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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards response to NRC position in Generic Ltr 84-23 re instrumentation for detection of inadequate core cooling. Facilities in general compliance w/target design features in Rept SLI-8211.No addl changes required.

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FEB 7 1985

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION
LICENSE CONDITION 2.C.(28)(d)(i) OF
OPERATING LICENSE NPF-14 AND LICENSE
CONDITION 2.C.(12)(e) of OPERATING
LICENSE NPF-22
ER 100450 FILE 841-2 Docket Nos. 50-387
PLA-2411 50-388

Dear Mr. Schwencer:

As required by License Condition 2.C.(28)(d)(i) of Operating License NPF-14 and License Condition 2.C.(12)(e) of Operating License NPF-22, attached is Pennsylvania Power & Light Company's response to the Staff's position on instrumentation for detection of inadequate core cooling as contained in Generic Letter 84-23.

This letter completes our action with respect to the License Conditions. If you have any questions please contact us.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

Attachment

cc: M. J. Campagnone USNRC
R. H. Jacobs USNRC

A002
1/1

Subject: Reactor Vessel Water Level Instrumentation in BWRs (NRC Generic Letter 84-23).

Pennsylvania Power & Light Co. has been a participant in the BWROG activities which sponsored the S. Levy Inc. Report SLI-8211 "Review of BWR Reactor Vessel Water Level Measurement Systems". That report provided a review and analysis of reactor water level measurement problems, and identified a number of design objectives for a reliable water level measurement system. NRC generic letter GL 84-23 endorsed the report and concluded that several design features described in the report should be considered as permanent physical improvement changes to BWRs. This letter addresses those design features as they exist on Susquehanna Station Units 1 and 2.

In summary, SSES Units 1 and 2 are in general compliance with the target design features described in report SLI-8211 and do not require additional changes. The water level instrumentation system utilizes the following features:

1. Two condensing pots used for supplying reference legs for wide range, narrow range and fuel zone range instruments; two additional condensing pots off the reactor vessel head vent line which are used to supply the upset range, extended range, and the shutdown range instruments.

2. Minimized vertical travel of the reference leg lines within the drywell for those reference legs supplying wide range, narrow range and fuel zone instruments and all RPS and ECCS water level functions.

3. Hard wired, human engineered clusters of reactor water level meters for the wide range and extended range instruments that will allow an operator to immediately assess the nature of a failure in a reference leg connection, a variable leg connection, an individual instrument, or a common divisionalized power source. The assessment is achieved by pattern recognition techniques using the four meter scale cluster along with RPV pressure instrument readings. Figure 1 attached shows this meter cluster which is used in two locations on the ECCS benchboard C601 corresponding to an operator's location while operating or monitoring either electrical division's complement of ECCS equipment. The meters used are SIGMA Lumigraph meters. All components of the circuitry are qualified to NUREG 0588 Category 1 in response to R.G. 1.97 requirements.

   A slightly different physical arrangement is used at the normal operating reactor benchboard station C651 as shown on Figure 2 attached. This display will also allow an operator to make a determination of individual or common instrument failures.

   Additionally, three narrow range meters are clustered on the Standby Information Panel, and wide range and fuel zone instruments are recorded on Panel C601.

With respect to the specific points addressed in the NRC generic letter, the following information is provided.

