UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO THE OFFSITE DOSE CALCULATION MANUAL

WISCONSIN ELECTRIC POWER COMPANY

POINT BEACH NUCLEAR PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-266 AND 50-301

Revision 1 of the Offsite Dose Calculation Manual (ODCM) for the Point Beach Nuclear Plant (PBNP) was reviewed earlier. The review is documented in EGG-PHY-7972, dated March 1988, transmitted to the NRC with a letter from F. B. Simpson (EG&G, Idaho), dated March 25, 1988. Detailed responses to deficiencies that were identified in the review of Revision 1 were transmitted to the NRC by Wisconsin Electric Power Company (WE), the licensee for PBNP, with a letter from C. W. Fay (WE), dated October 6, 1988. Discussed below are two "additional deficiencies" identified during the present review and seven deficiencies from the earlier review that were not adequately addressed in the licensee's responses. In the discussions that follow, numbers assigned to the deficiencies and responses by the licensee are used for reference purposes. The additional deficiencies were not introduced by ODCM Revision 3, but rather are related to deficiencies previously identified.

Additional Deficiency 1.

The licensee applies an "additional dilution factor" of 5 to liquid effluents when calculating dose commitments due to fish consumption, and an additional dilution factor of 100 when calculating dose commitments due to consumption of potable water. For plants with once-through main condenser cooling systems, NUREG-0133 specifies the circulating water flow as the dilution flow to be used to calculate dose commitments due to fish consumption. Therefore, the licensee should use an additional dilution factor of 1 instead of 5.

The dilution flow permitted by NUREG-0133 for plants with once-through cooling systems includes all releases within one-quarter mile. Section 6.4 of the ODCM specifies 644 $ft^3$/sec for hand calculations of the dose due to liquid effluents. This is far below the average liquid discharge of 1295 $ft^3$/sec reported for 1986. Also, information available to the staff indicates that the average annual discharge flow rate for PBNP is 783 $ft^3$/sec per reactor unit. Both of these values imply that PBNP may be using a dilution flow corresponding to the circulating water flow of only one unit. In addition to reducing the value of the additional dilution factor to 1, the licensee should verify or correct the dilution flow used in the liquid dose calculations. The discussions of doses due to liquid effluents that follow are based on use by the reviewer of 783 $ft^3$/sec per unit (1566 $ft^3$/sec) as the average annual liquid discharge flow.

Additional Deficiency 2

The licensee uses "equivalent curies", identified in the ODCM, as a principal part of the methodology to determine setpoints and annual release limits for liquid and gaseous effluents. If determined correctly, equivalent curries can be a useful device for simplifying some calculations. However, equivalent curies as defined in the PBNP ODCM are very inaccurate.

To give an accurate representation of the effect of the mixture of nuclides actually released, equivalent curies should be calculated using: (a) the half-lives of all radionuclides (to allow for decay in transmit); (b) the bioaccumulation factor (for liquid effluents); (c) the stable element transfer factors (for gaseous effluents); (d) the inhalation or ingestion dose factors of the radionuclides; and (e) the pathway from release to the individual for whom the dose is being calculated (i.e., a complete dose calculation should be done for each radionuclide and pathway). The licensee calculates equivalent curies using only the ingestion dose factors.

Releases of radioactive materials in gaseous effluent. For releases of radioactive materials in gaseous effluents, the ODCM for PBNP specifies equivalent curie release limits separately for noble gases, tritium, radioiodines, and particulates (radionuclides other than tritium, noble gases or iodines). The effectiveness of these release limits to prevent offsite dose commitment limits from being exceeded is discussed below:

Noble gas releases. The equivalent curie noble gas release limit will permit release of enough Kr-83m to give an annual skin dose of 2810 mrem or enough Kr-85 to give an annual skin dose of 1190 mrem. The most significant of these is Kr-85, which accounted for 7% of noble gas releases during 1985 and 1986. The above results demonstrate the problems with the equivalent curie procedure as used at PBNP, although these extreme cases are not likely to occur. A calculation was performed scaling the noble gas releases for 1985 and 1986 to the equivalent curie release limit, and using a X/Q that gives 10 mrem to the total body at the release limits. The doses obtained from this circulation were 20.2 mrem total skin dose, 12.6 mrad beta air dose, 15 mrad gamma air dose, and the expected 10 mrem total body dose. Results from this calculation may be fairly representative of results which will be obtained in practice under normal operating conditions. However, if the equivalent curie methodology is retained, a release limit based on the skin dose limit should be determined and the lower of this or the present limit should be used to ensure that the technical specification dose limits are not exceeded.

Tritium releases. The equivalent curie release limit for tritium in gaseous effluents is straightforward, since only a single radionuclide is involved. Calculations show that the annual dose commitment to the thyroid of an infant from H-3 is 7 mrem at the release limit of 29,400 Ci. The release limit for H-3 should be reduced, since it is now so high that it can never be reached and, assuming releases at the present limit, adds significantly to the maximum calculated doses.

Radioiodine releases. The equivalent curie radioiodine release limits should be conservative, since the iodine isotope with the longest half-life is used as the reference isotope and the bioaccumulation factor, the stable element transfer factor, and the dose pathways are the same for all isotopes. However, a complete dose calculation using the iodine releases in gaseous effluents for 1985 and 1986 scaled to the equivalent curie release limit gives a dose of 30 mrem to the thyroid of an infant, equal the organ dose limit. The calculated dose is 33.8 mrem if the release is assumed to consist entirely of I-131. This calculation depends on the fraction of time the milk animals are on pasture and the fraction of feed that is pasture grass while the animals are on pasture. The values used in the present calculations were one-half the time on pasture and one-half of the feed from pasture while on pasture, inferred from the values in Section 6.3.B.3 of the ODCM. If these fractions are smaller than the correct values, the equivalent curie limit for radioiodines in gaseous effluents should be reduced appropriately.

Particular releases. A complete calculation using particulate releases from 1985 to 1986 scaled to the equivalent curie limit gives a maximum organ dose of 9.9 mrem to an infant's liver. A calculation assuming Co-60 at the equivalent curie limit gives a maximum dose of 13.9 mrem to the total body of a child, mainly via the ground plane pathway.

