INFORMATION ONLY

Design Criteria

Ginna Station

Post Accident Sampling System Implementation

Rochester Gas and Electric Corporation

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Rochester, New York 14649

EWR 2606

Revision 1

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1.0 Summary Description of the Design

1.1 Summary

1.1.1 As a result of the inability at Three Mile Island to rapidly obtain reactor coolant samples to ascertain the extent of core damage, the NRC is requiring that all licensees evaluate and, if required, upgrade their plants to enable acquisition of appropriate expeditious samples after an accident. Ability to assess the conditions of the core early in an accident can result in taking remedial actions which could limit or even preclude core damage.

1.1.2 The sampling system at Ginna has been evaluated to be marginally adequate for post-accident conditions and consequently remedial modifications are planned.

1.1.3 A new Post Accident Sampling System (PASS) will be installed which will enable the station to obtain and analyze reactor coolant, containment air, and containment sump samples within 3 hours of the decision to sample. The PASS will also enable sampling of these streams during normal operation.

1.1.4 In-line chemical instrumentation will be provided in a new Liquid and Gas Sample Panel (LGSP) which will remotely determine important chemical parameters of reactor coolant, containment air, and containment sump.

1.1.5 The LGSP will enable acquisition of diluted and undiluted grab samples of both reactor coolant and containment air for isotopic analysis in the existing counting lab.

1.1.6 The LGSP will be controlled from a new Electric Control Panel (ECP) and Instrument Panel (IP) to be located in the Hot Shop. Remotely operated valves and instruments external to the LGSP will also be controlled from the ECP. The LGSP will be located on the 253'-6" elevation of the controlled portion of the Intermediate Building.

1.1.7 The PASS is designed to meet the requirements of NUREG 0578 and NUREG 0737 (Section II.B.3). Furthermore, the PASS installation at Ginna is to have adequate provisions to allow compliance with the containment sump sampling, pH and oxygen analysis requirements now invoked by Regulatory Guide 1.97 (Rev. 2) dated December 1980.

1.1.8 Sample lines associated with the PASS will be installed in such a manner that the post accident dose criteria will be met for sampling and access to vital areas.

1.1.9 The necessary modifications are shown schematically on the attached Figure 1. The general arrangement of equipment is shown on Figure 2.

1.1.10 Steam generator blowdown sample lines from containment penetrations 206 and 207 to the existing sample room are to be rerouted (for ALARA considerations) using the same design criteria discussed herein. These two lines are being rerouted to reduce operator exposure for routine sampling and are not required as a part of NUREG-0737 or Reg. Guide 1.97 (Rev. 2).

1.2 Functions

1.2.1 The new PASS functional requirements are given in the attached Table 1. The PASS sample source design parameters are given in the attached Table 2. The PASS major component design parameters are given in Table 3.

1.2.2 The new PASS shall provide for disposition of the sample waste to a new waste collection system during post-accident operation. The new Waste Tank and Waste Transfer Pump will collect sample waste for return to the containment sump during post accident conditions.

1.2.3 During normal operation, valving is provided to direct the sampling waste to the volume control tank or to plant liquid radwaste system.

1.2.4 The basic functions of the PASS can be performed while the operator is in a shielded, remote location from the LGSP. The LGSP is designed with integral lead shot shielding which will minimize the dose rate to adjacent areas of the intermediate, auxiliary, and service buildings.

1.2.5 Liquid and Gas Sample Panel (LGSP)

1.2.5.1 The LGSP will provide the functions given in the attached Table 1.

1.2.5.2 The specific analytical parameters measured by the LGSP instrumentation are given in the attached Table 3 (Item 1).

1.2.5.3 All PASS analytical and sample components which contain post accident liquids and gases are mounted in the LGSP behind a shield structure.

1.2.5.4. The rear of the LGSP is enclosed and has provisions for exhausting to the station HVAC system to prevent airborne contamination in the event of component leakage.

1.2.5.5 The LGSP has an integral internal spray system for washdown and decontamination prior to maintenance.

1.2.5.6 The LGSP contains a means to strip reactor coolant of dissolved gases for subsequent analysis.

1.2.5.7 The LGSP contains a means to dilute reactor coolant, containment air, and containment sump samples by a factor of approximately 1000. The diluted samples can be withdrawn by a shielded syringe via port connections located on the front of the LGSP. The LGSP contains a means to obtain an undiluted reactor coolant gas and liquid grab sample during normal operation.

A means is provided to obtain a undiluted containment air sample.

1.2.5.8 The motive force for reactor coolant samples to the LGSP is provided by primary coolant pressure.

1.2.5.9 The motive force for obtaining the containment sump sample is from a new containment sump sampling pump located in Containment Sump 'A'.