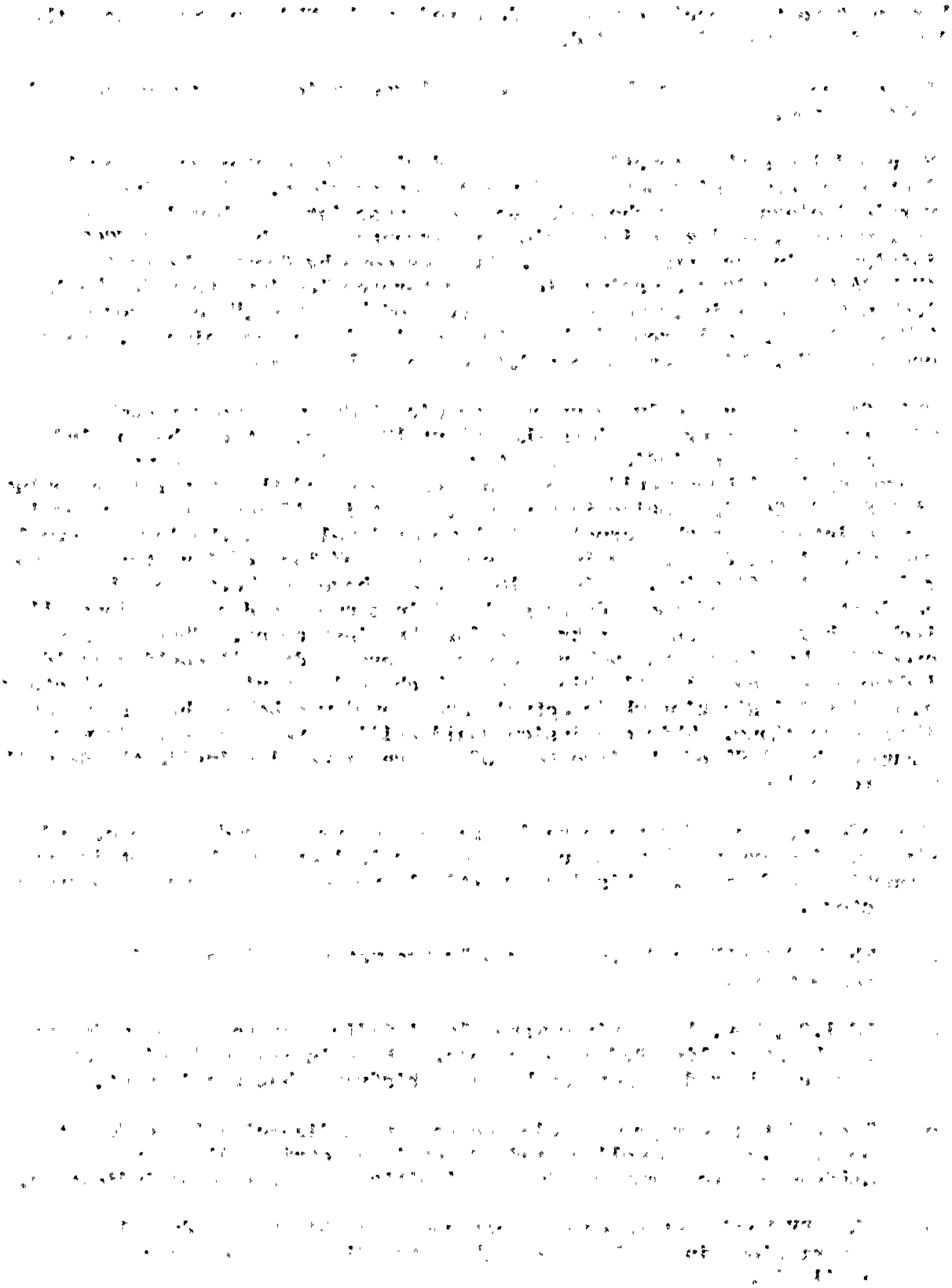
1. Improvements to plants that will reduce large indication errors due to dry well heating.

   Figure 3 lists the elevations associated with the reactor water level instrument condensing pots and dry well penetrations. The maximum vertical elevation for the reference legs associated with wide range, narrow range, fuel zone indication instruments, and the RPS and ECCS initiating instruments is 7 feet. Studies done by General Electric (NEDE24801) limit the maximum loss of reference leg inventory for "cold leg" water level instruments, as a result of "flashing," to approximately 30% of the vertical drop of the reference leg inside containment. In the case of SSES, this amounts to a 2.1 foot possible error.

   This flashing could only occur as a result of dry well heatup combined with low RPV pressures of less than about 100 psig. It can be concluded that maintenance of indicated reactor water level near the normal operating level band would ensure core coverage and the proper functioning of RPS and ECCS initiating instruments. That is, if reactor water level were maintained at the normal 35 inch water level mark, the lowest actual water level would be at 10 inches assuming a 30% loss of inventory due to reference leg flashing. This is 160 inches above the bottom of the calibrated range of the wide range level instrument and an additional 11 inches above the vessel penetration for that instrument. Thus it is not credible that in the Susquehanna design a loss of drywell cooling could induce a reference leg flashing event which would result in a satisfactory water level indication while actual water level was below the instrument line connections. This conclusion would still be valid even if it were assumed that 100% of the inventory of the reference leg inside the drywell were to be lost.

