ATTACHMENT E

ZION STATION

OFF-SITE DOSE CALCULATION MANUAL

CHAPTER 12

REVISION O.E

ERRATA FOR OFF-SITE DOSE

CALCULATION MANUAL, REVISION O.E.

Subject	Page	Description
Table 12.2-1	12-7	Action 1, Item 1 Reference to Section 12.2.1.B should be changed to Section 12.3.1.B.
Table 12.2-3	12-12	Item 7.B, "Miscellaneous Vent Stack", Reference to Applicable Mode "6" should be changed to Applicable Mode "1, 2, 3, 4, 7" for all instruments.
Table 12.5-1	12-39	Item 2, "Direct Radiation (TLD)", Reference to forty two locations should be changed to forty locations.

ZNLD/2541/61

SPECIAL NOTE

Until removal of the Radiological Effluent Technical Specifications from the Zion Station Technical Specifications has been approved by the Nuclear Regulatory Commission, the requirements of the Technical Specifications shall take precedence over this chapter, should any differences occur.

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CHAPTER 12

RADIOACTIVE EFFLUENT TECHNICAL STANDARDS (RETS) TABLE OF CONTENTS

CHAPTER 12

RADIOACTIVE EFFLUENT TECHNICAL STANDARDS (RETS) LIST OF TABLES

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 TEST shall be:

a. 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.

b. 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 A GASEOUS RADWASTE TREATMENT SYSTEM any system designed and installed to reduce radioactive gaseous effluents by collecting 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.

12.1.9 MEMBERS(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or its vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational or other purposes not associated with the plant.

12.1.10 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).

12.1.11 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.

12.1.12 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.

12.1.13 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.

12.1.14 The SITE BOUNDARY shall be that line beyond which the land is not owned, leased or otherwise controlled by the licensee.

12.1.15 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

12.1.16 The SURVEILLANCE FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 12.1-1.

12.1.17 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional and/or recreational purposes.

12.1.18 A VENTILATION EXHAUST TREATMENT SYSTEM is any system designed and installed to reduce gaseous radiodine 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 release to the environment. Such a system is not considered to have any effect on noble gas effluents. Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

12.1.19 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.

TABLE 12.1-1

SURVEILLANCE FREQUENCY NOTATION

NOTATION	FREQUENCY *
S (Shiftly)	At least once per scheduled shift
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 (Semi-Annually)	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; but the combined time interval for any three consecutive surveillance intervals shall not exceed 3.25 times the specified surveillance interval.

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 10CFR Part 20. 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 TABLE

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION #	APPLICABLE MODES
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 12.2-1

RADIOACTIVE 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) of at least 10^{-7} μCi/ml.

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.

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TABLE 12.2-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION(1)	CHANNEL FUNCTIONAL TEST (2)
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 and a SOURCE CHECK.

(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):
a) Instrument indicates levels above the alarm setpoints.
b) Circuit failure.
c) Instrument indicates a downscale failure.
d) 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

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION	APPLICABLE MODES
1. Gas Decay Tank			
A. Gas Activity Monitor			
1. OR-PR10A Low range gas	1	5	All
2. OR-PR10B High range gas	1	5	All
B. Particulate/Iodine Monitor			
1. OR-PR10C	1	5	All
C. Flow Rate Monitor			
1. OF-WG03	1	9	All
2. Air Ejector Off-Gas			
A. Gas Activity Monitor			
1. 1R-0015 Gas	1	6	1,2,3,4,7
2. 2R-0015 Gas	1	6	1,2,3,4,7
B. Particulate/Iodine Monitor			
1. 1R-PR26	1	6	1,2,3,4,7
2. 2R-PR26	1	6	1,2,3,4,7
C. Flow Rate Monitor			
1. 1F-0G10	1	12	1,2,3,4,7
2. 2F-0G10	1	12	1,2,3,4,7
3. Containment Purge or Vent			
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 VENTING
[2] During PURGING

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION
(Cont'd)

