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THREE MILE ISLAND NUCLEAR STATION

UNIT #2 OPERATING PROCEDURE 2105-1.12

RADIATION MONIORING SYSTEM SETPOINTS

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Unit 1 Staff Recommends Approval

Approval N.A. Date ——

Cognizant Dept. Head

Unit 2 Staff Recommends Approval

Approval N.A. Date ——

Cognizant Dept. Head

Unit 1 PORC Recommends Approval

N.A. Date ——

Chairman of PORC

Unit 2 PORC Recommends Approval

J. F. Thibush Date 11/9/78

Chairman of PORC

Unit 1 Superintendent Approval

N.A. Date ——

Unit 2 Superintendent Approval

J. L. Seelinger Date 11/9/78

Manager Generation Quality Assurance Approval: N.A. Date ——

198 078

TMI 55 A Rev 8/77

THREE MILE ISLAND NUCLEAR STATION

UNIT #2 OPERATING PROCEDURE 2105-1.12

Radiation Monitoring System Setpoints

1. PURPOSE

The intent of this procedure is to provide a list of current Radiation Monitoring System alert and hi-alarm setpoints, the basis for the setpoint and the calculations used to determine the setpoint.

2.0 DESCRIPTION

The Radiation Monitoring System alert and hi-alarm setpoints are intended to be both a means of informing control room personnel of abnormal radiation contamination levels and of initiating automatic action to reduce the consequences of these abnormal radiation levels. This document describes these setpoints but does not detail automatic or manual responses to any alarm. This document should be used in conjunction with the following:

1. TMI-2 Final Safety Analysis Report.
2. TMI-2 Technical Specifications.
3. Emergency Procedure 2207-1.7; Excessive Radiation Levels.
4. Response to Alarm procedure 2204-12.

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198 079

AREA MONITORS

MONITOR		ALERT ALARM	HIGH ALARM
HP-R-201		0.7 MR/hr	1.4 MR/hr
HP-R-202		0.7 MR/hr	1.4 MR/hr
HP-R-204		1.0 MR/hr	2.0 MR/hr
HP-R-205		1.0 MR/hr	2.0 MR/hr
HP-R-206		10.0 MR/hr	20.0 MR/hr
HP-R-207		1.0 MR/hr	2.0 MR/hr
HP-R-209	(Modes 1,2,3,4 & 5)	2.0 R/hr	5.0 R/hr
	(Mode 6)	100.0 MR/hr	1.0 R/hr
HP-R-210	(Modes 1,2,3,4 & 5)	2.0 R/hr	5.0 R/hr
	(Mode 6)	100.0 MR/hr	1.0 R/hr
HP-R-211		25.0 MR/hr	50.0 MR/hr
HP-R-212		25.0 MR/hr	50.0 MR/hr
HP-R-213		25.0 MR/hr	50.0 MR/hr
HP-R-214		25.0 MR/hr	8.0 R/hr
HP-R-215		10.0 MR/hr	20.0 MR/hr
HP-R-218		25.0 MR/hr	50.0 MR/hr
HP-R-231		500.0 MR/hr	1.0 R/hr
HP-R-232		1.2 MR/hr	2.0 MR/hr
HP-R-233		1.0 MR/hr	2.0 MR/hr
HP-R-234		1.0 MR/hr	2.0 MR/hr
HP-R-3236		10.0 MR/hr	20.0 MR/hr
HP-R-3238		10.0 MR/hr	20.0 MR/hr
HP-R-3240		10.0 MR/hr	20.0 MR/hr

198 080

ATMOSPHERIC MONITOR

MONITOR	ALERT ALARM	HIGH ALARM
HP-R-219 (P)	$6.5 \times 10^{+2}$ CPM	$1.3 \times 10^{+3}$ CPM
HP-R-219 (I)	$7.9 \times 10^{+4}$ CPM	$1.58 \times 10^{+5}$ CPM
HP-R-219 (G)	$5.0 \times 10^{+3}$ CPM	$1.0 \times 10^{+4}$ CPM
HP-R-220 (P)	150 CPM	300 CPM
HP-R-220 (I)	100,000 CPM	200,000 CPM
HP-R-220 (G)	130 CPM	260 CPM
HP-R-221A (P)	4000 CPM	8000 CPM
HP-R-221A (I)	125,000 CPM	250,000 CPM
HP-R-221A (G)	20,000 CPM	40,000 CPM
HP-R-221B (P)	3500 CPM	7000 CPM
HP-R-221B (I)	100,000 CPM	200,000 CPM
HP-R-221B (G)	15,000 CPM	30,000 CPM
HP-R-222 (P)	2500 CPM	5000 CPM
HP-R-222 (I)	75,000 CPM	150,000 CPM
HP-R-222 (G)	10,000 CPM	20,000 CPM
HP-R-223 (P)	$5.5 \times 10^{+2}$ CPM	$1.1 \times 10^{+3}$
HP-R-223 (I)	$1.15 \times 10^{+5}$ CPM	$2.3 \times 10^{+5}$ CPM
HP-R-223 (G)	130 CPM	260 CPM
HP-R-224 (P)	$5.5 \times 10^{+2}$ CPM	$1.1 \times 10^{+3}$ CPM
HP-R-224 (I)	$1.15 \times 10^{+5}$ CPM	$2.3 \times 10^{+5}$ CPM
HP-R-224 (G)	130 CPM	260 CPM
HP-R-225 (P)	5000 CPM	10,000 CPM
HP-R-225 (I)	100,000 CPM	200,000 CPM
HP-R-225 (G)	40,000 CPM	80,000 CPM

