Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

March 3, 1972

Dr. Peter A. Morris, Director
Division of Reactor Licensing
United States Atomic Energy Commission
Washington, DC 20545

Re: Docket 50-155
DPR-6 (ZEK)

Dear Dr. Morris:

This is intended to apprise you of the loss of an off-site power incident which occurred at our Big Rock Point Nuclear Plant on January 25, 1972. During the outage caused by the loss of off-site power, a two-to-three-foot drop in the spent fuel pool water level was experienced and one of two d-c operated emergency condenser valve (MO-7063) failed after opening automatically as required by reactor pressure conditions.

The loss of off-site power was attributed to a combination of unusually severe weather conditions and several equipment failures.

On the evening of January 24, 1972, an intense storm system passed through the area which consisted of rain that later changed to heavy snow as the temperatures fell. High winds on the following day caused the ice laden power lines to dance and sway. This resulted in a phenomenon called "galloping conductors" in which line faults occurred as the lines move relative to one another. The location of these line faults was calculated to be approximately 10 miles from the Gaylord Substation and on the 138 kV power line (see attached sketch). The Gaylord 388 oil circuit breaker (OCB) operated 12 times to clear the momentary line faults. On the thirteenth fault, the trip coil burned out and the 388 OCB failed to operate. Relays in substations feeding into and out of the Gaylord Substation caused breaker operations at their respective locations to clear the fault. As a result, the Big Rock Point Plant became momentarily isolated from the rest of the system and with essentially no load on the generator the unit tripped off on overspeed (116 OCB opened). This occurred at approximately 1304. The reactor scrammed due to high flux.

Since the fault occurred on the Gaylord side of the Emmet 488 OCB, a trip signal was not sent to the Big Rock Point 199 OCB and a load rejection did not occur. However, the 199 OCB was opened manually since the 138 kV line was de-energized intermittently over a span of approximately 20 minutes. Normally, the station power would have automatically transferred on undervoltage to the 46 kV source to supply the station power equipment. However, a stuck contact of an instantaneous overcurrent relay in the Emmet 46 kV bus protection relay scheme coupled with the operation of the undervoltage (UV) bus fault detector relay (which would have reopened had the fault cleared within a few cycles - fault lasted for 69 cycles) caused the 1288 OCB to trip and thus de-energize the 46 kV line to Big Rock. The two relays are connected in series and both must be closed simultaneously for a few cycles to cause the breaker to trip. The line was de-energized for approximately two hours until repairmen, who were hampered by considerable blowing and drifting of snow, could make the essential repairs and return the system to normal. The overcurrent relay had failed closed prior to the undervoltage condition occurring; it should not have operated under the conditions of the incident.

Upon the loss of both the normal and backup supplies of station power, the diesel generator started and closed onto bus 2-B to provide power for operation of essential emergency equipment.

Approximately 20 minutes after the turbine trip (1324), full potential was restored to the 138 kV line. However, when attempts were made to reclose the 199 OCB, a false tripping signal (from the audio tone relay equipment) caused the breaker to immediately retrip. The audio tone control was then put into the "off" position defeating the tripping signal and the 199 OCB was then reclosed successfully. The tone controls were then reconnected and station power loads were returned to their normal station power supply at 1353. The diesel generator was not shut down until approximately 1507.

Extensive inspection of the line section between the calculated fault location and the Gaylord Substation did not produce any evidence of damage. The faulty trip coil (388 OCB) and the faulty overcurrent relay (1288 OCB) have been repaired. The false tripping signal observed in the tone relaying equipment is being investigated as is the trip scheme for the 199 OCB.

In summary, the simultaneous loss of the normal and backup off-site station power supplies was caused by extremely severe and unusual weather conditions and two equipment failures. The length of time that off-site power was lost was extended by difficulties in getting substation operators to the substations and further compounded by a false tripping signal in tone relaying equipment. It is not considered possible that a plant-initiated event would cause a loss of the normal station power supply because of the size of the plant with respect to the system size. The plant provides up to 71 MWe (net) to Michigan Power Pool system of approximately 10,000 MWe.

The 46 kV station power supply was installed in March 1968 to provide a redundant station power supply to the Big Rock Point Plant. Since that installation, the loss of off-site power experienced January 25, 1972 is the only instance where both off-site power supplies were not available at the same time. From the review of this occurrence, it is considered highly unlikely that a similar incident will ever occur again.

