ILLINOIS POWER COMPANY

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CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

October 17, 1985

Docket No. 50-461

Director of Nuclear Reactor Regulation
Attention: Mr. W. R. Butler, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Clinton Power Station (CPS) Unit 1
TMI Action Plan Item II.F.1, "Additional Accident Monitoring Instrumentation"

Dear Mr. Butler:

In January, 1985, Region III of the Nuclear Regulatory Commission conducted an audit of TMI Action Plan Item II.F.1-Parts 1, 2, and 3, "Additional Accident Monitoring Instrumentation". During this audit, Illinois Power Company (IP) was requested to perform a line-by-line compliance analysis review to determine if variance requests for NUREG-0737 requirements were needed.

IP has completed the compliance analysis review and has identified the need for the following four variance requests:

1) Display units for Standby Gas Treatment System (SGTS) exhaust line and Heating Venting and Air Conditioning (HVAC) stack high-range noble gas radiation monitors.

2) Flow control device to maintain isokinetic sampling in high-range particulate and iodine radiation monitors.

3) Provisions to ensure that the iodine filters for the high-range radiation monitors are not degraded by moisture.

4) Low energy gamma response of drywell high-range radiation monitors.

IP has also identified two areas where additional variances may be needed. One concerns in-situ calibration of the high range gamma radiation monitors for the drywell and the other concerns the sample line iodine and particulate loss correction factors, as stated in Regulatory Guide 1.97, Revision 3, for the accident range gaseous effluent monitors. Variance requests, if necessary, on these two areas will be submitted by November 22, 1985.



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A discussion justifying Illinois Power's position concerning these variances from NUREG-0737 requirements is provided in the attachments. The information provided should properly justify relief from the NUREG-0737 requirements. Please notify us at your earliest convenience if the enclosed information is adequate for your review and approval of these variance requests.

Sincerely yours,

F. A. Spangenberg

F. A. Spangenberg
Manager - Licensing & Safety

JBD/jkp

Attachments

cc: Mr. B. L. Siegel, NRC Clinton Licensing Project Manager
NRC Resident Office
Regional Administrator, Region III USNRC
C. F. Gill, Region III USNRC
Illinois Department of Nuclear Safety

# VARIANCE REQUEST

## Display Units for SGTS and HVAC Stack High-Range Noble Gas Radiation Monitors

### System Description

Illinois Power Company will utilize Eberline AXM-1 Radiation Monitors to meet the requirements of TMI Action Plan Item II.F.1(1), "Noble Gas Effluent Radiation Monitoring". The AXM-1 radiation monitors will provide the capability for continuous accident range noble gas monitoring of the Standby Gas Treatment System (SGTS) exhaust line and the Station Ventilation (HVAC) stack effluents.

The sample is drawn from the SGTS exhaust line or the HVAC stack by an isokinetic probe and transported to the AXM-1 grab sample pallet thru heat-traced 1" diameter tubing. A small portion of the flow is diverted at the grab sample pallet for particulate and iodine sampling. From the grab sample pallet, the main sample goes to the bulk filter assembly where iodine and particulates are removed. The sample is then cooled (SGTS monitor only) before passing thru a diaphragm pump and flow meter. The diaphragm pump forces the sample thru the noble gas sampler assemblies, SA-14 and SA-15, and returns it to the SGTS exhaust line or HVAC stack.

The SA-14 sampler assembly is an intermediate range detector assembly with a chamber volume of 2.7 liters and an energy compensated Geiger-Muller (G-M) tube at its center. The sample chamber is surrounded by 5" of lead shielding. The ranges for the SGTS and HVAC stack SA-14 sampler assemblies are $3.2 \times 10^{-4}$ to 3.9 to $10^{1}$ uCi/cc Xe-133 and $3.5 \times 10^{-4}$ to $4.6 \times 10^{1}$ uCi/cc Xe-133, respectively. The high-range SA-15 sampler assembly uses a 1" outside diameter tube viewed by an energy compensated G-M tube surrounded by 5" of lead shielding. The ranges for the SGTS and HVAC stack SA-15 sampler assemblies are $1.8 \times 10^{-1}$ to $1.0 \times 10^{5}$ uCi/cc Xe-133 and $2.1 \times 10^{-1}$ to $1.1 \times 10^{5}$ uCi/cc Xe-133, respectively.

The SA-15 lead shield contains a G-M tube to detect the background radiation level, which is subtracted from the detector readings to minimize the effects of background. The G-M tubes interface with a microprocessor in a data acquisition module which provides for communication between the AXM-1s and the radiation monitoring control terminals in the Main Control Room and the Health Physics office.

