NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

Nine Mile Point Nuclear Station
Post Office Box 32
Lycoming, New York 13093

November 29, 1972

Mr. Donald J. Skovholt
Assistant Director for Reactor Operations
Division of Reactor Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Skovholt:

Re: Provisional Operation License: DPR-17
Docket No.: 50-220

On November 19, 1972 at 0527:30, Nine Mile Point Unit #1 while operating at 1820 MW (t) was inadvertently tripped during the testing of the Turbine thrust bearing wear detector, a routine weekly test.

The resultant turbine trip caused a reactor scram with the inadvertant opening of a safety valve for 9 seconds and subsequent pressurization of the drywell to 2.9 psig.

During the transient the maximum reactor pressure attained was 1083 psig or 7 psi below the actuation pressure of the first electromatic relief valve and 153 psi below the normal actuation pressure for the safety valve. Feedwater control system performance during the transient was acceptable, maintaining the reactor water level at a minimum of -3.15 feet and a maximum of 1.43 feet. Normal reactor water level is 0-1.5 feet. As a result no flooding of reactor vessel nozzles occurred and all safety systems could have operated, if needed, in their normal manner. The operator response during the transient was consistant with procedures and feedwater transient instructions provided to maintain reactor water level within the prescribed range.

Detailed analysis and calculations based upon operating recorders and computer monitoring systems provided the following:

1. The turbine - generator system functioned as designed with turbine bypass available to limit reactor pressure rise resulting from turbine stop valve closure, See Enclosure 1.

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2. Safety Valve #6267 operated for 9 seconds releasing approximately 290 gals. of coolent into the drywell floor drain system. The operation of the safety valve limited reactor pressure to less than the operating pressure of the first electromatic relief valve which is designed to provide pressure relief in this type of transient. As a result no steam was released to the torus via the electromatic relief system. Using the Nitrogen test and correlation to steam relieving pressures, it was found that Safety valve #6267 relieved at approximately 1080 psig instead of its design of 1236 psig. No apparent reason for the early relief was forthcoming from on site inspection. The valve will be sent to Dresser Valve Company for a thorough analysis. Although it was not indicated that the safety valve had been inadvertently adjusted during the 1971 maintenance overhaul, all safety valves were scribed on the adjusting nut to indicate in the future any deviations. Enclosure 4 includes the past history of each safety valve and the results of the on site nitrogen testing.

3. Damage in the drywell was limited to the upper section surrounding the affected safety valve and concerned mainly the insulation on the valve and vent piping to the drywell coolers. This is as would be expected. No higher temperatures than 10-15°F above normal full power operation were noted in the lower portion of the drywell. Enclosure 2 provides a detailed description of the gaseous releases to the drywell and to the environment.

4. No emergency systems actuation parameters were reached during the transient. Subsequent analysis of the transient and the parameters plotted for the safety analysis for a turbine trip at this power level showed no inconsistancies in parameter response and range considering the safety valve opening excepting the recirculation system response. See Enclosure 3.

5. The recirculation system indicated a minimum flow of approximately 6×10^6 #/hr. 45 seconds following the turbine trip. This occurred with increasing reactor water level, decreasing (approximately zero) feedwater flow, and decreasing reactor pressure.

   It would appear that void formation in the recirculation loops and/or flow sensing lines caused this phenomena. Collected data has been forwarded to General Electric for analysis and solution to this problem. The reduction in flow occurred over an 18 sec. time span and presented no safety problem in as much as the reactor had already been shutdown.

6. The turbine trip was caused by the failure of a micro-switch in the turbine thrust bearing wear detector test circuit. The micro-switch, which is activated when the wear detector mode switch is placed in the "test" position, blocks the thrust bearing wear detector turbine trip signal and provides an annunciator alarm. The failure of the micro-switch to function enabled the turbine trip and did not alarm the annunciator.

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6. The operator did not recognize the significance of the lack of the annunciator and when attempting to proceed with the test, tripped the turbine.

Following a thorough review of the transient the following corrective actions were taken prior to start-up of the reactor.

