Telephone 617 366-9011
TWX
710-390-0739

WYR 76-96

Regulatory Docket File

YANKEE ATOMIC ELECTRIC COMPANY

20 Turnpike Road Westborough, Massachusetts 01581

September 16, 1976

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Office of Nuclear Reactor Regulation

Reference: 1. License No. DPR-3 (Docket No. 50-29)
2. NRC letter dated August 12, 1976

Dear Sir:

As required in Reference 2, we are providing the following information. The item numbers used are identical to the numbers in your request.

The Yankee Nuclear Power Station (Yankee Rowe) does not have a conventional auxiliary power system consisting of unit auxiliary transformers, reserve auxiliary transformers and associated transfer facilities between the two sources. Therefore some questions in your request for information are not quite applicable to Yankee Rowe.

Attachment No. 1 shows the main one line diagram at the Yankee Nuclear Power Station. Electric power from the transmission network to the onsite electric distribution system is supplied by two physically independent circuits. One is the 115 kV Cabot line (Y-177) and the other the 115 kV Harriman line (Z-126). Both of the lines occupy the same switchyard which is located in close proximity to the turbine generator building.

The 115 kV incoming lines (Z-126, Y-177) are tapped on the line sides of the circuit breakers near the switchyard and are connected to the 115/2.4 kV station service transformers No. 2 and 3 respectively, with overhead lines. The secondaries of the two station service transformers are connected directly to the 2400 volt indoor metal clad switchgear buses No. 2 and 3, and also to the 480 volt switchgear, via two 2400/480 volt station service transformers (No. 5 and No. 6).

When energized, the two 115 kV incoming lines are both available immediately without the need for transfer following a loss of the main generator.

The two outer buses (2400V buses 2 and 3) are thus always connected to offsite power. The center bus (2400 volt bus 1) is connected to the main generator and is without power immediately following a generator trip. Power is restored by manually closing a tie breaker unless the trip is caused by a fault in the generator at which time the center bus is automatically tied to bus No. 3

When the main generator is connected to the grid, the voltage at the switchyard is essentially controlled by the generator. When the main generator is disconnected from the grid, the voltage at the switchyard is controlled by the grid.

The a-c power systems that are safety related and which require emergency onsite power following the loss of normal power, consist of the three separate 480 volt emergency buses, their power supplies and their loads.

The normal and emergency supplies to these buses are shown in attachment No. 1. The normal power supply for each emergency bus is an individual 480 volt station bus. An emergency diesel generator is connected to each emergency bus to provide emergency power in the event that normal power is lost. This arrangement assures that sufficient sources of power are available at all times to start and supply the safety related loads which require emergency onsite power following the loss of normal power.

When voltage is lost on an emergency bus, the circuit breakers supplying normal power receive a signal to open and the emergency diesel generator receives a signal to start. When normal voltage is reached at the generator terminals, the emergency generator circuit breaker is automatically closed onto the dead bus, thus providing the emergency bus with a source of onsite power.

1.a The plant auxiliary systems are supplied by offsite power when the main generator is not connected to the grid. From the time of initial startup in 1960 through July 1976, the plant auxiliaries have been supplied by offsite power for approximately 20% of the time.

1.b The nominal value of the grid voltage at Yankee Rowe is 115 kV. The normal operating range of grid system voltage with the generator connected to the grid is 113 to 115 kV. The corresponding values at the emergency buses are from 454 to 462 volts.

1.c The present transformer tap settings have been chosen by analysis of the bus voltages over the operating period of Yankee Rowe. The only conditions where the auxiliary system is fed directly by offsite power is when the generator is not connected to the grid. Under this condition, the range of grid voltages is 109 to 117 kV. The corresponding voltages at the emergency buses are from 442 to 474 volts.

It is apparent that the voltage profiles at the safety related buses are satisfactory for operation of all connected safety related equipment (see item 1.g).

1.d With the generator operating (the plant distribution system supplied by the generator) and grid voltages of 113 kV and 115 kV, the corresponding voltages on the emergency buses are 454 and 462 volts.

There are no identifiable degraded conditions that would require a generator trip.