Problem

NUREG-0737, Item II.F.1(1), requires that the display units for the SGTS exhaust line and HVAC stack high-range noble gas radiation monitors be in units of Xe-133 equivalent uCi/cc or in actual uCi/cc. However, the Eberline AXM-1 monitor calibration data shows that the output is not proportional to either of these. Eberline generic calibration data for the high-range AXM-1 channel is as follows:

| | Count Rate Response at Detector | |
|---|---|---|
| | cpm/(uCi/cc) | cpm/( -Bq*-MeV/cc) |
| Xe-133 | 8.4 | $5.0 \times 10^{-3}$ |
| Kr-85 | 2.2 | $2.9 \times 10^{-2}$ |

The factor of 4 difference in the first column of count rates indicates that the monitor count rate is not proportional to actual uCi/cc. The factor of 6 difference in the second column of count rates indicates that the monitor count rate is not proportional to Xe-133 equivalent uCi/cc.

Illinois Power Position

To obtain readings in the desired units, Illinois Power Company intends to develop a time dependent correction factor curve to be included in the CPS emergency off site dose calculation procedure. The effluent radioactivity concentration will be obtained in the desired units by multiplying the monitor output by the correction factor.

The correction factor curve will be developed for a CPS design basis accident and will take into account the decay, composition, and energy of radionuclide noble gases as a function of time after an accident. It is IP's position that with the development of the correction factor curve, the design will meet the intent of this NUREG-0737 requirement.

* 1 Bq = 1 Disintegration Per Second

# VARIANCE REQUEST

## Flow Control Device to Maintain Isokinetic Sampling in High-Range Particulate and Iodine Radiation Monitors

### System Description

The Eberline AXM-1 Radiation Monitors described in Attachment 1 will also be used to meet the requirements of TMI Action Plan Item II.F.1(2), "Sampling and Analysis of Plant Effluents". The AXM-1s allow for sampling of the SGTS exhaust line and HVAC stack for post-accident releases of radioactive iodines and particulates.

As stated in Attachment 1, the sample is taken from the SGTS exhaust line or HVAC stack by an isokinetic probe and routed to the AXM-1 grab sample pallet. An extraction nozzle collects a sample at a rate of 1/60 of the main sample flow for iodine and particulate sampling. The small sample passes through an isolation valve and into the SA-16 sampler assembly which contains the particulate and iodine filters surrounded by 2" of lead. The sample then passes through a flowmeter and an isolation valve and then is recombined with the main sample flow.

The SA-16 sampler assembly is furnished with an energy compensated G-M detector which is utilized to indicate the relative amount of radiation present in the filters. The G-M tube interfaces with the microprocessor in the data acquisition module.

### Problem

NUREG-0737, Item II.F.1(2) requires that the design of systems for the sampling of iodines and particulates should provide for sample nozzle entry velocities which are approximately isokinetic with expected induct or instack air velocities. Flow control devices should have the capability of maintaining isokinetic conditions with variations in stack or duct design flow velocity of ±20%.

The isokinetic probes provided with the SGTS exhaust line and HVAC stack high- range radiation monitors are sized in accordance with the design basis post-accident stack flow rates. The capability to accommodate varying flow rates is not provided.

### Illinois Power Position

The CPS design is such that the SGTS exhaust line is expected to be the major source of post-accident radioactive airborne effluents. The requirement for the capability to accommodate varying flow rates for the SGTS exhaust line is not applicable because the SGTS is designed to maintain an approximately

constant flow rate in the SGTS exhaust line. Flow through this line comes from two redundant, safety-related exhaust trains, each of which can provide the required flow rate. Each SGTS train contains an automatic control damper for the purpose of maintaining a constant flow rate. Finally, the current CPS draft Technical Specifications (Section 3/4.6.6.3 provide for periodic verification that the flow rate is within specified limits (4000 cfm ±10%).

As stated above, the design sampling flow rate of the HVAC stack high-range radiation monitor provides isokinetic sampling of the HVAC stack for the design basis post-accident flow rate. This flow rate takes into account expected reductions from normal stack flow rate for a design basis accident (e.g., isolation of primary and secondary containment). Also, CPS is designed such that major post-accident releases are routed through the SGTS exhaust line rather than the HVAC stack.