1. To provide the most reliable set of safety valves for the reactor.

    a. The 7 existing spare safety valves that had recently been steam tested were installed matching relieving pressure for relieving pressure (including the safety valve that relieved early).

    b. The remaining 9 safety valves on the head were nitrogen tested and correlated to steam relieving pressures. Those that met the criteria were placed back on the vessel head.

    c. Two valves were needed from the 7 safety valves initially removed. These were nitrogen tested and correlated to steam providing 16 reliable valves to be installed on the vessel head.

2. To eliminate the possible reoccurance of a trip resulting from the thrust bearing wear detector test.

    a. A circuit was installed which will provide a light at the bearing wear detector test switch in the control room to indicate operation of the micro-switch.

    b. The micro-switch that failed was replaced.

3. To determine the effect of the transient on other operating systems, and the drywell.

    a. The transient results were compared with the safety analysis to assure that the response of all systems to the transient was in agreement with design, considering the inadvertent operation of a safety valve.

    b. General Electric Company was provided with sufficient data to determine what can be done to eliminate the void effect seen in the recirculation system loop and/or flow instrumentation lines.

3. c. Electrical equipment in the drywell, including cable insulation was inspected for possible damage. No damage was found.

   d. Damage occurring in and around the safety valve discharge was repaired.

   e. A post-start-up hydrostatic test at 1000 psig was performed.

4. An analysis and review of these corrective actions was undertaken by the Site Operations Review Committee prior to Station start-up.

   Results of the review by the Site Operations Review Committee 24 hours prior to station start-up showed:

   1. That no undue safety or radiological hazard was presented to the general public.

   2. No unreviewed safety question exists and all systems with the exception of those now under study as previously mentioned, performed their intended function in their designed manner.

   3. All safety valves would in the future be required to have a nitrogen correlation particular to that valve, to enable testing just prior to the installation on the vessel head.

Very truly yours,

P. Allister Burt

P. Allister Burt
General Superintendent
Nuclear Generation

PAB/cm

Enclosures.

The turbine-generator system operation is based upon the ability of the bypass system to operate upon control valve closing thus limiting the pressure in the reactor vessel. Following closure of the turbine stop valves the bypass system should be in operation within .3 seconds. A detailed analysis of the system operation requires a distinction between the transient time (in milliseconds) and computer time (in seconds) and the correlation between the scanning frequency of both.

An analog point is scanned normally in a prescribed group sequence, that is, the software selects an analog point on each one of the analog switch matrix terminations and scans these points as a group. Therefore knowing the hardware timing limits and the software conversion timing it is possible to tell the approximate time within a one second time frame that the individual point was scanned. In addition a check can be made upon this value using the API priority structure. The Automatic Priority Interrupt can recognize an event occurrance within .5μ sec. Therefore knowing the time in milliseconds that a particular parameter exceeded its alarm point (such as in the sequence of events which are all API generated) a back fitting to the post mortem log can be made to determine the fraction of the second that the parameter exceeded its alarm value. The sequence of event log indicates that the computer time changed from 5:27:31 to 5:27:32 between 1369 ms and 1401 ms into the transient. Therefore it is exactly correct to say that the trip occurred at 5:27:30 and 599-631 ms. The reactor high pressure sequence of event point went into alarm (1080) 796 ms into the transient or at 5:27:31 and 395 ms computer time. On the post mortem log wide range reactor pressure (which was scanned at 5:27:31 and approx. 400 ms) indicated above 1080 psig where as the narrow range reactor pressure (which was scanned at 5:27:31 and approx. 0 ms) indicated 1013 psig. Therefore by determining the computer time in ms that the analog point was read, a proper analysis of the post mortem can be made. Applying this same analysis to the bypass valve position, shows that the bypass valves are fully open within the 5:27:31 second time frame.

As an independent verification of this fact, the transient recorder shows the bypass valves 100% open approximately .3 seconds following closure of the stop valves. Comparing the above results with the safety analysis for turbine trip with failure of the bypass system, Neutron flux would peak at 163%, .83 seconds following the trip. No alarms, indicating neutron flux exceeded its trip point of 120%, were in evidence during the November 19th transient, a further indication of proper action of the bypass system.