198 081

ATMOSPHERIC MONITOR (cont'd)

MONITOR	ALERT ALARM	HIGH ALARM
HP-R-226 (P)	5000 CPM	10,000 CPM
HP-R-226 (I)	100,000 CPM	200,000 CPM
HP-R-226 (G)	40,000 CPM	80,000 CPM
HP-R-227 (P)	25,000 CPM	50,000 CPM
HP-R-227 (I)	2000 CPM	5000 CPM
HP-R-227 (G)	10,000 CPM	20,000 CPM
HP-R-228 (P)	2000 CPM	4000 CPM
HP-R-228 (I)	50,000 CPM	100,000 CPM
HP-R-228 (G)	10,000 CPM	20,000 CPM
HP-R-229 (P)	80,000 CPM	160,000 CPM
HP-R-229 (I)	200,000 CPM	400,000 CPM
HP-R-229 (G)	60,000 CPM	120,000 CPM
WDG-R-1480 (G)	200,000 CPM	400,000 CPM
WDG-R-1485 (G)	150,000 CPM	300,000 CPM
WDG-R-1486 (G)	150,000 CPM	300,000 CPM
VA-R-748 (G)	1000 CPM	2000 CPM

198 082

LIQUID MONITORS

MONITOR	ALERT ALARM	HIGH ALARM
MU-R-720 (Gross)	$2.5 \times 10^{+5}$ CPM	$5.0 \times 10^{+5}$ CPM
MU-R-720 (Analyze)	$2.5 \times 10^{+5}$ CPM	$5.0 \times 10^{+5}$ CPM
IC-R-1091	1000 CPM	5000 CPM
IC-R-1092	1000 CPM	5000 CPM
IC-R-1093	400 CPM	2000 CPM
WDL-R-1311*	1800 CPM	9000 CPM
DC-R-3399	400 CPM	2000 CPM
DC-R-3400	400 CPM	2000 CPM
NS-R-3401	400 CPM	2000 CPM
SF-R-3402	4000 CPM	10,000 CPM
WT-R-3894	1000 CPM	2000 CPM
WT-R-3895	750 CPM	1500 CPM

*During Release see HPP 1621.2 Releasing Radioactive Liquid Waste, for determination of setpoint, since the setpoint will vary depending on concentration to be released.

198 083

HP-R-201

Location: Control Room

HIGH ALARM SETPOINT: 1.4 mR/hr

Basis: The Control Room is designed for continuous occupancy at a maximum of 3 REM in 90 days.

Calculation: $$\frac{3 \times 10^3 \text{ mR}}{(90 \text{ Days})(24 \text{ hous/day})} = 1.4 \text{ mR/hr}$$

ALERT SETPOINT: 0.7 mR/hr

Basis: 50% of high alarm setpoint.

198 084

HP-R-202

Location: Cable Room

HIGH ALARM SETPOINT: 1.4 mR/hr

Basis: The Control Room is designed for continuous occupancy at a maximum of 3 REM in 90 days.

Calculation: $$\frac{3 \times 10^3 \text{ mR}}{(90 \text{ Days})(24 \text{ hous/day})} = 1.4 \text{ mR/hr}$$

ALERT SETPOINT: 0.7 mR/hr

Basis: 50% of high alarm setpoint

198 085

HP-R-204

Location: Auxiliary Building 281' Elevation - Reactor Building Emergency Cooling Booster Pump Area.

HIGH ALARM SETPOINT: 2.0 MR/hr

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Reference: TMI Unit #2 FSAR; Section 12.1.

ALERT ALARM SETPOINT: 1.0 MR/hr

Basis: 50% of the High Alarm Setpoint.

198 086

HP-R-205

Location: Auxiliary Building 281' elevation - Reactor Coolant Evaporator Control Panel Area.

HIGH ALARM SETPOINT: 2.0 MR/hr

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Ref: TMI-2 FSAR: Section 12.1.

ALERT SETPOINT: 1.0 MR/hr

Basis: 50% of the High Alarm Setpoint

HP-R-206

Location: Auxiliary Building - 281' elevation - Make-Up Tank Area.

