

September 17, 1996

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Please perform the following update to the Offsite Dose Calculation Manual:

Zion Annex

Remove Chapter 11, Revision 1.0

Insert Chapter 11, Revision 1.1

Remove Chapter 12, Revision 1.6

Insert Chapter 12, Revision 1.7*

*Incorporates onsite reviews OSR/083/95 and OSR/042/096.

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ZION & NEX INDEX

Chapter 11

Revision 1.1

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CHAPTER 11

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The parameters of the radiological environmental monitoring program for the environs around Zion Station are given in Table 11-1.

Figures 11-1 through 11-3 show sampling and monitoring locations.

Table 11-1
Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sampling or Monitoring Locations	Sampling or Collection Frequency	Type and Frequency of Analysis
<p>1. <u>Airborne</u></p> <p><u>Radioiodine and Particulates</u></p>	<p>a. <u>Indicators</u> - Near Field</p> <p>Z-01 Onsite No. 1 South side, 0.5 mi S (0.5 km J)</p> <p>Z-02 Onsite No. 2 West side, 0.2 mi W (0.3 km N)</p> <p>Z-03 Onsite No. 3 North side, 0.2 mi NNW (0.3 km R)</p> <p>Z-06 Zion, 2.5 mi WNW (4.0 km P)</p> <p>b. <u>Indicators</u> - Far Field</p> <p>Z-05 Zion, 3.5 mi WSW (5.6 km M)</p> <p>Z-08 Kenosha Road (Coleman), 3.6 mi W (5.8 km N)</p> <p>Z-09 Waukegan, 4.5 mi SSW (7.2 km K)</p> <p>c. <u>Control</u></p> <p>Z-11 WEPCO Southport Substation, 7.7 mi N (11.2 km A)</p>	<p>Continuous sampler operation with particulate filter collection weekly, or more frequently if required by dust loading, and radioiodine canister collection biweekly.</p>	<p><u>Particulate Sampler:</u></p> <p>Gross beta analysis following weekly filter change² and gamma isotopic analysis³ quarterly on composite filters by location on near field and control samples¹.</p> <p><u>Radioiodine Canister:</u></p> <p>I-131 analysis biweekly on near field and control samples¹.</p>

Table 11-1
Radiological Environmental Monitoring Program - Cont.

Exposure Pathway and/or Sample	Sampling or Monitoring Locations	Sampling or Collection Frequency	Type and Frequency of Analysis
2. <u>Direct Radiation</u>	<p>a. <u>indicators</u> - Inner Ring⁵</p> <p>Z-101-1 0.2 mi N (0.3 km A) Z-101-2 0.2 mi N (0.3 km A) Z-102-1 0.2 mi NNE (0.3 km B) Z-102-2 0.2 mi NNE (0.3 km B) Z-104-1 0.1 mi ENE (0.2 km D) Z-104-2 0.1 mi ENE (0.2 km D) Z-105-1 0.1 mi E (0.2 km E) Z-105-2 0.1 mi E (0.2 km E) Z-107-1 0.1 mi SE (0.2 km G) Z-107-2 0.1 mi SE (0.2 km G) Z-110-1 0.2 mi SSW (0.3 km K) Z-110-2 0.2 mi SSW (0.3 km K) Z-111-1 0.3 mi SW (0.5 km L) Z-111-2 0.3 mi SW (0.5 km L) Z-112-1 0.7 mi WSW (1.1 km M) Z-112-2 0.7 mi WSW (1.1 km M) Z-113-1 0.6 mi W (1.0 km N) Z-113-2 0.6 mi W (1.0 km N) Z-114-1 0.6 mi WNW (1.0 km P) Z-114-2 0.6 mi WNW (1.0 km P) Z-115-1 0.4 mi NW (0.6 km Q) Z-115-2 0.3 mi NW (0.5 km Q)</p>	Quarterly	Gamma dose on each TLD quarterly

Table 11-1
Radiological Environmental Monitoring Program - Cont.

Exposure Pathway and/or Sample	Sampling or Monitoring Locations	Sampling or Collection Frequency	Type and Frequency of Analysis
2. <u>Direct Radiation</u> (Cont'd)	<p>b. <u>Indicators</u> - Outer Ring</p> <p>Z-209-1 4.6 mi S (7.4 km J) Z-209-2 4.6 mi S (7.4 km J) Z-210-1 4.7 mi SSW (7.6 km K) Z-210-2 4.7 mi SSW (7.6 km K) Z-211-1 4.6 mi SW (7.4 km L) Z-211-2 4.6 mi SW (7.4 km L) Z-212-1 4.5 mi WSW (7.2 km M) Z-212-2 4.5 mi WSW (7.2 km M) Z-213-1 4.6 mi W (7.4 km N) Z-213-2 4.6 mi W (7.4 km N) Z-214-1 4.4 mi WNW (7.1 km P) Z-214-2 4.4 mi WNW (7.1 km P) Z-215-1 4.0 mi NW (6.4 km Q) Z-215-2 4.0 mi NW (6.4 km Q) Z-216-1 3.0 mi NNW (4.8 km R) Z-216-2 3.0 mi NNW (4.8 km R)</p> <p>c. <u>Other</u></p> <p>One at each airborne location given in 1.a and 1.b.</p> <p>d. <u>Control</u></p> <p>One at each airborne control location given in 1.c.</p>		

Table 11-1
Radiological Environmental Monitoring Program - Cont.

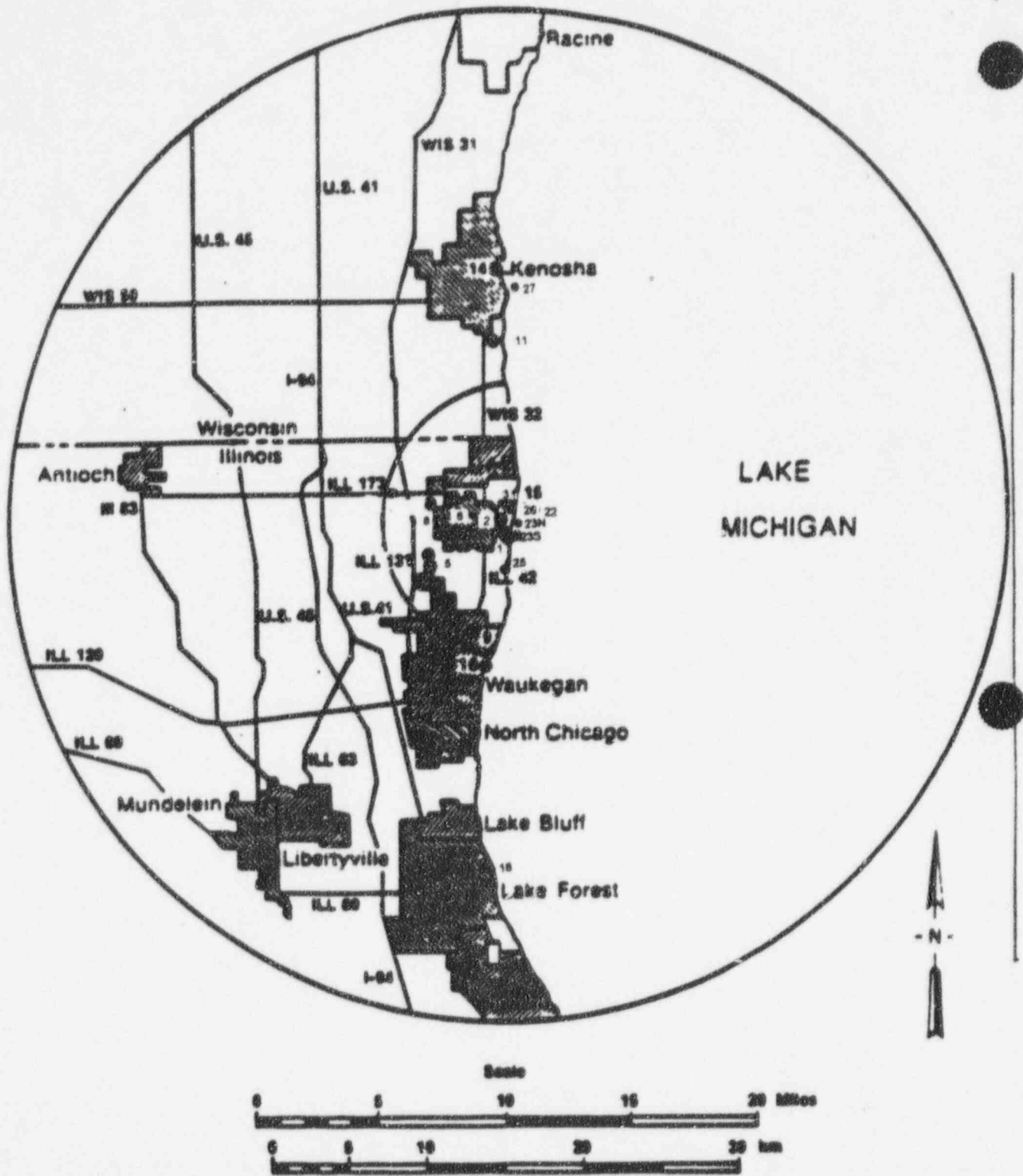
Exposure Pathway and/or Sample	Sampling or Monitoring Locations	Sampling or Collection Frequency	Type and Frequency of Analysis
3. <u>Waterborne</u>	a. <u>Indicator</u>		
a. <u>Drinking Water</u> ⁶	Z-15 Lake County Water Works, 1.4 mi NNW (2.2 km R) Z-16 Waukegan Water Works, 6.1 mi S (9.8 km J)	Weekly grab samples.	Gross beta and gamma isotopic ³ analysis on monthly composite; tritium analysis on quarterly composite.
b. <u>Sediments</u>	Z-25 Lake Michigan, Illinois Beach State Park, 2.0 mi S (3.2 km J)	Semiannually	Gamma isotopic ³ analysis semiannually.
c. <u>Control</u> ⁶	a. <u>Control</u>		
	Z-14 Kenosha Water Works, 10.0 mi N (16.0 km A) Z-18 Lake Forest Water Works, 12.9 mi S (20.8 km J)	Weekly grab samples.	Gross beta and gamma isotopic ³ analysis on monthly composite; tritium analysis on quarterly composite.
d. <u>Cooling Water</u>	a. Z-22, Unit 1 inlet at station b. Z-23S, Unit 1 discharge at station c. Z-23N, Unit 2 discharge at station	Weekly	Gross beta analysis weekly; tritium analysis on quarterly composite.