1.2.5.10 The motive force for obtaining the containment air sample is from a vacuum pump contained within the LGSP.

1.2.6 PASS Coolers

1.2.6.1 A PASS cooler will be provided for each reactor coolant and containment sump sample, refer to Table 1. A separate cooler for each liquid sample line will ensure sample representativeness, and minimize the liklihood of sample cross-contamination.

1.2.6.2 The coolers (4 required) will be shell and tube type. Sample fluid will circulate through the tube side.

1.2.6.3 The coolers will be mounted on a rack which will be located directly behind the LGSP. The LGSP integral shielding will thus shield the coolers from adjacent areas.

1.2.6.4 The cooler rack can be isolated for maintenance.

1.2.6.5 The cooler design parameters are given in the attached Table 3 (Item 2).

1.2.7 PASS Waste Tank

1.2.7.1 A PASS Waste Tank is provided to collect sample waste from purge, flush, and analysis operations.

1.2.7.2 The PASS Waste Tank is sized to contain the fluid generated while purging any sample inlet line for a minimum of three line volumes during a single sample operation.

1.2.7.3 The PASS Waste Tank is provided with two means to transfer fluid contents in the event of Waste Tank transfer pump failure. The primary method is a transfer pump; the backup method is by nitrogen displacement.

1.2.7.4 The PASS Waste Tank is provided with an evacuating compressor to remove gases which will evolve from reactor coolant samples to vent the tank during sampling back to containment.

1.2.7.5 The tank is protected from over pressurization by a rupture disc. A rupture disc is selected for leak tightness and to assure adequate response to rapid pressure excursions as would occur with a hydrogen detonation. During operation the rupture disc discharge in routed to the Intermediate Building HVAC System.

1.2.7.6 The PASS Waste Tank is to be located within the pad which supports the LGSP. The tank will be situated below the drain connection on the LGSP to assure gravity drainage when necessary. The pad and LGSP will thus provide shielding of the tank contents.

1.2.7.7 The design parameters for the PASS Waste Tank are given in the attached Table 3 (Item 3).

1.2.8 PASS Waste Transfer Pump

1.2.8.1 A new PASS Waste Transfer Pump will provide the motive force to empty the PASS Waste Tank of its contents during typical operation. For post accident operation the Waste Transfer Pump will discharge to the Containment 'A' Sump. This will be accomplished by pumping in the reverse-to-normal flow direction through the Containment 'A' Sump Pump discharge line (Penetration No. 107).

1.2.8.2 The PASS Waste Transfer Pump will also have the capability to discharge to the plant liquid radwaste system when used during normal operation.

1.2.8.3 The design parameters for the PASS Waste Transfer Pump are given in the attached Table 3 (Item 4).

1.2.9 PASS Waste Tank Evacuating Compressor

1.2.9.1 A new PASS Waste Tank Evacuating Compressor is provided to maintain the PASS Waste Tank at atmospheric pressure to ensure adequate gravity drainage from the LGSP.

1.2.9.2 The evacuating compressor will discharge to the containment during post accident operation since the process stream could contain post accident gases which evolve from the reactor coolant.

1.2.9.3 During normal, non-post accident operation, the tank is vented to the Intermediate Building HVAC system via the LGSP plenum.

1.3 Performance Requirements

1.3.1 The new PASS shall be capable of extracting and analyzing the samples indicated in the attached Table 1. The samples must be obtained and analyzed within three hours of the decision to sample.

1.3.2 The analytical parameters and ranges of the instrumentation for in-line measurement are given in Table 3 (Item 1).

1.3.3 The PASS shall be capable of obtaining diluted (Approx. 1000:1) post accident reactor coolant, containment sump, and containment air samples for isotopic analysis or off-site shipment.

1.3.4 During normal operation the PASS can be used to obtain undiluted reactor coolant dissolved gas grab samples from a gas sample bomb.

1.3.5 The PASS shall have the ability to extract the sample in Table 1 while minimizing operator exposure. This shall be accomplished by a combination of shielding, remote/automatic operation, and by minimizing the time necessary to perform the sampling procedure.

1.3.6 The total dose that a single operator can receive while obtaining and analyzing a single sample is 5 Rem whole body and 75 Rem to the extremities.

1.3.7 The dose to the operator must include:

1. High radiation levels from sample lines

2. High radiation levels from other equipment which may be post accident sources including containment shine.

3. Exposure while entering and exiting the sample area

1.3.8 The PASS shall be capable of operating during normal and post accident conditions (pressure, temperature,

and radiation) in the reactor coolant system and the containment atmosphere.

