SNUPPS
Standardized Nuclear Unit
Power Plant System

5 Choke Cherry Road
Rockville, Maryland 20850
(301) 869-8010

June 21, 1984

Nicholas A. Petrick
Executive Director

SLNRC 84-0094 FILE: 0278
SUBJ: NUREG-0737 II.B.3, Post Accident Sampling Capability

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Docket Nos.: STN 50-482 and STN 50-483

References: 1. SLNRC 84-0074, dated April 24, 1984: Same Subject
2. Safety Evaluation Report Related to the Operation of Callaway Plant Unit No. 1, NUREG-0830, Supplement No. 3, May 1984

Dear Mr. Denton:

Reference 1 provided information to the NRC Staff regarding the capability of the SNUPPS plants - Callaway Plant Unit No. 1 and Wolf Creek Generating Station Unit No. 1 - to perform post-accident sampling in accordance with NUREG-0737, Item II.B.3. This issue is a License Condition for both SNUPPS plants. Based on the description of the subject review in Reference 2 and on additional discussions with the NRC staff, the need for further information has been identified in order to resolve this issue. Therefore, enclosed are 1) a revised Callaway Plant core damage assessment procedure which is based on a generic Westinghouse methodology previously approved by the NRC and 2) additional information regarding the capability of the SNUPPS Post Accident Sampling System (PASS) to perform in a postulated post-accident environment. Reference 1 previously addressed related issues regarding operational status of the PASS and training of personnel for PASS operation.

The enclosed information, together with the information provided in Reference 1, forms the basis for resolution of the License Condition for Callaway Plant and also for Wolf Creek - pending submittal of a Wolf Creek core damage assessment procedure.

Very truly yours,

NA Petrick

Nicholas A. Petrick

MHF/10b7
Attachment
cc: See Page 2

B001
1/1

cc:

G. L. Koester	KGE
D. T. McPhee	KCPL
D. F. Schnell	UE
J. Neisler/B. Little	USNRC/CAL
H. Bundy	USNRC/WC
B. L. Forney	USNRC/RIII
E. H. Johnson	USNRC/RIV

Enclosure 1

Core Damage Assessment Procedure

Attached is the Callaway Plant procedure for assessing core damage, EDP-ZZ-00005, Rev. 1. (The Wolf Creek Generating Station procedure will be submitted at a later date). This procedure is used in conjunction with the plant procedure for obtaining post-accident samples. Guidance for selection of sample locations is provided in the sampling procedure.

MHF/nldl0b17

Enclosure 2

Additional Information Regarding Post Accident Sampling System (PASS) Capability

The SNUPPS post accident sampling system (PASS) is an online automated system designed to provide immediate detailed analysis of liquid and gas samples. The system is capable of analyzing for radionuclides and various chemical species in reactor coolant, containment atmosphere and containment sump samples taken during normal and/or accident conditions. Sample collection and analysis is possible upon the decision to take a sample. Valving and sample flow control is performed by computer from a control panel located in the health physics area. This area is considered a vital area for which continuous occupancy is assured during accidents as described in Section 18.2.2 of the FSAR.

The PASS also can be used to take grab samples by automatic or remote manual methods and handle them by semi-remote manual methods in the event of failure of the on-line system. Redundant sample points are provided with sample isolation valves (i.e., containment isolation valves) powered via class IE redundant circuits to assure sample availability.

The on-line sampling capability includes analysis for:

Liquid Samples (reactor coolant and containment sump):

ANALYSIS	RANGE	SPECIFIED ACCURACY
Gross Radioactivity	10^{-3} μCi/cc to 10Ci/cc	Better than a factor of two
Gamma Spectrum	Isotopic Analysis	
Boron Content	0-6500 ppm	±2% at 6500 ppm ±5% at 500 ppm ±40% at 50 ppm
Chloride Content	0.1 to 20 ppm	±10% to 1 ppm, ±0.15 below 1 ppm
Conductivity	0.1 to 1000 μ mhos	±1% of full scale
pH	0-14	±0.1
Dissolved Oxygen	0-20 ppm	±1% of full scale
Dissolved Hydrogen	0-3000 cc/kg	±5% of measured value

Gas Samples (containment atmosphere):

ANALYSIS	RANGE	SPECIFIED ACCURACY
Gross Radioactivity	10^{-7} μCi/cc to 10^{5} μCi/cc	Better than a factor of two
Gamma Spectrum	Isotopic Analysis	
Hydrogen	0-10 Volume Percent	±2.5% full scale
Oxygen	0-30 wt %	±1% full scale

The results of the factory and site acceptance tests demonstrate that specified accuracy requirements are met.

