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NUCLEAR PRODUCTION DEPARTMENT

March 15, 1982

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/L-334.0
Containment Purge, SER Item 1.9(9)
AECM-82/28

As requested in Supplement No. 1 to the Safety Evaluation Report (SER) for Grand Gulf Nuclear Station, NUREG-0831, Mississippi Power & Light (MP&L) is providing the attached report on the use of containment purge. This information addresses concerns identified as SER Outstanding Issue 1.9(9).

As discussed in the attached, Grand Gulf's Mark III containment presents a unique design, placing the majority of reactor coolant carrying systems inside an isolable primary boundary. This design, as a result, enhances public safety, but requires more frequent containment entries than other containment designs. As stated in subsection 6.2.4.1 of SER Supplement No. 1, MP&L has advised the Containment System Branch reviewer that estimates have been completed indicating a requirement to provide continuous filtered purge from the containment to meet MP&L occupational exposure goals for personnel requiring containment entry.

Additional clarification and justification for that estimate is provided in the attached report. It is MP&L's contention that the described estimates are as realistic as possible. The evaluation is based on expected coolant leakages into the containment atmosphere. The evaluation will be refined once operational experience is gained, and those results will be reported for your review. MP&L proposes that continuous containment purge is required until the first regularly scheduled refueling outage; at which time, the requirement for containment purge will be re-evaluated.

By virtue of the satisfactory evaluation of isolation valve operability, accident dose assessments while purging, system overall design, and adequate surveillance measures proposed, MP&L concludes that interim operation employing continuous containment purge is justified. The attached report provides detailed information on each of the above points.

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Upon final resolution of this issue, appropriate portions of the attached information will be incorporated into the Grand Gulf FSAR.

Please advise if additional information is required.

Yours truly,

L. F. Dale
Manager of Nuclear Services

JGC/JDR:lm
Attachments

cc: Mr. N. L. Stampley (w/a)
Mr. G. B. Taylor (w/a)
Mr. R. B. McGehee (w/a)
Mr. T. B. Conner (w/a)

Mr. Richard C. DeYoung, Director (w/a)
Office of Inspection & Enforcement
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Washington, D.C. 20555

1.0 Mark III Containment and Use of Containment Purge

As discussed in the MP&L response to NRC Question 021.42 (FSAR Amendment 50, August, 1981), MP&L maintains that the unique Mark III containment design enhances the safety of the public by providing an isolable primary containment boundary for the majority of components associated with reactor coolant support systems. Both normal and accident leakages from these components are released into a structure designed to contain such releases.

With the majority of these components inside the containment building, personnel entry must be allowed due to inspection and maintenance requirements during plant operation. The containment HVAC system, including ventilation, filtration, and purging functions, should be employed to maintain airborne radioisotopes within ALARA levels, consistent with personnel access requirements and the guidelines of 10 CFR 20 for personnel exposure.

Furthermore the Mark III design response to LOCA type events presents relatively low post accident differential pressures across the containment purge isolation valves. This results in a less severe challenge to these valves and thus increases confidence that they will function as required. See Section 5.2 of this attachment.

2.0 Containment Purge System Description

Containment purge is accomplished by the Containment Ventilation and Filtration System, which is described in FSAR subsection 9.4.7. There are two major modes of purging the containment atmosphere, namely, a low volume purge (LVP) and a high volume purge (HVP). Each mode involves the use of separate supply and exhaust penetrations, separate supply and exhaust fans, and separate charcoal filter trains. The LVP is rated at 500 cfm, using single supply and exhaust penetrations (6" lines). The HVP is rated at a maximum of 6000 cfm, also utilizing single supply and exhaust penetrations (20" lines). A summary design description of those portions of the Containment Ventilation and Filtration System, pertinent to containment purging, is provided as Attachment 2. This attachment includes a simplified composite drawing of the systems involved (Figure 1.1-1).

Use of the LVP will generally include the employment of filtered recirculation within the containment (recirculation flow rates of 3000 and 6000 cfm) to provide additional purification of the containment atmosphere while utilizing the LVP flow path. As discussed in Attachment 2, the LVP flow path includes final passage through a charcoal filter train in the Auxiliary Building prior to being discharged to the environment.

3.0 Proposed Use of Containment Purge

An evaluation was conducted to estimate the use of containment purge during normal power operations. Based on expected coolant leakages into the containment atmosphere, this evaluation concluded that a continuous use of the containment purge (LVP) would be required to meet the ALARA limits set by MP&L based on the guidelines of 10 CFR 20. It should be emphasized that this evaluation is based on expected leakages. Only with plant operating experience can a more accurate assessment of coolant leakage and containment airborne radioactivity be made. Prior to the startup from the first regularly scheduled refueling outage, this evaluation will be repeated based on GGNS operating experience information. A summary of that evaluation's findings will be provided prior to returning to normal power operations. Additional information on this evaluation is provided below.

