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MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

September 6, 1985
PY-CEI/NRR-0327 L

Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
NUREG 0737 - II.F.1
(Attachments 1 & 2)
& II.B.3 Implementation
and Clarifications

Dear Mr. Youngblood:

At the recommendation of Region III Inspectors, Cleveland Electric has performed a preliminary review for conformance to NUREG 0737 in the following areas: post-accident sampling (Section II.B.3), noble gas effluent monitors (II.F.1, Attachment 1), and accident range iodine and particulate sampling (II.F.1, Attachment 2).

Attachments to this letter describe how the Perry design implements the requirements of NUREG 0737 in specific areas. To facilitate future inspections, we are seeking your specific written concurrence with each of these attachments.

Design modifications described in this letter will be incorporated in a future FSAR amendment. If you have any questions on our implementation of applicable NRC guidance, please call.

Very truly yours,

R. Koplan for

Murray R. Edelman
Vice President
Nuclear Group

MRE:njc

Attachments

cc: Jay Silberg, Esq.
John Stefano (2)
J. Grobe
C. Gill (Region III)
D. Miller (Region (III)

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GASEOUS EFFLUENT SAMPLING SYSTEMS: REPRESENTATIVENESS & DESIGN CHANGES

Summary

The as-built particulate and iodine (P/I) sampling systems, modified as described below, satisfactorily implement the guidance of NUREG-0737 Table II.F.1, Attachment 2, with respect to the representative sampling of plant gaseous effluents. Calculations indicate that the P/I sampling systems installed at PNPP will collect representative samples in accordance with NUREG-0737 and ANSI N13.1-1969. In light of the uncertainties regarding iodine chemical species and particulate size distribution during design basis accident conditions, CEI believes these calculations are sufficient in lieu of empirical testing.

However, CEI is evaluating the feasibility of empirical line loss determinations in the as-built sample delivery systems. A decision regarding actual demonstration of P/I deposition, based on sound engineering and economic considerations, will be made prior to second cycle startup.

Discussion

NUREG 0737, Section II.F.1 Attachment 2, requires that sample flows from gaseous effluent pathways be representative and isokinetic. There are four gaseous effluent pathways which will be functional during the operation of Perry Unit 1:

Unit 1 Vent
Unit 2 Vent
Turbine Bldg/Heater Bay Vent
Offgas Vent

Each particulate and iodine sampling system is designed in accordance with ANSI N13.1-1969. The following is a description of the as-built sampling systems and design modifications which assure representative sampling.

The sampling system originally on each gaseous effluent pathway was comprised of four sampling skids: An Air Monitor Corporation (AMC) isokinetic sampler and flow rate measurement skid, a Victoreen normal range radiation monitor with P/I sampling capability, a Nuclear Research Corporation (NRC) P/I sample panel and a Kaman post-accident range radiation monitor with P/I sampling capability. The original design of the system was as follows:

A. The AMC skid measured impact and static pressure in the vent and converted this data to vent flow rate.

B. Based on the measured vent flow rate, the AMC skid extracted a relatively turbulent sample from a series of nozzles, through 1" nominal diameter smooth bore stainless steel pipe and controlled the sample linear velocity in proportion to vent flow in order to maintain the isokinetic condition.

C. At the AMC skid, a nominal 1 cfm secondary sample was extracted from the primary sample through a single nozzle and transported to the Victoreen normal range radiation monitor via a short run of 1" nominal diameter smooth bore stainless steel pipe.

D. As identified in FSAR Table 7.1-4 Note 17, the AMC and Victoreen equipment and sample line piping were designed non-safety related and not supplied with 1E power or qualified as Class 1E equipment. This is allowed by subnote 9 in Regulatory Guide 1.97 Rev. 2 which permits the use of this pre-existing equipment.

E. The NRC sampling skid extracted a sample from the vent through appropriately sized nozzles and transported it to the sample panel via nominal 0.25" OD stainless steel tube.

F. The Kaman post-accident radition monitor extracted a non-isokinetic sample from the vent and transported it to the skid via nominal 0.25" OD stainless steel tube. The Kaman equipment was procured as safety related, Class 1E equipment.

CEI reviewed two recent articles which addressed the plateout of radioiodine in sample lines (2,3). Based upon the application of methodologies outlined in these articles, CEI determined that the plateout of radioiodine in the Kaman and NRC sample lines would be unacceptable. The following design modifications* were made which will reduce radioiodine plateout in order to provide for representative sampling:

A. The NRC sample panels have been deleted from service. Three P/I collectors on the Kaman skid will be used in conjunction with the normal range radiation monitor P/I collectors in order to continuously collect P/I samples through the required range.

B. The AMC sample lines have been routed to the Kaman post-accident skids where a secondary sample will be extracted such that the isokinetic condition is maintained at expected operating vent flow. The secondary sample will be transported via nominal 0.25" OD tube, designed such that the length of the tube is as short as practicable.

C. All gaseous effluent inlet sampling lines (both normal and post-accident range) will be heat-traced and insulated in order to overcome sample line heat loss and therefore reduce the possibility of condensation as the sample stream passes through particulate and iodine filters.

In order to demonstrate that representative samples will be collected using the modified system described above, CEI has calculated expected particulate sample line losses using the methods described in ANSI N13.1-1969 (4) and expected radioiodine plateout using the methods described in references 2 and 3. The following is a summary of the results of these calculations:

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* System description exerpts are included, along with a highlighted P&I diagram, to reflect these changes.

A. The sample delivery systems were designed to minimize the length of sample tube (<15 ft) in which laminar flow occurs in order to minimize particulate deposition via Brownian diffusion and gravity settling.

The estimated deposition of 0.1 and 1.0 micrometer diameter particles (density = 2 g/cm^3) due to Brownian diffusion, gravity settling and turbulent impaction was calculated using the methods and data in Appendix B of ANSI-N13.1. This estimated deposition was shown to be less than 6% for the sampling systems on each of the four effluent pathways.

