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Washington Public Power Supply System

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REGION V I&E

June 27, 1985
G02-85-347

Docket No. 50-397

Mr. J. B. Martin
Regional Administrator
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596

Dear Mr. Martin:

Subject: NUCLEAR PLANT NO. 2
POSITION ON IODINE PLATE-OUT

Reference: I&E Inspection Report 85-20 Unresolved Item 04, dated June 13, 1985

As noted in the referenced report, additional information was required on the Supply System evaluation of iodine plate-out potential in the WNP-2 Post LOCA sampler. Additionally, in separate communication, Mr. G. Yuhas of your staff requested additional information on REA-SR-48. Accordingly, the attached information is provided.

Should you have any questions, please contact Mr. P. L. Powell, Manager, WNP-2 Licensing.

Very truly yours,

G C Sorensen

G. C. Sorensen, Manager
Regulatory Programs

PLP/tmh
Attachment

cc: JO Bradfute - NRC
WS Chin - BPA
E Revell - BPA
NS Reynolds - BLCP&R
AD Toth - NRC Site
G Yuhas - NRC RV

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WNP-2 POSITION ON IODINE PLATE-OUT

This report is submitted in response to IE Inspection 85-20 and a request for information on REA-SR-48, roof top sampler, by Greg Yuhas.

REA-SR-48 is an iodine gaseous effluent sampling system that must comply with the requirements of NUREG 0737 II.F.1, Attachment 2. REA-SR-48 samples reactor building effluent releases and is not a part of the Post Accident Sampling System (PASS) which is governed by NUREG 0737 II.B.3 requirements. REA-SR-48 is also governed by Regulatory Guide 1.97 as a Type E variable.

NUREG 0737 II.F.1, Attachment 2 requires continuous sampling of plant gaseous effluent for post accident releases of radioactive iodines and particulates in concentrations of up to 10^2 µCi/cc with a 30 minute sampling time and average gamma energy of 0.5 mev. The sampling system must have a 90% effective adsorption for all forms of gaseous iodine and a 90% effective retention for 0.3 micron diameter particles. Moisture entrained in the effluent stream should not degrade the adsorber, and provisions for limiting personnel exposure should be incorporated in the sampling system. The sampling system should provide for isokinetic (same velocity) sampling of particulates and iodine within ± 20% of in-duct air velocities during normal and accident conditions.

Regulatory Guide 1.97 specifies the same criteria as NUREG 0737 II.F.1, Attachment 2. An additional requirement is also added by Regulatory Guide 1.97, i.e., collection of representative samples should also include an evaluation of line losses or line deposition. Line losses or line deposition should be empirically predetermined and appropriate loss correction factors should be applied.

REA-RIS-19A and REA-RIS-19 provide the continuous iodine gaseous ioskinetic sampling of reactor building effluent releases during normal operation. During post accident conditions, the normal reactor building ventilation system isolates and standby gas treatment system (SGTS) processes all reactor building effluent prior to release. To provide accessibility to a reactor building effluent sampler during post accident conditions, a post-LOCA isokinetic sample system (REA-SR-48) was added on the turbine building roof. REA-SR-48 automatically initiates on a high-high radiation signal from REA-RIS-19, which is postulated to occur because of elevated concentrations of noble gases in the reactor building effluent during the postulated accident.

Both the normal and post-LOCA sampling systems use adsorber and particulate filters which meet or exceed the specified collection efficiency, 90% adsorption for all gaseous iodine and 90% retention for .3 micron diameter particles. Due to demister treatment in the SGTS, moisture is not entrained in the potentially contaminated reactor building effluent. The sampling system shielding and handling requirements are designed for continuous sampling of radioactive iodines and particulates based on the source term of 10^2 µCi/cc and a 30 minute sampling time with an average gamma energy of 0.5 Mev. The silver zeolite cartridge used exceeds the 90% iodine absorption criteria and reduces the retention of noble gases, thereby enhancing the effectiveness of the post-LOCA sampling system with respect to its designed use with a charcoal cartridge.

The line losses or line deposition determination required by Regulatory Guide 1.97 for the effluent release sampler has been done. The methodology recommended by the NRC for plate-out calculations has been used to determine the worst radiological source that can reach the standby gas treatment system for discharge into the release duct.