ENCLOSURE 2

1. Total fission gases released

   from 0530 hrs.------------> 2400 hrs. 714 Ci.

2. Average release rate fission gases

   from 0530 hrs.------------> 2400 hrs. 10,715 μCi/sec.

3. Average release rate during drywell

   purge 0900 hrs.----------> 1100 hrs. 54,120 μCi/sec.

4. Max. release rate during drywell purge.

   time 0915 hrs. 131,350 μCi/sec.

5. I released during drywell purge

   from 0900 hrs.-----------> 1100 hrs. 6.5×10^{-4} Ci.

6. I release rate during drywell purge.

   0900 Hrs. ---------> 1100 Hrs. 9×10^{-2} μCi/sec.

7. Fission gases concentration in drywell

   before purging $\sim 1 \times 10^{2}$ Ci/cc

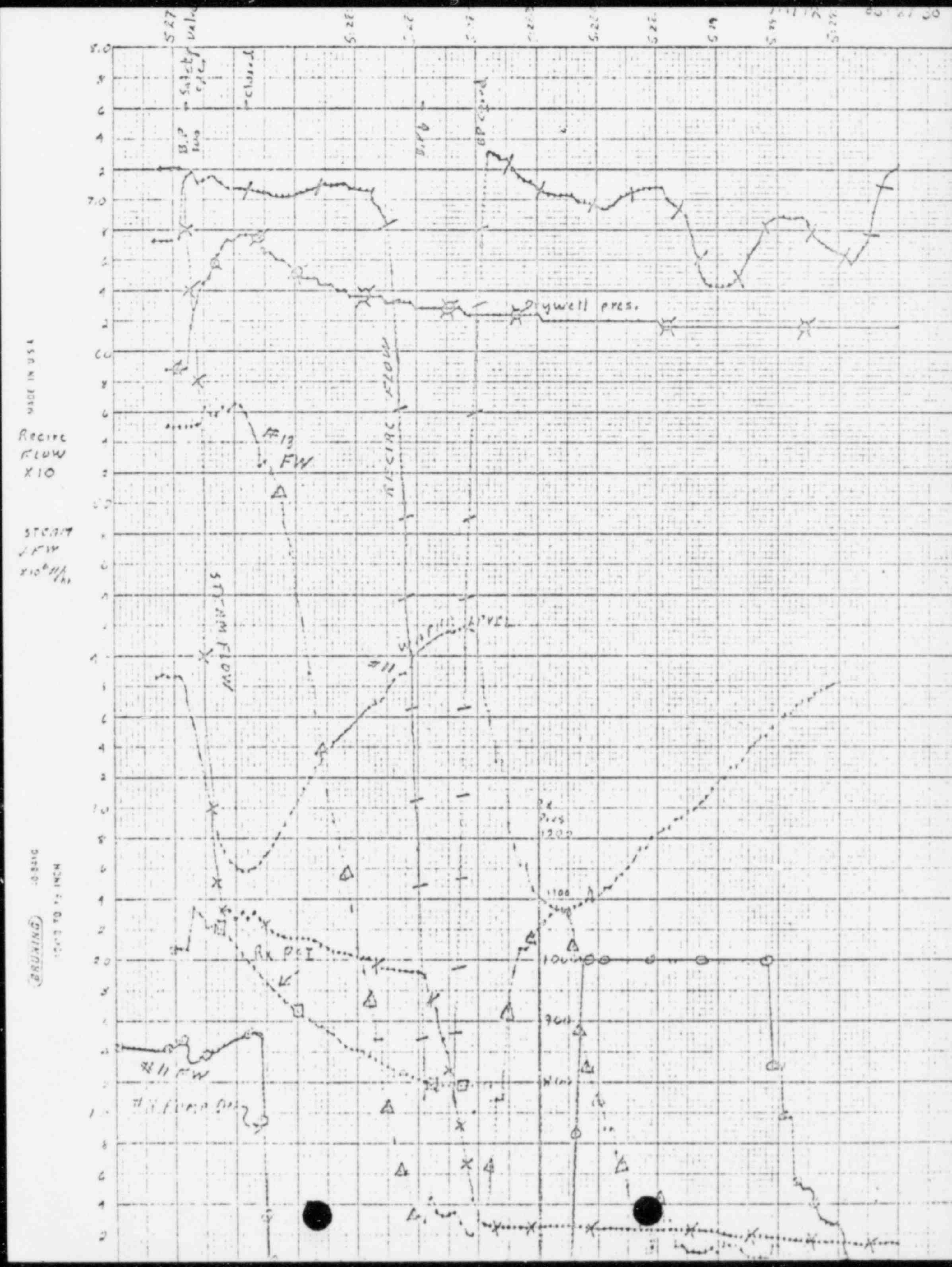
8. I Concentration in drywell

   before purging $\sim 2 \times 10^{-8}$ μCi/cc

9. Wind direction was from the south east. Velocity approx. 20 MPH.

ENCLOSURE 3

Figure 1 shows the vital parameter changes that occurred as a result of the turbine trip from 1820 MW (t) on November 19, 1972. The comparison with the safety analysis (submitted February 28, 1972) shows an acceptable transient with no significant variation of measured values of thermal, nuclear or hydraulic characteristics from the predicted safety analysis considering the safety valve operation. The recirculation flow reduction, the suspected result of void generation in the loops and/or flow sensing lines, is being analyzed by General Electric and Nine Mile Point Site Personnel. In any event the change in recirculation flow is beyond the time when it would be considered significant to the safety analysis (16 seconds). The excellent response of the bypass system to limit the resultant reactor pressure spike and corresponding neutron flux peak to better than acceptable values (less than 105% on the APRM's) indicates the effort to the "Fine Tune" this system in the past, paid dividends during the transient.



Recirc FLOW X10
STEAM / FW X10^6 #/hr
Drywell pres.
RECIRC FLOW
#13 FW
STEAM FLOW
#11
WATER LEVEL
Rx PSI
#11 FW
Rx Pres 1200
1100
1000
900
B.P. open
B.P. Valve opened
Safety valve cycled
closed
MADE IN USA
BRUNING

ENCLOSURE 4

