NORTHEAST UTILITIES

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

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December 6, 1979

Docket Nos. 50-213
50-336

Office of Nuclear Reactor Regulation
Attn: Mr. H. Denton, Director
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

References: (1) W. G. Counsil letter to J. Hendrie dated November 30, 1979.
(2) H. R. Denton letter to All Operating Nuclear Power Plants dated October 30, 1979.

Gentlemen:

Haddam Neck Plant
Millstone Nuclear Power Station, Unit No. 2
Automatic Initiation of Auxiliary Feedwater

In Reference (1), Connecticut Yankee Atomic Power Company (CYAPCO) and Northeast Nuclear Energy Company (NNECO) provided a comprehensive description of the evolution of the NRC Staff requirement to automate the auxiliary feedwater system, and the status of the implementation effort at the Haddam Neck Plant and Millstone Unit No. 2. Subsequent telephone conversations with the Staff have resulted in a Staff request for specific design details, and demonstration of compliance with each of the clarification points provided in Reference (2). In response to that verbal request, Attachments (1) and (2), Proposed Automatic Initiation Scheme of Auxiliary Feedwater Systems, are provided for the Haddam Neck Plant and Millstone Unit No. 2, respectively.

As explicitly stated in Reference (1) and emphasized in recent verbal communications with the Staff, CYAPCO and NNECO have been intensively designing and engineering a scheme to comply with the Staff requirement since its initial promulgation. Attachments (1) and (2) provide documentation to that effect. Equipment has been ordered in an attempt to comply with the schedule of Reference (2). These efforts have been and are continuing on a priority basis, the evaluations and determinations of Reference (1) notwithstanding.

As noted in Reference (1), final implementation of these designs is prohibited without documented Staff approval.

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We trust the attached information facilitates your review of the issues identified in Reference (1).

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
Vice President

Attachment

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DOCKET NO. 50-213

ATTACHMENT 1

HADDAM NECK PLANT

PROPOSED AUTOMATIC INITIATION OF AUXILIARY FEEDWATER SYSTEMS

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DECEMBER, 1979

Introduction

The scheme proposed is intended to meet the short-term recommendations for auto initiation of AFW systems using essentially control grade devices. Due to the limited time allowed to implement even a short-term scheme together with the constraints of trying to interface with existing equipments and systems, the long-term scheme requiring safety-grade devices, may or may not be similar to the subject proposal.

In the scheme now proposed, the initiating signals will open the two steam admission valves for the redundant turbine driven auxiliary feedwater pumps, and also open four bypass valves around the main feedwater regulating valves. This action will then initiate AFW flow to the steam generators. Opening these valves will be accomplished by exhausting compressed air from the air operated valves, thereby allowing the valve springs to open the valves and initiate the AFW systems. There are no provisions in this scheme for flow control of auxiliary feedwater while the AFW systems are operative in the auto initiation mode of control, nor are there any provisions in the design for detection of steam or feedwater line breaks and automatic isolation of auxiliary feedwater.

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Initiating Signals

The initiating signals will consist of low level in any steam generator, low-low level in any steam generator, or the coincidence of both electric driven main feed pump circuit breakers being open. The plant is a four loop plant so that there will be a total of eight steam generator level sensors (2 per generator), and any one will start automatically the AFW systems. Four of these level sensors are associated with the existing narrow range level instrumentation, with one on each of the four steam generators. The remaining four level sensors consist of the existing wide range steam generator level instrumentation; again, one on each of the four generators. The set point on the narrow range devices will be 10% corresponding to a level of 278 inches, and this level is the same as that utilized in the reactor protection system for the steam/feedwater flow mismatch coincident with low steam generator level trip. It is also set at such a level that shrinking of steam generator levels on a normal plant full load trip would actuate the AFW systems. To provide redundancy in monitoring the level of each steam generator, the wide range instrumentation is also utilized to auto initiate the AFW systems. The wide range devices are set at 45% on the wide range scale and this corresponds to the normal low-low level alarm point of 180 inches. Both levels (in inches) reference the setpoints as distance above the SG bottom support flange.

In addition to these eight steam generator level sensors, circuit breaker contacts on both main feed pump circuit breakers will be used in series to auto initiate the AFW systems. Therefore, whenever both main feed pump circuit breakers are open, such as would happen given a loss of off-site electric power, auto start of the AFW systems will occur. The attached logic diagram is provided to illustrate the above description.