A complete calculation of offsite doses using all releases of radioactive material in gaseous effluents released during 1985 and 1986 scaled to the applicable equivalent curie limits gives a dose commitment of 38 mrem to the thyroid of an infant. A calculation using H-3, I-131, and Co-60 at the equivalent curie limits gives a dose commitment of 54.4 mrem to the thyroid of an infant. The contributions were 7.1 mrem from H-3 (mainly via the cow-milk pathway), 33.8 mrem from I-131 (mainly via the cow-milk pathway), and 13.5 mrem from Co-60 (mainly via the ground plane pathway). If the equivalent curie methodology is retained, the release limits should be reduced so the sum of these three contributions is less than or equal to 30 mrem.

Radioactive materials in liquid effluents. For radioactive materials in liquid effluents, the ODCM specifies separate equivalent curie release limits for tritium, radioiodines, and "others" (radionuclides other than tritium, noble gases, or iodines). Calculations of doses due to liquid effluents were performed using a dilution flow of 1566 ft$^3$/sec (the value from an NRC informal communication), an additional dilution factor of 100 for water consumption, and an additional dilution factor of 1.0 (as specified in NUREG-0133) for the fish consumption pathway. Scaling the actual releases to the equivalent curie limits gives 19.8 mrem to a teen's liver compared to the limit of 20 mrem. If a release at the equivalent curie limit consists entirely of Cs-137 (or Cs-134), doses of 28.1 mrem to a teen's liver and 13.5 mrem to an adult's total body are calculated. These are 141% and 225% of the technical specification limits.

It is recommended that the licensee use the additional dilution factor of 1.0 recommended by NUREG-0133. This, combined with a circulating water flow of 1566 $ft^3/sec$, would require the release limits for "other" radionuclides to be reduced to approximately 42 (i.e., 94.7/2.25) equivalent curies of Co-60 to ensure that the total body dose design objective is not exceeded.

Previous Deficiency 1.

The review of ODCM Revision 1 states, "Ir Section 3.5, it is not clear how the mix of radionuclides in the calibration source used to determine the calibration constant for the liquid effluent monitors is representative of the mix of nuclides in the actual release...." The licensee's response identified partially decayed primary coolant from the refueling water storage tank as the radionuclide source currently used to calibrate the liquid effluent monitors. It is reasonable to expect the radioactivity in this tank to be primarily due to long-lived radionuclides such as Co-60 and Cs-137. Therefore, it does not seem reasonable to expect the radionuclide mixture in a calibration source from this tank to be representative of the mixture in liquids released, which in recent years have been dominated by short-lived radionuclides such as Na-24 and the radioiodines. The calibration source for the monitor should be representative of the radioactive liquids released. However, calibration with a source consisting of the long-lived radionuclides and then monitoring releases consisting of 50% Na-24 appears conservative. If the monitors are not calibrated using a source representative of the mixtures released, the calibration methodology should be justified in the ODCM.

Previous Deficiency 2.

The review of ODCM Revision 1 stated, "In Section 3.0 of the ODCM, there is no provision or consideration of simultaneous releases from each of the four gaseous release points when determining the alarm trip setpoints for the noble gas monitors." The licensee's response included a fairly complete discussion to the control of releases from the four monitored release points, explaining why it is not reasonable to expect releases to be high enough to cause the MPC limit of 10 CFR Part 20 to be exceeded. The setpoints of the monitors should be identified in the ODCM. However, this is not absolutely essential if the document identified in the ODCM, "PBNP RMS Alarm Setpoint and Response Book," as containing details concerning the alert and alarm and trip setpoints is available for review.

Previous Deficiency 3.

The review of ODCM Revision 1 states, "In Section 3.5, it is not clear how the mix of radionuclides in the calibration source used to determine the calibration constant for the gaseous effluent monitors is representative of the mix of nuclides in the actual release...." The licensee's response identified "a radioactive coolant gas obtained from the Letdown Gas Stripper System" as the calibration source. The response also states, "The gas sample obtained is considered representative of the nuclide mix at those gaseous

monitors having control function (isolation or termination of release)." Figure 2-2 in the ODCM shows the gas decay tanks exhausting through the Auxiliary Building Vent. The gas decay tanks would be expected to release higher fractions of long-lived radionuclides than are present in the letdown system. The licensee's response states that releases from these tanks are controlled to produce a small fraction of the MPC limits. If gases from the letdown system are used to calibrate the effluent monitors, the ODCM should specify the maximum release rate from the gas decay tanks and the limits on other release rates should take into account the maximum release rate from the tanks.

Previous Deficiency 5.

Concerning doses due to liquid effluents, the review of ODCM Revision 1 states, "In Section 4.3.B.1, it is not clear why the total body and not the thyroid is the limiting organ for the radioiodines." The licensee's response and additions in ODCM Revision 3 clarify the meaning of Section 4.3.B.1 somewhat. However, the logic used is difficult to follow, since the dose (to the adult whole body) that is defined as limiting is not the dose that approaches the technical specification limit if radioiodines are released at the equivalent curie limit. Exact references for data (such as calculated releases and calculated doses) used to determine equivalent curie release limits should be given in the ODCM. The terminology and explanations in this section could be improved. The limits obtained by the methodology appear to control the offsite doses received to within the required limits with an additional dilution factor of 5 used for the fish consumption pathway. However, these limits should be reduced as recommended in "Additional Deficiency 2" above so the calculated doses are within the technical specification limits for an additional dilution factor of 1.

Previous Deficiency 6.

Concerning release limits for liquid effluents, the review of ODCM Revision 1 states, "In Section 4.3.B.1, it is not clear why the total body and not the liver is the limiting organ for tritium and other particulates, i.e., Cs-134 and Cs-137." The licensee's response discusses how the equivalent curie limits are determined. Most of this discussion has been added to the ODCM in Revision 3. The discussion of this identified deficiency appears more logical than that given for Previous Deficiency 5 above, but the methodology is still confusing and an effort should be made to clarify the discussion. Exact references for all data (such as calculated releases and calculated doses) used to determine equivalent curie limits should be included in the ODCM. Complete calculations show the release limits for liquid effluents are too high. They should be reduced to limit the calculated doses to the technical specification limits when an additional dilution factor of 1 is used for the fish pathway. See Additional Deficiency 1 and Additional Deficiency 2 above for more complete discussions.