B. The plateout of radioiodine was calculated for the worst case scenario of 100% elemental iodine combined with the design details of the PNPP Unit 1 sample system and the methodology derived by Kabat (2). These calculation indicate that the plateout of elemental radioiodine will be less than 30%.

C. The expected plateout of elemental iodine, hypoiodous acid and methyl iodide was calculated using the average distribution of these species in the reactor building of Pilgrim, Monticello, Oyster Creek and Vermont Yankee presented in NUREG/CR-0395 (5), combined with the design details of the PNPP Unit 1 sample systems and the methodology derived by Kabat (2). These calculations indicate that the expected plateout of radioiodine will be less than 11% during normal operation.

REFERENCES

1. U.S. Nuclear Regulatory Commission, Region III, Report No. 50-440/84-13 (DRSS). Summary of July 9-12, 1984 Routine Preoperational Inspection, dated July 27, 1984.

2. M. J. Kabat, "Deposition of Airborne Radioiodine Species on Surfaces of Metals and Plastics"; presented at the 17th DOE Nuclear Air Cleaning Conference, 1982.

3. P.J. Unrein, C.A. Pelletier, J.E. Cline and P.G. Voilleque', "Transmission of Radioiodine Through Sampling Lines"; presented at the 18 DOE Nuclear Airborne Waste Management and Air Cleaning Conference, 1984.

4. ANSI N13.1-1969, American National Standard Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.

5. NUREG/CR-0395, Evaluation of Radioiodine Measurements at Pilgrim Nuclear Power Plant, 1978.

CONVERSION OF POST-ACCIDENT RADIATION MONITOR READINGS TO RELEASE RATES

Summary:

Perry accident range effluent monitors continuously display and record post-accident noble gas concentrations with acceptable range and accuracy.

To improve accuracy, detector response will be corrected for the shift in gamma spectrum with time for computer-calculated offsite doses. Appropriate correction factors will be documented in instructions for manual calculation of post-accident doses assessment instructions prior to fuel load. The analytical basis for determining these factors is presented below, and is in compliance with the intent of NUREG-0737 and supporting references noted.

Discussion

Clarification Item (4) (b) of NUREG-0737, Item II.F.1 Attachment 1, requires procedures or calculations/methods to convert post-accident instrument readings to release rates based on exhaust air flow and considering radionuclide spectrum distribution as a function of time after shutdown. CEI has reviewed the applicable regulatory guidance and interprets this requirement in the following manner:

1. Revision 2 of Regulatory Guide 1.97 states that "Monitors should be capable of detecting and measuring radioactive gaseous effluent concentrations with compositions ranging from fresh equilibrium noble gas fission product mixtures to 10-day-old mixtures, with overall system accuracies within a factor of 2". This has been interpreted to include all fission product noble gases which have significant dosimetric implications; namely the Krypton and Xenon radionuclides listed in Table B-1 of Regulatory Guide 1.109 Revision 1.

2. Reg. Guide 1.97 states that "Effluent concentrations may be expressed in terms of Xe-133 equivalents or in terms of any noble gas nuclide(s)." NUREG-0737 further clarifies this guidance, stating "Design range values may be expressed in Xe-133 equivalent values for monitors employing gamma radiations and microcuries per cubic centimeter of air at standard temperature and pressure (STP) for monitors employing beta radiation detectors". These documents clearly state the acceptability of expressing the responses of:

    a. Beta scintillation detectors in terms of uCi/cc of total noble gas.

    b. Geiger-Mueller detectors in terms of uCi/cc of Xe-133 dose equivalent (Xe-133 dose equivalence of a mixture of noble gases is derived using whole body dose conversion factors from Reg. Guide 1.109).

3. Table II.F.1-1 of NUREG -0737 states that this instrumentation should continuously display and record equivalent Xe-133 concentrations of uCi/cc of actual noble gases. For the PNPP systems, the low range beta channel response is displayed in units of CPM and the mid/high range gamma channels are displayed in uCi/cc Xe-133 equivalent (utilizing a single CPM to uci/cc conversion constant). This display requirement is applicable as described in Item 2 above and should be within the factor of 2 accuracy stated in Reg. Guide 1.97.

An algorithm was written in order to evaluate the effect of the decay of fission product noble gases on the response of the radiation detectors used to monitor gaseous effluents at Perry. The parameters used in these calculations include:

a. The initial inventory of fission product noble gases. These source terms were taken from the Perry FSAR Chapter 15 accident scenarios and the Chapter 12 Initial Core Inventory.

b. The decay constants and radiation types, energies and yields for the above radionuclides, from Reference 5.

c. The energy response characteristics of each radiation detector type and geometry, calculated for each noble gas using data from References 6, 7 and 8.

d. The whole body dose conversion factors for the above noble gases, from Reg. Guide 1.109 (3).

Table 2.1 summarizes the results of the calculations in terms of the extremes of detector response (converted to detector efficiencies) for each detector/ geometry configuration from time 0 to 1.0E8 seconds after the postulated accident. From these calculations, if detector responses (in CPM) are converted to the units discussed in item 2 above, a single conversion factor for each detector type (the mean of the calculated efficiency extremes) will ensure compliance with the factor of 2 accuracy required by Reg. Guide 1.97. Specifically, the low range beta scintillator conversion constant is 2.6E-8 uCi/cc of total noble gas per cpm, and the mid range G-M tube and high range G-M tube conversion constants are 1.8E-4 and 1.4E-1 uCi/cc of Xe-133 equivalent per cpm, respectively. The conversion constants for the mid and high range channels will be loaded into software such that the display and recording of data for these channels is in uCi/cc of Xe-133 equivalent. Since the low range channel is used by the plant staff to assess routine releases in cpm, the instrument display and recorder units will not be altered, rather the conversion constant for this channel will be incorporated into appropriate Emergency Plan Instructions.