Controls

Output contacts from the low level, low-low level and circuit breakers position input devices will actuate two DC operated lockout or latching relays. One lockout or latching relay will be supplied from one redundant station battery while the other relay will be supplied from the other redundant station battery.

Two control switches will be located on the main control board at or near the existing controls for the AFW systems. These switches will have two maintained positions: auto and manual. When these swi' hes, one for each of the redundant turbine driven AFW pump, are in the auto position, any one of the previously described level or circuit breaker position inputs will automatically initiate AFW. In the circuit, between the contacts of the input devices and the two lockout relays, a contact of the auto-manual switch will be included so that when the switch is in the manual mode the train auto initiation lockout relay cannot be actuated. In addition, when either of these auto-manual switches is in the manual position, an alarm will be present to provide a status indication. Selection from manual to auto and vice versa will take place at appropriate times during the start up and shut down sequence.

A test switch will be provided to test the automatic initiation of both AFW trains. This test switch will de-energize the eight steam generator level input relays and a series circuit of normally closed contacts will verify that all eight input relays function properly. In addition, auto initiation of the AFW systems will be verified.

Auto initiation of AFW will be accomplished by having each of the two lockout or latching relays de-energize six 3-way solenoid valves. Two of these valves

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will admit steam to the redundant AFW pumps and four of these valves will open the bypass paths around the main feedwater regulating valves. This action is all that is required to activate the AFW system(s) into operation. De-energizing the solenoid valves will exhaust compressed air from the valve operators, thereby, allowing the valve springs to open the valves. Note that the loss of the power supply to these solenoid valves will also cause them to fail safe, i.e., initiate AFW.

Power Sources

The power supplies for all devices and their circuits associated with the proposed auto initiation scheme will be obtained from safety related sources. All circuits will be fed by either of the two station batteries or from one of the four 120 VAC vital instrumentation sources (inverters) which presently supply the steam generator level instrumentation. Credit will be taken for existing circuit breakers in panelboards, etc., as interrupting or isolating devices to ensure that faults or malfunctions in the control grade auto initiation scheme will not impact the Class 1E safety related power sources.

Similarly, where new control grade circuitary interfaces with the existing steam generator level instrumentation, credit is taken for the isolation provided by electro mechanical contacts in the existing bistables, as satisfactory assurance that the control grade scheme will not adversely impact the existing instrumentation loops.

NUREG-0578 Positions

Position 1 states that the design shall provide for the automatic initiation of the auxiliary feedwater system. As described earlier, when either of the two mode switches are in the auto position, both AFW trains will be automatically initiated by any low (or low-low) level signal from any steam generator or the coincidence of both main feedwater pump circuit breakers being open.

Position 2 requires that the automatic initiation signals and circuits shall be designed so that a single failure will not result in the loss of auxiliary feedwater system function. Our analysis shows that no credible single failure will prevent the AFW system from performing its function. There are postulated failures which will falsely start the system, or start an AFW pump, or open a bypass valve. However, none of these presents a scheme failure. The scheme is essentially fail-safe such that auto initiation of AFW is assured. If the system auto initiates through the electrical control circuitry, there will also be an alarm. Should an AFW pump falsely start, its recirculation line will prevent pump damage. If a bypass valve opens, check valves will prevent the main feed pump pressure from impinging on the AFW pumps. Additionally, the main feed regulating valve for that feedwater line would tend to close slightly to compensate for the open three-inch bypass line around it.

Position 3 requires that testability of the initiating signals and circuitry shall be a feature of the design. All the new circuitry will be testable. The redundant AFW trains will be started and verified running when the test signal is injected into the new circuitry. Insofar as the initiating S/G level signals are taken from existing instrumentation loops, testing of these portions of the scheme will be governed by existing plant testing practices and the constraints of the existing plant design. It is not considered necessary to test (other than at refueling intervals) the circuit breaker inputs which initiate AFW as these are only an anticipatory input that AFW will be needed. Actual requirements for AFW are considered to be dictated by the S/G level inputs. Furthermore, breaker auxiliary contacts have demonstrated an excellent record, in terms of reliable operation, for all power plant operations where they are used.

Position 4 requires that the initiating signals and circuits shall be powered from the emergency buses. The present instrumentation loops are fed from 120 VAC vital supplies derived from four inverters and the two safeguards station batteries. As indicated earlier, the new circuitry will also be powered from these same Class 1E sources.