Previous Deficiency 7.

The review of ODCM Revision 1 states, "In Section 5.2, it is not clear how the individual curie releases for tritium, radioiodines, and others are combined to ensure the dose limit is not exceeded...." Section 5.2 pertains to limits on the releases of radioactive material in liquid effluents. In response to this deficiency, the licensee discussed the methodology to determine the release limits in terms of equivalent curies, but did not really explain the logic. The methodology is still confusing, and the terminology and logic should be clarified. Recommendations for setting release limits to ensure the offsite dose design objectives are not exceeded are given in Additional Deficiency 1 and Additional Deficiency 2 above.

Previous Deficiency 9.

The review of ODCM Revision 1 states, "In Section 5.3, it is not clear how the individual curies released for tritium, radioiodines, and others are combined to ensure the dose limit is not exceeded...." Section 5.3 pertains to limits on the releases of radioactive material in gaseous effluents. In response to this deficiency, the licensee discussed the methodology to determine the release limits in terms of equivalent curies, but did not really explain the logic. The method used in this section to determine the equivalent curie limit for particulates is more confusing than that for iodines or the various groups of radionuclides in liquid effluents. The conversion factor for each radionuclide is obtained by dividing the highest dose ingestion factor for that radionuclide by the GI-LLI dose ingestion factor for Co-60. The methodology is still confusing, and the terminology and logic should be clarified. Exact references for all data (such as calculated releases and calculated doses) used to determine release limits in terms of equivalent curies should be included in the ODCM. Recommendations for setting release limits to ensure that offsite dose limits are not exceeded are given in Additional Deficiency 2 above.

A change should be made in Section 6.3.D to prevent missing some non-trivial dose contributions. In this section the licensee identifies by implication that the highest dose due to releases of particulates in gaseous effluents is likely to be obtained via the inhalation pathway. Higher doses are often calculated via the cow-milk, vegetation, and ground plane pathways. Section 6.3.d should be changed to reflect this fact.

## SUMMARY

The best solution to the problem of ensuring that releases of radioactive materials in gaseous and liquid effluents are within the limits of 10 CFR Part 20 and 10 CFR Part 50, as required by the PBNP technical specifications, would be to revise the ODCM to require accurate calculations of the offsite doses and dose rates. However, studies of "worst case" mixtures of radionuclides in effluents show that the equivalent curie methodology used in ODCM Revision 3 will provide the means of keeping releases within the release limits if the following changes are made to the ODCM.

1. The additional dilution factor for the fish pathway should be changed from 5 to 1. For dose calculations, this factor should be applied to the total liquid release (within one-fourth mile from the release) from the plant. (For resolution of Additional Deficiency 1 and Previous Deficiency 7).

2. A noble gas equivalent curie release limit should be specified to limit the skin dose as well as the total body dose. (Additional Deficiency 2 and Previous Deficiency 7).

3. The release limit for H-3 should be reduced to a more reasonable value since it contributes significantly to several maximum calculated doses. (Additional Deficiency 2 and Previous Deficiency 7).

4. The release limits for radioiodines and particulates should be reduced so that, combined with the reduction in the H-3 release limit recommended in 3 above, the maximum offsite organ dose due the gaseous effluents is reduced from 54.4 mrem to 30 mrem. (Additional Deficiency 2 and Previous Deficiency 7).

5. Release rate limits for "other" radionuclides in liquid effluents should be reduced to compensate for the reduction to 1 of the additional dilution factor for the fish pathway. This will require reduction of the equivalent curie release limit to about 55% of its present value. (Additional Deficiency 2 and Previous Deficiency 7).

6. The use of a mixture of relatively long-lived radionuclides to calibrate the liquid effluent monitor, which monitors a mixture of shorter-lived radionuclides, should be justified. (Previous Deficiency 1).

7. The ODCM should include more information concerning setpoints of the four gaseous effluent monitors or a more complete statement of the availability of the "PBNP PMS Alarm Setpoint and Response Book." (Previous Deficiency 2).

8. Specific release rate limits should be given for gaseous releases whose mixture of nuclides does not correspond to the mixture used to calibrate the monitors; e.g., releases from the gas decay tanks. (Previous Deficiency 3).

9. Exact references for data (such as calculated releases and calculated doses) used to establish equivalent curie release limits should be added to the ODCM. (Previous Deficiencies 5 and 6).

10. The manual dose calculation instructions in Section 6.3.d should require calculation of doses via to the cow-milk, vegetation, and ground plane pathways. (Previous Deficiency 9).

INEL
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ENCLOSURE 2

December 8, 1988

Mr. Wayne Meinke
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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

REVIEW OF POINT BEACH RESPONSE TO ODCM REVISION 1 REVIEW - SIM-134-88

Dear Mr. Meinke:

Attachment 1 contains our review of the Wisconsin Electric Power Company (WE) responses to the questions listed in the review of ODCM Revision 1, included as Appendix D of the Technical Evaluation Report prepared by EG&G Idaho (EGG-PHY-7572) dated March 1988. A Safety Evaluation (SER) and Appendix D of the TER were transmitted to WE as enclosures to a letter from D. H. Wagner (NRC) to C. W. Fay (WE) dated May 12, 1988 and revisions to the ODCM and Environmental Manual were requested. Attachment 2 is a copy of the WE responses transmitted to the NRC by a letter from C. W. Fay (WE) to Document Control Desk (NRC) dated October 6, 1988, included for easy reference.

The main problems remaining in the ODCM concern: (a) the method of calculating the equivalent curies used to determine monitor setpoints and radionuclide release limits; and (b) the use of calibration standards not reasonably certain to correspond to the radionuclide mix being released. The most reasonable resolution of these problems would appear to be for the licensee to commit to; (a) determine release limits on the basis of dose calculations using the radionuclide distribution in the radioactive material being released, and (b) use actual samples of the radioactive materials being released as calibration standards. This would require a significant revision of the ODCM. However, it does seem that as a minimum the calculation of equivalent curies should include the bioaccumulation factors or stable element transfer factors as appropriate, and that the ODCM demonstrate that the radionuclide mixes in the calibration sources are reasonably similar to the mixes in the radioactive materials being released. (This review was done by T. E. Young.)