Calculational methods for converting instrument readings to effluent release rates are contained in PNPP Instructions EPI-B7A and EPI-B7B (both attached) and consist of the following:

1. Instructions in the use of the Meteorological Information and Dose Assessment System (MIDAS), a software package which is capable of calculating release rate and offsite doses based on real-time, user input or default radiation monitor and vent flow rate data.

2. Instructions in the use of DOSEPROJ, a software package which is capable of calculating release rates and offsite doses based on user-input or default radiation monitor and vent flow rate data.

3. Instructions in the use of backup hand calculations, which are capable of calculating release rates and offsite dose based on observed or default radiation monitor and vent flow rate data.

For further information on Perry dose assessment, including methods of hand calculation, a description of the MIDAS model, and meteorological data assessment, please refer to report NUS-4336 submitted by PY-CEI/NRR-0159L January 4, 1985. The Perry Emergency Plan also discusses dose assessment systems and analytical procedures in Section 7.3.

TABLE 2.1: POST ACCIDENT RADIATION MONITOR RESPONSE EXTREMES

Source Term	BETA Detector Efficiency uCi/cc/cpm	Mid-Range G-M Efficiency uCi/cc Xe-133 equiv/cpm	High-Range G-M Efficiency uCi/cc Xe-133 equiv/cpm
Initial Core Inventory FSAR Table 12.6-2	2.1E-8 to 3.5E-8	9.1E-5 to 2.1E-4	1.0E-1 to 1.5E-1
Control Rod Drop Design Basis Analysis FSAR Table 14.4-13	2.0E-8 to 3.3E-8	9.2E-5 to 2.9E-4	1.1E-1 to 1.9E-1
Control Rod Drop Realistic Analysis FSAR Table 15.4-15	2.1E-8 to 3.2E-8	9.3E-5 to 2.0E-4	1.1E-1 to 1.4E-1
Steam Line Break Design Basis Analysis FSAR Table 15.6-7	1.9E-8 to 3.5E-8	9.1E-5 to 3.4E-4	9.8E-2 to 2.2E-1
Steam Line Break Realistic Analysis FSAR Table 15.6-10	1.9E-8 to 3.4E-8	9.1E-5 to 3.4E-4	9.8E-2 to 2.2E-1
Loss of Coolant Design Basis Analysis FSAR Table 15.6-14	2.1E-8 to 3.3E-8	9.2E-5 to 1.8E-4	1.1E-1 to 1.2E-1
Loss of Coolant Realistic Analysis FSAR Table 15.6-17	2.0E-8 to 3.3E-8	9.2E-5 to 2.8E-4	1.0E-1 to 1.9E-1
Rechar Pipe Break FSAR Table 15.7-3	2.0E-8 to 3.4E-8	9.1E-5 to 2.8E-4	9.8E-2 to 1.8E-1
SJAE Line Failure Realistic Analysis FSAR Table 15.7-9	1.9E-8 to 2.6E-8	9.5E-5 to 3.4E-4	9.8E-2 to 2.2E-1

REFERENCES

1. U.S. Nuclear Regulatory Commission, Region III, Report No. 50-400/84-13(DRSS). Summary of July 9-12, 1984 Routine Preoperational Inspection, dated July 27, 1984.

2. Regulatory Guide 1.97, Revision 2, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident. December, 1980.

3. Regulatory Guide 1.109, Revision 1, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, October, 1977.

4. NUREG-0737, Clarification of TMI Action Plan Requirements, November, 1980.

5. D.C. Kocher, Radioactive Decay Tables, 1981.

6. Victoreen Report No. E33320381, 1982.

7. Kaman Instrumentation Report K-82-69-U(R), 1983.

8. Kaman Instrumentation Report K-82-108-U (R), 1983.

NUREG 0737 TABLE II.F.1-2
DESIGN BASIS SHIELDING ENVELOPE

Summary

The iodine, particulate and noble gas concentrations used to determine NUREG-0737 compliance are 0.70, 0.70 and 12.6 uCi/cc, respectively. These values are a conservative upper limit appropriate for use as a PNPP-specific shielding envelope for determining compliance with NUREG-0737 (personnel exposure limits in II.B.3 Clarification 6 and II.F.1 Attachment 2 Clarification 2, and sample collection times per Table II.F.1-2 "Design Basis Shielding Envelope").

Discussion

Table II.F.1 - 2 of NUREG-0737 states that the design basis shielding envelope for sampling and analysis of particulate and iodine gaseous effluents is 100 uCi/cc of each deposited on sampling media for 30 minutes. This shielding envelope is unrealistically conservative with respect to the design of the Perry Nuclear Plant. The shielding envelope used by Perry to assess analytical capability and compliance with GDC 19 is based on the following assumptions:

1. Containment leakrate is 0.2%/day.
2. Containment design bypass leakrate (test value divided by .75) is 8.07 SCFH. (This corresponds to 6.72% bypass).
3. No arbitrary passive failure of an ECCS component and no containment leakage from feedwater isolation valves.
4. MSIV leakage equals 100 SCFH.
5. Water leakage equals 10 gph.
6. Dilution of activity restricted to the minimum plant vent flow. A value of 1 cfm was used in calculating the concentrations given below. This can be factored for any desired dilution flow.
7. Annulus Exhaust Gas Treatment System flow rate to plant vent equals 2000 cfm. No other dilution flow is assumed to be present.

Iodine Analysis

1. In the first 30 minutes post-LOCA, 239.6 Curies of iodine are released via the water leakage pathway. Therefore,

$$\frac{239.6\ \text{Ci}}{30\ \text{min.}} \times \frac{\text{min}}{1\ \text{ft}^3} \times \frac{10^6\ \text{uCi}}{\text{Ci}} \times \frac{\text{ft}^3}{28317\ \text{cc}} = 282\ \text{uCi/cc}$$

assuming a unity dilution flow.

