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December 3, 1982

Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
NUREG-0737, Item II.B.3 - Post-Accident Sampling Capability
Post-Implementation Review
San Onofre Nuclear Generating Station
Unit 1

References:
1. Letter, D. M. Crutchfield, NRC, to R. Dietch, SCE, NUREG-0737, Item II.B.3-Post-Accident Sampling System, June 30, 1982
2. Letter, R. W. Krieger, SCE, to D. M. Crutchfield, NRC, NUREG-0737, Item II.B.3-Post-Accident Sampling Capability, November 2, 1982
3. Letter, K. P. Baskin, SCE, to D. M. Crutchfield, NRC, NUREG-0737, Item II.B.3-Post-Accident Sampling Capability, April 15, 1982

Reference 2 provided our schedule to respond to Reference 1 with the necessary documentation for the post-implementation review of the subject requirement. Reference 1 also contained some additional clarification to the subject criteria. The purpose of this correspondence is to provide the documentation necessary for you to complete your post-implementation review and a revision to the information in Reference 3 with a description of our final plans to install chloride monitoring.

The Post-Accident Sampling System (PASS) at San Onofre Unit 1 was supplied by Combustion Engineering (CE) of Windsor, Connecticut. It is a skid-mounted sampling unit with the sampling capabilities as described below in our responses to the design criteria. The following discussion provides the responses to the design criteria as they apply to the San Onofre Unit 1 PASS.

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Criterion (1) The licensee shall have the capability to promptly obtain reactor coolant samples and containment atmosphere samples. The combined time allotted for sampling and analysis should be 3 hours or less from the time a decision is made to take a sample.

Response: The San Onofre Unit 1 Post-Accident Sampling System (PASS) provides the capability to obtain pressurized and unpressurized reactor coolant liquid and containment atmosphere samples. Samples will be taken and analyzed at a (with the exception of chlorides) shielded underground sample station approximately 400 feet from the control room. A control panel is provided in the control side of the sample station which will enable remote analysis of the reactor coolant chemistry, with remote collection and dilution of the reactor coolant and containment atmosphere samples for subsequent radiological analysis by using Unit 1 laboratory equipment. The sample station and the chemical laboratory are located within walking distance (i.e., 450 feet) of each other. The grab sample will be transported by site Nuclear Chemistry Technicians to the chemical laboratory. The combined time for sampling and analysis of any one sample will be less than 3 hours from the time a decision is made to take a sample, provided a sample operation is not currently underway. This is due to the fact that the PASS can only process one sample at a time.

A description of the methods by which samples are obtained and analyzed is as follows:

1. Reactor Coolant Sampling System (Hot Leg and Containment Sump)

   The system permits the operator to remotely purge the reactor coolant hot leg or containment sump samples through in-line instruments for the measurement of boron and pH. The sample purge flow is returned to the chemical volume control tank or containment sump, thereby, precluding a buildup of highly contaminated fluid outside the containment. A sample of the pressurized reactor coolant is collected, and degassed via depressurization and circulation. When degassing of the sample is completed, burette level is recorded for total gas concentration determination and the gas is circulated through in-line instruments to determine hydrogen and oxygen so that the existing radioanalysis equipment can be used to quantify the radioisotopes in the gas sample. A volume of degassed liquid sample is likewise diluted with demineralized water so that existing radioanalysis equipment can be used to determine the radioisotopes within the liquid sample. The system is then purged with nitrogen and demineralized water and placed in standby for the next sample.

2. Containment Air Sampling System

The system permits the operator to remotely purge the containment atmosphere sample using an air pump. A containment atmosphere sample is then isolated and diluted with nitrogen so that the existing radioanalysis equipment can be used to determine the radiological quantification of the gas.

The Unit 1 Diesel Generators will be the alternative backup power source for the Post-Accident Sampling System if loss of offsite power occurs. The D.G. Units can provide standby power immediately so that Station Nuclear Chemistry Technicians will have sufficient time to perform sampling and analysis in the three-hour time limit. The PASS is powered from MCC 3A with automatic switching capability to MCC 1C for alternate power in the event of failure of the primary source (MCC 3A).