3.1 Estimate of Purge Usage

Radiation dose rate limits for this evaluation were established by the MP&L Corporate Health Physicist and the GGNS Staff Health Physicist as part of the ALARA program. Those limits were established as follows:

whole body/gonads	1 mRem/hr
skin/thyroid	4 mRem/hr

These units are based on the dose rate guidelines proposed by ICRP Publication 2 for weekly allowed doses and the guidelines of 10 CFR 20.103.

The source of airborne radioactivity in containment was assumed to be expected values for leakage of reactor coolant. These values are presented in FSAR Table 12.2-16 and are discussed in FSAR Section 12.2. These values are:

reactor steam (safety relief valves)	2000 lb/hr
reactor water to containment atmosphere	50 lb/hr
reactor steam to containment atmosphere	5 lb/hr

As mentioned above these are expected leakage values, used for design purposes. This information represents the best available information for this evaluation of estimated purge usage. Once operating experience is gained, a far more accurate assessment of leakage can be made.

Design values for coolant fission product concentrations were provided by General Electric based on BWR operating experience. These values are presented in FSAR Tables 11.1-1 and 11.1-2 for noble gases and halogens, respectively. Certain assumptions were made to eliminate some isotopes from the analysis based on holdup time and half life. The concentrations of the isotopes remaining, combined with the expected leakages discussed above, constituted the bases for the determination of airborne radioactivity levels for a given purge routine.

Equilibrium dose rates are given in Table 1 for various purge flow rates. Filtered containment recirculation was assumed when applicable.

TABLE 1

Equilibrium Dose Rates for Various Purge Rates

Purge Rate (cfm)	Filtered Recirc. (cfm)	Equilibrium Dose Rate (mRem/hr) Thyroid	Beta - Skin	Whole Body
0	3000	8.2	2.1	0.31
0	6000	4.6	2.1	0.31
500*	3000	6.8	1.4	0.24
500*	6000	4.1	1.4	0.24
6000*	N/A	3.0	0.63	0.11

*Continuous

As can be seen from the results provided in Table 1, the dose rate to the thyroid is the most limiting with respect to the dose criteria presented above. With maximum filtered recirculation (6000 cfm) and a continuous purge of 500 cfm, the equilibrium value for the dose rate to the thyroid is 4.1 mRem/hr. Since this value is approximately equal to the ALARA based criteria of 4.0 mRem/hr, the use of continuous containment purge (500 cfm) during power operations is required.

However, continuous use of maximum filtered recirculation flow (both containment cooling charcoal filter trains) would not be the most desirable equipment configuration from a maintenance standpoint in that both trains would require continuous operations. It is for this reason that allowance should be made to use the HVP for limited periods during Conditions 1, 2, and 3, as discussed in Section 3.2 below.

3.2 Restrictions Applied to Containment Purge

Containment purging will not be employed to control temperature or humidity. In addition, at no time shall more than one supply line and one exhaust line be employed for containment purging. Both restrictions discussed will be enforced by administrative controls and are consistent with the recommendations of Branch Technical Position CSB 6-4.

Containment purging through the 6" penetration (LVP) will be unrestricted with regard to plant operational conditions, as defined in Table 1.2 of the plant technical specifications.

1 - Power Operation
2 - Startup
3 - Hot Shutdown
4 - Cold Shutdown
5 - Refueling

Continuous containment purge using the 20" penetration (HVP) shall be limited to only Conditions 4 and 5. Use of the HVP during Conditions 1, 2, and 3 is allowed only intermittently to reduce airborne activity levels. Use of the

HVP during Conditions 1, 2, and 3 shall not exceed 2000 hours per 365 days and will be administratively controlled. Cumulative use of the HVP in a given 365 day period will be determined at least weekly.

4.0 Dose Assessment Under LOCA Conditions

4.1 Normal Operating Conditions

FSAR subsection 11.3.3 presents the evaluation of doses associated with gaseous effluents during normal plant operations. Calculations of annual gaseous effluent releases were performed using the BWR-GALE Code, as approved by the NRC in NUREG-0016. This code basically utilizes source term information that is based on release information from BWR operating experience.