The methods of analysis for samples are:

ANALYSIS	METHOD
Radioisotopic	Gamma Isotopic Analysis
Dissolved Oxygen	Amperometric (Current flow Proportional to oxygen conc.)
Dissolved Hydrogen	Thermal conductivity of degassed sample
Chloride	Specific ion
Boron	Neutron absorption
pH	Specific ion
Conductivity	Electrical conductance of the solution
Gaseous Oxygen	Amperometric

Radionuclide analysis for containment atmosphere, containment sump and reactor coolant is performed by an inline intrinsic germanium detector and associated multichannel analyzer. A rotating tungsten-alloy collimator is used to select the proper sampling geometry for the wide range of activities possible. Isotope identification and quantification are performed automatically. The concentration of a particular radioactive species is used to evaluate fuel performance during steady state operations and transients and to characterize fuel damage during accident conditions. The SNUPPS PASS was manufactured by Science Applications Incorporated and is comprised of the following analyzers.

COMPONENT	MAKE AND MODEL #
Radioisotopic	
High Purity Germanium Detector	Canberra
High Voltage supply	Canberra 3105
Preamps	Canberra 2001
Low LN_2 alarm sensor	Canberra 1786
Log Ratemeter	Tennelec TC595
Analyzer	Canberra Jupiter Series 80 MCA Series 80 Chassis 8683A 3 amplifiers/ADC 8623 PHA/LTC
Chemical Analyzers	
Dissolved oxygen	Beckman 7002
Dissolved hydrogen	Teledyne Analytical 225
Chloride	Orion Model 1617
Boron	SAI Model 804
pH	Foxboro E99
Conductivity	Beckman RA6X8
Oxygen	Beckman 7003

The safety grade containment atmosphere hydrogen analyzers belong to a different system. They are Comsip-Delphi K III's.

The SNUPPS PASS has been designed to function in both normal and post-accident environments. The radiation detection and analysis system, inline chemical analysis components, data aquisition hardware and software, and sample delivery systems are components that have been carefully selected from suppliers of products of proven capability and reliability.

The Orion chloride analyzer was tested with the standard NRC test matrix as identified in NRC Post Accident Sampling System NUREG 0737, II.B.3 Evaluation Criteria Guidelines. The boronmeter employed in the SNUPPS PASS is a fission counter which functions on the principle of neutron absorption and will not be affected by chemical interferences. The remaining inline analyzers are off-the-shelf analyzers widely used in the chemical and power industries. Their wide use and acceptance coupled with successful completion of the factory acceptance testing with the below listed chemical matrixes demonstrates the ability to perform their specific analysis. The SNUPPS PASS was tested during the factory acceptance tests with the following chemical matrixes:

	PASS TEST MATRIXES(1)		MATRIX CONSTITUENTS	
Analysis	Matrix #1	Matrix #2	Matrix #1	Matrix #2
Boron	1200 ppm	600 ppm	6.890 gm H_3BO_3	3.433 gm H_3BO_3
Chloride	10 ppm	5 ppm	0.0166 gm NaCL	8.25×10^{-3} gm NaCL
pH(2)	4.9	4.4	3.987×10^{5} gm NaOH	
Conductivity	33 umhos	17 umhos	In one liter at 25°C	In one liter at 25°C
DO_2	8 ppm	8 ppm		
DH_2	5 ppm	5 ppm		

NOTES: (1) The above sample matrixes possess chemical species (interfering ions) typical of the containment spray additives.