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION	APPLICABLE MODES
3. Containment and Purge or Vent			
C. Particulate Monitor			
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. Auxiliary Building Ventilation and Miscellaneous Ventilation Stack			
A. Gas Activity Monitor			
1. OR-0014 or	1	6	All
2. 1R-PR25 and 2R-PR25	1	6	All
3. OR-PR18B Gas	1	6	All
4. 1R-PR49E (Channel 5)	1	6	All
5. 2R-PR49E (Channel 5)	1	6	All
B. Iodine Monitor			
1. 1R-PR49C (Channel 3)	1	8	All
2. 2R-PR49C (Channel 3)	1	8	All
C. Particulate Monitor			
1. OR-PR18A Particulate	1	6	All
1. 1R-PR49A (Channel 1)	1	8	All
2. 2R-PR49A (Channel 1)	1	8	All
D. Flow Rate Monitor			
1. 1LP-084	1	9	All
2. 2LP-084	1	9	All
5. Service Building Ventilation			
A. Gas Activity Monitor			
1. OR-PR22	1	8	All
B. Particulate/Iodine Monitor			
1. OR-PR36	1	8	All

[1] During VENTING
[2] During PURGING

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION
(Cont'd)

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION	APPLICABLE MODES
6. Steam Generator Atmospheric Relief and Safety Valves			
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
7. Accident Monitoring			
A. Containment			
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. Miscellaneous Vent Stack			
1. 1R-PR49G (Channel 7)	1	10	6
2. 2R-PR49G (Channel 7)	1	10	6
3. 1R-PR49I (Channel 9)	1	10	6
4. 2R-PR49I (Channel 9)	1	10	6
C. Containment Fuel Handling Area Monitor*			
1. 1R-AR04A	1	11	6
2. 1R-AR04B	1	11	6
3. 2R-AR04A	1	11	6
4. 2R-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.

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TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE

	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION (1)	CHANNEL FUNCTIONAL TEST (2)
1. Gas Decay Tank				
A. Gas Activity Monitor				
1. OR-PR10A Low range gas	P	P	R	Q
2. OR-PR10B High range gas	P	P	R	Q
B. Particulate/Iodine Monitor				
1. OR-PR10C	P	P	R	Q
C. Flow Rate Monitor				
1. OF-WG03	P	N/A	N/A	Q (5)
2. Air Ejector Off-Gas				
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
C. Flow Rate Monitor				
1. 1F-0G10	D	N/A	R	N/A
2. 2F-0G10	D	N/A	R	N/A

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TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION (1)	CHANNEL FUNCTIONAL TEST (2)
3. Containment Purge or Vent				
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)

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION (1)	CHANNEL FUNCTIONAL TEST (2)
4. Auxiliary Building Ventilation and Miscellaneous Ventilation Stack				
A. Gas Activity Monitor				
1. OR-0014 Gas or	D	M	R	Q
2. 1RT-PR25 and 2RT-PR25	D	M	R	Q
3. OR-PR18B	D	M	R	Q
4. 1R-PR49E (Channel 5)	D	M	R	Q
5. 2R-PR49E (Channel 5)	D	M	R	Q
B. Iodine Monitor				
1. 1R-PR49C (Channel 3)	D	M	R	Q
2. 2R-PR49C (Channel 3)	D	M	R	Q
C. Particulate Monitor				
1. OR-PR18A	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
5. Service Building Ventilation				
A. Gas Activity Monitor				
1. OR-PR22	D	M	R	Q
B. Particulate/Iodine Monitor				
1. OR-PR36	N/A	N/A	N/A	N/A

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE
(Cont'd)

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION (1)	CHANNEL FUNCTIONAL TEST (2)
6. Steam Generator Atmospheric Relief and Safety Valves				
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
7. Accident Monitoring				
A. Containment				
1. 1R-PR40G (Channel 7)	ND/A	N/A	R	Q
2. 2R-PR40G (Channel 7)	ND/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. Miscellaneous Vent Stack				
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. Fuel Handling Area				
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 12.2-4

RADIOACTIVE 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 (see Zion Station ODCM Annex, Appendix F, Figure F-1) shall be limited to the concentrations specified in 10CFR Part 20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the limit is shown in Table 12.3-1.

