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Task Scope OPTIONS FOR SHORT TERM (2-4 month) CORE COOLING - RECOMMENDED PLAN

To: M. Levenson
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Task No. 42 Date Complete 5/2/79

Reason felt task is complete:

GPU Short Term Plan Review and Changes Are Recommended.

Members of Committee

PHIL MEYER
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Woody Straube
Signed
Committee Leader

2004 347

TASK 42 - OPTIONS FOR SHORT TERM
(2-4 month) CORE COOLING - RECOMMENDED PLAN

The objective of this task is to review the short term plan (2-4 months) suggested by GPU - Attachment I. The results of the review are:

1. Steaming using the "A" OTSG using natural circulation should continue as the cooling mode.

2. We agree with most of the suggested actions in Attachment I, e.g. reducing primary pressure to 500 ± 50 psig. See Attachment I and III specifics.

3. Comments are provided below on the recommendation to operate the primary system solid. This mode of operation should be used as a last alternative.

4. It is recommended by the IAG that the "B" loop heat exchanger (when it is ready) be used as the backup system in case natural circulation cannot be maintained in the "A" steam generators. Until the "B" loop heat exchanger is ready the backup mode should be steaming the "B" OTSG.

5. Attachment II shows a decision diagram of the IAG's recommended actions if natural circulation is lost on the "A" OTSG.

Discussion

At the current low core power, about 2 MW, the flow is lightly damped and small disturbances may stop natural circulation. Thus, the reactor should be kept in the current mode of steaming through the "A" OTSG and any changes; make-up, valve position changes, etc., should be made very carefully. The heat losses from the system should be minimized so as to maximize the heat transfer through the OTSG and maximize the stability of the system. Steaming on "A" OTSG should be maintained until inadvertently lost or until the core power is low enough that it will not support natural circulation. An estimate should be made of when natural circulation will be lost and the appropriate actions planned in advance.

The option in Attachment I to operate the primary system as a solid system should be treated as a last resort. Operating the primary system in a solid mode will increase leakage to the containment. Instead, it is recommended that the pressurizer be operated at a higher level e.g. 375" - 400" and thus calibration by going solid periodically could be performed much less frequently than if the level is held at 250".

In the event natural circulation is lost in the "A" loop the initial operation response should be to continue to steam so that the secondary side cools while the primary side is heating. This is expected to restablish natural circulation. Should this fail the 2A reactor coolant (if that fails use 1A) pump should be energized for about 5 seconds to move the flow blockage (cold trap or vapor bubble) and re-establish natural circulation flow. This action will also mix water from the vessel region with the cold water in the bottom of the "B" loop.

Thus, if natural circulation is not established in "A", the chances of establishing natural circulation in the "B" loop will be improved.

If natural circulation is lost in the "A" loop after the "B" long term OTSG cooling system is ready for service, the preferred mode for establishing natural circulation in the "B" loop is with solid water circulating in the long term system. There are several reasons for this:

1) Release of activity to the environment will be reduced.

2) Contamination of the condenser and bypass system will stop.

3) The long term system is not subject to loss of condenser vacuum which could release activity to the environment and will cause a substantial rise in the thermocouple temperatures.

4) The primary system could be brought to a lower temperature and thus natural circulation would be more stable for a longer period because additional heat would be removed through the steam generator.

5) The long term OTSG cooling system could be used for long term cooling.

6) The long term OTSG cooling system can be operated at 550 psig with the primary system at 500 psig. This will prevent leakage of primary water into the "B" steam generator and consequently to the turbine building.

7) The equipment used for the long term system is simpler and we believe it to provide a more reliable system. (See Tables II and III)

8) The system is compact and major components can be easily shielded if required..

9) It is recommended that this system be cross tied to the "A" steam generator to provide a backup in the event operation with the "B" loop becomes undesirable.

We concur that the preferred cooling mode is continued natural circulation on the "A" loop. However, once the new long term OTSG cooling system is available the backup mode should be solid operation of "B" using the new system.

TABLE I

Critical equipment for either 1) "B" steaming or 2) "B" solid to long term OTSG cooling system.

Components -	Letdown and Make Up valves
	Makeup pumps
	Pressurizer Heaters
	Condensate pumps (required continuously for mode 1 and for makeup fill only for mode 2)
	Start up FW control valves
	Auxiliary Steam Boiler (required continuously for mode 1 and initially only for steam heating for mode 2)
	Emergency power for pumps, valves, and heaters
	Existing Plant Condensate Polishing System
	Primary Coolant Sampling Equipment
Instrumentation -	Primary HL and CL RTD's
	Core T/C's
	Core Flux Monitor
	Steam RDT's
	Primary Pressure
	Pressurizer RTD
	MU Tank Level
	MU Tank Temperature

7.

CORE COOLING RECOMMENDATION

ATTACHMENT I   COMMENTS ADDED BY IAG
5/1/79
EB

Short Term (2-4 Months)

Core Cooling - Natural Circulation

Primary System Temp. - Floating - set by decay heat level and secondary conditions. Agree but cool primary as much as possible

Primary Pressure - 300 ± 50 psi initially. Agree - will reduce leakage

Pressurizer - Level ≈ 250 inches. Agree, but if must start or jog pumps + raise to 350"

Level determined by DR + periodically going solid to benchmark Agree

Optional - solid operation NO - it will increase leakage.

OPTIONAL - operate @ water level higher than 250"

Steam Generators

A - Steaming. Level at 400" - 430" agree, current level

VWO thru bypass to condenser agree

B - Isolated, Level at 373" - 388", ready for use in steaming - OK for now. BUT when B is ready for solid w/ heat exchanger use solid mode if "A" lost.

