Duke Power Company

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October 25, 1979

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Mr. Robert L. Baer, Chief
Light Water Reactor Project Branch #2

Re: McGuire Nuclear Station
Units 1 and 2
Docket Nos. 50-369, -370

Dear Mr. Denton:

The attached information concerning potential overpressurization of containment in the event of a main steam line break is provided in response to the request for additional information transmitted by Mr. Robert L. Baer's letter of September 21, 1979.

Very truly yours,

William O. Parker, Jr.

William O. Parker, Jr.

GAC/sch
Attachment

Electricity for a Progressive Piedmont
5th Anniversary
Duke Power 1904-1979

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McGuire Nuclear Station

Response to NRC Request for Additional Information "Potential Over-Pressurization of Containment in the Event of MSLB."

Response 1

The assumptions made in the analysis are described in Section 6.2.1.3.12 of the McGuire FSAR. They are:

a. Breaks were assumed to be double-ended ruptures occurring at the nozzle at one steam generator.

b. Blowdown from the broken steam line is assumed to be saturated steam.

c. Steam line and feedwater line isolation are completed at 10 seconds after the break occurs. The isolation signal is generated by a high steam flow/low steam line pressure signal from the Solid State Protection System. Maximum closure time for both the steam line and feedwater line isolation valves is 5 seconds, thus a full 5 seconds is allowed for signal generation, processing and delay.

d. Plant power levels of 102 percent of nominal full load power, 30 percent of nominal full load power, and zero power were considered.

e. Full double-ended guillotine (1.4 square foot), 0.6 square foot, and 0.4 square foot ruptures were evaluated.

f. Failures of a main steam isolation valve, a diesel generator, a feedwater isolation valve, and auxiliary feedwater runout control were considered individually.

g. The auxiliary feedwater system is manually re-aligned by the operator after 10 minutes.

h. For the full double-ended ruptures, the main feedwater flow to the steam generator with the broken steam line was calculated based on an initial flow of 100 percent of nominal full power flow and a conservatively rapid steam generator depressurization. The peak value of this flow occurring just prior to isolation is 32.6 percent of nominal For the smaller breaks, this same feedwater transient was conservatively assumed.

The auxiliary feedwater system will be actuated shortly after the occurrence of a steamline break. The mass addition to the faulted steam generator was from the auxiliary feedwater system may be conservatively determined by using the following assumptions.

a. The entire auxiliary feedwater system is assumed to be actuated at the time of the break and instantaneously pumping at its maximum capacity.

b. The affected steam generator is assumed to be at atmospheric pressure.

c. The intact steam generators are assumed to be at the safety valve set pressure.

d. Flow to the affected steam generator is calculated from the auxiliary feedwater system head curves, assumptions 2 and 3 above and the system line resistances. The effects of any flow limiting devices are considered.

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e. The flow to the faulted steam generator from the auxiliary feedwater system is assumed to exist from the time of rupture to until realignment of the system is completed.

Certain changes have been made to the Auxiliary Feedwater System on the McGuire Nuclear Plant, i.e., the resistance of the motor-pump discharge line has been increased. The purpose of this modification is to limit-pump runout under low steam generator pressure conditions. Pump protection no longer requires credit for operation of automatic air operated controllers; thus auxiliary feedwater flowrate to a faulted loop during steamline break will be lower than the flowrates used for the containment analysis.

Response 2

a. The analysis presented in Section 6.2.1.3.12 of McGuire FSAR used the following auxiliary feedwater flow rates:

   1) With runout protection operational a constant auxiliary feed flow of 1400 gpm to the faulted steam generator.

   2) Failure of runout control was simulated by assuming a constant auxiliary feedwater flow of 200 gpm to the faulted steam generator.

The above flowrates were held constant from time of break until realignment which was assumed at 10 minutes. These assumptions are very conservative since under the current design, no more than 800 gpm is supplied to the faulted steam generator under any conditions.

b. Each motor driven auxiliary feedwater pump is rated at 450 gpm. The turbine driven pump is rated at 900 gpm.