Criterion (2) The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the three-hour time frame established above, quantification of the following:

a. Certain radionuclides in the reactor coolant and containment atmosphere that may be indicators of the degree of core damage (e.g., noble gases; iodines and cesiums, and nonvolatile isotopes).

b. Hydrogen levels in the containment atmosphere.

c. Dissolved gases (e.g., H_2), chloride (time allotted for analysis subject to discussion below), and boron concentration of liquids.

d. Alternatively, have in-line monitoring capabilities to perform all or part of the above analyses.

Response: Unit 1 PASS provides a means to quantify the following:

a. Certain isotopes in the reactor coolant and containment atmosphere that are indicators of the degree of core damage (i.e., noble gases, iodines, cesiums, and nonvolatile isotopes) by grab samples and by in-line detectors as discussed below:

High Radiation Sampling System
Influent Chemistry Design Parameters

Atm	Reactor Coolant	Containment
Pressure	atm-2485 psig	-1 in. Hg - 60 psig
Temp	50-650^oF	50-300^oF
H_2	$\leq 2000 \frac{CC(STP)}{Kg}$ ($\pm$ *)	0-10 Volume% $\pm$ 2%
O_2	Saturated @ atm $\pm$2%	-
Boron	100-4400 ppm $\pm$2%	-
pH	3-12 $\pm$.5	-
Cl^-	0-2 ppm	-
Radio Chemistry:		
Nuclides (gross)	$<10^7$ Ci/cc	$<10^5$ Ci/cc
Sample Line Dose Rate	5×10^4 R/hr	1×10^4 R/hr
Dissolved Solids	5-20 ppm	-
Iodine (I-131)	2.6×10^4 Ci/cc	3.5×10^2 Ci/cc
Noble Gas (Kr-85)	4.3×10^2 Ci/cc	10 Ci/cc
(Xe-133)	1×10^5 Ci/cc	2.8×10^3 Ci/cc

*See response to Criterion (4)

b. A Post-Accident Hydrogen Monitoring System is provided separately with the capabilities of providing to the Main Control Room continuous indications of containment atmosphere hydrogen levels. It also has recording capabilities via the Technical Support Center's computer system for Train "A" only.

c. Dissolved gases (i.e., H_2, O_2), boron concentration and pH of the reactor coolant can be obtained with the Unit 1 PASS. Total gas concentrations of up to approximately 2000 cc/kg at standard temperature and pressure can be measured. An undiluted chloride grab sample facility for Unit 1 will be provided by sharing a shielded sample pig with San Onofre Units 2&3. The undiluted grab sample facility is currently in the engineering design phase and construction is scheduled to be completed and in operation during the Cycle 9 refueling outage, which is estimated to be 18 calendar months from the end of the current outage.

d. The Unit 1 PASS also has in-line monitoring capabilities to perform H_2, O_2, boron concentration and pH analysis of the reactor coolant. A dissolved oxygen analyzer to monitor dissolved oxygen concentration in the reactor coolant under the post-accident conditions required by Regulatory Guide 1.97, Rev. 2, is also currently in the engineering design phase. Installation of the O_2 meter is scheduled to be completed during the Cycle 9 refueling outage.

The boron meter (AI 2116) is a specific gravity measuring device which determines and indicates the amount of boron (ppm) present in the liquid sample of fluid.

The pH meter (AI 2117) determines and indicates pH in the liquid sample fluid.

The H_2 analyzer (AE 2118) is a thermal conductivity device that determines and indicates the volume percent of H_2 present in the gas removed from the liquid sample.

The O_2 analyzer (AE 2119) is a para-magnetic device that determines and indicates the volume of O_2 present in the sample fluid gas taken out of the liquid solution.

Criterion (3) Reactor coolant and containment atmosphere sampling during post-accident conditions shall not require an isolated auxiliary system [e.g., the letdown system, reactor water cleanup system (RWCUS)] to be placed in operation in order to use the sampling system.

