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TASK CLOSE OUT DOCUMENT

Task Scope Long Term Cooling PLAN

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Task No. 43 Date Complete 5/4/79

Reason felt task is complete:

The options for long term cooling have been reviewed and specific recommendations are made in the attached document

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TASK 43 LONG TERM COOLING PLAN

Recommendations:

1) The decay heat removal system should not be used unless natural cooling through the use of steam generators is not functioning effectively. However, DHR is far better than HPI since DHR will not add large amounts of water to the containment.

2) DH-V2 should be opened before the containment water level reaches it. At current rates this would occur about June 13,1979. Increased leakage into containment or pumping from the containment sump would change this date.

3) The ADHR tap-in should be completed prior to the opening of DH-V2. If this does not occur, it may be impossible to tap-in.

4) From the point of view of radioactivity, there is little advantage in delaying the use of DHR beyond August 2, 1979.

5) Need for the DHR pumps during plant recovery or future operation should be evaluated to determine whether pump design lifetime is a limiting factor.

6) Use of DHR pumps to remove water from the containment sump should be evaluated to assure that (1) water from the pump is not mixed with water from the primary system and (2) redundancy of pumps is not a problem.

Problem: Place Primary System In Long Term Cooling Mode Starting From Current Situation

Definitions:

Current Situation -

a) P ~ 900 psig
b) T_{hot} ~ 175°F
c) no incore T/C ≥ 325°F
d) water being added via
   9 gpm - make-up
   12 gpm - pump seal injection
e) water being lost to containment via
   2 gpm - leakage
   ? gpm - relief valves
f) containment water level ~ 67" and rising at ~ ½" per day
g) Aux bldg. contaminated with unidentified sources of activity near makeup tank
h) offsite dose ≪ MPC
i) natural circulation thru "A" which is steaming
j) "B" stratified
k) secondary system pressure ~ 0 psig
l) neither "B" nor "A" ready to go solid
m) equipment for pumping 150,000 gal. out of containment and storing still ~ 30 days from start-up
n) equipment for treating containment water ~ 60 days from start-up

Constraints:

a) Dose to the public
b) Dose to workers
c) Liquid handling rates and storage capacity
d) Rad waste storage and handling capability

Uncertainties:

a) Instrumentation and equipment inside containment
b) Schedules for design and construction of new systems
c) Equipment downtime for repairs
d) Human errors
e) Non-controllable events (weather, loss-of-off-site power, etc.)
f) Radiation leaks

Timing of Move to DHR:

Considerations:

a) Time at which radioactive decay will not reduce activity more than a given small fraction.
b) Need for DHR in plant recovery and any future operation.
c) Time at which cooling of the core will no longer be required.
d) Water level in containment must be kept below DHR valves.

Discussion of Considerations:

a) Table 1 shows that there is little advantage in waiting beyond October 2, 1979 (from the point of view of radioactivity) before starting the DHR. Actually, since BA 140 will be dissolved in the water, and has little tendency to come out of solution, there is little advantage in delaying DHR beyond August 2, 1979 (from a radioactivity viewpoint).
b) The DHR pumps have a finite lifetime. Since they may be needed during plant recovery, and for future plant operation, the design life of the pumps must be considered.
c) See Task 46 Write-up.
d) As of 5/2/79, the water level inside containment is estimated at 67" and rising at a rate of ½" per day. The lowest DHR valve (DH-V2) is approximately 88 inches above the floor. Therefore, if no water is removed from containment and the leak rate remains constant, it would be necessary to open DH-V2 in about 42 days (June 13, 1979). Reducing system pressure will reduce the leak rate. However, uncertainties in the actual level and the possibility of accidental spills during periodic attempts to go solid must be considered in any decision to open DH-V2.

Long Term Cooling Mode:

a) $P \leq 50$ psig
b) $T_{hot} \leq 120^{o}F$
c) No incore $T/C \geq 212^{o}F$
d) No water being added to containment
e) No active components required inside containment
f) Aux bldg. contamination cleaned up and controlled
g) Offsite doses $\ll$ MPC
h) No measurable water inside containment
i) Cooling being done by safety related systems

Transitions to Long Term Cooling Mode:

a) P reduced in steps to 50 psig watching for non-condensible gases coming out of solution. If this happens, stop and degas via makeup.
b) T_{hot} maintained less than T_{sat} instrument error. If T_{hot} approaches T_{sat}, stop reducing pressure until system stabilizes.
c) Keep all incore T/C's below T_{sat} - Instrument error. If any start to approach T_{sat}, stop reducing pressure while system stabilizes. If temp doesn't stabilize, evaluate whether T/C is measuring liquid or metal temperatures.
d) Pump water out of sump using external pumps (neither DHR nor ADHR)
e) Stop using make up system, process water in make up tank, (repair leaks in MU pumps and/or valves). Get MU system ready to operate - use only to maintain water level in pressurizer.
f) Stop seal injection, use "natural" cooling unless system becomes "unstable" or if neither "A" nor "B" OTSG's available. Then go to DHR system. If DHR not possible, use feed and bleed with HPIS.

g) Once in DHR or feed and bleed mode, clean-up RCS water by batch processing.

DH-V2 must open in order that either the DHR or the ADHR be available. The reason why DH-V2 hasn't been opened is that one of the upstream DH valves may be leaking and opening DH-V2 would permit contaminated water into piping which is inside the auxiliary building. The ADHR tie-in could not be made if this occurred.

As of this writing, the ADHR tap-in will not be completed until 5/18/79. If that schedule slips by three weeks, and if water level in containment continues to rise at ½" per day, then it is likely that DH-V2 will have to be opened without the ADHR in place.

TABLE I

Isotope	Measured 7:30 A.M. 4/10/79 Primary Coolant Activity UC/CC	Half-Life	100 Day Cycle 0.1% Failed Fuel Activity UC/CC	Calculated 7:30 A.M. 5/2/79 Primary Coolant Activity UC/CC	Time To Reach 100 Day Cycle 0.1% FF Activity	Time To Reach 100 Day Cycle 1% FF Activity
I131	4.6×10^{3}	8.06D	0.16	6.94×10^{2}	97D	70D
I133	0	20.8H	0.268	0	-	-
CS134	7.7×10^{1}	2.06Y	0.175	7.5×10^{1}	18Y	11Y
CS136	1.2×10^{2}	13.0D	0.0529	3.7×10^{1}	122.9D	79.7D
CS137	3.2×10^{2}	30.2Y	1.75	3.2×10^{2}	227Y	127Y
SR89	1.5×10^{3}	50.8D	3.1×10^{-4}	1.1×10^{3}	3.02Y= 1105D	2.57Y= 937D
SR90	1.5×10^{3}	28.9Y	1.5×10^{-5}	1.5×10^{3}	768Y	672Y
BA140	1.7×10^{2}	12.8D	4.0×10^{-4}	5.2×10^{1}	217.5D	175D
LA140	1.4×10^{2}	40.23H	1.6×10^{-4}	1.6×10^{-2}	267.3H= 11D	133.6H= 5.6D
MO99	1.3×10^{2}	66.6H	0.291	5.3×10^{-1}	57.6H= 2.4D	-
CE144	1.05×10^{2}	284.4D	4.5×10^{-5}	9.9×10^{1}	16.44= 5993D	13.8Y 5048D

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On 8/2/79, I131, CS136, LA140, and MO99 will all be below the 1% FF activity.

By 10/2/79, BA140 will also be below 1% FF activity.

It will take until December 1981 before SR89 reaches 1% FF activity.

Then about 8 more years are required for the next isotope to reach 1% FF activity.