It is important to note that deviation from isokinetic sampling by ±20% would result in a worst case sampling error of ±25% for very large particles and lesser errors for smaller particles, according to data in Appendix C of ANSI N13.1-1969, "American National Standard Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities". An error of less than 25% is acceptable in view of the accuracy requirement for comparable types of monitoring (e.g., Regulatory Guide 1.97, Rev.3, requires an accuracy of a factor of 2 for monitoring of noble gas effluents).

It is IP's position that compliance is provided for this requirement by sizing the isokinetic probe for the HVAC stack in accordance with the expected design basis post-accident flow rate and that accommodating flow variations of up to ±20% is not needed.

# VARIANCE REQUEST

## Provisions to Ensure that the Particulate and Iodine Filters for the High-Range Radiation Monitors are not Degraded by Moisture

### System Description

As described in Attachment 1, Clinton's SGTS exhaust line and HVAC stack high-range radiation monitors are provided with heat tracing which keeps the effluent sample in the sample lines above the dew point for worst case conditions. The sample lines are heat traced from the point of sampling (except for the portion of the HVAC system sampling line which is routed inside the HVAC stack) to the inlet of the AXM-1's grab sample pallets (GSP-1). The SGTS sample line heat tracing will keep the sample at 180°F. The HVAC stack sample line heat tracing is set for a temperature of 130°F.

As the sample enters the GSP-1 it passes through a shutoff valve and approximately 12 inches of 3/8 inch outside diameter tubing before reaching an isokinetic nozzle which draws 100 $cm^3$/min. from the main sample. The isokinetic nozzle is connected to the particulate/ iodine sample assembly (SA-16) by approximately 8-10 inches of 1/8 inch O.D. tubing. The SA-16 sampler assembly contains the particulate and iodine filters required for continuous sampling of post accident releases of radioactive iodines and particulates and is designed to allow quick removal from the GSP-1 for transportation to the laboratory for analysis.

### Problem

NUREG-0737, Item II.F.1(2), requires that effluent streams which may contain air with entrained water have provisions to ensure that the adsorber is not degraded while providing a representative sample. In addition, Region III requested that Illinois Power perform a thermal analysis to determine the necessity of identifying a variance from compliance with NUREG-0737, Item II.F.1(2). The thermal analysis is not a requirement of NUREG-0737, but was performed as a result of the NRC's safety inspection audit on a similar system at the Enrico Fermi Unit 2 Nuclear Power Station. The thermal analysis was performed for both Clinton's SGTS exhaust line and HVAC stack AXM-1s. The thermal analysis for the HVAC stack AXM-1 was conducted assuming worst case design basis characteristics of the HVAC stack effluent which is 90% relative humidity for air at 122°F.

Three different plant conditions were evaluated for the SGTS AXM-1. These three plant conditions are as follows:

1) Case 1 represents a high energy line break (HELB) in the secondary containment and yields the highest amount of condensation that can form in the sample line and SA-16 sampler assembly on the GSP-1. However, if no additional failures occur (other than the line break) and the line break is isolated via containment isolation valves, then Case 1 can be ignored because the SGTS and its associated AXM-1 will not be automatically initiated. The high humidity conditions inside secondary containment will be dissipated in 3-4 hours via the Fuel Building HVAC system.

2) Case 2 is where high humidity in the Fuel Building is caused by boiloff from the spent fuel storage pool subsequent to a Loss of Coolant Accident (LOCA) inside Drywell or Containment. In this case, SGTS and its associated AXM-1 will initiate on high drywell pressure or low reactor water level. Calculations show that the bounding humidity condition for the secondary containment is 95% relative humidity at an air temperature of 110°F. This condition assumes that the fuel pool cooling and cleanup pump motors are tripped when the pump room temperature exceeds qualification limits of 104°F.

3) Case 3 represents the maximum secondary containment conditions during normal operation and would be the initial conditions at the start of a LOCA. After initiation of a LOCA, secondary containment temperatures may increase but the moisture content of the sample should remain the same.

Assuming no additional plant failures for a HELB inside secondary containment, Case 1 can be ignored and the thermal analysis shows Case 2 to be the worst case for the SGTS AXM-1. Based on a conservative ambient temperature of 65°F and an effluent condition of 110°F at 95% relative humidity, water would condense in the sample line between the inlet to the GSP-1 and the SA-16 isokinetic nozzle at the rate of 13.4 $cm^3$/hr. An additional 0.31 $cm^3$/hr of water will condense inside the SA-16 sampler assembly. The thermal analysis for the HVAC stack AXM-1 shows that 2.3 $cm^3$/hr of moisture will condense in the sample line at the GSP-1 and that an additional 0.46 $cm^3$/hr will condense in the SA-16. This is based on a conservative ambient temperature of 65°F and an effluent condition of 122°F at 90% relative humidity. The above condensation rates in the SA-16 assume that a portion of the moisture condensed in the sample line upstream of the isokinetic nozzle is carried over to the SA-16 sampler assembly.