1.3.9 The LGSP will contain provisions for connection to a portable chloride analyzer in the event a post accident chloride analysis is required. These connections will also be used to obtain undiluted liquid samples during normal operation.

1.4 Control

1.4.1 Control and readout for the PASS shall be from a new Electric Control Panel (ECP) and Instrument Panel (IP) located in the Hot Shop.

1.4.2 The PASS does not require tie-in to the stations safety buses. A reliable source of normal AC power can be utilized.

1.4.3 The PASS ECP will contain controls for the remote operation of the LGSP.

1.4.4 The PASS IP will contain the readout devices for the in-line instrumentation located in the LGSP.

1.4.5 Calibration solutions and gases for the in-line instrumentation in the LGSP will be controlled from the IP.

1.4.6 Components of PASS which are external to the LGSP will also be controlled from the ECP. This includes the Waste Tank and Transfer Pump controls, the Evacuating Compressor controls, tie-in valve controls.

1.4.7 Controls for the existing sample line containment isolation valves associated with the PASS operation will be from existing control stations, e.g., the main control room or the primary sample room panel.

1.5 Modes of Operation

1.5.1 The operation of the PASS is remote, manual. The system will be designed to obtain and analyze a sample within three hours of the decision to obtain a sample.

1.5.2 The PASS may also be used by plant chemistry personnel during normal operation to perform routine chemical analysis of reactor coolant and containment atmosphere samples.

1.5.3 Interlocks will be provided to prevent post accident sample solutions from being routed to the station liquid radwaste system or volume control tank.

2.0 Referenced Documents

The following documents are referenced herein. Their applicability or requirements for design are as specified in this criteria document.

2.1 USNRC Regulatory Guide

2.1.1 No. 1.4, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Pressurized Water Reactors, Rev. 2, 1974.

2.1.2 No. 1.21, Measuring, Evaluating and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Rev. 1, 1974.

2.1.3 No. 1.26, Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants, Rev. 3, 1976.

2.1.4 No. 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident, Rev. 2, December 1980.

2.1.5 NUREG-0578, TMI-2 Lessons Learned Task Force Status Report and Short Term Commendations, 1979.

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

2.1.7 No. 1.29, "Seismic Design Classification," Rev. 3, September 1978.

2.1.8 No. 1.48, "Design Limits and Loading Combinations for Seismic Category I Fluid System Components," May 1973.

2.1.9 No. 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plans," Rev. 1, December 1973.

2.1.10 No. 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," October 1973.

2.1.11 No. 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis, "Rev. 1, February, 1976.

2.1.12 No. 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants, Rev. 1, August 1977.

2.2 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code - 1980 Edition with Addenda through Winter 1980.

Section III - Nuclear Power Plant Components

Section V - Nondestructive Testing

Section VIII - Pressure Vessels, Division 1 & 2

Section IX - Welding and Brazing Qualifications

2.3 American National Standards Institute (ANSI)

2.3.1 ANSI N45.2.1 - 1973, "Cleaning of Fluid Systems and Associated Components During Construction Phase of Nuclear Power Plants".

2.3.2 ANSI N45.2.2 - 1972, "Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants".

2.3.3. ANSI N45.2.3 - 1973, "Housekeeping During the Construction Phase of Nuclear Power Plants".

2.3.4 ANSI N45.2.8 - 1975, "Supplemental Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems for the Construction Phase of Nuclear Power Plants".

2.3.5 ANSI N13.1

2.3.6 ANSI 18.2

2.3.7 B16.5 Steel Pipe Flanges and Flanged Fittings, 1980.

2.3.8 B31.1 Power Piping, 1980.

2.4 Institute of Electrical and Electronic Engineers (IEEE)

2.4.1 IEEE-323-1974, "Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations".

2.4.2 IEEE-344, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Operating Stations, 1975.

2.4.3 IEEE-383, Standard for Type Test of Class 1E Electrical Cables, Field Splices and Connections for Nuclear Power Operating Stations, 1974.

2.4.4 IEEE-384, Standard Criteria for Independence of Class 1E Equipment and Circuits, 1977.

2.5 American Institute of Steel Construction (AISC) "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," November 1, 1978.

2.6 American Concrete Institute (ACI)
ACI Standard 318-77, Building Code Requirements for Reinforced Concrete, 1977 Edition.

2.7 Tubular Exchange Manufacturer's Association (TEMA), TEMA Standards, 1978 Edition.

2.8 Rochester Gas & Electric Fire Protection Evaluation, Gilbert Associates, Inc. Report 1936, March 1977.

2.9 American Welding Society (AWS) D1.1, Structural Welding Code, 1981.

2.10 National Electric Code, 1978.

2.11 Final Safety Analysis Report for the Ginna Station

2.12 Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems which may be used in Post Accident Operations Outside Containment at R.E. Ginna Nuclear Power Plant, December, 1979.

