INDIANA & MICHIGAN ELECTRIC COMPANY

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June 27, 1986
AEP:NRC:0678V

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NUREG-0737, SECTION II.B.3
POST-ACCIDENT SAMPLING SYSTEM

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

Dear Mr. Denton:

Per Item I of our letter AEP:NRC:0678S, dated February 19, 1986, attached is a complete and detailed description of the Post-Accident Sampling (PAS) System relative to the requirements of NUREG-0737, Section II.B.3. As a result of the evaluation completed by NUS Corporation, we are requesting exemptions from NUREG-0737, Section II.B.3 for the following:

1. Undiluted backup grab samples for in-line monitoring.
2. Heat-tracing containment air sample line to prevent plate-out of iodine.
3. Transporting containment atmosphere sample for hydrogen analysis.

Our schedule for closing out NUREG-0737, Section II.B.3 (MPA #F-12) is dependent on the NRC's response to the above requests for exemption.

Pursuant to the requirements of 10 CFR 170.12(c), we have enclosed an application fee of $150.00 for review of this exemption request.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich BRS 6/25/86
Vice President

cm
Attachment
cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman

A047 1/1 w/check @ 150.00 #168-0227

D. C. COOK PLANT PAS PROGRAM

As a result of NUREG-0578, NUS Corporation was contracted in May 1980 to design and fabricate a post-accident sampling (PAS) system for the Donald C. Cook Nuclear Plant. In October 1980, during fabrication of the PAS panels, NUREG-0737 was issued. New requirements and clarifications for the PAS system were included in Item II.B.3. which had not been originally incorporated in the PAS panel design. These requirements specifically included chloride analysis of reactor coolant samples. Due to size constraints and stipulated installation deadlines, in-line chloride analysis could not be incorporated into the PAS sampling equipment.

Fabrication and testing of the equipment were completed in August 1981. The equipment was shipped in September 1981. Clarifications to NUREG-0737 Item II.B.3 were issued in June 1982 adding new requirements to the PAS system.

To comply with these requirements, several modifications to the PAS system were initiated. After completion of these modifications, NUS was contracted in 1985 to provide verification and compliance testing of the PAS system. This test work was completed in May 1986.

The results of this test work and review of the PAS system to meet the intent of NUREG-0737 have resulted in a request for the following exemptions from NUREG-0737:

1) Exemption from undiluted backup grab samples for in-line monitoring.

In-line monitoring for pH and dissolved oxygen and in-line degassing for dissolved hydrogen are preferable to and more accurate than grab sample analyses. To insure the functional capability of these in-line apparatus, a preventive maintenance program is performed semi-annually. Also, routine use of these systems is necessitated by the plant training program. If failure should occur during long-term post-accident conditions, the capability exists to flush all sample lines and replace the failed components.

2) Exemption from heat-tracing containment air sample line to prevent plate-out of iodine.

The PAS containment air samples are analyzed for isotopic noble gases and hydrogen only. Isotopic iodines and non-volatile fission products are analyzed in the reactor coolant and containment sump for assessment of core damage. Therefore, heat-tracing of the containment air sample line is not necessary and would serve no purpose.

3) Exemption from transporting containment atmosphere sample for hydrogen analysis.

The PAS system has the capability to obtain and analyze an undiluted containment atmosphere sample for hydrogen using an in-line gas chromatograph. Otherwise, containment atmosphere samples are diluted and transported to the counting facility

for noble gas analysis. Analysis of the diluted sample for hydrogen would not be within the range of the laboratory gas chromatograph.

PAS SYSTEM DESCRIPTION

The D. C. Cook Plant PAS system consists of a liquid and gas sample panel (LGSP), an Undiluted Liquid Sample Station (ULSS), and related control panels. The sample collection stations are located on elevation 587' of the auxiliary building. The sample analysis facilities are located on elevation 609' of the auxiliary building approximately 220' from the PAS sampling panel locations. Grab samples from either sampling station are removed by lead-shielded syringe and transported in a shielded container to the analytical facilities.