12.3.1.A.2 During the release of radioactive liquid wastes, a minimum dilution water flow rate of 44,000 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 two service water pumps or a 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 will be less than the concentration levels specified in 10CFR Part 20, Appendix B, Table II, Column 2. 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 an individual, and (2) the limits of 10 CFR 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases, MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

TABLE 12.3-1

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

NUCLIDE	MPC(mci/ml)*
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 & ANALYSIS SURVEILLANCE

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT (a,e) OF DETECTION (LLD) (μCi/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 (b) Composite(b)	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
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

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TABLE 12.3-2

TABLE NOTATIONS

RADIOACTIVE LIQUID EFFLUENT SAMPLING & 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 radio-nuclide 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 12.3-2

TABLE NOTATIONS

RADIOACTIVE LIQUID EFFLUENT SAMPLING & 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 throughly 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 Dose Calculations - Cumulative dose contributions from liquid effluents shall be determined by calculation at least once per month and a cumulative summation of these total body and any organ doses shall be maintained for each calendar quarter.

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 Operability Requirements implement 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.

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 Operability Requirements implement 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 0.13 mrem to the total body or 0.42 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 month in accordance with the ODCM.

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 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 suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10CFR Part 50, for liquid effluents.

Bases

12.4.1.C This Section is provided to ensure that the dose at the UNRESTRICTED AREA boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10CFR Part 20. The annual dose limits are the doses associated with the concentrations of 10CFR Part 20, Appendix B, Table II Column 1. Those limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an UNRESTRICTED AREA to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10CFR Part 20 (10CFR Part 20, 106 (b)(1)). 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 UNRESTRICTED AREA 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 two stacks are considered a mixed mode release.

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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 (e) DETECTION (LLD) µCi/cc
A. Gas Decay Tank	Grab Sample Prior To Each Release	Prior To Each Release (c)	Noble Gases Principal Gamma Emitters (d)	1E-4
	Continuous Sample During Each Release	After Each Release (c)	Particulate Principal Gamma Emitters (d)	1E-11
			Tritium	1E-6
			I-131 (Charcoal Sample)	1E-12
			I-133 (Charcoal Sample	1E-10
	Composite	Quarterly (c)	Sr-89 Particulate	1E-11
			Sr-90 Particulate	1E-11
			Gross Alpha	1E-11
B. Containment Vent and Purge	Prior To Each Release (a)	Prior To Each Release (c)	Principal Gaseous Gamma Emitters (d)	1E-4
			Particulate Gamma Emitters (d)	1E-11
			Tritium	1E-6
			I-131 (Charcoal)	1E-12
			I-133 (Charcoal)	1E-10
	Composite	Quarterly (c)	Sr-89 Particulate	1E-11
			Sr-90 Particulate	1E-11
			Gross Alpha	1E-11

TABLE 12.4-1

RADIOACTIVE GASEOUS EFFLUENT SAMPLING AND ANALYSIS PROGRAM
(Cont'd)

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF (e) DETECTION (LLD) (μCi/cc)
C. Continuous Release Points	Grab (b)	Monthly	Principal Gaseous and Gamma Emitters	1E-4
1. Air Ejector for Both (2) Units	Continuous (b)	Monthly	Tritium	1E-6
2. Aux Bldg Vent for Both (2) Units	Continuous (b)	Weekly	I-131 (Charcoal Sample)	1E-12
3. Misc. Ventiltn. Stack			I-133 (Charcoal Sample)	1E-10
4. Serv. Bldg. Vent	Continuous (b)	Weekly (c)	Particulate Principal Gamma Emitters	1E-11
5. Cont. Purge for Both (2) Units	Composite	Quarterly (c)	Sr-89 Particulate	1E-11
6. Turbine Bldg.			Sr-90 Particulate	1E-11
			Gross Alpha	1E-11

TABLE 12.4-1

TABLE NOTATIONS

RADIOACTIVE 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) from this/these release point 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.

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 (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 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 - Radioiodine - Particulate - Other Than Noble Gas

Operability Requirements

12.4.3.A The dose to a MEMBER OF THE PUBLIC from radioiodine and radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than 8 day in gaseous effluents released from the site (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

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 12.4.3.A.

2. 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:

   a. 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.

   b. 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 radioiodines, radioactive materials in particulate form and radionuclides (other than noble gas) with half-lives greater than 8 days shall be determined in accordance with 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. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. 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, in the UNRESTRICTED AREA. 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.

12.5 RADIOLOGICAL ENVIRONMENTAL MONITORING

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 unavailibility, contractor omission which is corrected as soon as discovered, malfunction of sampling equipment, or if a person who participates in the program by providing samples goes out of business.