Very truly yours,

F. B. Simpson
Nuclear Sciences

Attachments:
As stated

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

Evaluation of the PBNP Response to the ODCM Revision 1 Review

Several of the Licensee's responses to questions raised in the Technical Evaluation Report (TER) transmitted to Wisconsin Electric Power Company (WE) as an attachment to the letter from D. H. Wagner (NRC) to C. W. Fay (WE) dated May 12, 1988 are related to the use of "equivalent curies" in the methodologies of the ODCM. During the review of these responses some apparent problems were noted concerning the use of equivalent curies as defined in the Licensee's ODCM. These problems are discussed in this introductory paragraph, which will be referred to in discussions of individual responses below.

The problems noted are:

1. The Licensee's method of calculating equivalent curies appears to be incomplete. As defined in the ODCM the number of equivalent curies due to a particular radionuclide is a function of only the number of curies released and the dose factors from Regulatory Guide 1.109. However, it is essential that the calculations of equivalent curies include bioaccumulation factors (for aquatic food pathways) or stable element transfer factors (for vegetable/soil, milk, and meat pathways) unless all radionuclides being considered are isotopes of the same element. Failure to use these factors could result in releases giving dose commitments much greater than intended.

2. For any application in which transport time to an individual is used, the half-life of each radionuclide should be considered in the calculation of equivalent curies. However, if the reference radionuclide has the longest half-life of any considered, or if all half-lives are long compared to the transit time from release to the individual, a conservative (or acceptably realistic) dose estimate can be made using equivalent curies calculated without using the half-lives.

3. The Licensee's equivalent curie limits appear to be based on the calculated releases given in Appendix I of the Point Beach Nuclear Plant (PBNP) Updated FSAR (USAR). The distributions of radionuclides in these calculated releases do not consistently represent the distributions in recent releases. Therefore, it is questionable if the limits established are always applicable to current releases, since not all the necessary factors (See Item 1 above) are used in the calculation of equivalent curies.

4. It does not appear to be correct to use the total body dose factors for all equivalent curie calculations. One case where this would not be appropriate would be a situation in which liquid releases contained a large component of Co-60, for which the GI-LLI dose factor is 8.5 times the total body dose factor, so the organ dose limit could be exceeded without exceeding the total body dose limit. A more complete study of this problem may be necessary.

ATTACHMENT
RESPONSES TO ODCM QUESTIONS
POINT BEACH NUCLEAR PLANT

(1) In Section 3.5, it is not clear how the mix of nuclides in the calibration source used to determine the calibration constant for the liquid effluent monitors is representative of the mix of nuclides in the actual release. It is this mix of radionuclides that are equated to an equivalent concentration of Co-60. If the calibration source is obtained via a well mixed grab sample of the radwaste intended for release, then it would be representative.

RESPONSE

The calibration of the liquid effluent monitors is done in accordance with the appropriate HP calibration procedure as stated in Section 3.5 of the ODCM. Because the HP calibration procedure addresses this item, it is not included in the ODCM. The procedure identifies the liquid radionuclide source to be used for calibrating the monitors. Currently, partially decayed primary coolant obtained from the refueling water storage tank is used. The isotopic composition of the liquid is determined by gamma isotopic analysis. Liquid effluents could result from either primary system sources or waste stream sources. We believe that either category is appropriate for the standard mix, although a primary system mix may exhibit somewhat less variation from time to time.

(1) The Licensee's response to question (1) identifies partially decayed primary coolant from the refueling water storage tank as the radionuclide source currently used to calibrate the liquid effluent monitors. It is reasonable to expect the radioactivity in this tank to be primarily due to long-lived radionuclides such as Co-60 and Cs-137. Therefore, it does not seem reasonable to expect a calibration source from this tank to be representative of liquids released, which in recent years have been dominated by short-lived radionuclides such as Na-24 and the radioiodines. The calibration source should be representative of the radioactive liquids released.

Release limits are expressed in terms of "equivalent curies" of Co-60. The comments in the introductory paragraph apply to the methodology related to this response.

(2) In Section 3.0 of the ODCM, there is no provision or consideration of simultaneous releases from each of the four gaseous release points when determining the alarm trip setpoints for the noble gas monitors.

RESPONSE

Simultaneous elevated releases from each of the four gaseous release points at PBNP are not considered when determining alarm setpoints because no set of credible operating circumstances (other than accidents invo'ving multiple failures) can be identified which would cause simultaneous elevated releases at all four release points.

In addition to the alarm setpoints, each release point monitor has an alert setpoint. The alert setpoint is set at approximately two times the steady-state reading for each monitor. The alert setpoint provides an early warning of changing plant radiological conditions, and PBNP procedures then require increased surveillance of the indicated system.

To further reduce the possibility of simultaneous elevated multiple releases, monitors utilized on the Auxiliary Building Exhaust Vent and Unit 1 and Unit 2 Purge Exhaust Vents have control functions associated with the release path to isolate or reduce releases. The Unit 1 and Unit 2 Purge Exhaust Vent monitors will cause containment ventilation isolation upon receipt of an alarm trip setpoint. Exceeding the Auxiliary Building Exhaust Vent monitor alarm setpoint will cause the gas release valve to shut and shifts the Auxiliary Building exhaust to be routed through charcoal filters in addition to the normal roughing and HEPA filters.

Other factors add to the conservatisms: containments are never purged at power; gas decay tank releases are procedurally limited to a small fraction of MPC by flow rate control; and, as a practical matter, a number of the alarm points are set well below MPC due to instrument design. Hence as a practical matter, it is not credible for all four release points to operate at levels which would be just under 4 MPC in total, and the issue need not be explicitly addressed in the ODCM.