   The reference legs for the extended range instruments and the upset and shutdown instruments have a much larger vertical drop within containment amounting to 32 feet. This large vertical drop exists because of a number of factors.

   - The BWR 4 RPV is designed for only two water level condensing pot connections.
   - RG 1.97, Rev. 1, requires water level indication up to the midpoint of the steam line RPV penetrations. The existing condensing pots were considered as not capable of satisfying that requirement.
   - The existing design was selected to obtain diversity in condensate pot connection as well as redundancy in electrical division assignments to ensure maximum reliability in water level indication.
   - The RPV head vent condensate pot was available but no drywell penetrations in the head area above the diaphragm seal were available.



Thus the upset range instrument was designed with the reference leg elevations shown on Figure 3 and a variable leg connection to the same penetration as the wide range level instruments. PP&L believes that the potential for flashing in these lines is not a concern because

(a) There are no RPS or ECCS controllers associated with this reference leg.

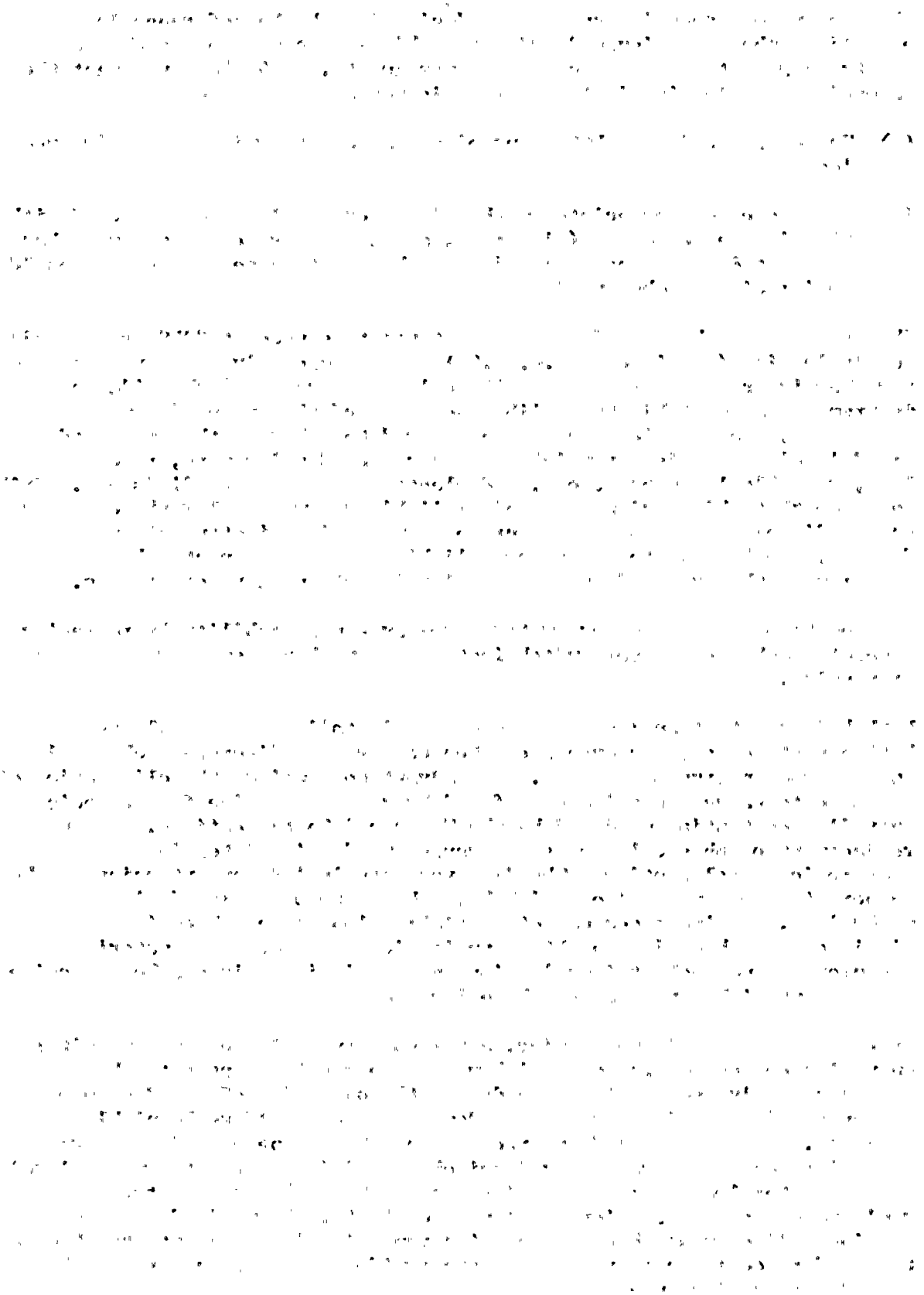
(b) The indicators associated with this reference leg are clustered with the wide range meters (different, shorter reference legs) such that flashing & erroneous indication of the upset range instruments would be immediately observable.