HIGH ALARM SETPOINT: 20.0 MR/hr

Basis: 25.0 MR/hr is the design value for the corridor between the Make-Up Tank Cubicle and the Make-Up Demineralizer Cubicle. Choosing the nearest lower meter graduation, the setpoint is 20.0 MR/hr.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 10.0 MR/hr

Basis: 50% of the High Alarm Setpoint.

HP-R-207

Location: Auxiliary Building 305' Elevation - Intermediate Cooling Pump Area.

HIGH ALARM SETPOINT: 2.0 MR/hr.

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Reference: TMI Unit #2 FSAR; Section 12.1.

ALERT ALARM SETPOINT: 1.0 MR/hr

Basis: 50% of the High Alarm Setpoint.

HP-R-209

Location: Reactor Building - Fuel Handling Bridge - North.

HIGH ALARM SETPOINT: Modes 1, 2, 3, 4, 5: 5 R/hr

Basis: 5 X Background: Background is anticipated to be approximately 1 R/hr on the fuel handling bridges during normal operations.

ALERT SETPOINT: Modes 1, 2, 3, 4, 5: 2 R/hr.

Basis: 2 X Background: Backgroung = 1 R/hr.

HIGH ALARM SETPOINT: Mode 6: 1 R/hr

Basis: 1 R/hr is indicative of radiation levels at the bridge due to accidents involving spent fuel, but above those levels which may be attributable to other sources.

ALERT SETPOINT: 100 MR/hr.

Basis: 100 MR/hr will alert the operator to notify the HP Dept of the need to control the area as a "High Radiation Area".

Ref: 10CFR20.202(b)(3)

HP-R-210

Location: Reactor Building - Fuel Handling Bridge - South

HIGH ALARM SETPOINT: Modes 1, 2, 3, 4, 5: 5 R/hr.

Basis: 5 X Background: Background is anticipated to be approximately 1 R/hr on the fuel handling bridges during normal operations.

ALERT SETPOINT: Modes 1, 2, 3, 4, 5: 2 R/hr.

Basis: 2 X Background: Background = 1 R/hr.

HIGH ALARM SETPOINT: Mode 6: 1 R/hr.

Basis: 1 R/hr is indicative of radiation levels at the bridge due to accidents involving spent fuel, but above those levels which may be attributable to other sources.

ALERT SETPOINT: 100 MR/hr.

Basis: 100 MR/hr will alert the operator to notify the HP Dept of the need to control the area as a "High Radiation Area".

Ref: 10CFR 20.202(b)(3).

HP-R-211

Location: Reactor Building 305' elev. - Personnel Access Hatch Area.

HIGH ALARM SETPOINT: 50 MR/hr.

Basis: 2 times the design value (25 MR/hr) for the 305' elevation of the Reactor Building outside the secondary shield in the vicinity of the Personnel Access Hatch.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 25 MR/hr.

Basis 50% of the High Alarm Setpoint.

198 092

HP-R-212

Location: Reactor Building 305' elev. - Equipment Access Hatch Area.

HIGH ALARM SETPOINT: 50 MR/hr.

Basis: 2 times the design value (25 MR/hr) for the 305' elevation of the Reactor Building outside the secondary shield in the vicinity of the Equipment Access Hatch.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 25 MR/hr.

Basis: 50% of the High Alarm Setpoint.

HP-R-213

Location: Reactor Building 305' elev. - In-Core Instrument Panel Area.

HIGH ALARM SETPOINT: 50 MR/hr.

Basis: 2 times the design value (25 MR/hr) for the 305' elevation of the Reactor Building outside the secondary shield in the vicinity of the In-Core Instrument Panel Area.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 25 MR/hr.

Basis: 50% of the High Alarm Setpoint.

HP-R-214

Location: Reactor Building Dome

HIGH ALARM SETPOINT: 8 R/hr.

Basis: Due to the attenuation rating of the ion-chamber lead shielded containment (10^9 MR/hr to 10^7 MR/hr), 8 R/hr is equivalent to 800 R/hr in the Reactor Building - a level indicative of a LOCA.

ALERT ALARM SETPOINT: 25 MR/hr.

Basis: While the Reactor is operating, HP-R-214 is not relied upon for personnel protection. However, it may be used as preliminary indication of radiation conditions in the Reactor Building prior to any entry.

HP-R-215

Location: Spent Fuel Pool Fuel Handling Bridge - Fuel Handling Building.

HIGH ALARM SETPOINT: 20 MR/hr

Basis: TMI Unit #2 Technical Specification, Table 3.3-6.1.

ALERT ALARM SETPOINT: 10 MR/hr.

Basis: 50% of High Alarm Setpoint

HP-R-218

Location: Auxiliary Building 281' Elevation - Waste Disposal Storage Area.

HIGH ALARM SETPOINT: 50 MR/hr.

Basis: 2 times the design value (25 MR/hr) for the Waste Disposal Storage Area.