1.e On each 480 volt emergency bus, there is one undervoltage relay. Each relay is located on the safety injection panel in the main control room, and is supplied bus potential from a 480 to 120 volt potential transformer located in the 480V emergency switchgear. The relays are Westinghouse type CV-7 electromagnetic induction disc relays with a tap setting of 105 volts and a time dial setting of 2. These relays will trip in 1.8 seconds if the voltage drops to zero. With 69 volts at the relay (277 bus volts), the relays will trip in 3.0 seconds; with 92.4 relay volts (370 bus volts), the relays will trip in approximately 7.0 seconds. These relays initiate the following action when tripped:

(a) start the diesel engine
(b) trip the incoming power feeder breakers
(c) close required load breakers in a predetermined sequence.

The undervoltage relays provided on the 480 volt emergency buses have been set to assure pickup in 1.8 seconds on complete loss of power (dead bus) and to initiate the action described. The tap setting chosen (105 volts) corresponds to 399 volts on the bus or 83.25% of the nominal 480 bus voltage and is considered adequate to prevent nuisance tripping due to starting of large auxiliary motors, and transitory disturbances on the transmission system.

1.f Due to the configuration of the auxiliary power system at Yankee Rowe, this item is considered not applicable. See introductory statement for an explanation. The undervoltage trip set point is 83.25% of nominal; the value of grid voltage corresponding to this setpoint is 98 8 kV.

1.g On emergency and non-emergency buses, a wide range of motors exists. Some are rated 480 volts, some 460 volts, and some 440 volts. NEMA MG-1 requires that motors operate successfully with a variation in voltage of ±10% of the rated voltage. The range for each motor voltage would be:

MOTOR	FROM	TO
480V	432	528
460V	414	506
440V	396	484

According to the manufacturer's data, the a.c. contactors on emergency and non-emergency buses are guaranteed for a minimum pickup voltage of 77% (370 bus volts). Tests performed at Yankee Rowe have verified this capability.

Yankee Rowe's safety related instrumentation is normally fed by the 125 volt D.C. battery system through a motor-generator set. Therefore, the safety related instrumentation is not affected by a short or long term degradation in the grid system voltage.

The bus voltage corresponding to the undervoltage relay tap setting of 83.25% is obviously below the operating range for some equipment. However, as shown in item 1c the expected bus voltages, when connected to offsite power, are well within the range required for continuous operation of the equipment.

1.h In the control room, the following bus voltages are continously monitored by the operators via panel meters.

Generator Volts
115 kV Z-126 Line
115 kV Y-177 Line
2400 Volt bus 1
2400 Volt bus 2
2400 Volt bus 3
480 Volt bus 4-1
480 Volt bus 5-2
480 Volt bus 6-3

In addition, 2400 volt buses 1, 2 and 3 are individually alarmed and annunciated in the control room for low voltage.

2. The functional safety requirements of the undervoltage trips is to detect the loss of offsite power system voltage and to initiate the necessary actions required to transfer safety related buses to the onsite power system. At Yankee Rowe, a loss of voltage to the emergency 480 volt buses for more than 1.8 seconds will result in initiation of automatic load shedding and load sequencing.

Connected to each 480 volt emergency bus is an undervoltage relay. When this relay senses a voltage below its setpoint, a high speed, lock out, electrically resetable (by manual action) relay is operated. This relay initiates the following action:

a. The diesel generator is started,
b. the bus is isolated by tripping all incoming power feeder breakers
c. required load breakers are closed in a predetermined sequence.

The bus load shedding features as described, ensure that a low voltage subsequent to initiation of load shedding and diesel generator load sequencing will not interfere with, or prevent any safety related load from performing its safety function.

3. The operating procedures for Yankee Rowe require adherence to the following limits:

	MAX	MIN
Voltage (kV)	121	109
MW	See Attachment No. 2, Generator Capability Curve	
MVARS	See Attachment No. 2, Generator Capability Curve	
Frequency (Hz)	60	60

These limits were determined in accordance with the generator's capability.

4. We have analyzed voltage data taken at Yankee Rowe over the last five years of operation.

The normal voltage range of the grid during plant shutdowns ranged from 109 to 117 kV. The lowest recorded voltage occurring on the grid was 106 kV which occurred during a plant shutdown. This corresponds to a voltage of 430 volts on the 480 volt emergency bus. 430 volts is adequate to ensure successful operation of all safety related components.