As discussed in FSAR 11.3.3, Grand Gulf specific input information to these calculations is presented in FSAR Table 11.3-8, with the nuclide specific release results for Grand Gulf presented in Table 11.3-9. The annual doses to the maximum exposed indivudal are shown in Table 11.3-12. The resulting values are well within the guidelines of Appendix I to 10 CFR 50.

For dose calculations in this report on containment purging, more conservative source terms were employed than that used in FSAR subsection 11.3.3, i.e., airborne radioactivity levels inside containment were based on design values for coolant fission product concentrations, as shown in FSAR Tables 11.1-1 and 11.1-2. See discussion in Section 3.1 of this attachment. Even with these more conservative input values, the continuous use of the HVP (20" exhaust line) does not significantly impact the analysis given in FSAR 11.3.3. The resulting doses and offsite concentrations remain within the guidelines of Appendix I to 10 CFR 50.

4.2 LOCA Conditions

Radiological consequences due to the occurrence of a postulated LOCA coincident with the purging of the containment atmosphere have been evaluated to determine compliance with BTP CSB 6-4. The resultant doses are a small fraction of those values allowed by 10 CFR 100, and thus meet the objectives of B.5.a of BTP CSB 6-4. This evaluation included many conservative assumptions, including the allowances of five seconds for isolation valves to fully close. The actual testing requirement[1] imposed by MP&L for valve closing times is four seconds. This evaluation is discussed in detail in FSAR subsection 6.2.4.3.3. Additional information can be

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[1]Testing requirements are presented in FSAR Table 6.2-44. It is noted that the valve closure time for valves E61F009 and F010 are incorrectly listed at five seconds. These values should be four seconds. This table will be corrected in FSAR Amendment 54.

found in response to NRC Question 021.40, in the Question & Response section of the FSAR.

5.0 Containment Isolation Valve Testing and Operability

Design information for the containment isolation valves associated with containment (or drywell) purging is provided in Attachment 2 of this report, Section 1.2.

5.1 Surveillance Testing

Each purge system containment isolation valve undergoes periodic testing for closure time and leakage. All valves in question are included in the Pump and Valve Pre/Inservice Inspection Program, reviewed and approved by the NRC Staff (GGNS SER 3.9.6). This program calls for a minimum testing frequency of once per 18 months. The valves are also tested for proper closure time every 90 days or following any maintenance on the valve. The acceptance criteria for valve closure time is set at four seconds. (See footnote 1 regarding error noted in Table 6.2-44, regarding valve closure times.)

5.2 Valve Operability Analysis

The valve supplier has conducted an analysis to provide assurance that the containment isolation valves associated with containment purge operations can close within the required time to maintain accident doses to within required limits. The analysis employs the most severe design-basis accident containment flow conditions for valve loading.

The maximum post-accident containment pressure which results (FSAR subsection 6.2.1.1.3.3.2) from a postulated design-basis main steam line break is given on FSAR Figure 6.2-10. As shown on this figure and since containment isolation will be initiated within the first second of the accident, the peak differential pressure which these purge valves would be required to close against is less than 3 psi. This is conservative because it ignores the lower containment pressures at times prior to five seconds.

The analysis results confirm that the containment isolation valves, for both the 6" and 20" lines, will close under design basis accident conditions. Applying a peak differential pressure of 3 psi at closure time, the analysis shows that no disc or valve body deformation occurs, nor is the resulting actuator torque in excess of that used for the actuator's design. The valve suplier has concluded that no additional rework, analysis, or testing of these valves is required to confirm operability.

This analysis, along with the valve surveillance program, provides adequate assurance that the isolation valves will function as required.

SUMMARY DESIGN DESCRIPTION, CONTAINMENT PURGING

System Description

The Containment Ventilation and Filtration System utilizes components of the Containment Cooling System (CCS). The overall function of the CCS is to provide a suitable environment under normal operating conditions for equipment inside containment and to limit the level of airborne radioisotopes, consistent with ALARA considerations, for the protection of personnel requiring entry into containment. This system is discussed in detail in FSAR subsection 9.4.7.

The major components utilized in containment and drywell purge operations are part of the Containment Ventilation and Filtration System (CVFS). For cooling and filtration purposes, the ductwork and valving design provides considerable flexibility, depending on the plant conditions and intended objective. For purging of the containment atmosphere, there are two principal valving/system arrangements, namely, a low volume purge (500 cfm) and a high volume purge (6000 cfm). The two lineups employ different supply penetrations and fans, different charcoal filter trains, and exhaust through different containment penetrations. Both lineups do utilize common exhaust ductwork in two locations, both, of which, are provided with radiation monitoring systems (RMS). One portion provided with RMS is inside containment, prior to the containment penetrations for the low and high volume purge. In addition, outside containment, the low and high volume ductwork join in the auxiliary building, pass through an effluent radiation monitor, and exhaust through the auxiliary building penthouse vent.

