IA-E-115
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TAG 4/1/79

SECONDARY SYSTEM

I. SCOPE

To define a means to lower and/or to maintain the Reactor Coolant temperature without removal of fluid from the containment during periods when offsite power is available as well as when the offsite power has been lost temporarily.

II. BRIEF DESCRIPTION

The scheme would utilize the installed Main Steam System, the Auxiliary Feed Pumps, a portion of the Main Feed System and a portion of the Auxiliary Feed System, the Condensate Storage tanks and two new portable diesel driven ~800 G PM pumps and high pressure hose or piping connecting the Main Condenser hot wells to the Condensate Storage tanks and a new cross. Connecting 4" pipe with flow control valve between the 4" Chem Connection on the Auxiliary Feed System in the Control Building access area downstream of EF-FHS 080 and 085 and the 10" Flush Connector on the Main Feed System downstream of FW-V18A and 18B. It should be noted that with this scheme with the loss of offsite power circulating water to the main condenser is lost.

In addition to the above scheme, a heat exchanger should be added in a new line installed between each turbine by-pass line and the condensate storage tanks. Service water to the heat exchangers will be provided by a separate diesel driven service water pumps. As a further backup, diesel driven pumps should be installed in parallel with each auxiliary feedwater pump.

III. (See attached diagram)

IV. ASSUMPTIONS

A. System can be demonstrated by actual system pressure drop calculations using actual pump curves, line losses, etc.

B. Inventory or water in system and rate of decay heat generated is small enough such that heat in solid feed water, condensater, hot well main steam system and steam generator will not rise pufficiently for concern while offsite power is lost and circulating water has stopped to the condenser. However, if the temperature does rise too much, the hotwell can be opened and quantities of ice can be inserted.

C. Access to Control Building Access area is possible for significant work (core drilling, welding, wiring piping hanging)

D. Reactor Coolant Pump is operating while the Offsite Power is available.

E. Natural circulation initiates after the loss of offsite power.

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PREREQUISITE

That the Reactor Coolant temperature is depressed sufficiently (to ~200°F) by dumping steam to the evacuated condenser from the A steam generator to go solid in the feedwater side of the A steam generator and slowly fill the main steam line.

ADVANTAGE

Reliably will supply cooling to reactor without withdrawing fluid from containment with or without offsite power.

Diesel Driven Nuclear River Water supplies backup suctions to the Auxiliary Feed Pump in an emergency.

DISADVANTAGE

Must make modification to system that involves piping, core drilling a protective (against pipe whip and jet impingement) wall and wiring a control valve to the control room. Further must pump by portable diesel pump from hot well to condensate storage tank when hot well level rises too high while Auxiliary Feed Pump take normal suction on Condensate Storage Tank.

RECOMMENDATION

Engineer and detail design system modification as outlined in first example in paragraph II and shown in schematic paragraph III, and install as soon as possible.

During the detailed design phase of this design, installation of heat exchanger as described in 2nd example in paragraph II should be explored to determine benefit to safety and reliability of reactor cooling facility and difficulty to accomplish.

