Docket Nos. 50-213

License Nos. DPR-61

RADIOLOGICAL EFFLUENT MONITORING AND OFFSITE DOSE CALCULATION MANUAL AND PROCESS CONTROL PROGRAM

HADDAM NECK PLANT

Connecticut Yankee
Atomic Power Co.

January 1989
Revision 1

SECTION I

RADIOLOGICAL EFFLUENT

MONITORING MANUAL

FOR THE
HADDAM NECK PLANT

DOCKET NO. 50-213

January 1989
Revision 1

RADIOLOGICAL EFFLUENT MONITORING MANUAL

TABLE OF CONTENTS

A. INTRODUCTION

The purpose of this manual is to provide the sampling and analysis programs which provide input to the ODCM for calculating liquid and gaseous effluent concentrations and offsite doses. Guidelines are provided for operating radioactive waste treatment systems in order that offsite doses are kept as-low-as-reasonably-achievable (ALARA).

The *Radiological Environmental Monitoring Program* outlined within this manual provides confirmation that the measurable concentrations of radioactive material released as a result of operations at the Haddam Neck Plant are not higher than expected.

In addition, this manual outlines the information required to be submitted to the NRC in both the *Annual Radiological Environmental Operating Report* and the *Semiannual Radioactive Effluent Release Report*.

B. RESPONSIBILITIES

All changes to this manual shall be reviewed by the Plant Operations Review Committee prior to implementation.

All changes to this manual shall be approved by the NRC prior to implementation.

All changes and their rationale shall be documented in the *Semiannual Radioactive Effluent Release Report*.

It shall be the responsibility of the Station Superintendent to ensure that this manual is used in performance of the surveillance requirements and administrative controls of the *Technical Specifications*.

C. LIQUID EFFLUENTS

C.1 Liquid Effluent Sampling and Analysis Program

Radioactive liquid wastes shall be sampled and analyzed in accordance with the program specified in *Table C-1* for the Haddam Neck Plant. The results of the radioactive analyses shall be input to the methodology of the ODCM to assure that the concentrations at the point of release are maintained within the limits of the *Technical Specification*.

Table C-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[a] (μCi/ml)
A. Batch Release[k]	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[e]	5×10^{-7}
1. Waste Test Tanks *and* Recycle Test Tanks			I-131, Mo-99 Zn-65, Cr-51 Ru-106	1×10^{-6}
			Ce-141, Ce-144	5×10^{-6}
	One Batch per Month[d,i]	Monthly	Kr-85	1×10^{-4}
			Other Dissolved and Entrained Gases	1×10^{-5}
2. Turbine Building Sumps (Waste Neutralization Tank)[h]	Prior to Each Batch	Monthly Composite[b,c]	H-3[j]	1×10^{-5}
			Gross alpha[j]	1×10^{-7}
	Prior to Each Batch	Quarterly Composite[b,c]	Sr-89[j], Sr-90[j]	5×10^{-8}
			Fe-55[j]	1×10^{-6}
B. Continuous Release	Daily[f] Grab Sample	Weekly Composite[c]	Principal Gamma Emitters[e]	5×10^{-7}
1. Steam Generator Blowdown			I-131, Mo-99 Zn-65, CR-51 Ru-106	1×10^{-6}
			Ce-141, Ce-144	5×10^{-6}
	Monthly Grab Sample	Monthly	Kr-85	1×10^{-4}
			Other Dissolved and Entrained Gases	1×10^{-5}
2. Service Water Effluent	Weekly Grab Sample	Monthly Composite[c]	H-3	1×10^{-5}
			Gross alpha[g]	1×10^{-7}
	Weekly Grab Sample	Quarterly Composite[c]	Sr-89[g], Sr-90[g]	5×10^{-8}
			Fe-55	1×10^{-6}

TABLE C-1 (Cont'd.)

TABLE NOTATIONS

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 x 10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLD's unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for that particular sample.

b. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

d. One batch per month means one batch from a waste test tank and one from a recycle test tank if they are discharged that month.

e. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Cs-134 and Cs-137. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLD's higher than required, the reasons shall be documented in the semiannual radioactive effluent release report.

f. At least 5 days per week.

g. For Service Water, these analyses are only required if a weekly gamma analysis indicates a gamma activity greater than 5×10^{-7} µCi/ml.

h. Turbine building sumps are pumped to the waste neutralization tank and then discharged on a batch basis. Each batch should be sampled and analyzed for principal gamma emitters only if the steam generator gamma activity is greater than 5×10^{-7} µCi/ml.

i. Not required for turbine building sumps (waste neutralization tank).

j. Only required for the turbine building sumps (waste neutralization tank) if the gamma activity of the batch is greater than 5×10^{-7} µCi/ml.

k. A batch release is the discharge of liquid waste of a discrete volume. Prior to sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided.