   Flow is controlled by throttle valve travel stops set to allow the turbine driven pump to supply 150 gpm to each of three intact steam generators with approximately 330 gpm supplied to the faulted generator. The turbine driven pump therefore supplies the required 450 gpm (3 x 150 = 450) to three intact steam generators.

   Throttle valve travel stops on each motor driven pump are set to limit flow to two intact steam generators 50 170 gpm each. This throttle position limits flow to the faulted steam generator to 380 gpm allowing 110 to be fed to the intact steam generator. Together the motor driven pumps supply the required 450 gpm (2 x 170) + 110 = 450 to three intact steam generators with 380 gpm lost to the faulted steam generator.

   The travel stops on the throttle valves limit pump runout to approximately 675 gpm for each motor driven pump and approximately 1100 gpm for the turbine driven pump assuming complete depressurization of all steam generators.

   See attached figures for pump head capacity curves.

c. See attached flow diagrams for system configuration.

d. The auxiliary feedwater system will be actuated shortly after the occurrence of a steamline break. In the analysis the auxiliary feedwater flow to the faulted steam generator was assumed to exist from the time of the rupture until realignment of the system is complete. The auxiliary feed-

water system is manuall/ realigned by the operator after 10 minutes. Therefore, the analysis assumes maximum auxiliary flow to a depressurized steam generator for fu.' 10 minutes.

e. Operator action is required to terminate auxiliary feedwater flow to the affe ted steam generator. Low steam generator pressure indication will alert the operator of the need to isolate auxiliary feedwater.

f. Several failures can be postulated which would impair the performance of various steamline break protection systems and therefore would change the net energy releases from a ruptured line. These are;

1. Main Steam Isolation Valve

   Failure of a main steam isolation valve increases the volume of steam piping which is not isolated from the break. When all valves operate, the piping volume capable of blowing down is located between the steam generator and the first isolation valve. If this valve fails, the volume between the break and the isolation valves in the other steam lines including safety and relief valve headers and other connecting lines will feed the break.

2. Failure of a diesel generator would result in the loss of one containment safeguards train resulting in minimum heat removal capability.

3. Failure of a feedwater isolation valve could only result in additional inventory in the feedwater line which would not be isolated from the steam generator. The mass in this volume can flush into the steam generator and exit through the break. Both the feedwater isolation valve and the feedwater regulating valve close in no more than 5 seconds precluding any additional feedwater from being pumped into the steam generator. The additional line volume available to flush into the steam generator is that between the feedwater isolation valve and the feedwater regulating valve, including all headers and connecting lines.

4. Failure of the auxiliary feedwater runout control equipment would result in higher auxiliary feedwater flows entering the steam generator prior to realignment of the auxiliary feed system. However, with the current design, pump runout protection is completely passive and not subject to single failure.

The effect of these failures is to provide additional fluid which may be released to the containment via the break or reduce the heat removal capability of the containment safeguard systems.

Failure of the auxiliary feedwater isolation valve to close has not been considered. The maximum auxiliary feedwater flow that can be delivered to a faulted steam generator has been assumed in the analysis for 10 minutes for the two cases being considered; 1) with runout protection operational, 2) with failure of runout protection. Only after 10 minutes the operator takes action to isolate auxiliary feedwater to the broken steam generator. At that time if the remote controlled auxiliary feedwater isolation valve fails to close, the operator can trip the two auxiliary feedwater pumps feeding the broken steam generator until this valve or another in the line is manually closed.

