TECHNICAL EVALUATION REPORT

# RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATION IMPLEMENTATION (A-2)

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

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# FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

# 1. INTRODUCTION

## 1.1 PURPOSE OF REVIEW

The purpose of this technical evaluation report (TER) is to review and evaluate the proposed changes in the Technical Specifications of Vermont Yankee Nuclear Power Station with regard to Radiological Effluent Technical Specifications (RETS) and the Offsite Dose Calculation Manual (ODCM).

The evaluation uses criteria proposed by the NRC staff in the Model Technical Specifications for boiling water reactors (BWRs), NUREG-0473 [1]. This effort is directed toward the NRC objective of implementing RETS which comply principally with the regulatory requirements of the Code of Federal Regulations, Title 10, Part 50 (10CFR50), "Domestic Licensing of Production and Utilization Facilities," Appendix I [2]. Other regulations pertinent to the control of effluent releases are also included within the scope of compliance.

## 1.2 GENERIC BACKGROUND

Since 1970, 10CFR50, Section 50.36a, "Technical Specifications on Effluents from Nuclear Power Reactors," has required licensees to provide technical specifications which ensure that radioactive releases will be kept as low as reasonably achievable (ALARA). In 1975, numerical guidance for the ALARA requirement was issued in 10CFR50, Appendix I [3]. The licensees of all operating reactors were required to submit, no later than June 4, 1976, their proposed ALARA Technical Specifications and information for evaluation in accordance with 10CFR50, Appendix I.

However, in February 1976, the NRC staff recommended that proposals to modify Technical Specifications be deferred until the NRC completed the model RETS. The model RETS deals with radioactive waste management systems and environmental monitoring. Although the model RETS closely parallels 10CFR50, Appendix I requirements, it also includes provisions for addressing other issues.

These other issues are specifically stipulated by the following regulations:

- 10CFR20 [4], "Standards for Protection Against Radiation," Paragraphs 20.105(c), 20.106(g), and 20.405(c) require that nuclear power plants and other licensees comply with 40CFR190 [5], "Environmental Radiation Protection Standards for Nuclear Power Operations," and submit reports to the NRC when the 40CFR190 limits have been or may be exceeded.

- 10CFR50, Appendix A [6], "General Design Criteria for Nuclear Power Plants," contains Criterion 60 - Control of releases of radioactive materials to the environment; Criterion 63 - Monitoring fuel and waste storage; and Criterion 64 - Monitoring radioactivity releases.

- 10CFR50, Appendix B [7], establishes the quality assurance required for nuclear power plants.

The NRC position on the model RETS was established in May 1978 when the NRC's Regulatory Requirements Review Committee approved the model RETS: NUREG-0473 [1] for BWRs and NUREG-0472 for pressurized water reactors (PWRs) [8]. Copies were sent to licensees in July 1978 with a request to submit proposed site-specific RETS on a staggered schedule over a 6-month period. Licensees responded with requests for clarifications and extensions.

The Atomic Industrial Forum (AIF) formed a task force to comment on the model RETS. NRC staff members first met with the AIF task force on June 17, 1978. The model RETS was subsequently revised to reflect comments from the AIF and others. A principal change was the transfer of much of the material concerning dose calculations from the model RETS to a separate ODCM.

The revised model RETS was sent to licensees on November 15 and 16, 1978 with guidance (NUREG-0133 [9]) for preparation of the RETS and the ODCM and a new schedule for responses, again staggered over a 6-month period.

Four regional seminars on the RETS were conducted by the NRC staff during November and December 1978. Subsequently, Revision 2 of the model RETS and additional guidance on the ODCM were issued in February 1979 to each utility at individual meetings. In response to the NRC's request, operating reactor licensees subsequently submitted initial proposals on plant RETS and the ODCM. Review leading to ultimate implementation of these documents was initiated by the NRC in 1981 using subcontracted independent teams as reviewers.

As the RETS review process has progressed since September 1981, feedback from the licensees has led the NRC to believe that modification to some of the guidelines in the current version of Revision 2 is needed to clarify specific concerns of the licensees and thus expedite the entire review process. Starting in April 1982, NRC distributed revised versions of RETS in draft form to the licensees during site visits. The new guidance on these changes was presented at the AIF meeting on May 19, 1982 [10]. Some interim changes regarding the Radiological Environmental Monitoring Section were issued in 1982 [11, 12]. With the incorporation of these new changes, NRC issued, in December 1983, a draft version of NUREG-0473, Revision 3 [13], to serve as new guidance for the review teams.

## 1.3 PLANT-SPECIFIC BACKGROUND

In response to the NRC's request, the Licensee, Vermont Yankee Nuclear Power Corporation (VYNPC), submitted a RETS proposal dated February 3, 1979 [14] on behalf of Vermont Yankee Nuclear Power Station, which was followed by a submittal of the ODCM [15]. In the RETS submittal, the Licensee had used non-standard format. In an initial evaluation by the Franklin Reseach Center (FRC), an independent review team, the Licensee's RETS submittal was evaluated against the model RETS (NUREG-0473, Draft Revision 3) and assessed for compliance with the stipulated provisions. Review of the ODCM was conducted in accordance with NRC-issued guidelines (NUREG-0133). Copies of the draft review, dated August 20, 1982 [16, 17], were delivered to the NRC and the Licensee prior to a site visit by the reviewers.