Table 11-1
Radiological Environmental Monitoring Program - Cont.

Exposure Pathway and/or Sample	Sampling or Monitoring Locations	Sampling or Collection Frequency	Type and Frequency of Analysis
4. <u>Ingestion</u>			
a. <u>Milk</u>	There are no dairies within 6.2 miles of the station.	Semiannually	Gamma isotopic ³ analysis on edible portions.
b. <u>Fish</u>	a. <u>Indicator</u> Z-26, Lake Michigan in vicinity of station discharge		
	b. <u>Control</u> Z-27, Lake Michigan, 10.0 mi N (16.0 km A)	Annually	Gamma isotopic ³ analysis on each sample
c. <u>Food Products</u>	a. <u>Indicator</u> Two samples from each of the two major quadrants (over land) within 6.2 miles of the station.		
	b. <u>Control</u> Two representative samples similar to indicator samples grown within 15 to 30 km (9.3 to 18.6 mi).		

Table 11-1
Radiological Environmental Monitoring Program - Cont.

- 1 Far field samples are analyzed when near field results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents released from the station, or at the discretion of the Radiation Protection Director.
- 2 Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on individual samples.
- 3 Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the station.
- 4 I-131 analysis means the analytical separation and counting procedure are specific for this radionuclide.
- 5 Limited TLD placements due to Lake Michigan and location of air samplers.
- 6 The closest drinking water locations (North/South) chosen for drinking water indicators; two other location beyond 6.2 miles (North/South) chosen for control samples.

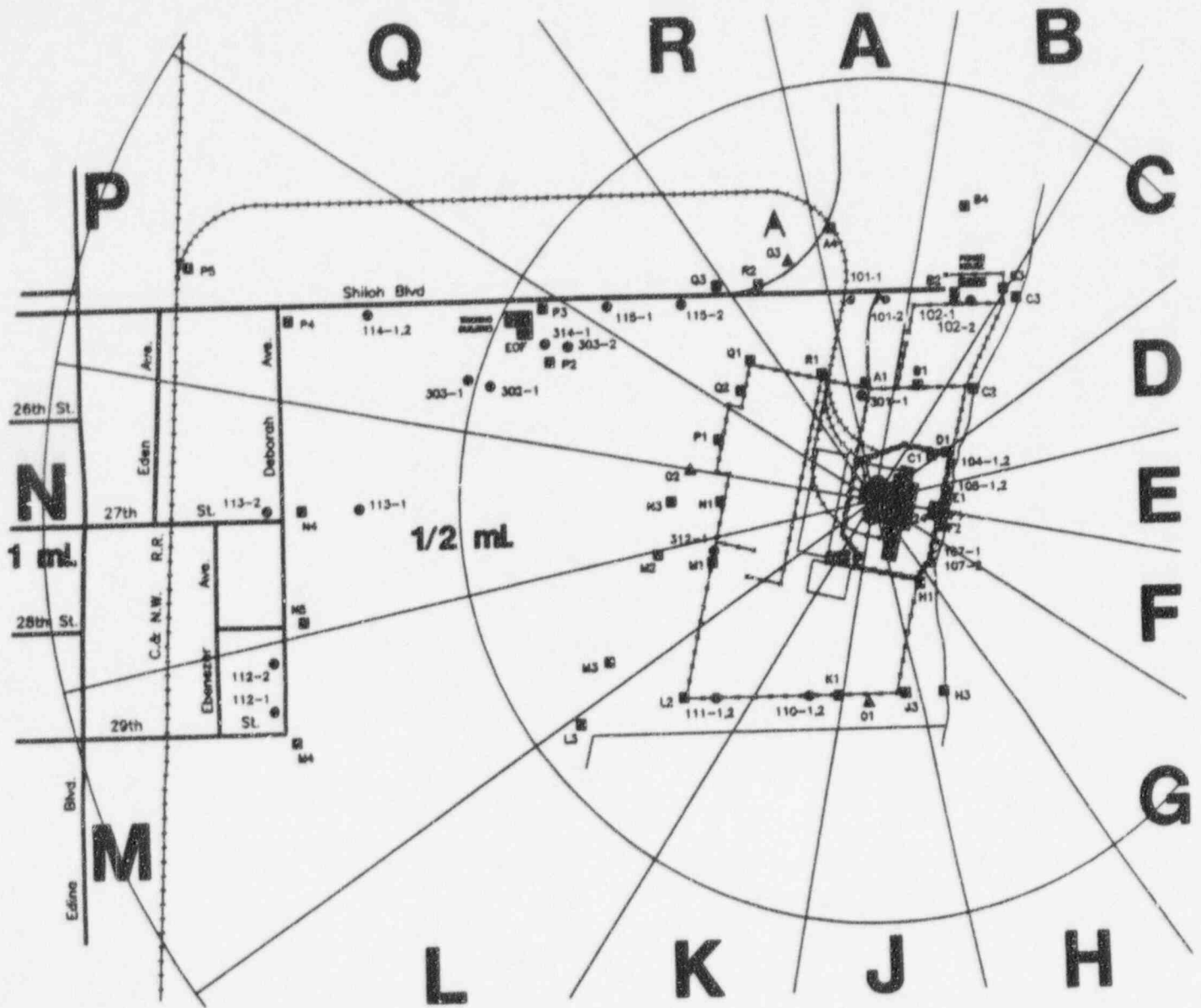


• Sampling Location

**OFFSITE DOSE CALCULATION MANUAL
ZION STATION**

FIGURE 11-1

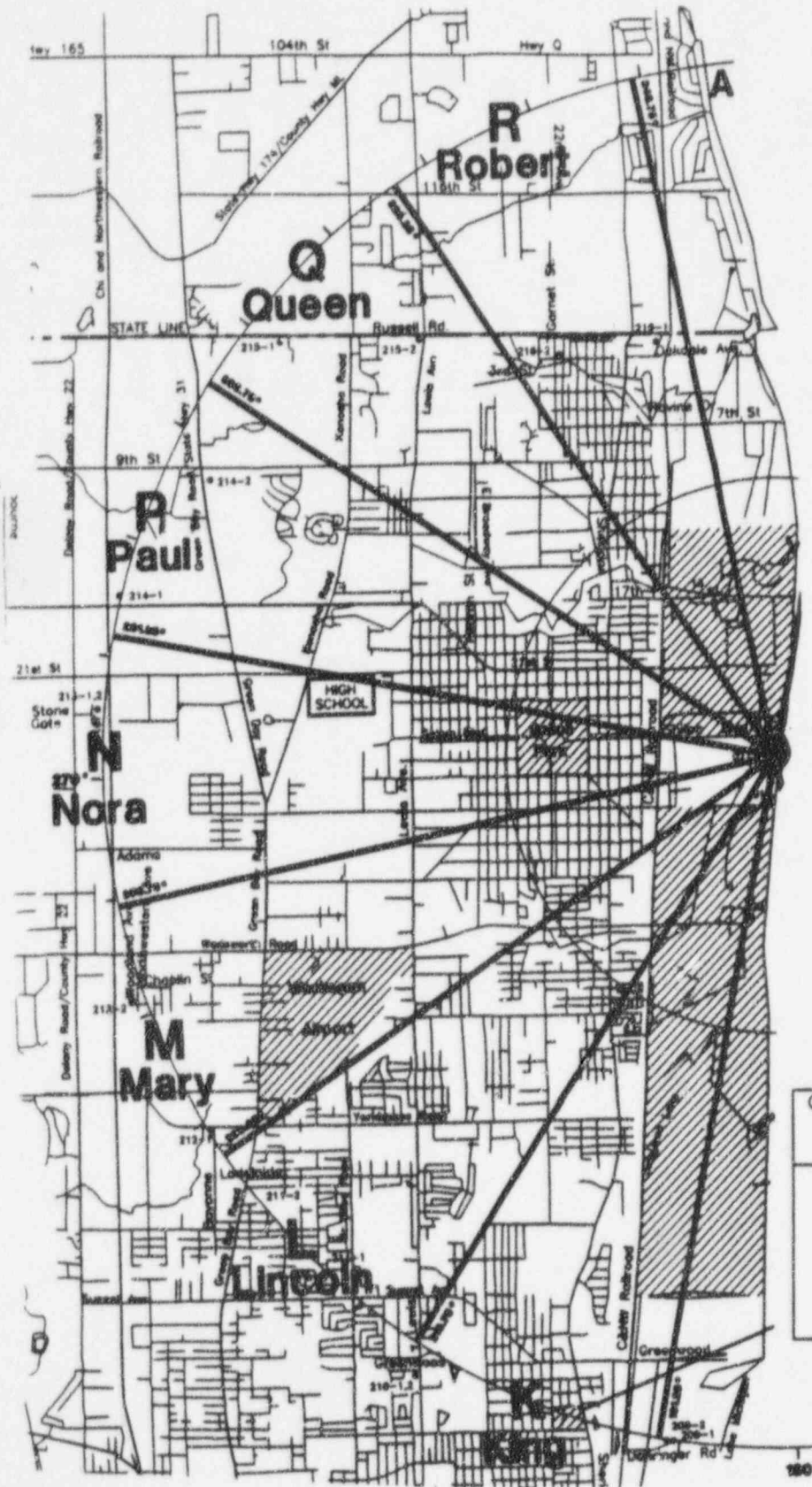
**LOCATION OF FIXED AIR, WATER AND
MILK SAMPLES**



Offsite Dose Calculation Manual
Zion Station

Figure 11-2
Inner Ring TLD Locations

▲ • TLD Location



Lake Michigan

Offsite Dose Calculation Manual
Zion Station

Figure 11-3

Outer Ring TLD Locations

• TLD Location

SPECIAL NOTE

The requirements of the Technical Specifications shall take precedence over this chapter, should any differences occur.