2. The equivalent bypass leakage source is 930.6 Ci in 30 minutes or 1095.5 uCi/cc for a unity dilution flow.

3. The containment leakage to the annulus and MSIV source (after filtration) is 16.3 Ci in 30 minutes or 19.2 uCi/cc for a unity dilution flow.

4. The total of the above three sources is 1396.7 uCi/cc for a unity dilution flow. For a dilution flow of 2000 cfm, the resultant concentration would be 0.70 uCi/cc. The equivalent particulate source term is also assumed to be 0.70 uCi/cc.

Noble Gas Analysis

The equivalent data for the noble gases is a total release of 10723 Ci in 30 minutes or approximately 12623 uCi/cc for a unity dilution flow (the water leakage does not contain noble gases). For a dilution flow of 2000 cfm, the resultant concentration would be 6.31 uCi/cc. Due to mechanistic-transfer of activity associated with the multinode model of the containment, drywell and annulus, the noble gas activity release will peak at a time later than 30 minutes. The maximum value of the noble gas peak activity was shown to be less than a factor of 2 over the 30 minute average. Therefore, a value of 12.6 uCi/cc will be used for noble gases.

NUREG 0737 SECTION II.B.3 CLARIFICATIONS 4 & 8
PRESSURIZED REACTOR COOLANT SAMPLES, BACKUP SAMPLING ANALYSIS

Summary

Suf:icient backup capability for hydrogen analysis exists to meet the intent of Criterion (8) of NUREG-0737, Item II.B.3.

Perry SSER 4 Section 9.3.2

"(8) Criterion (8) of NUREG-0737, Item II.B.3, specifies that if in-line monitoring is used for any sampling and analytical capability, the applicant shall provide backup sampling through grab samples. Established planning for analysis at offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one sample per day for 7 days following onset of the accident, and at leas' one sample per week until the accident condition no longer exist

In the Perry design, undiluted and diluted reactor coolant grab samples and containment atmosphere grab samples will be obtained for the chemical and isotopic analyses. In addition, an in-line chemical analysis panel is provided for reactor coolant pH and containment atmospheric hydrogen concentrations. The staff finds that this is consistent with Criterion (8) of NUREG-0737, Item II.B.3."

Discussion

As accepted by the NRC in Perry SSER 4 dated February 1984 (based on PY-CEI/NRR-0060L dated 9/16/83) back-up analysis for dissolved hydrogen will be provided by gas chromotography on reactor coolant grab sample off gas. The range of detection by this back-up method is comparable to the in-line meaurement.

In addition, the Combustible Gas Control System contains two in-line hydrogen analyzers (Class 1E) which provide hydrogen concentration in the containment atmosphere. Core damage assessment procedures will utilize this containment atmosphere in-line hydrogen analyzer.

NUREG 0737/II.B.3
BORON ANALYSIS

Summary

The above described PASS modification continues to meet criterion (7) of NUREG 0737, Item II.B.3, as invoked by Revision 2 of Regulatory Guide 1.97.

Perry SSER 4 Section 9.3.2

"(7) Criterion (7) of NUREG-0737, Item II.B.3, specifies that the analysis of primary coolant samples for boron is required for PWR's. However, Revision 2 of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," specifies the need for primary coolant boron analysis capability at BWR plants, thereby making this criterion applicable to the Perry post-accident sampling system design.

In the Perry design, boron analysis is performed by ion-chromatography on a diluted sample collected at the sampling panel. The accuracy for this method is ±8%. The staff considers that this design capability meets Criterion (7) of NUREG-0737, Item II.B.3, as invoked by Revision 2 of Regulatory Guide 1.97."

Discussion

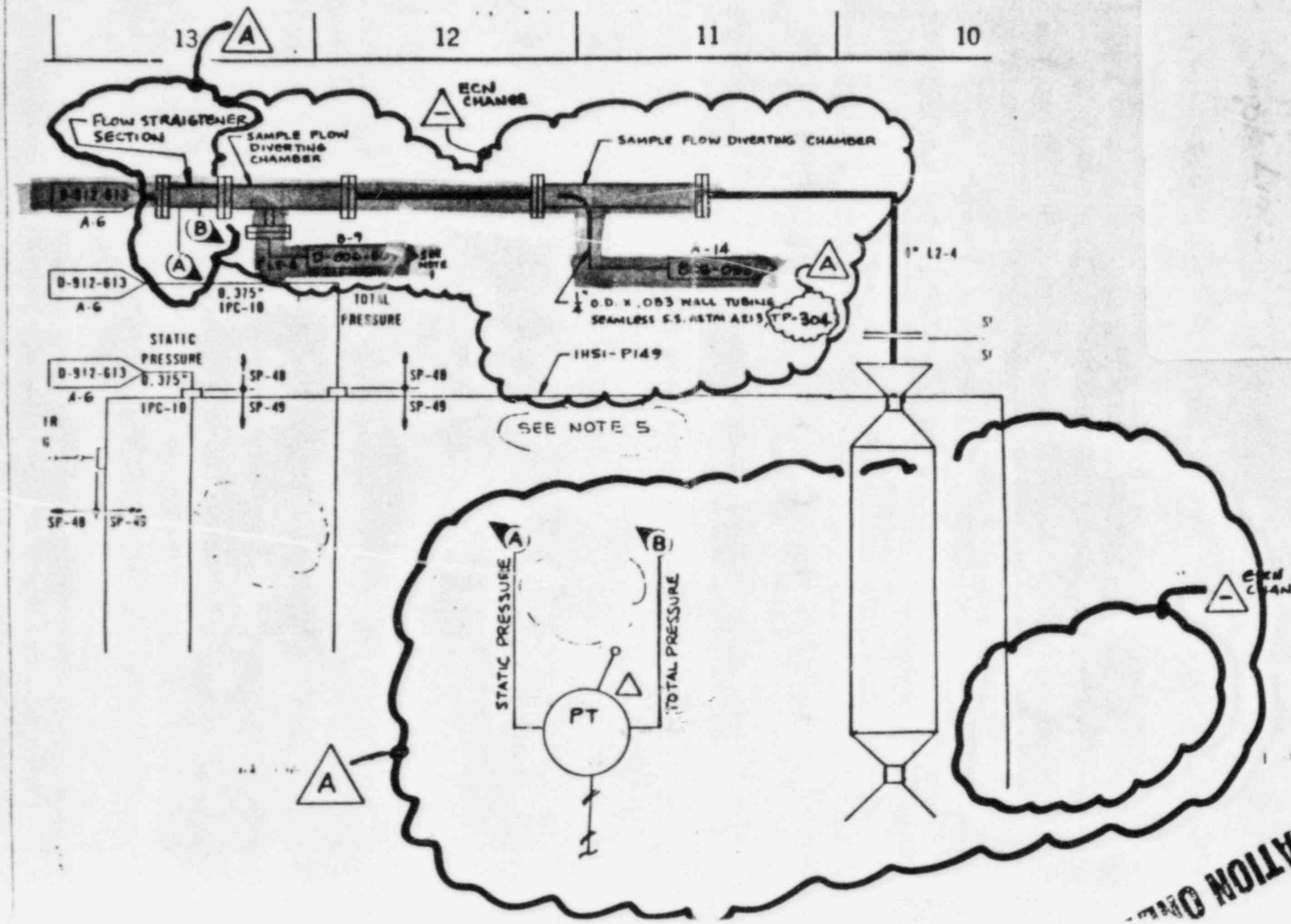
By letter PY-CEI/NRR-0060 L dated September 16, 1983, CEI described post-accident sampling system (PASS) design and analytical laboratory provisions for boron analysis of a diluted sample in the chemistry lab. Modifications to the portable Dionex 2010i ion chromatography (IC) system will be made to permit boron determination at the Chemical Analysis Panel (CAP). An improvement in accuracy to ±5% is expected. The following description, revised from the original submittal (page 3.6 from Sentry Report No. 162), applies to the modification:

Primary Coolant - Chloride and Boron Content

The PASS Chemical Analysis Panel provides means for chloride and boron determination using portable modules from a Dionex 2010i ion chromatography system. The modules (eluent and regenerant chemical reservoirs, pump, conductivity monitor, and chart recorder) are brought to the shielded CAP front on a cart. Dedicated sample loop, chromatograph valves, columns and conductivity detector (CE-2) are located in the CAP rear. At the panel rear, entering sample fluid passes through a phase separator (DG-1) to remove gas bubbles from the depressurized liquid sample stream and to assure the chromatograph sample loop is liquid solid. Eluent is pumped from the panel front through the shield, to the panel rear where the chromatographic anion separation and detection is performed. Analysis results are complete approximately 10 minutes after initiation and are displayed on the chart recorder. Recorded peak heights are simply ratioed to a calibration solution peak height to establish the sample concentration.

REFEr ICE:
D-606-023

ECN 27978-E -1910 REV. B
ATTACHMENT # 12

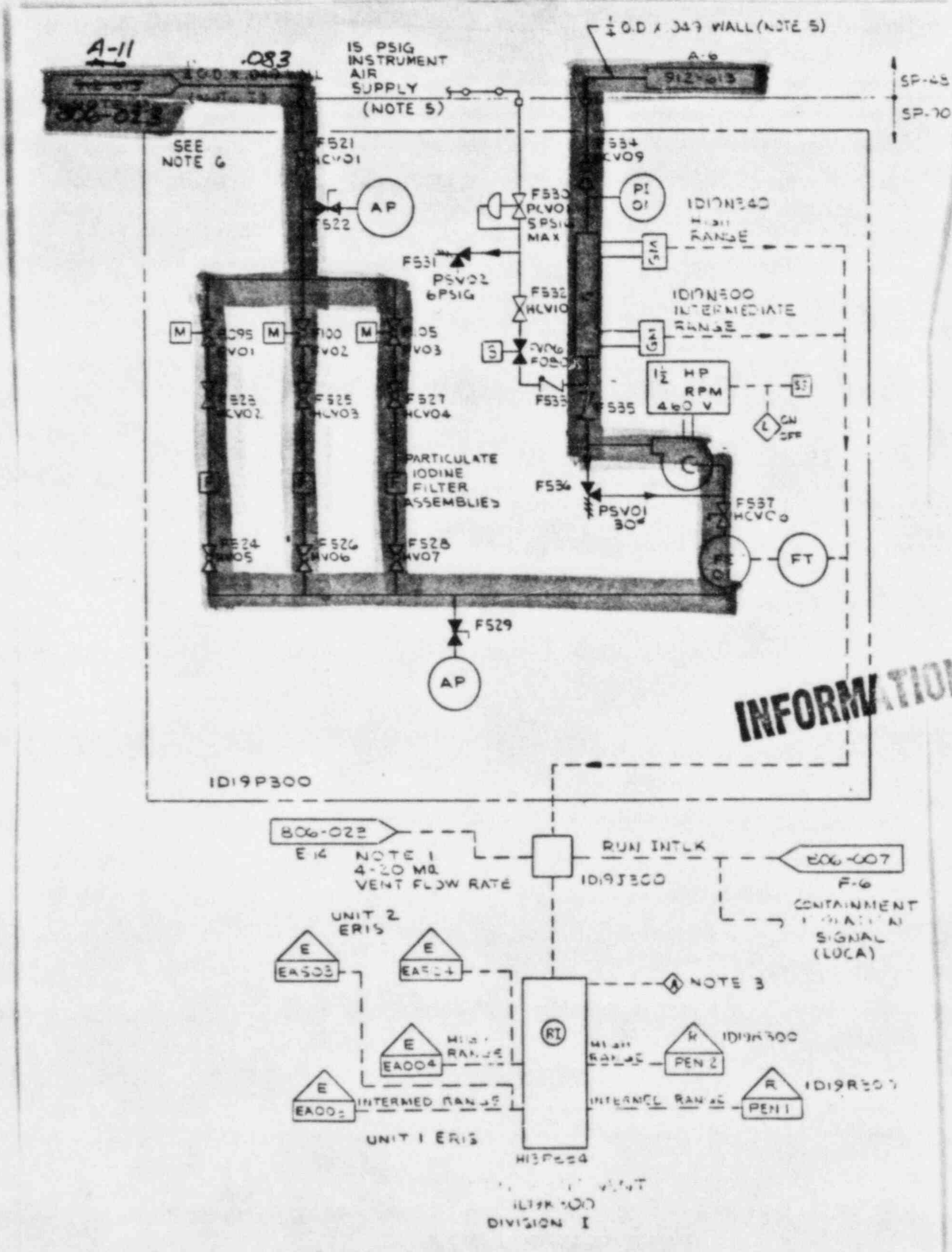


MAIN PLANT VENT
AMC SAMPLE LINES

INFORMATION ONLY

MAIN PLANT VENT

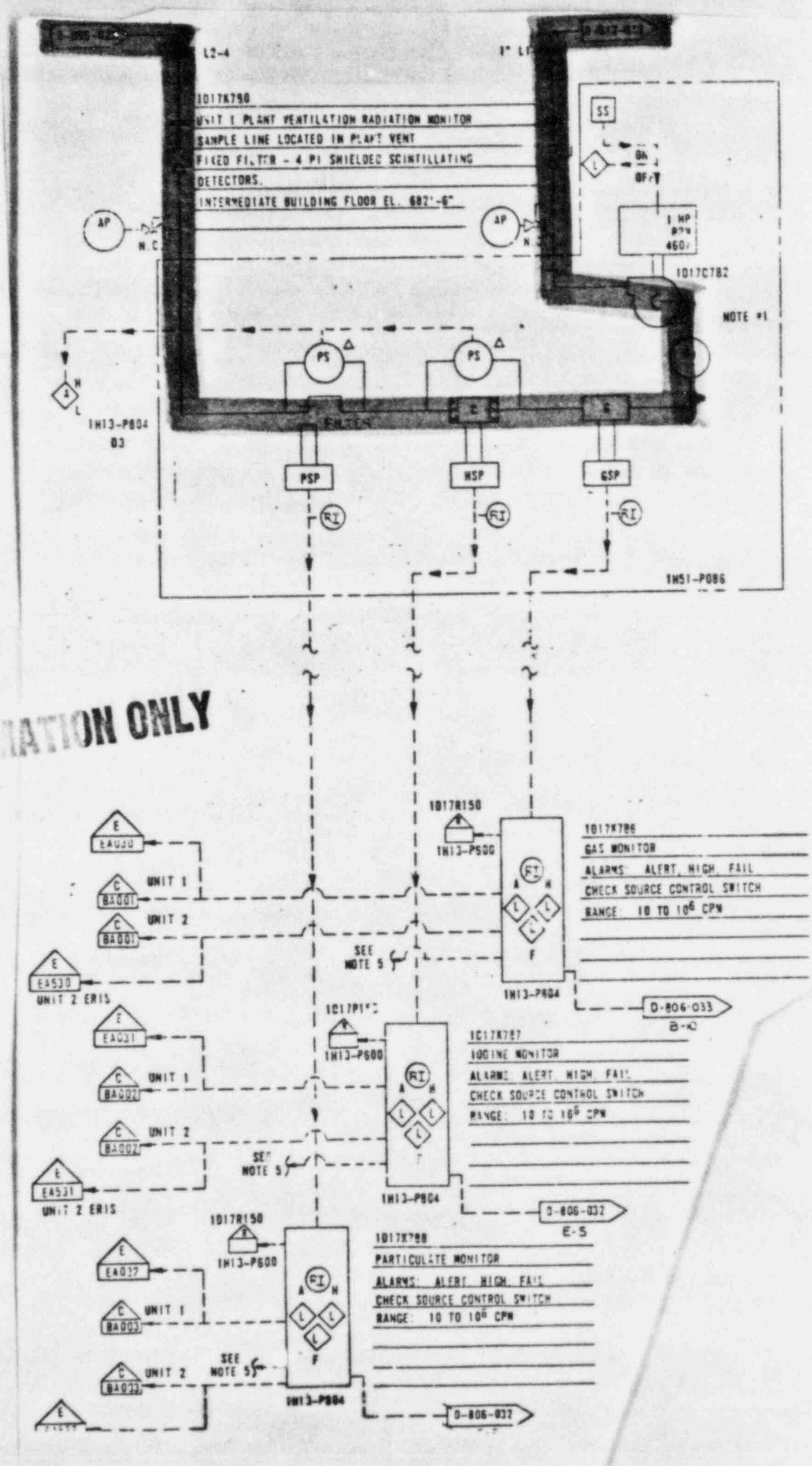
D19 KAMAN

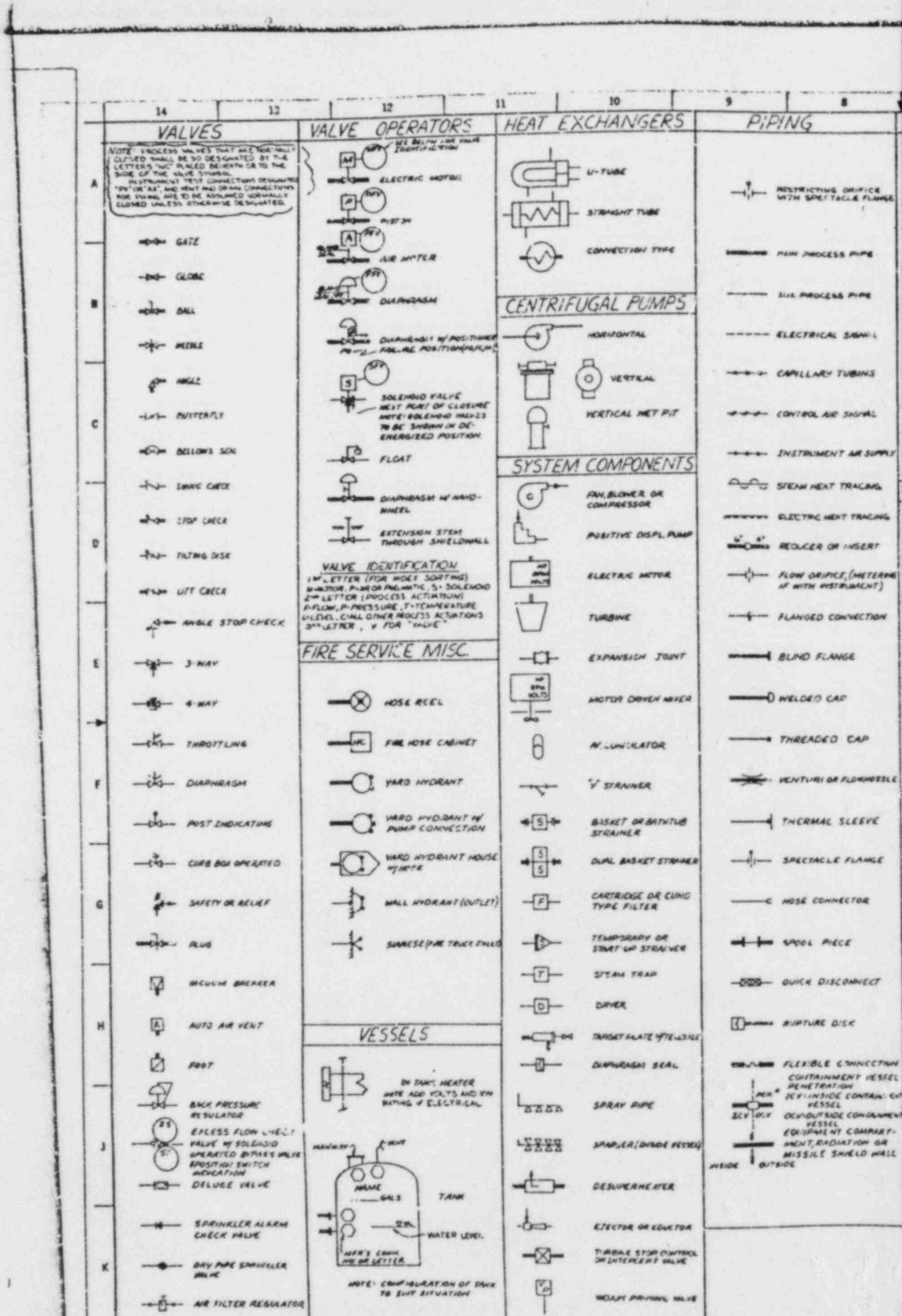


INFORMATION ONLY

MAIN PLANT VENT

D17 VICTOREEN





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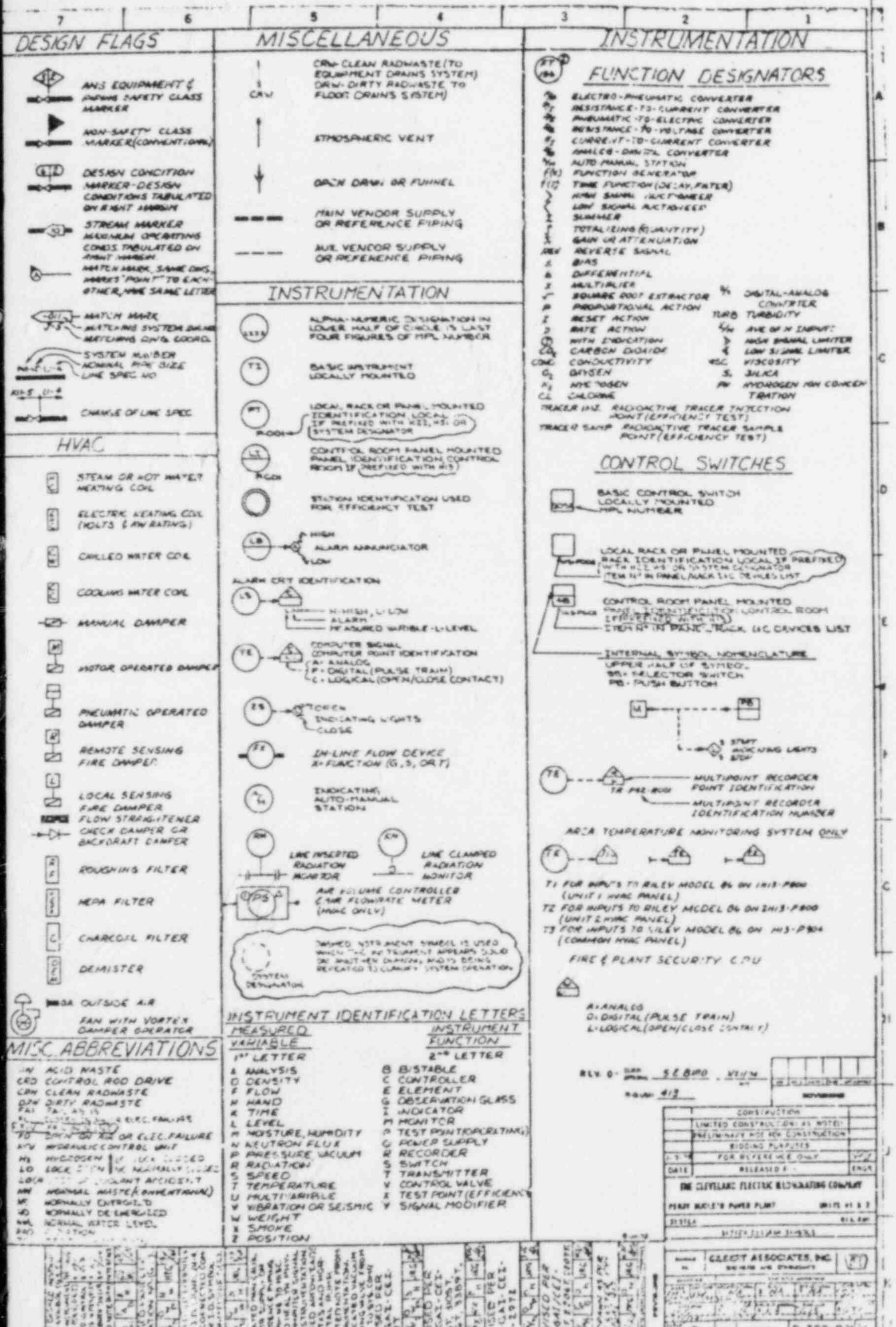
VALVES
NOTE: PROCESS VALVES THAT ARE NORMALLY CLOSED SHALL BE SO DESIGNATED BY THE LETTERS "NC" PLACED BENEATH OR TO THE SIDE OF THE VALVE SYMBOL.
INSTRUMENT TEST CONNECTIONS DESIGNATED "PX" OR "AX", AND VENT AND DRAIN CONNECTIONS FOR PIPING ARE TO BE ASSUMED NORMALLY CLOSED UNLESS OTHERWISE DESIGNATED.
GATE
GLOBE
BALL
NEEDLE
ANGLE
BUTTERFLY
BELLOWS SEAL
SWING CHECK
STOP CHECK
TILTING DISK
LIFT CHECK
ANGLE STOP CHECK
3-WAY
4-WAY
THROTTLING
DIAPHRAGM
POST INDICATING
CURB BOX OPERATED
SAFETY OR RELIEF
PLUG
VACUUM BREAKER
AUTO AIR VENT
FOOT
BACK PRESSURE REGULATOR
EXCESS FLOW CHECK VALVE W/ SOLENOID OPERATED BYPASS VALVE & POSITION SWITCH INDICATION
DELUGE VALVE