Illinois Power Position

The condensation rates determined in the thermal analysis are based on the expected maximum moisture content of the effluent streams and minimum ambient temperatures at the GSP-1s and are, therefore, conservative. Also, the air samples drawn by the SGTS AXM-1 will not contain as much moisture as stated because the

SGTS filter trains contain demisters to remove moisture. The thermal analysis did not take credit for the moisture removal capabilities of the demisters and thus, the calculated condensation rates are higher than what could actually be experienced.

The AXM-1s were furnished with Hollingsworth Vose type LB5211 filter paper. Hollingsworth Vose advised that an equivalent waterproofed filter paper, type 5212, can be used. The type 5212 filter has the same retention efficiency as the type 5211 and will not cause a significant increase in air flow resistance. Also, a 180°F sample temperature will not be a problem. Illinois Power Company will purchase the Hollingsworth Vose type 5212 waterproof filter paper or equivalent for use in the AXM-1s.

The SA-16 sampler assembly is furnished with a Triethylene Diamine (TEDA) impregnated activated charcoal iodine filter manufactured by Scott Aviation. However, Illinois Power will use Science Applications International Corp. (SAIC) or equivalent silver zeolite cartridges. SAIC was contacted to determine the effects of moisture condensation on Model GY-130 silver zeolite iodine filters. SAIC stated that their filters are batch tested at 95% relative humidity. If condensation occurs in the bed, the collection efficiency can be greatly diminished. The decrease in efficiency depends on the sample flow rate, temperature, exposure time and location of the moisture in the bed. Based on the inability to quantify the effects of condensation on the silver zeolite iodine filter, the reduction in efficiency due to condensation is not known. If moisture is discovered in the SA-16 sample assembly iodine filter cartridge, the measured release rate will be multiplied by a factor of 2 to account for any drop in iodine collection efficiency.

Most of the moisture that is condensed at the GSP-1 will be in the sample line between the entrance to the GSP-1 and the SA-16 isokinetic nozzle. Illinois Power Company will extend the heat tracing to include the above portion of sample line. Although this will probably not decrease the amount of moisture that is condensed in the SA-16 sampler assembly, it will prevent the potential for plugging the isokinetic nozzle or 1/8 inch O.D. tubing which draws a sample to the SA-16.

With the incorporation of the above procedural and design changes, Illinois Power Company believes that the intent of the NUREG-0737, Item II.F.1(2) requirement is met.

## VARIANCE REQUEST

### Low Energy Gamma Response of Drywell High-Range Radiation Monitors

### System Description

The Clinton Power Station Containment Atmosphere Monitoring System includes two drywell and two containment high-range gamma radiation monitors to meet the requirements of TMI Action Plan Item II.F.1(3), "Containment High-Range Radiation Monitors". The high-range gamma radiation monitoring subsystem consists of two redundant divisions which are physically and electrically independent. Each division provides the capability of monitoring and indicating high-range gamma radiation levels in the drywell and the containment.

Each radiation monitor consists of an electronic radiation detector and a readout monitor. The readout monitors are located on Main Control Room panels and are provided with indicators with a range of 1 to $10^7$ R/hr. Each monitor has a high gamma radiation level alarm, an alert gamma radiation level alarm, and a system failure alarm.

The containment radiation detectors are mounted at elevation 834' (6' above the refueling floor) and are located approximately 180° circumferentially from each other. The drywell radiation detectors are mounted inside thin-wall penetration sleeves at the approximate elevation of 798'. The two drywell detectors are located about 180° circumferentially from each other.

### Problem

NUREG-0737, Item II.F.1(3), requires that the radiation monitors provide a linear response (±20%) for gamma photons of 0.1 meV to 3 meV. As stated above, the two drywell monitors are installed inside thin-wall penetration sleeves. These sleeves attenuate low-energy gamma radiation. Calculations for the shielded drywell monitors show that the response is constant to within ±29% over the range 0.1 meV to 3 meV.

### Illinois Power Position

The calculations performed for the drywell radiation monitors show that the response is linear to within ±20% over the range of 0.12 meV to 3 meV. Illinois Power Company will develop a graphical time dependent correction factor to correct for the radiation monitor's underresponse to noble gases.