Reference: TMI Unit #2 FSAR, Section 12.1.

ALERT ALARM SETPOINT: 25 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 097

HP-R-231

Location: Auxiliary Building 280' Elevation - Auxiliary Building Sump Tank Filter Room.

HIGH ALARM SETPOINT: 1 R/hr.

Basis: 1 R/hr requires the area to be maintained locked and is indicative of a severe radiological hazard.

Reference:

ALERT ALARM SETPOINT: 500 MR/hr.

Basis: 50% of the High Alarm Setpoint.

HP-R-232

Location; Auxiliary Building 315'-6" Elevation - Mezzanine Area above Reactor Building Sump Filters.

HIGH ALARM SETPOINT: 2.0 MR/hr.

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Reference: TMI Unit #2 FSAR; Section 12.1.

ALERT ALARM SETPOINT: 1.2 MR/hr.

Basis: $\approx$ 50% of the design value for accessible areas in the Auxiliary Building.

198 099

HP-R-233

Location: Auxiliary Building 315'-6" Elevation - Mezzanine Area above Spent Fuel Cooling Filters

HIGH ALARM SETPOINT: 2.0 MR/hr.

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Reference: TMI Unit #2 FSAR; Section 12.1.

ALERT ALARM SETPOINT: 1.0 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 100

HP-R-234

Location: Service Building 281' Elevation - Contaminated Drain Tank Room Area.

HIGH ALARM SETPOINT: 2.0 MR/hr.

Basis: 2.5 MR/hr is the design value for accessible areas in the Auxiliary Building during normal operations. Choosing the nearest lower meter graduation, the setpoint is 2.0 MR/hr.

Reference: TMI Unit #2 FSAR; Section 12.1.

ALERT ALARM SETPOINT: 1.0 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 101

HP-R-3236

Location: Auxiliary Building 328' Elevation - Reactor Building Purge Air Exhaust Unit Area.

HIGH ALARM SETPOINT: 20.0 MR/hr.

Basis: 25.0 MR/hr is the design value for the Reactor Building Purge Air Exhaust Unit Area. Choosing the nearest lower meter graduation, the setpoint is 20.0 MR/hr.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 10.0 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 102

HP-R-3238

Location: Auxiliary Building 328' Elevation - Auxiliary Building Exhaust Unit Area.

HIGH ALARM SETPOINT: 20.0 MR/hr.

Basis: 25.0 MR/hr is the design value for the Auxiliary Building Exhaust Unit Area. Choosing the nearest lower meter graduation, the setpoint is 20.0 MR/hr.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 10.0 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 103

HP-R-3240

Location: Auxiliary Building 328' Elevation - Fuel Handling Building Exhaust Unit Area.

HIGH ALARM SETPOINT: 20.0 MR/hr.

Basis: 25.0 MR/hr is the design value for the Fuel Handling Building Exhaust Unit Area. Choosing the nearest lower meter graduation, the setpoint is 20.0 MR/hr.

Ref: TMI-2 FSAR; Section 12.1.

ALERT SETPOINT: 10.0 MR/hr.

Basis: 50% of the High Alarm Setpoint.

198 104

HP-R-219 (Particulate)

Location: Station Vent.

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (Sr-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 1,300 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec and a meter error factor of 75%.

Ref: TMI-2 Technical Specifications, Appendix B, Specification 2.3.2.b.

Case:

1.) Assumed flowrate thru duct of 147,695 CFM (6.97×10^{7} cc/sec) - Normal flow.

$(0.5)(0.63\ \mu Ci/sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75) / (6.97 \times 10^{+7}\ cc/sec) = 1.7964 \times 10^{3}$ CPM.

2.) Assumed flowrate thru duct of 197,695 CFM ($9.33 \times 10^{+7}$ cc/sec) - Reactor Building Purge in operation + normal flowrate.

$(0.5)(0.63\ \mu Ci/sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75) / (9.33 \times 10^{+7}\ cc/sec) = 1.342 \times 10^{3}$ CPM.

Choosing the most conservative case the setpoint would be 1.342×10^{3} CPM, however, since there is no meter graduation at this point, adjust the setpoint to 1.3×10^{3} CPM.

ALERT ALARM SETPOINT: $6.5 \times 10^{+2}$ CPM.

Basis: 50% of High Alarm Setpoint.

$(1.3 \times 10^{3}\ CPM)(0.5) = 650$ CPM

HP-R-219 (Iodine)

Location: Station Vent.

Sensitivity: $5.83 \times 10^{+11}$ CPM/Min./μCi/cc (I-131) assuming a 90% collection efficiency at 1.0 SCFM after 8 hours.

HIGH ALARM SETPOINT: 60,000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.30 μCi/sec is exceeded for 7 days assuming a ± 8.0% error due to flow variations and a meter error factor of 75%.

Ref: TMI-2 Technical Specifications, Appendix B, Specification 2.3.2.b.

