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October 15, 1984

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

Subject: Byron Generating Station Units 1 and 2
Braidwood Generation Station Units 1 and 2
Post Accident Sampling System
NRC Docket No. 50-454/455 and 50-456/457

Reference (a): T. R. Tramm letter to H. R. Denton
dated September 26, 1984

Dear Mr. Denton:

This is to request review and approval of several issues in connection with our implementation at Byron and Braidwood Stations of requirements set forth in NUREG-0737. These issues have been identified as open items in recent I&E Inspections at Byron Station.

Attachments 1 through 8 to this letter each present a separate area for review as follows:

Attachment 1: Discusses a proposed empirical determination of line loss correction factors for post accident iodine and particulate sampling.

Attachment 2: Discusses shielding for iodine sampling in conjunction with the calculatons presented in Reference (a).

Attachment 3: Requests waiver for Main Steam Line Monitor displays

Attachment 4: Requests a waiver for use of low range channel of the Wide Range Gas Monitor in release rate calculations.

Attachment 5: Requests a waiver for Wide Range Gas Monitor displays.

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Attachment 6: Discusses Heat Tracing on Sample Lines.

Attachment 7: Requests a Waiver for Containment High Range Radiation Monitor Calibration.

Attachment 8: Contains Proposed Replacement Pages to the FSAR Reflecting Use of the Noble Gas Monitor and the Containment High-Range Radiation Monitor Calibration.

Please address further questions regarding this matter to this office. One signed original and fifteen copies of this letter and the attachments are provided for NRC review.

Very truly yours,

David H. Smith
Nuclear Licensing Administrator

Attachments

cc: Byron - Resident Inspector
J. Streeter - RIII

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ATTACHMENT 1
Byron Nuclear Station
Unit 1

Empirical Determination of Line Loss Correction Factors for Post Accident Iodine and Particulate Sampling - Wide Range Gas Monitoring and Containment Air Sampling System

NRC Region III inspection reports 50-454/84-33, 50-455/84-26 and 50-454/84-54, 50-455/84-37 on Byron Station raise the issue of empirical determination of line loss correction factors for post accident iodine and particulate sampling. These specifically refer to Byron's Wide Range Gas Monitor and Containment Air Sampling Systems to-date. These inspection reports make specific reference to NUREG-0737 section II.F.1, Attachment 2. The Region III inspectors have taken the position that such empirical line loss correction factors are necessary.

Commonwealth Edison's review of NUREG 0737 reveals no specific or implied requirement for such empirical determinations. The only source of such a requirement is contained in Regulatory Guide 1.97 Rev. 3, May 1983, in a tabular footnote. The Byron FSAR commits Edison to revision 2 of this Regulatory Guide. The imposition of revision 3 requirements is, therefore, not appropriate in terms of the Byron operating license.

The imposition of empirical determinations relating the post accident (ie degraded core in the 0737 context) source terms is not technically feasible at this time. Neither the industry nor the NRC have progressed far enough in the on-going research into degraded core source term behavior to quantitatively specify iodine and particulate chemical and physical characteristics in sufficient detail for this purpose.

This research has been directed at the establishment of a technical state of knowledge sufficient to quantitatively model the relatively insensitive, macrocosmic interactions germaine to large scale fission product distribution and behavior (pertinent to containment failures) as a function of time. The time scales have typically been on the order of hours or tens of hours. Little or no available work has been published that is directly applicable to the much more sensitive arena of small scale interactions on short time frames associated with sampling. For example, the detailed chemical species associated with iodine alone are as much a matter of speculation as hard data. The effects of species prevelance and behavior, quantitatively, on line losses for sample lines with large length to diameter ratios has not been investigated. Similar arguements apply to the detailed physical characteristics of the various iodine species and to the chemical and physical nature of other sampled species. As a result of this, it is not feasible to establish a proposed source term for empirical determinations that has any firm basis in existing technical knowledge.

ATTACHMENT #1 (Continued)

Similarly, it is not feasible to establish such a source term for either analytical evaluations or for any kind of cross calibration with readouts from noble gas monitors. In the latter case, one might postulate that degraded core research should allow the noble gas releases to be correlated with the iodine and particulate releases on a macrocosmic level. This argument has an element of validity for any given degraded core scenario. However, it fails to stand up when the full spectrum of such scenarios is considered. The ratio, for example, of noble gases to other fission products released to the containment is by no means a constant for these scenarios.