The function of the extended range instrument as used at SSES is primarily for indication (required by R.G. 1.97), and secondarily for a verification for the wide range instruments. The calibrated range of the wide range instrument falls within the calibrated range of the extended range instrument. Both indications are clustered together in the same hard wired level meter display which use diverse condensing pots, reference legs, variable leg connections, and electrical separation divisions. PP&L believes that this design is highly reliable and will allow the operator to immediately determine the nature of any specific instrument system failure. No benefit to safety or reliability can be expected by a redesign of the extended range water level instrument reference leg.

2. Changes to plants to improve water level system reliability by replacing discrete mechanical level switch instruments with transmitters and analog trip units.

PP&L believes that analog trip systems as installed by some plants have both advantages and disadvantages when compared to discrete mechanical switch type instrument systems. The advantages include the elimination of the need to valve the switches off and back onto the line for periodic surveillance testing mandated by the Technical Specifications, and the replacement of physical process pressure and dP signal testing by electronic signal testing. The disadvantages include an extension of the number of components all of which have their own potential failure mechanisms, and increased use of available floor space which is a significant problem in a backfit application. The cost for material procurement and backfit installation in an existing unit can be excessive and can outweigh any perceived benefits.

In the SSES design in particular, after some initial problems in Unit 1 surveillance test operations which were resolved by changes to the instrument valve sequencing procedures, the operation of the discrete mechanical level switch system has demonstrated itself to be highly reliable. Further, should an error be made by an operator in a valving operation for a wide range level switch surveillance test the water level meter cluster located in three places on each Unit's main control board would make that information available to the RO. It would do this by showing a discrepancy between the wide range level instrument attached to that reference leg compared to the other wide range instrument and the two extended range instruments.



