069

October 5, 1967

MEMORANDUM

To : Dr. J. E. McKee
Dr. S. H. Bush
Dr. S. H. Hanauer
Mr. N. J. Palladino
Dr. W. R. Stratton
Dr. C. W. Zabel

From : M. C. Gaske, Assistant to Exec. Secretary
ACRS

Subject: OYSTER CREEK

Dr. McKee has requested that the attached evaluation by Mr. Epler of the Oyster Creek instrumentation system be distributed to the Oyster Creek Subcommittee. There is a question as to whether Mr. Epler's comments have been adequately taken into account in the final design of the Oyster Creek instrumentation system.

Attachment:
Mr. Epler's Comments dated May 26, 1964.

OFFICE ▶	ACRS					
SURNAME ▶	MCG:bmd					
DATE ▶	10-5-67					

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OAK RIDGE NATIONAL LAEORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37831

May 26, 1964

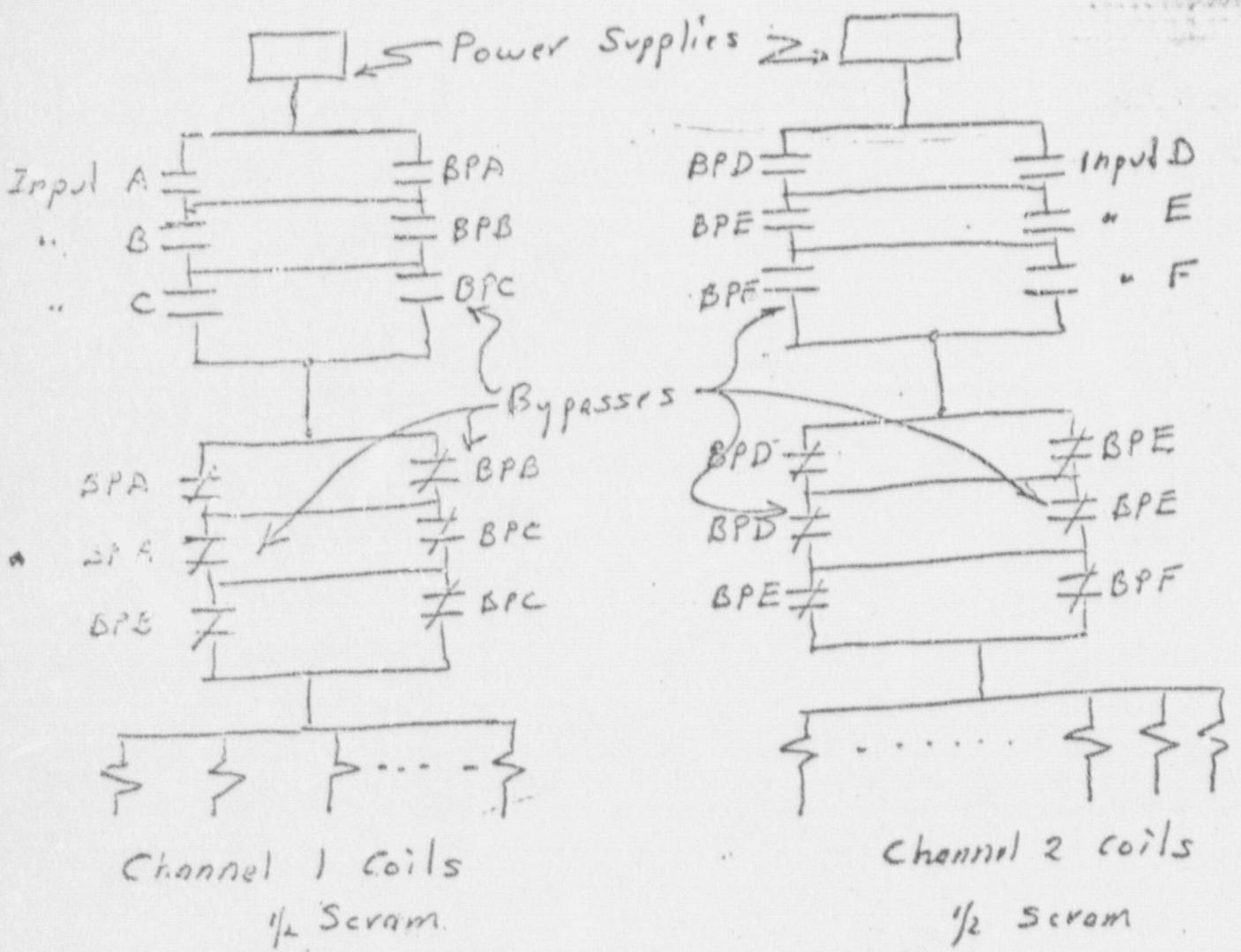
H. W. Newson
Duke University
Durham, N. C.

