GENERAL ELECTRIC

NUCLEAR ENERGY

SYSTEMS DIVISION
NUCLEAR ENERGY
PROJECTS DIVISION

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
MC 682, (408) 925-5040

MFN-482-77

77-007-005 (e)

December 16, 1977

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Case:

SUBJECT: SELECTION OF BWR/6 RELIEF VALVE CONTROL SYSTEM MODIFICATION

On October 6, 1977, General Electric advised representatives of Inspection and Enforcement and Nuclear Reactor Regulation of a reportable condition under 10CFR21. That condition was connected with the relief valve control system which, under certain transient isolation events, would allow more than one relief valve to reopen resulting in load combinations not currently specified in the licensing documentation. On October 11, 1977 General Electric submitted a report which described the relief valve control system deficiency under 10CFR Part 21. Since that time, General Electric has met with members of the NRC staff on October 13, 1977 and November 11, 1977 to discuss this matter.

Although this letter identifies the selection of a relief valve control system modification in the context of BWR/6 plants, the modification selected to remedy this condition can be applied generically for use on BWRs in Mark I and Mark II plants if required. This modification to the relief valve control system is referred to the low-low set relief logic.

This letter provides a summary of the information presented to the NRC staff regarding low-low set relief logic addition to the relief valve control system. The low-low set relief logic assures that the number of relief valves which could reopen following a reactor isloation event do not exceed those currently used as the licensing basis for design. It is a further purpose of this letter to seek concurrence by the staff that the approach being taken by General Electric for resolution of this item is acceptable.

Discussion

The low-low set relief system logic improvement has been selected to resolve the concern for multiple valve subsequent actuation on BWR/6 Mark III. This selection was made on the basis that when compared to other alternatives, it best satisfies all design objectives and requirements. The design objectives and design requirements for the relief system logic are summarized on Page 1 of the attachment. Page 2 of the

attachment summarizes the setpoint arrangement for both the normal pressure relief setpoints and for the low-low set relief portion of the control system. Note that the design is single-failure proof and further does not compromise margins for either overpressure protection or inadvertent relief valve opening. The design is also testable during normal operation.

The low-low set relief logic system adds circuitry which imposes preestablished lower opening and closing set points for selected valves which override the normal setpoints following the initial opening of these valves. This logic is armed or activated by the existing pressure sensors of the second normal relief setpoint group. Once the transient has ended, the low setpoints can be disengaged by manual reset. A schematic logic diagram for the BWR/6 relief valve control system with the low-low set feature is attached. See Pages 3 and 4 of the attachment to this letter.

The reactor performance during an isolation event with the low-low set relief system is summarized on Page 5 of the attachment. All valves would be expected to open on the first pressure rise after isolation when conservative design assumptions/models are employed. Subsequent pressure peaks will result in no more than one relief valve experiencing subsequent actuations, with a margin of ~40 psi existing between the lowest set valve and the next lowest set valve in the armed logic.

The low-low set relief system maintains the current design documented basis for containment and NSSS equipment evaluation methods and for overpressure transients. Thus, no additional load cases for containment or NSSS equipment are required and the overpressure transients will not have to be redone. In addition, introduction of this system will result in a significant reduction in containment fatigue duty cycles resulting from relief valve cycling during the decay heat dominant period late in an isolation transient. This represents an increase in design margins in the fatigue area.

It will not be necessary to reevaluate any transient analyses presented in Chapter 15 of GESSAR because the current submittals will not be invalidated. The purpose of the events presented in Chapter 15 is to demonstrate that established overpressure protection and fuel thermal limits criteria are met for the expected spectrum of abnormal transients. This is accomplished by making conservative assumptions with regard to equipment performance and initial conditions. For example, the upper range of the nominal opening relief valve setpoints are conservatively used. Any effect of low-low set relief on transient response occurs

considerably later in the transient than the time of minimum margins, i.e., peak vessel pressures and minimum MCPRs for the limiting events occur on the initial pressure rise, whereas low-low set affects subsequent pressure peaks. Although the subsequent pressure signature after the initial peak may change due to low-low set, the established peak vessel pressures and minimum therm margins will not change from that currently presented in Chapter 15 of GESSAR.