CHAPTER 12

REVISION 1.7

CHAPTER 12

RADIOLOGICAL EFFLUENT TECHNICAL STANDARDS
(RETS)
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CHAPTER 12

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(RETS)
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12.1 **DEFINITIONS**

- 12.1.1 **ACTION** shall be that part of the sections which prescribes remedial measures required under designated conditions.
- 12.1.2 A **BATCH RELEASE** is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated and then thoroughly mixed to assure representative sampling.
- 12.1.3 A **CHANNEL CALIBRATION** shall be the adjustment, as necessary, of the channel such that it responds with the necessary range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors (where possible), alarm interlock and/or trip functions and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.
- 12.1.4 A **CHANNEL CHECK** shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent INSTRUMENT CHANNELS measuring the same parameter.
- 12.1.5 A **CHANNEL FUNCTIONAL CHECK** shall be:
- Instruments-The injection of a simulated signal(s) into the channel as close to the primary sensor(s) as practicable to verify OPERABILITY, including all channel outputs, as appropriate.
 - Logics-The application of input signals, or the operation of relays or switch contacts, in all the combinations required to produce the required decision outputs including the operation of all ACTUATION DEVICES. Where practicable, the test shall include the operation of the ACTUATED EQUIPMENT as well (i.e. pumps will be started, valves operated, etc.).
- 12.1.6 A **COMPOSITE SAMPLE** is one in which the quantity of liquid sample 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.
- 12.1.7 A **CONTINUOUS RELEASE** is the discharge of liquid or gaseous wastes of a nondiscrete volume (e.g. from a volume or system that has an input flow during the release).
- 12.1.8 **DOSE EQUIVALENT I-131** shall be that concentration of I-131 (microcurie/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The Thyroid Dose Conversion factors used for this calculation shall be those listed in Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites" or Table E-7 of NRC Regulatory Guide 1.109 Rev. 1, dated October, 1977.
- 12.1.9 **MEMBER OF THE PUBLIC** means any individual except when that individual is receiving an occupational dose.

- 12.1.10 OCCUPATIONAL DOSE means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation and/or radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include dose from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.
- 12.1.11 A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).
- 12.1.12 OPERATING is defined as performing the intended function in the intended manner.
- 12.1.13 The OPERATING CYCLE shall be the interval between the end of one major refueling outage and the end of the next subsequent major refueling outage per unit.
- 12.1.14 An OPERATIONAL MODE (i.e., Mode) shall correspond to any one inclusive combination of core reactivity condition, power level, and average reactor coolant temperature specified in Table 1.1 of the Technical Specifications, when fuel assemblies are present in the reactor vessel.
- 12.1.15 The PROCESS CONTROL PROGRAM (PCP) shall contain the current formulas, sampling, analyses, test, and determinations to be made to ensure that processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste.
- 12.1.16 PURGE OR PURGING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner, that replacement air or gas is required to purify the confinement.
- 12.1.17 RATED THERMAL POWER shall be a total steady state reactor core heat transfer rate to the reactor coolant of 3250 MWT.
- 12.1.18 The REACTOR PRESSURE shall be the pressure in the steam space of the pressurizer.
- 12.1.19 The SITE BOUNDARY shall be that line beyond which the land is not owned, leased or otherwise controlled by the licensee.
- 12.1.20 SOLIDIFICATION shall be the conversion of radioactive liquid, resin and sludge wastes from liquid systems into a form that meets shipping and burial site requirements.
- 12.1.21 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.
- 12.1.22 The SURVEILLANCE FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 12.1-1.
- 12.1.23 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

- 12.1.24 UNRESTRICTED AREA means an area, access to which is neither limited nor controlled by the licensee.
- 12.1.25 VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radiiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any affect on noble gas effluents.
- 12.1.26 VENTING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during venting. Vent, used in system names, does not imply a venting process.
- 12.1.27 WASTE GAS HOLDUP SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting Reactor Coolant System off-gases from the Reactor Coolant System and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

TABLE 12.1-1SURVEILLANCE FREQUENCY NOTATIONS

<u>NOTATION</u>	<u>FREQUENCY *</u>
S (Shiftly)	At least once per 12 hours
D (Daily)	At least once per 24 hours
W (Weekly)	At least once per 7 days
M (Monthly)	At least once per 31 days
Q (Quarterly)	At least once per 92 days
SA (Semiannually)	At least once per 184 days
R (Refueling Cycle)	At least once per 18 months
S/U (Startup)	Prior to reactor startup
P (Prior)	Complete prior to start of release
EFPM	At least once per effective full power month
N/A	Not Applicable

* Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance interval. These frequency notations do not apply to the Radiological Environmental Monitoring Program as described in Section 12.5.

12.2 INSTRUMENTATION**12.2.1 Radioactive Liquid Effluent Monitoring Instrumentation**Operability Requirements

- 12.2.1.A The radioactive liquid effluent monitoring instrumentation channels shown in Table 12.2-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Section 12.3.1.A are met.

Applicability: At all times.

Action

1. With a radioactive liquid effluent monitoring instrument channel trip setpoint less conservative than the value necessary to prevent violating the limits of Section 12.3.1.A, immediately suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel inoperable.
2. With one or more radioactive liquid effluent monitoring instrumentation channels inoperable, take the ACTION shown in Table 12.2-1.

Surveillance Requirements

- 12.2.1.B.1 The setpoints shall be determined in accordance with procedures as described in the ODCM.
- 12.2.1.B.2 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of a CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 12.2-2.

Bases

- 12.2.1.C The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the release of radioactive materials in liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of RETS. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10CFR Part 50.

TABLE 12.2-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

<u>INSTRUMENT</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>ACTION #</u>	<u>APPLICABLE MODES</u>
1. Gross Activity Monitors Providing Automatic Termination of Release			
A. Lake Discharge Tank (LDT)			
1. OR-PR04	See ACTION 1	1	All
2. OR-PR05	See ACTION 1	1	All
B. Turbine Bldg.			
1. OR-PR25	1	2	All
2. Continuous Composite Sampler			
A. Turbine Building Fire Sump	1	2	All
3. Flow Rate Monitors			
A. Lake Discharge Tank			
1. OF-WD63	1	3	All
2. OF-WD67	1	3	All

TABLE 12.2-1RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

(Cont'd)

- ACTION 1 With one of the LDT monitors Inoperable, all LDT releases shall be made through the OPERABLE monitored pathway. If both monitors are inoperable, effluent releases from the tank may continue for up to 14 days, provided that prior to initiating the release:
1. At least two independent samples of the tank's contents are analyzed, in accordance with Section 12.2.1.B and
 2. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge flow path valving;
- Otherwise, suspend release of radioactive effluents via this pathway.
- ACTION 2 With the number of channels OPERABLE less the minimum number required, effluent releases via this pathway may continue, provided that at least once per shift grab samples are analyzed for gross radioactivity (beta /gamma or isotopic) at a lower limit of detection (LLD) as specified in Table 12.3-2.
- ACTION 3 With the number of channels OPERABLE less than the minimum number required, effluent releases via this pathway may continue, for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be used to estimate flow.

TABLE 12.2-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE

<u>INSTRUMENT</u>	<u>CHANNEL CHECK</u>	<u>SOURCE CHECK</u>	<u>CHANNEL CALIBRATION(1)</u>	<u>CHANNEL FUNCTIONAL TEST (2)</u>
1. Gross Activity Monitors Providing Automatic Termination Of Release				
A. Lake Discharge Tank (LDT)				
1. OR-PR04	P	P	R	Q
2. OR-PR05	P	P	R	Q
B. Turbine Bldg.				
1. OR-PR25	D(3)	M	R	Q
2. Continuous Composite Sampler				
A. Turbine Building Fire Sump	D	N/A	N/A	N/A
3. Flow Rate Monitors				
A. Lake Discharge Tank				
1. OF-WD63	D(3)	N/A	R*	N/A
2. OF-WD67	D(3)	N/A	R*	N/A

(1) CHANNEL CALIBRATION shall include performance of a CHANNEL FUNCTIONAL TEST.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that any automatic isolation of this pathway occurs and that control room alarm annunciation occurs if any of the following conditions exist. (if the capability is installed):

- Instrument indicates levels above the alarm setpoints.
- Circuit failure.
- Instrument indicates a downscale failure.
- Instrument controls not set in operate mode.

(3) CHANNEL CHECK shall be made at least once daily on any day on which continuous, periodic, or BATCH RELEASES are made.