During the reactor pressure transient resulting from the turbine overspeed trip on January 25, the two emergency condenser outlet valves (MO-7063 and MO-7053) opened automatically as designed. Approximately two and one half hours later, when an attempt was made to shut MO-7063, the valve failed to operate. The emergency condenser inlet valve MO-7062 in the affected loop was shut to maintain reactor pressure. MO-7053 operated normally.

The motor unit of MO-7063 was disassembled and taken to a local motor rewinding shop for inspection and possible repair. The insulation on shunt and series fields was found burned to the extent that it required rewinding. However, there were no grounds or shorts found in either winding which suggested the burnup may have been caused by excessive running of the motor beyond its shutoff limits. Upon reinstallation of the motor, the torque switches were inspected for proper settings. The open torque switch was adjusted to allow for a wider margin between the valve automatic stop and manual stop.

It was concluded that the failure of the valve operator motor was probably due to an improperly set torque switch. A replacement motor for the valve operator has been ordered. When it arrives, it will be installed and the present motor returned to the vendor for a detailed inspection. This motor failed and was rewound once previously. The previous failure occurred while maintenance was being performed on the motor and was due to a maintenance error.

The first indication of an abnormal spent fuel pool water level was at 0100 on January 26, 1972 when the Control Room Operator observed a gradual increase in the fuel pool area monitor readings (approximately 12 mR). A visual inspection followed. The fuel pool water level was discovered to be two to three feet below the normal overflow to surge tank level. Detailed investigations of this decrease in fuel pool water level revealed the cause to be a siphoning action created by the piping configuration and valve alignment.

At the time the outage occurred, the fuel pool was valved for recycle through the radwaste system. However, upon loss of the normal station power, the fuel pit, radwaste and treated waste pumps ceased to operate and the fuel pit to radwaste isolation valves CV-4027 and CV-4117 closed automatically.

The critical elevations in the piping sequence are as follows:

1. Discharge Pipe at Bottom of Pool - 601'-6"

2. Highest Elevation of Pipe at Pool Surface - 630'-6"

3. Elevation of Sphere Isolation Valves - 593'-6"

4. Elevation of Pipe Where It Opens Into Clean Waste Receiver Tanks - 590'

Thus, the hydraulic head was available to create a siphoning action (11'-6" head) from the fuel pool to the clean waste receiver tanks when the isolation valves were reopened. (See Attachments 2 and 3.)

With the loss of two to three feet of water, equipment hanging on the side of the pool such as flange protectors, sample specimen racks and vacuum hoses were exposed to some extent. A fuel bundle was located in the elevator which was at the top of its vertical travel. The elevator has a pneumatic stop at seven feet below normal water surface and a mechanical stop at six feet. The decrease in water shielding allowed an increase in radiation dose rate in the vicinity of the fuel pool.

After the discovery, the valve to radwaste ("T" handle valve in fuel pit pump room) was closed and the fuel pool level restored via the waste hold tanks.

Two to three feet of water represents approximately 7,800 to 11,700 gallons. Since water was being processed to the condensate storage tank and the reactor valved for blowdown, the increasing amount of water to the radwaste system from the fuel pool was not immediately evident. Each of two clean waste and waste hold tanks has a high level alarm set at approximately 90%. The condensate storage tank high level alarm annunciates at about 95%. The storage tank level is also recorded on a chart on the front panel of the control room. Since these tanks are monitored frequently, it is inconceivable that the tank levels would have continued to rise unnoticed. Even assuming that they did, the spent fuel pool area monitor is set to alarm at 15 mR. It was reading approximately 12 mR and rising slowly when low pool level was first detected.

To prevent any further reoccurrence of the problem, a siphon breaker has been added to the inlet piping of the spent fuel pool. Three 7/16" holes were drilled in a horizontal pattern on the vertical section of inlet piping about 2" below the normal fuel pool level. On February 2, a test of the siphon breaker was conducted under conditions similar to those of January 25 and the siphoning action ceased when the pool level reached the three holes.

The addition of the siphon breaker eliminates any potential for losing the spent fuel pool water level. However, assuming that a loss of fuel pool water level were to again occur, the spent fuel pool area monitor remote indicators and alarms and radwaste system tank level indicators and alarms would provide early notice of the abnormal condition.