(2) Post-accident liquid samples will typically possess a pH greater than 7. The pH analyzer was tested during the factory acceptance test with buffered solutions of pH 10 with acceptable results.

Based on the test of the chloride analyzer with the NRC Standard Test Matrix, it was determined that the silver chloride (AgCl) sensing element on the chloride electrode can become fouled by extended exposure to traces of iodide ion, I^-, iodate ion, IO_3^- and possibly other trace constituents of the sample, reagent, and standard solutions. The progress of the fouling is indicated by gradual decrease in the Nernst "slope" value. When this occurs the analysis is terminated and the system goes into the etch mode. This results in the pumping of etch solution, 1 M ammonium hydroxide and 10 ppm chloride to the Sensor Panel. When the ammonium hydroxide, NH_4OH contacts the chloride elecrode, the impurities, as well as some silver chloride, are removed

from the surface, resulting in a new electrode surface. An electrode can be restored over 50 times before actual replacement is necessary.

The SNUPPS PASS is controlled from a panel located in the health physics area which is below grade elevation in the control building. The health physics area is considered a vital area for which continuous occupancy is assured during accidents and has a dose rate less than 0.015 R/hr, as described in Section 18.2.2 and figure 18.2-7 of the FSAR. Only in the event of failure of the online system is the operator required to retrieve grab samples from the sampling cabinet for offline analysis. The grab sample system is designed so that operator doses will be as low as reasonably achievable and within limits specified in GDC 19. The provisions to minimize personnel exposure while retrieving grab samples are as follows:

1. The sample line sizes and component internal volumes were minimized to reduce the amount of radioactivity at the sample panel location.

2. The sample can be drawn automatically by operator selection at the remote panel, thereby minimizing operator time in the vicinity of the sample.

3. The sample lines within the sample panel are purged automatically after sampling with demineralized water, or instrument air as appropriate, including the connections to the cask and those on the cask itself.

4. Diluted or undiluted samples can be obtained.

5. The casks can be remotely disconnected from the panel.

6. The sample panel is shielded with lead.

7. The undiluted sample casks are heavily shielded and the transport cart is electrically powered with an 8 ft control cable to maximize distance between the source and the operator.

The design of the PASS is such that radiation sensitive components are removed from the sample panel where feasible and located in a lower radiation environment. Sample lines and holdup volumes were minimized to reduce the activity in the panel. Detailed dose calculations were performed for the sample panel using the high activity sources postulated post accident. As a result of these calculations worst case integrated doses were calculated for the electrical components in the sample panel. In all cases, the total dose to any electrical component was below its damage threshold. All wetted materials in the system were also reviewed in light of the high activity and care was taken to select only those materials suitable for this service.

The boronmeter and its associated electronics were included in the dose calculation analysis cited above. The large energy release per reaction (Neutron in U^{235}) makes it possible to discriminate the neutron flux in large gamma fields. The boronmeter vendor has determined that the maximum gamma dose rate (sample and background) to the fission counter to be 10^5 R/hr. This is well within the operational range of the detector. Additionally, the PASS boronmeter was placed in a hot cell to determine the effect of high gamma fields on the detector. Results showed that the dose rates anticipated will not adversely affect the boronmeter's ability to analyze a liquid sample post accident. As a result of this analysis and test the boronmeter is considered acceptable for operation in the high gamma fields post accident.

Based on the above mentioned design features, testing and analysis, the SNUPPS PASS has demonstrated its ability to adequately provide an accurate analysis of liquid and gaseous samples under post-accident conditions.

The SNUPPS PASS was designed for use during both normal plant operation and following postulated accidents. The procedures for sample analysis in a post-accident environment are identical to those used to obtain a PASS sample during normal operation with the exception of the need for additional emphasis on health physics requirements resulting from increased post-accident radiation levels. As discussed above, the PASS instrument accuracies will be maintained within required limits in the post-accident environment. Procedures for sampling in the post-accident environment, including obtaining grab samples, are practiced in conjunction with periodic emergency planning drills. The PASS sampling procedures were evaluated and found acceptable during the March 21, 1984 emergency planning drill at Callaway Plant.

MHF/nldl0b11-15