TECHNICAL EVALUATION OF THE RESPONSE TO ATTACHMENT 1 OF ITEM II.F.1 OF NUREG-0737 "ADDITIONAL ACCIDENT MONITORING INSTRUMENTATION" FOR THE H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2 (DOCKET NO. 50-261)

BY

R. L. HUCHTON

EXXON Nuclear Idaho Company, Inc.
P. O. Box 2800
Idaho Falls, Idaho 83401

REFERENCE:

II.F.1-1 Noble Gas Effluent Monitor
H. B. Robinson submittal, E. E. Utley to H. R. Denton, 3 March 1981

INTRODUCTION AND BACKGROUND:

H. B. Robinson proposes the use of inline radiation detectors which are either internally (inline) or externally (online) mounted on the effluent duct to monitor noble gas releases from the plant. Detectors mounted externally to the duct would provide useful measurements of effluent releases for the first hours following an accident; however, the energy spectrum of effluent releases undergoes a change with time such that the average energy of the noble gases remaining, principally Xe-133, is very low and releases are not accurately detected by externally mounted detectors. A detector mounted inside a duct (inline) is considered acceptable for monitoring concentrations of noble gases from 10^2 µCi/cc to 10^5 µCi/cc provided the detector wall is sufficiently thin to detect low-energy, gamma radiation.

LICENSEE'S POSITION:

H. B. Robinson, in a letter dated 3 March 1981, states that detectors mounted either internally (inline) or externally (online) to the effluent duct will be used to monitor releases of noble gases. Use of either the internally or externally mounted detectors will be dependent upon the range of the monitor. This detector geometry is proposed versus offline monitoring where a continuous, representative sample of the effluent stream is counted by a detector away from the duct. CP&L does not consider the proposed mounting conditions to be a deviation from the NRC requirements and defines the term "inline" for clarification only.

DESIGN BASIS AND REVIEW CRITERIA:

The design basis and review criteria for this item is contained in Section II.F.1 of NUREG-0737, pages 3-94 through 3-99.

TECHNICAL EVALUATION:

NUREG-0737, Section II.F.1-1, requires licensees to provide noble gas effluent monitoring for the total range of concentrations extending from normal condition (as low as reasonably achievable- ALARA) concentrations to a maximum of 10^5 µCi/cc. The monitors must be capable of functioning both during and following an accident. Proposed system designs shall accommodate a design basis release and then be capable of following decreasing concentrations of noble gases. Systems utilizing detectors located internally (inline) to the duct are acceptable for monitoring noble gas effluent concentrations from 10^2 µCi/cc to 10^5 µCi/cc; however, offline sampling is considered necessary for accurately measuring noble gas concentrations below 10^2 µCi/cc. Because the monitors are intended to provide plant personnel and emergency planning agencies with effluent release data for determining subsequent actions, it is the NRC's position that no condition exist which could result in the detectors being off-scale.

Depending upon the effluent release path and the range requirements for the associated monitors, CP&L has proposed using detectors mounted either internally (inline) or externally (online) to the effluent duct being monitored. No offline sampling capability has been proposed. Although the licensee states the proposed systems do not deviate from the NRC requirements, as independent monitoring systems neither system has the capability of fulfilling the monitoring requirements of Section II.F.1.1 of NUREG-0737.

The use of monitoring systems employing detectors mounted externally to the effluent duct can provide reasonably accurate measurements of noble gas concentrations for the first hours following an accident. During this time the detector response from the fission product noble gases is due primarily to the high-energy, short-lived noble gases. With time, however, the energy spectrum changes and becomes dominated by the low-energy gamma emitters--primarily Xe-133. As this shift in the noble gas energy spectrum occurs, the contribution of the low-energy photon flux on the detector response increases. As a result, the attenuation of low-energy photons in the effluent duct materials and detector becomes important and can significantly affect the accuracy of the effluent release measurements.

For the effluent release pathways in which CP&L intends on using monitors that are mounted internally (inline), Section II.F.1-1 specifically states that such monitors are adequate for measuring release concentrations of noble gases between 10^2 μCi/cc and 10^5 μCi/cc. This holds true only for those detectors with walls sufficiently thin to respond to photon energies of 60 KeV. For noble gas effluent concentrations below 10^2 μCi/cc, the NRC holds that offline sampling is required in conjunction with the high-range, inline sampling system.

CONCLUSIONS:

It is the conclusion of this Technical Evaluation that the licensee, in order to comply with NUREG-0737, Section II.F.1-1, should provide a system capable of measuring noble gas effluent concentrations from normal operating condition (ALARA) concentrations to a maximum concentration of 10^5 μCi/cc. As presently proposed neither of the detectors mounted externally or internally to the effluent duct are sufficient as noble gas effluent monitoring systems to meet the requirements of NUREG-0737, Section II.F.1-1. For detectors mounted externally to the effluent duct, the attenuation of the low-energy, gamma radiation associated with the long-lived, noble gases precludes the capability of accurately measuring noble gas releases and is, therefore, unacceptable.

Inline detectors are considered appropriate for measuring noble gas concentrations between 10^2 μCi/cc and 10^5 μCi/cc provided the detector wall is sufficiently thin to respond to 60 KeV photons. However, offline sampling is required to monitor concentrations below 10^2 μCi/cc and is required in conjunction with the inline monitoring system to meet the range requirements of Table II.F.1-1.