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INTERIM REPORT

EGG-EA-5150

May 1980

TECHNICAL EVALUATION REPORT OF THE ELECTRICAL, INSTRUMENTATION AND CONTROL FEATURES OF PROPOSED HPCI AND ESAP MODIFICATIONS OF THE DRESDEN NUCLEAR STATION, UNIT 1

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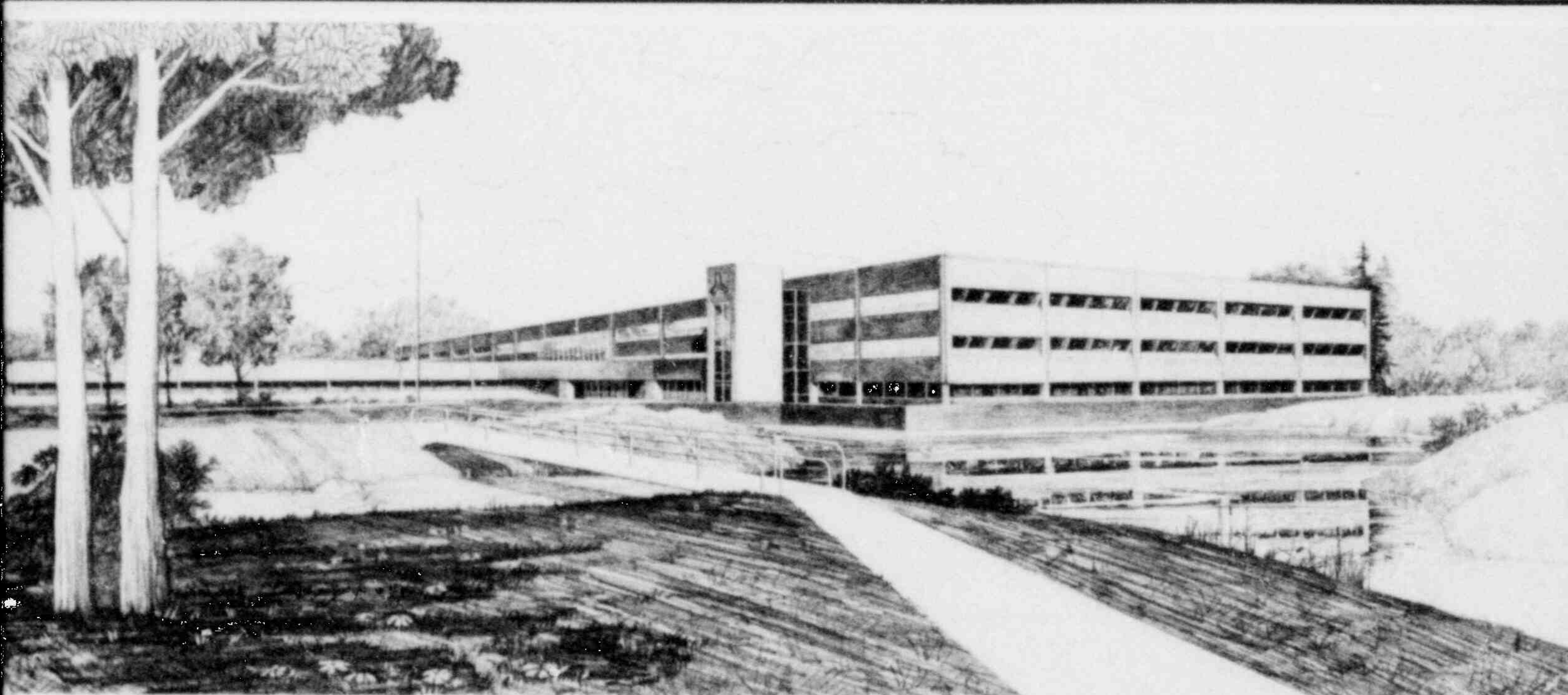
Idaho Operations Office • Idaho National Engineering Laboratory