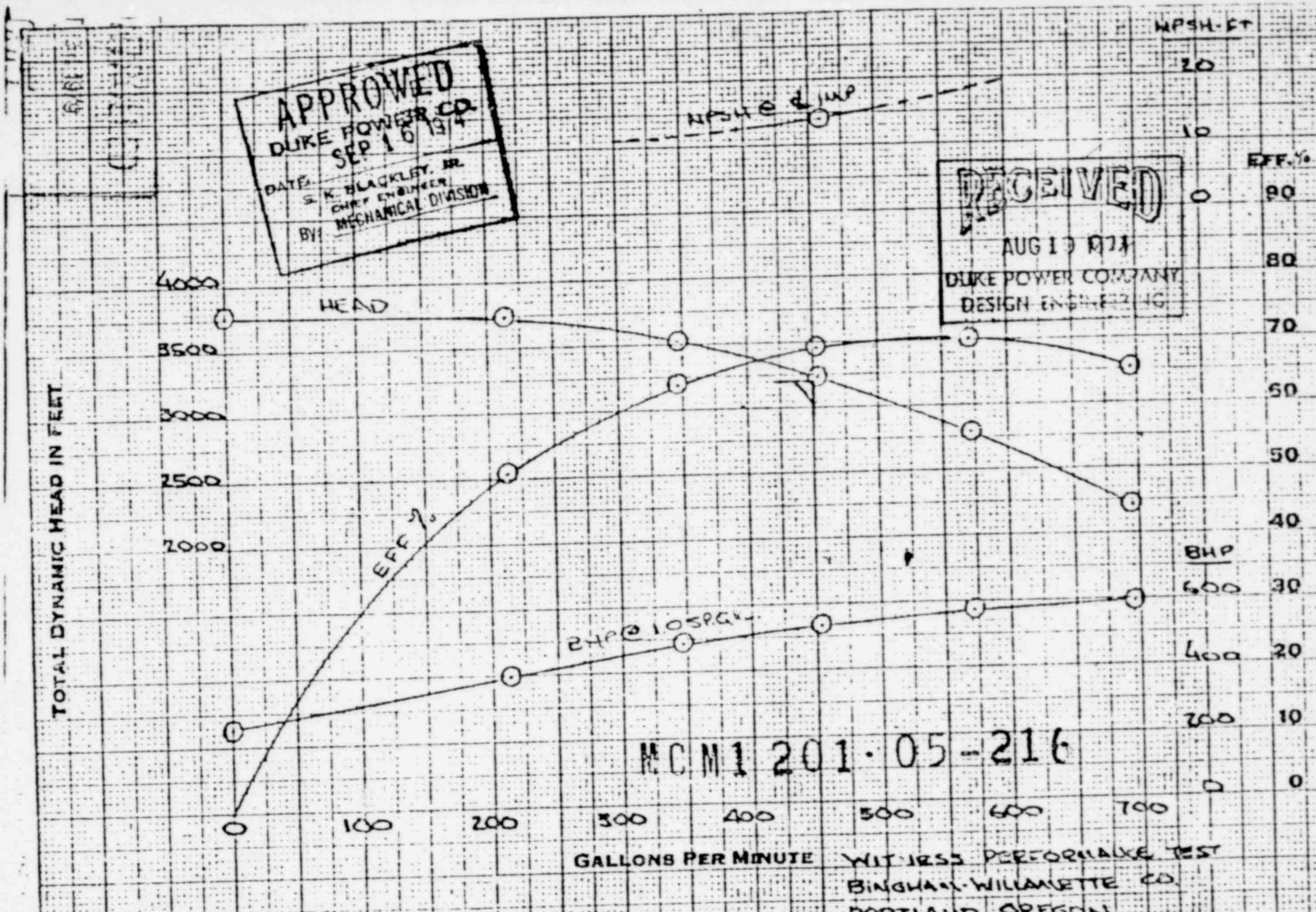
g. An analysis of a spectrum of steamline break at various power levels assuming several different single failures has been performed for McGuire and reported in FSAR Section 6.2.1.3.12. These analyses include cases assuming failure of auxiliary feedwater runout protection.

Consistent with the licensing basis for the McGuire Plant operator action to realign auxiliary feedwater has been assumed only at 10 minutes.

The mass and energy release rates are considerably less than the RCS double ended breaks and their total integrated energy is not sufficient to cause ice bed meltout. The containment pressure transients generated for the RCS breaks will be more severe.

h. The mass and energy release data for the various cases analyzed are provided in the McGuire FSAR Section 6.2.1.3.12.

Since McGuire has no lower compartment sprays the time at which the containment sprays become effective is not an important parameter. The air return fan is effective within 10 minutes after the transient is initiated. The active containment heat removal systems are described in Chapter 6 of the FSAR.



