Docket Nos.: 50-528, 50-529 and 50-530

MAR 21 1984

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Mr. E. E. Van Brunt, Jr.
Vice President - Nuclear Projects
Arizona Public Service Company
Post Office Box 21666
Phoenix, Arizona 85036

Dear Mr. Van Brunt:

Subject: Kaman Instrumentation for Palo Verde

As a result of the staff's further review of the high range noble gas monitors (Kaman Instrumentation) for Palo Verde, we have determined that the instrumentation installed at Palo Verde does not meet the requirements of Item II.F.1 of NUREG-0737. The staff's evaluation is provided as Enclosure 1.

We request that you reassess your design for the high range noble gas monitors and that you inform us of how you will correct the deficiency noted in the enclosed evaluation. In addition, we ask that you advise us within two weeks of receipt of this letter as to when you plan to respond to this request.

If you have any questions regarding this request, you should contact Manny Licitra, the Licensing Project Manager.

Sincerely,

Original signed by:
George W. Knighton

George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

Enclosure:
As stated

cc: See next page

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EALicitra/yt
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GWKnighton
3/20/84

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Palo Verde

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POST-IMPLEMENTATION REVIEW OF NOBLE GAS EFFLUENT MONITORS (NUREG-0737, ITEM II.F.1, ATTACHMENT 1) INSTALLED AT PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 1

INTRODUCTION

Subsequent to the TMI-2 incident, the need was recognized for high range noble gas effluent monitors to detect and measure concentrations of noble gas fission products in plant gaseous effluents during and following an accident. Criteria for an acceptable monitoring system design are set out in NUREG-0737, Item II.F.1, Attachment 1, and Regulatory Guide 1.97, Revision 2. To meet these requirements, the applicant installed high range noble gas effluent monitors furnished by Kaman Instrumentation Company (Model KDGM-ER detector in model KSG-HRH sampler) in potential gaseous release points at Palo Verde, Unit No. 1 (plant vent, main condenser/gland seal exhaust, and fuel building vent). These high range noble gas monitors are described in detail in Section 11.5 of Palo Verde FSAR and in Section II.F.1 of Palo Verde Lessons Learned Implementation Report, dated May 24, 1982. The applicant stated in these sections that high range noble gas monitors meet the requirements set out in NUREG-0737, Item II.F.1, Attachment 1, and Regulatory Guide 1.97, Revision 2.

Meanwhile, the vendor (Kaman Instrumentation Company) learned that his monitors have an extreme photon energy dependence which makes them unable to detect or measure noble gas concentrations of 10^5 uCi/cc for photon energy above 80 Kev. The Kaman monitors are designed to meet the required 10^5 uCi/cc noble gas concentration based on Xe-133 photon energy of 80 Kev. Consequently, the vendor notified all their customers, including Palo Verde, through Bechtel Power Corporation, of the extreme photon energy dependence characteristics of the monitors and proposed the monitor design modifications to extend the range of detectable and measurable noble gas concentrations above 80 Kev photon energy.

During the course of preoperational inspection by Region V at Palo Verde, Unit No. 1, it was learned that the applicant is using the Kaman instrumentation to meet the requirements of II.F.1-1 of NUREG-0737. It was confirmed that (1) the applicant has not incorporated the design change proposed by the vendor, and (2) the vendor's calibration data has shown the high range of the effluent monitors to be extremely energy dependent.

Therefore, pursuant to the provisons of H. R. Denton's March 15, 1982 memorandum on technical assistance to the Regions, Region V requested that NRR review the technical adequacy of the high range noble gas effluent monitors installed at Palo Vérde, Unit No. 1, to meet the requirements specified in NUREG-0737, Item II.F.1, Attachment 1, for acceptance.

EVALUATION

The design basis maximum ranges for high range noble gas effluent monitors stated in the Palo Verde FSAR (10^5 uCi/cc) are based on isotopic calibration using high concentrations of low energy emitting (80 Kev) Xe-133 gas.

During our licensing review, the detailed calibration procedures were not questioned or reviewed since the applicant stated in the FSAR that the monitors meet the requirements set out in NUREG-0737 and Regulatory Guide 1.97, Revision 2.

However, Regulatory Guide 1.97, Revision 2, clearly states that noble gas effluent concentrations may be expressed in terms of Xe-133 equivalents or in terms of any noble gas nuclide(s) but the monitors should be capable of detecting and measuring effluent concentrations with compositions ranging from fresh equilibrium noble gas fission product mixtures to 10-day-old mixtures, with overall system accuracies within a factor of 2. The staff position and purpose of the high range effluent noble gas monitors are to detect and measure concentrations of noble gas fission products in plant gaseous effluents during and following an accident, and NUREG-0737, Item II.F.1, Table II.F.1-1, further stated that the decay of noble gases after an accident, as well as the distribution of noble gase changes, should be taken into account in the design of the monitors.