Response: The Post-Accident Sampling Station is designed to be able to take samples under Post-Accident conditions. The operation of the PASS does not require an isolated auxiliary system. Reactor coolant samples are taken from Loop C of the reactor coolant system through containment penetration B-12 and routed to the PASS sample station. During post-accident conditions, samples can be directly obtained from the operation of the control panel located in the control side of the sample station. In the same way, containment atmosphere samples are taken through penetration B-18B to the PASS sample station. All valves, tubing and fittings required for sampling are stainless steel and environmentally qualified for the post-accident conditions in which they must operate.

Criterion (4) Pressurized reactor coolant samples are not required if the licensee can quantify the amount of dissolved gases with unpressurized reactor coolant samples. The measurement of either total dissolved gases or H_2 gas in reactor coolant samples is considered adequate. Measuring the O_2 concentration is recommended, but is not mandatory.

Response: The PASS is able to obtain pressurized reactor coolant samples and also can quantify the amount of dissolved gases. O_2 concentration measurement capabilities is being provided to meet the requirements of Regulatory Guide 1.97, Rev. 2. The oxygen analyzer will provide an auto-ranging remote readout with four ranges: 0 to 19.9 ppb, a 1.8 to 199 ppb, a 0.18 to 1.999 ppm and 1.8 to 19.990 ppm. The accuracy of the reading is $\pm$ 4% in the lowest range.

Criterion (5) The time for a chloride analysis to be performed is dependent upon two factors: (1) if the plant's coolant water is seawater or brackish water, and (b) if there is only a single barrier between primary containment systems and the cooling water.

Under both of the above conditions, the licensee shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the licensee shall provide for the analysis to be completed within 4 days. The chloride analysis does not have to be done onsite.

Response: Unit 1 is required to perform a chloride analysis in 96 hours since it is a PWR plant with two barriers between reactor coolant and the plant cooling water source (seawater). An undiluted chloride grab sample facility will be provided (see response to 2c above). The analysis of the undiluted sample will be done offsite at General Atomic Company after a contract currently in negotiations is issued.

The decision to use an undiluted grab sample in lieu of in-line monitoring for chloride analysis is based on the clarification to Criterion (5) in Reference 1 which stated that undiluted grab sampling capability within 30 days is mandatory.

Criterion (6) The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis must assume that it is possible to obtain and analyze a sample without radiation exposures to any individual exceeding the criteria of GDC 19 (Appendix A, 10 CFR Part 50) (i.e., 5 rem whole body, 75 rem extremities). [Note that the design and operational review criterion was changed from the operational limits of 10 CFR Part 20 (NUREG-0578) to the GDC 19 criterion (October 30, 1979 letter from H. R. Denton to all licensees)].

Response: The Unit 1 PASS design with lead and concrete shielding allows for post-accident sampling operations with resulting personnel radiation exposure not exceeding 3 and 18 3/4 rem to the whole body and extremities, respectively, assuming Regulatory Guide 1.4, Revision 2 or 1.3, Revision 1 source terms.

Criterion (7) The analysis of primary coolant samples for boron is required for PWRs. (Note that Rev. 2 of Regulatory Guide 1.97 specifies the need for primary coolant boron analysis capability at BWR plants.)

Response: The PASS provides boron analysis from primary coolant samples using an in-line boron meter. The range and accuracy of the boron meter is given in our response to item 2.c.

Criterion (8) If in-line monitoring is used for any sampling and analytical capability specified herein, the licensee shall provide backup sampling through grab samples, and shall demonstrate the capability of analyzing the 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 least one sample per week until the accident condition no longer exists.

Response: The PASS already has diluted grab sample capability and will have undiluted backup grab sample capability to be able to sample within 30 days as required. Diluted grab samples will be analyzed in accordance with Criterion (8) at the Unit 1 site and undiluted samples will be sent offsite for analysis. Provisions to flush in-line monitors are provided in the PASS using demineralized water and nitrogen.

Criterion (9) The licensee's radiological and chemical analysis capability shall include provision to:

a. Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source terms given in Regulatory Guide 1.3 or 1.4 and 1.7. Where necessary and practicable, the ability to dilute samples to provide capability for measurement and reduction of personnel exposure should be provided. Sensitivity of onsite liquid sample analysis capability should be in the range from approximately 1 Ci/g to 10 Ci/g.

b. Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of a ventilation system design which will control the presence of airborne radioactivity.