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CUST. P.O. A 8183

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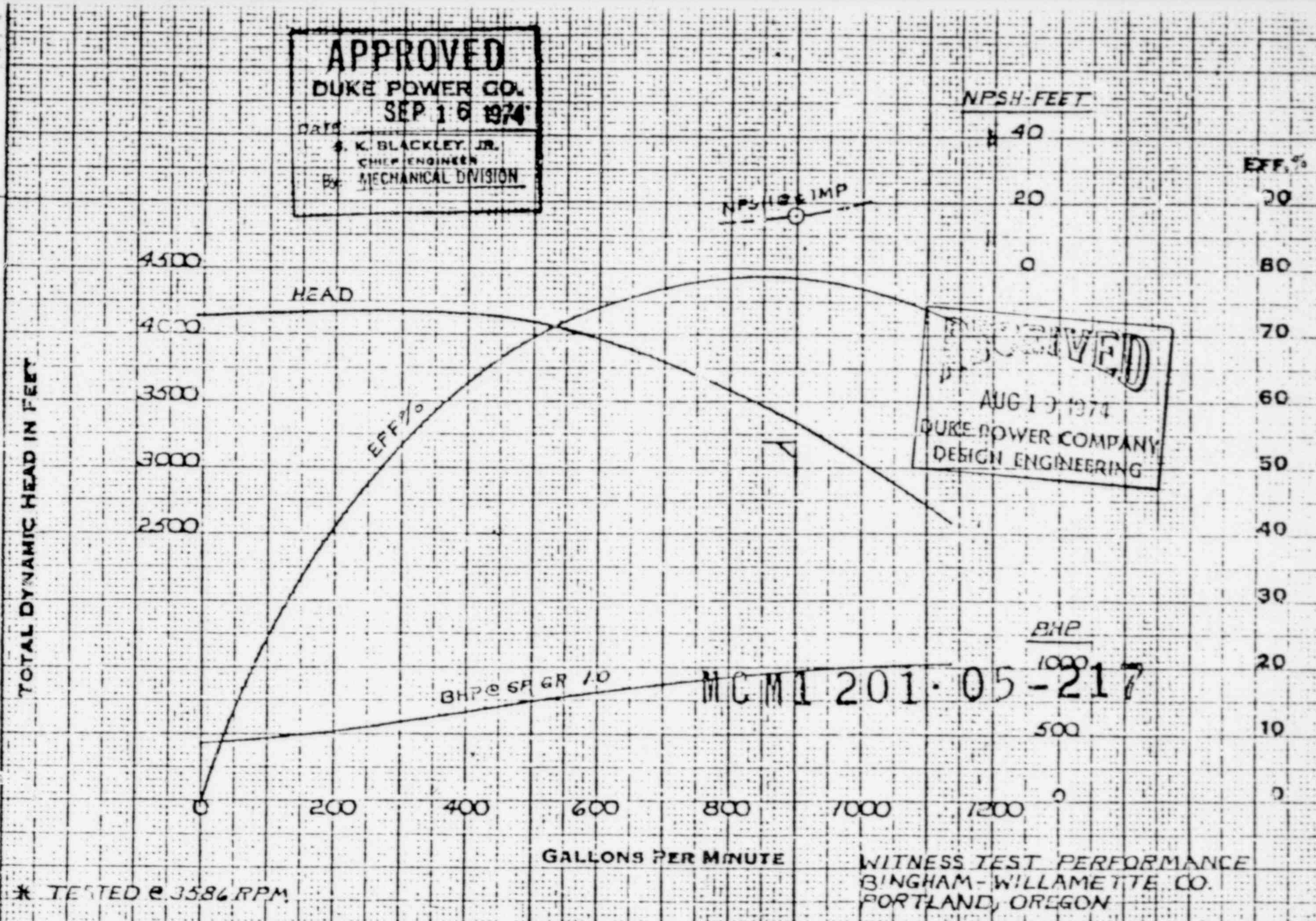
		MIN. DIA. [illegible]	DIA IMPELLER 10	IMPELLER PATT. 313MSD-6 / 313120-1-24/13	3560 R.P.M.
		EYE AREA 11.9 SQ IN	NPSH REQUIRED	REFERENCE	CURVE NO 33057