The staff obtained from the vendor the gamma energy response characteristic curves for the high range noble gas effluent monitor installed at Palo Verde, Unit No. 1 (Attachment 1), and that of the modified and proposed by the vendor (Attachment 2). The installed monitor energy response characteristics reveal an extreme energy dependency of approximately four decades (40 to 1.3×10^5 cpm per uCi/cc) over the 80 Kev to 3 Mev gamma energy range. The fresh equilibrium noble gas fission product mixtures with higher energy gamma emissions would saturate the detector during the initial hours following an accident causing no indication on instrument readouts.

The maximum noble gas concentrations that the installed monitor could detect and measure without the possibility of monitor saturation at various photon energy levels can be obtained by multiplying the ratios of two detector (installed and modified) efficiencies at a given photon energy with the maximum design noble gas concentration of 10^5 uCi/cc. For example, at a photon energy of 0.7 Mev per disintegration, the maximum noble gas concentration detectable and measurable is only 800 uCi/cc. Therefore, contrary to the statements in the FSAR, the monitors do not meet the requirements set out in NUREG-0737, Item II.F.1, Attachment 1 or range specification in Regulatory Guide 1.97, Revision 2. On the other hand, the modified detector described and proposed by the vendor (Attachment 2) has the energy response characteristics of a nearly linear 1.5 decade (35 to 650 cpm per uCi/cc) energy dependency over the same gamma energy range and meets the above requirements, and therefore would be acceptable.

CONCLUSION

Based on the foregoing evaluation, we find that the high range noble gas effluent monitors, as built and installed at Palo Verde, Unit No. 1, are not capable of detecting and measuring higher concentrations of all noble gas fission products in plant gaseous effluents during and following an accident, as specified in NUREG-0737, Item II.F.1, Attachment 1, and Regulatory Guide 1.97, Revision 2. Therefore, the monitors are not acceptable. Also, we find that the monitors with modified detector and sampler design by the vendor, as described and proposed in a letter to D. Gibson of Bechtel Power Corporation (Palo Verde Project) from D. Piraino of Kaman Instrumentation, dated November 9, 1983, are capable of meeting the requirements set out in NUREG-0737, Item II.F.1, Attachment 1, and Regulatory Guide 1.97, Revision 2, specifications. Therefore, the modified monitors would be acceptable.