The following is a history of the 16 safety valves residing on the reactor vessel head during the transient of November 19, 1972, plus spares. Following the history is the data generated as a result of the nitrogen testing program. Figure 1 shows the present safety valve alignment and Figure 2 shows the nitrogen correlation used to determine the steam relieving pressures.

#6250 Pressure: 1218 lbs.

1. 1969 Installed Position N7F.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc. X-rayed disc.
3. 1972 Installed Position N7J.

#6253 Pressure: 1227 lbs.

1. 1971 Installed Position N7D.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. reassembled and installed position N7D.

#6254 Pressure: 1245 lbs.

1. 1969 Installed Position N7N.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed position N7N.
3. 1972 Removed, dismantled, cleaned, lapped seat and disc. Dye checked nozzle. Reassembled and installed Position N7N.

#6255 Pressure: 1236 lbs.

1. 1971 Installed Position N7C.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled. Shipped to Dresser Industries to check popping pressure. Also to test with nitrogen.

#6256 Pressure: 1236 lbs.

1. 1971 Installed Position N7E.
2. 1972 Removed, dismantled, cleaned, lapped seat & disc. Reassembled and installed position N7E.

#6267 Pressure: 1236 lbs.

1. 1969 Installed position N7K.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed position N7K.

#6280 Pressure: 1236 lbs.

1. 1969 Installed Position N7E.
2. 1971 Removed, dismantled, cleaned, lapped sent & disc. Reassembled and installed position N7J.
3. 1972 Removed, dismantled, cleaned, lapped seat and disc. Dye checked nozzle. Reassembled. Shipped to Dresser Industries to check popping pressure. Also to test with nitrogen.

#6291 Pressure: 1227 lbs.

1. 1971 Installed position N7G.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed Position N7G.

#6292 Pressure: 1254 lbs.

1. 1969 Installed Position N7T.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc.
3. 1972 Dismantled, Dye checked nozzle reassembled. Shipped to Dresser Industries to check popping pressure. Also to test with nitrogen.