2.13 NRC Fire Protection Safety Evaluation Report for Ginna Station and supplements, February 14, 1979, Docket 50-244.

3.0 <u>Seismic Category</u>

3.1 The new PASS is classified non-seismic except for the component cooling water and V.C.T. purge line tie-ins which are seismic Category I. The isolation relays to obtain the position indication for existing reactor coolant sample line containment isolation valves will be housed in a seismic Category I supported electrical enclosure.

3.2 All equipment supports for the PASS will be analyzed for seismic loadings to preclude gross failure which could damage nearby safety related components. The Electric Control Panel (ECP) and Instrument Panel (IP) will not be analyzed for seismic loadings since they are to be located in the Hot Shop.

3.3 The existing primary sample system is defined as non-seismic in the Ginna FSAR (Reference: FSAR Section 9.4) at all points of tie-in to the PASS, except for the existing component cooling water system, existing sample coolers shell side, and liquid/gas sample lines up to the containment isolation valves. The tie-in to the V.C.T. for sample purge is also seismic.

4.0 Quality Group

4.1 Consistent with Regulatory Guide 1.26 the new PASS system components are assigned Quality Group D except for the component cooling water tie-in up to and including the tie-in automatic isolation valves which are Quality Group C, and the tie-in valve to the V.C.T. for purging which is Quality Group B.

5.0 Code Class

5.1 The new PASS components are non-ASME III code except for the component cooling water tie-in up to and including the remote operated automatic isolation valves on the supply and return headers, and the tie-in to the V.C.T. for purging. The component cooling water isolation valves will be ASME III, Class 3. The V.C.T. line tie-in valve will be Class 2.

5.2 The new PASS Waste Tank is designed in accordance with ASME VIII, Division 1.

6.0 Codes, Standards, and Regulatory Requirements

The following requirements shall apply to the design and installation of the PASS.

6.1 The design, materials, fabrication, installation, examination and testing of the Quality Group B and C portion of the system shall be in accordance with the appropriate subsections of ASME Section III. The first seismic support beyond the safety related systems interfaced shall be included under this criteria. Field fabrication does not require stamping or third party inspection.

6.2 All seismic supports will be analyzed to Section NF of ASME III. Non seismic supports shall be designed in accordance with AISC. Field fabrication does not require stamping or third party inspection.

6.3 The materials, fabrication, installation, examination and testing of Quality Group D portions shall be in accordance with the appropriate sections of ANSI-B31.1, Power Piping Code, 1980.

6.4 Design activities of non-code items will be in accordance with ANSI-N45.2.11, 1974.

6.5 Base plate and expansion anchor bolt analysis will be performed using the criteria of NRC I.E. Bulletin 79-02, "Pipe Support Base Plate Design Using Concrete Expansion Anchor Bolts, dated March 8, 1979, in order to account for plate flexibility and bolt sizing loads.

6.6 Modifications and additions to concrete structure shall be designed and installed in accordance with the requirements of ACI 318-77.

6.7 Cleanliness of the PASS shall meet the requirements of ANSI N45.2.1 Class C to the extent practicable.

6.8 Housekeeping during construction shall be in accordance with the requirements of ANSI N45.2.3.

6.9 Installation of the PASS shall be in accordance with Sections 4 and 5 of ANSI N45.2.8.

6.10 Tubing within the LGSP is designed in accordance with ANSI B31.1.0.

7.0 Design Parameter

7.1 The PASS design parameters are given in Tables 1 and 2.

7.2 The PASS components design parameters are given in Table 3.

7.3 The PASS is shown in Figures 1 and 2.

8.0 Load Conditions

The following requirements shall apply to the design of the PASS.

8.1 The new PASS supports shall be designed to sustain loads due to seismic accelerations and displacements, weight, pressure, and thermal expansion, as applicable.

8.2 Mechanical component supports shall be designed to retain structural integrity following the SSE.

8.3 All non-safety related piping/tubing will be designed to maintain pressure retaining integrity during a SSE. Stress will be limited to the material yield strength. Normal loading conditions will be limited to the allowable in ANSI B31.1.

8.4 Seismic analyses shall be based on the damping values required by USNRC Reg. Guide 1.61.

8.5 The seismic analysis criteria of NUREG 75/087 Standard Review Plan Section 3.7.2 "Seismic System Analysis" dated November 24, 1975 shall be followed. Both dynamic and equivalent static load methods will be used

depending on the situation. When performing dynamic analysis the response spectrum method will be applied.