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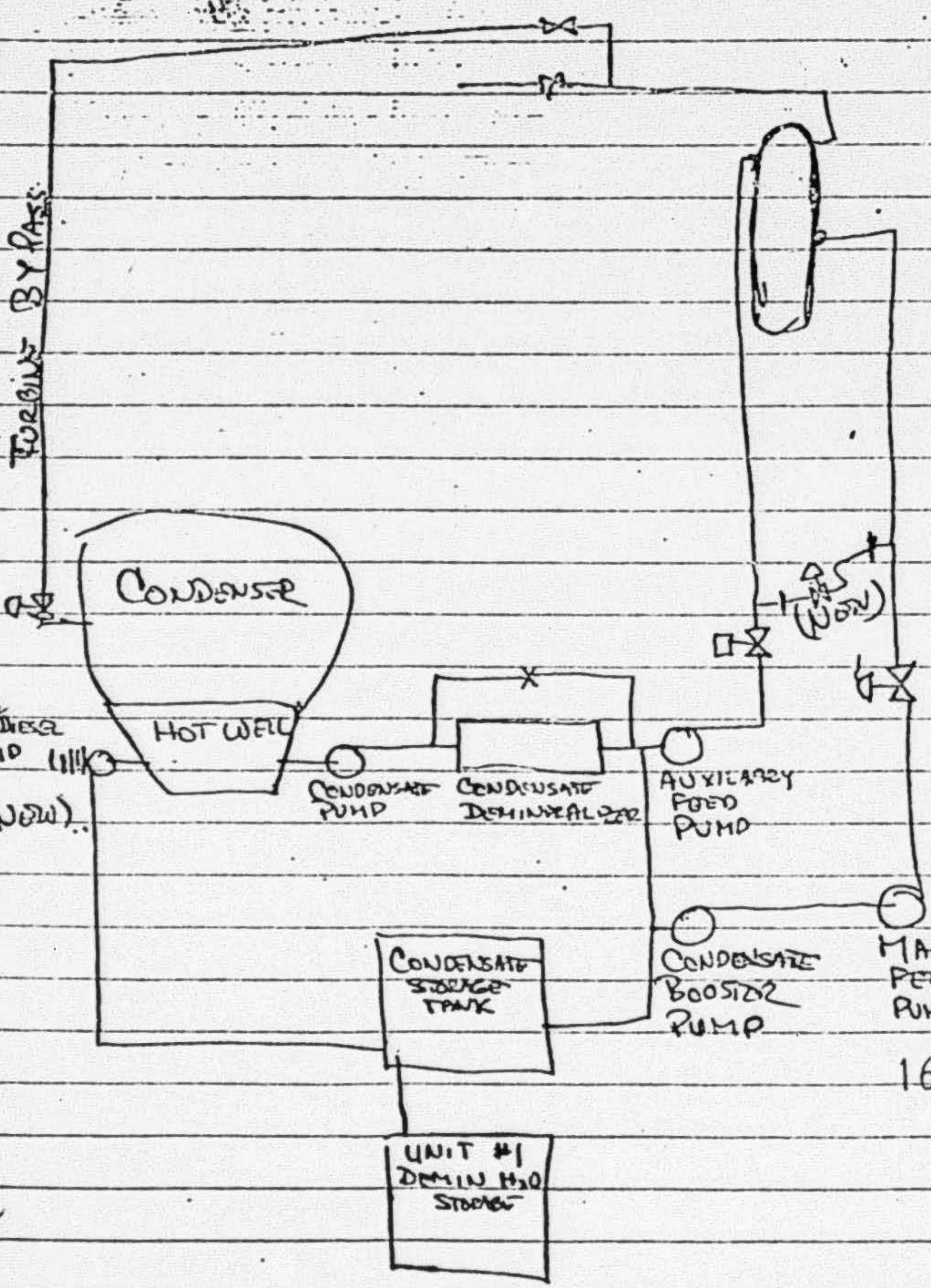
3 Schematic



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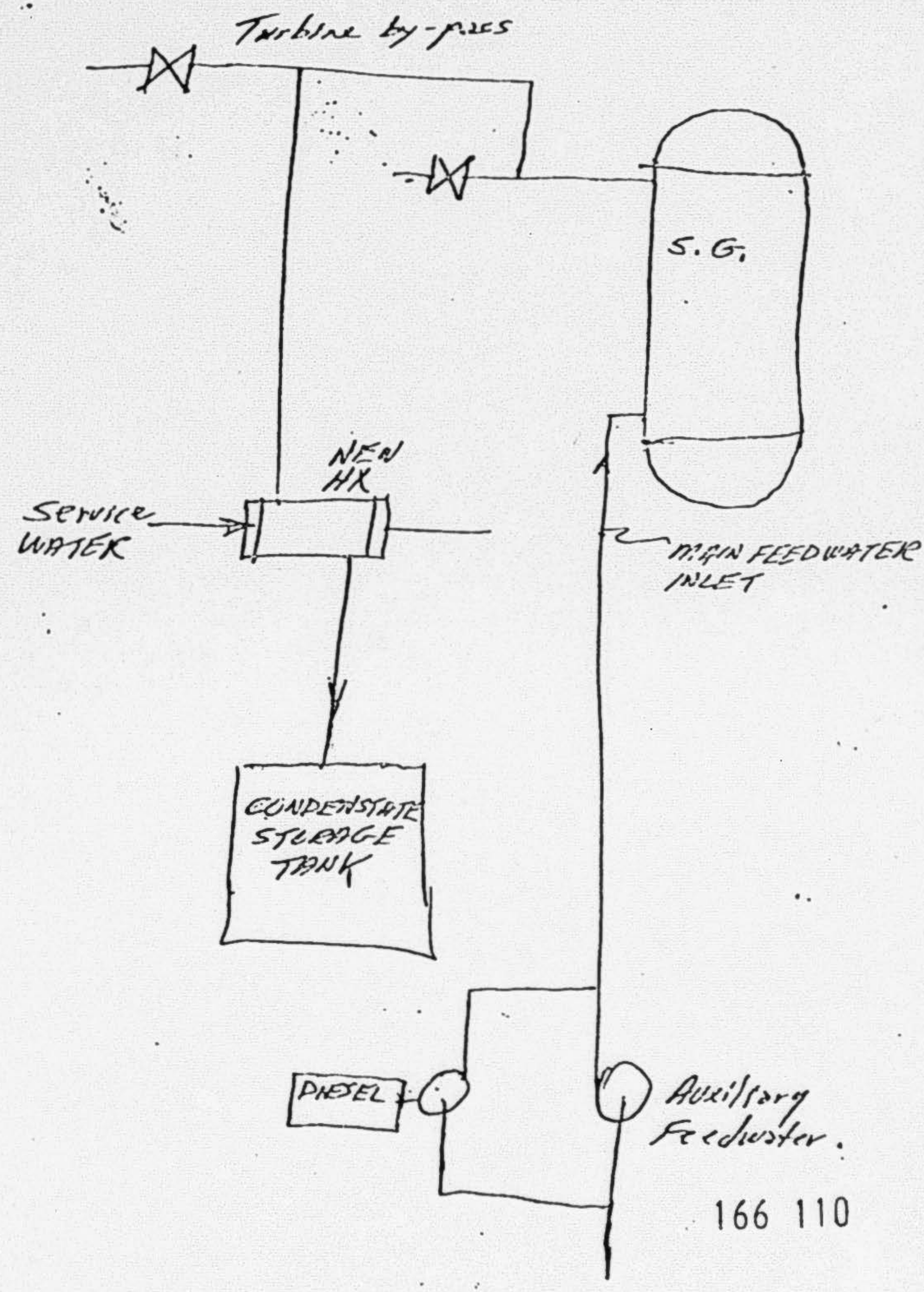
Turbine by-pass
S.G.
NEW
HX
Service
WATER
MAIN FEEDWATER
INLET
CONDENSATE
STORAGE
TANK
DIESEL
Auxiliary
Feedwater.

