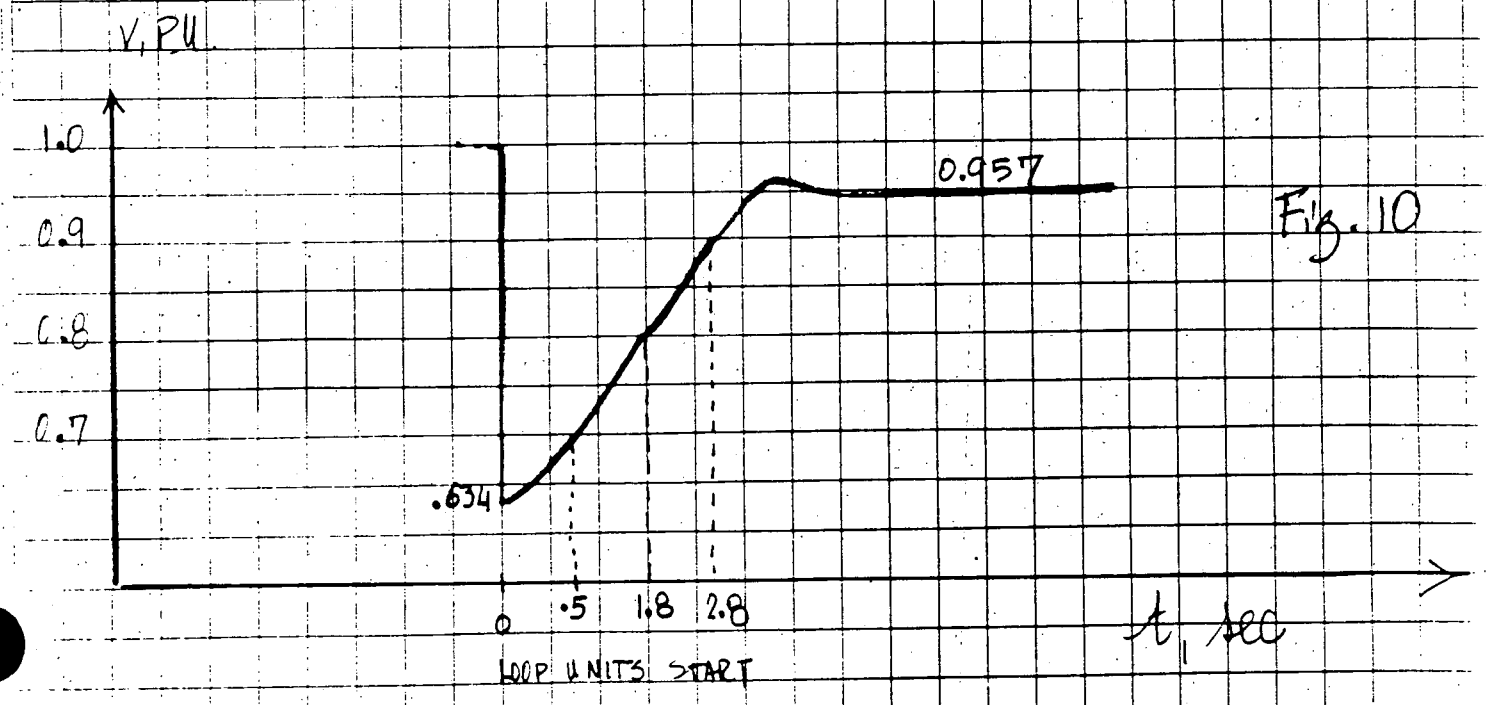

Fig. 10

Form 00184 (R4-88)