Case:

1.) Assumed flowrate thru duct of 147,695 CFM (6.97×10^{7} cc/sec)
- Normal flow.
(0.5)(0.30 μCi/sec)($5.83 \times 10^{+11}$ CPM/μCi/cc)(0.75-0.08)(2 hours)
(60 min/hr) / (6.97×10^{7} cc/sec) = 100,800 CPM.

2.) Assumed flowrate thru duct of 197,695 CFM ($9.33 \times 10^{+7}$ cc/sec)
- Reactor Building Purge (Both) in addition to normal flowrate.
(0.5)(0.30 μCi/sec)($4.83 \times 10^{+11}$ CPM/Min/μCi/cc)(0.75-0.08)(2 hours)
(60 min/hr) / ($9.33 \times 10^{+7}$ cc/sec) = 75,300 CPM.

Choosing the most conservative case the setpoint would be 75,300 CPM, however, since there is no meter graduation at this point, adjust the setpoint to $6.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 30,000 CPM.

Basis: 50% of High Alarm Setpoint.
($6.0 \times 10^{+4}$ CPM) (0.5) = $3.0 \times 10^{+4}$

198 106

HP-R-219 (Gas)

Location: Station

Sensitivity: 3.55 X Ci/cc. (Xe-133)

HIGH ALARM SETPOINT: 10,000

Basis: Tech Sp of 1.2×10^5 M^3/sec for gross gasous and a meter error factor of 75%. XePC is 3×10^{-7} $\mu Ci/cc$.

Ref: 10 20, Appendix B

TMnical Specifications, Appendix B, Spion 2.3.2.a.

Cases:

1.) Assumed flowrate thru 147,695 CFM (69.7 M^3/sec) Normal flow.

$$\frac{(1.2 \times 10^5 \ M^3/sec)(3.0^{\mu Ci}/cc)}{(69.7 \ M} (3.55 \times 10^{+7} \ CPM/\mu Ci/cc)(0.75)$$

= 1.375CPM.

2.) Assumed flowrate thru 197,695 CFM (93.3 M^3/sec) Reactor Building Purge (Both) tion + normal flowrate.

$$\frac{(1.2 \times 10^{+5} \ M^3/sec)(3.0^{\mu Ci}/cc)}{(93.3 \ M^3} (3.55 \times 10^{+7} \ CPM/\mu Ci/cc)(0.75)$$

= 1.0273PM.

Choosing the most conservatithe setpoint would be 1.0273×10^4 CPM, however, since thermeter graduation at this point, adjust the setpoint to 1.0 X.

ALERT ALARM SETPOINT: 5000 CPM

Basis: 50% of Hi Setpoint.

$(1.0 \times 10^{4.5}) = 0.5 \times 10^3$ CPM.

HP-R-220 (Particulate)

Location: Control Room Intake Duct

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (Sr-90) at 1 in/Hr filter movement and 8.5 SCFM.

HIGH ALARM SETPOINT: 300 CPM

Basis: MPC_a for restricted areas of 1×10^{-9} μCi/cc for Sr-90 assuming a ± 8.0% error due to flow variations and a 75% meter error factor.

Ref: 10CFR Part 20, Appendix B

Calclculations: $(1 \times 10^{-9}$ μCi/cc$)(5.3 \times 10^{+11}$ CPM/μCi/cc$)$ $(0.75 - 0.08) = 355.1$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, 300 CPM.

ALERT ALARM SETPOINT: 150 CPM

Basis: 50% of high alarm setpoint.

Calculation: (300 CPM)(0.5) = 150 CPM

198 108

HP-R-220 (Iodine)

Location: Control Room Intake Duct.

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/μCi/cc (I-131) assuming a 77% collection efficiency of 8.55 CFM after 8 hours.

HIGH ALARM SETPOINT: 200,000 CPM

Basis: MPC_a for restricted areas of 9×10^{-9} μCi/cc for I-131, alarm will activate in 10 minutes with MPC_a conditions assuming a ± 8.0% error due to flow variations and a 75% meter error factor.

Ref: 10 CFR Part 20, Appendix B

Calculations: $(9 \times 10^{-9}$ μCi/cc$)(3.895 \times 10^{+12}$ CPM/min./μCi/cc$)$ (10 min)(0.75-0.08) = $2.349 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, round setpoint to next lower ten-thousands CPM, 2.0×10^5 CPM.

ALERT ALARM SETPOINT: 100,000 CPM

Basis: 50% of high alarm setpoint.

Calculation: $(2.0 \times 10^5$ CPM$)(0.5) = 1.0 \times 10^5$ CPM.

198 109

HP-R-220 (Gas)

Location: Control Room Intake Duct

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (XE-133)

HIGH ALARM SETPOINT: 260 CPM

Basis: MPC_a for unrestricted areas of 1×10^{-5} μCi/cc for XE-133. Assumes meter error factor of 75%.