Response: The PASS uses the High Purity Germanium (HPGe) Detector Systems for analysis of the samples from the reactor coolant and containment atmosphere. HPGe Detectors provide the operator with the capability of remotely monitor and quantify the isotopes of the nuclide categories to levels corresponding to the source terms given in Regulatory Guide 1.4, Rev. 2 and 1.7. The activity detection range for reactor coolant is 1 to 10^7 Ci/cc. The detecting system has a capability of +100% and -50% accuracy in the radiological and chemical analysis. Shielding and ventilation of the sample station area are provided to minimize errors.

In addition, due to the fact that the sample station is underground and provided with additional concrete shielding, essentially the only source of activity is from the sample station itself.

Criterion (10) Accuracy, range, and sensitivity shall be adequate to provide pertinent data to the operator in order to describe radiological and chemical status of the reactor coolant systems.

Response: The PASS and error range capability is defined in our response to item 2 for the required accident sample analyses. To meet chloride analysis requirements, Unit 1 is in the process of designing an undiluted grab sample facility.

The equipment and procedures used for post-accident sampling and analyses will be calibrated and chemistry personnel retrained in the use of the system on a minimum frequency of every six (6) months in accordance with Criterion (10).

Criterion (11) In the design of the post-accident sampling and analysis capability, consideration should be given to the following items:

a. Provisons for purging sample lines, for reducing plateout in sample lines, for minimizing sample loss or distortion, for preventing blockage of sample lines by loose material in the RCS or containment, for appropriate disposal of the samples, and for flow restrictions to limit reactor coolant loss from a rupture of the sample line. The post-accident reactor coolant and containment atmosphere samples should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident. The sample lines should be as short as possible to minimize the volume of fluid to be taken from containment. The residues of sample collection should be returned to containment or to a closed system.

b. The ventilation exhaust from the sampling station should be filtered with charcoal absorbers and high-efficiency particulate air (HEPA) filters.

Response: Liquid sample lines for the PASS will be purged by demineralized water supplied from the Unit 1 primary plant make-up tank (D-7). Gas sample lines for the PASS will also be purged by nitrogen gas from nitrogen bottles located near the PASS Sample Station. For reducing plateout in the containment atmosphere sample lines, the design provides piping insulation and electrical heat tracing to maintain the piping at a temperature of 275^{o}F (minimum) and 295^{o}F (maximum) to prevent condensation blockage. Both reactor coolant and containment atmosphere sample flows are designed to return to the containment to ensure that high level radiation waste remains isolated within the containment. A safety-related containment isolation design requirement was provided for the sample lines at the containment penetrations. It will prevent reactor coolant loss and containment atmosphere release from a rupture of the sample line. The reactor coolant sample is directly taken from loop C reactor coolant system and the containment atmosphere sample is taken from the same containment air penetration currently used for the existing Unit 1 radiation monitoring system. In both cases, the samples taken will be representative of core conditions under a Post-Accident Condition.

The ventilation exhaust from the sample skid hood has been designed with a charcoal filter on the top of the sample cabinet. The sample station exhaust system capacity is 250 scfm (minimum) and 330 scfm (maximum). The air is passed through HEPA filters after entering the ventilation building duct and exhausted out to the station exhaust stack, eliminating buildup of radioactive and potentially explosives gases.