The site visit was conducted on September 16-17, 1982 by the reviewers with the participation of plant personnel and the NRC staff. Discussions focused on the initial review of the proposed changes to the RETS and on the technical approaches for an ODCM. The deficiencies in the Licensee's proposed RETS were considered, deviations from NRC guidelines were pointed out, many differences were clarified, and only a few items remained unresolved pending justification by the Licensee. These issues are summarized in Reference 18.

In a letter transmittal dated January 24, 1983 [19], the Licensee sent FRC a revised draft RETS for review. In this submittal, the RETS was written in a non-standard format. Also included in the package was a list of justifications for major deviations from the model RETS. The Licensee also submitted a draft ODCM to FRC for review on July 14, 1983 [20]. Both draft submittals were reviewed by FRC, and discrepancies were documented [21, 22] and transmitted to NRC.

The final version of the Vermont Yankee RETS [23], dated December 1983, was submitted to the NRC and transmitted to the FRC reviewers together with justifications provided by the Licensee. The document was subsequently reviewed. Final evaluation of RETS was detailed in a comparison report [24] which used NUREG-0473, Draft Revision 3 [12] to evaluate the Licensee's submittal. The comparison report also incorporates NRC comments [25, 26] which serve as additional guidelines regarding plant-specific issues.

## 2. REVIEW CRITERIA

Review criteria for the RETS and ODCM were provided by the NRC in three documents:

NUREG-0472, RETS for PWRs

NUREG-0473, RETS for BWRs

NUREG-0133, Preparation of RETS for Nuclear Power Plants.

Twelve essential criteria are given for the RETS and ODCM:

1. All significant releases of radioactivity shall be controlled and monitored.

2. Offsite concentrations of radioactivity shall not exceed the 10CFR20, Appendix B, Table II limits.

3. Offsite radiation doses of radioactivity shall be ALARA.

4. Equipment shall be maintained and used to keep offsite doses ALARA.

5. Radwaste tank inventories shall be limited so that failures will not cause offsite doses exceeding 10CFR20 limits.

6. Hydrogen and/or oxygen concentration in the waste gas system shall be controlled to prevent explosive mixtures.

7. Wastes shall be processed to shipping and burial ground criteria under a documented program, subject to quality assurance verification.

8. An environmental monitoring program, including a land-use census and an interlaboratory comparison program, shall be implemented.

9. The radwaste management program shall be subject to regular audits and reviews.

10. Procedures for control of liquid and gaseous effluents shall be maintained and followed.

11. Periodic and special reports on environmental monitoring and on releases shall be submitted.

12. Offsite dose calculations shall be performed using documented and approved methods consistent with NRC methodology.

Subsequent to the publication of NUREG-0472 and NUREG-0473, the NRC staff issued guidelines [27, 28], clarifications [29, 30], and branch positions [31, 32, 33, 34] establishing a policy that guides the licensees of operating reactors to meet the intent, if not the letter, of the model RETS provisions. The NRC branch positions issued since the RETS implementation review began have clarified the model RETS implementation for operating reactors.

Review of the ODCM was based on the following NRC guidelines: Branch Technical Position, "General Content of the Offsite Dose Calculation Manual" [35]; NUREG-0133 [9]; and Regulatory Guide 1.109 [36]. The ODCM format is left to the licensee and may be simplified by tables and grid printouts.

# 3. TECHNICAL EVALUATION

## 3.1 GENERAL DESCRIPTION OF RADIOLOGICAL EFFLUENT SYSTEM

This section briefly describes the liquid and gaseous effluent radwaste treatment systems, release paths, and control systems installed at Vermont Yankee Nuclear Power Station, a BWR.

### 3.1.1 Radioactive Liquid Effluent

The liquid radioactive wastes at the Vermont Yankee plant consist of four categories: high purity wastes, low purity wastes, chemical wastes, and detergent wastes. The high purity wastes are processed by filtration and ion exchange through the waste collector filter or fuel pool and waste demineralizer as required. Following processing, the liquid is pumped to the waste sample tank where it is sampled. If high purity requirements are met, the waste contents are normally transferred to the condensate storage tank. Otherwise, the liquid wastes are either recycled through the radwaste system or discharged. The low purity wastes, chemical wastes, and detergent wastes generally have a low concentration of radioactive impurities, and processing consists of simple filtration. If necessary, these wastes can be combined with the high purity wastes for subsequent processing. All wastes are discharged in batches into the circulating water discharge structure (see Figure 1) for release to the Connecticut River. Also joined into the circulating water is the continuous discharge of service water.