* Does not include flow sensor.

12.2.2 Radioactive Gaseous Effluent Monitoring Instrumentation

Operability Requirements

- 12.2.2.A The radioactive gaseous effluent monitoring instrumentation channels shown in Table 12.2-3 shall be OPERABLE with their alarm/trip setpoints set in accordance with the method prescribed in the ODCM to ensure that the limits of Section 12.4.1.A are met.

Applicability: At all times, except as indicated in Table 12.2-3.

Action

1. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Section, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel or declare the channel inoperable.
2. With one or more radioactive gaseous effluent monitoring instrumentation channels inoperable, take ACTION as shown in Table 12.2-3.

Surveillance Requirements

- 12.2.2.B.1 The setpoints shall be determined in accordance with procedures as described in the ODCM.
- 12.2.2.B.2 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of a CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 12.2-4.

Bases

- 12.2.2.C The radioactive gaseous effluent instrumentation is provided to monitor, record and control, as applicable, the release of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10CFR Part 20.

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

<u>INSTRUMENT</u>		<u>MINIMUM CHANNELS OPERABLE</u>	<u>ACTION</u>	<u>APPLICABLE MODES</u>
1.	<u>Gas Decay Tank</u>			
A.	Gas Activity Monitor			
1.	OR-PR10 (Low gas-Channel 1)	1	5	All
2.	OR-PR10 (Mid gas-Channel 3)	1	5	All
B.	Flow Rate Monitor			
1.	OF-WG03	1	9	All
2.	<u>Air Ejector Off-Gas</u>			
A.	Gas Activity Monitor			
1.	1R-0015 Gas	1	6	1,2
2.	2R-0015 Gas	1	6	1,2
B.	Particulate/Iodine Monitor			
1.	1R-PR26	1	6	1,2
2.	2R-PR26	1	6	1,2
3.	<u>Containment Purge or Vent</u>			
A.	Gas Activity Monitor			
1.	1R-PR09A Gas	1	6 ¹ , 7 ²	All
2.	2R-PR09A Gas	1	6 ¹ , 7 ²	All
3.	1R-PR40E (Channel 5)	1	6 ¹ , 7 ²	All
4.	2R-PR40E (Channel 5)	1	6 ¹ , 7 ²	All
B.	Iodine Monitor			
1.	1R-PR09B Iodine	1	6 ¹ , 7 ²	All
2.	2R-PR09B Iodine	1	6 ¹ , 7 ²	All
3.	1R-PR40C (Channel 3)	1	6 ¹ , 7 ²	All
4.	2R-PR40C (Channel 3)	1	6 ¹ , 7 ²	All

¹ During VENTING² During PURGING

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION
(Cont'd)

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION	APPLICABLE MODES
3. <u>Containment Purge or Vent</u>			
C. <u>Particulate Monitor</u>			
1. 1R-PR09C Particulate	1	6 ¹ , 7 ²	All
2. 2R-PR09C Particulate	1	6 ¹ , 7 ²	All
3. 1R-PR40A (Channel 1)	1	6 ¹ , 7 ²	All
4. 2R-PR40A (Channel 1)	1	6 ¹ , 7 ²	All
4. <u>Auxiliary Building Ventilation and Miscellaneous Ventilation Stack</u>			
A. <u>Gas Activity Monitor</u>			
1. OR-0014 or	1	6	All
2. 1R-PR25 and 2R-PR25	1	6	All
3. 1R-PR49E (Channel 5)	1	13	All
4. 2R-PR49E (Channel 5)	1	13	All
B. <u>Iodine Monitor</u>			
1. OR-PR12B	1	15	All
2. 1R-PR49C (Channel 3)	1	14	All
3. 2R-PR49C (Channel 3)	1	14	All
C. <u>Particulate Monitor</u>			
1. OR-PR12A	1	6	All
2. 1R-PR49A (Channel 1)	1	14	All
3. 2R-PR49A (Channel 1)	1	14	All
D. <u>Flow Rate Monitor</u>			
1. 1LP-084	1	9	All
2. 2LP-084	1	9	All

¹ During Venting² During Purging

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION
(Cont'd)

<u>INSTRUMENT</u>		<u>MINIMUM CHANNELS OPERABLE</u>	<u>ACTION</u>	<u>APPLICABLE MODES</u>
5. <u>Steam Generator Atmospheric Relief and Safety Valves</u>				
A.	1R-PR58	1	10	1,2,3,7
B.	2R-PR58	1	10	1,2,3,7
C.	1R-PR59	1	10	1,2,3,7
D.	2R-PR59	1	10	1,2,3,7
E.	1R-PR60	1	10	1,2,3,7
F.	2R-PR60	1	10	1,2,3,7
G.	1R-PR61	1	10	1,2,3,7
H.	2R-PR61	1	10	1,2,3,7
6. <u>Accident Monitoring</u>				
A. <u>Containment</u>				
1.	1R-PR40G (Channel 7)	1	10	1,2,3,4,7
2.	2R-PR40G (Channel 7)	1	10	1,2,3,4,7
3.	1R-PR40I (Channel 9)	1	10	1,2,3,4,7
4.	2R-PR40I (Channel 9)	1	10	1,2,3,4,7
B. <u>Miscellaneous Vent Stack</u>				
1.	1R-PR49G (Channel 7)	1	10	1,2,3,4,7
2.	2R-PR49G (Channel 7)	1	10	1,2,3,4,7
3.	1R-PR49I (Channel 9)	1	10	1,2,3,4,7
4.	2R-PR49I (Channel 9)	1	10	1,2,3,4,7
C. <u>Containment Fuel Handling Area Monitor*</u>				
1.	1R-AR04A	1	11	6
2.	1R-AR04B	1	11	6
3.	2R-AR04A	1	11	6
4.	1R-AR04B	1	11	6

* When purging during fuel handling operations

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION
(Cont'd)TABLE NOTATIONS

- ACTION 5 - With the number of channels OPERABLE less than the minimum number required, the contents of the tank may be released to the environment provided that prior to initiating the release:
1. At least two independent samples of the tank's content are analyzed, and
 2. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge flow path valving;
- Otherwise, suspend release of radioactive effluents via this pathway.
- ACTION 6 - With the number of channels OPERABLE less than the minimum number required, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per shift and these samples are analyzed for gross activity within 24 hours.
- ACTION 7 - With the number of channels OPERABLE less than the minimum number required, and no redundant monitor OPERABLE in this flow path, immediately suspend PURGING of radioactive effluents via this pathway.
- ACTION 8 - With the number of channels OPERABLE less than the minimum number required, effluent releases via this pathway may continue for up to 30 days, provided samples are continuously collected with auxiliary sampling equipment as required in Table 12.4-1.
- ACTION 9 - With the number of OPERABLE channels less than the minimum number required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per shift while release is in progress.
- ACTION 10 - With the number of channels OPERABLE less than the minimum number required, restore the inoperable monitor to OPERABLE status within 30 days or establish an alternate means of monitoring the parameter.
- ACTION 11 - With the number of OPERABLE channels less than the minimum number required, suspend vent and purge operations and close each vent and purge valve providing direct access from the containment atmosphere to the outside atmosphere or suspend the movement of nuclear fuel and reactor components in the vicinity of the reactor, refueling cavity, and transfer canal (containment side).
- ACTION 12 - With the number of OPERABLE channels less than the minimum number required, effluent releases via this pathway may continue provided the effluent flow is being accounted for in the total plant effluent.
- ACTION 13 - With the number of OPERABLE channels less than the minimum number required, restore the channel to OPERABLE status within 30 days or conduct a station review to determine a plan of action to restore the channel to OPERABLE status. Effluent release via this pathway may continue provided grab samples are taken at least once per shift and these samples are analyzed for gross activity within 24 hours.
- ACTION 14 - With the number of OPERABLE channels less than the minimum number required, restore the channel to OPERABLE status within 30 days or conduct a station review to determine a plan of action to restore the channel to OPERABLE status. Effluent release via this pathway may continue provided grab samples are continuously collected with auxiliary sampling equipment as required in Table 12.4-1.
- ACTION 15 - With the number of OPERABLE channels less than the minimum number required, Auxiliary Building Cubicle ventilation shall be routed through the Auxiliary Building ventilation charcoal adsorber units. This alignment shall be verified daily.