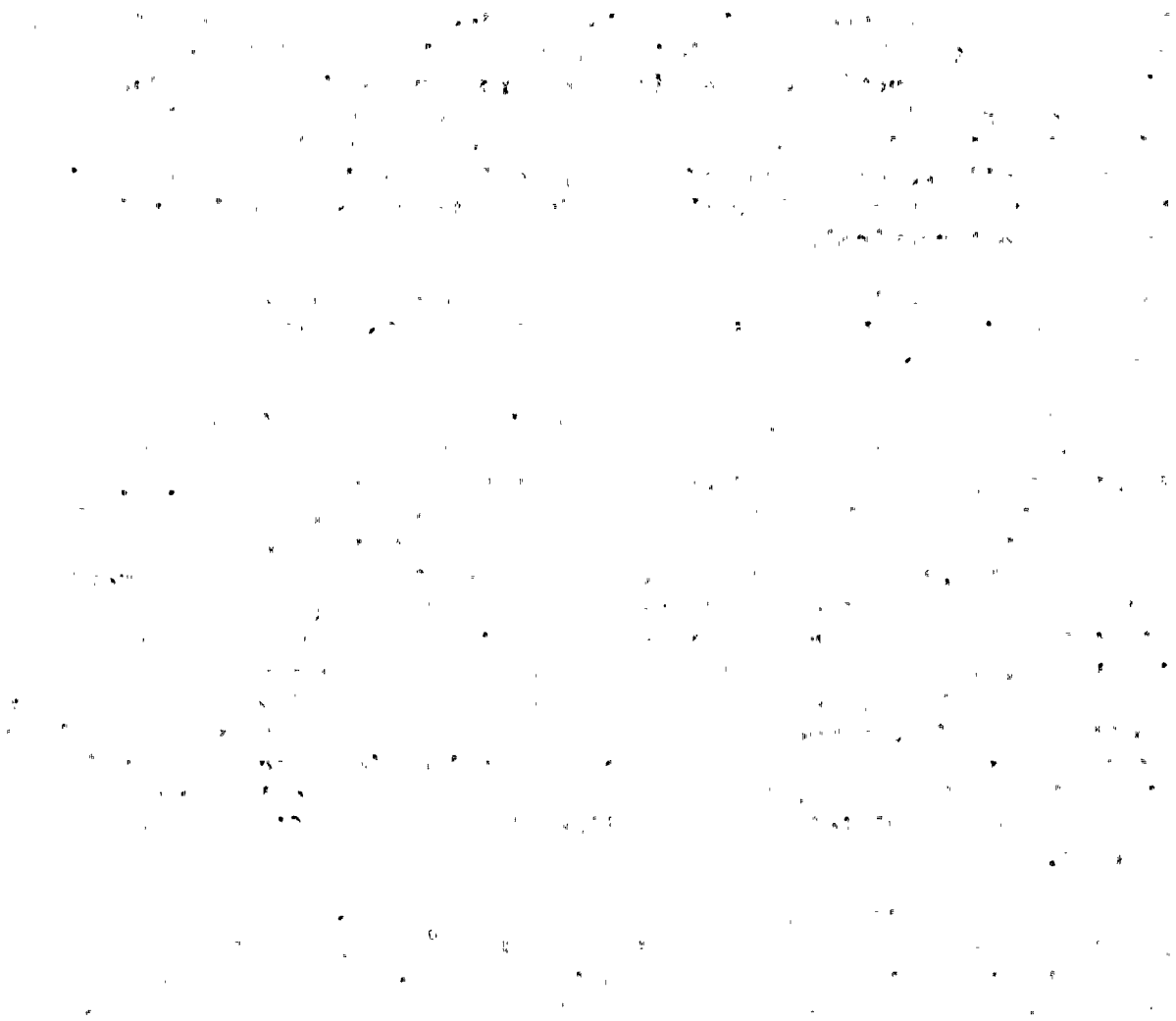
PP&L is presently studying the possible inclusion of an analog trip system into the plant with the study being driven by the potential benefits to be obtained by a reduction of the time and manpower required to conduct required surveillance testing. Due to the demonstrated high reliability of the installed discrete mechanical switch system, we believe that the exception allowed by the generic letter applies to the SSES design and that a commitment to replace the existing system with an analog trip system is not required.

3. Changes to protection system logic to mitigate the consequences of a reference line break affecting one RPS/ECCS division with a single failure existing in the opposite division.

   SSES Units 1 & 2 are typical of a two condensing pot BWR 4 reactor pressure vessel. It should be noted however that the design of the water level indicating system as installed at SSES in response to R.G. 1.97 makes it highly unlikely that loss of a reference leg could occur without the event being immediately obvious to the R.O. This results from the fact that the cluster of wide range and extended range indicators would allow prompt identification of any instrument which was reading significantly different from the remaining instruments where the reference leg loss occurred as a result of incorrect valve operation. Where the reference leg loss occurred as a small break LOCA, the level meter cluster would be used in conjunction with other diverse instrument systems such as drywell temperature, radiation, sump water collection, etc. to pinpoint the problem. Therefore, PP&L believes the reference leg loss combined with an opposite division single failure is not a significant safety concern.

   In summary, the SSES water level system is a well designed system consistent with the design objectives of the S. Levy, Inc. Report SLI 8211. No design changes are considered necessary to achieve these objectives. Should you require any additional information, please do not hesitate to ask.

