VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 3, 1979

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Albert Schwencer
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 292
PO/FHT:scj
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Dear Mr. Denton:

In response to your letter of February 22, 1979, requesting additional information concerning the environmental qualification testing performed on the Continental Instrument Cable in use at Surry Power Station, we are providing the following information.

1. NRC request: Provide the basis for concluding that thermal aging of cable samples at 100°C for 60 hours simulates an additional thirty-three (33) years of in-plant use at a maximum ambient temperature of 50°C. These accelerated aging parameters were used in test sequence 1 on page 10 of the test report submitted with VEPCO letter dated December 15, 1978.

   Response: We have reviewed data provided by the cable manufacturer, Anaconda/Continental, on the aging properties of its cross-linked polyethylene compound, CC-2210. This material was used for the insulation of the subject instrument cable installed at Surry. Data on the aging properties of this material are shown on attachment 1 in the form of an Arrenhius curve, the slope of which was determined using aging points of 90°C for 40 years and 150°C for 168 hours.

   The thirty-three years of accelerated aging was based on a nominal forty year plant life minus the seven years the cable sample was in use. The test sample was subjected to an accelerated aging of 100°C for 60 hours to simulate thirty-three years of in-plant aging.

   To translate 60 hours at 100°C into equivalent lifetimes at different temperatures, a line is plotted on attachment 1 parallel to the line representing the manufacturer's data through the 60 hours at 100°C point. The cable can be considered to be at ambient temperatures due to negligible I^2R losses since the cable is used for instrumentation. Containment average bulk air temperature is 40°C (see note below). From the line plotted, it is seen that at 40°C, a 150-year life is indicated and at 45°C, a 53-year life is indicated. Thus, the aging process used is judged to be acceptable.

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1/1

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NOTE: In the past, the containment temperature has been significantly greater than 40°C. The effect this has on cable life is included in our test since the cable sample was removed from the station. A modification has been made to the containment cooling system to ensure a maintained temperature of 40°C in the future.

2. NRC Request: Provide the test report from Haveg Industries showing the data of the measurements of physical and electrical properties of the cable samples. This report was committed to be forwarded as an Addendum to the test report (Refer to item 6, page 12 of the test report submitted with VEPCO letter dated December 15, 1978).

Response: We are forwarding as Attachment 2 Addendum 1 to Test Report IPS-383 covering Haveg Industries, Inc., Analysis of Instrumentation Cable Samples for Virginia Electric and Power Company. Please note that certain of the tests were not performed due to the inability to obtain suitable test specimens.

If you have any questions or require additional information, please contact this office.