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DRAFT
4/3/79

To: Mr. Ed Zabrowski, Group Leader

From: W. A. Riehl

Subject: Transfer of Hydrogen from Waste Gas Storage Tanks

It is understood that two waste gas storage tanks contain approximately 25,000 cuft of 53% Hydrogen, 46% N_2 (1% other) gas mixture, [illegible]. These tanks have relief valves - which could vent the radioactive gas mixture. In order to preclude filling the tanks to relief venting - methods of transfer of some of the contents are under consideration (by Burns & Roe, Inc.).

The long term approach is by transfer - through a suitable piping system through a charcoal absorber - to additional storage tanks. At a later date, the remaining gas would be burned in a flow stack.

I have made suggestions to minimize flammable mixtures during installation, purge, and checkout with Mr. Frank Patti, Chief Nuclear Engineer, of Burns & Roe. Some of the major precautions included:

- Eliminate or minimize potential deadends or pockets.
- Provide for N_2 purge flow through all lines.
- Verify adequate nitrogen purge - by sampling several points and either chemical or instrumental analysis.
- 1.0% maximum O_2 content prior to entry of waste gas (53% H_2).

The transfer system is now in design, and purge procedures will be prepared within several days. A copy of these will be provided subsequently for my review and comments (at Marshall Space Flight Center). 166 111

Mr. Patti also inquired whether I may be able to assist in inspection of the piping after installation and prior to activation onsite at the Three Mile

Island Plant. I informed him that this probably can be arranged and I will consult NASA management along this line.

It is understood that it will be at least a week before the above system could be used, Contingency planning - in the event of approach of relief venting - prior to the above measure - is also underway. In that case - relief venting back to the containment room rather than the atmosphere is under consideration.

A separate memo cited the maximum allowable H_2 input to the containment room as 2600 cu. ft. per day to prevent a concentration increase under current conditions therein (2% H_2 by volume - one recombiner at 90 cfm flow). This would allow 4900 cu. ft. per day of 53% H_2 mixture (3.4 cfm). An additional safety margin obviously exists in that a second recombiner also has been installed but not yet activated in order to provide a higher permissible flow.

During entry of the 53% H_2 mixture into the containment room, a flammable zone will occur and spurious ignition cannot be ruled out. Thus there is a reasonable possibility that a flame may at the waste gas entry point. However, this should be a localized stable flame, without propagation into the general room volume or propagation back toward the waste gas tank. Potential hazards would be limited to overheating of adjacent items. At a flow rate of 3.4 cfm (NTP), the maximum rate of heat solution (from 53% H_2 gas) would be 126 kilo calories per minute. This aspect should be considered by engineers familiar with the system.

This approach and contingency plan considered safe and reasonable with respect to flammability hazards subject to the review and precautionary conditions and limits cited above.

Wilbur Riehl
Hydrogen Combustion Consultant

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