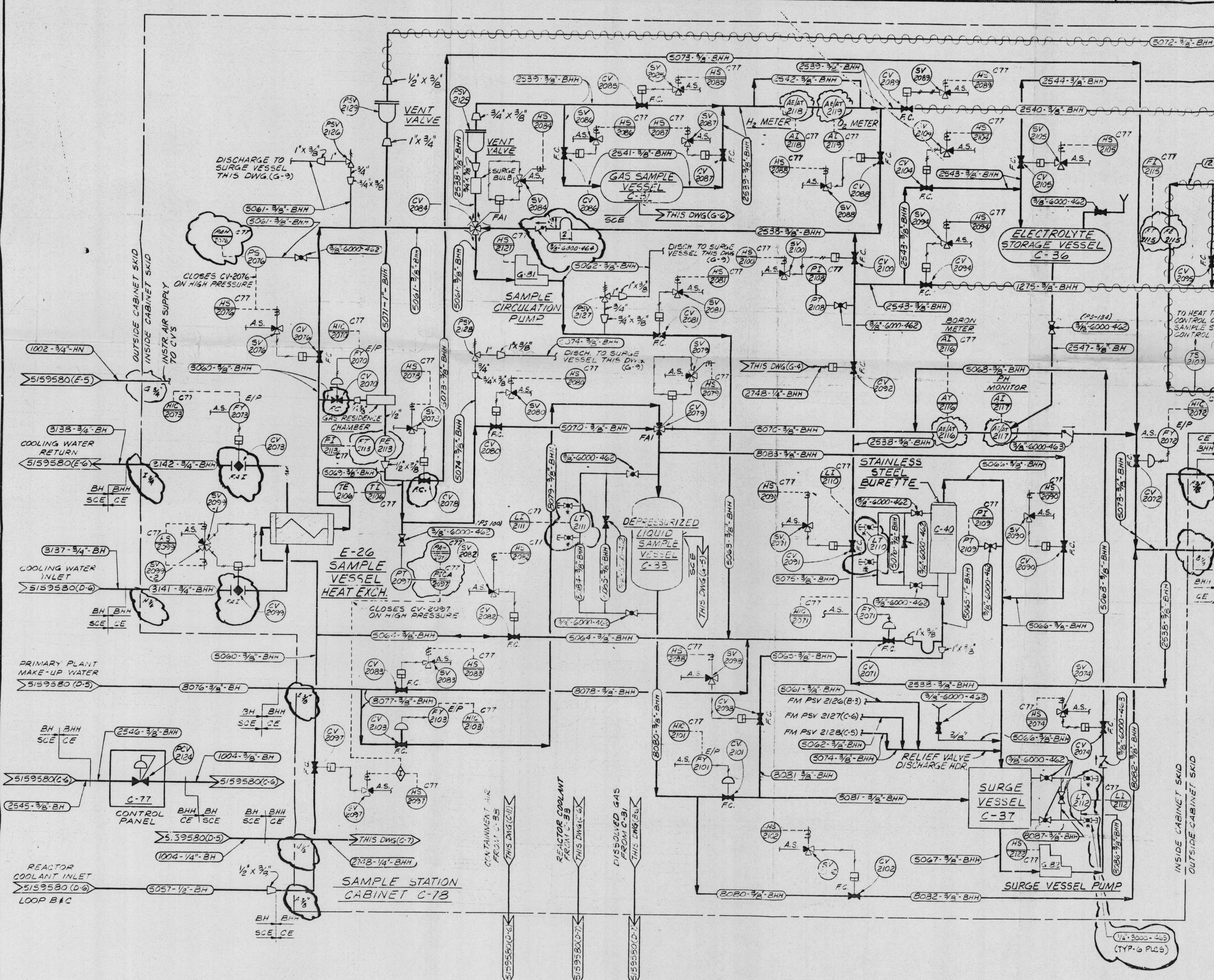
It should be noted that the start-up problems encountered at San Onofre Unit 2, and communicated to the NRC staff, on a similar C-E PASS will be corrected for the San Onofre Unit 1 PASS. The PASS, as described above will be operable prior to return to power from the current outage except where noted.

The above responses to the design criterion combined with the enclosed P&ID's should provide adequate information for your post-implementation review, but if you have any questions, please let me know.

Very truly yours,

MP Baskin

Enclosures



NOTES:

1. ALL ITEMS SHOWN WITHIN SAMPLE STATION CABINET SKID ARE PROVIDED AND DESIGNED BY COMBUSTION ENGINEERING INC.
2. REFER TO C-E DWG. NO. E-15380-310-152 FOR P&I ENGINEERING REFERENCE.
3. SCE TAG NUMBERS AND LINE NUMBERS ARE PROVIDED FOR THE ENGINEERING RECORDS OF THE SYSTEM DESIGN, AND FOR SYSTEM OPERABILITY.
4. FOR CROSS REFERENCE OF SCE TAG NUMBERS AND LINE NUMBERS TO COMBUSTION ENGINEERING NUMBERS ARE FOUNDED IN TABLES 1 AND 2, DWG NO. 5180769
5. REFER TO C-E TECHNICAL MANUALS, VOLUME 1 AND VOLUME 2, FOR DETAIL SYSTEM DESCRIPTION, OPERATION AND MAINTENANCE INFORMATION.