Appendix D of NUREG 0588, Rev. 1 specifies an acceptable methodology for determining the concentration of fission products in air, specifically referencing NUREG/CR-0009 as an acceptable method of determining elemental iodine plate-out. NUREG-0588, Rev. 1 allows the removal of elemental iodine by plate-out until the elemental iodine concentration is reduced by a factor of 200 (99.5% iodine loss). Using iodine plate-out for the design basis analysis requires an increase of the instantaneous released source from 100% of the noble gases and 25% of the core halogens to 100% of the noble gases and 50% of the core halogens. The Supply System has utilized the plate-out methodology recommended by the NRC in NUREG 0588, Rev. 1 and NUREG/CR-0009 to determine our source terms during the post-LOCA scenario as documented by the following portions of WNP-2 FSAR, App. J: Section 2.1.2, Tables 3.1, 3.3 and 3.4, App. B and App. F. Ignoring plate-out from sprays, the maximum allowable plate-out from natural convection (99.5% of the elemental iodine) occurs in approximately six hours due to the large amount of steel surface present in the drywell (3.2×10^7 cm^2, from WNP-2 FSAR, App. J, page B-14).

Iodine plate-out discussed in NUREG/CR-0009 is a natural phenomena that will occur regardless of the postulated accident scenario for releasing core halogens. Figure 1 depicts a simplified illustration of the flow paths that released core halogens must travel to reach the standby gas treatment system (SGTS) which exhausts into the elevated release duct. Based on the analysis that indicates 99.5% of the elemental iodine plates out within six hours and the torturous path with large metal surface areas that are exposed to iodine enroute to the SGTS, all plateable iodine will have been deposited on these surfaces prior to reaching the SGTS. The nonplateable balance of the iodines (.5% of the elemental and any other unplateable organic and inorganic forms) will be removed by adsorption in the charcoal beds of the SGTS prior to exhausting to the elevated release duct.

Therefore, the Supply System position is that no iodine will be released into the exhaust duct if all systems function as designed. However, even if the SGTS fails to function as designed, the iodine grab sample rack on the turbine building roof (REA-SR-48) will provide an accurate sample of the iodine released to the environment. The basis for this statement is that no plateable iodine remains in the effluent stream in the elevated release duct due to the natural convection plate-out of the elemental iodine prior to reaching the SGTS. The correction factor therefore should be 1.0.

The flow rate of the sampler (REA-SR-48) has been adjusted to ~0.05 cfm (~3 SCFH) to ensure that an isokinetic sample representative of the actual release through the duct will be collected. Collection efficiency for any iodine that may be in the sample is nominally greater than 99%. The counting efficiencies of the analyzers used to count the trapped iodine are known, and based on reasonable counting statistics, a known accuracy for quantifying any iodine releases can be obtained. As stated above, in the event of any iodine bypassing the SGTS, essentially no iodine will be lost from the sampled gases in the tubing during transit to the adsorber. The chemical form of any iodines that "survive" the trip from the fuel to reactor vessel, into containment, and through the SGTS, to the sample point in the elevated release duct will be a gaseous, nonplateable iodine species and will be effectively absorbed by the sampling media. Therefore, the Supply System's position

is that the currently installed iodine sampling capability for reactor building effluents is consistent with our NRC approved design basis and meets the requirements of NUREG-0588, Rev. 1; NUREG-0737; and Reg. Guide 1.97.

App. B, Item II.F.1.2 also specified use of a different radiological source term based on 50% plate-out to assure conservatism for determining the shielding and handling requirements for the radwaste and turbine building effluent sampling systems (see the attached revised FSAR response for clarification). The iodine plate-out assumed for this determination was conservatively selected to show that no shielding is required for the radwaste and turbine building sample holders, and was not provided to represent the Supply System position on iodine plate-out.