Position 5 requires that manual capability to initiate the auxiliary feedwater system from the control room shall be retained and shall be designed so that a single failure in the manual circuits will not result in the loss of system function. The capability to initiate AFW manually from the control room will be retained. The operator will be able to manually initiate AFW simply by selecting the new auto-manual switch to the manual position and then utilizing the existing pressure indicating controller(s) for the steam valve(s) and the existing hand indicating controller(s) for the bypass valves in the feedwater piping system. Any failure in the manual initiation system of one AFW train would still leave the other train available for the operator to utilize. A complete loss of air supply would equally affect both AFW trains and the system would fail safe, i.e., initiate AFW. Control could still be exercised by using hand wheels on valves within the AFW system.

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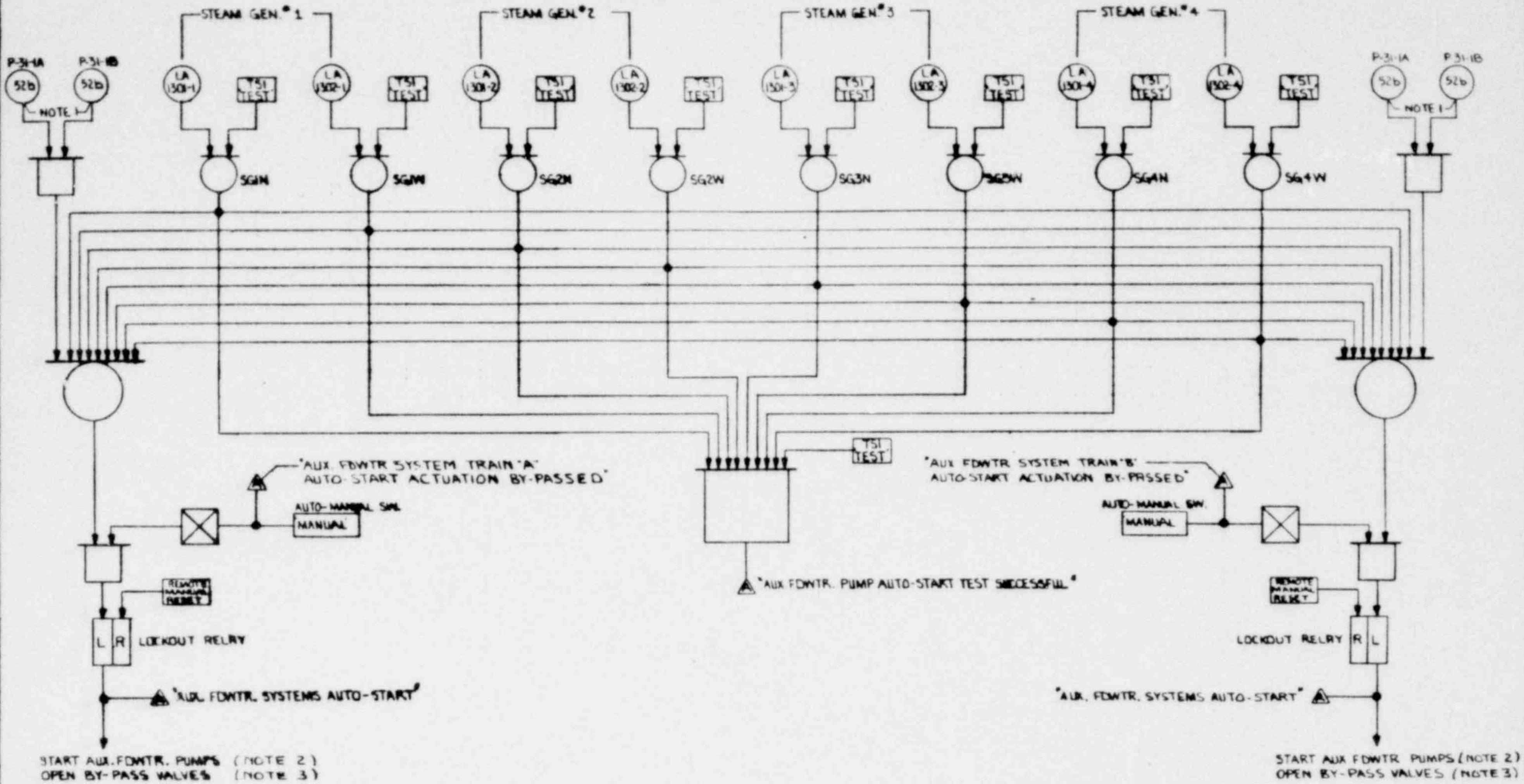
Position 6 requires that AC motor-driven pumps and valves shall be included in the automatic actuation of the loads to the emergency buses. The Haddam Neck plant does not utilize motor-driven AFW pumps in the AFW system; therefore, this requirement is not applicable. There is one motor operated valve in the AFW system; however, this is in an alternate flow path and is not normally required to initiate AFW. There are no plans to automatically connect this MOV to the diesel generators, and furthermore, the valve has a hand wheel for manual operation if necessary.

