NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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January 31, 1985

Docket No. 50-336
B11426

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

References:

(1) W. G. Counsil letter to D. G. Eisenhut, dated March 1, 1982, Docket No. 50-336.

(2) W. G. Counsil letter to D. G. Eisenhut, dated July 16, 1982, Docket No. 50-336.

(3) D. M. Crutchfield letter to W. G. Counsil, dated January 6, 1983, Docket No. 50-336.

(4) W. G. Counsil letter to D. G. Eisenhut, dated April 15, 1983, Docket No. 50-336 (Subject: Millstone Nuclear Power Station, Unit Nos. 1 and 2 -- Information Supporting 10CFR50 Appendix R Review).

(5) W. G. Counsil letter to D. G. Eisenhut, dated May 25, 1983, Docket No. 50-336 (Subject: Millstone Nuclear Power Station, Unit No. 2 -- Control Room Fire Review Supporting Exemptions from 10CFR50, Appendix R).

(6) W. G. Counsil letter to D. G. Eisenhut, dated December 15, 1982, Docket No. 50-213.

(7) W. G. Counsil letter to D. G. Eisenhut, dated January 31, 1983, Docket No. 50-213.

(8) W. G. Counsil letter to D. G. Eisenhut, dated March 30, 1983, Docket No. 50-213.

(9) W. G. Counsil letter to D. G. Eisenhut, dated April 22, 1983, Docket No. 50-213.

(10) W. G. Counsil letter to D. G. Eisenhut, dated November 4, 1983, Docket No. 50-213.

(11) W. G. Counsil letter to D. G. Eisenhut, dated December 21, 1983, Docket No. 50-213.

(12) D. G. Eisenhut letter to W. G. Counsil, dated November 14, 1984, Docket No. 50-213.

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(13) W. G. Counsil letter to D. G. Eisenhut, dated December 4, 1984, Docket No. 50-245.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Information Supporting 10CFR50
Appendix R Review

By References (1) and (2), Northeast Nuclear Energy Company (NNECO) provided the NRC Staff an assessment of the fire protection features at Unit No. 2 of the Millstone Nuclear Power Station, including requests for exemption from certain provisions of Appendix R to 10CFR Part 50. By Reference (3), the NRC Staff issued its draft SER evaluating NNECO's submittals and preliminarily recommended denial of several exemption requests, including that associated with the Millstone Unit No. 2 control room. In Reference (3), the Staff requested that NNECO review the draft SER and propose actions to resolve the outstanding issues.

In accordance with the Staff request, NNECO reviewed the draft SER and on March 18, 1983, met with the Staff to propose actions to resolve outstanding issues. In References (4) and (5), NNECO documented the results of the March 18 meeting and provided the NRC Staff required additional information thought to be necessary to bring all outstanding issues to a close.

With specific regard to the control room exemption request, it was agreed that the evaluation criteria found to be acceptable by the Staff in its ongoing review of the Haddam Neck control room exemption request would be applied to Millstone Unit No. 2. While the specific evaluation criteria (set forth in Reference (6)) have remained unchanged, the information required by the Staff to complete its evaluation has expanded. In this regard, References (6), (7), (8), (9), (10), and (11) reflect additional information supplied to the Staff concerning the Haddam Neck exemption request.

Due to the uncertainty of the Staff review on the Haddam Neck control room exemption request, and in an attempt to avoid unnecessary commitment of Staff and utility resources, it was agreed that NNECO would not provide additional information regarding the Millstone Unit Nos. 1 and 2 control room exemption requests until after the Staff had completed its review of, and taken final action on, the Haddam Neck exemption request. On November 14, 1984, the Staff issued the final Haddam Neck fire protection SER which included approval of the control room exemption request (Reference 12). Accordingly, NNECO compiled the supplemental information regarding the Millstone Unit Nos. 1 and 2 control rooms which basically corresponds to the information determined to be necessary by the Staff in its evaluation of Haddam Neck. The supplemental information regarding Millstone Unit No. 1 was forwarded to the Staff by Reference (13). The supplemental information regarding Millstone Unit No. 2 is attached hereto and briefly described below.

As set forth in the Attachment, NNECO seeks an exemption from the provisions of Section III.G.2 of Appendix R to 10CFR Part 50 for the Millstone Unit No. 2 control room. References (1), (2), (4), and (5), in combination with the attached information, demonstrate that the active and passive fire protection features

associated with the Millstone Unit No. 2 control room provide an equivalent level of protection to that specified in Section III.G.2. The information provided is essentially the same type as that provided to the Staff which resulted in favorable consideration of the Haddam Neck control room exemption request.

This equivalency is achieved by a three-level approach to fire protection. Specifically, active and passive fire protection measures provide assurance that (1) the likelihood of a fire in the control room is remote, (2) even assuming a fire, the likelihood that it will damage redundant safe shutdown equipment is remote, and (3) even if a fire was large enough and went undetected so as to damage redundant safe shutdown equipment, operator action can be taken to comply with the three criteria established by the NRC Staff in review of the Haddam Neck exemption request (set forth in Reference (6)) necessary to provide equivalency. These three criteria are:

- operability to safe shutdown with loss of two adjacent main control board panel sections or a single fully enclosed auxiliary control board panel, or a technically justified evaluation of a fire within the main control board of a magnitude smaller than two adjacent main control board panels;

- that spurious equipment operation can be compensated for using either a system approach or loss of adjacent panel section analysis;

- actions being taken outside of the control room are achievable considering fire in the control room, time needed to accomplish the function, and manpower required.

To meet the NRC Staff's three criteria, noted above, NNECO divided the Millstone Unit No. 2 control room into two fire zones, Fire Zone B contains one panel of isolation switches and Fire Zone A contains the remainder of the control room (see Figure 1 in the Attachment). (This division is significantly more conservative than that set forth in the three criteria determined by the Staff to be acceptable, as noted above.) An evaluation was conducted to assure that actions could be taken in a timely manner with available crew to bring the plant to safe shutdown. This evaluation assumed the burn-out of either control room fire zone, an event that NNECO clearly views as incredible. In this evaluation the possibility of spurious operation was appropriately considered.

The attached information provides a description of the passive and active fire protection measures taken to provide equivalent protection, including the details of the control room fire zone burnout analysis. Table 1 of the Attachment provides a control room zone-by-zone listing of safe shutdown circuits, failure modes, the effect of a burnout on safe shutdown and compensatory actions. Table 2 provides a listing of operator actions (within and outside the control room) with corresponding locations and overall time estimates for completion, assuming a burnout of Zone A. (Operator actions assuming a Zone B burnout are minimal and set forth in Table 1.) It should be noted that Tables 1 and 2 address spurious operation of equipment that can affect safe shutdown capability, and, as with the Haddam Neck submittal, assumes a scram of the reactor is accomplished from the control room. Table 3 lists the operator actions required to bring the plant to cold shutdown. As with the Haddam Neck submittal, the

attached information also addresses proposed modifications, control room habitability, fire brigade actions and communications between operators and fire brigade members.

The attached information is compiled to consolidate and update the pertinent information set forth in References (1), (2), (4), and (5) regarding the control room exemption request. However, some general information included in these References which was provided in response to specific questions posed by the Staff was not consolidated, e.g., responses to Generic Letter 81-12 questions are included in Reference (5). With regard to proposed modifications and alternative actions, the Attachment supersedes these other references. The major changes in direction reflected in the attached information are NNECO's decisions (1) to use a Millstone Unit No. 1 diesel generator to supply emergency power capability to Millstone Unit No. 2 during a fire condition, (2) to install isolation switches in the control room as Zone B and for analytical purposes assume a complete burnout of the remainder of the control room, and (3) based on (2) above, to withdraw proposed modifications related to closure of cabinet openings, sealing floor/cabinet junctions, installation of ramps and installation of halon suppression system for the main control board.

In conclusion, NNECO maintains that the information contained herein together with that submitted in References (1), (2), (4), and (5) is sufficient to allow the NRC Staff to act favorably on all outstanding exemption requests for Millstone Unit No. 2. The detailed operating procedures and the associated plant modifications noted in this information will be implemented on a schedule which will be finalized subsequent to NRC Staff issuance of a favorable SER. To the extent that the NRC staff proposes to take action denying the control room or any of the remaining unresolved exemption requests, NNECO reaffirms its request as set forth in References (4) and (5) for an appeal meeting prior to issuance of the final fire protection SER for Millstone Unit No. 2.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
Senior Vice President

cc: R. H. Vollmer
W. V. Johnston

Docket No. 50-336

Attachment

Millstone Nuclear Power Station, Unit No. 2

Supplemental Information Regarding Appendix R
Control Room Exemption Request

January, 1985

Millstone 2

Supplement Information Regarding App. R,

Control Room Exemption Request

El. 38'6" Auxiliary Buildings

Main Control Room Fire Area No. A-42

Exemption Request

NNECO requests an exemption for the Millstone Unit 2 control room from the requirements for twenty foot separation with no intervening combustibles between redundant, safe shutdown equipment and suppression as set forth in Section III.G.2 of Appendix R to 10CFRPart 50.