Ref: 10 CFR Part 20, Appendix B.

Calculation: $(1 \times 10^{-5}$ μCi/cc$)(3.55 \times 10^{+7}$ CPM/μCi/cc$)(0.75)$ = 266.25 CPM.

NOTE: Since there is no meter graduation at this point the setpoint to the next lower tens CPM, 260 CPM.

ALERT ALARM SETPOINT: 130 CPM

Basis: 50% of high alarm setpoint.

Calculation: (260 CPM)(0.5) = 130 CPM

198 110

HP-R-221A (Particulate)

Location: Fuel Handling Building Exhaust Duct Upstream of Filter

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (SR-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 8000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec at an exhaust flowrate of 38,000 CPM and a meter factor of 75%. In order to maintain isokinetic sampling, the sampler flowrate will be maintained at 5.5 scfm. For this calculation we will use a 90% overall collection efficiency for the filter.

Calculation: $$\frac{(0.50)(0.63\ \mu Ci/Sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)(8.5\ scfm)}{(2.66 \times 10^{+7}\ Ci/Sec)(0.90)(5.5\ scfm)} = 8082\ scfm$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $8.0 \times 10^{+3}$ CPM.

ALERT ALARM SETPOINT: 4000 CPM

Basis: 50% of high alarm setpoint

Calculation: $(8.0 \times 10^{+3}\ CPM)(0.5) = 4.0 \times 10^{+3}$ CPM.

198 111

HP-R-221A (Iodine)

Location: Fuel Handling Building Exhaust Duct Upstream of Filter.

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 250,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.30 μCi/sec is exceeded for 7 days assuming a ± 8.0% error due (-8.0% most conservative) to flow variations and a meter error factor of 75%. In order to maintain isokinetic sampling, the sampler flowrate will be maintained at 5.5 scfm For this calculation we will use a 90% overall collection efficiency for the filter.

Calculation:

$$\frac{(0.5)(0.30\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min/\mu Ci/cc)(0.75-0.08)(10\ min)(8.5\ scfm}{(2.66 \times 10^{+7}\ cc/sec)\ (0.90)(5.5\ scfm)}$$

$= 2.5 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point adjust the setpoint to $2.5 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 125,000 CPM

Basis: 50% of high alarm setpoint

Calculation: $(2.5 \times 10^{+5}\ CPM)\ (0.5) = 1.25 \times 10^{+5}$ CPM

198 112

HP-R-221A (Gas)

Location: Fuel Handling Building Exhaust Dust Upstream of Filter.

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 40,000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75%. Xe-133 MPC is 3×10^{-7} μCi/cc. For this calculation we will use a 90% overall collection efficiency for the filter.

Ref: 10 CFR Part 20, Appendix B.

TMI - Unit 2 Tech Specifications, Appendix B, Section 2.3.2.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(2.66 \times 10^{+1}\ M^3/sec)(0.90)}$$

$= 4.0 \times 10^{+4}$ CPM

ALERT ALARM SETPOINT: 20,000 CPM

Basis: 50% of high alarm setpoint.

Calculation: $(4.0 \times 10^{+4}\ CPM)\ (0.5) = 2.0 \times 10^{+4}$ CPM

198 113

HP-R-221B (Particulate)

Location: Fuel Handling Building Exhaust Duct Downstream of Filter

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (SR-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 7000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/Sec at an exhaust flowrate of 38,000 CPM and a meter factor of 75%. In order to maintain isokinetic sampling, the sampler flowrate will be maintained at 5.5 scfm.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/Sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)(8.5\ scfm)}{(2.66 \times 10^{+7}\ Ci/Sec)(5.5\ scfm)} = 7274$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $7.0 \times 10^{+3}$ CPM.

ALERT ALARM SETPOINT: 3500 CPM

Basis: 50% of high alarm setpoint

Calculation: $(7.0 \times 10^{+3}\ CPM)(0.5) = 3.5 \times 10^{+3}$ CPM.

198 114

HP-R-221B (Iodine)

Location: Fuel Handling Building Exhaust Duct Downstream of Filter.

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 200,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.30 μCi/sec is exceeded for 7 days assuming a ± 8.0% error due (-8.0% most conservative) to flow variations and a meter error factor of 75%.

Ref: TMI-2 Tech Spec, Appendix B.

Calculation:

$$\frac{(0.5)(0.30\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min/\mu Ci/cc)(0.75-0.08)(10\ min)(8.5\ scfr}{(2.66 \times 10^{+7}\ cc/sec)\ (5.5\ scfm)}$$

$= 2.27 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point adjust the setpoint to $2.0 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 100,000 CPM

Basis: 50% of high alarm setpoint

Calculation: $(2.0 \times 10^{+5}\ CPM)\ (0.5) = 1.0 \times 10^{+5}$ CPM

198 115

HP-R-221B (Gas)

Location: Fuel Handling Building Exhaust Dust Downstream of Filter.