Time and motion studies have been conducted to verify that samples of reactor coolant and containment atmosphere can be obtained and analyzed within three hours from the time a decision is made to take a sample.

The PAS stations are powered from an emergency power supply or from the 250 V.D.C. station battery system, and therefore samples can be obtained during loss of offsite power. The samples requiring laboratory analysis can be analyzed only after offsite power is restored. Based on the number and high reliability of Cook Plant offsite power sources, the sample analysis can be made within the three hours from the time a decision is made to take a sample.

Table I shows the sampling and analytical capabilities of the PAS system. The system has provisions for sampling the locations shown in Table I for either unit following a LOCA.

PAS samples are collected in either the LGSP or the ULSS. The LGSP is designed for in-line analysis of undiluted samples and for dilution of grab samples. In-line analyses are provided for pH and dissolved oxygen measurements. Dissolved hydrogen in the reactor coolant is analyzed by an in-line gas chromatograph.

Dilution of liquid grab samples is performed by isolating a 10 ml sample of reactor coolant in the LGSP and diluting with 10 liters of demineralized water. Verification of the dilution factor was performed using lithium hydroxide and comparison of soluble isotopes I-131, I-133, I-135 and Na-24. A comparison of all isotopes (such as Cs-134, Te-129 and Sr-89) was not possible because of the low levels of radioactivity in the test data LGSP diluted samples. The mean dilution factor was determined to be 846.

The LGSP and ULSS have eight inches of lead shielding. The LGSP has a ventilation system to remove airborne radiation should a leak occur in the panel. This exhaust is filtered through a charcoal adsorber and a high-efficiency particulate filter into the auxiliary building ventilation system. The system is designed to obtain samples under LOCA conditions without exposing any individual to radiation in excess of 5 rem to the whole body and or 75 rem to the extremities.

The ULSS is designed to collect an undiluted reactor coolant sample from Hot Legs 1 or 3 within 96 hours of the accident. The sample is removed by a lead-shielded syringe in 30 days to provide backup chloride analysis.

The PAS system incorporates means for adequate purging of gas and liquid sample lines. The purge rates for liquid and gas samples are dependent on the pressure drop and driving force of each sample point.

The minimum purge time for the furthermost point (the Unit 2 Hot Legs 1 & 3)is approximately 5 minutes at 4 gpm. To minimize sample leakage, the sample lines up to and from the LGSP and ULSS are welded. Demineralized water or nitrogen is available to be used to flush all post-accident sample lines to minimize blockage. The LGSP liquid sample inlet filter can be back-flushed with demineralized water.

Sample purge and flush fluids are routed to a PAS waste collection tank, then pumped to the containment of the unit where the accident has occurred. These sample waste lines have remotely operated containment isolation valves to shut off waste flow if necessary.

All PAS valves not accessible after an accident have been modified to be environmentally qualified for conditions in which they must operate. To operate the three air-operated sample isolation valves inside containment, procedures provide for opening the instrument air containment isolation valves after a containment isolation signal has been initiated.

Comparison of analytical results of samples from the various locations can be used to evaluate sample representativeness and adequacy of mixing. In conjunction with this comparison, comparison of physical parameters, e.g., core temperature and reactor coolant system pressure, is available to further ensure that representative samples are being taken.

Process auxiliary systems carrying reactor coolant or containment atmosphere gases which are isolated post accident (i.e., the letdown system or the reactor water cleanup system) are not required to be placed in operation, but portions of the existing Nuclear Sampling System must be placed in service to obtain post-accident samples.

A PAS preventive maintenance program has been developed and will be performed every six months by an outside contractor, commencing approximately October 1986. This program includes service of all PAS components and comparison testing to normal sample data.

The PAS training program consists of classroom and on-the-job training. Qualification for the PAS System operation is performed by classroom and panel operation testing. Chemistry technicians are requalified every six months.

PAS ANALYTICAL CAPABILITIES

Table II depicts the analytical capabilities of the post-accident sampling system. Matrix testing for boron, dissolved oxygen, chloride and pH analysis were performed by NUS Corporation. A description of each analysis follows.