ATTACHMENT 1

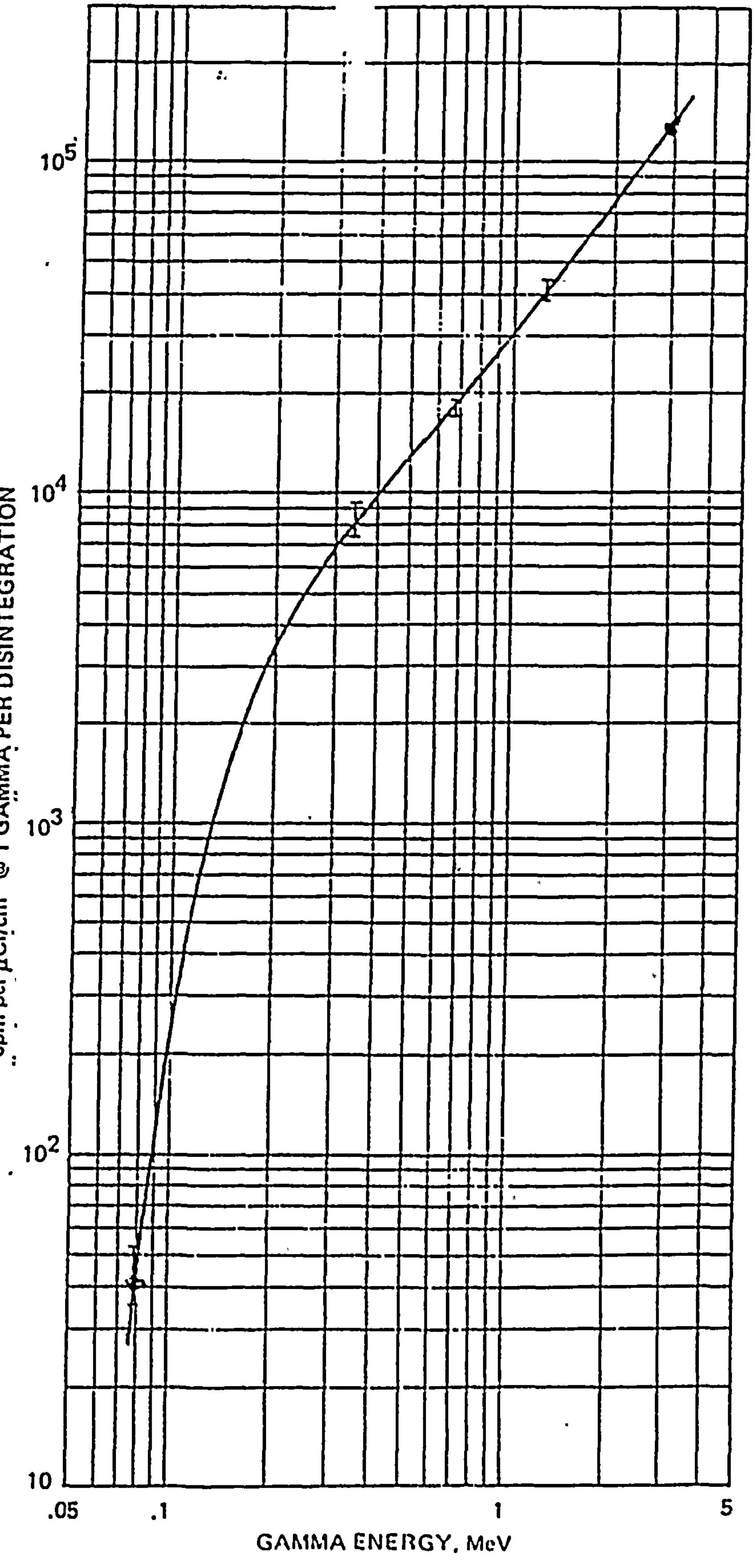

Figure 5. KDGM-ER DETECTOR IN KSG-HRH SAMPLER, HIGH RANGE POSITION ENERGY DEPENDENCE CHARACTERISTIC

ATTACHMENT 2

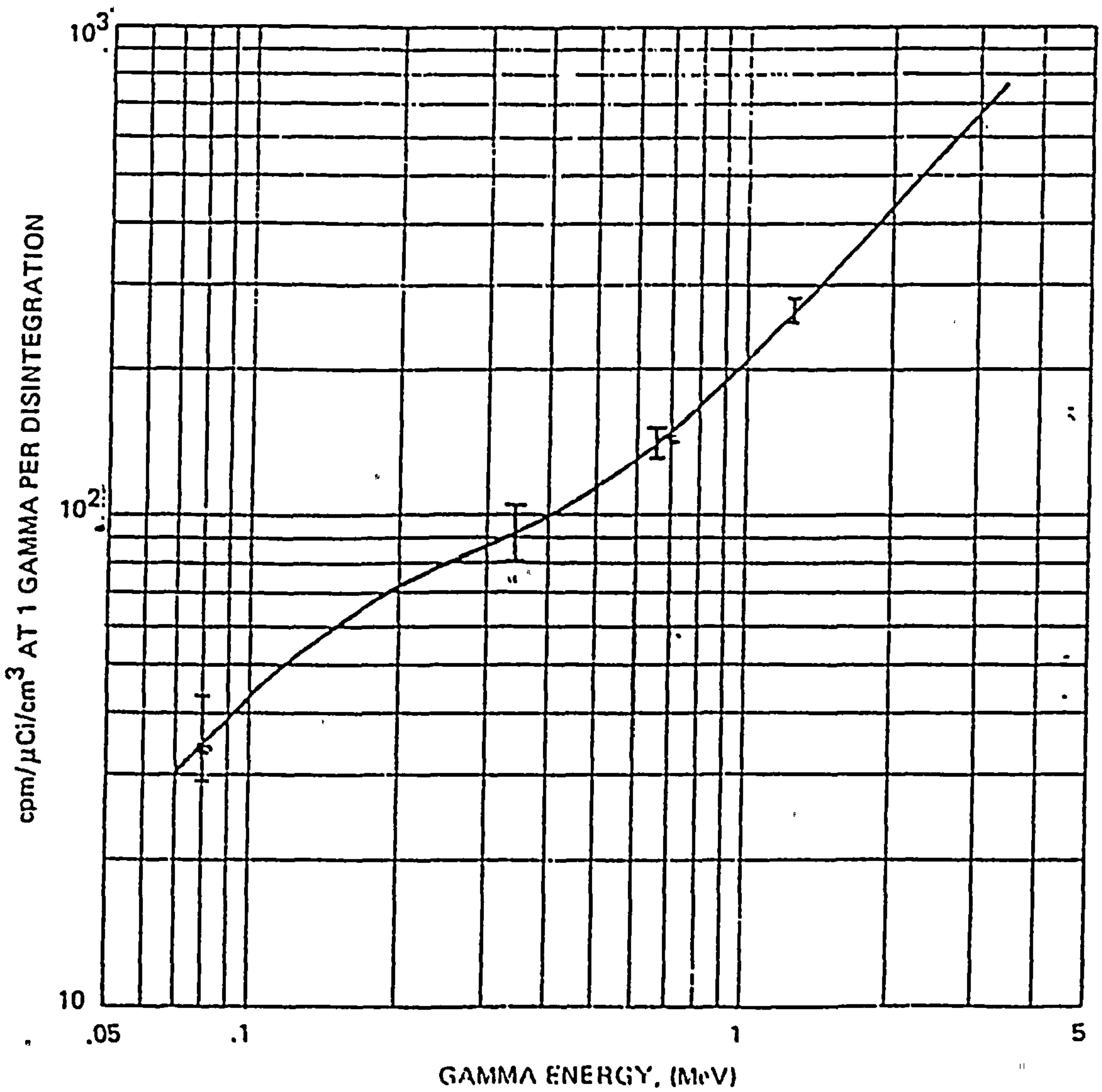

Figure 5. KDGM-ER ENHANCED DETECTOR IN KSG-HRH SAMPLER,
ENHANCED HIGH RANGE POSITION
ENERGY DEPENDENCE CHARACTERISTIC