Safe Shutdown Equipment

A list of safe shutdown systems is provided in the W. G. Counsil letter to D. G. Eisenhut, dated May 20, 1983, Docket No. 50-336, as attachment 1, question (a).

Safe shutdown equipment in the control room is generally contained in the main control board (MCB) and auxiliary control boards (ACB). See Figure 1. This equipment is identified in Table 1. As shown in Figure 1, the control room is divided into two fire zones, Zone B which contains only a proposed panel of isolation switches and Zone A which includes the remainder of the control room and contains redundant safe shutdown equipment.

Fire Loading

Combustible Materials	Class	ft^3	BTU/ft^2
Cable & paper	C and A	100	23,100

- Fire Duration = 17.5 min.

Design Features

The control room is bounded on the east by a 24" thick reinforced concrete wall (12" block around the stairway), on the north by a 24" thick reinforced concrete wall, and on the west by a 18" thick reinforced concrete wall. On the south there is an acoustic metal panel and sliding glass partition separating the adjacent Millstone Unit No. 1 and Unit No. 2 control rooms. The exit doors are made of steel. The floor and ceiling are reinforced concrete slabs 12" and 24" thick, respectively. The control room is separated from other fire areas containing alternative shutdown equipment and controls by equivalent three hour barriers. Other control room design features include the following:

- control room volume equals 41,104 ft^3.
- All penetrations are sealed with RTV foam.
- Fire dampers have been installed in ventilation duct work.
- Floor tile and ceiling material are noncombustible.

Existing Fire Protection Features

Existing fire protection features include the following:

- Two 17 lb. Halon 1211 extinguishers.

- Three 20 lb. carbon dioxide extinguishers.

- Early warning ionization smoke detectors in the return ducts of the air supply system which cause an alarm and initiate a control room purge upon sensing smoke or products of combustion.

- Smoke detection equipment is located in areas that are out of the line of vision of the operators at the control console, but not directly inside the MCB or ACBs.

- Three 9,600 cfm portable smoke ejectors are available. Two of these are in the fire lockers located outside the control room. The third is located in the fire locker next to the Health Physics Office (elevation 14'16", on the north side of the Millstone Unit No. 1 turbine building). Power for these smoke ejectors could be provided from throughout Millstone Unit No. 1 control room.

- Breathing air capacity includes nine 30-minutes Scott Air Pacs and a hardpiped station air source which provides continuous air for six persons. These are located in the control room.

Proposed Modifications

In addition to existing fire protection features, NNECO proposes the following modifications:

1. Customized administrative controls (similar to those accepted for Haddam Neck) will be implemented to minimize introduction of flammable materials in the control room.

2. Normal operating procedures will be revised to require an inspection of the control room for flammable materials during each shift.

3. A transfer scheme utilizing a Wiedmuller Test Block (or equivalent) to isolate required instrumentation from the control room and redirect the instrumentation signals to the new remote Fire Shutdown Panel (see Figure 7) will be installed.

4. Disconnecting devices for pressurizer PORVs, main steam isolation valves, atmospheric dump valves, and SG blowdown valve control circuitry will be installed to assure closure of these valves during a control room fire (see Figure 2).

5. The Millstone Unit No. 1 - Millstone Unit No. 2, 4-kV cross-feed bus will be modified to facilitate the alignment of Unit No. 1 emergency AC power to the Unit No. 2 emergency buses (see Figure 3).

6. Manual/air operated valves to provide RCS level and pressure control for cold shutdown will be installed in charging and auxiliary spray flow paths.

7. The pressurizer and reactor head vent control circuits will be modified to protect against hot shorts for control room fires.

8. A remote Fire Shutdown Panel in Fire Zone T8 will be installed (see Figure 4).

9. Procedures to assure the following will be developed:

   - o Capability to achieve safe shutdown with the loss of equipment in any one of the two fire zones shown in Figure 1.

   - o Spurious operation of affected equipment can be compensated for using alternate systems and manual actions.

   - o Actions being taken outside the control room are achievable considering a fire in the control room, time needed to accomplish the function and manpower required.

Discussion

The bases and justification for the requested exemption for the Millstone Unit No. 2 control room involves three tiers or levels of protection/defense:

- Level I - The likelihood of a fire in the Millstone Unit No. 2 control room is remote due to the unique features of the control room, and proposed customized administrative controls.

- Level II - Hypothetically assuming a fire does occur, due to the existing and proposed fire protection features, the likelihood that it will render redundant safe shutdown equipment inoperable is remote.

- Level III - Hypothetically assuming a fire occurs, that causes damage to redundant safe shutdown equipment, alternate operator action is identified which provides assurance that safe shutdown can be achieved.

With regard to Levels I and II, the control room differs from all other areas of the power plant with respect to the potential for starting or sustaining a destructive fire that could impact redundant safe shutdown equipment. (Destructive fires that could adversely affect redundant trains of safe shutdown equipment could only result from fires that go undetected for considerable periods of time, or those fires that develop rapidly because of large quantities of combustibles, such as flammable liquids.) The control room has unique features which greatly reduce the possibility of fire and virtually eliminate the possibility of destructive fires, as noted above. These unique features include the following:

1. Continuously manned by licensed operators who have fire protection training.

2. Restricted area with controlled access.

3. Totally enclosed by reinforced concrete with restricted entry. A smoke barrier (metal and wire glass) was installed to separate the adjacent Millstone 1 and 2 control rooms. This was installed in accordance with the NRC BTP 9.5.1 review.

4. No significant permanent combustibles, and the distribution of combustibles such that, if a fire were to occur, the likelihood of rapid propagation is virtually nonexistent.

5. No high/medium voltage power sources, except for 7.9 horsepower shutdown cooling isolation MOV (480 volt, energized only when valve is to be operated for cold shutdown) disconnect switches; minimal potential ignition sources.

6. Adequate fire protection for type and quantity of combustibles; portable extinguishers located throughout the room.

7. Early warning detection provided by control room licensed operators and ionization detection.

8. Proposed customized administrative controls to restrict flammable materials in the control room.

Technical Specifications require that four (4) licensed operators be on shift in Modes 1 through 4 and two (2) licensed operators in Modes 5 and 6. (However, it is NNECO's current policy to have a minimum shift complement of six persons.) While the likelihood of any fire is remote, if a fire starts is would likely be a slow smoldering fire because of the type and quantity of combustible materials present and heat sources available. This type of incipient fire would be detected promptly by licensed personnel on duty and/or the installed ionization smoke detection system. Portable extinguishers can readily handle any control room fire that could occur. (It should be noted also that essentially all licensed operators are trained members of the plant fire brigade.) Because the control room is a locked/restricted area, the potential for introducing large quantities of transient combustibles is remote.

The control panel wiring installed in the Millstone Unit No. 2 control room cabinets is IEEE-383 qualified providing a high degree of resistance to damage from the effects of a fire. The damage threshold for cabling qualified to IEEE-383 has been demonstrated to be on the order of 260°C. Should a cable fire start, it would be slow in developing, easily detected and quickly extinguished due to its inherent properties.

The control room also has many other favorable features which contribute to the prevention, quick detection, and/or rapid suppression of a fire. In 1978, the NRC conducted site fire protection inspections to evaluate compliance with Branch Technical Positions 9.5-1, Appendix A. All fire protection recommendations generated for the control room by the NRC and their fire protection consultants have been implemented.

The combined features listed above represent a defense-in-depth approach to fire protection by providing sufficient levels of active, passive, and administrative control features to assure that the control room remains functional. This basis alone, in our view, is sufficient to justify the exemption requested. Although we do not deem further consideration of a damaging fire warranted, additional reviews were conducted to demonstrate to the Staff that even under incredible hypotheses of fire initiation and propagation, safe shutdown integrity is maintained. This hypothesis is characterized as Level III protection.