C.2 Liquid Radioactive Waste Treatment

All applicable liquid radioactive waste treatment systems will be operated when the projected dose due to liquid effluents averaged over 31 days exceeds 0.06 mrem to the total body or 0.2 mrem to any organ.

The term "all applicable liquid radioactive waste treatment" is defined as that equipment applicable to a waste stream responsible for greater than ten percent (10%) of the total projected dose. The liquid radioactive waste treatment systems equipment at the Haddam Neck Plant consists of the following:

- Portable mixed bed demineralizer and either evaporator or mixed bed polishing demineralizer
- Letdown system mixed bed demineralizer and either evaporator or boron recovery mixed bed polishing demineralizer

With radioactive liquid waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission a report that includes the following information:

1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,
2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and
3. Summary description of action(s) taken to prevent a recurrence.

If the above treatment systems are not routinely operating, doses due to liquid effluents to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

D. GASEOUS EFFLUENTS

D.1 Gaseous Effluents Sampling and Analysis Program

Radioactive gaseous wastes shall be sampled and analyzed in accordance with the program specified in *Table D-1* for the Haddam Neck Plant. The results of the radioactive analyses shall be input to the methodology of the ODCM to assure that the offsite dose rates are maintained within the limits of the *Technical Specification*.

TABLE D-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[a] (μCi/cc)
A. Waste Gas Decay Tank	Grab Sample Prior to Each Tank Discharge	Prior to Each Tank	Principal Gamma Emitters[e] H-3 Xe-138	1×10^{-4} 1×10^{-6} 3×10^{-4}
B. Containment Purge	Grab Sample Prior to Each Purge	Prior to Each Purge	Principal Gamma Emitters[e] H-3[f] Xe-138	1×10^{-4} 1×10^{-6} 3×10^{-4}
C. Main Stack	Monthly[c] Gaseous Grab Samples	Monthly[c]	Principal Gamma Emitters[e] H-3 Xe-138	1×10^{-4} 1×10^{-6} 3×10^{-4}
	Continuous[d]	Weekly[b] Charcoal Sample	I-131 I-133	1×10^{-12} 1×10^{-10}
	Continuous[d]	Weekly[b] Particulate Sample	Principal Particulate Gamma Emitters[e] (I-131, others with Half lives > 8 days)	1×10^{-11}
	Continuous[d]	Monthly Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous[d]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[d]	Noble Gas Monitor	Noble Gases Gross Activity	1×10^{-6}

TABLE D-1 (Cont'd.)

TABLE NOTATIONS

a. The lower limit of detection (LLD) is defined in *Table Notations* of *Table C-1*.

b. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing. Special sampling and analysis of iodine and particulate filters shall also be performed whenever reactor coolant I-131 samples taken 2-6 hours following a THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER in one hour show an increase of greater than a factor of 5. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLD's may be increased by a factor of 10 for these samples.

c. Sampling and analysis of principal gamma emitters shall also be performed within 8 hours following shutdown, startup, or a THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER within one hour unless *(1)* analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 3 and *(2)* the noble gas activity monitor shows that effluent activity has not increased by more than a factor of 3.

d. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with *Technical Specifications*.

e. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, and Xe-135 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the *Semiannual Radioactive Effluent Release Report*.

f. When the refueling cavity is flooded and purging is in progress, samples shall be taken at least once every 24 hours from the charging floor (refueling floor) and analyzed for tritium. The results shall be used along with containment purge flow rates to determine tritium releases.

D.2 Gaseous Radioactive Waste Treatment

All applicable gaseous radioactive waste treatment systems shall be operated when the projected dose due to gaseous effluents averaged over 31 days exceeds 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ due to gaseous particulate effluents.

The term all applicable gaseous radioactive treatment is defined as that equipment applicable to a waste stream responsible for greater than ten percent (10%) of the total projected dose. The gaseous radioactive waste treatment systems equipment at the Haddam Neck Plant consists of the following:

- Waste Gas Surge Tank, Waste Gas Compressor A or B and at least one Waste Gas Decay Tank
- Ventilation System HEPA Filter and Charcoal Filter

With gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission a report that includes the following information:

1. Explanation of why gaseous radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reasons for the inoperability,
2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and
3. Summary description of action(s) taken to prevent a recurrence.