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TECHNICAL EVALUATION REPORT
ELECTRICAL, INSTRUMENTATION, AND CONTROL FEATURES OF PROPOSED HPCI AND ESAP MODIFICATIONS

DRESDEN NUCLEAR STATION, UNIT 1

Commonwealth Edison Company

Docket No. 50-10

May 1980

S. E. Mays

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DRESDEN NUCLEAR STATION, UNIT 1

1.0 INTRODUCTION

The purpose of the review is to determine whether or not the proposed modifications to the High Pressure Coolant Injection (HPCI) and the Essential Service Auxiliary Power (ESAP) systems at Dresden 1 meet the single failure criteria; are fully testable; have the capacity and capability to accomplish the intended safety function; and satisfy applicable requirements of the regulations and the recommedations of the Institute of Electrical and Electronic Engineers (IEEE) standards, regulatory guides, and Branch Technical Positions (BTP). Commonwealth Edison submitted the proposed modifications to the NRC for review. The NRC requested additional information concerning the modifications in a letter (D. L. Ziemann) to Commonwealth Edison (D. L. Peoples) dated October 11, 1979. Commonwealth Edison responded to these questions in a letter (R. F. Janecek) to NRC (D. L. Ziemann) dated November 6, 1979.

Dresden 1 is one of 11 plants indentified in the Systematic Evaluation Program (SEP). While this report evaluates the Dresden 1 compliance with requirements in SRP 7 and 8, it also covers subjects identified in several SEP Topics, including III-1, Classification of Structures, Components, and Systems; VI-7.C.1, Independence of Redundant Onsite Power Sources; VIII-3, Systems Required for Safe Shutdown; and VIII-2, Onsite Emergency Power Systems--Diesel Generator. Specifically, this report reviews Topics VI-7.C.1 and VIII-2 in full and provides information for the other topics in part.

2.0 REVIEW CRITERIA

Current regulation requirements and other guidelines for EICS features of HPCI and ESAP systems are contained in SRP 7.3 and SRP 8.3. Requirements with regard to the HPCI system, include:

1. The actuation systems must be diverse; redundant; independent; physically separated; capable of initiating the required systems, assuming a single failure; and designed to Class 1E standards

2. The HPCI system should be capable of performing its required functions automatically, assuming a single failure

3. Adequate indications and controls should be available in the control room

4. The system should be testable during reactor operation.

Requirements for onsite emergency power sources include:

1. Redundant ac and dc supplies are required with sufficient capacity to provide the required loads

2. Redundant emergency power supplies are required to be electrically independent, physically separated, designed to Class 1E standards, and capable of providing the minimum required loads automatically, assuming a loss of offsite power and a single failure

3. Onsite ac and dc supplies must be testable during reactor operation

4. Adequate indications and controls must be available in the control room.

3.0 DISCUSSION AND EVALUATION

3.1 HPCI System. The new HPCI system consists of two loops which deliver water from a common 200,000-gallon water storage tank to the reactor vessel. Each loop has a pump and two MOVs to isolate the system from the reactor. The pump discharge piping is common to both loops in three locations. A common test loop with two MOVs connects the discharge side of each pump to the water storage tank so that the pumps can be tested during reactor operation. Figure 1 is a simiplified one-line drawing of the HPCI system.

The HPCI system can accomplish its required function if either pump is operating and one MOV in each of two pairs of MOVs in the discharge lines is open. Each pump is powered from redundant ESAP sources as are each MOV in the two pairs of valves in the discharge lines. Failure of any one component or failure of either ESAP source will not prevent the system from operating when required.

The HPCI actuation system consists of two independent actuation systems using separate sensors and powered from redundant ESAP sources. The actuation system operates to start the HPCI diesel generator, start the HPCI pump, open the discharge line MOVs, and close the test line MOV if open. In addition, this system will cause initiation of the ESAP system associated with the HPCI acutation system (ESF Division I or II).

Each HPCI pump and MOV is normally operated from the control room, but also has a local control station. Each HPCI loop has indication in the control room of pump status, pump discharge pressure, flow, valve position, and temperature. Instruments for each loop are powered by redundant sources. These indications are also available at the local control stations. The 200,000-gallon water tank has redundant level and temperature indications and alarms in the control room and at the local control station.