#6297 Pressure: 1245 lbs.

1. 1969 Installed Position N7S.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed Position N7S.

#6298 Pressure: 1254 lbs.

1. 1969 Installed Position N7U.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed Position N7U.

#6301 Pressure: 1254 lbs.

1. 1969 Installed Position N7R.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Dye checked nozzle. Reassembled and installed position N7R.

#6303 Pressure: 1254 lbs.

1. 1971 Installed position N7T.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and installed position N7T.

#6313 Pressure: 1245 lbs.

1. 1969 Installed Position N7H.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc.
   X-rayed disc. Reassembled.
3. 1972. Installed Position N7H.

#6316 Pressure: 1245 lbs.

1. 1971 Installed Position N7H.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc.
   Dye checked nozzle reassembled.
   Shipped to Dresser Industries to check popping pressure.
   Also to check with nitrogen.

#6317 Pressure: 1227 lbs.

1. 1969 Installed Position N7D.
2. 1971 Removed, dismantled, cleaned, lapped seat & disc.
3. 1972 Dismantled, dye checked nozzle.
   Shipped to Dresser Industries July 12 for testing popping pressure. Also to check with nitrogen.

#6319 Pressure: 1227 lbs.

1. 1969 Installed Position N7G.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc.
3. 1972 Dismantled dye checked nozzle reassembled.
   Shipped to Dresser Industries for checking popping pressure.
   Also to be tested with nitrogen.

#6325 Pressure: 1227 lbs.

1. 1969 Installed Position N7B.
2. 1971 Dismantled, cleaned, lapped seat and Disc.
   Reassembled and Reinstalled Position N7B.
3. 1972 Dismantled, cleaned, lapped seat and disc.
   Reassembled and Reinstalled Position N7B.

#6520 Pressure: 1218 lbs.

1. 1969 Installed Position N7J.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc.
3. 1972 Dismantled dye checked nozzle - Reassembled and installed as position N7A.

#6521 Pressure: 1218 lbs.

1. 1970 Installed Position N7A for increase in power.
2. 1972 Removed, dismantled, cleaned, lapped seat and disc.
   Shipped to Dresser Industries July 12 for checking popping pressure

#6522 Pressure: 1218 lbs.

1. 1971 Installed Position N7F.
2. 1972 Dismantled, cleaned, lapped seat and disc. Reassembled and reinstalled position N7F.

#6524 Pressure: 1218 lbs.

1. 1969 Installed Position N7M.
2. 1971 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and Reinstalled Position N7M.
3. 1972 Removed, dismantled, cleaned, lapped seat and disc. Reassembled and Reinstalled Position N7M.

#6535 Pressure: 1236 lbs.

1. 1969 Installed Position N7C.
2. 1971 Removed, dismantled, cleaned, lapped seat and Disc.
3. 1972 Dismantled dye checked nozzle. Reassembled and Installee Position N7C.