With regards to Level III, NNECO performed failure mode and effects analyses of the main control board (MCB) and auxiliary control boards (ACB), including the Foxboro Spec 200 instrument panel, to determine the impact on safe shutdown of a control room fire which involves the internals of these panels. The results of the analyses presented herein demonstrate that safe shutdown can be achieved with alternate operator actions performed inside and outside the control room, assuming the complete loss of the main control board (MCB), the enclosed auxiliary control board (ACB) panels, and all Foxboro Spec 200 instrumentation panels. The purpose of the analyses was to demonstrate:

1. capability to achieve shutdown safely with loss of all controls in the main Control Room with the exception of the equipment in Fire Zone B, i.e. one cabinet consisting of proposed isolation ("kill") switches for the MSIV, PORV, atmospheric dump valve and SG blowdown valve control circuitry (see Figure 1);

2. spurious operation of affected equipment can be compensated for by taking corrective actions, both inside and outside the control room; and

3. actions taken outside the control room are achievable considering a fire in the control room, time needed to accomplish the functions, and manpower required.

The control room analysis divided the control room into 2 fire zones, Zones A and B (see Figure 1). Fire Zone B encompasses the new proposed Isolation ("kill") switches for the MSIV, PORV, atmospheric dump valve and SG blowdown valve control circuitry. Fire Zone A encompasses the remainder of the control room. NNECO has expanded the loss of control panel analysis from the previously agreed upon two adjacent panels to the two fire zones shown in Figure 1. Based upon the results of the expanded analysis and the proposed modifications, NNECO concluded that Millstone Unit No. 2 can be safely shut down, despite complete burnout of either Fire Zone A or B. In the event of burnout of Fire Zone A, operator action inside the control room would be limited to isolating the MSIVs, PORVs, atmospheric dump valves and SG blowdown valves by utilizing the proposed isolation switches as the operators exit the control room. Operator Action for a Zone B fire (inside proposed Isolation "kill" switch cabinet) would be limited to using (normal) controls on the MCB for opening circuits which provides power to the Isolation switches (cabinet), thus causing the effected components to go closed.

Cabling to these switches will be routed such that the system affected will not be subjected to spurious operation due to hot shorts. NNECO intends to locate

these switches inside the control room (Fire Zone B) to limit personnel access (security considerations) and assure quick response time. It is NNECO's position that these switches would not be affected by a control room fire in Fire Zone A, based upon the following:

- Isolation switches will be enclosed in a sheet metal cabinet.

- Limited combustibles within control room.

- Spacial separation between this cabinet and adjacent cabinets (approximately 15' of clear air space). A fire generated from within the MCB would not affect isolation switches due to the lack of a propagation mechanism and insulation properties associated with the air space.

- Due to consideration for personnel access (near doorway), no combustibles are stored or allowed to be stored anywhere near this proposed cabinet.

- Switches would only be required to be operational assuming the control room operators exit the control room due to a massive hypothetical fire in Fire Zone A.

Should a fire occur in Fire Zone A which makes further control from the control room impossible (due to habitability), the operators would trip the reactor, and isolate MSIVs, PORVs, atmospheric dump valves, and steam generator blowdown

valves at the proposed isolation panel (see Figure 5) as they exit the control room. Then, from outside the control room, the plant would be put into hot shutdown using alternate operator actions as described in Table 2.

Control of the plant will be maintained at the proposed new Fire Shutdown Panel, located in Fire Area T.8 (El 56'-6", Turbine Building), and illustrated in Figure 4. The Fire Shutdown Panel will contain essential primary and secondary RCS and Steam Generator process instrumentation and the key controls necessary to control RCS pressures, levels and cool-down rates. Once the plant has been stabilized in a hot standby condition, it can be cooled to shutdown cooling entry conditions with the use of the controls on the proposed Fire Shutdown Panel and alternate operator actions. Cold shutdown can be achieved in 72 hours using alternate operator actions as described in Table 3.

Assuming a fire in the Control Room, a total of three (3) operators would be required to initiate alternative shutdown actions from inside and outside the control room.

The Millstone Unit No. 2 fire brigade would be supplemented by personnel from Millstone Unit No. 1, as is current practice. The on-shift complement of personnel at both plants is more than adequate to fulfill both the fire fighting and alternate shutdown activities for a postulated control room fire. Communications between operators would be through normal interplant systems with portable two-way radios as backup.

Control Room Habitability

Although not required for safe shutdown, NNECO intends to maintain operator presence in the control room in the event of a fire. It is NNECO's position that the type and size of a fire that is postulated for the control room would not generate enough smoke to affect control room operation. Ceiling height assures that any smoke generated from the fire would rise away from the control panels to the space above. This space (72.75 feet by 56.5 feet by 2 feet) is capable of containing 8220.8 cubic feet of smoke before starting to affect visibility. Should smoke become a problem, smoke detectors in the ventilation ductwork would sense the smoke and automatically initiate operation of the existing smoke removal system. As a backup to the control room smoke removal system, the fire brigade can position the plant's three, 9,600 cfm smoke ejectors in the doorway leading to the turbine building (Figure 6). The three ejectors are capable of displacing 28,800 cfm or approximately one air change per every 1.5 minutes. It should be noted that these smoke ejectors can be powered from the Unit 1 control room.

If smoke build-up continues to be a problem, the control room operators would be able to don 30-minute Scott Air Pacs (nine of which are located in the control room) or utilize the existing breathing air system (hardpiped), which provides a continuous supply of air for six persons.

While NNECO does not believe that it is credible to assume a fire that would force evacuation of the control room, control room evacuation would not adversely impact safe shutdown of the plant.

Conclusion

NNECO concludes that the defense-in-depth approach to fire protection in the control room of Millstone Unit No. 2 provides an equivalent level of protection to that of Section III.G.2 of Appendix R. In addition, the proposed modifications together with the available alternate operator actions noted above, provide reasonable assurance that safe shutdown will be achieved and maintained in the event of a control room fire.