Boron

Boron analysis is performed using a fluoroborate selective ion electrode. The range of analysis is 375 to 2000 ppm boron with an accuracy of $\pm$ 11.4%. This range is adequate to confirm minimum shutdown margin during post-accident conditions.

Comparison testing showed the PAS analysis to be within 11.7% of the analysis of a normal (undiluted) sample.

Dissolved Hydrogen

Dissolved hydrogen analysis is performed by isolating 10 ml of undiluted reactor coolant in the LGSP. The sample is stripped and

degassed using nitrogen (revisions are to be made to use argon for this purpose) and collected in a 150 ml panel-mounted flask. (A design change currently being processed will substitute argon as the stripping gas.) The stripped gas is swept through the evacuated system into a Baseline Gas Chromatograph (GC). The hydrogen content is recorded on a strip chart.

The GC is calibrated over a 0-2000 cc/kg range. The accuracy of the GC was determined to be ± 11% for 15 cc/kg and ± 5.6% for 750 cc/kg. The comparison test showed the PAS analysis to be within ± 5 cc/kg of the analysis of a normal sample (40cc/kg).

Dissolved Oxygen

Dissolved oxygen analysis is performed using an in-line Yellow Springs Instrument dissolved oxygen probe and remote analyzer-recorder. The range of the analyzer is 0-20 ppm with an accuracy of ± 10%. A PAS analysis showed 2.4 ppm and 0.05 ppm compared to the analysis of a normal sample (2 ppm and 0 ppm, respectively).

pH

The pH analysis is performed using an in-line Horizon analog pH meter equipped with a gel-filled combination pH sensing electrode. The range of the analyzer is 0-14 pH with a accuracy of ± .15 pH units. Comparison testing with normal sampling analyses was within .01 to .05 pH units.

Chloride

Chloride analysis can be performed on a diluted reactor coolant grab sample within 96 hours of the initiation of the LOCA. The lower

limit of detectability is approximately 10 ppm using an Ion Chromatograph. Additionally, ULSS is used to obtain an undiluted backup grab sample from the reactor coolant Hot Legs 1 or 3 for chloride analysis. This sample is collected in an in-line 75 ml flask in the sample station. (A design change has been initiated to install the in-line flask which is on site. Presently, samples are collected in a 50 ml bottle inside a lead pig). Within 30 days, a sample can be obtained from the flask using a lead-lined syringe and analyzed in the Ion Chromatograph. The undiluted sample's lower limit of detectability is 10 ppb chlorides. Comparison testing could not be performed due to the low level of chloride in the reactor coolant.

Radionuclides

Radionuclide analysis of reactor coolant is performed on a diluted grab sample. The sample is removed using a lead-lined syringe and taken to the counting room for gamma analysis using the Series 85 MCA with pdp 11/24 computer and Ge(Li)/HPGe detector.

The detector is completely surrounded by a 4-inch-thick lead cave which acts as a shield from external radiation fields. The detector must be shielded, since at radiation fields greater than 10 mR/hr, the detector does not function properly. An external background radiation field of 50 mR/hr, the expected dose rate from unisolated letdown flow will be reduced by a factor of 5000 to approximately 0.01 mR/hr, which will not affect the operation of the detector. However, in the unlikely event of counting room ventilation failure, the airborne activity in the counting facility could potentially rise to a dose rate of up to 981 mR/hr. Therefore, samples could not be analyzed as the

dose rate inside the cave would exceed the 10 mR/hr operational limit for the detector due to airborne contamination. In that case, radionuclide analysis would have to be delayed until the condition was corrected.

The range of the counting equipment for radionuclides will be within the 1 uCi/g to 10 Ci/g with an accuracy of ± 10%. Dilution of PAS samples will reduce the activity to normal sample levels. Comparison to daily surveillance samples showed a deviation range from -7.7% to 10.5%.

Containment Atmosphere Noble Gas and Hydrogen

Analysis of noble gas from the lower containment atmosphere is performed on a diluted grab sample. Containment atmosphere samples are captured in the LGSP in either a 0.5 cc or 5.0 cc isolation chamber. The sample is then purged into an evacuated 1 liter panel-mounted vessel using argon for dilution. Samples are then removed from the vessel using a lead-shielded syringe and transported to the counting room for noble gas analysis.