Our analysis has shown that the grid in the vicinity of Yankee Rowe with its associated generation and transmission system has a capacity sufficiently large enough to preclude a low voltage situation similar to that which occurred at Millstone 2. This is accomplished through the proper scheduling and supervision of the generation and transmission system by the dispatcher, (REMVEC-Rhode Island, Eastern Massachusetts and Vermont Energy Control).

We, therefore, believe that the degraded voltage conditions described in your letter are a combination of events pertinent to the auxiliary system at Millstone and its load dispatching facilities and are not typical of, or applicable to, the transmission grid at Yankee Rowe or the auxiliary system at Yankee Rowe.

However, as a precautionary measure, we are proposing to install at the next refueling outage an additional undervoltage relay on each emergency bus. These relays will be set to respond to a voltage above the minimum required to ensure operation of safety related equipment. They will have a time delay of several seconds duration to eliminate spurious pick-up due to short duration voltage transients on the grid and the auxiliary system. In the unlikely event that these relays actuate, an annunciator will be activated in the control room. The operators will have instructions to manually start the diesel generators and synchronize them to the bus experiencing low voltage. After synchronization, the off-site supply will be disconnected, thus

supplying the bus with on-site emergency power. As an alterrative, procedures may require the operators to trip the incoming feeder breaker so as to initiate a no-voltage condition on the emergency bus.

We trust that you find this information satisfactory; however, should you desire additional information, please contact us.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