Position 7 requires that the automatic initiating signals and circuits shall be designed so that their failure will not result in the loss of manual capability to initiate the AFWS from the control room. There are no identifiable credible single failures in the new circuitry which would prevent the initiation of the AFW systems. In the worst case, the redundant AFW systems would auto initiate leaving the plant operators to manually control system flow by the manual operation of valves via hand wheels.

Additionally, H. R. Denton's October 30, 1979 clarification of NUREG-0578 indicated that for those designs where instrument air was needed for operation, their electric power supply requirement should be capable of being manually connected to the emergency power sources. At the Haddam Neck plant the air supply compressors are normally supplied from the emergency buses and no manual switching is required to satisfy the requirements for emergency power to the air system.



NOTES:
1- BREAKER POSITION CONTACTS ON MAIN FDWTR. PUMP MOTOR SUPPLY BREAKERS.
2- P-32-1A + P-32-1B (OPEN VALVES MS-PICV-1206A + MS-PICV-1206B)
3- FW-HICV-1301-1, FW-HICV-1301-2, FW-HICV-1301-3 + FW-HICV-1301-4

PRELIMINARY

REVISIONS DURING CONSTRUCTION		P.A.# 79-202			
A	12-4-79	PRELIMINARY FOR CONCEPTUAL DESIGN	DD		

NORTHEAST UTILITIES SERVICE CO.
FOR CONN YANKEE ATOMIC PWR CO.
TITLE AUX FEEDWATER SYSTEM
AUTO-START LOGIC DIAGRAM

BY D.E.D. DATE 12-4-79
CHKD DATE 12-5-79
P.A.# 79-202
DWG. NO. SKDD12479

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DOCKET NO. 50-336

ATTACHMENT 2

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

PROPOSED AUTOMATIC INITIATION SCHEME

FOR AUXILIARY FEEDWATER SYSTEMS

DECEMBER, 1979

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Introduction

The AFW system at MP-2 consists of two half capacity motor driven AFW pumps and one full capacity turbine driven pump. Each motor driven pump is powered from a separate and redundant emergency bus. The turbine is supplied with steam from either main steam header. Each AFW turbine steam supply header isolation valve is normally open. The combined header steam admission valve is normally closed.

The auxiliary feedwater valves will be left in their operating position so that only the check valves have to change position to commence feeding. The AFW feed regulating valves will be prepositioned to provide 300 GPM flow to each SG at normal isolated SG pressure. The pump discharge crossconnect valve will be normally open. This allows feeding either steam generator with two motor driven AFW pumps or with the turbine driven AFW pump. The pump suction crossconnect valve will be normally closed thus the turbine driven pump will receive water from the condensate storage tank from one suction line while the motor driven pumps will receive water from the condensate storage tank from another suction line. The attached diagram is provided to illustrate the above description.

AFW Initiation

Steam generator level will be the only parameter sensed to initiate AFW automatically. The system will consist of two trains, Facility Z1 and Facility Z2. For each train two level signals from each steam generator will be applied to bistables. The dry contact outputs of the bistables will be matrixed to two out of four. The matrix will control two lockout relays per train. Two control selector switches between the bistables and the lockout relays will be used to pass or block the auto start signal, trip the lockout relays, or reset the lockout relays. One switch will be located on the control room panel

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(C05) the other on the hot shutdown control panel (C21). The block is accomplished by moving either switch to a "pull or lock" position. The pull to lock operation requires an extra step from normal switch operation, and once accomplished the switch is in a visually abnormal position, making it distinct from other switches on the control board. The block position will also be annunciated in the control room and an amber light will be lit at panel C21.