Future Actions

In accordance with discussions with members of the NRC Staff, General Electric has agreed to provide, in January 1978, additional information regarding the design and analyses of the low-low relief set alternative. This information will be of the same level of detail as that contained in the 238 Nuclear Island GESSAR. The following identifies the contents of the January 1978 submittal which will be transmitted by letter on the 238 Nuclear Island GESSAR, Docket STN 50-447:

- Replacement documentation for portions of the GESSAR affected by addition of the low-low relief set logic.
- System description, analyses, FCD's, P&ID's and elementary wiring diagrams as they pertain to low-low relief set logic.
- Typical information as identified above for the ADS Inhibit feature should GE propose it as part of the standard design.

We request that the NRC staff concur that the addition of the low-low set relief logic to the BWR/6 relief valve control system, if designed in accordance with the criteria described herein, is acceptable as the remedy to the condition as reported in our letter of October 11, 1977.

Because of the critical schedules associated with this item, we would appreciate receiving your concurrence on this matter as early in January 1978 as is feasible. If you have any questions or comments regarding this matter, please contact Mr. J. F. Quirk of my staff.

Very truly yours,

G. G. Sherwood

G. G. Sherwood, Manager
Safety and Licensing
BWR Projects Department
Mail Code 676, Ext. 5040

GGS:sj/59-61

Attachment

cc: R. Boyd V. Stello, Jr.
R. J. Mattsen E. Volgenau
L. S. Gifford

ATTACHMENT

MARK III BWR/6 SRV CONTROL SYSTEM EVALUATIONS FOR SUBSEQUENT ACTUATION

DESIGN OBJECTIVES

1. ONE SRV SUBSEQUENT ACTUATION
2. MAINTAIN CURRENT DESIGN BASIS
   - CONTAINMENT LOADS
   - OVERPRESSURE TRANSIENTS
3. SIMPLICITY OF IMPLEMENTATION
4. GENERIC APPLICATION
5. REDUCE LONG TERM SRV CYCLING

DESIGN REQUIREMENTS

1. RETAIN CURRENT LOAD ENVELOPE
   - $\leq$ 3 SRV'S SUBSEQUENT ACTUATION
2. ACCEPTABLE OVERPRESSURE PROTECTION
3. DO NOT OPEN S/R VALVES ON SPRING (SAFETY) SET POINT
4. ACCEPTABLE MARGIN AGAINST INADVERTENT OPENING
5. SINGLE FAILURE PROOF LOGIC
6. TESTABLE DURING NORMAL OPERATION