8.6 For piping systems equal to a greater than 2 inch diameter, support stiffnesses should be incorporated in the dynamic analysis modeling. When the equivalent static load method is used, supports shall be designed rigid to prevent response amplification. A component, equipment or support is considered to be rigid when the weight of the support and equipment can be accelerated in all three directions with an acceleration of 1 g. and have a frequency equal to or greater than 33 hertz.

8.7 The LGSP will be analyzed to insure the panel structure does not fail during a safe shutdown earthquake (SSE). If the fundamental vibration frequency is greater than 33 Hz., a static analysis will be performed using the maximum SSE accelerations of the floor at the attachment locations (zero period accelerations from the response spectra). If the fundamental vibration frequency is less than 33 Hz., a dynamic analysis will be performed using a nodal response spectra analysis. The instrument and control panels will not be analyzed since they will be located in a non-seismic area, the Hot Shop. Tubing within the LGSP is not seismically supported.

9.0 <u>Environmental Conditions</u>

9.1 The design conditions inside of the containment are as follows:

Pressure:	Atm to 60 psig
Temperature:	286^{o}F
Relative Hudmidity:	0-100%
Radiation:	2 x 10^{8} Rads, Integrated Dose

These are maximum design conditions which occur at approximately 1 minute after a loss of coolant accident.

9.2 The design conditions in areas outside of containment are as follows:

Pressure:	Atmospheric
Temperature:	50-104^{o}F
Relative Humidity:	0-100%

9.3 Components outside containment handling radioactive fluids/gases shall be capable of withstanding a two-year integrated dose of 1 x 10^{7} Rads. This value shall be used in design specifications as applicable. Components not in contact with process fluids but located in a radiation environment shall be capable of

withstanding 1 x 10^6 rads integrated dose except Teflon which is capable of withstanding 1 x 10^5 rads. All components containing Teflon are to be immediately flushed after service, and to be designed for easy changeout. The immersion dose to LGSP components are verified by calculation not to exceed 1 x 10^6 Rads.

10.0 <u>Interface Requirements</u>

10.1 Process

10.1.1 The PASS will interface with the existing reactor coolant sampling system and containment air sampling system. The containment sump sample will be obtained from the Containment Sump 'A'.

10.2 Structural

10.2.1 The 253'-6" elevation of the Intermediate Building will be the location of the LGSP. The loads imposed on the existing Intermediate Building floor will be analyzed to determine if additional reinforcement and/or bracing is required.

10.3 Mechanical

10.3.1 HVAC, component cooling water, demineralized water, plant air, for the PASS will interface with station facilities.

10.4 Electrical

10.4.1 Power for the PASS is to be drawn from nearby electrical supplies. It is not necessary to supply power from emergency buses.

11.0 <u>Material Requirements</u>.

11.1 Materials for the new PASS components are given in the attached Table 3.

11.2 In general, material in contact with the process sample fluid will be 300 series stainless steel. Portions of the system in contact with support services (e.g., component cooling, instrument air, HVAC) will be of the same material as the existing system.

11.3 Teflon or other elastomer valve packings are acceptable provided the potential for radiation damage and its consequences are assessed as acceptable. Those components containing Teflon shall be immediately flushable after contact with radioactive fluids.

12.0 Mechanical Requirements

12.1 The new PASS Waste Tank shall be provided with alternate means for fluid transfer such as a nitrogen displacement system.

12.2 Motor driven components of the PASS need not be served by electric power from an emergency bus. The pumps, evacuating compressors need not be redundant.

12.3 Piping, tubing and their supports shall be designed for normal process loads including thermal. Additional loading of seismic accelerations must be considered on pipe which, due to pipe rupture and pipe whip, may affect a nearby safety related system.

12.4 Isolation, throttling and waste valves for sample lines shall be selected to meet process requirements and to minimize crud traps.

12.5 Ventilation ductwork shall be galvanized sheetmetal constructed in accordance with the recommendations of SMACNA High Pressure Duct Construction.

12.6 Depending upon the process temperature, piping and ventilation ductwork shall be insulated for personnel protection, anti-sweat protection, or heat loss reduction.

12.7 Stainless steel, galvanized sheetmetal and non-ferrous alloy surfaces will not be painted. Other surfaces will be painted with inorganic base paints not susceptible to scaling or peeling.

12.8 Pressure relief protection shall be provided for the LGSP. Relief discharge shall be routed to the PASS Waste Tank.

12.9 Plenum exhaust is provided to collect leakage of radioactive gases from process equipment unless leakproof components are selected or if equipment is located in properly ventilated areas not requiring access during sampling operation.