One lockout relay per train supplies a contact to start a motor driven AFW pump. The start signal to the motor driven pump will be blocked if the emergency diesel generator is required to start and sequentially accept loads from its emergency bus. In this mode (and with SG level low) the AFW pump will be sequenced onto the diesel in load group four, twenty seconds after sequencing commences. Another contact from the first lockout relay causes an alarm in the control room and lights a red light at C05 and C21 indicating pickup of the lockout relay and automatic AFW system initiation. The second lockout relay in the train provides a contact to the circuit for the motor operated AFW regulating valve associated with the train, and a contact to open the combined steam admission valve for the turbine driven AFW pump. The open signal to the AFW regulating valve will be interrupted by a valve position limit switch. The AFW regulating valve will be prepositioned as mentioned before and the open signal is provided to guarantee that a flow path is available.

One lockout relay in each train starts its respective motor driven AFW pump. A second lockout relay in each train provides start signals to the turbine and guarantees a flow path for its respective train.

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NUREG 0578 Design Requirements

1. The design provides for the automatic initiation of the auxiliary feedwater system by sensing a low steam generator level, starting the three AFW pumps and assuring an adequate flow path.

2. The signals and circuits have been designed so that a single failure will not result in the loss of auxiliary feedwater system function. The signals and circuits will be arranged in trains. Separation of signals and circuits will be maintained in accordance with established plant separation criteria for safeguard systems. Two level signals from each steam generator will be used per train. The level signals will be grouped according to their power source either Z1 or Z2. Two separate two out of four matrices will be extablished to operate four relays (two per train). The loss of one complete power train would still provide a minimum of one AFW flow path and one motor driven pump. The turbine driven pump would not start automatically if power for the steam admission valve was aligned to the unavailable power facility. The operator has turbine RPM, inlet steam pressure, and steam admission valve position indicating lights displayed on control room panel C05. For the assumed case where the turbine driven pump has failed to start because power to the selected emergency bus has been lost, turbine speed and inlet steam pressure would be zero, indicating the turbine driven pump has failed to start. Both the open and the closed indicating lights for the steam admission valve would be out indicating a loss of power to the valve control circuit, thus indicating the cause for the failure of the turbine driven pump to start. The operator would have ample time to proceed to the Hot Shutdown

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Control Panel (C21), about fifty feet away, and select the known available power source. This will be identified because one of the motor driven pumps will have started, and be providing fifty percent of the required auxiliary feedwater flow. Loss of one complete power train would still permit responding to a low steam generator level in either steam generator as two level detectors for each steam generator would still be operable and powered from the redundant train.

3. Testability of the level signals will be included in the design engineering of the proposed change. The entire system can be tested by inserting signals in the level current loops. This method may also be employed in testing one current loop and associated bistable at a time. The lockout relays and actuated equipment can be tested by placing either of the switches between the bistables and the relays in the start position. The entire system can be tested as a whole or the signal portion and the relay and actuated equipment portion can be tested separately.

4. The initiating signals and circuits are powered from the emergency buses, from the vital buses via the inverters, or from the battery buses. Power to operate the combined steam admission valve to the turbine driven AFW pump may come from a Z1 motor control center or a Z2 motor control center. Cable separation will be verified before upgrading its classification from facility 5 to facility Z5.

5. Manual capability to initiate the auxiliary feedwater system from the control room will be retained. The AFW system may be started either by operating individual switches for each component or by going to the start position with the two new switches on C05. A single failure in the manual circuit will affect only one of the two redundant trains.