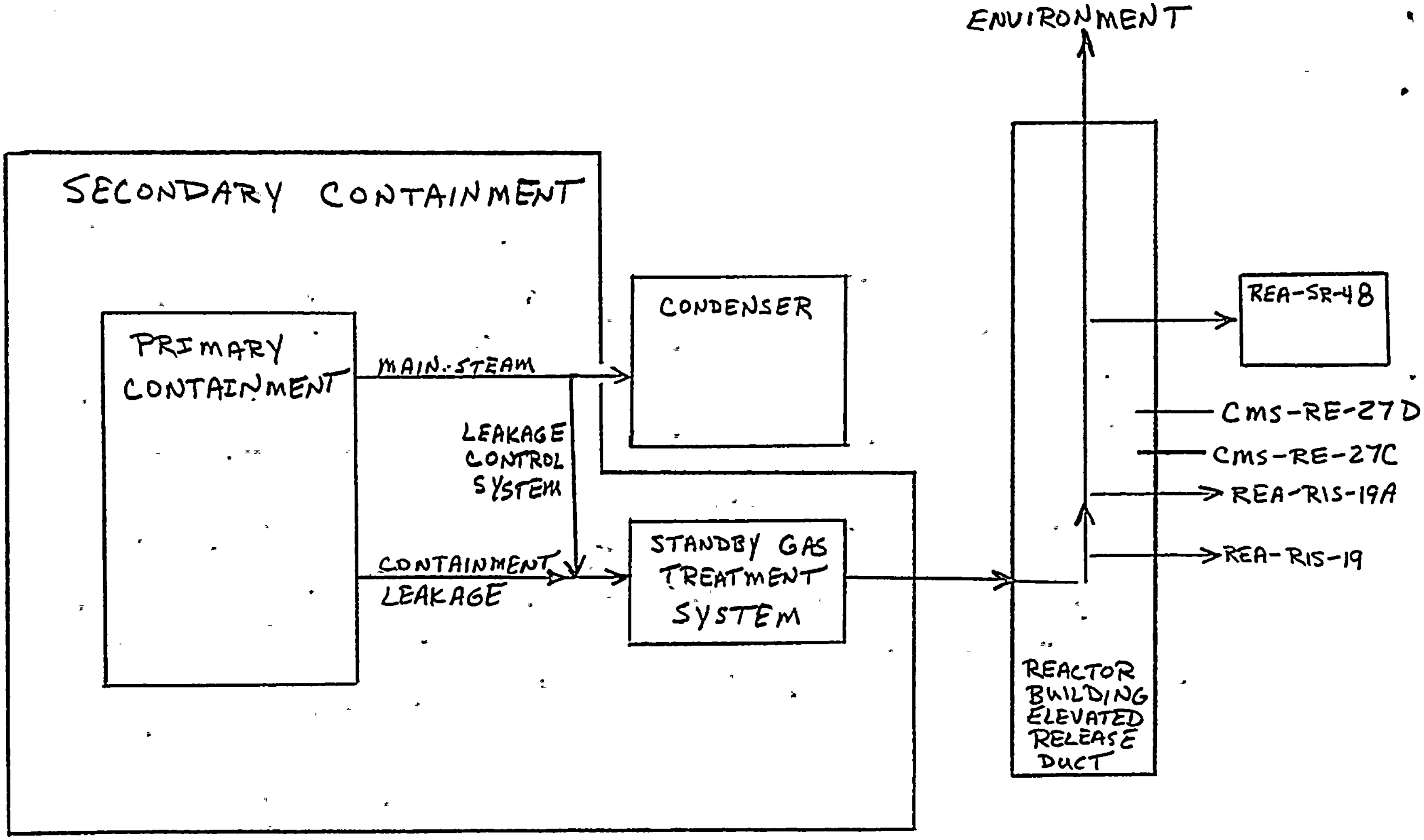
ENVIRONMENT
SECONDARY CONTAINMENT
PRIMARY CONTAINMENT
MAIN STEAM
CONDENSER
LEAKAGE CONTROL SYSTEM
CONTAINMENT LEAKAGE
STANDBY GAS TREATMENT SYSTEM
REA-SR-48
CMS-RE-27D
CMS-RE-27C
REA-RIS-19A
REA-RIS-19
REACTOR BUILDING ELEVATED RELEASE DUCT

FIGURE 1

Proposed . FSAR change

If there were a reactor accident with a core fission product release, the reactor building (secondary containment) immediately isolates. It's atmosphere is maintained at a 0.25" H_2O vacuum by the standby gas treatment system (SGTS). The only potential airborne contamination that could reach the other builings is from the SGTS by-pass leakage as listed in Table 6.1-16 which totals 0.74 scfh of which 0.35 scfh is into the radwaste building. ~~Assuming an iodine concentration of 3.7 X 10^4 μCi/cc (50% core inventory is released in the drywell atmosphere and 50% plates out) in the in leakage air to the radwaste building, then the building exhaust (83,000 cfm) concentration will be 2.6 X 10^{-3} μCi/cc if the building volume dilution is ignored.~~ The normal effluent sampler operates at 3 cfm; therefore, the charcoal cartridge 30 minute accumulation would be 6.7 mCi. This would result in a dose rate of 21 mR/hr at one foot from the cartridge. Doubling the dose rate to account for particulates yields 42 mR/hr at one foot from the sample assembly. Because of the high exhaust flow rate (260,000 cfm) and less in-leakage (0.24 scfh) the turbine building exhaust is less concentrated. Therefore, the radwaste and turbine building normal effluent sampling systems are considered adequate for post-accident sampling and no shielding is necessary. (See 11.5.2.2.1.5 and Figure 11.5-5.)

For the purpose of defining the shielding requirements for the radwaste and turbine building, an iodine concentration of 3.7 x10^4 μCi/cc is assumed to exist in the in-leakage air. This iodine concentration is based on a 50% core inventory release to the drywell atmosphere and a 50% plate out factor. This plate out factor is conservative ~~relative to for~~ determining sample shielding requirements. With 0.35 scfh bypass leakage into the radwaste building, the building exhaust (83,000 cfm) concentration will be 2.6 x10^{-3} μCi/cc, ignoring building volume dilution.