Condenser - Vacuum maintained as practical - controlled if S/G vacuum too high - agree

RC Pump Seal Flow - 2 gpm each - agree (lower if possible)

RC Pump Breakers - Open agree - will prevent inadvertent pump start.

Intermediate Closed Cooling System - Secured. NUCLEAR SERVICE WATER - agree will reduce heat loss and possibly leakage to the containment.

MU Tank Temperature - As high as possible below 150° F. agree but why not higher temperature.

MU Water - Degassed. Agree

MINIMIZE LETDOWN FLOW IF POSSIBLE

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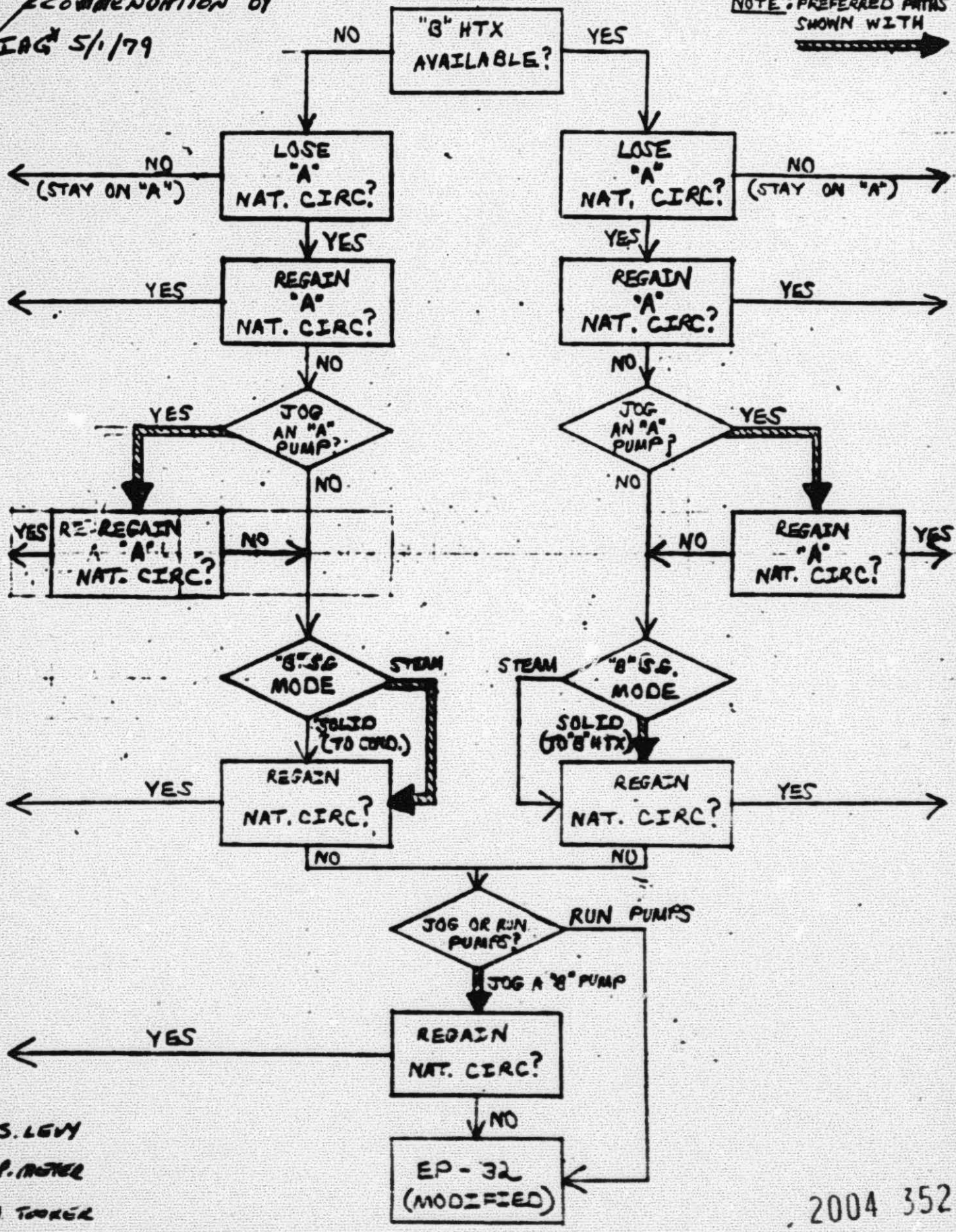
ATTACHMENT II

RECOMMENDATION BY IAG 5/1/79

NOTE: PREFERRED PATHS SHOWN WITH →



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2004 352

ATTACHMENT III

Recommendations:

1) Reduce Pressure to ≤500 psi

   Advantages:

   1) Loss Primary Leakage
   2) Loss Heat Losses
   3) Smaller Shrinkage Problems

   Disadvantages:

   1) Gas Formation (minor)
   2) Less Margin to Boiling (minor)
   3) Restart of pumps more difficult

2) Reduce Seal Flow to 2 GPM

   Advantages:

   1) Less letdown heat loss
   2) Better level control

   Disadvantages:

   1) May jeopardize the pump seals (minor)

3) Cut off the Intermediate Heat Exchanger flow to letdown coolers

4) Make-up tank temperature raised

5) Make-up water should be degassed

6) Pressurizer level shall be raised to 350" prior to

   a) going solid or steaming "B"
   b) jogging RC pump
   c) starting RC pump

7) Minimize letdown flow

8) Recommend considering connecting the "B" long term OTSG cooling system heat exchanger to the "A" loop.