1.1 The equipment and flowpaths for these two lineups are shown in FSAR Figures 9.4-11 and 9.4-12. A brief description of those flowpaths for purging are provided below. In addition a simplified composite drawing of the systems described here is provided as Figure 1.1-1, in this attachment.

1.1.1 Low Volume Purge (LVP)

Supply air is provided by the Containment Ventilaton Supply fans (auxiliary building) and is passed through the Combustible Gas Control System, penetrating containment at penetration No. 65. Exhaust air is drawn from the containment dome, (valve M41-F003 is shut in this mode), enters the high volume ductwork, and passes the radiation elements of the Containment and Drywell Ventilation Exhaust Radiation Monitoring Systems, (see subsection 1.3 of this attachment). Downstream of the radiation elements the LVP line branches off of the larger ductwork and penetrates containment at penetration No. 66 (6" line).

Once in the auxiliary building, the LVP utilizes the Containment Exhaust Charcoal Filter Train and ventilation exhaust fans and rejoins the high volume purge ductwork.

This filter train is similar in design and function to the Containment Cooling Charcoal Filter trains, described below. This exhaust line is sampled and monitored by the Containment Ventilation Radiation Monitoring System and exits the auxiliary building through two isolation valves and the penthouse vent.

The LVP operation is normally coincidental with the use of filtered recirculation internal to containment, providing additional purification of the containment atmosphere. Filtered recirculation employs one or both of the Containment Cooling Charcoal Filter Trains, providing a recirculation flow rate of 3000 and 6000 cfm, respectively. Each train consists of the following components:

1. Demister
2. Heater
3. Prefilter
4. High efficiency particulate air (HEPA) filter bank
5. Charcoal filter bank
6. HEPA filter bank
7. Centrifugal fan

These trains are discussed in FSAR subsection 9.4.7.2.2 and are shown in FSAR Figure 9.4-11.

1.1.2 High Volume Purge (HVP)

Supply air is provided by the Drywell/Containment Purge fans (auxiliary building) and penetrates containment at penetration No. 34. Exhaust air passes through one or both of two, parallel Containment Cooling Charcoal Filter Trains and is joined by the LVP ductwork and then monitored by the radiation elements of the Containment and Drywell Ventilation Exhaust Radiation Monitoring System, (Section 1.3 of this attachment). Following the branch off of the LVP line, the HVP line penetrates containment at penetration No. 35 (20" line). It is then joined again by the LVP ductwork, passes through the Containment Ventilation Radiation Monitoring System, and exits the auxiliary building through two isolation valves and the penthouse vent.

During HVP operation there is no filtered recirculation flow as in the LVP operation since HVP flow is through the Containment Cooling Charcoal Filter Trains (M41-F003 open, M41-F005 closed). See FSAR Figure 9.4-11.

1.2 Containment Penetration and Valve Design

All containment penetrations discussed in Section 1.1 above are designed Seismic Category I and are provided with safety grade inboard and outboard isolation valves. All of these valves are pneumatic, piston operating, butterfly valves which are provided divisional, Class 1E power, fail closed on loss of power, and isolate on high radiation or LOCA signal (Reference FSAR Table 6.2-44).

There are eight valves involved (four containment penetrations). All of these valves are of the symmetric disc design, manufactured by Henry Pratt. Additional information on valve testing and operability is provided in Attachment 1 (Section 5.0).

1.3 Radiation Monitoring of Purge and Ventilation Exhaust

Containment/drywell ventilation exhaust is monitored by two radiation monitoring systems (RMS), namely, the Containment and Drywell Ventilation Exhaust RMS and the Containment Ventilation RMS.

1.3.1 Containment and Drywell Ventilation Exhaust RMS

This RMS monitors purge exhaust ductwork inside containment, downstream of valve E41-F003 and prior to the high and low volume purge containment penetrations. This RMS is discussed in detail in FSAR subsection 11.5.2.1.2.

This system is designed fully safety grade and Seismic Category I. It provides the trip signal to isolate the purge supply and exhaust lines. Alarms on high radiation are annunciated in the control room.

1.3.2 Containment Ventilation RMS

This RMS monitors ventilation exhaust exiting the auxiliary building. A representative sample is continuously extracted prior to the auxiliary building ventilation exhaust isolation valves. This system provides exhaust monitoring capability during normal and accident conditions. This is a monitoring system and provides no isolation function. More information on this RMS is provided in FSAR subsection 11.5.2.2.4.