TEST DATA

Nov. 21, 1972

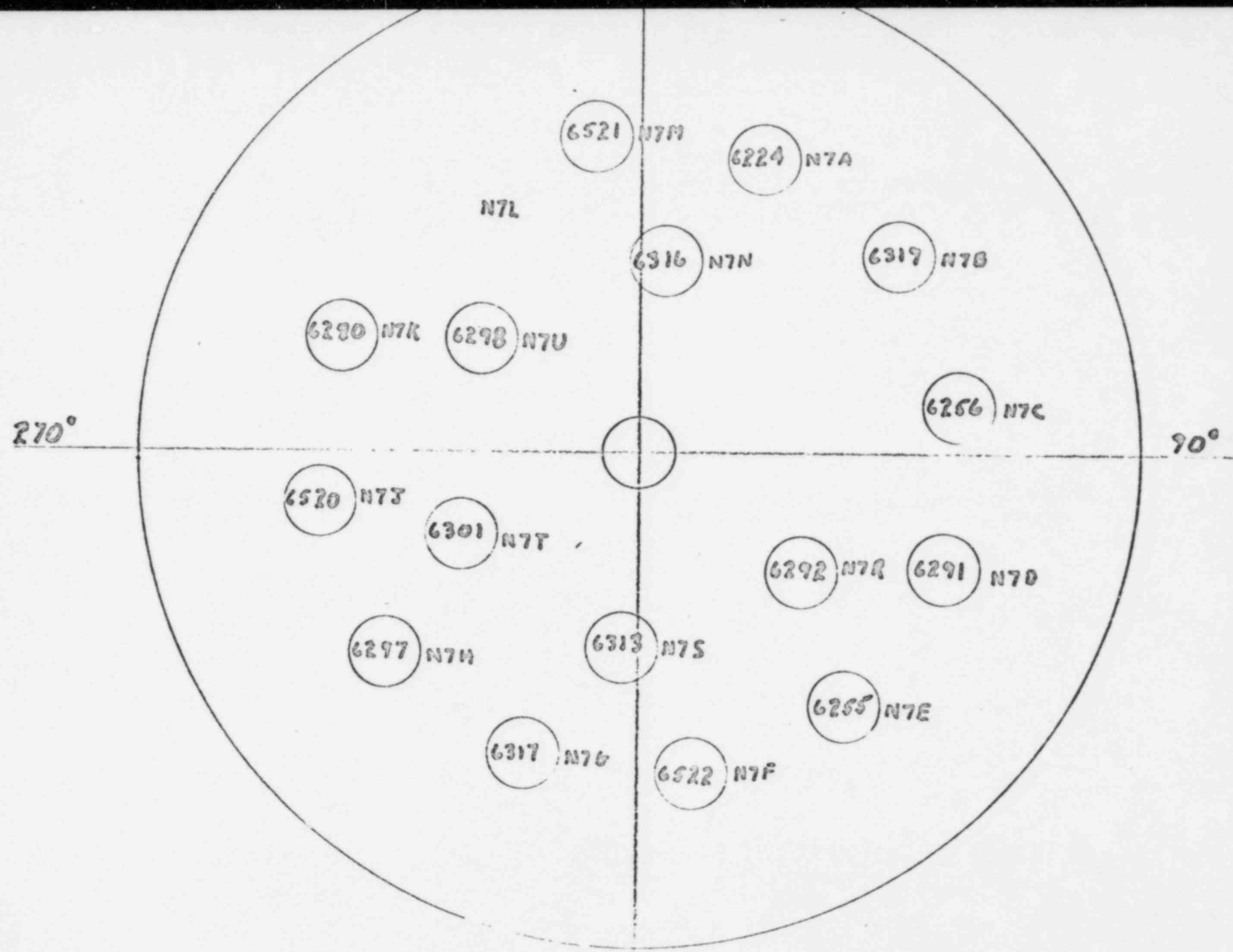
VALVE S/N	SET PSIG	TEST 1 N^2 PSIG	TEST 1 Δ	TEST 2 N^2 PSIG	TEST 2 Δ	TEST 3 N^2 PSIG	TEST 3 Δ
6267*	1236	1025	211	1027	209	1026	210
6267*	1236	1018	218	1020	216		
6256	1236	1150	86	1135	101	1140	96
6254**	1245	1215	30	1210	35	1205	40
6301	1254	1155	99	1150	104	1145	109
6325	1227	1150	77	1125	102	1125	102
6524	1218	1140	78	1105	113	1105	113
6291	1227	1165	62	1160	67	1160	67
6267*	1236	1025	211	1025	211		

Nov. 22, 1972

VALVE S/N	SET PSIG	TEST 1 N^2 PSIG	TEST 1 Δ	TEST 2 N^2 PSIG	TEST 2 Δ	TEST 3 N^2 PSIG	TEST 3 Δ
6520	1218	1135	83	1135	83	1135	83
6313	1245	1185	60	1175	70	1175	70
6250**	1218	1215	3	1185	33	1190	28
6522	1218	1125	93	1100	118	1100	118
6298	1254	1170	84	1180	74	1175	79
6297	1245	1165	80	1165	80	1160	85
6267*	1236	1050	186	1025	211	1025	211