### 3.1.2 Radioactive Gaseous Effluent

The process gases from the Vermont Yankee Nuclear Power Station are routed to the plant stack for dilution and elevated release for discharge to the atmosphere (see Figure 2). The substreams routed to the plant stack are the building ventilation, the turbine gland seal/mechanical vacuum pumps, and the standby gas treatment system. The gaseous radwaste system includes the augmented offgas subsystem (AOG) for the main condenser air ejectors and other

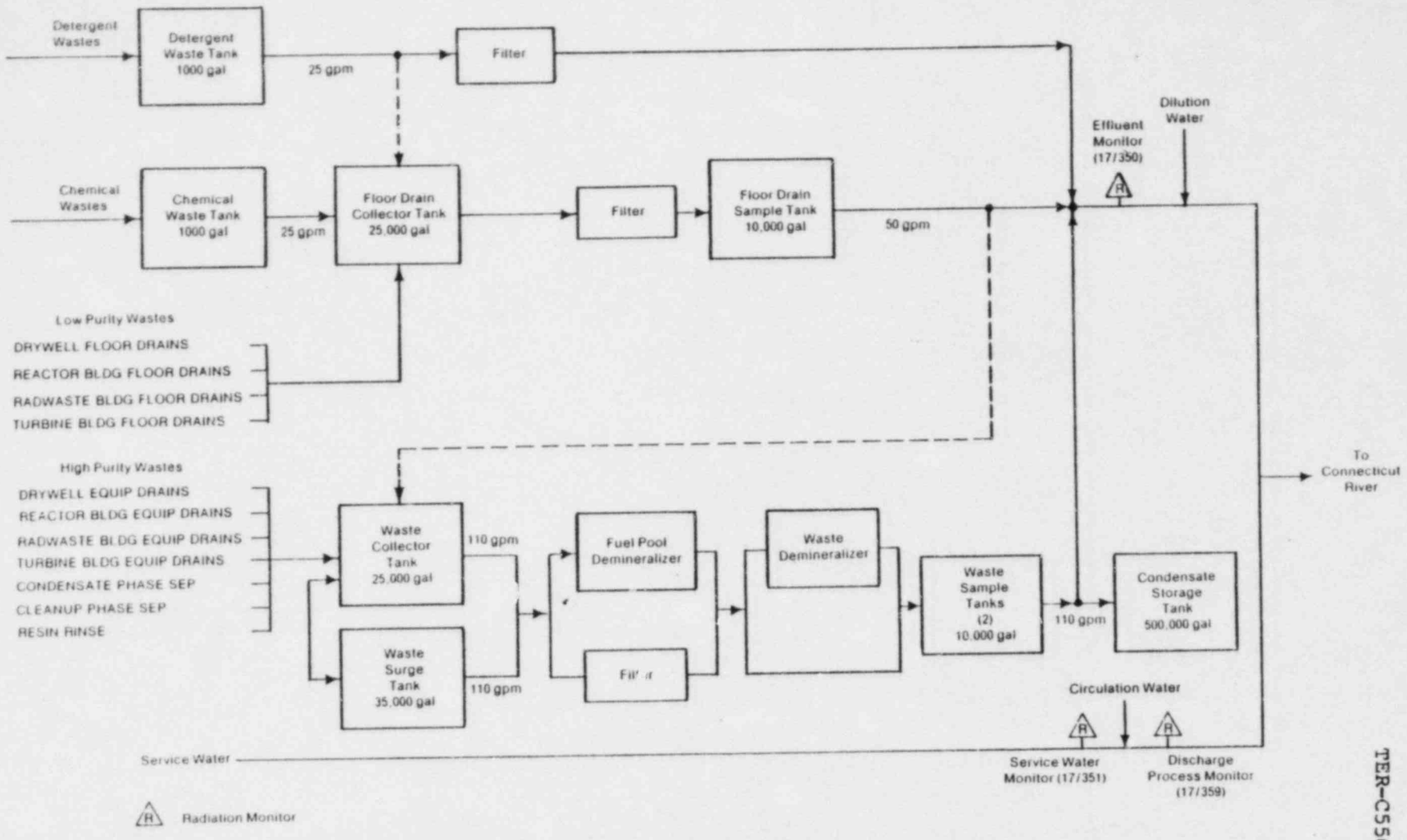


Figure 1. Liquid Radwaste Treatment Systems, Effluent Paths, and Controls for Vermont Yankee Nuclear Power Station