Commonwealth Edison therefore proposes to delay any empirical determination of sampling line losses until such time as the ongoing industry and/or NRC research programs develop reasonably definative data sufficient for the development of the necessary source term. Given the current rate of progress in this area we do not believe that an undue time will pass before this work comes to fruition. In the interim, Commonwealth Edison will place the sampling systems into service and maintain them in accordance with the applicable technical specification requirements.

ATTACHMENT 2

Source Term to be Used to Gaseous Effluent Streams

NUREG 0737, Table II.F.1-2 specifies a source term to be employed in assessing the shielding envelope for gaseous effluent streams. As applied to Byron Station, this would pertain to the Wide Range Gas Monitoring System. The source term cited has been judged to be substantially more conservative than is necessary for safe operation. Commonwealth Edison has therefore proposed an alternate source term based on conservative but more realistic assessments. The use of more realistic assessments is expected to enhance the effective and timely acquisition of samples in the unlikely event of a degraded core accident.

Commonwealth Edison, as an active participant in the Industry Degraded Core Program, (IDCOR) has detailed analyses of a variety of degraded core scenarios which have been performed for the Zion Station. In an effort to develop a source term for this application Edison selected a full core melt scenario based on a transient initiator coupled with a full loss of all A.C. power and a full loss of all auxiliary feedwater capability. The IDCOR program has treated a number of scenarios for Zion and this selection is considered a worst case, baseline event. The source term from the IDCOR program was scaled up from Zion's power level to Byron's and additional margin was added to account for possible variations in containment failure mode details. Under the conditions of the scenario, releases into the auxiliary building would not readily reach the stack since the fans in the ventilating system would be inoperable. This would result in substantial fission product attenuation via aerosol settling. However, to develop the source term, an air flow in the auxiliary building comparable to post accident, fan supplied flow was assumed. This insures a rapid sweep of fission products to the monitoring system. The fission product concentrations were calculated and appropriate dose levels at the sample panel were then derived.

Edison believes that this alternative source term, although conservative, is substantially more effective in assessing the doses at the panel than the source term in NUREG 0737.

In reference (a) Commonwealth Edison requested permission to employ the alternate source term instead.

The calculations forming the basis for this request were submitted with Reference (a). Attachment 1 to Reference (a) contains an error. Part 5 of that attachment should read:

5. Assume Charcoal is 10% effluent for Iodines.

1.04E 0 uCi/cc x .90 = 0.936 mCi/cc Iodine Source Term

ATTACHMENT 3

Main Steamline Monitor Displays

A permanent waiver is requested for main steamline monitor displays to acknowledge the acceptability of main control room displays which include:

1. One RM-23 dedicated digital display for each train of four detectors reading in mR/Hr and located in the main control room.

2. Recording by the RM-11 digital data system of detector readings in mR/Hr and located in the main control room.

The detector readings in mR/Hr are used by station personnel in a station procedure to calculate the release rate from the steam generator atmospheric relief and the safety relief valves.

A permanent waiver is requested.

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ATTACHMENT 4

Low Range Channel of the Wide Range Gas Monitor

A waiver is requested for not including the low range channel of the GA Technologies, Inc. Wide Range Gas Monitor used on the Auxiliary Building Vent Stack in the release rate calculations of II.F.1, Attachment 1 Clarification 4(b). NUREG-0737 has been interpreted to not require the low range channel for post accident monitoring since it is the normal operation range and the mid and high range channels envelope post accident conditions. NRC I&E personnel have indicated that inclusions of the low range channel may not be necessary.

A permanent waiver is requested. If it is ruled that it is required, a variance for time is requested so that calculations and associated methodology for quantifying the post accident noble gas release rate can be prepared.

ATTACHMENT 5

Wide Range Gas Monitor (WRGM) Displays

A permanent waiver is requested from the requirement that the monitor display and recording be in terms of uCi/cc of Xe-133 equivalent or actual noble gas mix. The variance is requested to acknowledge the acceptability of main control room displays which include:

1. One RM-23 dedicated digital display for each WRGM capable of reading uCi/cc of pseudo noble gas for each of the three channels.