The hydrogen analysis is performed on an undiluted containment atmosphere sample using the in-line Baseline Gas Chromatograph.

Gas dilution system testing was performed by NUS Corporation. The dilution factors obtained from the testing demonstrated a dilution of 1:225 for the 5.0 cc sample and 1:1997 for the 0.5 cc sample with an accuracy of -0.2% to +11.25%.

TABLE II

ANALYSIS	RANGE	ACCURACY	METHOD
Reactor Coolant			
Boron	0.375 - 2.0 ppm	± 11.4%	Fluoroborate Selective Ion Electrode
Dissolved Hydrogen	0 - 2000 cc/kg	± 5.6% > 50 cc/kg ± 11% < 50 cc/kg	Gas Chromatography
Dissolved Oxygen	0.1 - 20 ppm	± 10%	In-line probe
pH	0 - 14	± 0.15 pH > 5 < 9 ± 0.15 pH < 5 > 9	In-line probe
Chloride	$\geq$ 10 ppm (diluted) $\geq$ 10 ppb (undiluted)		Ion Chromatography
Radionuclide	1 µCi/g - 10 Ci/g	Factor of 2	Ge(Li) Detector
Containment Atmosphere			
Noble Gas	1 µCi/g - 10 Ci/g	Factor of 2	Ge(Li) Detector
Hydrogen	0 - 4%		Gas Chromatograph

TABLE I

SAMPLE LOCATION	RADIONUCLIDES	BORON	CHLORIDE	D.O.	D.H.	pH	H_2
Hot Leg 1 or 3	D,G	D,G	D or U,G	U,I	U,I	U,I	N/A
Pressurizer Steam Space	D,G	D,G	D,G	U,I	N/A	U,I	N/A
RHR E or W	D,G	D,G	D,G	U,I	N/A	U,I	N/A
Lower Containment Sump	D,G	D,G	D,G	U,I	N/A	U,I	N/A
Lower Containment Atmosphere	D,G	N/A	N/A	N/A	N/A	N/A	U,I

N/A Not Applicable
G - Grab Sample
I - In-Line Analysis
D - Diluted
U - Undiluted
D.O. - Dissolved Oxygen
D.H. - Dissolved Hydrogen

DISTRIBUTION: w/o enclosure
Docket File
PRC System
NRC PDR
Local PDR
PWR#4 Rdg
BJYoungblood Rdg
MDuncan
DWigginton
OGC
ACRS (10)
JPartlow
BGrimes
EJordan
NThompson

June 24, 1986

DOCKET NO(S). 50-315/316

Mr. John Dolan, VicePresident
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

SUBJECT:
D. C. Cook Plant, Units 1 and 2

The following documents concerning our review of the subject facility are transmitted for your information.

☐ Notice of Receipt of Application, dated _____.

☐ Draft/Final Environmental Statment, dated _____.

☐ Notice of Availability of Draft/Final Environmental Statement, dated _____.

☐ Safety Evaluation Report, or Supplement No. _____, dated _____.

☐ Notice of Hearing on Application for Construction Permit, dated _____.

☐ Notice of Consideration of Issuance of Facility Operating License, dated _____.

☒ Monthly Notice; Applications and Amendments to Operating Licenses Involving no Significant Hazards Considerations, dated July 16, 1986. (See page 25770)

☐ Application and Safety Analysis Report, Volume _____.

☐ Amendment No. _____ to Application/SAR dated _____.

☐ Construction Permit No. CPPR- _____, Amendment No. _____ dated _____.

☐ Facility Operating License No. _____, Amendment No. _____, dated _____.

☐ Order Extending Construction Completion Date, dated _____.

☐ Other *(Specify)* _____

Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc: See next page

OFFICE	PWR#4/DPWR-A		PWR#4/DPWR-A				
SURNAME	MDuncan/mac		DWigginton				
DATE	07/22/86		07/22/86				

NRC FORM 318 (1/84) NRCM 0240

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