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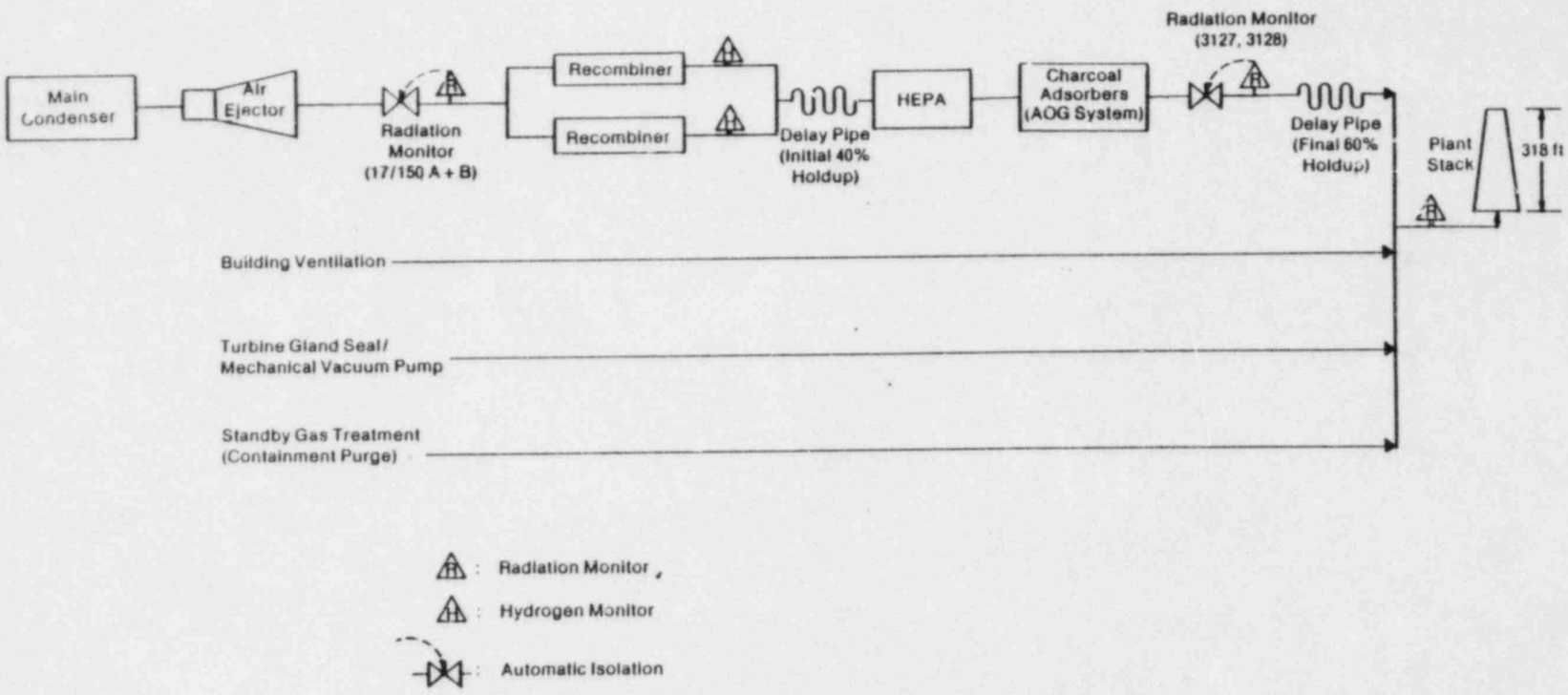


Figure 2. Gaseous Radwaste Treatment Systems, Effluent Paths, and Controls for Vermont Yankee Nuclear Power Station

subsystems for the startup vacuum pump and the gland seal condenser. The AOG system consists of a dual hydrogen dilution and recombiner subsystem and a single charcoal adsorber subsystem.

## 3.2 RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS

The evaluation of the Licensee's proposed RETS against the provisions of NUREG-0473 included the following: (1) a review of information provided in the Licensee's 1979 and 1983 draft submittals [14, 15, 19, 20], (2) the resolution of problem areas in those submittals by means of a site visit [18], and (3) a review of the Licensee's December 1983 RETS submittal [23].

### 3.2.1 Effluent Instrumentation

The objective of the RETS with regard to effluent instrumentation is to ensure that all significant releases of radioactivity are monitored. The RETS specify that all effluent monitors be operable and alarm/trip setpoints be determined to ensure that radioactivity levels do not exceed the maximum permissible concentration (MPC) set by 10CFR20. To further ensure that the instrumentation functions properly, surveillance requirements are needed in the specifications.

#### 3.2.1.1 Radioactive Liquid Effluent Monitoring Instrumentation

A radiation monitor (No. 17/350) has been installed for the liquid radwaste effluent line (Figure 1) which combines effluent streams from the releases of high purity wastes, low purity wastes, chemical wastes, and detergent wastes. The Licensee has also provided a monitor (No. 17/351) for the main service water, which combines with the circulation water at the discharge structure, where a process monitor (No. 17/359) is also provided.

The Licensee has not provided automatic isolation function for the liquid radwaste effluent line. However, because of the infrequent nature of the batch discharges (on the order of once per year or less) and the adequate sampling program provided by the Licensee, the instrumentation monitoring system is deemed to meet the intent of NUREG-0473.

These existing monitoring capabilities have provided adequate assurance that the provisions of NUREG-0473 for the radioactive liquid effluent monitoring instrumentation are met.

3.2.1.2 Radioactive Gaseous Effluent Monitoring Instrumentation

The plant main stack is provided with a monitoring system capable of monitoring noble gases, iodines, and particulates. The main condenser air ejector for each unit also has a redundant noble gas monitor (No. 17/150 A and B). The Licensee has also provided redundant radiation monitors (No. 3127, 3128) for the AOG treatment system. This AOG monitor is equipped with automatic isolation capability as specified by NUREG-0473.

The existing monitoring capabilities provided by the Licensee have met the intent of NUREG-0473 for radioactive gaseous effluent monitor instrumentation.