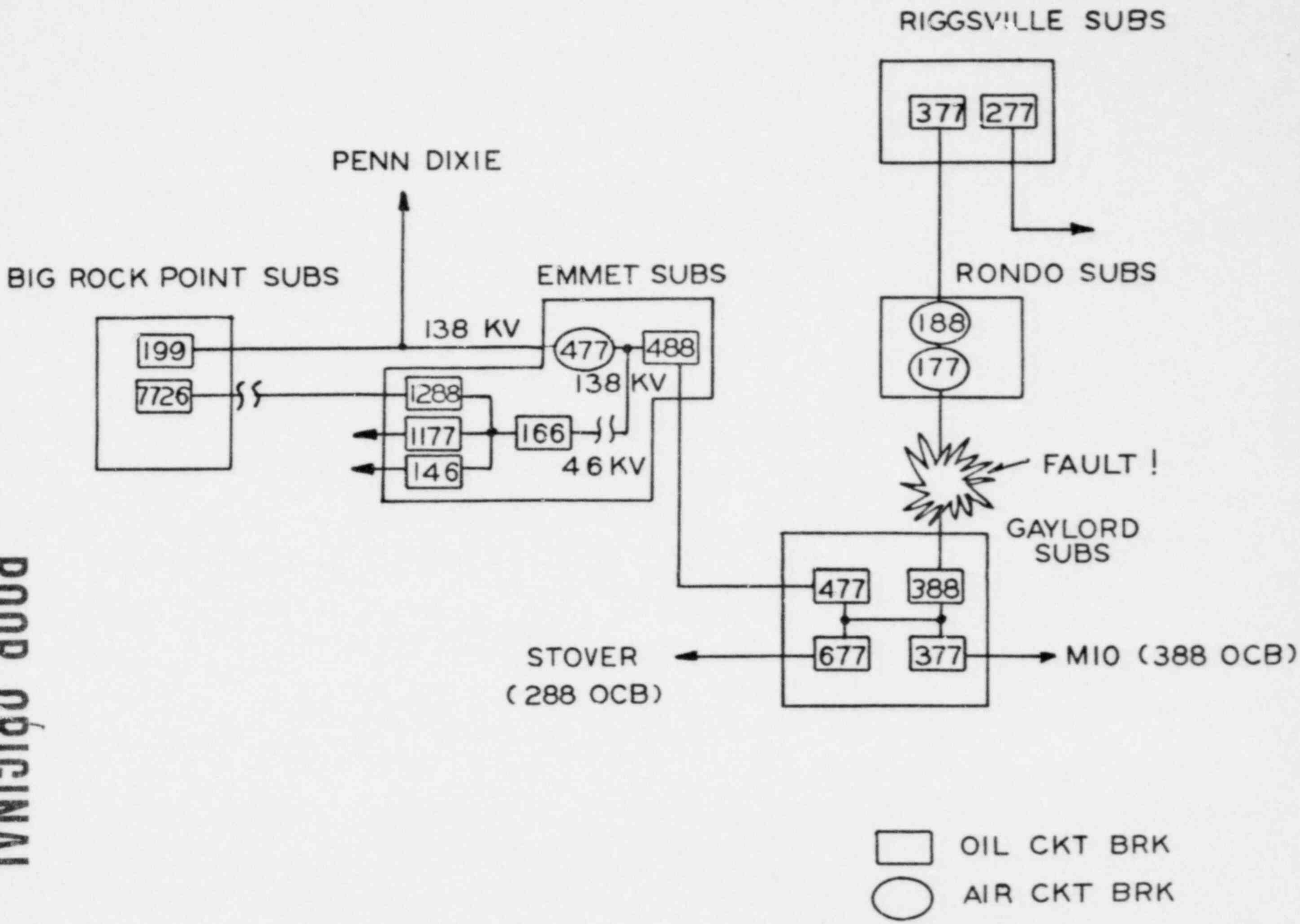
Yours very truly,

Ralph B. Sewell

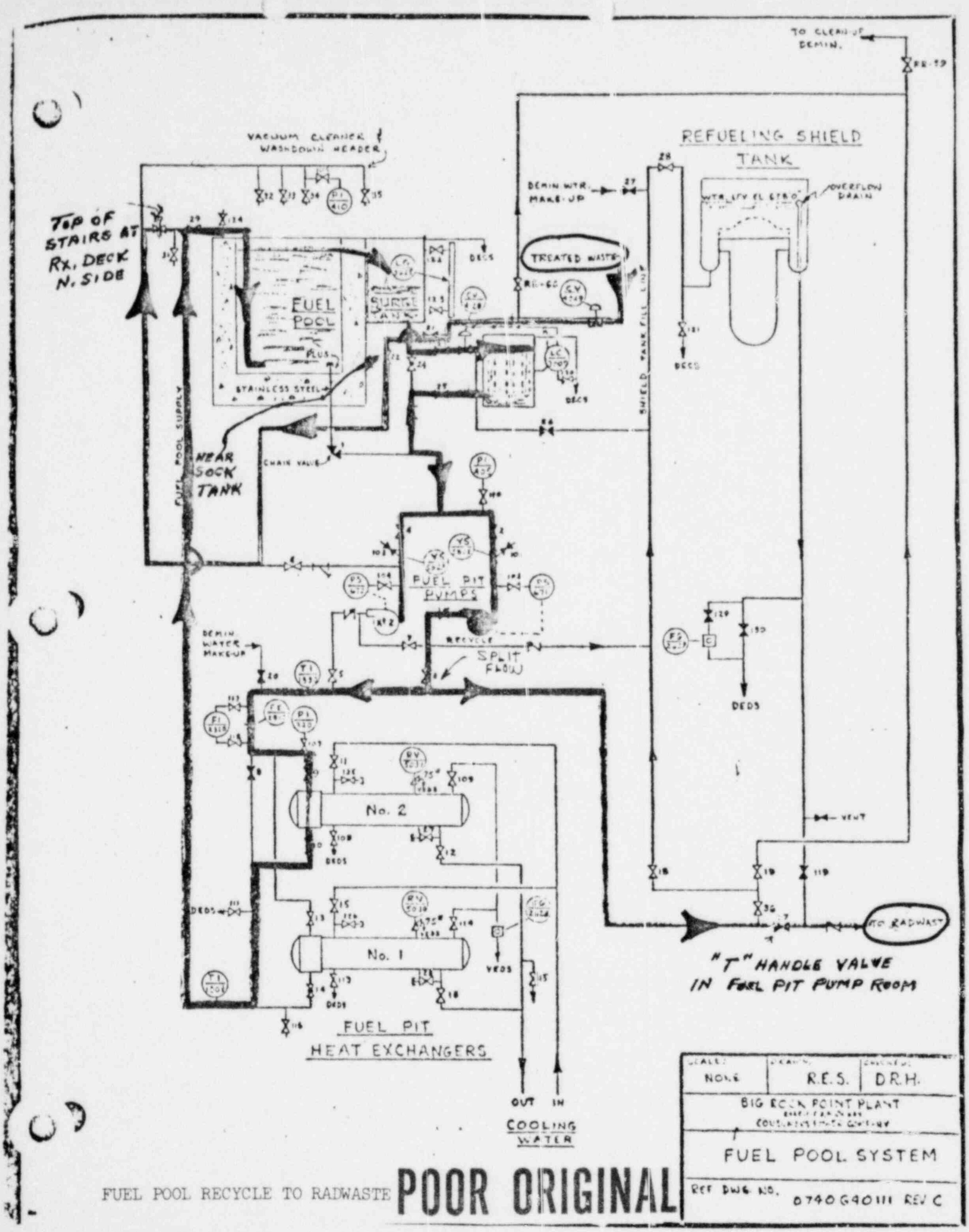
RBS/dmb

Ralph B. Sewell
Nuclear Licensing
Administrator

CC: BHGrier,
USAEC

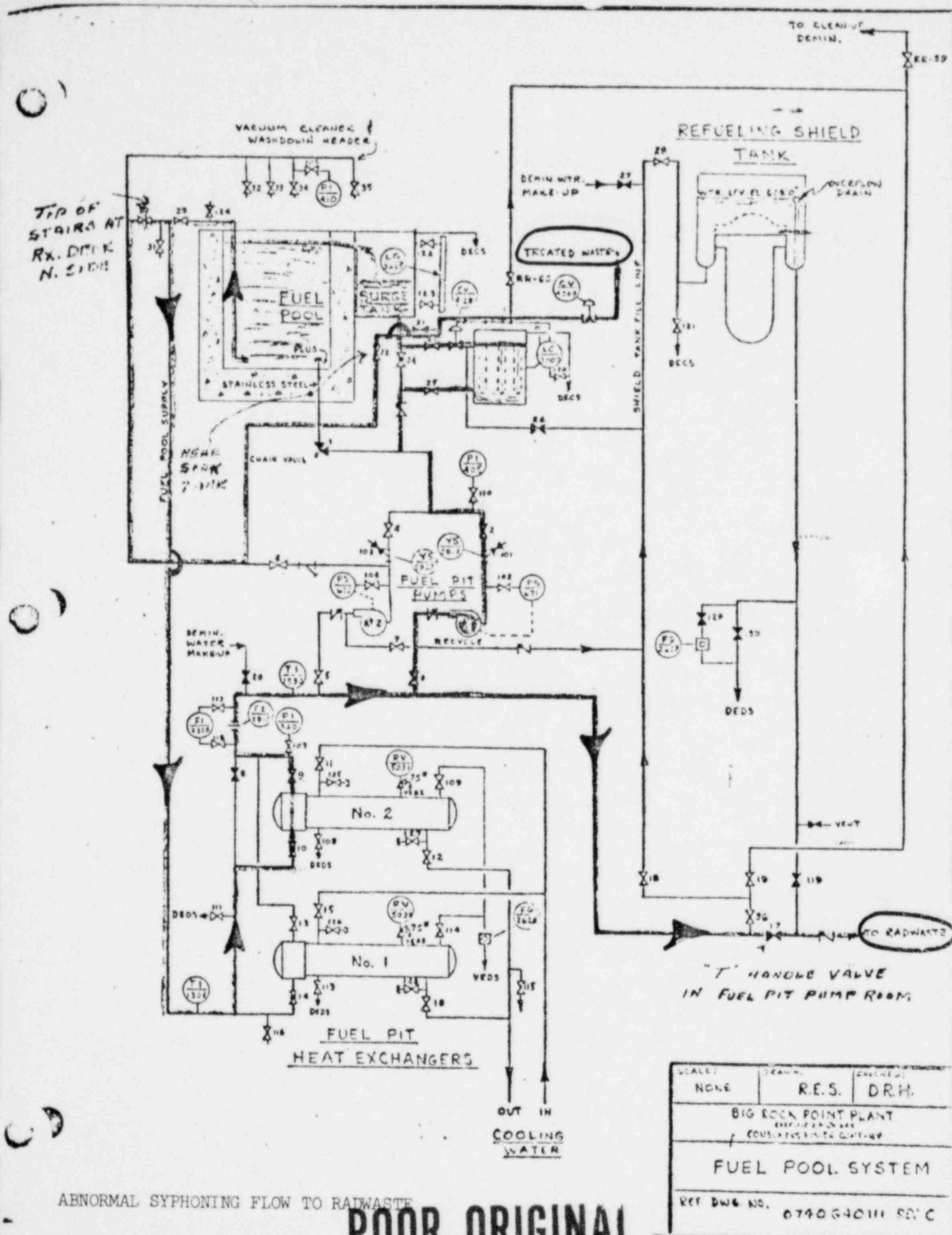

RIGGSVILLE SUBS
377
277
PENN DIXIE
BIG ROCK POINT SUBS
EMMET SUBS
RONDO SUBS
138 KV
199
7726
477
488
138 KV
1288
1177
146
166
46 KV
188
177
FAULT !
GAYLORD SUBS
477
388
677
377
STOVER
(288 OCB)
M10 (388 OCB)
OIL CKT BRK
AIR CKT BRK

2/28/72



FUEL POOL RECYCLE TO RADWASTE