SPRINKLER ALARM CHECK VALVE
DRY PIPE SPRINKLER VALVE
AIR FILTER REGULATOR
VALVE OPERATORS
SEE BELOW FOR VALVE IDENTIFICATION
ELECTRIC MOTOR
PISTON
AIR MOTOR
DIAPHRAGM
DIAPHRAGM W/ POSITIONER
FAILURE POSITION
SOLENOID VALVE
NEXT POINT OF CLOSURE
NOTE: SOLENOID VALVES TO BE SHOWN IN DE-ENERGIZED POSITION.
FLOAT
DIAPHRAGM W/ HANDWHEEL
EXTENSION STEM THROUGH SHIELDWALL
VALVE IDENTIFICATION
1ST LETTER (FOR WORK SORTING) M=MOTOR, P=AIR OR PNEUMATIC, S=SOLENOID
2ND LETTER (PROCESS ACTUATION) F=FLOW, P=PRESSURE, T=TEMPERATURE L=LEVEL, C=ALL OTHER PROCESS ACTUATIONS
3RD LETTER, V FOR "VALVE"
FIRE SERVICE MISC.
HOSE REEL
FIRE HOSE CABINET
YARD HYDRANT
YARD HYDRANT W/ PUMP CONNECTION
YARD HYDRANT HOUSE W/ HOSE
WALL HYDRANT (OUTLET)
SIAMESE (FIRE TRUCK FILL)
VESSELS
IN TANK HEATER
NOTE ADD VOLTS AND KW RATING IF ELECTRICAL
MANWAY
VENT
NAME
GALS
TANK
WATER LEVEL
MFR'S CONN. NO. OR LETTER
NOTE: CONFIGURATION OF TANK TO SUIT SITUATION
HEAT EXCHANGERS
U-TUBE
STRAIGHT TUBE
CONVECTION TYPE
CENTRIFUGAL PUMPS
HORIZONTAL
VERTICAL
VERTICAL WET PIT
SYSTEM COMPONENTS
FAN, BLOWER OR COMPRESSOR