The HPCI system is testable during reactor operation by operating the pumps and the test line to verify flow rates, etc. The isolation valves may also be tested during reactor operation without causing injection of water to the reactor or loss of reactor water inventory.

3.1.1 Evaluation. The EICS features of the new HPCI system are designed to Class 1E standards, are capable of performing their required functions with a single failure, are testable during reactor operation, and have the necessary controls and indications available in the control room.

3.2 ESAP Systems. The new ESAP system consists of two redundant power systems. Each redundant train has two 4160 V buses, an ESAP diesel generator, an HPCI diesel generator, two 480 V buses, and a 125 V dc battery and bus. The 4160 V buses have a tie breaker between the two, and each can power the 480 V bus via a transformer. One 480 V bus provides power to various ESAP diesel and HPCI system auxiliary loads. This 480 V bus also provides power to a battery charger for the 125 V dc bus. This bus provides dc control power for the various ESF Division I (II) switchgear and actuation systems as well as power for the instrumentation for monitoring each system. Figure 2 is a simplified diagram of the new ESAP system.

The two ESAP actuation systems are redundant, electrically independent, physically separate, and designed to Class 1E standards. Each will actuate its respective ESAP train on loss of normal power or on emergency core cooling system (ECCS) actuation.

The HPCI bus 111 (113) consists of a 3250 KVA HPCI diesel generator, a 3000 hp HPCI pump, a 300 KVA transformer feed to the 480 V bus 115 (117), and a tie breaker from the ESAP bus 110 (112). The HPCI bus 111 (113) is normally supplied from offsite power via bus 110 (112). The tie breaker will trip on overcurrent, on an HPCI actuation signal when the HPCI diesel is at rated speed and voltage, or when the ESAP diesel breaker is closed and no path for offsite power to bus 110 (112) is available. It will automatically close if the HPCI diesel-generator breaker is open. The feed for the 300 KVA transformer to bus 115 (117) is normally open but will automatically close if bus 115 loses power (other feed open) and bus 110 (112) loses power or an HPCI actuation signal occurs. It will trip open if the normal feed breaker is closed and the ESAP diesel-generator breaker is closed.

The HPCI diesel generators have sufficient capacity (3250 KVA) to power the HPCI pump (3000 hp) and the 300 KVA transformer. When an HPCI condition exists, all HPCI diesel-generator trips are bypassed except generator differential current and engine overspeed, as required by Branch Technical Position (BTP) ICSB-17. The HPCI diesel generators are testable during reactor operation.

The 4160 V ESAP bus 110 (112) consists of an 1125 KVA ESAP diesel generator, a 300 KVA transformer feed to bus 115 (117), a tie breaker to the HPCI bus 111 (113), and a tie breaker to bus 12 (11) and the 750 KVA transformer feeding 480 V ESAP bus 15 (16). The feed breaker to the 300 KVA transformer to bus 115 (117) is normally closed and will trip open on loss of power to bus 115 with a loss of power to bus 110 or an HPCI actuation signal. It will automatically close if the tie breaker from bus 110 to 111 (112 to 113) is closed. The tie breaker to bus 12 (11) and the bus 15 (16) transformer is normally closed and trips on overcurrent. On an HPCI actuation signal, this overcurrent trip is bypassed.

Separation of non-essential 4160 V buses from the ESAP 4160 V buses occurs by tripping the feed breaker on bus 12 (11), which normally feed bus 110 (112) and the transformer for bus 15 (16). However, control power for these breakers comes from a common source and is, therefore, susceptible to single failure. Commonwealth Edison has committed to install redundant trip coils powered from redundant Class 1E sources in these breakers to ensure that the separation feature is not susceptible to single failure. Provided that adequate physical separation is maintained between the proposed additional trip coils and the existing control circuitry, this measure would provide for the required bus separation.