   If the equipment malfunctions, corrective actions shall be completed as soon as practical. If a person supplying samples goes out of business, a replacement will 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 in an environmental sampling medium at one or more of the locations specified in the ODCM exceeding the limits of Table 12.5-2, 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 12.5-2 to be exceeded. 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.

3. With milk samples unavailable from any of the sample locations required by Table 12.5-1, identify locations for obtaining replacement samples and add them to the Radiological Environmental Monitoring Program within 30 days. The locations from which samples were unavailable may then be deleted from the program. Identify the cause of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the Annual Radiological Environmental Operating Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

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.

12.5.1.B.2 The results of analyses performed on the Radiological Environmental Monitoring samples shall be summarized in the Annual Radiological Environmental Operating Report. See Section 12.6.1.

Bases

12.5.1.C The Radiological Environmental Monitoring Program required by Table 12.5-1 provides for measurement 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 the station 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. Changes to the initially specified monitoring program may be initiated based on operational experience.

The detection capabilities required by Table 12.5-3 are state of-the-art for routine environmental measurements in industrial laboratories. The specified lower limits of detection for I-131 in water, milk and other food products correspond to approximately one-quarter of the Appendix I to 10CFR Part 50 design objective dose-equivalent of 15 mrem/year for atmospheric releases and 10 mrem/year for liquid releases to the most sensitive organ and individual. They are based on the assumption given in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I", October 1977, except the change for an infant consuming 330 liters/year of drinking water instead of 510 liters/year.

TABLE 12.5-1

ZION STANDARD RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION SITE	TYPE OF ANALYSIS	FREQUENCY
3. Waterborne			
A. Public Water Supply	6 Locations	a) Gamma Isotopic	a) Monthly Analysis of weekly composites
		b) Tritium	b) Quarterly Composite
B. Cooling Water Sample	(1) Inlet	a) Gross Beta	a) Weekly
	(2) Discharge	b) Tritium	b) Quarterly Composite
C. Sediment	Lake Michigan Shoreline 1 Location	Gamma Isotopic	Semi-Annually
4. Ingestion			
A. Milk	2 Dairy Farms	I^{131} and gamma isotopic	Semi-Monthly - May to Oct, Monthly at all other times.
B. Fish	Lake Michigan Near Zion Station	Gamma Isotopic on edible portions	Semi-Annually

TABLE 12.5-1

ZION STANDARD RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION SITE	TYPE OF ANALYSIS	FREQUENCY
4. Ingestion (Continued)			
C. Food Products	Samples of three different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed.	Gamma isotopic and I-131 analysis.	Monthly when available.
	One sample of each of the similar broad leaf vegetation grown 15 to 30 km distant in the least prevalent wind direction if milk sampling is not performed.	Gamma isotopic and I-131 analysis.	Monthly when available.

Footnotes:

1. Bi-Weekly shall mean at the frequency of once every other week.

2. A gamma isotopic analysis shall be performed whenever the gross beta concentration in a sample exceeds by five times (5x) the average concentration of the proceeding calendar quarter for the sample location.

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	2×10^4 (a)				
^{54}Mn	1×10^3		3×10^4		
^{59}Fe	4×10^2		1×10^4		
^{58}Co	1×10^3		3×10^4		
^{60}Co	3×10^2		1×10^4		
^{65}Zn	3×10^2		2×10^4		
^{95}Zr-Nb	4×10^2 (b)				
^{131}I	2	0.9		3	1×10^2
^{134}Cs	30	10	1×10^3	60	1×10^3
^{137}Cs	50	20	2×10^3	70	2×10^3
^{140}Ba-La	2×10^2 (b)			3×10^2 (b)	

(a) For drinking water samples. This is 40 CFR Part 141 value.
(b) Total for parent and daughter

TABLE 12.5-3
MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION
(LLD) a,b

	Water	Airborne Particulate	Fish	Milk	Food Products	Sediment
^{54}Mn	15		130			
^{59}Fe	30		260			
$^{58,60}Co$	15		130			
^{65}Zn	30		260			
$^{95}Zr-Nb$	15[c]					
^{131}I	1[b]	7×10^{-2}		1	60	
$^{134,137}Cs$	15 (10[b]),18	1×10^{-2}	130	15	60	150
$^{140}Ba-La$	15[c]			15[c]		

TABLE 12.5-3

TABLE NOTATIONS
(Cont'd)

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with only 5% probability of falsely concluding its presence.