If the above treatment systems are not routinely operating, doses due to gaseous effluents to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

E. RADIOLOGICAL ENVIRONMENTAL MONITORING

E.1 Sampling and Analysis

The radiological sampling and analyses provide measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from plant operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Program changes may be made based on operational experience.

The sampling and analyses shall be conducted as specified in *Table E-1* for the locations shown in *Appendix G* of the ODCM. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment or other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period.

All deviations from the sampling schedule shall be documented in the *Annual Radiological Environmental Operating Report* pursuant to *Section F.1*. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In these instances, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in the next *Semiannual Radioactive Effluent Release Report* and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

If milk samples are unavailable from any one or more of the milk sample locations required by *Table E-1*, a grass sample shall be substituted until a suitable milk location is evaluated as a replacement or until milk is available from the original location. Such an occurrence will be documented in the Annual Radiological Environmental Operating Report.

If the level of radioactivity in an environmental sampling medium at one or more of the locations specified in *Table E-1* exceeds the report levels of *Table E-2* when averaged over any calendar quarter, prepare and submit to the Commission within 30 days from the end of the affected calendar quarter, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the limits of *Table E-2* to be exceeded. When more than one of the radionuclides in *Table E-2* are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \cdots \geq 1.0$$

When radionuclides other than those in *Table E-2* are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the appropriate calendar year limit of the *Technical Specifications*. This report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the *Annual Radiological Environmental Operating Report*.

The detection capabilities required by *Table E-3* are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. All analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLD's unachievable. In such cases, the contributing factors will be identified and described in the *Annual Radiological Environmental Operating Report*.

E.2 Land Use Census

The land use census ensures that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of *Section IV.B.3* of *Appendix I* to *10 CFR Part 50*. The land use census shall be maintained and shall identify the location of the milk animals in each of the 16 meteorological sectors within a distance of five miles.*

The validity of the land use census shall be verified at least once per 12 months by either a door-to-door survey, aerial survey, consulting local agriculture authorities, or any combination of these methods.*

With a land use census identifying a location(s) which yields a calculated dose or dose commitment greater than the doses currently being calculated in the ODCM, make the appropriate changes in the sample locations of *Table E-2*.

With a land use census identifying a location(s) which has a higher D/Q than a current indicator location the following shall apply:

(1) If the D/Q is at least 20% greater than the previously highest D/Q, replace one of the present sample locations with the new one within 30 days if milk is available.

(2) If the D/Q is not 20% greater than the previously highest D/Q, consider direction, distance, availability of milk, and D/Q in deciding whether to replace one of the existing sample locations. If applicable, replacement should be within 30 days. If no replacement is made, sufficient justification should be given in the annual report.

Sample location changes shall be noted in the *Annual Radiological Environmental Operating Report*.

*Broad leaf vegetation (a composite of at least 3 different kinds of vegetation) is sampled at the site boundary in each of 2 different direction sectors with the highest D/Q in lieu of a garden census.

E.3 Interlaboratory Comparison Program

The Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which has been approved by the Commission. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the *Annual Radiological Environmental Operating Report*.

With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the *Annual Radiological Environmental Operating Report*.

TABLE E-1

HADDAM NECK RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1.a. Gamma Dose - Environmental TLD	14	Monthly	Gamma Dose - Monthly
1.b. Gamma Dose - Accident TLD	27	Quarterly(a)	N/A(a)
2. Airborne Particulate	7	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual sample if gross beta is greater than 10 times the mean of the weekly control stations gross beta results.
3. Airborne Iodine	7	Continuous sampler - weekly canister change	I-131 - Weekly
4. Vegetation	4	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5. Milk	6	Monthly	Gamma Isotopic, I-131, Sr-89 and Sr-90 on each sample
6. Well Water	2	Quarterly	Gross Beta, Gamma Isotopic, and Tritium on each sample
7. Bottom Sediment	3	Quarterly	Gamma Isotopic
8. River Water	2	Quarterly Sample - Indicator is Continuous Composite; Background is Composite of Six Weekly Grab Samples	Quarterly - Gross Beta, Gamma Isotopic and Tritium

TABLE E-1 (Cont'd.)

HADDAM NECK RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
9. Fish - Bullheads and, when available, Perch or other edible fish	3	Quarterly	Gamma Isotopic - Quarterly
10. Shellfish	2	Quarterly	Gamma Isotopic - Quarterly

(a) Accident monitoring TLD's to be dedosed at least quarterly.