Separation of ESAP 480 V buses and non-essential 480 V buses occurs by tripping the tie breaker between buses 15 and 14 (16 and 17). These breakers are normally open but will trip open if closed when power to bus 15 (16) is not being supplied from offsite power. However, these breakers have a common control power source and are, therefore, susceptible to single failures which could prevent them from opening to separate ESAP and non-essential buses. This could result in overloading the ESAP diesel generator or inadventent paralleling of the ESAP diesel generators through tie breakers which can connect bus 14 and 17 load centers. There are no limiting conditions for operation (LCO) requirements prohibiting closure of these breakers during reactor operation. Therefore, these breakers do not comply with current licensing requirements for independence of redundant onsite emergency power systems.

Manual tie breakers exist which can connect redundant load centers powered by buses 15 and 16. These breakers have no interlocks to prevent paralleling of redundant onsite emergency power sources. There are no LCO requirements prohibiting closure of these breakers during reactor operation. These breakers do not comply with the current licensing requirements for independence of onsite emergency power systems.

The ESAP diesel generators have sufficient capacity (1125 KVA) to provide power to the 300 KVA transformer for buses 115 and 117 and the 750 KVA transformer for buses 15 and 16. When an HPCI condition exists, all ESAP diesel-generator trips are bypassed except generator differential current and engine overspeed as required by BTP ICSB-17. The ESAP diesel generators are testable during reactor operation.

The ESAP 125 V dc system consists of two redundant battery/charger systems and their associated distribution systems. Each ESAP 125 V dc bus and its loads are independent of, and physically separated from, each other. A third non-essential 125 V dc system also exists at Dresden 1. The ESAP 125 V dc systems are independent of, and separated from, this system also. The ESAP 125 V dc systems are designed to Class 1E standards. The battery charger for ESF Division I (II) system is powered from bus 115 (117).

Instrumentation for each of the ESAP buses is provided by current or potential transformers on the bus. Each diesel generator has indication in the control room and at the local control station of voltage, frequency, current, and power. Each bus has voltage indication and each transformer has current indication locally and in the control room. Each ESAP battery has current indication while voltage is indicated on the supply and load side of the feed breaker from the battery/charger supply. The batteries are testable during reactor operation.

3.2.2 Evaluation. The redundant ESAP systems at Dresden 1 meet the requirements for electrical independence, redundance, capacity, physical separation, and ability to perform with a single failure, with the exception of the tie breakers connecting buses 14 and 15 (16 and 17) and connecting load centers supplied by buses 15 and 16. The breakers connecting buses 14 and 15 and buses 16 and 17 have a common source of control power and are susceptible to single failures which could cause failure of ESAP and non-essential bus separation, and could cause paralleling of redundant sources. The breakers connecting load centers supplied by buses 15 and 16 have no interlocks to prevent paralleling redundant onsite emergency power supplies. There are no LCO requirements prohibiting operation of these breakers during reactor operation.

4.0 SUMMARY

The new HPCI and ESAP systems at Dresden 1 meet the requirements for electrical independence, physical separation, redundancy, testability, capacity, and ability to perform with a single failure with the exception of the tie breakers connecting redundant load centers and the breakers connecting 480 V ESAP buses to non-essential 480 V buses. The breakers connecting redundant load centers have no interlocks or LCO requirements to prevent paralleling redundant onsite emergency sources. The breakers connecting ESAP buses 15 and 16 to non-essential buses 14 and 17, respectively, have a common source of control power susceptible to single failures which could prevent separation of ESAP and non-essential buses, and could cause paralleling of redundant onsite emergency sources.