MARK III BWR/6 SRV CONTROL SYSTEM EVALUATION

LOW-LOW SET RELIEF DESCRIPTION

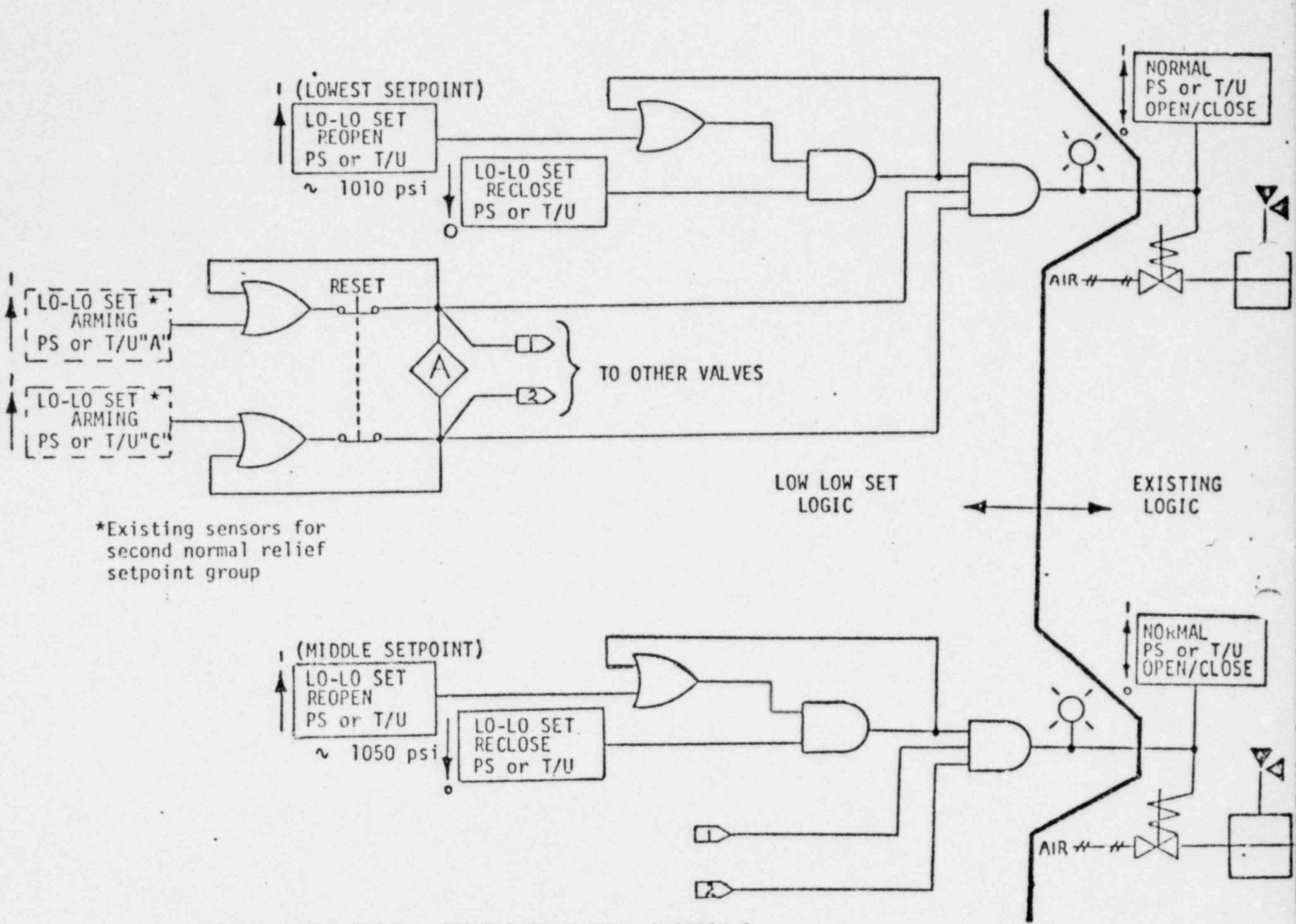
ADD INSTRUMENTS AND LOGIC WHICH WOULD SET DOWN BOTH THE OPENINGS AND CLOSING SET POINT OF SOME VALVES FOLLOWING THE INITIAL LIFT.

GROUPS	EXISTING No. (ADS)	EXISTING Nominal Set Pt.	LOW-LOW SET No.	LOW-LOW SET Set/Reset After 1st
A	1	1103	1	1010/880
B	9(4)	1113	1	1050/900
C	9(4)	1123	4	1090/940