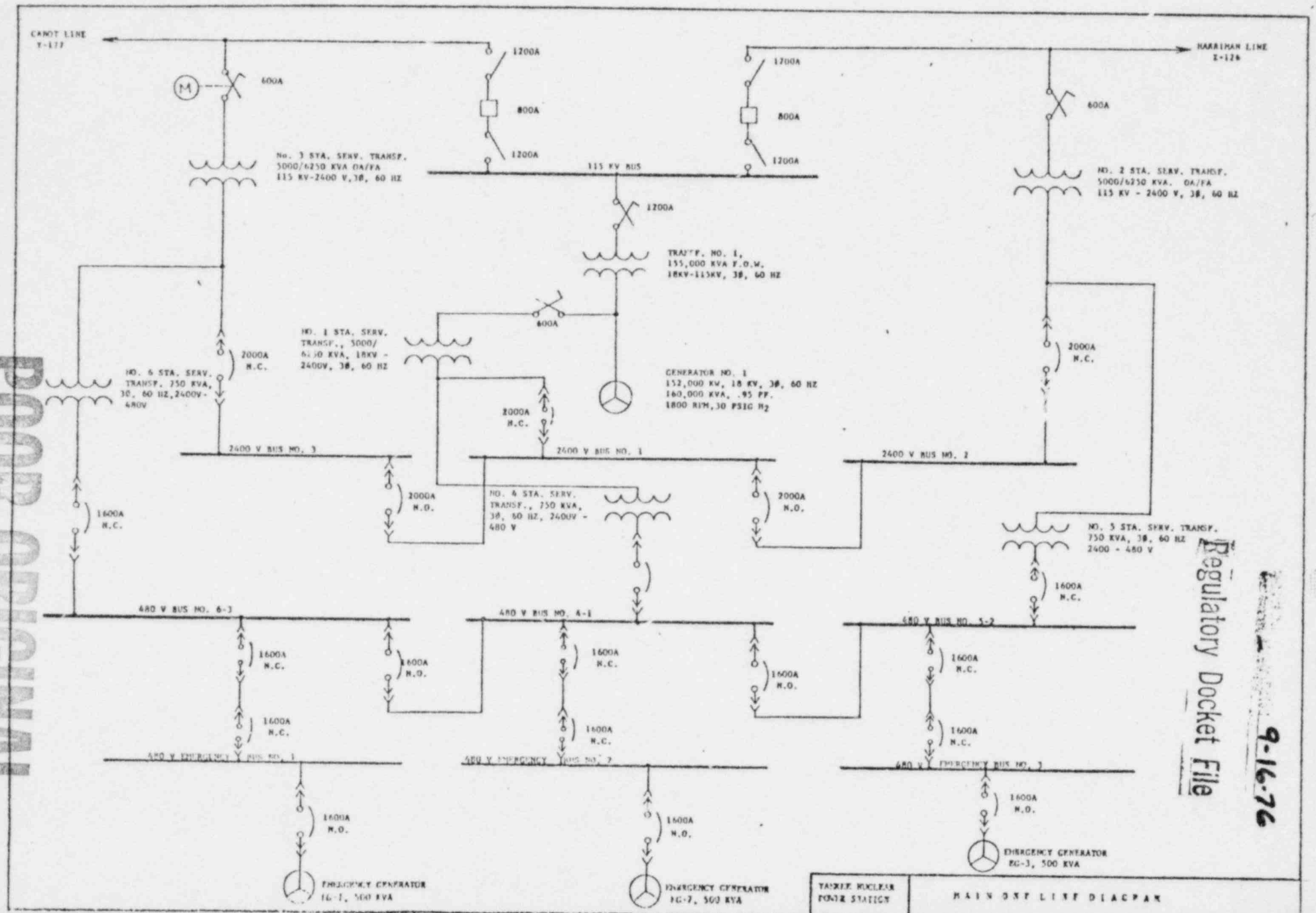
Robert H Groce

R. H. Groce
Licensing Engineer

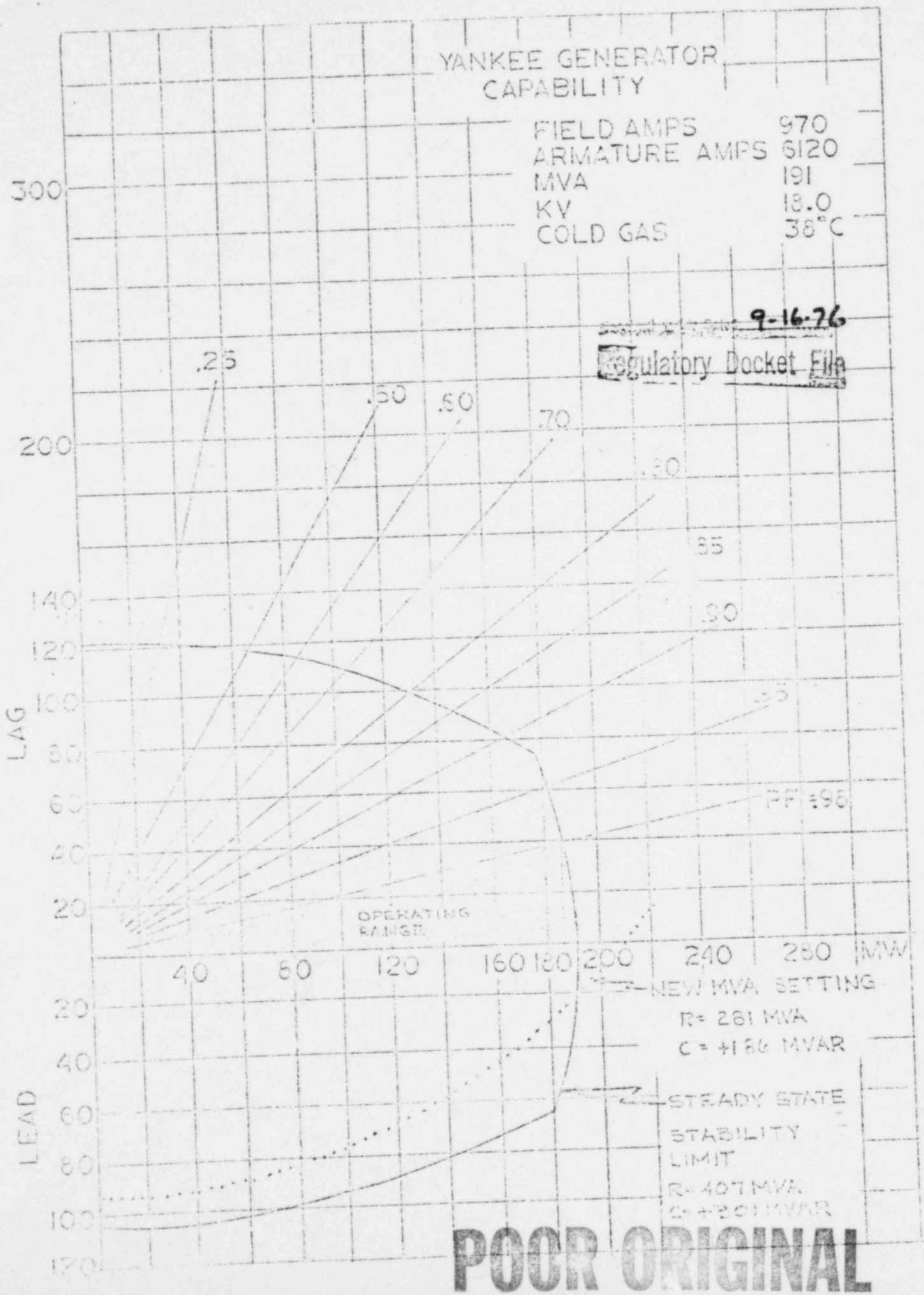
dm

Attachments

ATTACHMENT 1



ATTACHMENT 2



NRC FORM 195
(2-76)

U.S. NUCLEAR REGULATORY COMMISSION

NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

DOCKET NUMBER: 50-29		
FILE NUMBER:		
TO: NRC	FROM: YAEC, Westborough, Mass. 01581, J.L. French	DATE OF DOCUMENT: 9-14-76
		DATE RECEIVED: 9-20-76
☒ LETTER ☒ ORIGINAL ☐ COPY ☐ NOTORIZED ☒ UNCLASSIFIED	PROP	INPUT FORM
		NUMBER OF COPIES RECEIVED: 3 signed 37 CC

DESCRIPTION: Ltr trans the folowing:

ENCLOSURE: Addl Information on Yard Crane Modifications Yankee Nuc. Power Station (Yankee Rowe)....

(40 cys encl rec'd)

[redacted]

PLANT NAME: Yankee Rowe

FOR ACTION/INFORMATION ENVIRO DHL 9-20-76

SAFETY		ENVIRO	
ASSIGNED AD:		ASSIGNED AD:	
☒ BRANCH CHIEF:	(6) Schwencer	BRANCH CHIEF:	
☒ PROJECT MANAGER:	Burger	PROJECT MANAGER:	