5.0 REFERENCES

1. Final Hazzards Summary Report, Dresden Nuclear Station, Unit 1.

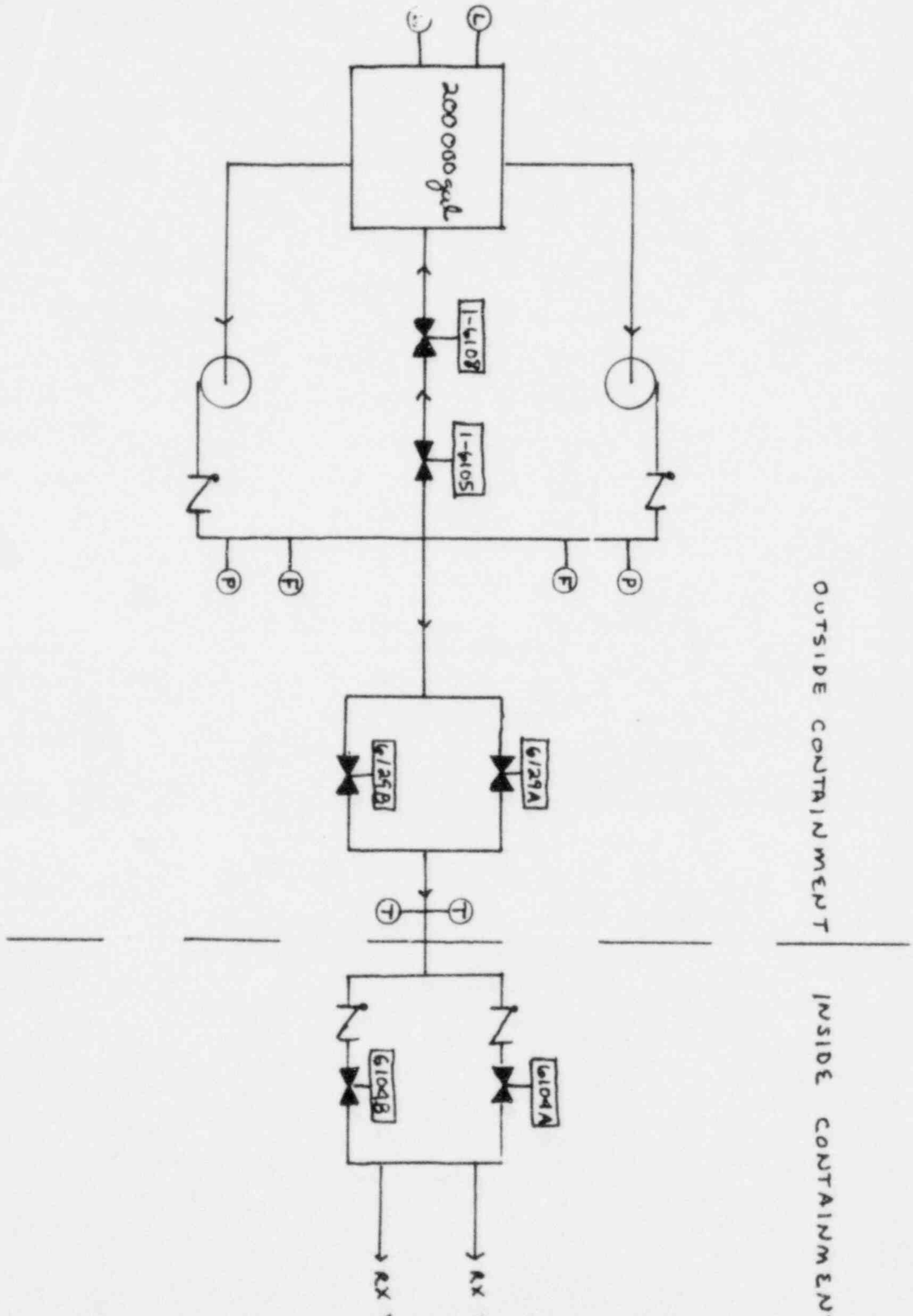
2. NRC letter (Ziemann), to Commonwealth Edison (Peoples), dated October 11, 1979.