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE

	<u>CHANNEL CHECK</u>	<u>SOURCE CHECK</u>	<u>CHANNEL CALIBRATION (1)</u>	<u>CHANNEL FUNCTIONAL TEST (2)</u>
1. <u>Gas Decay Tank</u>				
A. Gas Activity Monitor				
1. OR-PR10 (Low gas-Channel 1)	P	P	R	Q
2. OR-PR10 (Mid gas-Channel 3)	P	P	R	Q
B. Flow Rate Monitor				
1. OF-WG03	P	N/A	N/A	Q (5)
2. <u>Air Ejector Off-Gas</u>				
A. Gas Activity Monitor				
1. 1R-0015 Gas	D	M	R	Q
2. 2R-0015 Gas	D	M	R	Q
B. Particulate/Iodine Monitor				
1. 1R-PR26	D	M	R	Q
2. 2R-PR26	D	M	R	Q

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)

<u>INSTRUMENT</u>	<u>CHANNEL CHECK</u>	<u>SOURCE CHECK</u>	<u>CHANNEL CALIBRATION (1)</u>	<u>CHANNEL FUNCTIONAL TEST (2)</u>
3. <u>Containment Purge or Vent</u>				
A. Gas Activity Monitor				
1. 1R-PR09A	D	M	R	Q
2. 2R-PR09A	D	M	R	Q
3. 1R-PR40E (Channel 5)	D	M	R	Q
4. 2R-PR40E (Channel 5)	D	M	R	Q
B. Iodine Monitor				
1. 1R-PR09B	D	M	R	Q
2. 2R-PR09B	D	M	R	Q
3. 1R-PR40C (Channel 3)	D	M	R	Q
4. 2R-PR40C (Channel 3)	D	M	R	Q
C. Particulate Monitor				
1. 1R-PR09C	D	M	R	Q
2. 2R-PR09C	D	M	R	Q
3. 1R-PR40A (Channel 1)	D	M	R	Q
4. 2R-PR40A (Channel 1)	D	M	R	Q

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)

<u>INSTRUMENT</u>	<u>CHANNEL CHECK</u>	<u>SOURCE CHECK</u>	<u>CHANNEL CALIBRATION (1)</u>	<u>CHANNEL FUNCTIONAL TEST (2)</u>
4. <u>Auxiliary Building Ventilation and Miscellaneous Ventilation Stack</u>				
A. Gas Activity Monitor				
1. 0R-0014 Gas or	D	M	R	Q
2. 1RT-PR25 and 2RT-PR25	D	M	R	Q
3. 1R-PR49E (Channel 5)	D	M	R	Q
4. 2R-PR49E (Channel 5)	D	M	R	Q
B. Iodine Monitor				
1. 0R-PR-12B	D	M	R	Q
2. 1R-PR49C (Channel 3)	D	M	R	Q
3. 2R-PR49C (Channel 3)	D	M	R	Q
C. Particulate Monitor				
1. 0R-PR12A	D	M	R	Q
2. 1R-PR49A (Channel 1)	D	M	R	Q
3. 2R-PR49A (Channel 1)	D	M	R	Q
D. Flow Rate Monitor				
1. 1LP-084	D	N/A	R	Q
2. 2LP-084	D	N/A	R	Q

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION (1)	CHANNEL FUNCTIONAL TEST (2)
5. <u>Steam Generator Atmospheric Relief and Safety Valves</u>				
1. 1R-PR58	D	M	R	Q
2. 2R-PR58	D	M	R	Q
3. 1R-PR59	D	M	R	Q
4. 2R-PR59	D	M	R	Q
5. 1R-PR60	D	M	R	Q
6. 2R-PR60	D	M	R	Q
7. 1R-PR61	D	M	R	Q
8. 2R-PR61	D	M	R	Q
6. <u>Accident Monitoring</u>				
A. <u>Containment</u>				
1. 1R-PR40G (Channel 7)	N/A	N/A	R	Q
2. 2R-PR40G (Channel 7)	N/A	N/A	R	Q
3. 1R-PR40I (Channel 9)	N/A	N/A	R	Q
4. 2R-PR40I (Channel 9)	N/A	N/A	R	Q
B. <u>Miscellaneous Vent Stack</u>				
1. 1R-PR49G (Channel 7)	N/A	N/A	R	Q
2. 2R-PR49G (Channel 7)	N/A	N/A	R	Q
3. 1R-PR49I (Channel 9)	N/A	N/A	R	Q
4. 2R-PR49I (Channel 9)	N/A	N/A	R	Q
C. <u>Fuel Handling Area</u>				
1. 1R-AR04A	D	M(3)	R	Q(4)
2. 1R-AR04B	D	M(3)	R	Q(4)
3. 2R-AR04A	D	M(3)	R	Q(4)
4. 2R-AR04B	D	M(3)	R	Q(4)

Table 12.2-4RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)TABLE NOTATIONS

- (1) CHANNEL CALIBRATION shall include performance of a CHANNEL FUNCTIONAL TEST.
- (2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that any automatic isolation occurs; and that Control Room alarm annunciation occurs if any of the following conditions exist (if the capability is installed):
 - a) Instrument indicates measured levels above the alarm setpoint.
 - b) Circuit failure.
 - c) Instrument indicates a downscale failure.
 - d) Instrument controls not set in "operate" mode.
- (3) Daily when PURGING the containment during fuel handling operations.
- (4) Within 72 hours prior to commencing refueling operations.
- (5) OPERABILITY test only.

12.3 LIQUID EFFLUENTS**12.3.1 Concentration**Operability Requirements

12.3.1.A.1 The concentration of radioactive material released from the site to UNRESTRICTED AREAS (see Zion Station ODCM Annex, Appendix F, Figure F-1) shall be limited to 10 times the concentrations specified in Appendix B, Table 2, Column 2 to 10CFR20.1001-20.2402, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentrations shall be limited to the values listed in Table 12.3-1.

12.3.1.A.2 During the release of radioactive liquid wastes, a minimum dilution water flow rate of 200,000 gpm is required.

Applicability: At all times.

Action

1. With the concentration of radioactive materials released from the site to UNRESTRICTED AREAS exceeding the limits specified in Section 12.3.1.A, immediately decrease the release rate of radioactive materials and/or increase the dilution flow rate to restore the concentration to within the above limits.

Surveillance Requirements

12.3.1.B.1 The radioactivity content of each batch of radioactive liquid waste shall be determined prior to release by sampling and analysis in accordance with Table 12.3-2. The results of pre-release analyses shall be used with the calculational methods in the ODCM to assure that the concentration at the point of release is maintained within the limits of Section 12.3.1.A.

12.3.1.B.2 Post-release analyses of samples composited from BATCH RELEASES shall be performed in accordance with Table 12.3-2. The results of the previous post-release analyses shall be used with the calculational methods in the ODCM to assure that the concentrations at the point of release were maintained within the limits of Section 12.3.1.A.

12.3.1.B.3 The radioactivity concentration of liquids discharged from continuous release points shall be determined by collection and analysis of samples in accordance with Table 12.3-2. The results of the analysis shall be used with the calculational methods in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Section 12.3.1.A.

12.3.1.B.4 At least one circulating water pump shall be operational on the discharge path.

Bases

- 12.3.1.C This Section is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to UNRESTRICTED AREAS will be less than ten (10) times the concentration levels specified in Appendix B, Table 2, Column 2 to 10CFR 20.1001-20.2402. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10CFR20.1301.

TABLE 12.3-1

ALLOWABLE CONCENTRATION OF DISSOLVED OR ENTRAINED NOBLE GASES
RELEASED FROM THE SITE TO UNRESTRICTED AREAS IN LIQUID EFFLUENTS

<u>NUCLIDE</u>	<u>A(mCi/ml)*</u>
Kr-85m	2×10^{-4}
Kr-85	5×10^{-4}
Kr-87	4×10^{-5}
Kr-88	9×10^{-5}
Ar-41	7×10^{-5}
Xe-131m	7×10^{-4}
Xe-133m	5×10^{-4}
Xe-133	6×10^{-4}
Xe-135m	2×10^{-4}
Xe-135	2×10^{-4}

* Computed from Equation 20 of ICRP Publication 2(1959), adjusted for infinite cloud submersion in water, and R = 0.01 rem/week, density = 1.0 g/cc and Pw/Pt = 1.0.

TABLE 12.3-2

RADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS SURVEILLANCE

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT (a,b) OF DETECTION (LLD) ($\mu\text{Ci/ml}$)
A. Lake Discharge Tank	Prior to Each Release (c)	Prior to Each Release	Principal Gamma Emitters	5E-7
			I-131	1E-6
	P One Batch/M(c)	M	Dissolved and Entrained Gases (Gamma Emitters(d))	1E-5
	P Each Batch (c)	M Composite (b)	Tritium	1E-5
			Gross Alpha	1E-7
	P Each Batch (c)	Q Composite (b)	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
B. Turbine Building Fire Sump (f)	Continuous During Release (d)	W	Principal Gamma Emitters(c)	5E-7
			I-131	1E-6
			Dissolved and Entrained Gases (Gamma Emitters)	1E-5
	Continuous (d)	M Composite (b)	Tritium	1E-5
			Gross Alpha	1E-7
	Continuous (d)	Q Composite (b)	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
C. Waste Neutralizing Tank	Prior to each Release	Prior to each Release	Principal Gamma Emitter	5E-7
			I-131	1E-6
	P Each Batch (c)	M Composite (b)	Tritium	1E-5
			Gross Alpha	1E-7

TABLE 12.3-2
TABLE NOTATIONS
RADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS SURVEILLANCE
(Cont'd)

- 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):

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

Where:

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

s_b is the square root of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

A is the number of gamma rays emitted per disintegration for gamma ray radionuclide analysis ($A = 1.0$) for gross alpha, strontium, and tritium measurement.

E is the counting efficiency (as counts per gamma),

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

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield when applicable (otherwise $Y = 1.0$)

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental sample).

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. In calculating the LLD for a radionuclide determined by gamma ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples. Typical values of E, V, Y, and Δt shall be used in the calculation. The background count rate is calculated from the background counts that are determined to be within \pm one FWHM (Full Width at Half Maximum) energy band about the energy of the gamma ray peak used for the quantitative analysis for that radionuclide.

TABLE 12.3-2TABLE NOTATIONSRADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS SURVEILLANCE

(Cont'd)

For certain mixtures of gamma emitters, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable.