☒ LIC. ASST.:	Sheppard	LIC. ASST.:	

INTERNAL DISTRIBUTION

☒ REG FILE	SYSTEMS SAFETY	PLANT SYSTEMS	SITE SAFETY &
☒ NRC PDR	HEINEMAN	TEDESCO	ENVIRO ANALYSIS
☒ I & E (2)	SCHROEDER	BENAROYA	DENTON & MULLER
☒ OELD		LAINAS	
☒ GOSSICK & STAFF	ENGINEERING	IPPOLITO	ENVIRO TECH.
MIPC	MACCARRY	KIRKWOOD	ERNST
CASE	KNIGHT		BALLARD
HANAUER	SIHWEIL	OPERATING REACTORS	SPANGLER
HARLESS	PAWLICKI	STELLO	
			SITE TECH.
PROJECT MANAGEMENT	REACTOR SAFETY	OPERATING TECH.	GAMMILL
BOYD	ROSS	☒ EISENHUT	STEPP
P. COLLINS	NOVAK	☒ SHAO	HULMAN
HOUSTON	ROSZTOCZY	☒ BAER	
PETERSON	CHECK	☒ BUTLER	SITE ANALYSIS
MELTZ		☒ GRIMES	VOLLMER
HELTEMES	AT & I		BUNCH
SKOVHOLT	SALTZMAN		☒ J. COLLINS
	RUTBERG		KREGER

EXTERNAL DISTRIBUTION

			CONTROL NUMBER
☒ LPDR Greenfield, Mass.	NAT LAB:	BROOKHAVEN NAT LAB	
TIC:	REG. VIE	ULRIKSON(ORNL)	9512
☒ NSIC:	LA PDR		
ASLB:	CONSULTANTS		
☒ ACRS 16 CYS [redacted] SENT	TO L.A.		