3.2.2 Concentration and Dose Rates of Effluents

3.2.2.1 Liquid Effluent Concentration

In Section 3.8.A of the Licensee's submittal, a commitment is made to maintain the concentration of radioactive liquid effluents released to unrestricted areas to within 10CFR20 limits, and, if the concentration of liquid effluents exceeds these limits, the concentration will be restored immediately to a value equal to or less than the MPC specified in 10CFR20. All batches of radioactive liquid effluents from the release tanks are sampled and analyzed in accordance with a sampling and analysis program (Table 4.8.1 of the Licensee's submittal) which meets the intent of NUREG-0473.

It was determined that the Licensee-proposed alternative meets the intent of NUREG-0473.

3.2.2.2 Gaseous Effluent Dose Rate

In Section 3.8.E of the Licensee's submittal, a commitment is made to maintain the offsite dose rate from radioactive gaseous effluents to areas at

and beyond the site boundary within 10CFR20 limits, or the equivalent dose rate values prescribed by Section 3.11.2.1 of NUREG-0473. If the dose rate of gaseous effluents exceeds these limits, it will be restored immediately to a value equal to or less than these limits. This commitment satisfies the provisions of NUREG-0473.

The radioactive gaseous waste sampling and analysis program (Table 4.8.2 of the Licensee's submittal) provides adequate sampling and analysis of the plant stack discharges, including the substreams, and therefore meets the intent of NUREG-0473.

3.2.3 Offsite Doses from Effluents

The objective of the RETS with regard to offsite doses from effluents is to ensure that offsite doses are kept ALARA and are in accordance with 10CFR50, Appendix I, and 40CFR190. The Licensee has made a commitment to (1) meet the quarterly and yearly dose limitations for liquid effluents, per Section II.A of Appendix I, 10CFR50; (2) restrict the air doses for beta and gamma radiation from the site to areas at and beyond the site boundary as specified in 10CFR50, Appendix I, Section II.B; (3) maintain the dose level at and beyond the site boundary from release of iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half lives greater than 8 days within the design objectives of 10CFR50, Appendix I, Section II.C; and (4) limit the annual dose from all station sources of the plant to any member of the public to within the requirements of 40CFR190. In each pertinent section, the Licensee has made a commitment to perform dose calculations in accordance with methods given in the ODCM. This satisfies the intent of NUREG-0473.

3.2.4 Effluent Treatment

The objectives of the RETS with regard to effluent treatment are to ensure that wastes are treated so keep releases ALARA and to satisfy the provisions of Technical Specifications governing the maintenance and use of radwaste treatment equipment. The Licensee has made a commitment to use the liquid (Section 3.8.C of the Licensee's submittal) radwaste treatment systems when

the projected dose, averaged over 31 days, exceed 25% of the annual dose design objectives, prorated monthly. For gaseous radwaste, the Licensee proposes to treat the effluents by operating the gaseous radwaste treatment system (AOG system) whenever the main condenser air ejector system is in operation. The Licensee's existing gaseous radwaste treatment system also includes the offgas holdup line, HEPA filters, and the stack filter house filtration. The Licensee has also made a commitment to use the ventilation exhaust treatment system when the projected monthly dose exceeds the limit specified by NUREG-0473. The Licensee has also made a commitment in the ODCM to calculate the projected doses on a monthly basis. It is determined that the Licensee's proposal meets the intent of NUREG-0473.

3.2.5 Radioactivity Inventory Limits

The objective of the RETS with regard to the liquid tank inventory limits is to ensure that the rupture of a radwaste tank would not cause offsite doses greater than the limits set in 10CFR20 for non-occupational exposure. Also, the gaseous radioactivity release inventory is to be limited to within a rate of 100 microcuries per second per megawatt thermal, during the operation of the main condenser air ejector. The Licensee has provided a limit of 10 curies for any outside temporary tanks. For radioactivity releases from the main condenser air ejector, a release rate limit of 0.16 curies/sec (after 30 min delay) has been set for noble gases, which is based on the rated thermal power of 1593 MWt at Vermont Yankee Nuclear Power Station. The Licensee has also made a commitment to take a more immediate action, i.e., to place the plant in hot standby within 12 hours, if the release rate from the air ejector exceeds 1.5 curies/sec. The Licensee's commitment to comply with these radioactivity inventory and release rate limits satisfies the intent of NUREG-0473.

3.2.6 Explosive Gas Mixtures

The objective of the RETS with regard to explosive gas mixtures is to prevent hydrogen explosions in waste gas systems. The Licensee claimed that

the waste gas system is designed to withstand a hydrogen explosion and has thus made a commitment to maintain a safe concentration of hydrogen in the main condenser offgas treatment system using redundant hydrogen monitoring systems for recombiner trains. This commitment satisfies the intent of NUREG-0473.

3.2.7 Solid Radwaste System

The objective of the RETS with regard to the solid radwaste system is to ensure that radwaste will be properly processed and packaged before it is shipped to the burial site. Specification 3.11.3 of NUREG-0473 provides for the establishment of a PCP, or the equivalent, to show compliance with this objective. The Licensee has made a commitment to implement such a program in accordance with a PCP and to thus ensure that radwaste is properly processed and packaged before it is shipped to the burial site. This meets the intent of NUREG-0473.