Dear Sir:

In accordance with your request I attended the GE presentation to DL&R on Tuesday, May 12. The following summarizes my evaluation of the system based on material presented at the meeting plus further study of the documents given us at the meeting.

The Oyster creek system is an improvement over the Dresden system, in that it consists of two complete independent channels each consisting of two sub channels placed in coincidence. In principle this is sound providing that each of the independent channels is itself sound. The reliability of the pair will be half that of each member, which is entirely acceptable. The success of the system will rest entirely on the manner in which the details are executed. i.e. it is vital that the subchannels be made independent. Further study of the drawing presented by GE discloses, on the face of the schematic, numerous violations of this principle indicating that the designer has given no thought to this aspect of the problem and that it will be corrected only on the insistance of DL&R.

The Dresden Scheme



The Dresden Scheme

1. Channel 1 coils plus channel 2 coils must be de-energized to produce scram.

2. A or B or C can produce a half scram.
   D or E or F can produce a half scram.

3. One channel only can be bypassed at one time in either string.

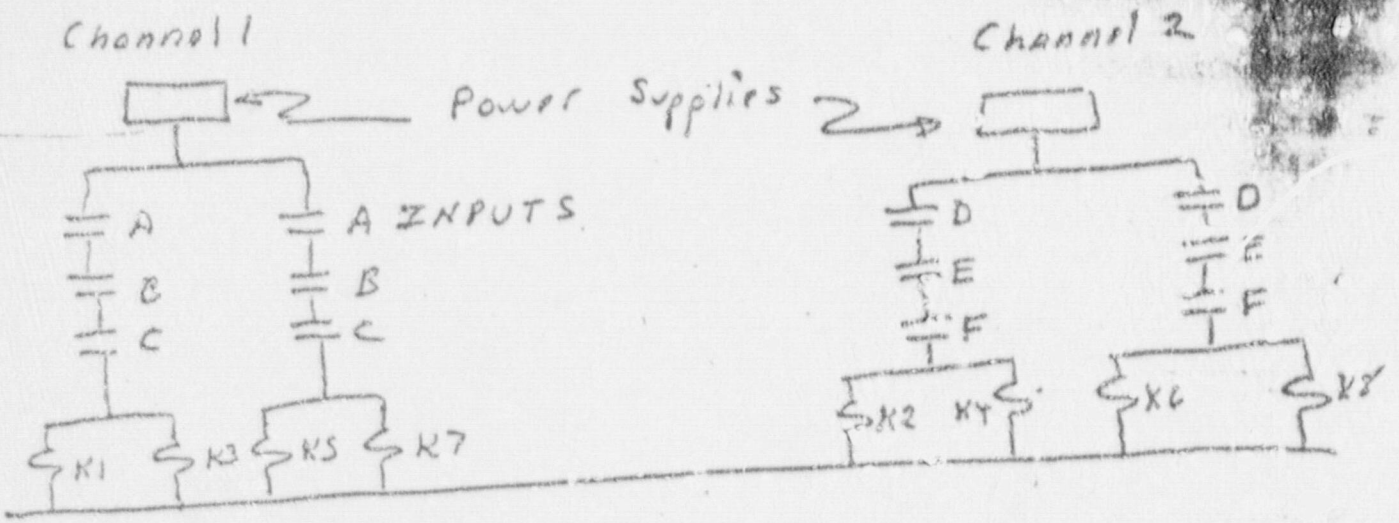
The Dresden scheme contains two outstanding defects:

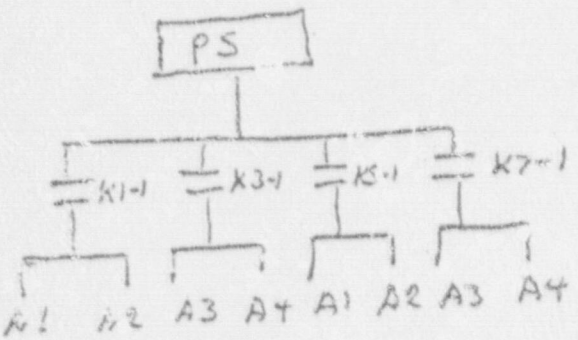
1. An electrical fault which bypasses all three inputs in either channel 1 or channel 2 will paralyze the system.