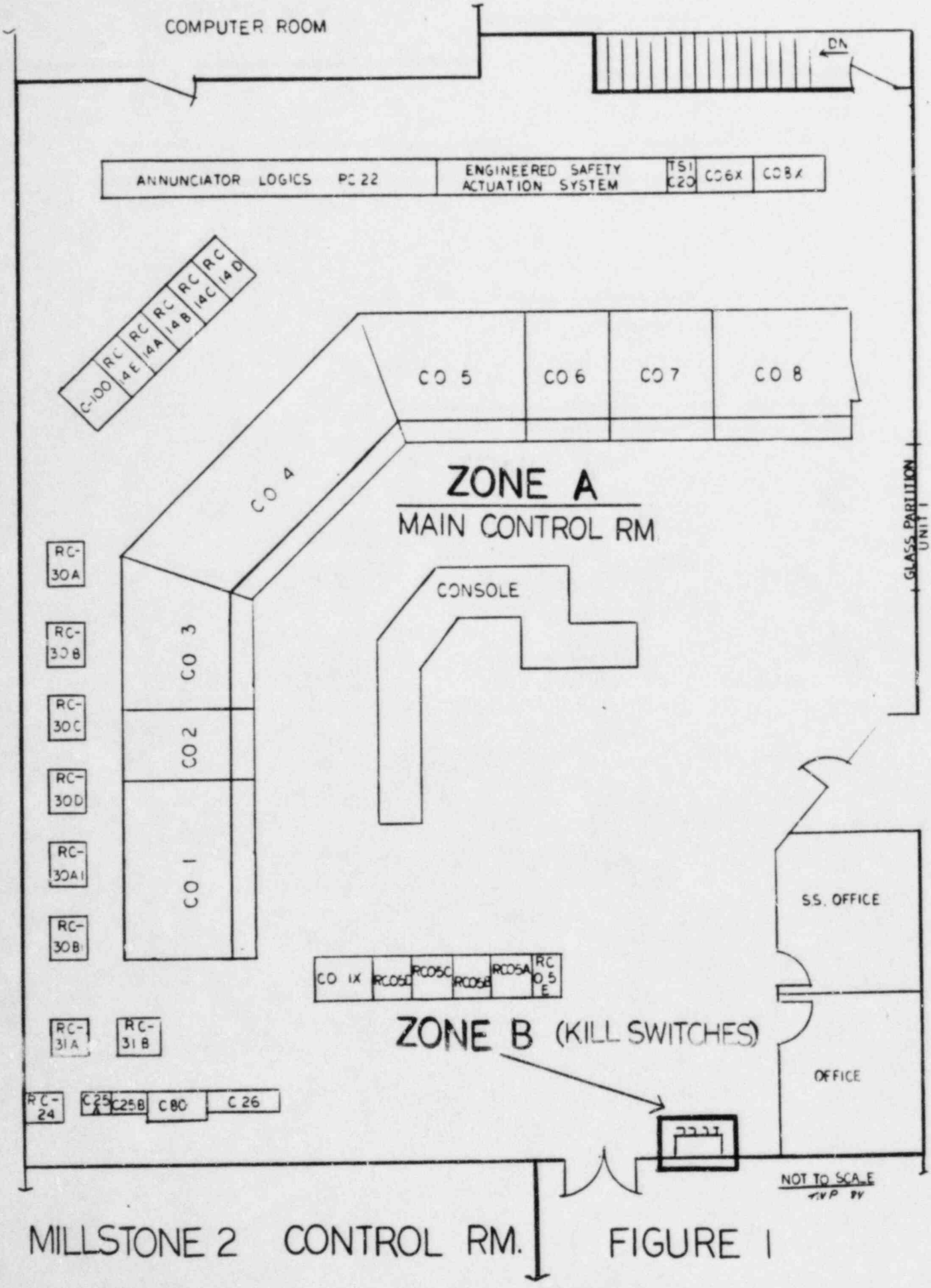
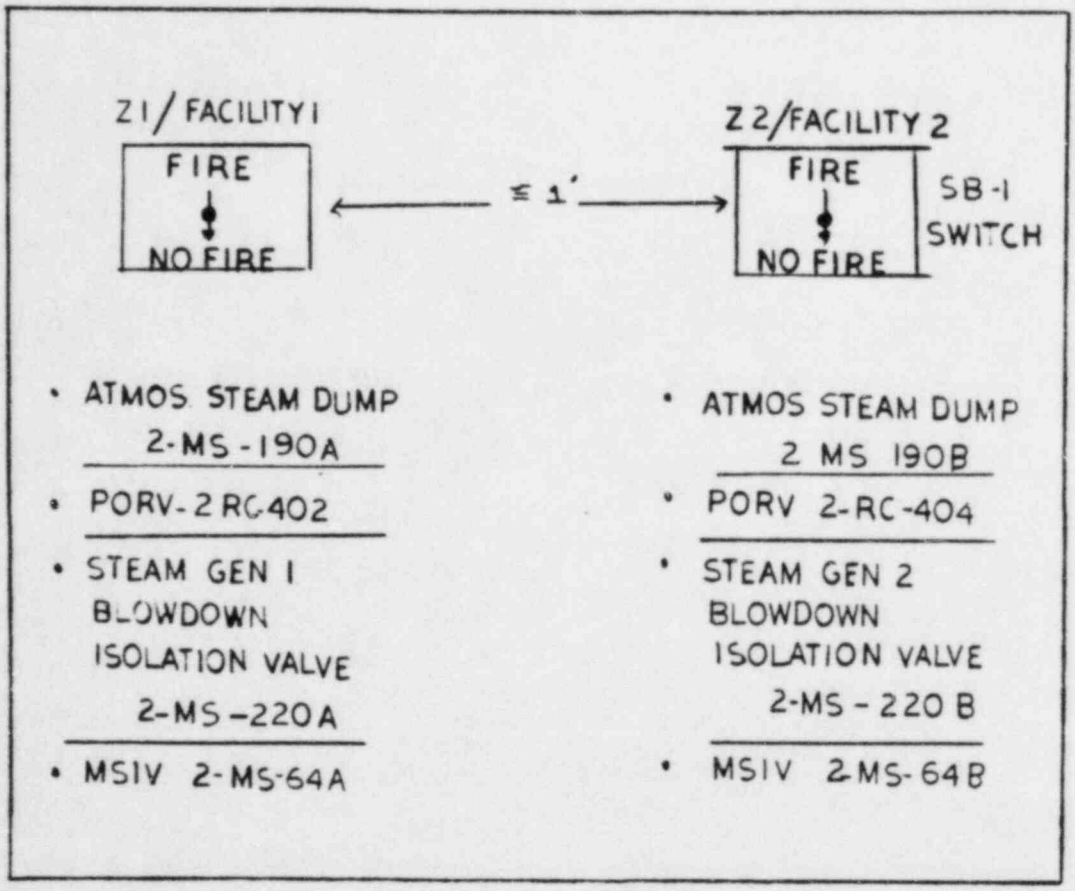

COMPUTER ROOM
DN
ANNUNCIATOR LOGICS PC 22
ENGINEERED SAFETY ACTUATION SYSTEM
TSI C20
C06X
C08X
RC 14D
RC 14C
RC 14B
RC 14A
RC 4E
C-100
CO 5
CO 6
CO 7
CO 8
CO 4
ZONE A
MAIN CONTROL RM
GLASS PARTITION UNIT 1
CONSOLE
RC-30A
RC-30B
RC-30C
RC-30D
RC-30A1
RC-30B1
CO 3
CO 2
CO 1
S.S. OFFICE
CO 1X
RC05D
RC05C
RC05B
RC05A
RC 05 E
ZONE B (KILL SWITCHES)
RC-31A
RC-31B
OFFICE
RC-24
C25A
C25B
C80
C 26
NOT TO SCALE
MILLSTONE 2 CONTROL RM.
FIGURE 1

FIGURE 2

PROPOSED ISOLATION "KILL" SWITCHES

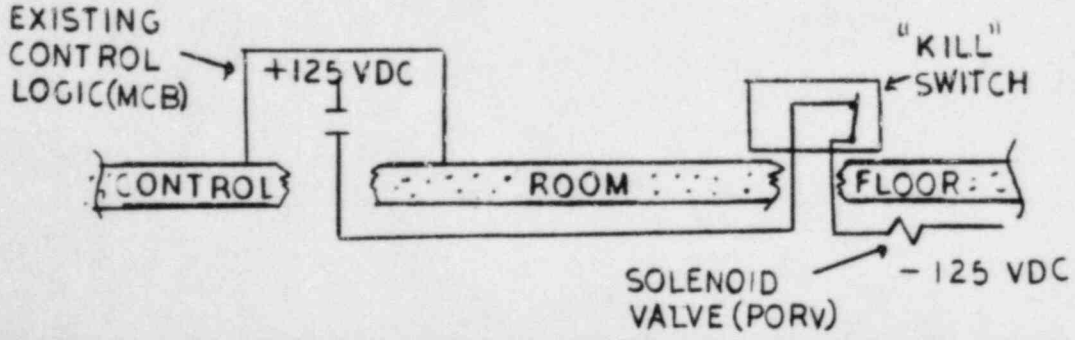
FIRE ZONE B



NOTE: •SWITCHES WILL BE ENCLOSED IN A METAL CABINET

•SWITCHES WILL ISOLATE POTENTIAL CONTROL ROOM "HOT SHORTS" FOR EQUIPMENT LISTED ABOVE

•TYPICAL CONTROL CIRCUIT MOD.