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 30,000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75%. Xe-133 MPC is 3×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B. Appendix B, Section 2.3.2.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(2.66 \times 10^{+1}\ M^3/sec)}$$

$= 3.60 \times 10^{+4}$ CPM

NOTE: Since there is no meter graduation at this point adjust the setpoint to $3.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 15,000 CPM

Basis: 50% of high alarm setpoint.

Calculation: $(0.5)(3.0 \times 10^{+4}) = 1.5 \times 10^{+4}$ CPM.

HP-R-222 (Particulate)

Location: Auxiliary Building Purge Air Exhaust Upstream of Filter

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (Sr-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 5,000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec at an exhaust flowrate of 50,715 CFM and a meter error factor of 75%. For this calculation we will use a 90% overall collection efficiency for the filter. In order to maintain isokinetic sampling when AH-V177 is selected OPEN, the sampler flowrate will be maintained at 6.0 scfm.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)(8.5\ scfm)}{(3.9 \times 10^{+7}\ cc/sec)\ (0.90)(6.0\ scfm)} = 5053\ CPM$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, $5.0 \times 10^{+3}$ CPM.

ALERT ALARM SETPOINT: 2500 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $5.0 \times 10^{+3}$ CPM) (0.5) = $2.5 \times 10^{+3}$ CPM

198 117

HP-R-222 (Iodine)

Location: Auxiliary Building Purge Air Exhaust Upstream of Filter

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 150,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.30 μCi/sec is exceeded for 7 days assuming a ± 8.0% error due (-8.0% most conservative) to flow variations and a meter error factor of 75%. For this calculation we will use a 90% overall collection efficiency for the filter. In order to maintain isokinetic sampling when AH-V177 is selected, OPEN, the sampler flowrate will be maintained at 6.0 scfm.

Ref: TMI-2 Tech Spec, Appendix B.

Calculation:

$$\frac{(0.5)(0.3\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min/\mu Ci/cc)(0.75-0.08)(10\ min)(8.5\ scfm)}{3.9 \times 10^{+7}\ cc/sec\ (0.9)(6.0\ scfm)}$$

$= 1.57 \times 10^{5}$ CPM

ALERT ALARM SETPOINT: 75,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(1.5 \times 10^{+5}\ CPM)(0.5) = 7.5 \times 10^{+4}$ CPM

198 118

HP-R-222 (Gas)

Location: Auxiliary Building Purge Air Exhaust Upstream of Filter

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 20,000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75%. Xe-133 MPC is 3×10^{-7} μCi/cc. For this calculation we will use a 90% overall collection efficiency for the filter.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Spec, Appendix B, Section 2.3.2.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(3.9 \times 10^{+1}\ M^3/sec)\ (0.90)}$$

$= 2.72 \times 10^{+4}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT:

Basis: 50% of High Alarm Setpoint.

Calculation: $(0.5)\ (2.0 \times 10^{+4}) = 1.0 \times 10^{+4}$ CPM).

198 119

HP-R-223 (Particulate)

Location: Spent Fuel Area (Moveable Monitor)

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc at 1 in/Hr filter movement and 8.5 SCFM (SR-90)

High Alarm Setpoint: 1,100 CPM

Basis: MPC_a for restricted areas of 3×10^{-9} μCi/cc for unknown mixture of isotopes. Alarm will activate with MPC_a condition, assuming 75% meter error factor. Ref: 10CFR Part 20, Appendix B.

Calculation: 3×10^{-9} μCi/cc x 5.3×10^{11} CPM/μCi/cc x .75

= 1192.5 CPM.

Since there is no meter graduation at this point, adjust setpoint to 1000 CPM.

Alert Setpoint: 500 CPM

Basis: 50% of high alarm setpoint.

198 120

HP-R-223 (Iodine)

Location: Spent Fuel Area (Moveable Monitor)

Sensitivity: $3.895 \times 10^{+12}$ CPM/min μCi/cc (I-131) assuming a 77% collection efficiency at 8.5 SCFM after 8 hours.

HIGH ALARM SETPOINT: 230,000 CPM

Basis: MPC_a for restricted areas of 9×10^{-9} μCi/cc for I-131 alarm will activate in 10 minutes with MPC_a condition assuming a ± 8.0% error due to flow variations and a 75% meter error factor.

Ref: 10 CFR Part 20, Appendix B.

Calculation:

$(9 \times 10^{-9}$ μCi/cc)$(3.895 \times 10^{+12}$ CPM/min μCi/cc)(10 min)(0.75-0.08)

$= 2.349 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.3 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 115,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(2.3 \times 10^{5}$ CPM)(0.5) $= 1.15 \times 10^{5}$ CPM.

198 121

HP-R-223 (Gas)

Location: Spent Fuel Area (Moveable Monitor).