- 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.
- 1) To be representative of the quantities and concentrations of radioactive materials in liquid effluents, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.
 - 2) The weekly and monthly Proportional Composite samples are not required provided that (1) the analysis required for each of these composite samples has been run on each batch discharged, and (2) a monthly record of radionuclides discharged (isotope and quantity) is maintained.
- c. A BATCH RELEASE is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated and then thoroughly mixed to assure representative sampling.
- d. A CONTINUOUS RELEASE is the discharge of liquid wastes of a nondiscrete volume; e.g., from a volume of system that has an input flow during the continuous release.
- e. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. 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 also be identified and reported. Nuclides which are below the LLD for the analyses shall be reported as "less than" the nuclide's LLD, and shall not be reported as being present at the LLD level for that nuclide. The "less than" values shall not be used in the required dose calculations.
- f. If the fire sump composite sampler is inoperable, grab samples will be taken from the turbine building fire sump once per shift.

12.3.2 Dose

Operability Requirements

12.3.2.A The dose or dose commitment to a MEMBER OF THE PUBLIC above background from radioactive materials in liquid effluents released from the site to UNRESTRICTED AREAS (see Zion Station ODCM Annex, Appendix F, Figure F-1) shall be limited:

1. During any calendar quarter to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ, and
2. During any calendar year to less than or equal to 6 mrem to the total body and to less than or equal to 20 mrem to any organ.

Applicability: At all times.

Action

1. With the calculated dose from the release of radioactive materials in liquid effluents exceeding twice the limits specified in Section 12.3.2.A, limit the subsequent releases such that the dose or dose commitment to a MEMBER OF THE PUBLIC from all uranium fuel cycle sources is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. Demonstrate that radiation exposures to all MEMBERS OF THE PUBLIC from all uranium fuel cycle sources (including all effluent pathways and direct radiation) are less than the 40CFR Part 190 and 40CFR Part 141 Standard, otherwise obtain a variance from the Commission to permit releases which exceed the 40CFR Part 141 or 190 Standard. The radiation exposure analysis shall use methods prescribed in the ODCM.

Surveillance Requirements

12.3.2.B Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodologies and parameters of the ODCM at least once per 31 days.

Bases

12.3.2.C

This Section is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10CFR Part 50. The limiting Condition of Operation implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required OPERATING flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "As Low As Is Reasonably Achievable". Also, for fresh water sites with drinking water supplies, which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are excess of the requirements of 40CFR 141. The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the dose due to the actual release rate of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Radioactive Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, Revision 1, October 1977 and Regulatory Guides 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I", April 1977.

This Section applies to the release of liquid effluents from the site. For shared radwaste treatment systems, the liquid effluents from the shared systems are proportioned among the units sharing the system.

12.3.3 Liquid Radwaste Treatment System

Operability Requirements

- 12.3.3.A The Liquid Radwaste Treatment System shall be OPERABLE.* The appropriate portions of the system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected dose due to liquid effluent releases from the site to UNRESTRICTED AREAS (see Zion Station ODCM Annex, Appendix F, Figure F-1) when averaged over 31 days would exceed 0.12 mrem to the total body or 0.40 to any organ.

* The liquid Radwaste Treatment System shall be considered OPERABLE, if liquid waste can be held up and/or discharged within applicable limits.

Applicability: At all times.

Action With the Liquid Radwaste Treatment System inoperable for more than 30 days or with radioactive liquid waste being discharged without treatment and in excess of the above limits, return the system to OPERABLE status and place the appropriate portions of the system in use.

Surveillance Requirements

- 12.3.3.B Doses due to liquid releases from the site to UNRESTRICTED AREAS, shall be projected at least once per 31 days in accordance with the methodologies and parameters of the ODCM when the Liquid Radwaste Treatment System is not being fully utilized.

Bases

- 12.3.3.C The OPERABILITY of the Liquid Radwaste Treatment System ensures that the system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified, provides assurance that the releases of radioactive materials in liquid effluents will be kept "As Low As is Reasonably Achievable". This Section implements the requirements of 10CFR Part 50.36a, General Design Criterion to of Appendix A to 10CFR Part 50 and the design objective given in Section II.D of Appendix I to 10CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Radwaste Treatment System were specified as a 2% fraction of the dose design objectives set forth in Section II.A of Appendix I, 10CFR Part 50, for liquid effluents.

12.4 **GASEOUS EFFLUENTS**

12.4.1 Dose Rate

Operating Requirements

12.4.1.A The dose rate due to radioactive materials released in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY (see Zion Station ODCM Annex, Appendix F, Figure F-1), shall be limited to the following:

1. For noble gases: Less than or equal to 500 mrem/yr to the whole body and less than or equal to 3000 mrem/yr to the skin, and
2. For Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

Applicability: At all times.

Action

With a release exceeding the above limits, immediately reduce the release rate to within the above limits.

Surveillance Requirements

12.4.1.B.1 The dose rate due to radioactive materials in gaseous effluents shall be determined to be within the prescribed limits in accordance with the methods and procedures of the ODCM.

12.4.1.B.2 The dose rate due to radioactive materials, other than noble gases in gaseous effluents shall be determined to be within the prescribed limits in accordance with the methods and procedures of the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 12.4-1.

Bases

12.4.1.C This Section is provided to ensure that the dose at or beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10CFR Part 20.1301. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the SITE BOUNDARY to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year. For purposes of calculating dose resulting from airborne releases, the stack is considered a ground level release.

TABLE 12.4-1

RADIOACTIVE GASEOUS EFFLUENT SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF ^(a) DETECTION (LLD) $\mu\text{Ci/cc}$
A. Gas Decay Tank	Grab Sample Prior to Each Release	Prior to Each Release	Noble Gases Principal Gamma Emitters (d)	1E-4
B. Containment Vent and Purge	Prior to Each Release (a)	Prior to Each Release	Noble Gases Principal Gamma Emitters (d)	1E-4
			Tritium	1E-6
C. Continuous Releases Vent Stack for both (2) units	Grab (b)	Monthly	Noble Gases Principal Gamma Emitters (d)	1E-4
			Tritium	1E-6
	Continuous (b)	Weekly	I-131 (Charcoal Sample)	1E-12
			I-133 (Charcoal Sample)	1E-10
	Continuous (b)	Weekly(c)	Particulate Principal Gamma Emitters (d)	1E-11
	Composite	Quarterly	Sr-89 Particulate	1E-11
			Sr-90 Particulate	1E-11
			Gross Alpha	1E-11
	Continuous (f)	N.A. Noble Gas Monitor	Noble Gases, Gross Beta or Gamma	1E-6

TABLE 12.4-1TABLE NOTATIONSRADIOACTIVE GASEOUS EFFLUENT SAMPLING AND ANALYSIS PROGRAM

(Cont'd)

- a. Should a shutdown, startup or power change greater than 50% occur which could alter the mixture of radionuclides after sampling, another analysis shall be performed prior to release.
- b. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period in Section 12.4.1.
- c. The particulate filter(s) shall be saved for a quarterly composite analysis for Sr-89 and Sr-90.
- d. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions, and Mn-54, Fe-59, Co-60, Zn-65, Co-58, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. Other peaks which are measurable and identifiable by gamma-ray spectrometry, together with the above nuclides, shall also be identified and reported when an actual analysis is performed on a sample. Nuclides which are below the LLD for the analyses shall not be reported as being at the LLD level for that nuclide.
- e. The LLD is defined in Notation a of Table 12.3-2.
- f. Refer to Table 12.2-3 for required actions when the noble gas monitor is not in service.

12.4.2 Dose - Noble Gases

Operability Requirements

12.4.2.A The air dose due to noble gases released in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY (see Zion Station ODCM Annex, Appendix F, Figure F-1) shall be limited to the following:

1. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and
2. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

Applicability: At all times

Action

1. With the calculated air dose from gaseous effluents exceeding the above limits, define the corrective action(s) to be taken to ensure that future releases are in compliance with Section 12.4.2.A.
2. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding twice the limits of Section 12.4.2.A:
 - a. Limit subsequent releases such that the dose or dose commitment to a MEMBER OF THE PUBLIC from all uranium fuel cycle sources is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months.
 - b. Prepare an analysis which demonstrates that radiation exposures to all MEMBERS OF THE PUBLIC from all uranium fuel cycle sources (including all effluents pathways and direct radiation) are less than the 40 CFR Part 190 Standard.

Surveillance Requirements

12.4.2.B Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodologies and parameters of the ODCM at least once every 31 days.

Bases

12.4.2.C

This Section implements the requirements of Sections II.B, III.A and IV.A of Appendix I, 10CFR Part 50. The Operability Requirements implement the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "As Low As Is Reasonably Achievable". The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculation procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated.

12.4.3 Dose - I-131, I-133, Tritium, and Radioactive Material in Particulate Form

Operability Requirements

12.4.3.A The dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 day in gaseous effluents released from the site to areas at or beyond the SITE BOUNDARY (see Zion Station ODCM Annex, Appendix F, Figure F-1) shall be limited to the following:

1. During any calendar quarter: Less than or equal to 7.5 mrem to any organ, and
2. During any calendar year: Less than or equal to 15 mrem to any organ.

Applicability: At all times.

Action

With the calculated dose from the release of Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents exceeding twice the limits of Section 12.4.3.A:

1. Limit subsequent releases such that the dose or dose commitment to a MEMBER OF THE PUBLIC from all uranium fuel cycle sources to less than or equal to 25 mrem to the total body or organ (except the thyroid which is limited to less than or equal to 75 mrem) over 12 consecutive months.
2. Prepare an analysis which demonstrates that radiation exposures to all MEMBERS OF THE PUBLIC from all uranium fuel cycle sources (including all effluent pathways and direct radiation) are less than the 40CFR Part 190 Standard. Otherwise, request a variance from the Commission to permit release which exceeds the 40CFR Part 190 Standard. The radiation exposure analysis shall use the methods prescribed in the ODCM.

Surveillance Requirements

12.4.3.B Cumulative dose contribution for the current calendar quarter and current calendar year for I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodologies and parameters in the ODCM at least once per 31 days.