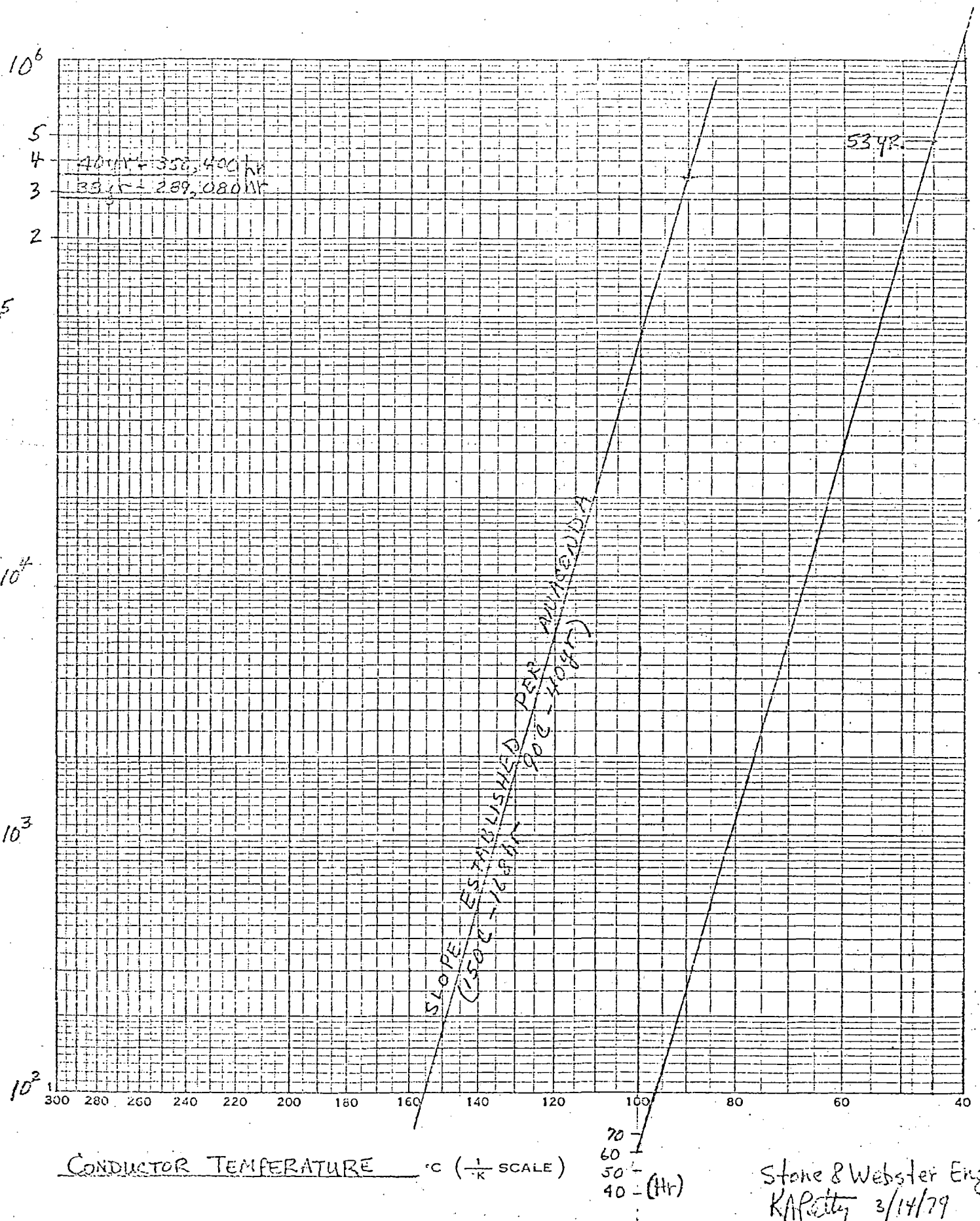
Very truly yours,

C. M. Stallings

C. M. Stallings
Vice President-Power Supply
and Production Operations

cc: Mr. James P. O'Reilly

ATTACHMENT 1



Stone & Webster Eng.
KAPetty 3/14/79

ADDENDUM NUMBER 1
TO TEST REPORT IPS-383
COVERING
HAVEG INDUSTRIES, INC.
ANALYSIS OF INSTRUMENTATION
CABLE SAMPLES
FOR
VIRGINIA ELECTRIC AND POWER CO.

ABSTRACT

This addendum incorporates the results of testing performed by Haveg Industries, Inc. on VEPCO Instrument Cable Samples supplied to them by Conax Corporation. The results of this testing is included in Haveg Engineering Report #2645 which forms a part of this addendum.

This testing involved the measurement of physical and electrical properties of Instrument Cable Samples selected at various stages of the test program conducted by Conax for VEPCO and reported in IPS-383.

This information is presented for analysis by the Virginia Electric and Power Company, as it pertains to specifications for Surry Power Stations, Units 1 and 2.

1.0 References

1.1 Page 7 of IPS-383

1.2 Page 12, Paragraph 6 of IPS-383

1.3 Haveg Industries, Inc. Certificate of Compliance. (dated 1-13-79) included herein.

2.0 Condition of Cable Samples Measured

Sample #1 1IT-496

Thermally aged 60 hours at 100°C and Irradiated to 20 Megarad dosage.

Sample #3 1IT-496

Thermally aged 60 hours at 100°C and Irradiated to 20 Kilorad dosage.

Sample #4 1IT-496

As received from VEPCO

Sample #6 2LF4

Thermally aged 60 hours at 100°C, Irradiated to 20 Kilorads dosage and subjected to MSLB #1 Test.

Sample #7 2LF4

Thermally aged 60 hours at 100°C, Irradiated to 20 Megarads dosage and subjected to LOCA Test.