TNP 1/15

FIGURE 3

MP1/MP2 BACK UP POWER FEED

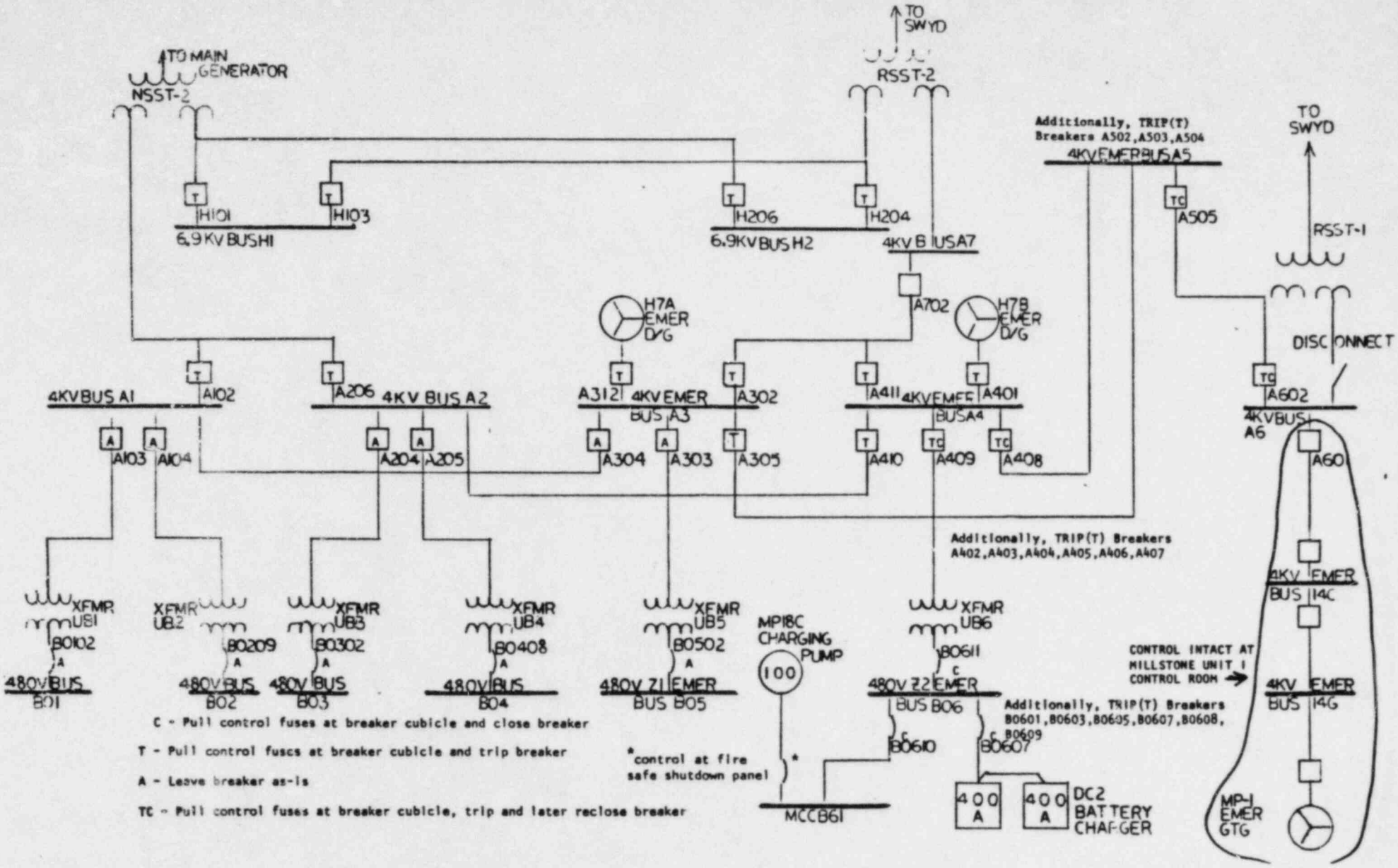


FIGURE 4

NEW FIRE SHUTDOWN PANEL

PROPOSED LOCATION - T-8

Z-2 INSTRUMENTATION & INDICATION

PRESSURIZER	RCS	STEAM GEN.	MISC.	
PRESSUR PRESS.	LOOP 2 T_{HOT}	GEN. 2 PRESS.	WIDE RANGE N.I.	NOTE: WIDE RANGE INCLUDES SOURCE RANGE
PRESSUR LEVEL	LOOP 2 T_{COLD}	GEN 2 LEVEL	COND. STORAGE TANK LEVEL	READ LOCALLY (MOD. REQ'D)

Z-2 ISOLATION & CONTROL SWITCHES

LETDOWN — CL OP — 2-CH-089 — FIRE — NO-FIRE

AUX. SPRAY — CL OP — 2-CH-517

CHARGING - FLOW PATH - CHARGING PUMP — CL OP — 2-CH-519

CL OP — 2-CH-429

STR. STR — P-18C

SB 1 CONTROL SWITCHES

AUX FEEDWATER - TERRY STEAM — CL OP — HS-4188 STOP VLV — FIRE — NO FIRE

DEC INC — GOV.

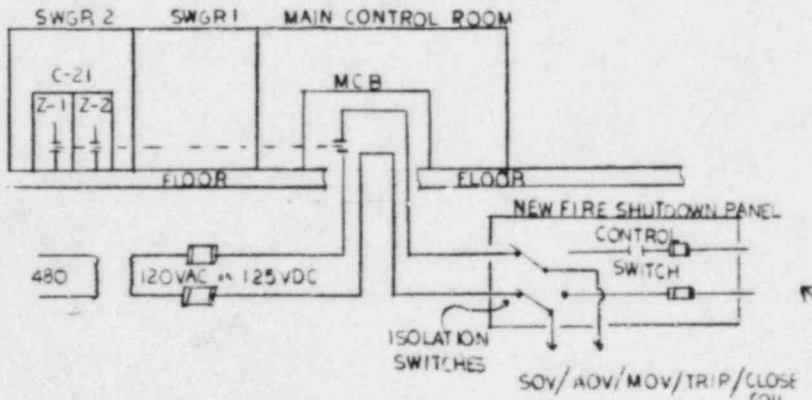
TURBINE CONDENSATE — CL OP — 2-FW-43B STOP VLV

HIC FOR 2MS-190E

SB1 CONTROL SWITCHES & HIC CONTROLLER

NOTE: CAT. 1E ISOLATION SWITCHES (BREAK BEFORE MAKE)

TYPICAL CONTROL CIRCUIT MODIFICATION :



NOT TO SCALE
TNP 1-85

REVISIONS DURING CONSTRUCTION

NORTHEAST UTILITIES SERVICE CO.

FIGURE 5

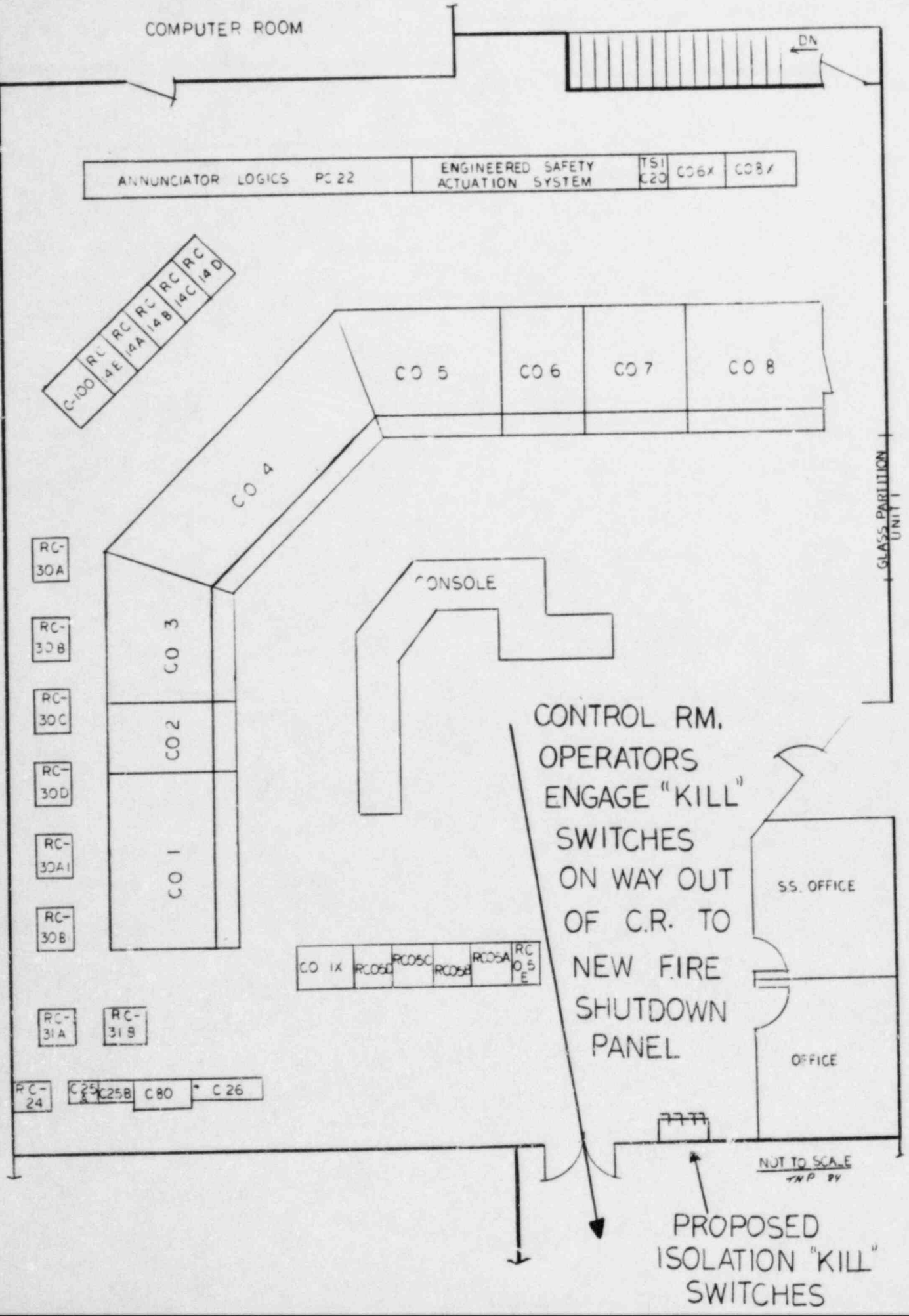

COMPUTER ROOM
DN
ANNUNCIATOR LOGICS PC 22
ENGINEERED SAFETY ACTUATION SYSTEM
TSI C20
CO6X
CO8X
RC 14D
RC 14C
RC 14B
RC 14A
RC 14E
C-100
CO 5
CO 6
CO 7
CO 8
CO 4
GLASS PARTITION UNIT 1
CONSOLE
RC-30A
RC-30B
RC-30C
RC-30D
RC-30A1
RC-30B
CO 3
CO 2
CO 1
CONTROL RM. OPERATORS ENGAGE "KILL" SWITCHES ON WAY OUT OF C.R. TO NEW FIRE SHUTDOWN PANEL
SS. OFFICE
OFFICE
CO 1X
RC05D
RC05C
RC05B
RC05A
RC 05 E
RC-31A
RC-31B
RC-24
C25A
C25B
C80
C 26
NOT TO SCALE
TNP 8Y
PROPOSED ISOLATION "KILL" SWITCHES