3.2.8 Radiological Environmental Monitoring Program

The objectives of the RETS with regard to environmental monitoring are to ensure that an adequate and full-area-coverage environmental monitoring program exists and that the 10CFR50, Appendix I requirements for technical specifications on environmental monitoring are satisfied. In all cases, the Licensee has followed NUREG-0473 guidelines, including the Branch Technical Position dated November 1979 [32], and has provided an adequate number (40) of sample locations for pathways identified. The Licensee's methods of analysis and maintenance of yearly records satisfy the NRC guidelines and meet the intent of 10CFR50, Appendix I. The Licensee has also made a commitment to document the environmental monitoring sample locations in the ODCM, which meets the intent of NUREG-0473. The specification for the land use census satisfies the provisions of Section 3.12.2 of NUREG-0473 by providing for an annual census in the specified areas. The Licensee participates in an interlaboratory comparison program approved by the NRC and reports the results in the Annual Radiological Environmental Operating Report, which also meets the intent of NUREG-0473.

3.2.9 Audits and Reviews

The objective of the RETS with regard to audits and reviews is to ensure that audits and reviews of the radwaste and environmental monitoring programs are properly conducted. The Licensee's administrative structure designates the Plant Operations Review Committee (PORC) and the Nuclear Safety Audit and Review Committee (NSARC) as the groups responsible for the review and audit of the radiological environmental monitoring program, the ODCM, and the PCP. The PORC is responsible for reviewing the procedures associated with these programs. The NSARC is responsible for auditing the program as often as is specified under NUREG-0473.

3.2.10 Procedures and Records

The objective of the RETS with regard to procedures is to satisfy the provisions for written procedures specified in NUREG-0473 for implementing the ODCM, the PCP, and the quality program (QA) program. It is also an objective of RETS to properly retain the documented records related to the environmental monitoring program and certain QA procedures. The Licensee has made a commitment to establish, implement, and maintain written procedures for the PCP, ODCM, and QA program according to the provisions of NUREG-0473 [13]. The Licensee intends to retain the records of the radiological environmental monitoring program for the duration of the facility operating license. It is determined that the Licensee has met the intent of NUREG-0473 in these areas.

3.2.11 Reports

In addition to the reporting requirements of Title 10, Code of Federal Regulations (10CFR), the objective of the RETS with regard to administrative controls is also to ensure that appropriate periodic and special reports are submitted to the NRC.

The Licensee made a commitment to follow applicable reporting requirements stipulated by 10CFR regulations and also the following reports specified by NUREG-0473:

1. Annual radiological environmental operating report. In Section 6.7.C.3 of the Licensee's submittal, a commitment was made to provide an annual radiological environmental surveillance report that includes summaries, interpretations, and analysis of the results of the environmental surveillance activities. The report also includes the results of land use censuses, and participation in an interlaboratory comparison program specified by Specification 3.12.3 of NUREG-0473.

2. Semiannual radioactive release reports. In Section 6.7.C.1 of the Licensee's submittal, a commitment was made to provide semiannual effluent release reports which include a summary of radioactive liquid and gaseous effluents and solid waste released, an assessment of offsite doses, and a list of unplanned releases. Listing of new locations for dose calculations identified by the land use census as well as any changes to ODCM and PCP are also included in the report.

3. Special report. In Section 6.7.C.2 of the Licensee's submittal, a commitment was made to file a 30-day special report to the NRC under the following conditions as prescribed by the proposed specifications:

   - Exceeding radioactive liquid effluent limits according to:

     Dose, Specification 3.8.B.1
     Liquid Waste Treatment, Specification 3.8.C.1

   - Exceeding radioactive gaseous effluent limits according to:

     Dose, Specifications 3.8.F.1 and 3.8.G.1
     Gaseous Waste Treatment, Specifications 3.8.H.1 and 3.8.I.1

   - Exceeding radioactive effluent limits according to:

     Uranium Fuel Cycle Dose Commitment, Specification 3.8.M

   - Exceeding the reporting levels of Table 3.9.4 for the radioactivity measured in the environmental sampling medium, Specification 3.9.C

   - Land use census not being conducted in accordance with Specification 3.9.D.

These reporting commitments have satisfied the provisions of NUREG-0473.

3.2.12 Implementation of Major Programs

One objective of the administrative controls is to ensure that implementation of major programs such as the ODCM, PCP, and major changes to the radioactive waste treatment system follow appropriate administrative

procedures. The Licensee has made a commitment to review, report, and implement major programs such as the ODCM, PCP, and major changes to the radioactive waste treatment system. This commitment meets the intent of NUREG-0473.

## 3.3 OFFSITE DOSE CALCULATION MANUAL (ODCM)

As specified in NUREG-0473, the ODCM is to be developed by the Licensee to document the methodology and approaches used to calculate offsite doses and maintain the operability of the effluent systems. As a minimum, the ODCM should provide equations and methodology for the following topics:

- o alarm and trip setpoint on effluent instrumentation
- o liquid effluent concentration in unrestricted areas
- o gaseous effluent dose rate at or beyond the site boundary
- o liquid and gaseous effluent dose contributions
- o liquid and gaseous effluent dose projections.

In addition, the ODCM should contain flow diagrams, consistent with the systems being used at the station, defining the treatment paths and the components of the radioactive liquid, gaseous, and solid waste management systems. Of course, these diagrams should be consistent with the systems being used at the station. A description and location of samples in support of the environmental monitoring program are also needed in the ODCM.