CONAX

CONAX CORPORATION
2300 Walden Ave . Buffalo, New York 14225

No. IPS-383

Addendum 1

HAVEG INDUSTRIES INC

P. O. Box 7, Winooski, Vermont 05404

RECEIVED
JAN 18 1979
PURCHASING DEPT.

CERTIFICATE OF COMPLIANCE

Shipped to:

CONAX CORPORATION
2300 WALDEN AVE
BUFFALO, NEW YORK
14225

Date 1-13-79

Purchase Order 54719

Our Order 30908

TESTING TESTED TO

We hereby certify that the ~~TESTING~~ above purchase order issued by you was ~~************~~ conform to applicable specifications or requirements.

Applicable specifications (latest issue) :

COMPANY PART NO : 99-00000

HAVEG INDUSTRIES, INC.

Clement L. Martin

Manager — Quality and Reliability

FORM NO. 0056

IPS-383

Addendum 1

HAVEG INDUSTRIES INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VERMONT 05404

CONAX TESTING

16 02050 7 2C

Haveg Engineering Report # 2645

Test Laboratory

Haveg Industries Inc.
Wire & Cable Division
Test Laboratory
Colchester, Vermont 05446

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT WR NO. 2645

DATE 1-8-79

PRODUCT 16 0250 7 00 2C

SPEC IPCEA S-66-524	TEST Insulation Resistance	
AMEND/DATE	REQ. PARA.	METHOD PARA. 6.15
OTHER REFERENCED DOCUMENTS	TEST DATE	
	TIME START	
	TIME STOP	
	DATE COMPLETED	

Requirement The insulation resistance shall be measured after the completed cable. Alternating current voltage tests or before any direct current voltage test specified in para. 6.14. Where the voltage tests are made on wire or cable immersed in water, the insulation resistance shall be measured while the cable is still immersed.

Results

Sample No.		MEGOHMS 1000 feet
1	black cond	21,538,000
	white cond	30,618,000
3	black cond	could not obtain
	white cond	36,859,000
4	black cond	49,728,000
	white cond	43,214,000
6	black cond	23,386,000
	white cond	19,988,000
7	black cond	67,520,000
	white cond	11,376,000

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Paul E. Campbell	

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT NO. 2645

DATE 1-8-79

PRODUCT 16 0250 7 00 2C

SPEC IPCEA S-66-524	TEST Dielectric withstanding - jacket
AMEND/DATE	REQ. PARA. / METHOD PARA. 4.5.7
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Requirements: Specimens shall be formed into the shape of a U. All conductors shall be electrically connected together with the shield on both ends of the specimen. The specimen shall be immersed one hour minimum. The test voltage shall be 1.0 KV one minute.

Results:

Sample No.	
1	Passed
3	Passed
4	Passed
6	Passed
7	Passed

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-8-79

PRODUCT 16 0250 7 00 2C

SPEC IPCEA S-66-524	TEST Dielectric withstanding - Primarys
AMEND/DATE	REQ. PARA. / METHOD PARA. 7.8.9.3
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Requirement: The insulated conductors shall withstand for five minutes either the alternating current or direct test voltage of 2.5 KV.

Results:

Sample No.		
1	black cond	Passed
	white cond	Passed
3	black cond	Failed at 800kv
	white cond	Passed
4	black cond	Passed
	white cond	Passed
6	black cond	Passed
	white cond	Passed
7	black cond	Passed
	white cond	Passed

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-8-79

PRODUCT 16 .0250 7 00 2C

SPEC	TEST Tensile and Elongation
AMEND/DATE	REQ. PARA. / METHOD PARA.
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

The tests could not be performed because the insulation could not be removed from the conductor in a slug form. The insulation would stick to the conductor on each sample for each conductor. The insulation was extremely hard to strip off the conductor.

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-3-79

PRODUCT 16 0250 700 2C

SPEC CSA C22.2	TEST Specific Inductive Capacity (SIC) & Power Factor
AMEND/DATE	REQ. PARA. / METHOD PARA 4.28.4
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Requirement: A 15 foot specimen of wire from which all coverings over the insulation have been removed, or the specimen may be selected from Production after vulcanization and prior to the application of any coverings. The middle 10 foot portion of the specimen shall be immersed in distilled water with the 2½ foot portion at each end kept above the water as leakage insulation.