DUKE POWER COMPANY

Station _____ Unit ____ Rev. ____ File No. _____ Sheet ____ Of ____

Subject Keowee MW - MVAR By SNC Date 2/28 F73

Prob No. _____ Checked By _____ Date _____

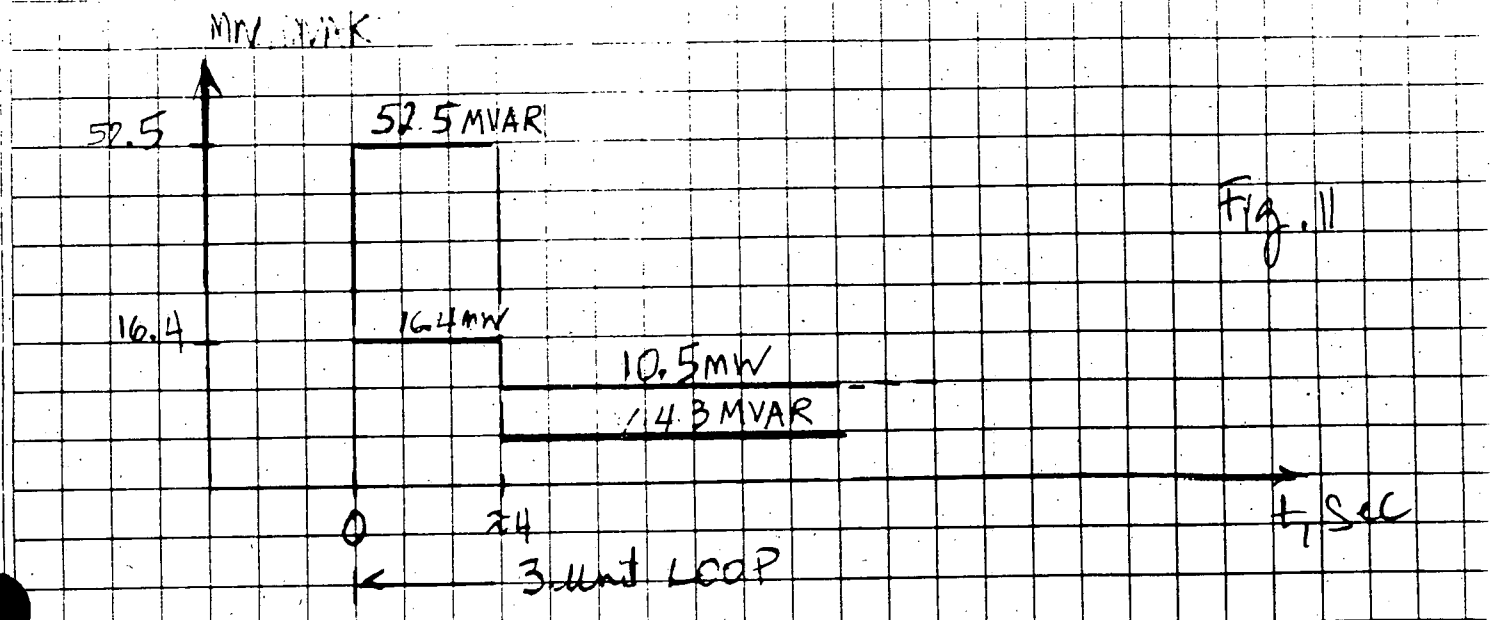

Fig. 11

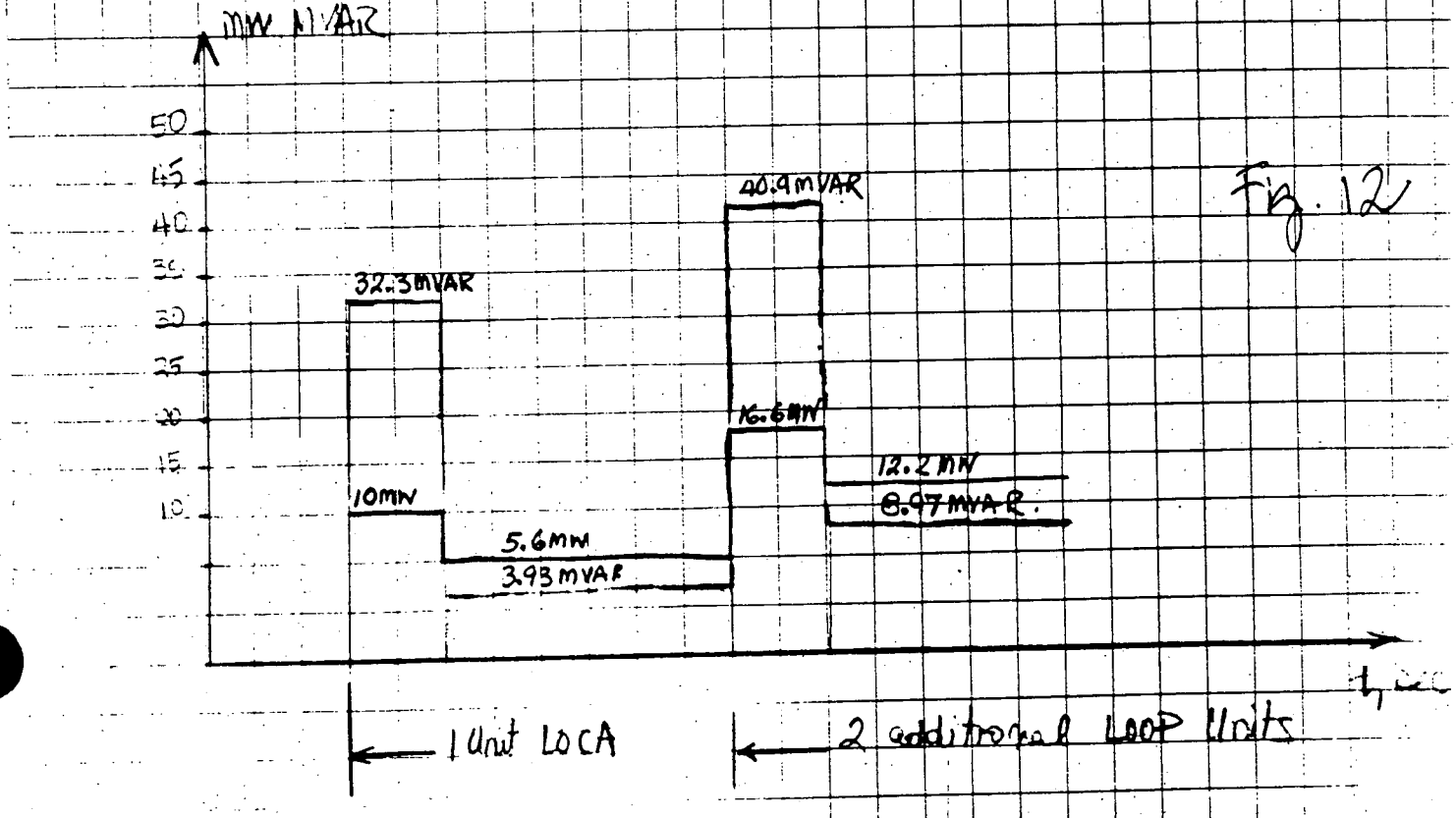

Fig. 12

Attachment 1

February 25, 1993

Oconee EDSFI
Auditor: Bill Raughley

Subject: Underfrequency Effects of a Keowee Start on Contactors

The following justification addresses the questions concerning the affects of underfrequency on electric motor starter contactors.

The FSAR allows Keowee to reach rated speed 23 seconds after the emergency start. It is a valid assumption to expect that the Keowee generator output voltage and frequency will probably be less than standard tolerances when the S-breakers close at T=11 seconds.

During the initial LOCA loads starting transient, the contactors in question will not actuate until the Keowee voltage recovers to approximately 85% voltage due to voltage drops in the transmission lines between Keowee and the MCC, and in the control circuit wiring. The constant V/f ration predicts that the frequency will also be approximately 85% when the contactors are energized.

According to the manufacturers, the contactor coils supplied for Oconee are identical to contactor coils supplied in European markets. The contactor coils are rated at 120V/60Hz and also 110V/50Hz with the standard tolerances of plus or minus 5%. The frequency at Keowee is expected to be initially 85% or 51Hz, but quickly improving to near rated frequency when the contactors are actuated. Therefore the contactor coils are adequately designed to cope with the temporary underfrequency transients during a Keowee start.

Attachment 2
page 1 of 2.

February 25, 1993

Oconee EDSFI
Auditor: Bill Raughley

Subject: Motor Control Center Control Fuse Adequacy During Keowee Start

The following is an explanation of the effect of the 23 second Keowee starting time and the resulting prolonged inrush currents on MCC control fuses until adequate voltage is restored.