FIGURE 6

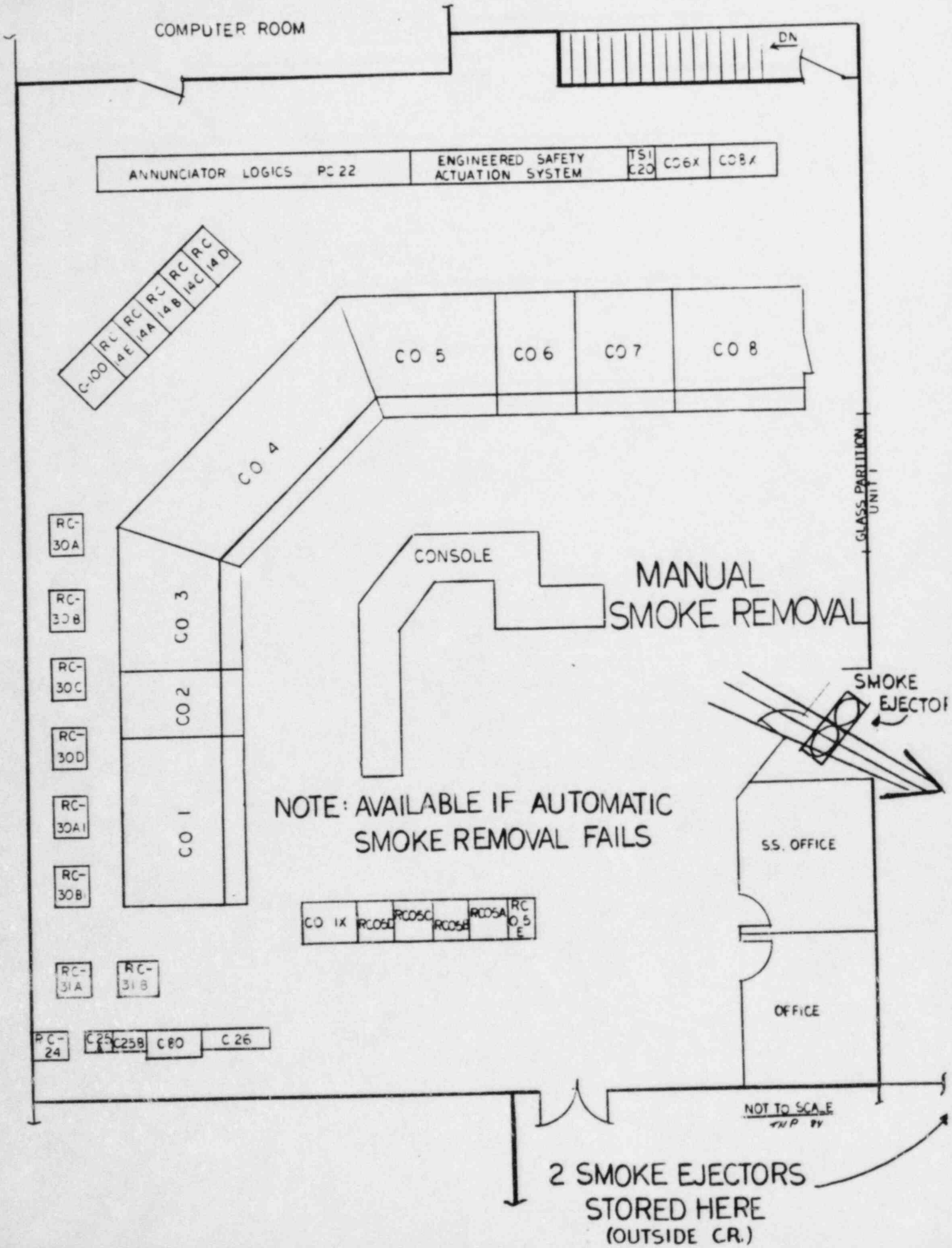
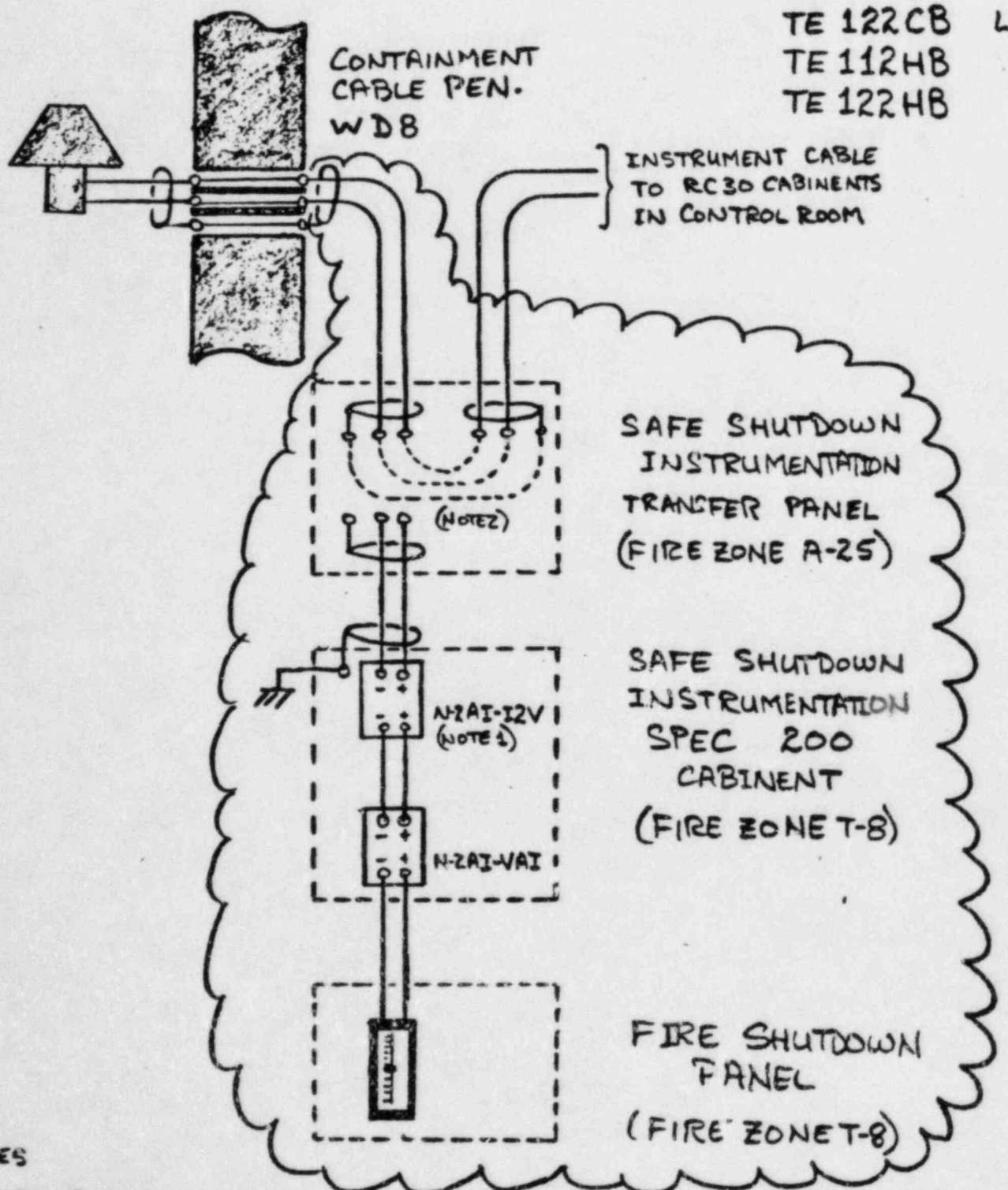

COMPUTER ROOM
DN
ANNUNCIATOR LOGICS PC 22
ENGINEERED SAFETY ACTUATION SYSTEM
TSI C20
C06X
C08X
RC 14D
RC 14C
RC 14B
RC 14A
RC 14E
C-100
CO 5
CO 6
CO 7
CO 8
CO 4
CO 3
CO 2
CO 1
GLASS PARTITION UNIT 1
CONSOLE
MANUAL SMOKE REMOVAL
SMOKE EJECTOR
NOTE: AVAILABLE IF AUTOMATIC SMOKE REMOVAL FAILS
RC-30A
RC-30B
RC-30C
RC-30D
RC-30A1
RC-30B
CO 1X
RC05D
RC05C
RC05H
RC05A
RC 0.5 E
RC-31A
RC-31B
PC-24
C25
C25B
C80
C 26
S.S. OFFICE
OFFICE
NOT TO SCALE
2 SMOKE EJECTORS STORED HERE (OUTSIDE C.R.)