Bases

12.4.3.C

This Section implements the requirements of Sections II.C, III.A and IV.A of Appendix I, 10CFR Part 50. The Operability Requirements are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time, implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "As Low As Is Reasonably Achievable". The ODCM calculation methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The release rate specifications for radioiodines, radioactive material in particulate form and radioiodines other than noble gases are dependent on the existing radionuclide pathways to man, at or beyond the SITE BOUNDARY. The pathways which are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) disposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man.

12.4.4 Gaseous Radwaste Treatment System

Operability Requirements

12.4.4.A The VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be OPERABLE* and appropriate portions of these systems shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at or beyond the SITE BOUNDARY (see Zion Station ODCM Annex, Appendix F, Figure F-1) would exceed:

1. 0.2 mrad to air from gamma radiation, or
2. 0.4 mrad to air from beta radiation, or
3. 0.3 mrem to any organ.

* The installed VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be considered OPERABLE by meetings Section 12.4.1, 12.4.2 and/or 12.4.3, as applicable

Applicability: At all times.

Action: With the Gaseous Radwaste Treatment System inoperable for more than 30 days or with radioactive gaseous waste being discharged without treatment and in excess of the above limits, return the system to OPERABLE status and place the appropriate portions of the system in use.

Surveillance Requirements

12.4.4.B Doses due to gaseous releases from each unit to areas at or beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodologies and parameters in the ODCM when the Gaseous Radwaste Treatment Systems are not being fully utilized.

Bases

12.4.4.C The OPERABILITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the system will be available for use whenever gaseous effluents require treatment prior to release to the environment.

The requirement that the appropriate portions of this system be used when specified provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This section implements the requirement of 10CFR50.36a, General Design Criterion 60 of Appendix A to 10CFR50 and the design objective given in Section II.D of Appendix I to 10CFR50. The specified limits governing the use of appropriate portions of the Gaseous Radwaste Treatment System were specified as a 2% fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10CFR50, for gaseous effluents.

12.5 **RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

12.5.1 Monitoring Program

Operability Requirements

- 12.5.1.A The Radiological Environmental Monitoring Program shall be conducted as specified in Table 12.5-1.

Applicability: At all times.

Action

1. With the Radiological Environmental Monitoring Program not being conducted as specified in Table 12.5-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting a program as required and the plans for preventing a recurrence.

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of sampling equipment, if a person who participates in the program goes out of business or no longer can provide sample, or contractor omission which is corrected as soon as discovered. If the equipment malfunctions, corrective actions shall be completed as soon as practical. If a person/business supplying samples goes out of business, a replacement supplier shall be found as soon as possible. All deviations from the sampling schedule shall be described in the Annual Radiological Environmental Operating Report.

2. With the level of radioactivity as a result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 12.5-2 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than the calendar year limits of Section 12.3.2, 12.4.2, or 12.4.3. When more than one of the radionuclides in Table 12.5.2 are detected in the sampling medium, this report shall be submitted if:

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

When radionuclides other than those in Table 12.5-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Section 12.3.2, 12.4.2, or 12.4.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such a event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

*The methodology and parameters used to estimate the potential dose to a MEMBER OF THE PUBLIC shall be indicated in the report.

3. If the sample type or sampling location(s) required by Table 12.5-1 become(s) permanently unavailable, identify suitable alternative sampling media for the pathway of interest and/or specific locations for obtaining replacement samples and add them to the Radiological Environmental Monitoring Program as soon as practicable. The specific locations from which samples were unavailable may then be deleted from the program.

Prepare and submit to a controlled version of the ODCM within 180 days including a revised figure(s) and table reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of new location(s) for obtaining samples.

Surveillance Requirements

- 12.5.1.B.1 The Radiological Environmental Monitoring samples shall be collected from the locations specified in the ODCM and analyzed pursuant to Table 12.5-1 and the detection capabilities required by Table 12.5-3.

Bases

- 12.5.1.C The Radiological Environmental Monitoring Program required by this section provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10CFR50 and 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. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. The initially specified monitoring program will be effective for at least 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLD). The LLDs required by Table 12.5-3 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a before the fact limit representing the capability of a measurement system and not as an after the fact limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination-Application to Radiochemistry," Anal. Chem. **40**, 586-93 (1968), and Gartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

Interpretations

12.5.1 D

Table 12.5-1 requires "one sample of each community drinking water supply downstream of the plant within 10 kilometers." Drinking water supply is defined as water taken from river, lakes, or reservoirs (not well water) which is used for drinking. Since Lake Michigan has no designated downstream or upstream direction, two drinking water locations (one north/one south) within 10 kilometers shall be sampled as drinking water indicator locations, and two other locations (one north/one south) beyond 10 kilometers shall be sampled as control locations.

TABLE 12.5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/ OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS ⁽¹⁾	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. Airborne Radioiodine and Particulates	<p>Samples from a total of eight locations:</p> <p>a. Indicator- Near Field</p> <p>Four samples from locations within 4 km (2.5 mi) in different sectors.</p> <p>b. Indicator- Far Field</p> <p>Three additional locations within 4 to 10 km (2.5 to 6.2 mi) in different sectors.</p> <p>c. Control</p> <p>One sample from a control location within 10 to 30 km (6.2 to 18.6 mi).</p>	Continuous sampler operation with: particular sample collection weekly (or more frequently if required due to dust loading), and radioactive canister collection biweekly.	<p><u>Radioiodine Canister:</u> I-131 analysis biweekly on near field and control samples.⁽²⁾</p> <p><u>Particulate Sampler:</u> Gross beta analysis following weekly filter change⁽³⁾ and gamma isotopic analysis⁽⁴⁾ quarterly on composite filters by location on near field samples.⁽²⁾</p>

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/ OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS ⁽¹⁾	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Direct Radiation ⁽⁵⁾	<p>Forty routine monitoring stations either with a thermoluminescent dosimeter (TLD) or with one instrument for measuring dose rate continuously, placed as follows:</p> <p>a. Indicator- Inner Ring (100 Series TLD) One in each meteorological sector, in the general area of the SITE BOUNDARY 0.1 to 1.5 mi);</p> <p>b. Indicator- Outer Ring (200 Series TLD) One in each meteorological sector, within 4.8 to 10 km (3.0 to 6.2 mi); and</p> <p>c. Other</p> <p>One at each Airborne location given in part 1.a. and 1.b.</p> <p>The balance of the TLDs to be placed at special interest locations beyond the Restricted Area where either a MEMBER OF THE PUBLIC or Commonwealth Edison employees have routine access. (300 Series TLD)</p> <p>d. Control</p> <p>One at each Airborne control location given in part 1.c.</p>	Quarterly	Gamma dose on each TLD quarterly

TABLE 12.5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/ OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS ⁽¹⁾	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. Waterborne			
a. Drinking ⁽⁶⁾	a. Indicator One Sample from each community drinking water supply that could be affected by the station discharge within 10 km (6.2 mi) downstream of discharge.	Weekly grab samples.	Gross beta and gamma isotopic analyses ⁽⁴⁾ on monthly composite; tritium analysis on quarterly composite.
b. Control Sample ⁽⁶⁾	a. Control One sample upstream of discharge.	Weekly grab samples.	Gross beta and gamma isotopic analyses ⁽⁴⁾ on monthly composite; tritium analysis on quarterly composite.
c. Sediment	a. Indicator At least one sample within 10 km (6.2 mi) of discharge	Semiannually.	Gamma isotopic analysis ⁽⁴⁾ semiannually.
d. Cooling Water Samples	a. Inlet b. Discharge	Weekly grab samples.	Gross beta analysis weekly; tritium analysis on quarterly composite.

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/ OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS ⁽¹⁾	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. Ingestion			
a. Milk ⁽⁷⁾	<p>a. Indicator</p> <p>Samples from milking animals from a maximum of three locations within 10 km (6.2 mi) distance.</p> <p>b. Control</p> <p>One sample from milking animals at a control location within 15 to 30 km (9.3 to 18.6 mi).</p>	Biweekly ⁽⁸⁾ when animals are on pasture (May through October), monthly at other times (November through April).	Gamma isotopic ⁽⁴⁾ and I-131 ⁽⁹⁾ analysis biweekly ⁽⁸⁾ when animals are on pasture (May through October), monthly at other times (November through April).
b. Fish	<p>a. Indicator</p> <p>Representative samples of commercially and recreationally important species in discharge area.</p> <p>b. Control</p> <p>Representative samples of commercially and recreationally important species not influenced by plant discharge.</p>	Two times annually.	Gamma isotopic analysis ⁽⁴⁾ on edible portions.
c. Food Products	<p>a. Indicator</p> <p>Two representative samples from the principal food pathways grown in each of two major quadrants (over land) within 10 km (6.2 mi):</p> <p>At least one root vegetable sample⁽¹⁰⁾</p> <p>At least one broad leaf vegetable (or vegetation)⁽¹⁰⁾</p> <p>b. Control</p> <p>Two representative samples similar to indicator samples grown within 15 to 30 km (9.3 to 18.6 mi).</p>	Annually	Gamma isotopic ⁽⁴⁾ analysis on each sample.