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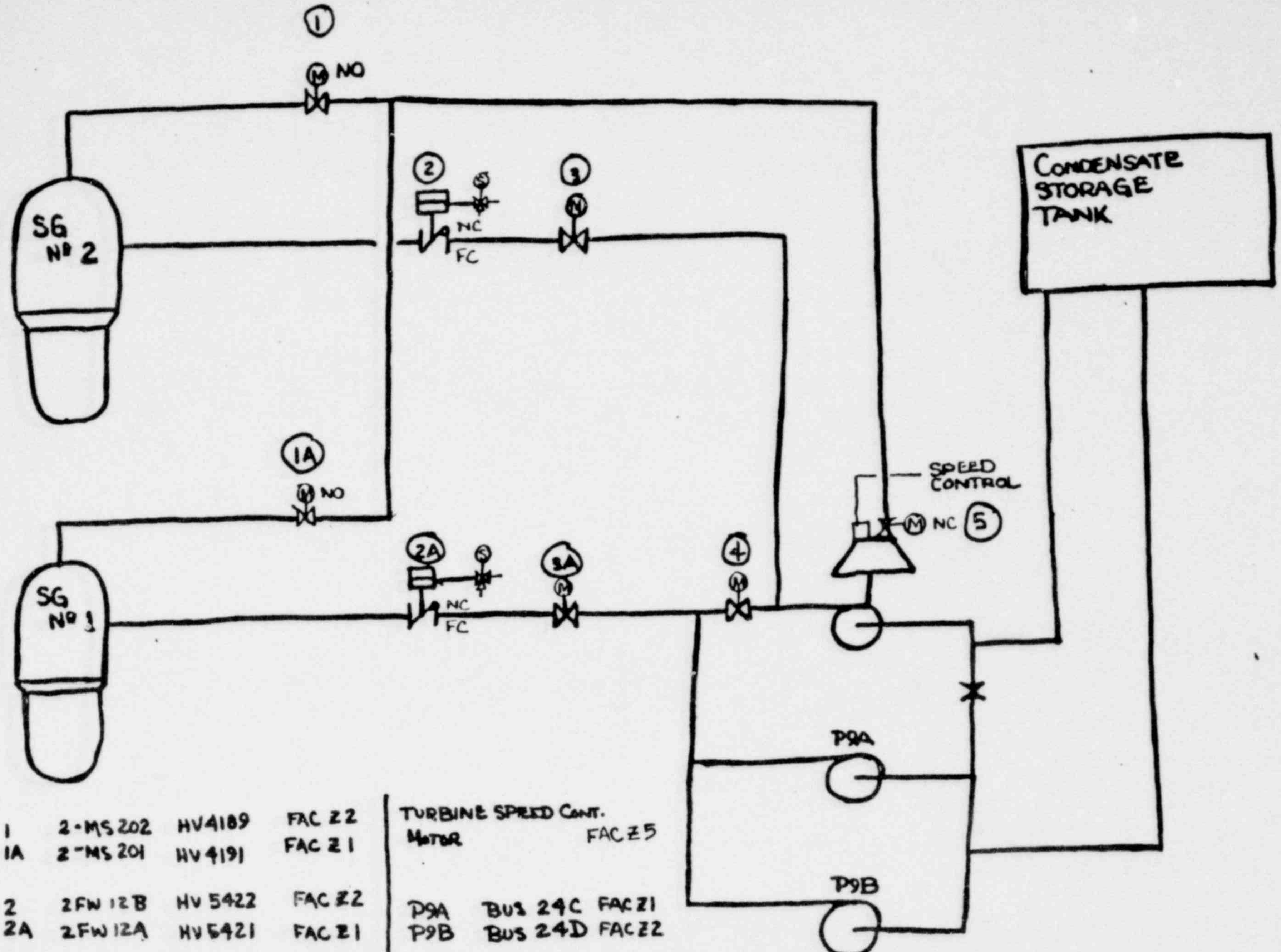
6. The AC motor driven pumps and valves in the auxiliary feedwater system have been included in the automatic actuation of the loads to the emergency buses. The valves receive open signals regardless of the emergency bus conditions since the motors involved are less than two horsepower total. The motor driven pumps are sequenced onto the emergency bus as previously discussed.

7. The automatic initiating signals and circuits have been designed so that their falure will not result in the loss of manual capability to initiate the AFW system from the control room. The automatic signals and circuits have been designed to supplement but not interrupt the manual control of the AFW system. Failure by short circuit could start one train but would not affect the other train. Failure by open circuit would still permit normal manual control.



1	2-MS202	HV4189	FAC Z2
1A	2-MS201	HV4191	FAC Z1
2	2FW12B	HV5422	FAC Z2
2A	2FW12A	HV5421	FAC Z1
3	2FW43B	HV5279	FAC Z2
3A	2FW43A	HV5276	FAC Z1
4	2FW44	HV5275	FAC Z2
5		SV4188	FAC 5

TURBINE SPEED CONT.
MOTOR FAC Z5

P9A	BUS 24C	FAC Z1
P9B	BUS 24D	FAC Z2

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