POSITIVE DISPL. PUMP
ELECTRIC MOTOR
TURBINE
EXPANSION JOINT
MOTOR DRIVEN MIXER
ACCUMULATOR
"Y" STRAINER
BASKET OR BATHTUB STRAINER
DUAL BASKET STRAINER
CARTRIDGE OR CUNO TYPE FILTER
TEMPORARY OR START-UP STRAINER
STEAM TRAP
DRYER
TARGET PLATE W/ TELLTALE
DIAPHRAGM SEAL
SPRAY PIPE
SPARGER (INSIDE VESSEL)
DESUPERHEATER
EJECTOR OR EDUCTOR
TURBINE STOP CONTROL OR INTERCEPT VALVE
VACUUM PRIMING VALVE
PIPING
RESTRICTING ORIFICE WITH SPECTACLE FLANGE
MAIN PROCESS PIPE
AUX. PROCESS PIPE
ELECTRICAL SIGNAL
CAPILLARY TUBING
CONTROL AIR SIGNAL
INSTRUMENT AIR SUPPLY
STEAM HEAT TRACING
ELECTRIC HEAT TRACING
REDUCER OR INSERT
FLOW ORIFICE, (METERING IF WITH INSTRUMENT)
FLANGED CONNECTION
BLIND FLANGE
WELDED CAP
THREADED CAP
VENTURI OR FLOWNOZZLE
THERMAL SLEEVE
SPECTACLE FLANGE
HOSE CONNECTOR
SPOOL PIECE
QUICK DISCONNECT
RUPTURE DISK
FLEXIBLE CONNECTION
CONTAINMENT VESSEL PENETRATION
ICV=INSIDE CONTAINMENT VESSEL
OCV=OUTSIDE CONTAINMENT VESSEL
EQUIPMENT COMPARTMENT, RADIATION OR MISSILE SHIELD WALL
INSIDE
OUTSIDE



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