POOR ORIGINAL



ABNORMAL SYPHONING FLOW TO RADWASTE

POOR ORIGINAL

Consumers Power Company
Jackson, Michigan 49?
Ralph B. Sewell

DATE OF DOCUMENT: 3-3-72	DATE RECEIVED: 3-6-72
NO.: [illegible]	
LTR.: x	MEMO:
REPORT:	OTHER:
ORIG.: 1 signed & 5 conf'd	CC:
OTHER:	
ACTION NECESSARY ☐	CONCURRENCE ☐
NO ACTION NECESSARY ☐	COMMENT ☐
DATE ANSWERED:	BY:
FILE CODE: 50-155	

TO:

Dr. Morris

CLASSIF.: U

POST OFFICE

REG. NO.:

DESCRIPTION: (Must Be Unclassified)

Ltr advising of loss of an off-site power incident on 1-25-72 at Big Rock
....

ENCLOSURES:

REMARKS:

REFERRED TO	DATE	RECEIVED BY	DATE
Ziemann W/9 cys for ACTION	3-6-72		
DISTRIBUTION:			
Reg Files			
AEC PDR			
Compliance (2)			
OGC, Rm P 506A			
Muntzing & Staff			
Denton			
Morris/Schroeder		DO NOT REMOVE	
Skovholt			
Boyd		ACKNOWLEDGED	
E. G. Case			
DTIE(Laughlin)		1149	
NSIC(Buchanan)		1149	fod

U.S. ATOMIC ENERGY COMMISSION MAIL CONTROL FORM FORM AEC-3265 (8-60)

U.S. GOVERNMENT PRINTING OFFICE: 1971-424-962

POOR ORIGINAL