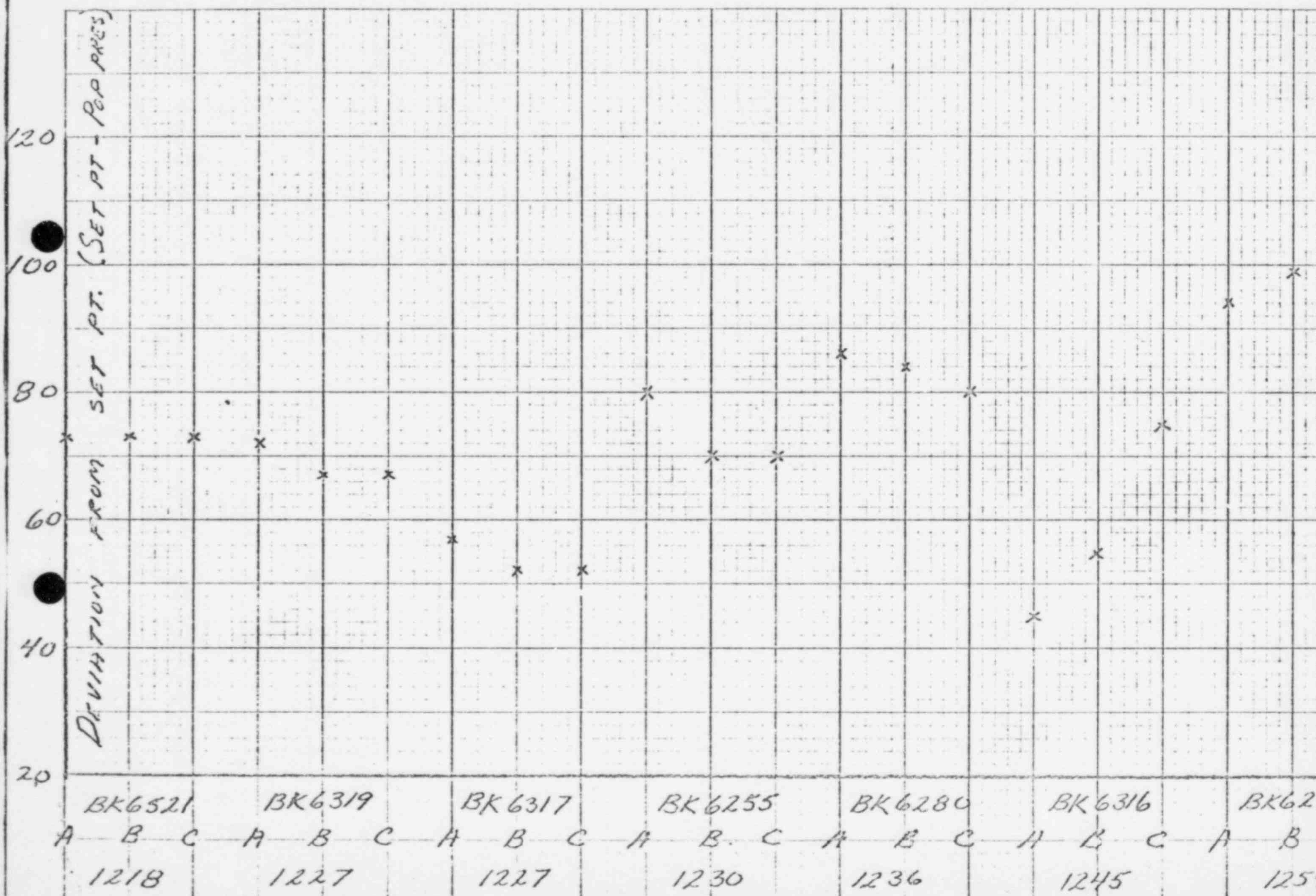
* Safety Valve that Relieved Early.

** Valves Rejected on N^2 Testing.



PRESENT VALVE POSITION 11-26-72

FIGURE 1


DEVIATION FROM SET PT. (SET PT - POP PRES)
120
100
80
60
40
20
BK6521
BK6319
BK6317
BK6255
BK6280
BK6316
BK629
A B C A B C A B C A B C A B C A B C A B
1218
1227
1227
1230
1236
1245
125