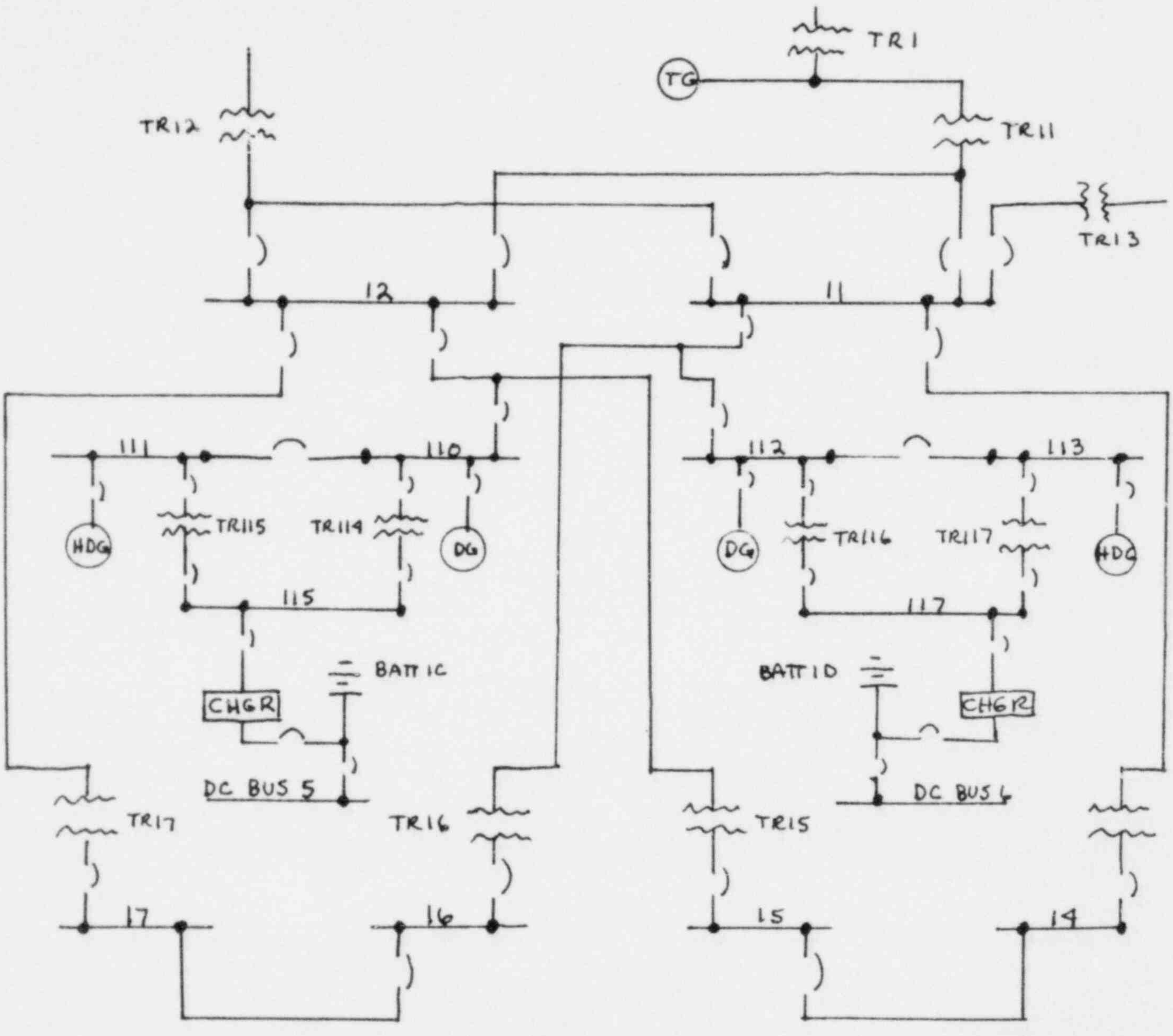
3. Commonwealth Edison letter (Janecek), to NRC 'Ziemann), dated November 6, 1979.

4. Dresden 1 Electrical Drawings 12E-5, 11, 18, 22, 24, 1375, 1376, 1378, 1384-1397, 1420-1423, and 1485.

5. Dresden 1 P&ID Drawings M-784, 785, and 788.

DRESDEN 1 HPCI FIG. 1

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BATT 1C
BATT 1D
CHGR
CHGR
DC BUS 5
DC BUS 6
TR17
TR16
TR15
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