2. Recording by the RM-11 digital data system of detector readings in uCi/cc of pseudo noble gas.

The variance is requested because Commonwealth Edison Company's GSEP A Model is based on the use of a pseudo noble gas, GR-999, having E = 0.8 MeV per disintegration and a E_{max} = 1.68 per disintegration. The weighted sensitivities to this psuedo noble gas will be programmed into the RM-80 (WRGM microprocessor).

Calculations in the RM-80 using channel sensitivity and counts per minute will yield uCi/cc of psuedo noble gas. In addition, stack flow rate is available to the RM-80. The WRGMs RM-23 digital display located in the control room will be able to retrieve from the RM-80 the following informatin:

1. Counts per minute.
2. Concentration of psuedo noble gas (uCi/cc-GR-999).
3. Stack flow rate (CFM).

Time dependent correction factors are required to account for the aging of the actual mix relative to the psuedo noble gas. The manual application of the release rate correction factors to the above items 2 and 3 will yield estimates of concentration of actual noble gas mix and release rate, respectively.

In conclusion, a manual method for estimating the release rate of actual noble gas mix, based on information extracted from the RM-80 at the RM-23 and transferred to the Technical Support Center, upon request, and release rate correction factors already located at the TSC, will be available so that TSC personnel can estimate the noble gas release rate.

A permanent waiver is requested.

ATTACHMENT 6

HEAT TRACE ON SAMPLE PIPING

There currently is no heat trace on a short length of sample line in the Containment Air Sample Panel nor on the sample lines leading to the Wide Range Gas Monitor. Appropriate Heat Tracing will be installed upon both of these lines prior to exceeding 5% power.

ATTACHMENT 7

CONTAINMENT HIGH RANGE RADIATION MONITOR CALIBRATION

NUREG 0737, Table II.F.1-3 requires "calibration for each detector for at least one point per decade of range between 1R/hr. and 10^3 R/hr."

Each Containment High Range Radiation Monitor used at Byron was calibrated by the manufacturer at approximately 200 R/hr., 2000 R/hr., and 20,000 R/hr. rather than each decade between 1 R/hr. and 10^3 R/hr. The manufacturer performed necessary testing to comply with other pertinent sections of Table II.F.1-3 of NUREG-0737. Factory calibrations are supplemented by "in situ" calibrations (source calibrated at 2 points less than 10 R/hr. and electronically calibrated at each decade from 0.1 R/hr. to 10^8 R/hr.)

Byron Station concludes that the calibrations performed on the Containment High Range Radiation Monitors are adequate in demonstrating the proper operability of the monitors as intended by NUREG 0737 and is therefore requesting a deviation from the "word-for-word" NUREG 0737 requirement for a factory calibration for each decade between 1 R/hr. and 10^3 R/hr.

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ATTACHMENT 8

B/B-FSAR

E.30 ADDITIONAL ACCIDENT-MONITORING INSTRUMENTATION (II.F.1)

POSITION:

1. Noble Gas Effluent Monitor (II.F.1-1)

a. Auxiliary Building Vent Stack

Two General Atomic Company wide-range monitors will be installed the auxiliary building vent stacks (final release points), one monitor per stack. The monitor has a range for radioactive gas concentration of 1×10^{-7} uCi/cc to $1 \times 10^{+5}$ uCi/cc. The monitor is designed to meet IE requirements and is qualified to IEEE 323-1974. The wide-range gas monitor meets the requirements of Table II.F.1-1 of NUREG-0737. The monitor includes the following: two isokinetic nozzles, one for normal conditions operating at 2 ft^3/min and one for high range conditions operation at 0.06 ft^3/min. sampling rack (reference discussion of II.F.1-2); sample conditioner, operating only at high range conditions to filter out large concentrations of radioiodine and particulates; and the wide-range gas detectors assembly, consisting of three radioactive gas detectors, a low-range detector (Model Number RD-52-61), a mid-range detector (RD-72-01) and a high range detector (Model Number RD-72-02). Each monitor system has a microprocessor which utilizes digital processing techniques to analyze data and control monitor functions. Control room readouts include an RM-23 remote display module for all monitor parameters.