ARMED FROM - SRV OPENING FOR NORMAL RELIEF AND

- REACTOR PRESS > NORMAL RELIEF

LOW-LOW SET RELIEF SOLUTION

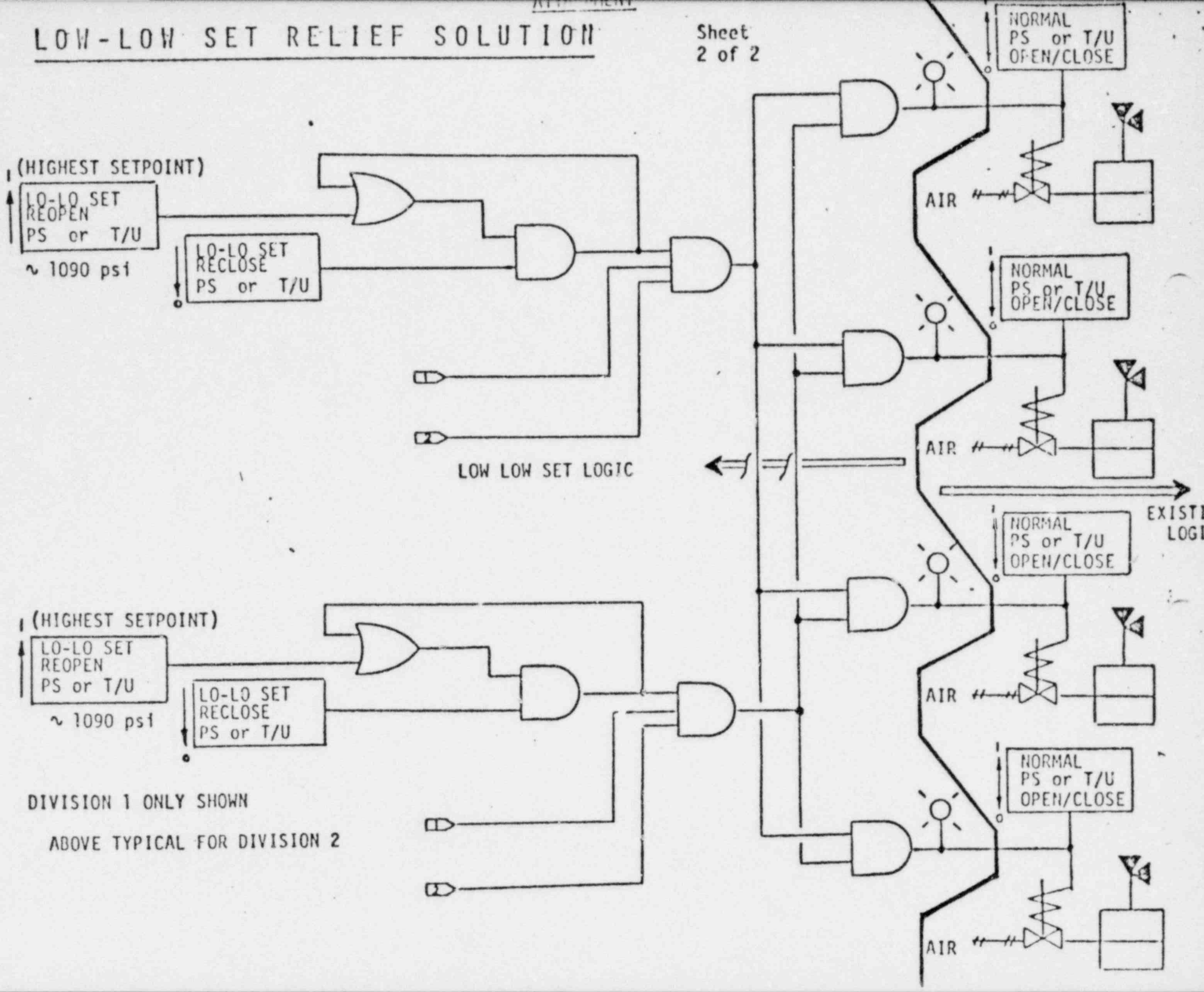


*Existing sensors for second normal relief setpoint group

DIVISION 1 ONLY SHOWN - ABOVE TYPICAL FOR DIVISION 2

LOW-LOW SET RELIEF SOLUTION

Sheet 2 of 2



MARK III BWR/6 SRV CONTROL SYSTEM EVALUATIONS

LOW-LOW SET RELIEF PERFORMANCE

- ISOLATION EVENT PERFORMANCE

  ALL VALVES 1ST ACTUATION

  1 VALVE SUBSEQUENT ACTUATION

  SUBSEQUENT PEAK PRESSURE MARGIN TO MULTIPLE VALVE REOPENING ~40-50 PSI.

- NORMAL OPERATION MARGIN TO RELIEF SET POINT ~60 PSI MAINTAINS CURRENT MARGIN

- SATISFIES ALL IDENTIFIED DESIGN OBJECTIVES AND REQUIREMENTS