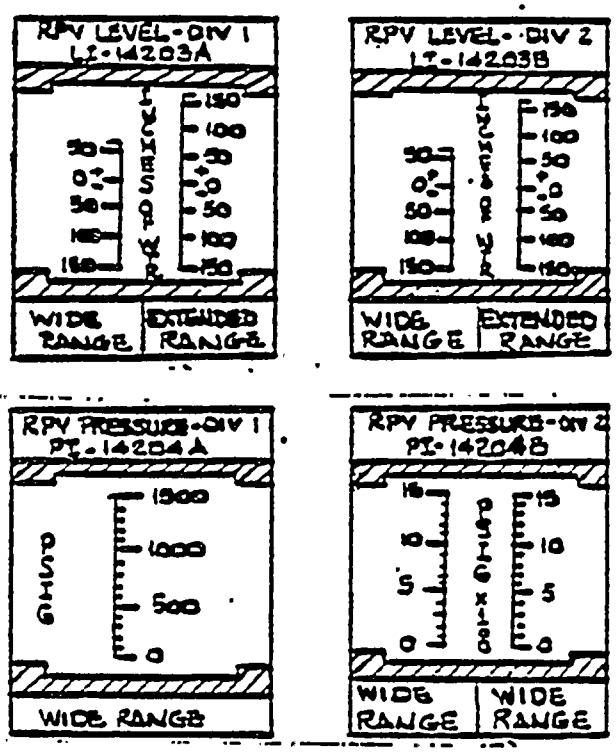
djc/b110c:del



REACTOR WATER LEVEL

HARD WIRED METER DISPLAY

ON PANEL 2/1C601



(TYPICAL OF TWO INSERTS

ON ECCS MAIN CONTROL BOARD.)