12.10 The Pass Waste Tank shall have level control to start and stop the PASS Transfer Pump and to provide high and low level alarms.

12.11 The Pass Waste Tank shall have a rupture disc pressure relief which discharges to HVAC.

12.12 The Pass Transfer Pump shall be capable of discharging to the containment sump "A" or to the plant radwaste system.

12.13 The PASS Evacuating Compressor shall be capable of discharging to the containment. It will be controllable from the Waste Tank pressure transmitter.

13.0 <u>Structural Requirements</u>

13.1 Location and sizes of structural members shall be determined to support design loads except where shielding requirements dictate greater thickness or different location without jeopardizing the structural integrity.

13.2 Loads imposed by permanent and/or portable shielding must be factored into the evaluation of structural integrity of existing structures.

13.3 Effects of seismic accelerations on those PASS components which could potentially damage adjacent safety related systems or components shall be evaluated to assure that gross failures do not occur.

14.0 <u>Hydraulic Requirement</u>

14.1 Existing sample lines shall be utilized to the greatest extent practicable.

14.2 Pipe sizing shall be such as to assure sufficient velocity to minimize plateout in the lines and assure representative samples. The Reynolds number is to be in the turbulent zone throughout the system insofar as is practicable.

14.3 Pipe routing shall avoid deadlegs, low points, and other similar crud trap orientations.

14.4 Pipe sizing shall be such as to allow flushing of the line prior to drawing sample. Flushing flows shall be set at a rate so that representative samples will be available in about 10 minutes. Flushing flows will be about 1900 cc/min.

14.5 Containment sump sample line design must consider possible elevated sump temperatures, debris in sump, chemical contaminants in sump, possible containment pressurization, as well as negative (subatmospheric) pressure in containment.

14.6 The PASS Waste Tank shall be sized to hold waste from one sample acquisition which shall include at least three line purges from the sample source.

15.0 Chemistry Requirements

15.1 The purpose of the PASS is to determine the chemistry of the process fluids.

15.2 The PASS Waste Tank will collect potentially low quality water from the Containment Sump sample, and chemicals from instrument calibration. Waste from these operations should not normally be returned to the volume control tank.

16.0 Electrical Requirements

16.1 Power supply for PASS shall be 120V, 1Ø, 60Hz except for the evacuating compressor which shall be 480/3Ø/60Hz.

16.2 Power (120 V) shall be obtained from power panel 1A - circuit 11. 480 volt power will be supplied from (later).

16.3 Intraplant communications shall be supplied for the PASS.

16.4 Heat tracing with insulation will be provided on the containment air sample inlet line to prevent iodine plateout up to the LGSP. Heat tracing shall be set at 10°F above maximum containment temperature at t=1 hours after DBA. The heat tracing will be continuously adjustable from 0 to 400°F, and will be set at 296°F for post accident operation.

16.5 Electrical Power for the PASS need not be from an emergency bus.

17.0 Operational Requirements

17.1 The PASS is to be designed so that it can be used for both normal and post-accident sampling without requiring any modification to change service.

17.2 For the post-accident condition, in-line analyzers are to be provided for chemical analysis of the sample to minimize personnel exposure.

17.3 Post accident shielding is designed using the source term existing 1 hour after reactor shutdown.

17.4 Whole body dose rates to individuals from sample lines assuming normal plant conditions (up to 0.25 percent

fuel defects) will not exceed 100 mR/hr at 1 foot in normally accessable areas.

17.5 To reduce general radiation levels, flushing and degassing means for the waste tank, piping and other potential sources shall be provided.

17.6 The LGSP is designed with integral lead shielding of sufficient thickness to limit the direct radiation dose at one meter in front of the panel to be less than 100 mR/hr at t=1 hour from sources within panel, excluding backscatter and other background sources.

18.0 <u>Instrumentation and Control</u>

18.1 An Electric Control Panel (ECP) shall be provided to indicate the status of pumps, compressors and other machinery as well as indicate valve positions.

18.2 The PASS Waste Tank shall be provided with a means to monitor the accumulation of sample waste. High and low level alarms are to be provided as is pressure indication with high alarm.

18.3 Valve position indication of existing reactor coolant liquid containment isolation valves shall be indicated on the new panel board. Control switches for these valves shall remain in the control room and at a local station in the sample room.

18.4 Due to the highly radioactive nature of the process fluid, instruments shall be designed to minimize the amount of fluid necessary to perform a measurement.

18.5 Instruments shall be standard, commercially available devices modified as required for the service intended.

18.6 Controls and indicators are to be mounted on a remote panel located to minimize operator exposure. The controls shall be such that inline analysis of chemical parameters is completely remote.