(2) Both the statement in the review TER and the Licensee's response to it may seem to imply that releases of radioactive material are acceptable up to four times the MPC specified in 10 CFR 20. Releases must be limited to the MPC limits of 10 CFR 20, a fact which was probably assumed by both the reviewer and the Licensee. The Licensee's response indicates that administrative controls are used to prevent the MPC limits from being exceeded by simulatneous releases. It is recommended that assurance that the offsite MPC limit will not be exceeded should be made specific by including a statement in the ODCM comparable to the explanation in the response; i.e., a statement to the effect that at all times administrative controls are used to prevent simultaneous releases that would result in exceeding the 10 CFR 20 MPC limits. An alternative would be to specify alarm-trip setpoints for the Unit 1 Purge, the Unit 2 Purge, the Auxiliary Building Exhaust, and the Drumming Area Vent that correspond to fractions (totaling less than 1.0) of the release rate limit. With a commitment to some such addition the Licensee's response would be considered acceptable.

(3) In Section 3.5, it is not clear how the mix of nuclides in the calibration source used to determine the calibration constant for the gaseous effluent monitors is representative of the mix of nuclides in the actual release. It is this mix of radionuclides that are equated to an equivalent concentration of Xe-133.

RESPONSE

As stated in Section 3.5 of the ODCM, the calibration of the gaseous effluent monitors is done in accordance with the appropriate HP calibration procedure. Because the HP calibration procedure addresses this item, it is not included in the ODCM. The procedure identifies a radioactive coolant gas obtained from the Letdown Gas Stripper System as the calibration source. Each sample of gas is isotopically quantified by gamma isotopic analysis of two subsamples. The gas sample obtained is considered representative of the nuclide mix at those gaseous monitors having a control function (isolation or termination of release).

(3) It is not clear that the use of calibration samples from the Letdown Gas Stripper System will give realistic or conservative results when used to calibrate monitors for releases from the gas decay tanks, containment purges, or the drumming area vent; which can reasonably be expected to include higher fractions of longer-lived radionuclides than gases from the Letdown Gas Stripper System. The calibration source should be representative of the radioactive gases released.

(4) In Section 3.7, a correction factor of $2.12 \times 10^3$ sec. $ft^3/min. m^3$ is omitted in the equation for the setpoint.

RESPONSE

The factor of 2.12E+03 sec-$ft^3$/min-$m^3$ has been used in the calculation of all gaseous effluent setpoints but was inadvertently omitted from the equation in the ODCM. It will be added in the next revision of the ODCM.

(4) The Licensee's response of adding the appropriate correction factor is acceptable.

(5) In Section 4.3.B.1, it is not clear why the total body and not the thyroid is the limiting organ for the radioiodines.

RESPONSE

The description in Section 4.3.B.1 of the OCDM is an oversimplification which will be amplified in the next revision. Indeed the child thyroid is the critical organ for radioiodine in liquid effluents. However, the upward scaling of equivalent curies of radioiodine to obtain equivalent curie release limit for Point Beach was limited by the adult whole body dose:

$$\frac{\text{Appendix I whole body dose} \times \text{2 reactors}}{\text{calculated whole body dose}} = \frac{3 \times 2}{0.19} = 31.6$$

$$\frac{\text{Appendix I organ dose} \times \text{2 reactors}}{\text{calculated organ (thyroid) dose}} = \frac{10 \times 2}{0.20} = 100.0$$

The upward scaling for radioiodines was limited to the 31.6 scaling factor, tantamount to assuming that the entire calculated whole body dose was due to radioiodine. In reality, very little of the whole body dose is attributable to radioiodine. However, this conservative choice of methodology was purposely selected to leave headroom to accommodate contributions from other nuclides. Carefully choosing the limiting scaling factors in this manner assures that the RETS limits (or Appendix I dose objectives) will not be exceeded, even if all nuclide groups are at their respective equivalent curie release limits.

(5) The Licensee's response correctly states that the critical organ for radioiodines in liquid effluents is the child thyroid. A brief calculation shows that the Licensee's limit on equivalent curies calculated using the total body dose factors restricts the dose to the child thyroid to less than the technical specification limit of 10 mrem/yr to an organ. However, meeting the organ dose limit depends partly on use of the dilution factor of 5 at the edge of the "mixing zone." The dilution factor of 5 is given in Appendix I of the USAR, which in turn states that Regulatory Guide 1.109 recommends the value of 5. (The reviewer could not find the recommendation in Regulatory Guide 1.109, Revision 1.)* Comments concerning half-lives in the introductory paragraph apply to the methodology related to this response.

*The recommendation to use a dilution factor of 5 is in Table A-1 of Regulatory Guide 1.109, March 1976; It is not in Reg. Guide 1.109, Rev. 1, October 1977. The staff position of March 1976 was changed by NUREG-0133, Oct 1978 to the recommendation that actual circulating water flow be used for plants with once-through cooling systems. This applies to Point Beach.

(6) In Section 4.3.B.2, it is not clear why the total body and not the liver is the limiting organ for tritium and other particulates, i.e., Cs-134 and Cs-137.

RESPONSE

It is true that the teen liver is the critical organ, in the sense of exhibiting a slightly higher dose for the given mix of nuclides. However, the 10 CFR 50 Appendix I design objective for liquid effluents is more restrictive for the whole body (3 mrem/yr/reactor) than for any organ (10 mrem/yr/reactor). The maximum equivalent release limits are established by scaling the FSAR calculated releases as follows:

(1) $$\frac{\text{Appendix I whole body dose} \times \text{2 reactors}}{\text{calculated whole body dose}} = \frac{2 \times 3 \text{ mrem}}{0.19 \text{ mrem}} = 31.6$$

(2) $$\frac{\text{Appendix I organ dose} \times \text{2 reactors}}{\text{calculated organ dose (liver)}} = \frac{2 \times 10 \text{ mrem}}{0.26 \text{ mrem}} = 76.9$$

Thus the adult whole body is more limiting. Put in another way, the calculated whole body dose is a larger fraction of the design objective for the whole body than is the calculated liver dose as a fraction of the design objective for the liver. In reality, the major contributors to liver dose are a different set of nuclides than the major contributors to whole body dose. However, the conservative choice of the more restrictive scaling factor assures that neither whole body nor liver dose limitations will be exceeded for any given mix of nuclides or nuclide groups.