FIGURE 1

Attachment to PLA 2411

REACTOR WATER LEVEL

HARD WIRED METER DISPLAY

ON PANEL 2/1C651

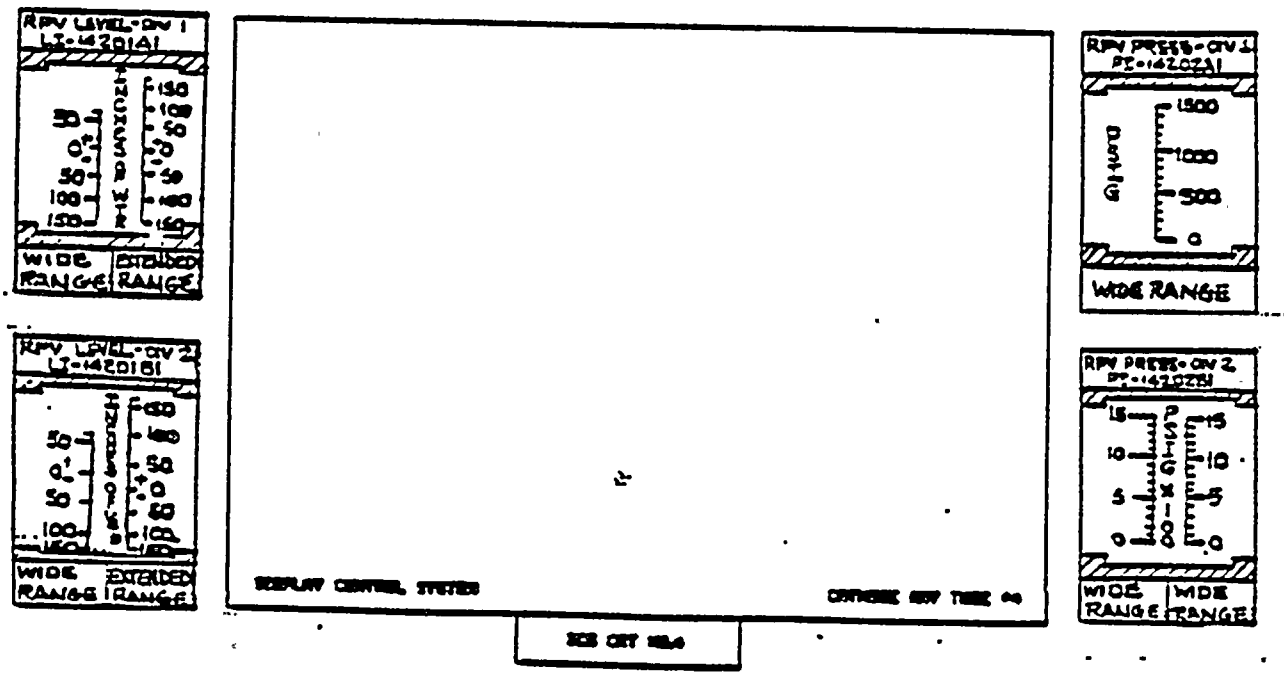
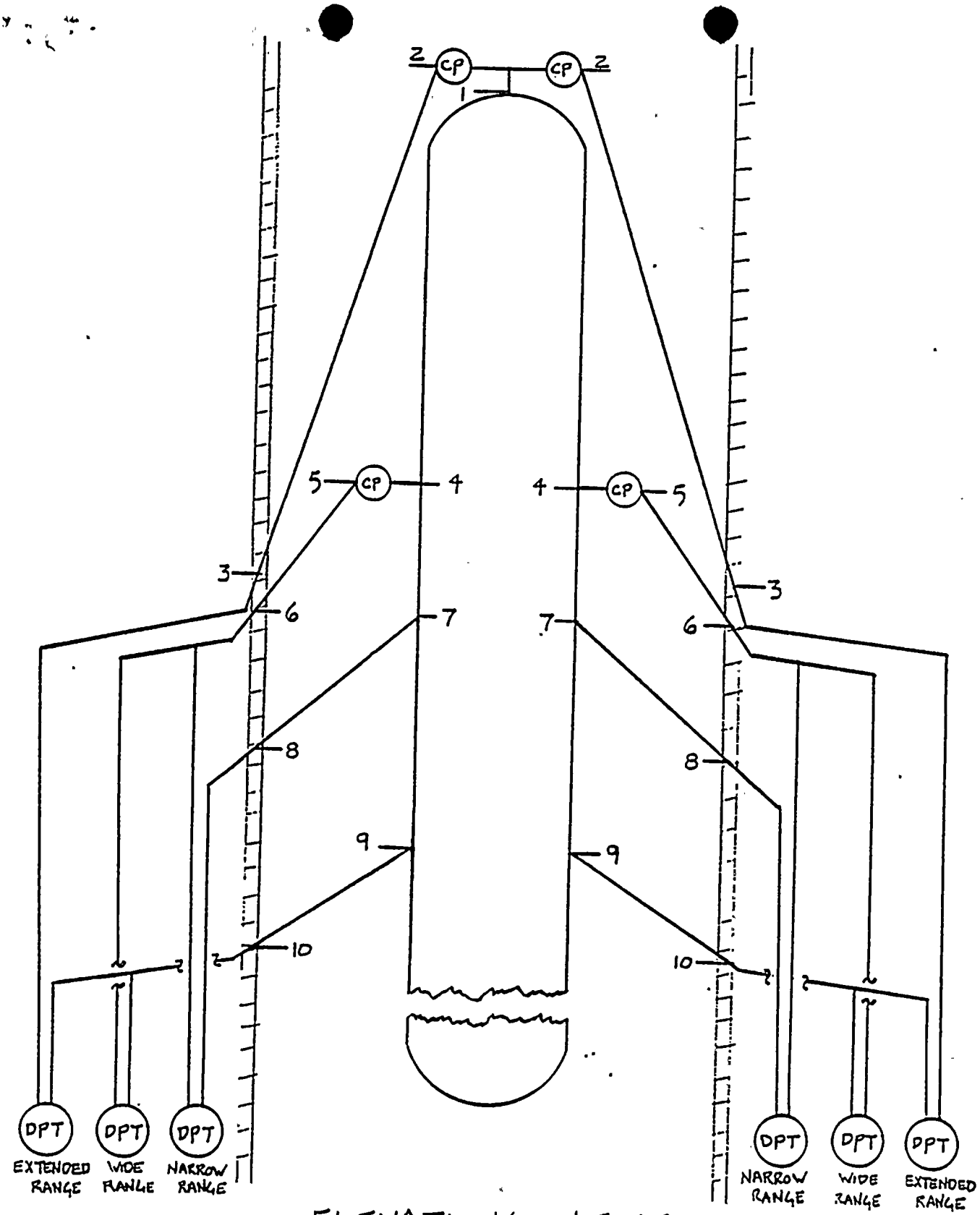


FIGURE 2

Attachment to PLA 2411



ELEVATIONS IN FEET

1) 804.9
2) 807.3
3) 775.5
4) 782.2
5) 782.4
6) 775.4
7) 775.4
8) 768.6
9) 762.8
10) 757.0

FIGURE 3