1.4 Debris Screens

As presented in FSAR subsection 9.4.7.2.2, debris screens are provided inboard of all containment isolation valves. Debris screens are located a minimum of one pipe diameter from the inner side of each inboard isolation valve. These screens are seismic Category I and are designed to withstand the LOCA peak differential pressure.

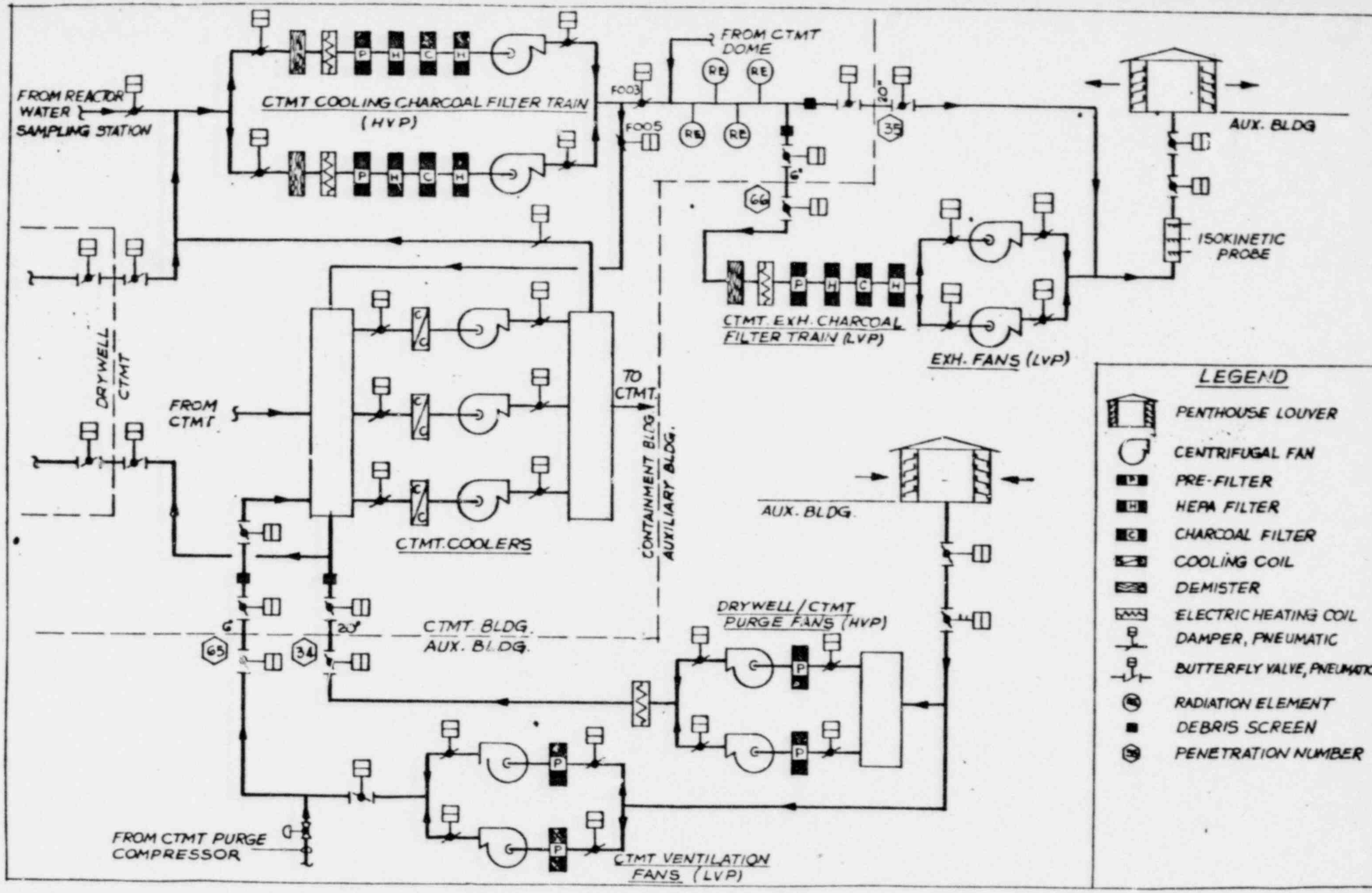

FIGURE 1.1-1

"Simplified Composite Drawing of the Containment Ventilation and Filtration System"