The discussion in the ODCM will be amplified in the next revision.

(6) The Licensee's response appears acceptable for most radionuclide mixes because the total body dose is limiting for most reasonable assumptions concerning releases in liquid effluents. However, it appears that the methodology may not be valid if the releases are dominated by radioiodines or Cs-134. The comments in the introductory paragraph apply to the methodology related to this response.

(7) In Section 5.2, it is not clear how the individual curies releases for tritium, radioiodines, and others are combined to ensure the dose limit is not exceeded. In other words, if the curies released for tritium, radioiodines, and Co-60 were at the limits stated in Section 5.2, the dose limit would be exceeded by a factor of three.

RESPONSE

This question has been partially answered by our resp[illegible] to the preceeding two questions. The applicable dose limit(s) will not be exceeded even if all groups (tritium, radioiodines, and others) in liquid effluents were at the stated maximums given in the ODCM and in RETS.

The key to understanding this approach lies in the choice of scaling factors, which are used to calculate the release limits. Recall that:

Release limit (equivalent curies) = Scaling Factor x FSAR Calculated Release (equivalent curies)

$$\text{Scaling Factor} = \frac{\text{Applicable Appendix I Design Objective Dose}}{\text{Calculated Dose}}$$

For each nuclide group, scaling factors were reviewed for the obvious critical organs (adult whole body, teen liver, and child thryoid). Two conservatisms were applied:

1) The most retrictive scaling factor was chosen, as described in our response to the previous two questions;

2) The total calculated dose to the critical organ of interest was used in calculating the scaling factor, rather than just that portion of the calculated dose attributable to the radionuclide group of interest.

These conservatisms assure that the applicable dose limits will not be exceeded, even if each of the nuclide groups is at its specified equivalent curie release limit.

(7) The Licensee's response appears acceptable if the equivalent curie methodology related to it is acceptable. However, comments related to Response (6) and comments in the introductory paragraph apply here.

(8) In Section 6.4.C.2, the $U_a$ is identified as 370 l/year instead of 730 l/year.

RESPONSE

Section 6.4.C.2 of the ODCM identifies the average adult with a consumption of 370 l/year as to be used for calculating the H-3 dose. This constant will be changed to 730 l/year for the maximally exposed adult. The equation in Section 6.4.C.2 will also be changed to reflect this modification. The Ua of 730 l/year was correctly used in the FSAR dose calculations. Hence, no other changes are required as a result of this change to 6.4.C.2 of the ODCM.

(8) The Licensee's response of changing the water consumption rate to the recommended maximum rate instead of the average rate is acceptable.

(9) In Section 5.3, it is not clear how the individual curies released for tritium, noble gases, radioiodines, and particulates are combined to ensure the dose limit is not exceeded. In other words, if the curies released for tritium, noble gas, radioiodines, and Co-60 were at the limits stated in Section 5.3, the dose limit would be exceeded by a factor of four.

RESPONSE

If all four radionuclide groups were at their respective equivalent curie release limits for airborne materials, the 10 CFR 50 Appendix I dose objectives would not be exceeded. Our approach to calculating curie limits is similar, but not identical, to the methodology used for liquid effluents. The only difference between the airborne and gaseous methodologies is occasioned by the manner in which airborne effluent design objectives are established in Appendix I as discussed in the following.

In 10 CFR 50, Appendix I, Section II, paragraph B.1 establishes "air dose" limits; paragraph B.2. establishes limits for "external dose... to the whole body"; and paragraph C establishes limits for "organ" doses from radioiodine and particulates. Since Appendix I provides external dose limits to the whole body independent of the internal contribution to whole body dose from radioiodine and particulates, the ODCM similarly establishes independent release limits for noble gases based on external dose.

The other radionuclide groups are viewed together in a manner similar to that used for liquid effluents to assure that Appendix I dose objectives are not exceeded:

(1) The scaling factor used for tritium is:

$$\frac{\text{Appendix I dose (organ) x 2 reactors}}{\text{FSAR dose (liver)}} = \frac{15 \times 2}{.63} = 48$$

This approach leaves adequate room for the contributions from radioiodines and particulates. At the tritium release limit specified in the ODCM, the dose to the whole body or to any other organ from tritium alone would only be 0.5 mrem per year, thereby demonstrating the conservatism of the approach.

(2) The scaling factor used for particulates is:

$$\frac{\text{Appendix I dose (organ) x 2 reactors}}{\text{FSAR DOSE (liver)}} \times \frac{15 \times 2}{.63} = 48$$

(continued)

(9) (Cont)

The FSAR dose used here includes the dose from radioiodine and tritium; thus adequate headroom is allowed for the organ (liver) dose contributions from radioiodine and tritium.

(3) The scaling factor used for radioiodine is:

$$\frac{\text{Appendix I Dose (organ)} \times \text{reactors}}{\text{FSAR dose (infant thyroid)}} = \frac{15 \times 2}{15} = 2$$

Since the radioiodine scaling factor is less than for tritium and particulates, there is a theoretical potential for nonconservatism here.

However, the following observations can be made:

(1) In the limiting case of the infant thyroid, the contribution to thyroid dose from non-radiciodine particulates by either ingestion or inhalation pathways is negligible.

(2) If tritium were at its maximum release limit, it would contribute less than 2% of the thyroid Appendix I limit. This is less than the inaccuracy of overall dose estimation.

(3) The tritium release limit in the ODCM is on the order of an order of magnitude higher than the total plant inventory of tritium; hence the potential tritium contribution is negligible in reality.

(4) The FSAR infant thyroid dose assumes a goat-milk pathway; in fact no goats have been noted in the readily observable limiting south sector. This leaves a headroom of 6 mrem for thyroid dose contributions from tritium and particulates.

For these reasons, further refinement of the iodine release limits is not needed.