1. The calibration techniques and procedures including the energy dependence of the detectors will be provided to meet the requirements of NUREG-0737.

2. The monitors will receive power from ESF buses.

3. Post - Accident plant release rate calculations will be made using Station procedures and vent stack monitor readings.

b. Main Steamline

Two General Atomic Company RD-10B detectors will be provided for each of the four main steamlines upstream of the safety and relief valves. The range of the monitor is 1×10^{-1} uCi/cc to 1×10^{4} uCi/cc. The monitor is designed to meet 1E requirements and is qualified to IEEE 323-1974. The monitors will be mounted external to the main steamline piping and corrections made for the loss of low energy gammas.

The detectors are connected to local mounted microprocessors that collect and store data. Main control room mounted remote readout modules are connected directly to the microprocessors to provide information to the operator during and following an accident. The main steamline detectors readout continuously in mR/hr. Conversion of detector readings to release rate (uCi/sec) is accomplished through the use of a station procedure.

2. Sampling and Analysis of Plant Effluents (II.F.1-2)

The General Atomic Company wide range gas monitor includes a sampling rack for collection of the auxiliary building vent stack particulate and radioiodine samples. Filter holders and valves are provided to allow grab sample collection for isotopic analysis in the stations; counting rooms. The sampling rack is shielded to minimize personnel exposure. The sampling media will be analyzed by a gamma ray spectrometer which utilizes a Ge(Li) detector. Filter cartridges will be reverse blown with air to purge interferring noble gases.

3. Containment High-Range Radiation Monitor (II.F. 1-3)

In accordance with NUREG - 0737 the following required documentation items as listed in the NUREG are listed with the response for the Byron/Braidwood Stations:

1. The description of or name of manufacturer and model number of the monitors;

   General Atomic Company Model RD-23 high range radiation detector, Model RM-80 microprocessor and RM-23 remote display unit.

2. Verification that the monitors meet the specifications of Table II.F.1-3;

REQUIREMENT	The capability to detect and measure the radiation level within the reactor containment during and following an accident.
	Comply.
RANGE	1R/hr to 10^7 (gamma only).
	Comply.
RESPONSE	60 KeV to MeV photons, with linear energy response + 20% for photons of 0.1 MeV to 3MeV. Instruments must be accurate enough to provide useable information.
	Comply.
REDUNDANT	A minimum of two physically separated monitors (i.e., monitoring widely separated spaces within containment).
	Comply.
DESIGN AND QUALIFICATION	Category 1 instruments as described in Appendex A except as listed below.
	We assume Category 1 refers to Regulatory Guide 1.97, Rev. 2. The design of the high range containment monitors complies with the Category 1 instrument requirements of Regulatory Guide 1.97, Rev. 2

SPECIAL CALIBRATION

In situ calibration by electronic signal substitution is acceptable for all range decades above 10R/hr. In situ calibration for at least one decade below 10R/hr shall be by means of calibrated radiation source. The original laboratory calibration is not an acceptable position due to the possible differences after in situ installation. For high-range calibration, no adequate sources exist, so an alternate was provided.

A General Atomic Company RT-11 portable calibration source will be used for the first decade requirement. Additionally, electronic operability check is provided by means of an internal current source corresponding to 10^5R/hr.

SPECIAL ENVIRONMENTAL QUALIFICATION

Calibration and type-test of representative specimens of detectors at sufficient points to demonstrate linearity through all scales up to 10^6R/hr. Prior to initial use, calibration of coil detector for at least one point per decade of range between 1R/hr and 10^3R/hr will be certified.

The radiation detectors have been tested over a range of 43.5 KeV to 4.5 MeV and at 5.17 x 10^6R/hr. Sufficient tests have been performed to demonstrate linearity. Calibrations prior to initial use are performed by the manufacturer at 200 R/hr, 2000R/hr, and 20000R/hr to satisfy special environmental qualification calibration requirements.

3. Verification that the monitors will be operable on June 15, 1984;

The requirement, as stated in Enclosure 2 of NUREG-0737, of the implementation four months prior to issuance of an operation license will be met.

4. A plant layout drawing showing the location of the monitors.

Figures E.30-1 shows the locations of the detectors in both the Unit 1 and Unit 2 containments.