18.7 The PASS Waste Tank will have level controls such that when the Transfer Pump switch is in the automatic position the Pump will start and stop automatically.

18.8 The PASS Waste Tank Evacuating Compressor will be controlled by the Waste Tank pressure when in the automatic mode.

18.9 Interlocks will be provided throughout the system to preclude post accident fluid from entering systems not

designed for post accident radiation levels (e.g. radwaste).

19.0 Access and Administration Controls

19.1 The PASS Electric Control Panel shall be accessible during the accident recovery phase.

19.2 The LGSP shall be accessible to the extent necessary to obtain a post accident diluted grab sample. Flushing provisions shall be incorporated to reduce radiation levels prior to approaching the LGSP. Crud traps are to be particularly avoided.

19.3 The sample piping is to be routed suitably to minimize personnel exposure. Where such routing is not practical, local shielding is to be provided.

20.0 Redundancy, Diversity, and Separation Requirements

20.1 Diversity in returning the sample waste to containment is provided by means of a transfer pump and alternately by nitrogen displacement.

21.0 Failure Effects Requirements

21.1 Although the PASS components are designated nonseismic (except for cooling water interfaces), equipment supports shall be analyzed and designed considering seismic loads to preclude gross failure of the fluid boundary or deleterious effects on nearby safety related systems.

21.2 System shall be designed such that operational failure of any component will not prejudice the shutdown of the sampling system and containment of the process fluids (liquid and gas).

21.3 Failure of the PASS will not effect any safety related system including containment isolation.

22.0 Test Requirements

22.1 Immediately prior to use of the system for post-accident sampling, the system shall be capable of being leak checked using air or nitrogen.

22.2 Built in calibration methods shall be provided for online chemical analysis equipment and the containment air gas chromatograph.

22.3 The PASS shall be hydrostatically tested in accordance with ANSI B 31.1, except for the portion of the system that is ASME III. Where hydrostatic testing is not practical, leak testing will be performed in accordance with ANSI B31.1. Testing of the code portion of the system will be in accordance with ASME Section III, Sub-Section "ND" Class 3 components.

22.4 The new PASS shall be functionally tested to verify proper operation of system cooler, waste tank and pump, evacuating compressor, and LGSP components. The PASS shall be tested to verify the analytical parameters of Table 3 are met.

23.0 <u>Accessibility, Maintenance, Repair and Inservice Inspection Program</u>

23.1 Fluid containing components of the PASS shall be flushed prior to maintenance. Flushing shall be accomplished from the remote Electric Control Panel.

23.2 Adequate space shall be provided around components for maintenance personnel to facilitate maintenance functions.

23.3 Access to existing plant equipment for routine maintenance shall not be adversely affected by the PASS installation.

24.0 <u>Personnel Requirement</u>

24.1 The design of the system requires only one operator to obtain and analyze samples with communication to the main control room.

25.0 <u>Transportability Requirement</u>

None

26.0 <u>Fire Protection Requirements</u>

26.1 Due to lack of combustible material in the PASS area, no automatic fire detection or suppression will be provided. Hand held portable fire extinguishers will be relied upon to handle any outbreak of small fires.

26.2 Pipe insulation will be fire resistant with a flame spread of 25 or less and a smoke developed rating of 25 or less.

26.3 The design of the new PASS shall, as necessary, be compatible with the present fire protection requirements as outlined in GAI Report 1936, and reference 2.13.

26.4 Cable shall meet fire retardent criteria of IEEE 383.

26.5 The electrical wiring of the LGSP, ECP, and IP will meet National Electric Code Standards.

27.0 Handling Requirements

27.1 The new PASS components and material to be used shall be shipped, handled, and stored in accordance with the appropriate requirements of ANSI N 45.2.2.

27.2 Level B requirements of ANSI N45.2.2 shall apply for all new electrical components with the exception of cable which shall meet Level C requirements.

27.3 Level B, C, and D requirements shall apply for other material and equipment and shall be indicated in the appropriate procurement documents.

28.0 Public Safety Requirements

28.1 Failure of any PASS components after an accident shall not result in Part 100 doses to be exceeded. On this basis the system is classified non-safety related.

29.0 Applicability

None

30.0 Personnel Safety Requirement

30.1 Shielding shall be provided for all equipment handling radioactive fluids under normal conditions to meet ALARA considerations. The design objective is to limit personnel exposure to 5 Rem per sample whole body and 75 Rem per sample additional to extremities to any individual operator during accident conditions.

30.2 Ventilation systems shall be provided to control and contain airborne radioactive releases. Hooded enclosures shall be provided as required.