* VALVES INSTALLED IN PLACE OF TRANSMITTER CASE VENTS (AND CAPPED) TO ENABLE FILLING OF REFERENCE LEGS AND TRANSMITTER CALIBRATION.

AFTER

Drwg. # 5180768-0

CC # 1

Sheet # 2 of 2

NON-SAFETY RELATED
TMI PHASE II
W.P. 2.1.3a

PRC APERTURE CARD

8212070266-01

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Docket # 50-206
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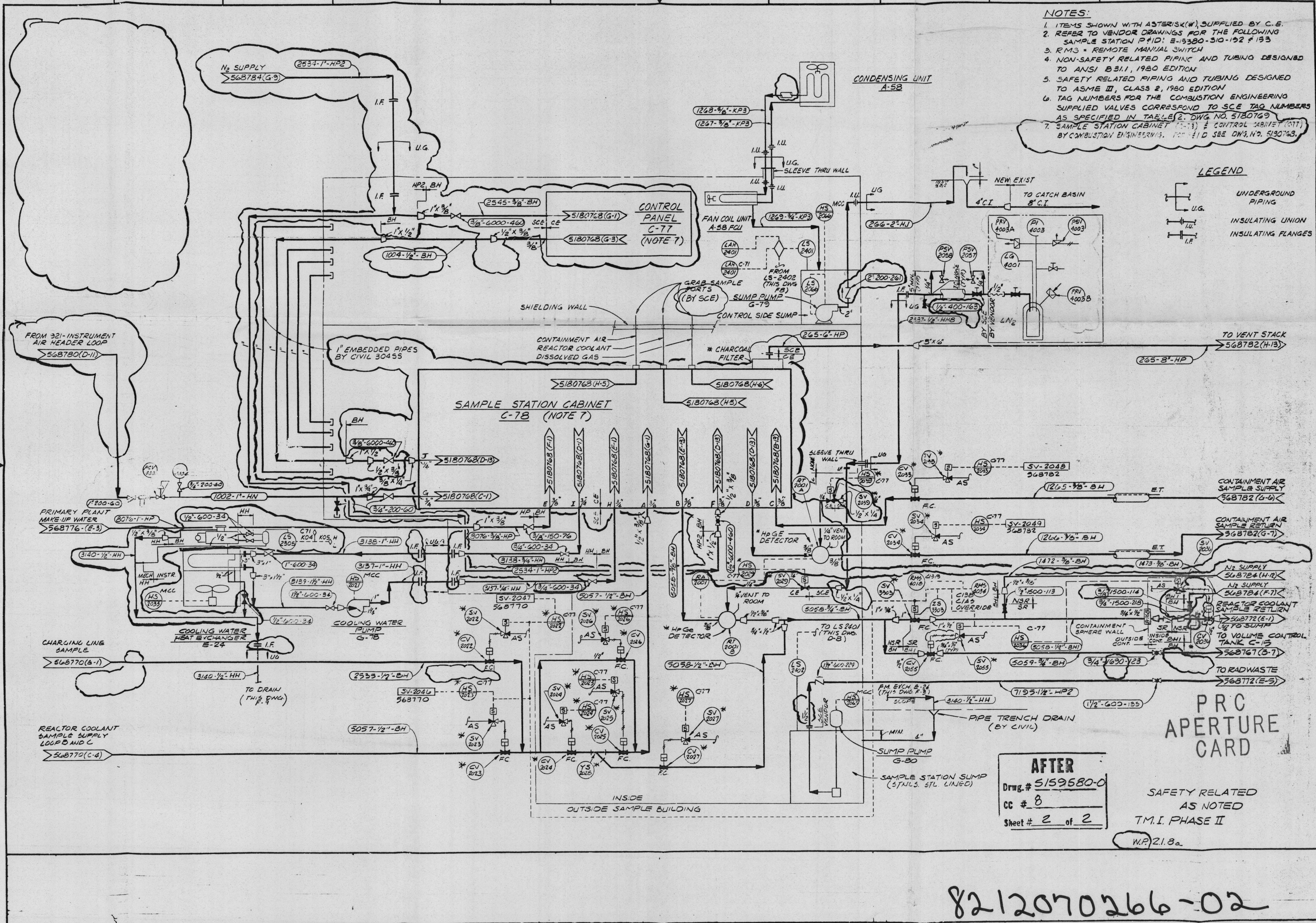
Date 12-03-82 of Document:
REGULATORY DOCKET FILE