2. The bypassing equipment places an excessive amount of monitoring equipment of minor importance directly in the safety string thus increasing the exposure to electrical faults.

As an example note that the contact BPA appears at the top of the string and again at the bottom. These are two contacts on the same relay or switch which may be no more than one inch apart which if connected together would make the safety system inoperative.

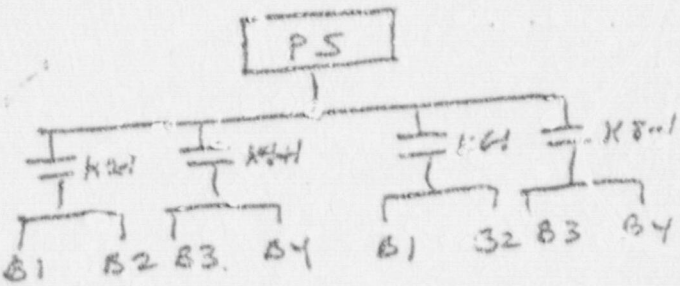
The Jersey Scheme





Channel 1 Rod Groups

1/2 Scram



Channel 2 Rod Groups

1/2 Scram

The Jersey Scheme

1. Both channel 1 and channel 2 must operate correctly in order to produce a scram.

2. Each input channel can produce a half scram in each of four groups of rods, i.e. channel A can produce a half scram in rod groups A1, A2, A3, & A4.

3. Bypasses and inputs for other process variables are not shown.

The Jersey scheme is much improved over the Dresden scheme and is fundamentally sound. Each of two channels must operate correctly to produce a scram, however each channel itself consists of two parts - (sub channels) either of which can produce a half scram. Thus if the sub channels are independent, no single fault can prevent a scram. If on the other hand the two sub channels are not independent a single fault which remains undetected can set up a situation such that the next fault will make the system inoperative.

It is therefore imperative that the two sub channels be made physically independent. The GE schematic attached shows many instances where unusually great exposure exists, which unnecessarily increases the probability of failure.

1. HF1-1 and HF1-2 are adjacent contacts on relay HF1. A fault in the relay or wiring which can tie these contacts together, will tie together the sub channels. The test which is performed by tripping, for example Pico Ammeter #1, will not disclose this fault. This illustrates a general situation which is true of all contacts for both process and nuclear variables as well as for PB1, a single push button for manual scram and to MR1-1 and MR1-2 (manual reset). The bypass system, when developed, will add many additional points of exposure and should be isolated from the safety circuit.

2. K1-1 contact is adjacent to the line contacts K1-2, K1-3, & K1-4. A failure which connects K1-1 to K1-2 will tie the scram relay to the bus and thereby fail the sub channel. This exposure exists for all relays K1 through K8. This fault cannot be detected by the test as proposed.

Although the system is basically sound, it is unsound as presented in that no thought has been given to channel isolation in the schematic. When this system is reduced to hardware, many additional exposure points will be introduced in the wiring layout, especially terminations, thus greatly increasing the probability of failure.