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
TABLE NOTATIONS

- (1) Specific parameters of distance and direction from the centerline of the midpoint of the two units and additional description where pertinent, shall be provided for each and every sample location in Table 1.1-1 of the CDCM Station Annexes. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979.
- (2) Far field samples are analyzed when the respective near field sample results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents from the station, or at the discretion of the Radiation Protection Director.
- (3) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.
- (4) Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the station.
- (5) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The 40 locations is not an absolute number. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., If a station is adjacent to a lake (i.e. Zion), some sectors may be over water thereby reducing the number of dosimeters which could be placed at the indicated distances. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.
- (6) Refer to Section 12.5.1.D for interpretation on the applicability of "downstream" and "upstream". If no community drinking water supply exists within 6.2 miles of the discharge, surface water sampling shall be performed.
- (7) If milking animals are not found in the designated indicator locations, or the owners decline to participate in the REMP, all milk sampling may be discontinued.
- (8) Biweekly refers to every two weeks.
- (9) I-131 analysis means the analytical separation and counting procedure are specific for this radionuclide.
- (10) One sample shall consist of a volume/weight of sample large enough to fill contractor specified container.

TABLE 12.5-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES*

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m ³)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000 ⁽¹⁾				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2 ⁽²⁾	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

(1) For drinking water samples. This is 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.

(2) If no drinking water pathway exists, a value of 20 pCi/l may be used.

* This table contains reporting levels for analyses beyond the requirements of Table 12.5-1.

TABLE 12.5-3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS⁽¹⁾

LOWER LIMIT OF DETECTION (LLD)⁽²⁾⁽³⁾

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m ³)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01	1000			
H-3	200					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131(6)	1/15 ⁽⁴⁾	0.07	100	0.5/5 ⁽⁵⁾	60	
Cs-134	15	0.01	100	15	60	150
Cs-137	18	0.01	100	18	80	180
Ba-La-140	15			15		

TABLE 12.5-3 (Continued)
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
TABLE NOTATIONS

- (1) This table contains lower limits of detection for analyses beyond the requirements of Table 12.5-1. This table does not imply that only these nuclides are to be detected and reported; other peaks which are measurable and identifiable in the analyses required by Table 12.5-1 shall be reported in the Annual Radiological Environmental Operating Report.
- (2) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.
- (3) The Lower Limit of Detection (LLD) is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation, the LLD is defined as follows:

$$LLD = \frac{4.66 S_b + 3/t_b}{(E)(V)(2.22)(Y)(\exp(-\lambda\Delta t))}$$

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

Where: $4.66 S_b \gg 3/t_b$

LLD = the "a priori" Lower Limit of Detection (picoCuries per unit mass or volume),

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

$$\frac{\sqrt{\text{Total Counts}}}{t_b}$$

=

E = the counting efficiency(counts per disintegration),

V = the sample size (units of mass or volume),

2.22 = the number of disintegrations per minute per picoCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}),

t_b = counting time of the background or blank (minutes), and

TABLE 12.5-3 (Continued)
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
TABLE NOTATIONS

Δt = the elapsed time between sample collection, or end of the sample collection period, and the time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

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

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

- (4) If no drinking water pathway exists, the value of 15 pCi/l may be used.
- (5) A value of 0.5 pCi/l shall be used when the animals are on pasture (May through October) and a value of 5 pCi/l shall be used at all other times (November through April).
- (6) This LLD applies only when the analytical separation and counting procedure are specific for this radionuclide.

12.5.2 LAND USE CENSUSOperability Requirements

- 12.5.2.A A Land Use Census shall be conducted and shall identify within a distance of 10 km (6.2 mi) the location, in each of the following meteorological sectors, A, J, K, L, M, N, P, Q, and R, of the nearest milk animal, the nearest residence**, and an enumeration of livestock. For dose calculation, a garden will be assumed at the nearest residence.

Applicability: At all times.

Action:

1. With a Land Use Census identifying location(s) that yields a calculated dose or dose commitment, via the same exposure pathway 20% greater than at a location from which samples are currently being obtained in accordance with Section 12.5.1, add the new location(s) within 30 days to the Radiological Environmental Monitoring Program given in Chapter 11 of the ODCM Station Annexes. The sampling location(s), excluding the control location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. Submit in the next Annual Radiological Environmental Operating Report documentation for a change in the ODCM including revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

** The nearest industrial facility shall also be documented if closer than the nearest residence.

Surveillance Requirements

- 12.5.2.B The Land Use Census shall be conducted during the growing season, between June 1 and October 1, at least once per calendar year using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report.

Bases

- 12.5.2.C This specification is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the Radiological Environmental Monitoring Program given in the ODCM 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. An annual garden census will not be required since the licensee will assume that there is a garden at the nearest residence in each sector for dose calculations.

12.5.3 INTERLABORATORY COMPARISON PROGRAM

Operability Requirements

- 12.5.3.A Analyses shall be performed on radioactive materials supplied as part of an interlaboratory comparison program that correspond to samples required by Table 12.5.1

Applicability: At all times.

Action:

- 1 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.

Surveillance Requirements

- 12.5.3.B 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.

Bases

- 12.5.3.C The requirement for participation in an interlaboratory comparison program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

12.6 REPORTING REQUIREMENTS12.6.1 Annual Radiological Environmental Operating Report*

Routine Annual Radiological Environmental Operating Report covering the operation of the Unit(s) during the previous calendar year shall be submitted prior to May 15 of each year. The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including, as found appropriate, a comparison of preoperational studies with operational controls or with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation on the environment.

The Annual Radiological Environmental Operating Report shall include the results of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the tables and figures in the Chapter 11 of the ODCM Station Annexes, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual 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 as soon as possible in a supplementary report.

The reports shall also include the following: a summary description of the Radiological Environmental Monitoring Program; legible maps covering all sampling locations keyed to a table giving distances and directions from the midpoint between the two units; reasons for not conducting the Radiological Environmental Monitoring Program as required by Section 12.5.1, and discussion for all deviations from the sampling schedule of Table 11.1-1; a Table of Missed Samples and a Table of Sample Anomalies for all deviations from the sampling schedule of Table 11.1-1; discussion of environmental sample measurements that exceed the reporting levels of Table 12.5-2 but are not the result of plant effluents; discussion of all analyses in which the LLD required by Table 12.5-3 was not achievable; results of the Land Use Census required by Section 12.5.2; and the results of licensee participation in an interlaboratory comparison program and the corrective actions being taken if the specified program is not being performed as required by Section 12.5.3.

The Annual Radiological Environmental Operating Report shall also include an annual summary of hourly meteorological data collected over the applicable year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. In lieu of submission with the Annual Radiological Environmental Operating 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.

* A single submittal may be made for a multiple unit station.

The Annual Radiological Environmental Operating Report shall also include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the Unit or Station during the previous calendar year. This report shall also include an assessment of radiation doses to the most likely exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the ODCM and in compliance with 10 CFR 20 and 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation."

12.6.2 Annual Radioactive Effluent Release Report**

Routine Annual Radioactive Effluent Release Reports covering the operation of the unit during the previous calendar year of operation shall be submitted no longer than 12 months since the previous report pursuant to 10CFR50.36a.

The Annual Radioactive Effluent Release Reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Material in Liquid and Gaseous Effluent from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The Annual Radioactive Effluent Release Report shall include a list and description of unplanned releases of radioactive material in liquid effluents from the site to UNRESTRICTED AREAS and of unplanned releases of radioactive material in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY during the reporting period.

The Annual Radioactive Effluent Release Report shall include any changes made during the reporting period to the Process Control Program as well as any major changes to Liquid, Gaseous or Solid Radwaste Treatment Systems, pursuant to Section 12.6.4.

The Annual Radioactive Effluent Release Report shall also include the following: an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified in Section 12.2.1 or 12.2.2, respectively; and description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specification 3.11 (ITS 5.5.10) or 3.12 (ITS 5.5.10), respectively.

**A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

12.6.3 Offsite Dose Calculation Manual (ODCM)

12.6.3.1 Changes to the ODCM:

- a. Shall be documented and records of reviews performed shall be retained as required by Specification 6.5.2 (ITS 5.5.1). This documentation shall contain:
 - 1. Sufficient Information to support the change together with the appropriate analyses or evaluations justifying the change(s); and
 - 2. A determination that the change will maintain the level of radioactive effluent control required by 10 CFR 20.1302, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.
 - 3. Documentation of the fact that the change has been reviewed and found acceptable by the Onsite Review Function.
- b. Shall become effective after review and acceptance by the Onsite Review and Investigative Function and the approval of the Plant Manager on the date specified by the Onsite Review and Investigative Function.
- c. Shall be submitted to the Commission in the form of a complete, legible copy of the entire ODCM as a part of or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made effective. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented.

12.6.4 Major Changes to Liquid and Gaseous Radwaste Treatment Systems***

Licensee-initiated major changes to the Radwaste Treatment Systems (liquid and gaseous):

- a. Shall be reported to the Commission in the Annual Radioactive Effluent Release Report for the period in which the evaluation was reviewed by the Onsite Review and Investigative Function. The discussion of each change shall contain:
- 1) A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR 50.59;
 - 2) Sufficient detailed information to totally support the reason for the change without benefit of additional and supplemental information;
 - 3) A detailed description of the equipment, components, and processes involved and the interfaces with other plant systems.
 - 4) An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents that differ from those previously predicted in the License application and amendments thereto;
 - 5) An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC and to the general population that differ from those previously estimated in the License application and amendments thereto;
 - 6) A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents, to the actual releases for the period prior to when the changes are to be made;
 - 7) An estimate of the exposure to plant operating personnel as a result of the change; and
 - 8) Documentation of the fact that the change was reviewed and found acceptable by the Onsite Review and Investigative Function.
- b. Shall become effective upon review and acceptance by the Onsite Review and Investigative Function.

*** Licensees may choose to submit the information called for in this standard as part of the annual FSAR update.