### 3.3.1 Evaluation

The Licensee has followed the methodology of NUREG-0133 [9] to determine the alarm and trip setpoints for the liquid and gaseous effluent monitors, which ensures that the maximum permissible concentrations, as specified in 10CFR20, will not be exceeded by discharges from various liquid or gaseous release points.

The Licensee demonstrated the method of calculating the radioactive liquid concentration by describing in the ODCM the means of collecting and analyzing representative samples prior to and after releasing liquid effluents

into the circulating water discharge. The method provides added assurance of compliance with 10CFR20 for liquid effluent releases.

Methods are also included for showing that dose rates at or beyond the site boundary due to noble gases, iodine-131, tritium, and particulates with half-lives greater than 8 days are in compliance with 10CFR20. In this calculation, the Licensee has considered effluent releases from the plant stack; those releases are being treated as elevated level. In all cases, the Licensee has used the highest annual average values of relative concentration (X/Q) and relative deposition (D/Q) to determine the controlling locations. For elevated releases from the main stack, the Licensee has also considered the direct radiation contribution from exposure to the finite plume. The Licensee intends to use the maximally exposed individual and the critical organ as the reference receptor. The Licensee has demonstrated that the described methods and relevant parameters have followed the conservative approaches provided by NUREG-0133 and Regulatory Guide 1.109. However, the Licensee has not specifically included iodine-133 in Table 1.1-1 of the submittal. Also, the Licensee has not shown the derivation of the site-specific dose rate factors provided in the proposed Table 1.1-12.

Evaluation of the cumulative dose is to ensure that the quarterly and annual dose design objectives specified in RETS are not exceeded.

For liquid releases, the Licensee has identified fish consumption from the Connecticut River as the viable pathway. In the calculation, the Licensee has used the suggested values given in Regulatory Guide 1.109. As in the case of dose rate calculation, the Licensee has used the maximally exposed individual as the reference receptor. To correctly assess the cumulative dose, the Licensee intends to estimate the dose once per 31 days.

Evaluation of the cumulative dose from noble gas releases includes both beta and gamma and air doses at and beyond the site boundary. The critical organs under consideration are the total body and skin for gamma and beta radiation, respectively. Again, the Licensee has used the maximum (X/Q) values as discussed earlier and has followed the methodology and parameters of NUREG-0133 and Regulatory Guide 1.109. However, the Licensee should clearly

define the average gamma dilution factor [$X/Q^{\gamma}$] and the method to calculate it. Also, the Licensee should include the derivation of the site-specific dose factors shown in the proposed Table 1.1-12.

For iodine-131, tritium, and particulates with half-lives greater than 8 days, the Licensee has provided a method to demonstrate that cumulative doses calculated from the release meet both quarterly and annual design objectives. Again, in the Licensee's Table 1.1-1, iodine-133 should specifically be included in the dose calculations.

Using the existing methodology for gaseous and liquid dose calculations, the Licensee has demonstrated a procedure to determine the monthly dose and to ensure that the design objectives for the liquid radwaste system and the ventilation exhaust system are not exceeded.

Adequate flow diagrams defining the effluent paths and components of the radioactive liquid and gaseous waste treatment systems have been provided by the Licensee. Radiation monitors specified in the Licensee-submitted RETS are also properly identified in the flow diagrams, except that the Licensee has not designated the hydrogen monitors. Also, the Licensee should delete the dose projection for the AOG treatment system, as the Licensee made a commitment to operate the AOG treatment system whenever the condenser air ejector system is in operation. The Licensee should also add a section for monthly dose projection for the ventilation exhaust treatment system.

The Licensee has provided a description of sampling locations in the ODCM and has identified them in Tables 4.1 and 4.2 and also in Figures 4-1 through 4-5 of that document. This description is consistent with the sampling locations specified in the Licensee's RETS Table 3.9.3 on environmental monitoring.

The Licensee has provided a method to assess the total dose (40CFR190 requirement) including the direct radiation, which satisfies the total dose provision of NUREG-0473.

In summary, except for the deficiencies discussed above, the Licensee's ODCM uses documented and approved methods that are consistent with the methodology and guidance in NUREG-0133, and therefore is an acceptable reference.

## 4. CONCLUSIONS

Table 1 summarizes the results of the final review and evaluation of the submittal for the Vermont Yankee Nuclear Power Station proposed Radiological Effluent Technical Specifications (RETS). The following conclusions have been reached:

1. The Licensee's proposed Radiological Effluent Technical Specifications (RETS) submitted January 23, 1984 [23] meet the intent of NUREG-0473, "Radiological Effluent Technical Specifications."

2. The Licensee's Offsite Dose Calculation Manual (ODCM) submitted July 14, 1983 [20] uses documented and approved methods that are consistent with the criteria of NUREG-0133 and applicable to the Vermont Yankee Nuclear Power Station, with the following exceptions:

   - The Licensee has not made a commitment to specifically include iodine-133 for the dose rate and dose calculations, as indicated by the Licensee's Table 1.1-1.