(9) The Licensee's response would be considered acceptable if the equivalent curie method used for determining the release limits for radioiodines and particulates were valid. However, the comments in the introductory paragraph apply. A preliminary calculation indicated that only the inhalation pathway was considered by the Licensee when calculating the dose due to tritium releases, but this is relatively unimportant because of the extremely conservative assumption used concerning the amount of tritium released (i.e., 19,600 Ci/yr compared to a probably more realistic release on the order of 600 Ci/yr.)

(10) According to Section 6.2.a, the Auxiliary Building Vent is the release point for the gas decay tanks and Table 1.4-2 assigns the dispersion values for the Auxiliary Building Vent to Category IIB. This is in disagreement with Section 6.3.A which states that all releases shall be grouped into Categories IA or IIA.

RESPONSE

We assume the first sentence of your question contains a typographical error and should end with the words "to Category IB". The two-fold categorization recommended as a simplification in the ODCM was based on the observation that the χ/Q's for Category I fall within the same order of magnitude (i.e., $3 - 9 \times 10^{-7}$), while all the remaining categories fall within another order of magnitude (i.e., $2 - 7 \times 10^{-6}$). Further refinement is within the error of dose estimation. However, in the next revision of the ODCM, a sentence will be added to require the specific use of Category IB if the gas decay tanks are a major contributor to releases through the Auxiliary Building Vent.

(10) The Licensee's commitment to add a sentence requiring the use of category IB dispersion factors if the gas decay tanks are a major contrubutor to releases through the Auxiliary Building Vent is considered an acceptable response.

(11) In Section 4.4.4 of the ODCM and in Technical Specification 15.7.5.H, it is not clear if the contribution to the total dose from the nearby Kewaunee plant is considered in a total dose calculation.

RESPONSE

Using the Point Beach annual average x/Q data and assuming that all three reactors (Point Beach Unit 1, Point Beach Unit 2, and Kewaunee) were operating with identical source terms, the contribution from Kewaunee at the critical point (highest total dose) along the Point Beach site boundary would add only from 1% to 8% above the dose from the Point Beach units, depending on the release mode.

If Point Beach were operating at twice the Appendix I objectives and Kewaunee were operating at an effluent level similar to either of the Point Beach units, the small percentage contribution from Kewaunee would not be sufficient to exceed 40 CFR 190 limits. Since it is highly unlikely that both Point Beach and Kewaunee would operate at twice the Appendix I levels for an entire year and even more improbable that such levels would be simultaneously exceeded at both plants, we elected not to add a separate discussion to the ODCM.

The identified critical sector for combined doses is along the site boundary in the south sector. Although a point along the boundary in the north sector was identified as having the highest percentage contribution from Kewaunee, the total dose at this point is less than that from Point Beach alone in the critical south sector for the stated release conditions.

(11) The Licensee's response gives a reasonable argument that it is highly unlikely that consideration of doses due to Kewaunee would be of any real significance if PBNP is required to do uranium fuel cycle dose calculations. However the ODCM should include a statement indicating that contributions from Kewaunee have been considered, and giving the upper dose limits expected in the vicinity of PBNP due to releases by Kewaunee. There should also be a commitment to consider doses due to

Kewaunee in the highly unlikely event that releases requiring uranium fuel cycle calculations occur at Kewaunee and PBNP during the same reporting period.

(12) In Table 5-1, the ratio term for Te-131m should be 1.49E-01 instead of 1.49E-02.

(13) A simplified diagram for the gaseous waste treatment system is supposed to be in Figure 2-2. However, Figure 2-2 is a repeat of the liquid radwaste treatment system which is shown in Figure 2-1 of the ODCM.

RESPONSE

The ratio term to Te-131m in Table 5-1 and the gaseous waste treatment system diagram of Figure 2-2 were corrected in the September 1987 revision to the ODCM. A copy of the correct figure is attached herewith.

(12) The Licensee's response is considered acceptable, since the erroneous ratio term was corrected in the September 1987 revision of the ODCM.

(13) The Licensee's response is considered acceptable since the proper figure was used in the September 1987 revision of the ODCM.

(14) A simplified diagram showing the solid waste treatment is not contained in the ODCM.

RESPONSE

The portions of solid waste treatment activities which could contribute to the off-site doses in the area surrounding PBNP are included in OCDM Figure 2-1 and Figure 2-2.

Liquids generated during the processing of radioactive waste are returned to the PBNP liquid waste treatment system via the flow path labelled Units 1 & 2 Miscellaneous Waste on Figure 2-1 of the ODCM. Effluents from the liquid waste treatment system to the environs surrounding PBNP are included in the "10 CFR 50, Appendix I, Evaluation of Radioactive Releases from PBNP."

Radioactive waste preparation activities for shipment off-site are completed in the Drumming and Truck Access areas. Gases and particulates generated during these activities are processed and released via the Drumming Area Exhaust Vent as shown in Figure 2-2 of the ODCM. Gaseous and particulate releases to the enrivons surrounding PBNP from these processes are included in the 10 CFR 50, Appendix I evaluation.

The processed radioactive waste is shipped off-site for disposal at a licensed disposal facility. This portion of the solid waste treatment activities does not impact the ingestion and inhalation pathways in the area surrounding PBNP and are therefore not included in the PBNP ODCM.

We believe your question may have been occasioned, at least in part, by the absence of the correct Figure 2-2 in Revision 0 of our ODCM. We trust the above explanation together with the attached, corrected copy of Figure 2-2 resolves the issue.

(14) The Licensee's response is considered acceptable. Figures 2-1 and 2-2 of the Licensee's ODCM, showing treatment systems and effluent pathways for liquid and gaseous effluents, include all release pathways from the solid waste treatment system. Since the proposed NUREG-1302 for transfer of the main part of the RETS to the ODCM includes no requirements for solid waste processing information, the Licensee's treatment of the solid waste processing system is considered acceptable.

(15) Table 15.7.7-1 of the Technical Specifications identifies 23 TLDs whereas Section 2.4.2 of the Environmental Manual states that TLDs will be posted at only 22 locations.

RESPONSE

One of the 23 TLDs is used as a transportation control; the remaining 22 TLDs are placed at the designated locations. This is consistent with the breakdown further specified in the table.

(15) The Licensee's response is considered acceptable. An extra TLD is used for transport control.