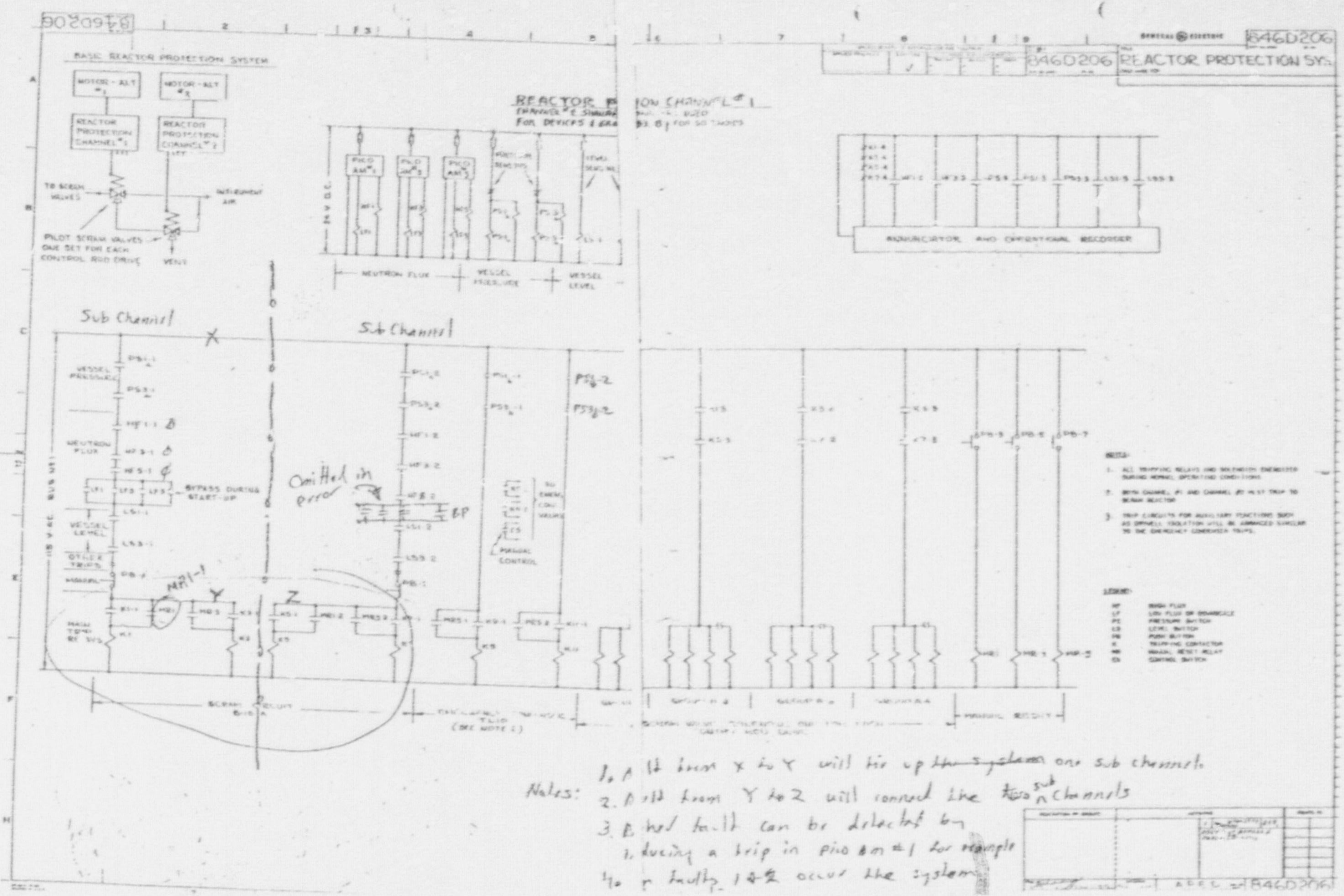
It is my recommendation that measures be taken to obtain complete sub channel isolation and that a test be devised so as to test each sub channel separately so as to discover the first failure as it occurs rather than the second failure as now designed.

E. P. Epler

EPE:jp

Attach

cc: M. M. Mann
R. F. Wilcox
M. C. Gaske
O. Frizzell


846D206
BASIC REACTOR PROTECTION SYSTEM
MOTOR - ALT #1
MOTOR - ALT #2
REACTOR PROTECTION CHANNEL #1
REACTOR PROTECTION CHANNEL #2
TO SCRAM VALVES
INSTRUMENT AIR
PILOT SCRAM VALVES ONE SET FOR EACH CONTROL ROD DRIVE
VENT
REACTOR P... ION CHANNEL #1
NEUTRON FLUX
VESSEL PRESSURE
VESSEL LEVEL
ANNUNCIATOR AND OPERATIONAL RECORDER
Sub Channel
X
Sub Channel
VESSEL PRESSURE
NEUTRON FLUX
BYPASS DURING START-UP
VESSEL LEVEL
OTHER TRIPS
MANUAL
Omitted in error
BP
MANUAL CONTROL
Y
Z
SCRAM CIRCUIT
GENERAL ELECTRIC
REACTOR PROTECTION SYS.
Notes:
1. Fault from X to Y will tie up one sub channel.
2. Fault from Y to Z will connect the two sub channels
3. Bad fault can be detected by
inducing a trip in PICO AM #1 for example