Results: This statement will be in effect for Page 5 of this report.

This test could not be conducted under the requirement as stated above because the lengths of the specimens that were submitted for test were too short.
The procedure that was used for the testing is listed before the results on each page of this report.

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Paul C. Gilbert	

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-3-79

PRODUCT 16 0250 700 2C

SPEC CSA C22.2	TEST SIC and Power factor
AMEND/DATE	REQ. PARA. / METHOD PARA.4.284
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Procedure:

Each specimen was cut to a length of 12 inches. The white conductor was connected to the unknown terminal and the black conductor was also connected to the unknown, the drain wire was the ground. The connections were to a General Radio capacitance bridge.

This type of a connection is called three terminal measurement.

Test results listed below:

Sample No.	Capacitance	Power Factor
1	6.7 pico farads per ft	.014%
3	5.9 " " " "	.012%
4	7.0 " " " "	.013%
6	6.2 " " " "	014%
7	8.7 " " " "	.024%

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Paul E. Campbell	

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-3-79

PRODUCT 16 0250 7 00 2C

SPEC CSA C22.2	TEST SIC & Power Factor
AMEND/DATE	REQ. PARA. / METHOD PARA. 4.284
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Procedure — Each specimen was cut to a length of 12 inches. The white conductor was connected to the unknown and the drain wire was connected to ground. After the black conductor was the unknown and the drain wire remained ground. This type of connection is called two terminal measurement.

	Sample No.	Capacitance	Power Factor
white cond	1	80.3 pico farads per ft	.014%
	3	79.7 " " " "	.011%
	4	80.7 " " " "	.012%
	6	89.0 " " " "	.034%
	7	91.9 " " " "	.025%
black cond	1	82.4 " " " "	.017%
	3	83.8 " " " "	.012%
	4	83.7 " " " "	.013%
	6	89.1 " " " "	.034%
	7	93.9 " " " "	.025%

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Janet C. Quill	

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REPORT/LWR NO. 2645

DATE 1-3-79

PRODUCT 16 0250 7 00 2C

SPEC CSA C 22.2	TEST SIC and Power Factor
AMEND/DATE	REQ. PARA. / METHOD PARA. 4.2.8.4
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Procedure Each specimen was cut to a length of 12 inches. The white conductor was connected to the unknown terminal and the black conductor to the ground. The drain wire was not connected.

Afterwards the black wire was connected to the unknown and the white conductor was the ground. The drain wire was not connected. Test results listed below.

Sample No.		Capacitance	Power Factor
white cond	1	45.7 pico farads per ft.	.014%
	3	45.5 " " " "	.014%
	4	46.9 " " " "	.015%
	6	49.5 " " " "	.016%
	7	51.1 " " " "	.017%
Black cond	1	45.8 " " " "	.015%
	3	45.5 " " " "	.014%
	4	47.0 " " " "	.015%
	6	49.5 " " " "	.016%
	7	51.1 " " " "	.017%

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Paul Cignell	

RAW DATA

HAVEG INDUSTRIES, INC.
WIRE & CABLE DIVISION
P.O. BOX 7
WINOOSKI, VT 05404

REP/LWR NO. 2645

DATE 1-4-79

PRODUCT 16 .0250 7 00 2C

SPEC CSA C22-2	TEST SIC and Power Factor
AMEND/DATE	REQ. PARA. / METHOD PARA. 4.2.8.4
OTHER REFERENCED DOCUMENTS	TEST DATE
	TIME START
	TIME STOP
	DATE COMPLETED

Procedure: Each specimen was cut to a length of 12 inches. Total measurement of the cable was obtained by braiding a metallic shield over the Hypolon jacket on each sample. The drain wire and both conductors were tied together and attached to the unknown and the braided shield was ground.

Test results listed below:

Results:

Sample No.	Capacitance	Power Factor
1	178.46 pico farads per ft	.035%
3	202.59 " " " "	.043%
4	183.38 " " " "	.038%
6	327.67 " " " "	.052%
7	258.52 " " " "	.036%

LAB TECHNICIAN	SUPERVISOR OF LAB SERVICES	DCAS QAR
	Frank C. Gulick	