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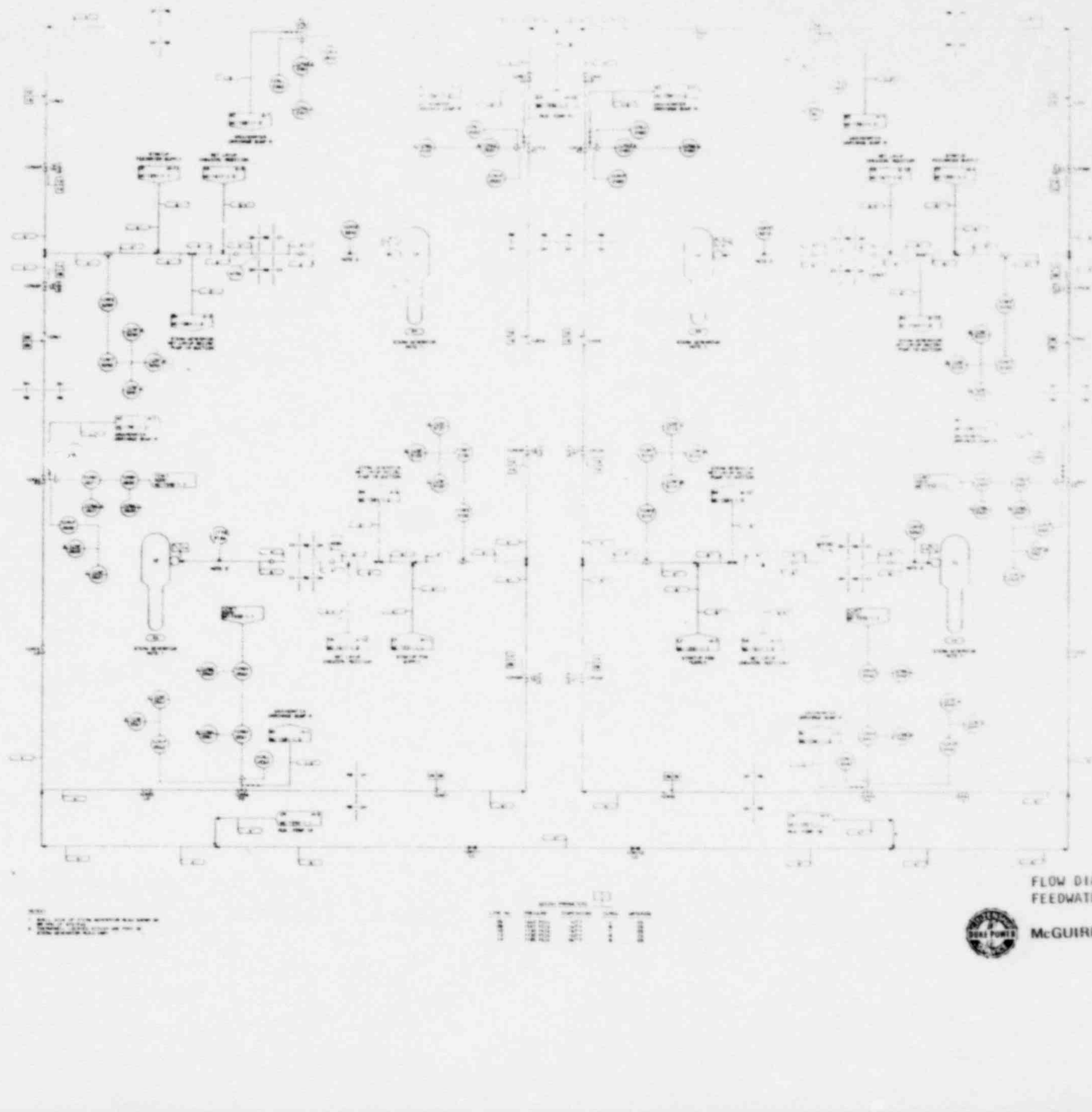