   - The Licensee has not clearly explained the derivation of the effective average gamma dilution factor [$X/Q^{\gamma}$], and has not provided a method for its derivation.

   - The Licensee's service water monitor (Section 2.2.2 of the Licensee's submittal) does not have a specified LLD (see proposed RETS Table 4.8.1), and the setpoint is currently set at three times the background level. An alternative is needed to ensure that such a setpoint would correctly pick up a potential radioactivity leakage into the service water.

   - The Licensee has included a dose projection for the AOG treatment system, which is inconsistent with the RETS submittal and should therefore be deleted.

   - The Licensee has not included a dose projection for the ventilation exhaust treatment system as specified by the submittal.

   - The Licensee has not designated hydrogen monitors in Figure 6-2 of the ODCM submittal.

   - In the last line of page 1-6 of the Licensee's submittal, the number $2 \times 10^{4}$ should read $2 \times 10^{-4}$ to be consistent with the RETS submittal.

Table 1. Evaluation of Proposed Radiological Effluent Technical Specifications (RETS), Vermont Yakee Nuclear Power Station

| RETS Requirement | Technical Specifications: NRC Staff Model RETS NUREG-0473 (Section) | Technical Specifications: Licensee Proposal (Section) | Replaces or Updates Existing Tech. Spec. (Section) | Evaluation |
|---|---|---|---|---|
| Effluent Instrumentation | 3/4.3.3.10, 3/4.3.3.11 | 3.9.A, 3.9.B | 3.9 | Meets the intent of NRC criteria |
| Radioactive Effluent Concentrations | 3/4.11.1.1, 3/4.11.2.1 | 3.8.A, 3.8.E | 3.8 | Meets the intent of NRC criteria |
| Offsite Doses | 3/4.11.1.2, 3/4.11.2.2, 3/4.11.2.3, 3/4.11.4 | 3.8.B, 3.8.F, 3.8.G, 3.8.M | 3.8 | Meets the intent of NRC criteria |
| Effluent Treatment | 3/4.11.1.3, 3/4.11.2.4, 3/4.11.2.5 | 3.8.C, 3.8.H, 3.8.I | Not addressed | Meets the intent of NRC criteria |
| Radioactivity Inventory Limits | 3/4.11.1.4, 3/4.11.2.7 | 3.8.D, 3.8.K | 3.8 | Meets the intent of NRC criteria |
| Explosive Gas Mixtures | 3/4.11.2.6 | 3.8.J | Not addressed | Meets the intent of NRC criteria |
| Solid Radioactive Waste | 3/4.11.3 | 3.8.N | Not addressed | Meets the intent of NRC criteria |
| Environmental Monitoring | 3/4.12.1 | 3.9.C | 3.9.D | Meets the intent of NRC criteria |
| Audits and Reviews | 6.5.1, 6.5.2 | 6.2.A, 6.2.B | 6.5.2, 6.5.3 | Meets the intent of NRC criteria |
| Procedures and Records | 6.8, 6.10 | 6.5, 6.6 | 6.5, 6.6 | Meets the intent of NRC criteria |
| Reports | 6.9.1.11, 6.9.1.12, 6.9.2 | 6.7.C.1, 6.7.C.2, 6.7.C.3 | 6.7 | Meets the intent of NRC criteria |
| Implementation of Major Programs | 6.13, 6.14, 6.15 | 6.12, 6.13, 6.14 | Not addressed | Meets the intent of NRC criteria |

## 5. REFERENCES


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   NUREG-0473

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3. Title 10, Code of Federal Regulations, Part 50, Appendix I, Section V, "Effective Dates"

4. Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

5. Title 40, Code of Federal Regulations, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations"

6. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants"

7. Title 10, Code of Federal Regulations, Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"

8. "Radiological Effluent Technical Specifications for Pressurized Water Reactors," Rev. 2
   NRC, July 1979
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    August 9, 1982

12. W. Meinke (NRC)
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NRC Docket No. 50-271

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17. Technical Review of Offsite Dose Calculation Manual for Vermont Yankee Nuclear Power Station (Draft)
Franklin Research Center, August 20, 1982

18. Franklin Research Center
Letter of Transmittal to NRC
Subject: Trip report on site visit to Vermont Yankee Nuclear Power Station
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January 24, 1983
NRC Docket No. 50-271

20. Vermont Yankee Offsite Dose Calculation Manual, Draft
Vermont Yankee Nuclear Corporation
July 14, 1983
NRC Docket No. 50-271

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Subject: FRC's Comments on Vermont Yankee's Draft RETS submittal
March 28, 1983

22. S. Pandey/S. Chen (FRC)
Memo to W. Meinke (NRC)
Subject: FRC's Comments on Vermont Yankee's Draft ODCM submittal
August 18, 1983

23. L. H. Heider (VYNPC)
Letter to D. G. Eisenhut (NRC)
Subject: Revised Vermont Yankee Radiological Effluent Technical Specifications (RETS)
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24. "Comparison of Specification NUREG-0473, Radiological Effluent Technical Specifications for BWRs, vs. Licensee Final Submittal, dated December 1983, of Radiological Effluent Technical Specifications for Vermont Yankee Nuclear Power Station"
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