NOTES:
1. ITEMS SHOWN WITH ASTERISK (*) SUPPLIED BY C.E.
2. REFER TO VENDOR DRAWINGS FOR THE FOLLOWING SAMPLE STATION P&ID: E-13380-310-132 & 133
3. RMS = REMOTE MANUAL SWITCH
4. NON-SAFETY RELATED PIPING AND TUBING DESIGNED TO ANSI B31.1, 1980 EDITION
5. SAFETY RELATED PIPING AND TUBING DESIGNED TO ASME III, CLASS 2, 1980 EDITION
6. TAG NUMBERS FOR THE COMBUSTION ENGINEERING SUPPLIED VALVES CORRESPOND TO SCE TAG NUMBERS AS SPECIFIED IN TABLE 2, DWG NO. 5180769
7. SAMPLE STATION CABINET (C-78) & CONTROL CABINET (C-77) BY COMBUSTION ENGINEERING. FOR P&ID SEE DWG. NO. 5180768.
LEGEND
UNDERGROUND PIPING
INSULATING UNION
INSULATING FLANGES
CONDENSING UNIT A-58
CONTROL PANEL C-77 (NOTE 7)
SAMPLE STATION CABINET C-78 (NOTE 7)
N2 SUPPLY 568784 (G-9)
FROM 321-INSTRUMENT AIR HEADER LOOP 568780 (D-11)
PRIMARY PLANT MAKE-UP WATER 568776 (E-3)
CHARGING LINE SAMPLE 568770 (B-1)
REACTOR COOLANT SAMPLE SUPPLY LOOP B AND C 568770 (C-4)
COOLING WATER HEAT EXCHANGER E-24
COOLING WATER PUMP G-78
FAN COIL UNIT A-58 FCU
SLEEVE THRU WALL
SHIELDING WALL
GRAB SAMPLE PORTS (BY SCE)
SUMP PUMP G-79
CONTROL SIDE SUMP
CONTAINMENT AIR
REACTOR COOLANT
DISSOLVED GAS
1" EMBEDDED PIPES BY CIVIL 30455
CHARCOAL FILTER
TO CATCH BASIN 8" C.I.
NEW EXIST
TO VENT STACK 568782 (H-13)
CONTAINMENT AIR SAMPLE SUPPLY 568782 (G-6)
CONTAINMENT AIR SAMPLE RETURN 568782 (G-7)
N2 SUPPLY 568784 (H-8)
N2 SUPPLY 568784 (F-7)
REACTOR COOLANT SAMPLE RETURN 568772 (E-1)
TO SUMP
TO VOLUME CONTROL TANK C-15 568761 (D-3)
TO RADWASTE 568712 (E-5)
HpGe DETECTOR
CONTAINMENT SPHERE WALL
PIPE TRENCH DRAIN (BY CIVIL)
SUMP PUMP G-80
SAMPLE STATION SUMP (STNLS. STL. LINED)
INSIDE
OUTSIDE SAMPLE BUILDING
TO DRAIN (THIS DWG.)
AFTER
Drwg.# 5159580-0
CC # 8
Sheet # 2 of 2
SAFETY RELATED AS NOTED
T.M.I. PHASE II
W.P. 21.8a
PRC APERTURE CARD
8212070266-02