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 (as pCi per unit mass or volume)

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

A is the number of gamma-rays emitted per disintegration for gamma-ray radio-nuclide analysis
(A = 1.0 for gross alpha, strontium, and tritium measurements)

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 transformations 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 sample collection and analysis.

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed background count or of the count of the blank samples (as appropriate) rather than on an unverified theoretically predicted value. Typical values of E, V, Y, Δt, shall be used in the calculation.

TABLE 12.5-3

TABLE NOTATIONS
(Cont'd)

a. (Cont'd)

For gamma-ray radionuclide analyses the background counts are determined from the total counts in the channels which are within plus or minus one FWHM (Full-Width-at-Half-Maximum) of the gamma-ray photopeak energy normally used for the quantitative analysis for that radionuclide. Typical values of the FWHM shall be used in the calculation.

b. The LLD for environmental measurement 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.

c. LLD for drinking water.

12.5.2 Land Use Census

Operability Requirements

12.5.2.A A Land Use Census shall be conducted to identify the location of the nearest residences and of animals producing milk for human consumption in each of the following meteorological sectors, A, J, K, L, M, N, P, Q and R within a distance of 5 miles.

Applicability: At all times.

Action

1. With a Land Use Census identifying a location which yields an ODCM calculated dose or dose commitment greater than the values currently being calculated in Section 12.4.3.A.1, this new location shall be added to the Radiological Environmental Monitoring Program within 30 days. The sampling location excluding the control station location having the lowest calculated dose or dose commitment (via the same exposure pathways), may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted.

Surveillance Requirements

12.5.2.B.1 The Land Use Census shall be conducted at least once per 12 months between the dates of June 1 and October 1, by a door-to-door survey, road survey, aerial survey, or by consulting local agriculture authorities.

12.5.2.B.2 The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report.

Bases

12.5.2.C The Land Use Census Section is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that the 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 10CFR Part 50.

12.5.3 Interlaboratory Comparison Program

Operability Requirements

12.5.3.A Analysis shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which has been approved by the Commission.

Applicability: At all times.

Action

1. With analysis 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 and in accordance with the ODCM shall be included in the Annual Radiological Environmental Operating Report.

Bases

12.5.3.C The requirement for participation in the Interlaboratory Comparison (crosscheck) Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the Quality Assurance Program for environmental monitoring in order to demonstrate that the results are reasonably valid.

12.6 REPORTING REQUIREMENTS

12.6.1 Annual Radiological Environmental Operating Report

An Annual Radiological Environmental Operating Report containing the data taken in the Standard Radiological Environmental Monitoring Program Table 12.5-1, shall be submitted by April 30 of the following year. The content of the report shall include:

1. Results of Radiological Environmental Sampling, summarized and tabulated, following the format of Regulatory Guide 4.8, Table 1 (December 1975); individual sample results will be retained at the station; in the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reason for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

2. An assessment of the monitoring results and radiation dose via the principal pathways of exposure resulting from plant emissions of radioactivity; including maximum noble gas gamma and beta air doses in the UNRESTRICTED AREA (dose calculations shall be performed in accordance with the ODCM).

3. Results of the census to determine the locations of animals producing milk for human consumption.

4. A summary of the meteorological conditions concurrent with the release of gaseous effluents during each quarter as outlined in Regulatory Guide 1.21 (Revision 1) dated June, 1974, following the format of Appendix B thereof.

5. A summary description of the Radiological Environmental Monitoring Program.

6. A map of all sampling locations keyed to a table giving approximate distances and directions from one reactor.

7. The results of the Interlaboratory Comparison Program required by Section 12.5.3.A.

12.6 REPORTING REQUIREMENTS (Continued)

8. This report shall also 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 of wind speed, wind direction, atmospheric stability, and precipitation (if measured) on magnetic tape, 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 station during the previous calendar year. This same report shall also include an assessment of the radiation doses from the radioactive liquid and gaseous effluents to individuals due to their activities inside the SITE BOUNDARY (see Zion Station ODCM Annex, Appendix F, Figure F-1) during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) shall be used for determinating the gaseous pathways doses. The assessment of radiation doses shall be performed in accordance with the ODCM.