30.3 Spills of fluids are to be controlled by use of curbs, drip pans or drains.

30.4 Grounding of electrical systems shall be provided.

30.5 Hot piping external to the LGSP, i.e., over 140°F, shall be insulated.

31.0 Unique Requirements

None

TABLE 1

PASS Functional Requirements

Sample Source[1]	In-Line Analysis for:	Grab Sample[2]
Reactor Coolant A) Pressurizer Vapor Space B) Pressurizer Liquid Space C) Hot Leg	Boron, pH, dissolved oxygen, dissolved hydrogen, conductivity, note[3]	Diluted (1000:1) grab samples (post accident Undiluted dissolved gas sample (normal operation) Undiluted reactor liquid sample (normal operation)
Containment A) Sump 'A'	Same as reactor coolant except dissolved O_2 and dissolved H_2, note[2(3)]	Diluted (1000:1) sample undiluted (normal operation)
B) Atmosphere	Hydrogen, Oxygen	Diluted (1000:1) sample

(1) Sample must be obtained and analyzed within 3 hours of the decision to sample.

(2) Grab samples to be used for isotopic analysis in the stations counting room or for off-site analysis.

(3) Connections are provided for chloride analysis by a portable instrument. These connections also used for obtaining undiluted samples during routine operation.

Table 2

PASS Sample Source Design

Parameters

	Pressure, psig	Temperature, °F
	Min./Max.	Min./Max
Reactor	200*/2485	140/680
Containment Sump 'A' (liquid)	Atm/60**	50/250
Containment Atmosphere	Atm/60**	50/286

* Detailed design will ascertain the lowest limit of pressure at which a sample can be obtained within the three hour time limit.

** Plus head of liquid

Table 3

PASS Component Design

Parameters

1. Liquid and Gas Sample Panel (LGSP), new Analytical Parameters

Parameter	Measurement Techniques	Range	Accuracy
LIQUID SAMPLES:			
pH	Probe	1-13	± 0.1 pH Unit
Conductivity	Probe	0.1-500 umho/cm	± 3%
Dissolved Oxygen[1]	Probe	0.01-20 ppm	±10%
Dissolved Hydrogen[1]	Gas Chromotograph	10-2000 cc/kg	±15%
Boron	Auto-titrator	50-6,000	±1%
GAS SAMPLES:			
Hydrogen	Gas Chromotograph	0-10%	±5%
Oxygen	Gas Chromatograph	0-30%	±5%

(1) Not required for sump samples.

Table 3 (Cont'd)

2. Sample Coolers, PAS-E-201 A, B, C, D; new

Quantity	4	
Type	coil-in-shell	
Design heat transfer, BTU/hr	51,395	
	Shell	Tube
Design pressure, psig	150	2485
Design temperature, ^{o}F	350	700
Design flow, gpm (Approx.)	10	0.1
Inlet temperature, ^{o}F	105	680
Oulet temperature, ^{o}F	152	120
Fluid circulated	C.C. Water	Sample
Material	A106GRB	Tp316SS
Design Codes	ASME VIII	ANSI B.31.1.0
Seismic Category	non-seismic	non-seismic

Table 3 (Cont'd)

3. Waste Tank, PAS-T-202; new

Quantity	1
Capacity, gal	18
Design pressure, psig	full vacuum to 150
Design temperature, °F	150
Operating pressure, psia	14.0 to 14.7
Operating temperature, °F	120
Material	ASTM A312Tp 316SS
Design Codes	ASME VIII
Seismic Category	non-seismic

4. Waste Transfer Pump, PAS-P-203; new

Quantity	1
Design Pressure, psig	150
Design temperature, °F	150
Design flow, gpm (Approx.)	1
NPSH available, Ft	24
Discharge pressure, psig	85
Material	ASTM A312 Tp 316 SS
Design Code	mnfr.stnd.
Seismic Category	non-seismic

Table 3 (Cont'd)

5. Waste Tank Evacuating Compressor, PAS-C-200; new

Quantity	1
Design pressure, psig	150
Design temperature, °F	120
Design flow, scfm	0.5 (min)
Suction Pressure, psia	14.0 to 14.7
Discharge pressure, psia	75
Material	SS
Design Code	mnfr. stnd.
Seismic Category	non-seismic

6. Containment Sump 'A' Sample Pump, PAS-P-204; new

Quantity	1
Design pressure, psig	150
Design temperature, °F (liquid)	250
Design flow, gpm (Approx.)	1
Discharge pressure, psig	50
Material	SS Tp 316
Design Code	mnfr. stnd.
Seismic Category	non-seismic
Radiation Qualification	N/A (air motor)