FLOW DIAGRAM OF AUXILIARY FEEDWATER

McGUIRE NUCLEAR STATION

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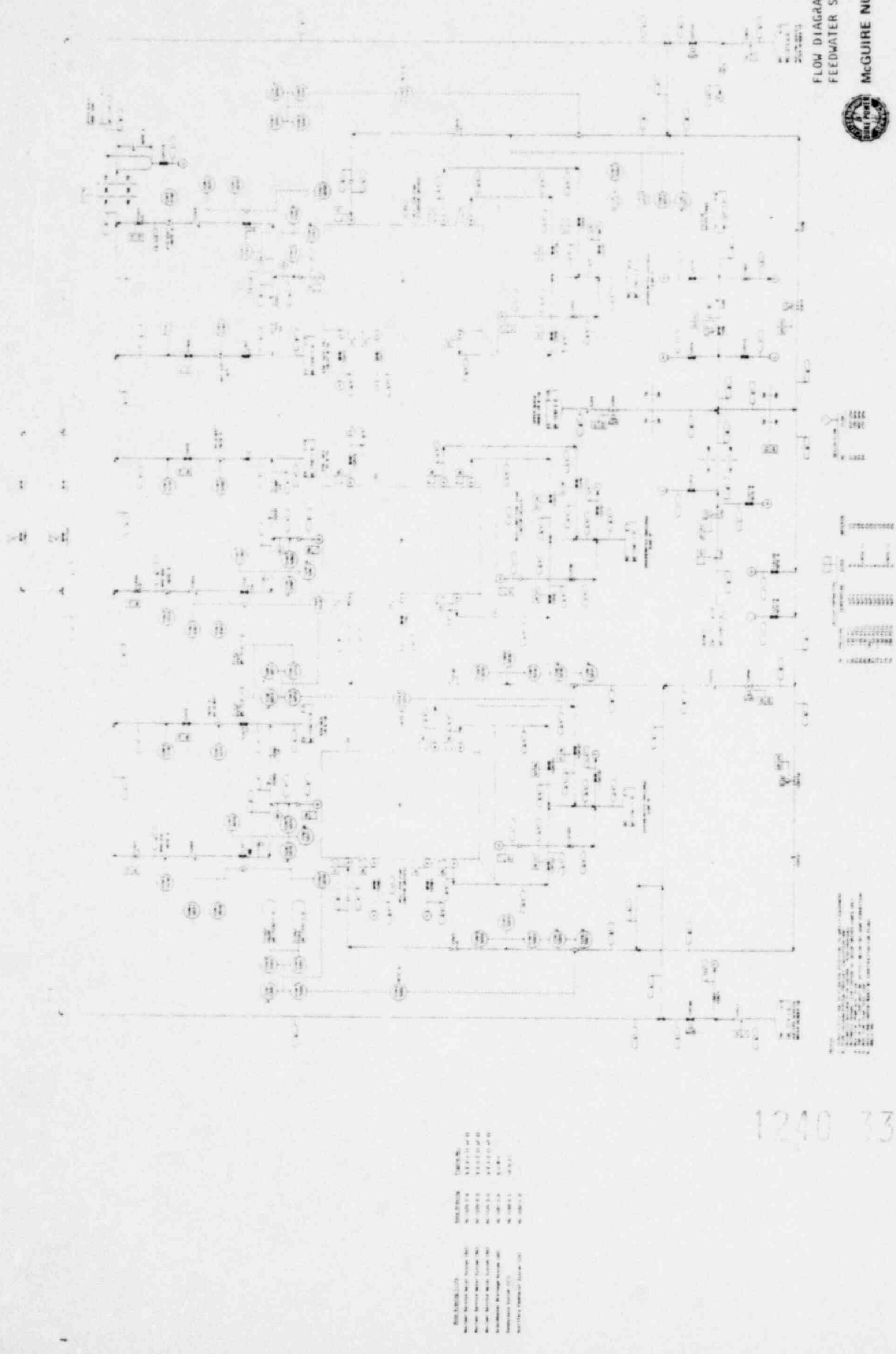

FLOW DIAGRAM OF AUXILIARY FEEDWATER SYSTEM

McGUIRE NUCLEAR STATION

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