   This report shall also include an assessment of radiation doses to the most likely exposed real individual from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluents pathways and direct radiation) for the previous 12 consecutive months to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1.

9. This report shall also include a special report pursuant to the requirements of the Technical Specification 3.3.6, whenever the reactor coolant specific activity limits have been exceeded.

12.6.2 Semiannual Radioactive Effluent Release Report

Within 60 days after January 1 and July 1 of each year, a report shall be submitted covering the radioactive content of effluents released to UNRESTRICTED AREAS during the previous six months operation. The data shall be in the format of Regulatory Guide 1.21, Rev. 1 (June 1974) and shall be summarized on a quarterly basis and shall include as a minimum:

1. Gaseous Effluents:

   a. Gross Radioactivity Releases:

      1) Total gross radioactivity (in curies) primarily noble and activation gases released.

      2) Maximum gross radioactivity release rate during any one-hour period.

      3) Total gross radioactivity (in curies) by nuclide released, based on representative isotopic analyses performed.

      4) Percent of ODCM limits.

   b. Iodine Releases:

      1) Total iodine radioactivity (in curies) by nuclide released, based on representative isotopic analyses performed.

      2) Percent of ODCM limits for I-131 released.

   c. Particulate Releases:

      1) Total gross radioactivity (Beta-Gamma) released (in curies) excluding background radioactivity.

      2) Total gross Alpha radioactivity released (in curies) excluding background radioactivity.

      3) Total gross radioactivity released (in curies) of nuclides with half-lives greater than 8 days.

      4) Percent of ODCM limits for particulate radioactivity with half-lives greater than 8 days.

2. Liquid Effluents:

   a. Total gross radioactivity (Beta-Gamma) released (in curies) excluding tritium and average concentration released to the UNRESTRICTED AREA.

   b. Total tritium and total Alpha radioactivity released (in curies) and average concentration released to the UNRESTRICTED AREA.

   c. Total dissolved noble gas radioactivity released (in curies) and average concentration released to the UNRESTRICTED AREA.

   d. Total volume (in liters) of liquid waste released.

   e. Total volume (in liters) of dilution water used prior to release from the restricted area.

   f. The maximum concentration of gross radioactivity (Beta-Gamma) released to the UNRESTRICTED AREA (average over the period of released).

   g. Total gross radioactivity (in curies) by nuclide released, based on representative isotopic analyses performed.

   h. Percent of ODCM limit.

3. Solid Radioactive Waste:

   Refer to the Semiannual Reporting Requirements provided in the PROCESS CONTROL PROGRAM (PCP).

4. The radioactive effluent release reports shall include unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents on a quarterly basis.

12.6.3 Unique Reporting Requirements

Non-Routine Reports:

1. Radiological Environmental Monitoring Program:

   If a confirmed measured radionuclide concentration in an environmental sampling medium averaged over any calendar quarter sampling period exceeds the reporting level given in Table 12.5-2 and if the radioactivity is attributable to plant operation, a written report shall be submitted to the Director of the NRC Regional Office of Inspection and Enforcement with a copy to the Director, Office of Nuclear Reactor Regulation within 30 days from the end of the quarter. When more than one of the radionuclides in Table 12.5-2 are detected in the medium, the reporting level shall have been exceeded if:

   $$\frac{Ci}{RLi} \geq 1$$

   where C is the concentration of the ith radionuclides in the medium and RL is the reporting level of radionuclide i.

2. If radionuclides other than those in Table 12.5-2 are detected and are due to plant effluents, a reporting level is exceeded if the potential annual dose of an individual is equal to or greater than the design objective doses of 10 CFR 50, Appendix I.

3. This report shall include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous effect.

12.6.4 Offsite Dose Calculation Manual (ODCM)

Changes to the ODCM:

a. Shall be documented and records of reviews performed shall be retained as required by Specification 6.5.2. 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, 106, 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 both the Onsite and Offsite Review Functions.

b. Shall become effective after review and acceptance by the Onsite Review and Investigative Function, the Offsite Review and Ivestigative 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 Semiannual 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.