Keowee is committed to be at rated voltage and speed within 23 seconds of an emergency start signal on a LOCA/LOOP. The Emergency Power Switching Logic (EPSL) dictates that the first station loads will be added at T=11 seconds via the standby "S" breakers. Therefore, it is postulated that the maximum time to have adequate voltage available to the MCC contactors is 12 seconds (even though experience and analysis has shown that it is most likely much less than 7 seconds, since tests show that Keowee comes up to speed within 18 seconds and only 85% bus voltage and frequency is necessary to pick up the contactor.) The worst case fuse time-current characteristics has demonstrated that the prolonged inrush current on the fuse can endure for a maximum of 16 seconds without interrupting the circuit's function. There are no possible scenarios that adequate voltage cannot be established within 12 seconds of the demand. Therefore, the fuses selected for these applications have been appropriately designed.

Maximum Fuse Operating Time Of ES Contactors While Under Sustained Inrush During LOCA Undervoltage Transients

MCC Compartment (Starter type)	Inrush current (A)	Control Fuse	Maximum Inrush operate time (sec)
1XS1/F2D (CY-2)	3.95	OT-3 NON-3 FRNR-3	20 Won't blow 130
1XS1/F4E (CY-2)	4.12	OT-3 NON-3 FRNR-3	16 200 110
1XS1/F4B (CY-1)	1.48	OT-3 NON-3 FRNR-3	Won't blow " " " "
1XS1/F1A (TM-5)	12.2	OT-20 NON-20 FRNR-20	Won't Blow " " " "
1XS2/F4E (CY-2)	4.12	OT-3 NON-3 FRNR-3	16 200 110
1XS3/1A (TM-5)	12.3	OT-20 NON-20 FRNR-20	Won't Blow " " " "
1XS3/3CB (CY-1)	1.74	OT-3 NON-3 FRNR-3	Won't Blow " " " "
1XS1/R2B (CY-1) 208V	1.52	OT-3 NON-3 FRNR-3	Won't Blow " " " "
1XS1/R5C (CY-1) 208V	1.63	OT-3 NON-3 FRNR-3	Won't Blow " " " "
1XSF/F01D (TM-1) 208V	1.59	FNM-1.6	Won't Blow
1XSF-1/1E (TM-1) 208V	1.60	FNM-1.6	Won't Blow

NOTE: Inrush current is calculated assuming that the voltage required to operate the contactor is 80% which is...

... 15% more conservative than CY contactor data.
... 9.8% more conservative than TM Size 5 contactor data.
... 5% more conservative than TM Size 1 contactor data.