(16) Table 15.7.7-1 of the Technical Specifications identifies nine TLDs to be located in the general area of the site boundary. In Figure 2-1 of the Environmental Manual, there appears to be only seven TLDs in the general area of the site boundary.

RESPONSE

Geographical considerations led to the exact locations of TLDs, including consideration of accessibility in winter months. As a result, locations #16 and #22 were placed somewhat further west of the boundary. The boundary in these areas is in a field; the actual TLD locations are along a road. In addition, a TLD (#12) is located along the lake at the eastern edge of the site. With about 20 years of data, it would not be prudent to change these locations, and additional sites would add little, if any, useful information. Historically, the locations have not changed since our RETS negotiations with the NRC staff, and the existing locations were understood to fall within the term "general area".

(16) The Licensee's response is considered acceptable. The two TLDs questioned in the review are located on a road instead of in a field, as would be required if they were located at the site boundary. Both locations are within one half mile of the site boundary, and are more accessible in winter than site boundary locations would be.

(17) Figure 2-1 in the Environmental Manual is illegible and must be replaced.

RESPONSE

This will be done in the next revision.

(17) The Licensee's response is considered acceptable. A commitment is included to provide a more legible Figure 2-1 in the Environmental Manual in the next revision.

(18) Another figure must be included in the Environmental Manual providing more plant detail to show sample locations within the site boundary, the liquid and gaseous release points, and boundaries for the unrestricted areas.

RESPONSE

A figure will be added to the next revision of the PBNP Environmental Manual. This will be similar to Figure 15.7.2-1 of the Point Beach Technical Specifications, with additional sampling locations shown.

(18) The Licensee's response is considered acceptable. A commitment is made to add a figure similar to Figure 15.7.2-2 of the PBNP Technical Specifications with additional sampling locations shown.

(19) The Environmental Manual describes the soil and shoreline sediment sampling program. However, these samples are not included in the technical specifications.

RESPONSE

In the course of developing RETS for Point Beach, both we and the NRC Staff agreed that neither soil nor shoreline sediment samples were required. However, we chose to continue these samples for historical continuity. There is no commitment or requirement to continue the samples, and thus no need to address them in the technical specifications.

(19) The Licensee's response is considered acceptable. The ODCM requires more monitoring than is required by the technical specifications.

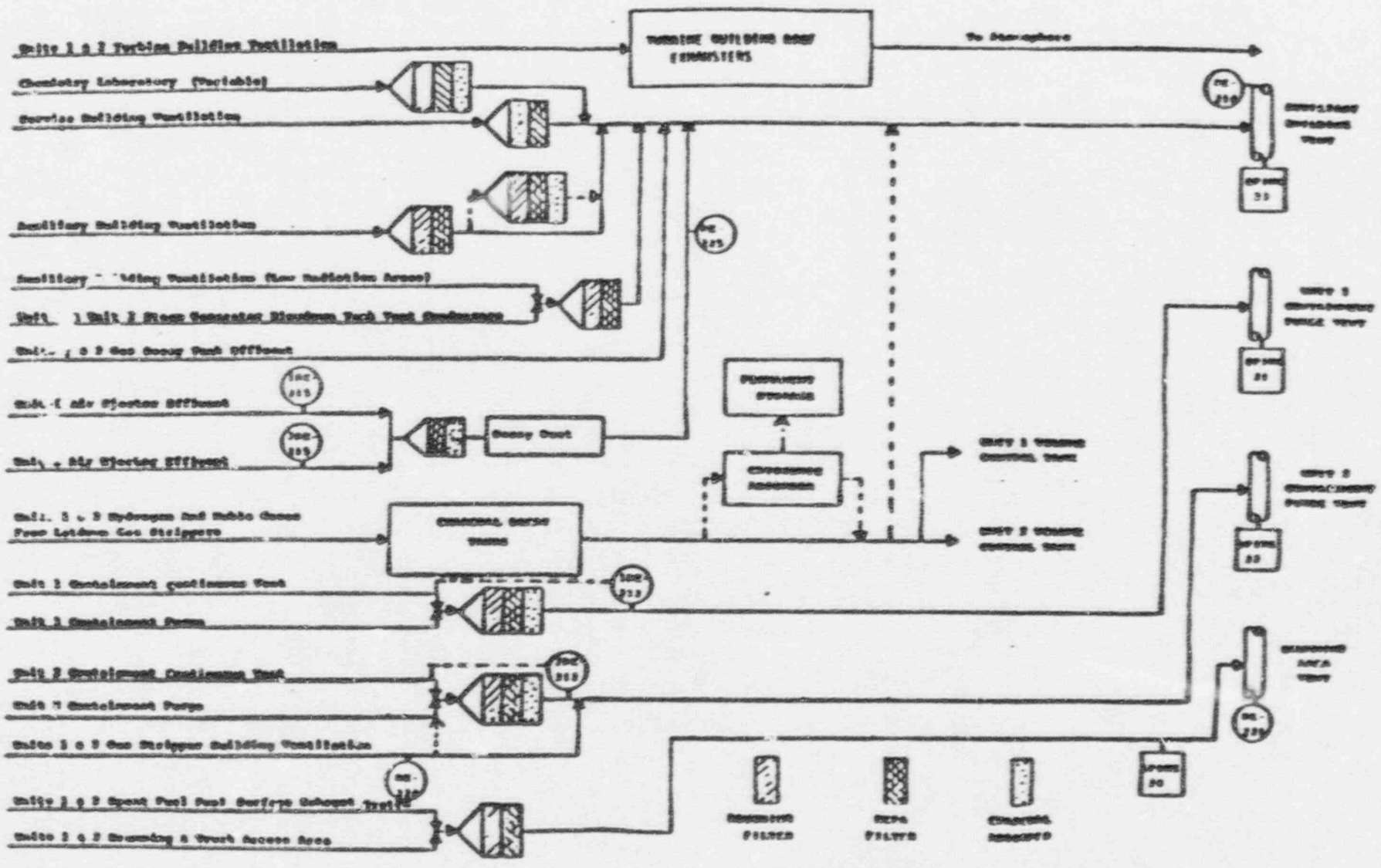

Figure 2-2