TABLE E-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/Kg, wet)	Milk (pCi/l)	Vegetables (pCi/Kg, wet)
H-3	2×10^4				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-95	4×10^2				
Nb-95	4×10^2				
I-131	(a)	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-140	2×10^2			3×10^2	
La-140	2×10^2			3×10^2	

(a) Level for I-131 not included since no radioactivity discharged to any drinking water pathways; other reporting levels are included for trending of long-lived isotopes only.

TABLE E-3

MAXIMUM VALUES FOR LOWER LIMITS OF DETECTION (LLD)[a]

Analysis	Well Water (pCi/l)	River* Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/Kg, wet)	Sediment (pCi/kg, dry)
gross beta	4	4	1×10^{-2}				
H-3	2000	2000					
Mn-54	15	30		130			
Fe-59	30	60		260			
Co-58, 60	15	30		130			
Zn-65	30	60		260			
Zr-95	30	60					
Nb-95	15	30					
I-131	c	c	7×10^{-2}		1	60[b]	
Cs-134	15	30	5×10^{-2}	130	15	60	150
Cs-137	18	40	6×10^{-2}	150	18	80	180
Ba-140	60	120[d]			70		
La-140	15	30[d]			25		

* River Water LLD's shall be reduced to those given for well water if the gross beta for the sample exceeds 15 pCi/l.

TABLE E-3 (Cont'd.)

TABLE NOTATIONS

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLD's unachievable. In such cases, the contributing factors will be identified and described in the *Annual Radiological Environmental Operating Report*.

b. LLD for leafy vegetables.

c. Background and onsite well water will not contain the short-lived I-131 isotope. River water is not used as offsite potable water supply and need not be analyzed for I-131.

d. From end of sample period.

F. REPORT CONTENT

F.1 Annual Radiological Environmental Operating Report

The *Annual Radiological Environmental Operating Report* shall include summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The report shall also include the results of the land use census required by *Section E.2* of this manual. If harmful effects are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

The report shall include a summary table of all radiological environmental samples which shall include the following information for each pathway sampled and each type of analysis:

(1) Total number of analyses performed at indicator locations.

(2) Total number of analyses performed at control locations.

(3) Lower limit of detection (LLD).

(4) Mean and range of all indicator locations together.

(5) Mean and range of all control locations together.

(6) Name, distance and direction from discharge, mean and range for the location with the highest annual mean (indicator or control).

(7) Number of nonroutine reported measurements as defined in these specifications.

In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in the next annual report.

The report shall also include a map of sampling locations keyed to a table giving distances and directions from the discharge; the report shall also include a summary of the Interlaboratory Comparison Data required by *Section E.3* of this manual.

F.2 Semiannual Radioactive Effluent Release Report

The *Semiannual Radioactive Effluent Release Report* shall include a summary of the quantities of radioactive liquid and gaseous effluents released from the unit as outlined in *Regulatory Guide 1.21, Revision 1*, June 1974, with data summarized on a quarterly basis following the format of *Appendix B* thereof.

In addition, a report to be submitted 90 days after January 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, and atmospheric stability, or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.** This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the site during the previous calendar year. The meteorological conditions concurrent with the time of release of radioactive material in gaseous effluents shall be used for determining the gaseous pathway doses. Dose calculations shall be performed in accordance with the *Offsite Dose Calculation Manual*.

In addition, the report to be submitted 90 days after January 1 of each year shall include an assessment of radiation doses to the likely most exposed REAL MEMBER OF THE PUBLIC from the site for the previous 12 consecutive months to show conformance with *40 CFR 190*. Doses shall be calculated in accordance with the *Offsite Dose Calculation Manual*.

The semiannual effluent report shall also include a summary of each type of solid radioactive waste shipped offsite for burial or final disposal during the report period. This summary shall include the following information for each type of waste:

a. Type of waste (e.g., spent resin, compacted dry waste, irradiated components, etc.).

b. Solidification agent (e.g., cement).

c. Total curies.

d. Total volume and typical container volumes.

e. Principal radionuclides (those greater than 10% of total activity).

f. Types of containers used (e.g., LSA, Type A, etc.).

The semiannual effluent report shall include the following information for all unplanned releases from the site to unrestricted areas of radioactive materials in gaseous and liquid effluents:

a. A description of the event and equipment involved.

b. Cause(s) for the unplanned release.

c. Actions taken to prevent recurrence.

d. Consequences of the unplanned release.

Any changes to the *RADIOLOGICAL EFFLUENT* and *OFFSITE DOSE CALCULATION MANUAL* and *Process Control Program* shall be submitted in the *Semiannual Radioactive Effluent Release Report*.

** In lieu of submission with the *Radioactive Effluent Release Report*, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.