FIGURE 7

PROPOSED INSTRUMENT LOOP MODS

LOOPS AFFECTED:

PT 1Ø2B	PT1Ø13B
LT 11ØY	PT1Ø23B
TE 112CB	LT1113B
TE 122CB	LT1123B
TE 112HB	
TE 122HB	



NOTES

1. RTD INPUTS TO N-2AI-P2V CARD
2. TRANSFER ACCOMPLISHED BY WEIDMULLER TEST BLOCKS

MP2 SK DVC 122684-1

TABLE 1

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C01

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
P42A P42B	LOW PRESSURE SAFETY INJECTION PUMPS, SHUTDOWN COOLING PUMPS	RUNNING	LOSS OF PUMP IF MINI-FLOW RECIRCULATION NOT OPEN	TRIP PUMPS AT 4KV BREAKERS
		NOT RUNNING	NONE	
P40A P40C P40B P40D	REACTOR COOLANT PUMPS	RUNNING	UNCONTROLLED DECREASE IN RCS PRESSURE IF SPRAY VALVE FAILS OPEN	TRIP PUMPS AT 6.9KV BREAKERS
		NOT RUNNING	NONE	

TABLE 1 cont.

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C02

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
CONTROL FOR PUMPS				
P18A P18B P18C	CHEMICAL/VOLUME CONTROLS SYSTEM-CHARGING PUMPS	RUNNING	POSSIBLE OVERFILL OF PRESSURIZER	1) KILL POWER AT 4 KV BREAKERS
		NOT RUNNING	LOSS OF CHARGING FLOW	2) OPERATE PUMP P18C FROM NEW "FIRE SHUTDOWN PANEL" IN SWGR ROOM FIRE AREA T-8
CONTROL CIRCUITS FOR VALVES: 2-CH-518 2-CH-519 2-CH-429	CHEMICAL/VOLUME CONTROL SYSTEM-CHARGING FLOW PATH	OPEN	NONE	
		CLOSED	LOSS OF CHARGING FLOW	1) OPEN VALVES 2-CH-429 & 2-CH-519 @ NEW "FIRE SHUTDOWN PANEL". NOTE: 2-CH-429 IS MOTOR OPERATED AND REQUIRES 480V POWER TO BE ESTABLISHED AT ITS BREAKER
CONTROL CIRCUITS FOR VALVES: 2-CH-515 2-CH-516	CHEMICAL/VOLUME CONTROL SYSTEM LETDOWN FLOW PATH	CLOSED	NONE	
		OPEN	LOSS OF RCS LEVEL	1) MANUALLY CLOSE AOV 2-CH-089 @ NEW "FIRE SHUTDOWN PANEL".
CONTROL CIRCUIT FOR VALVE 2-CH-517	PRESSURIZER AUXILIARY SPRAY	CLOSED	NONE	
		OPEN	DECREASE IN RCS PRESSURE	1) MANUALLY CLOSE AOV 2-CH-517 @ NEW "FIRE SHUTDOWN PANEL".
CONTROL CIRCUIT FOR VALVE RC-402 RC-404	PRESSURIZER POWER OPERATED RELIEF VALVES	CLOSED	NONE	
		OPEN	DECREASE IN RCS PRESSURE AND INVENTORY	1) INSTALL ISOLATING KILL SWITCH NEAR CONTROL ROOM EXIT DOOR.

TABLE 1 cont.

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C03

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
PRESSURIZER PRESSURE AND LEVEL CONTROL	RCS PRESSURIZER	HEATERS OFF	NONE	
		HEATERS ON	INCREASE IN RCS PRESSURE	1) TRIP PRESSURIZER HEATERS AT BREAKERS
			LOSS OF LEVEL CONTROL	2) REGULATE LEVEL USING CONTROLS FROM CHARGING FLOW PATH AT NEW "FIRE SHUTDOWN PANEL".
CONTROL FOR VALVES 2-RC-100E 2-RC-100F	RCS/PRESSURIZER SPRAY VALVES	CLOSED	NONE	
		OPEN	DECREASE IN RCS PRESSURE IF RCP's RUNNING	1) TRIP RCP's @ BREAKERS
CONTROL FOR VALVES: 2-RC-414 2-RC-415 2-RC-416 2-RC-417 2-RC-422 2-RC-423 2-RC-424 2-RC-425	RCS/HEAD VENT VALVES AND PRESSURIZER VENT VALVES	CLOSED	NONE	
		OPEN	LOSS OF COOLANT	NOTE: CONTROL ROOM CIRCUIT MODIFICATION WILL PROTECT AGAINST VIABLE HOT SHORTS

TABLE 1 cont.

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C04

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
				PRIOR TO RESUMING CHARING PUMP OPERATION:
MAKEUP FLOW BORATION CONTROL CIRCUIT	CHEMICALS/VOLUME CONTROL SYSTEM	BORATE AS IS DILUTE	NONE NONE DECREASE IN SHUTDOWN MARGIN	1) MANUALLY CLOSE HAND OPERATED VALVE 2-CH-195 2) MANUALLY CLOSE MOTOR OPERATED VALVE 2-CH-501 AT VALVE 3) MANUALLY OPEN MOTOR OPERATED VALVES 2-CH-508 & 2-CH-509 AT VALVES.

TABLE 1 cont.

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C05

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
CONTROL OF FEED WATER PUMPS	MAIN FEEDWATER SYSTEM	RUNNING	OVERFILL OF STEAM GENERATORS	1) CLOSE MSIV'S TO TRIP PUMPS
P1A P1B		NOT RUNNING	NONE	2) USE AUXILIARY FEED WATER CONTROLS ON NEW "FIRE SHUTDOWN PANEL".
CONTROL OF PUMPS P9A P9B	AUXILIARY FEED WATER SYSTEM/ ELECTRIC DRIVEN PUMPS	RUNNING NOT RUNNING	NONE NONE	1) USE STEAM DRIVEN AUXILIARY FEEDWATER PUMP. CONTROLS ARE LOCATED ON NEW "FIRE SHUTDOWN PANEL".
				2) TRIP ELECTRIC PUMPS AT BREAKERS
CONTROL FOR VALVES: 2-MS-201 2-MS-202 2-HV-4188	AUXILIARY FEED WATER SYSTEM/STEAM SUPPLY TO AUXILIARY FEED PUMP	OPEN CLOSED	NONE LOSS OF AUXILIARY FEEDWATER TURBINE	1) OPERATOR ACTIONS TO OPEN VALVE 2-MS-202 MANUALLY
				2) OPEN D.C. MOV 2-HV-4188 @ NEW "FIRE SHUTDOWN PANEL".

TABLE 1 cont.

A. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C05

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
CONTROL FOR VALVES: 2-FW-43A 2-FW-43B	AUXILIARY FEED-WATER SYSTEM/ FEEDWATER FLOW PATH	OPEN	NONE	
		CLOSED	LOSS OF AUXILIARY FEED FLOW	1) OPEN CONTROL VALVE 2-FW-43B @ NEW "FIRE SHUTDOWN PANEL".
CONTROL FOR VALVE 2-FW-44	AUXILIARY FEED-WATER SYSTEM/ FEEDWATER FLOW PATH	OPEN	UNCONTROLLED AUX. FEED FLOW TO STEAM GENERATOR #1.	1) OPERATOR ACTIONS TO MANUALLY CLOSE VALVE 2-FW-44.
		CLOSED	NONE	
SPEED CONTROL FOR STEAM DRIVEN AUXIL-IARY FEED PUMP	AUXILIARY FEED WATER SYSTEM/ STEAM DRIVEN PUMP	HIGH/LOW SPEED	LOSS OF STEAM TURBINE AUXILIARY FEEDWATER PUMP	1) CONTROL TURBINE SPEED AT NEW "FIRE SHUTDOWN PANEL".
CONTROL FOR VALVES: 2-MS-65A 2-MS-65B	MAIN STEAM/ MSIV BYPASS VALVES	CLOSED	NONE	1) MOV's 2-MS-65A & 2-MS-65B CIRCUIT BREAKERS WILL BE ADMINISTRATIVELY LEFT OPEN WITH THE VALVES IN THE CLOSED POSITION.
		OPEN	UNCONTROLLED COOLDOWN	
CONTROL FOR VALVES: 2-MS-64A 2-MS-64B	MAIN STEAM/ MSIV's	CLOSED	NONE	
		OPEN	UNCONTROLLED COOLDOWN	1) INSTALL ISOLATING KILL SWITCH NEAR CONTROL ROOM EXIT DOOR
2-MS-220A 2-MS-220B	MAIN STEAM/	CLOSED	NONE	
	BLOWDOWN ISOLATION VALVES	OPEN	LOSS OF FEEDWATER DEPLETION OF CONDENSATE	1) INSTALL ISOLATING KILL SWITCH NEAR CONTROL ROOM NEAR EXIT DOOR.

TABLE 1 cont.

EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE A

SECTION C05

CIRCUIT	SYSTEM/EQUIPMENT AFFECTED	FAILURE MODES	EFFECT ON SAFE SHUTDOWN	COMPENSATORY ACTION/PLANT MODIFICATIONS
2-MS-190A 2-MS-190B	MAIN STEAM/ ATMOSPHERIC STEAM DUMP VALVES	CLOSED OPEN	NONE UNCONTROLLED COOLDOWN	1) INSTALL ISOLATING KILL SWITCH NEAR CONTROL ROOM EXIT DOOR. 2) CONTROL 2-MS-190B @ NEW "FIRE SHTUDOWN PANEL".

B. EFFECT ON SAFE SHUTDOWN (TO HOT SHUTDOWN) WITH TOTAL LOSS OF ZONE B

CONTROL FOR VALVES: RC-402 RC-404	PRESSURIZER POWER OPERATED RELIEF VALVES	CLOSED OPEN	NONE DECREASE IN RCS PRESSURE AND INVENTORY	1) CLOSE VALVES AT MAIN CONTROL BOARD
CONTROL FOR VALVES: 2-MS-64A 2-MS-64B	MAIN STEAM?MSIVs	CLOSED OPEN	NONE UNCONTROLLED COOLDOWN	1) CLOSE VALVES AT MAIN CONTROL BOARD
2-MS-220A 2-MS-220B	MAIN STEAM/BLOWDOWN ISOLATION VAVLES	CLOSED OPEN	NONE LOSS OF FEEDWATER DEPLETION OF CONDENSATE	1) CLOSE VALVES AT MAIN CONTROL BOARD
2-MS-190A 2-MS-190B	MAIN STEAM/ ATMOSPHERIC STEAM DUMP VALVES	CLOSED OPEN	NONE UNCONTROLLED COOLDOWN	1) CLOSE VALVES AT MAIN CONTROL BOARD

TABLE 2

HOT SHUTDOWN ALTERNATE OPERATOR ACTIONS

ASSUMING ZONE A FIRE

I. IMMEDIATE ACTIONS (0-60 MINUTES)

Plant Location	Compensatory Action
A42	1) Open kill switches by control room exit doors. - Atmospheric Dumps - PORVs - SG Blowdown - MSIVs
T8	1) At Fire Shutdown Control Panel - Isolate letdown - Isolate charging (Z2) - Initiate Aux Feedwater (Check Position of 2-MS-202, 2-FW-44) 2) Trip Breaker** - A401 (Only if power available; - A410 required to trip running LPSI - A411 pump and pressurizer heaters) 3) Trip Breakers** - H204 (Only if power available; - H206 required to trip running RCPs) 4) Monitor instrumentation*
A25	1) Isolate safe shutdown instrumentation and align to fire shutdown panel
T7	1) Trip Breakers** - A302 (only if power available; - A305 required to trip running - A312 LPSI, Charging pumps and pressurizer heaters) 2) Trip Breakers** - H101 (Only if power available; - H103 required to trip running RCPs)

*Instrumentation at Fire Shutdown Panel
1) Pressurizer Pressure (0-3000 psia)
2) Pressurizer Level (Cold Cal)
3) RCS Loop 2 Thot (0-700°F)
4) RCS Loop 2 Tcold (0-700°F)
5) Wide Range Nuclear Inst. (includes source range)
6) Steam Generator 2 Pressure
7) Steam Generator 2 Level

**Running pumps: RCPs cause uncontrolled decrease in RCS pressure if spray valve spuriously opens. LPSI pumps could be damaged if left running and minimum flow line spuriously isolated (cold shutdown equipment). Charging pumps will cause uncontrolled increase in pressurizer level and pressurizer heaters will increase pressurizer pressure if left on.

TABLE 2 Cont.

II SUBSEQUENT ACTIONS (60-240 MINUTES)

Plant Location	Compensatory Action
T7	Trip Breakers - A102 - A502 - A503 - A504
T8	Trip Breakers - A402 - A403 - A404 - A405 - A406 - A407
	Trip Breakers - B0601 - B0606 - B0603 - B0608 - B0605 - B0609
	Close Breakers - B0607 - B0611 - B0610
T7	Close Breakers - A505
4KV 24F	1) Open disconnect and close breaker A602 2) Coordinate with Unit 1 to align GT/DG to 24F/24E
T8	Close Breakers - A408 - A409

TABLE 2 Cont.

II SUBSEQUENT ACTIONS (240 MINUTES)

Plant Location	Compensatory Action
A14	Open Valves Manually - 2-CH-508 - 2-CH-509
A9	Close Valve - 2-CH-501
	Close CH-195
	1) Align Charging Flow Path 2) Start Charging Pump (Z2) after Boric Acid alignment
	Manually close valves - 2-CH-766 - 2-CH-767

TABLE 3

COLD SHUTDOWN ALTERNATE OPERATOR ACTIONS

COMPENSATORY ACTION	TIME REQUIRED FOR ACTION
1. OPEN VALVES HV3011 (REPAIR) 2-CH-192 (REPAIR) 2-CS-2B 2-CH-504 CLOSE VALVES 2-CH-508 2-CH-509 TO TRANSFER CHARGING PUMP SUCTION FROM BAT'S TO RWST BEFORE BAT'S ARE DRAINED	APPROXIMATELY 4 HOURS AFTER START OF COOLDOWN
2. OPEN VALVE 2-FIRE-94C CLOSE VALVE 2-CN-30 TO SUPPLY FIRE WATER TO AFP SUCTION PRIOR TO DRAINING CST	APPROXIMATELY 10 HOURS AFTER REACTOR TRIP
3. OPEN VALVES 2-SW-3.1 A 2-SW-3.1 B 2-SW-8.1 A 2-SW-8.1 B TO PROVIDE SERVICE WATER TO RBCCW HEAT EXCHANGERS	

TABLE 3 Cont.

COLD SHUTDOWN ALTERNATE OPERATOR ACTIONS

	COMPENSATORY ACTION	TIME REQUIRED FOR ACTION
4.	OPEN VALVES 2-RB-211 A THRU 211 F 2-RB-4.1 A THRU 4.1 F 2-RB-251 A 2-RB-251 B 2-RB-13.1 A 2-RB-13.1 B RBCWW HEADER SUCTION AND DISCHARGE TO SHUTDOWN COOLING HEAT EXCHANGERS	
5.	START RBCCW PUMPS: P11 A P11 B P11 C	
6.	CLOSE VALVES 2-CH518 AND 2-CH-519 AND OPEN VALVE 2-CH-517 MANUALLY	PRIOR TO SHUTDOWN OF SHUTDOWN COOLING
7.	CLOSE VALVES: 2-SI-662 2-SI-663 2-SI-659	
8.	OPEN VALVES: 2-SI-615 2-SI-625 2-SI-635 2-SI-645 2-SI-651 2-SI-652 RCS FLOW TO SHUTDOWN COOLING HEAT EXCHANGERS	PRIOR TO INITIATION OF SHUTDOWN COOLING

TABLE 3 Cont.

COLD SHUTDOWN ALTERNATE OPERATOR ACTIONS

	COMPENSATORY ACTION	TIME REQUIRED FOR ACTION
9.	START LPSI PUMPS P42A P42B	
10.	MODULATE VALVES 2-SI-657 2-SI-306 TO CONTROL COOLDOWN RATE AND HEAT REMOVAL	AS REQUIRED