Sensitivity: 3.55×10^7 CPM/μCi/cc (Xe-133).

High Alarm Setpoint: 260 CPM

Basis: MPCa for unrestricted areas of 1×10^{-5} μCi/cc for Xe-133. Assumes meter error factor of 75%.

Calculation: $(1 \times 10^{-5}$ μCi/cc) $(3.55 \times 10^7$ CPM/μCi/cc) (.75) = 266.25 CPM.

Since there is no meter graduation at this point, adjust setpoint to next lower tens CPM, 260 CPM.

Alert Setpoint: 130 CPM.

Basis: 50% of high alarm setpoint.

HP-R-224 (Particulate)

Location: Auxiliary Building (Moveable Monitor)

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc at 1 in/Hr filter movement and 8.5 SCFM (SR-90)

High Alarm Setpoint: 1100 CPM

Basis: MPC_a for restricted areas of 3×10^{-9} μCi/cc for unknown mixture of isotopes. Alarm will activate with MPC_a condition, assuming 75% meter error factor. Ref: 10CFR Part 20, Appendix B.

Calculation: $(3 \times 10^{-9}$ μCi/cc) $(5.3 \times 10^{11}$ CPM/μCi/cc) (.75)
= 1192.5 CPM
Since there is no meter graduation at this point, adjust setpoint to next lower hundreds CPM, 1100 CPM.

Alert Setpoint: 550 CPM

Basis: 50% of high alarm setpoint.

HP-R-224 (Iodine)

Location: Auxiliary Building (Moveable Monitor)

Sensitivity: $3.895 \times 10^{+12}$ CPM/min µCi/cc (I-131) assuming a 77% collection efficiency at 8.5 SCFM after 8 hours.

HIGH ALARM SETPOINT: 230,000 CPM

Basis: MPC_a for restricted areas of 9×10^{-9} µCi/cc for I-131 alarm will activate in 10 minutes with MPC_a condition assuming a ± 8.0% error due to flow variations and a 75% meter error factor.

Ref: 10 CFR Part 20, Appendix B.

Calculation:

$(9 \times 10^{-9}$ µCi/cc$)(3.895 \times 10^{+12}$ CPM/min µCi/cc$)(10$ min$)(0.75-0.08)$

$= 2.349 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.3 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 115,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(2.3 \times 10^5$ CPM$)(0.5) = 1.15 \times 10^5$ CPM.

198 124

HP-R-224 (Gas)

Location: Auxiliary Building (Moveable Monitor).

Sensitivity: 3.55×10^7 CPM/μCi/cc (Xe-133).

High Alarm Setpoint: 260 CPM

Basis: MPCa for unrestricted areas of 1×10^{-5} μCi/cc for Xe-133. Assumes meter error factor of 75%.

Calculation: $(1 \times 10^{-5}$ μCi/cc) $(3.5 \times 10^7$ CPM/μCi/cc) (.75) = 262.5 CPM.

Since there is no meter graduation at this point, round setpoint to next lower tens CPM, 260.

Alert Setpoint: 130 CPM.

Basis: 50% of high alarm setpoint.

HP-R-225 (Particulate)

Location: Reactor Building Purge Exhaust A

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (SR-90 @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 10,000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec at an exhaust flowrate of 25,000 CFM and a meter error factor of 75%.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/cc)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)}{(1.18 \times 10^{+7}\ cc/sec)} = 10{,}600.0\ CPM$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, $1.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 5000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(1.0 \times 10^{+4}\ CPM)(0.5) = 5.0 \times 10^{+3}$ CPM

HP-R-225 (Iodine)

Location: Reactor Building Purge Exhaust A

Sensitivity: $3.895 \times 10^{+12}$ CPM/min-μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 200,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.3 μCi/sec is exceeded for 7 days assuming a ± 8.0 % error due (-8.0% most conservative) to flow variations and a meter error factor of 75%.

Ref: TMI-2 Tech Spec, Appendix B.

Calculation:

$$\frac{(0.5)(0.3\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min\text{-}\mu Ci/cc)(0.75\text{-}0.08)(10\ min)}{1.18 \times 10^{+7}\ cc/sec}$$

$= 3.3 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.0 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 100,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(2.0 \times 10^{+5}\ CPM)(0.5) = 1.0 \times 10^{+5}$ CPM

HP-R-225 (Gas)

Location: Reactor Building Purge Exhaust A

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 80,000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75% Xe-133 MPC is 3×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Specs, Appendix B, Section 2.3.2.a.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/\text{sec})(3.0 \times 10^{-7}\ \mu\text{Ci/cc})(3.55 \times 10^{+7}\ \text{CPM}/\mu\text{Ci/cc})(0.75)}{1.18 \times 10^{+1}\ M^3/\text{sec})}$$

$= 8.12 \times 10^{+4}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $8.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 40,000

Basis: 50% of High Alarm Setpoint

Calculation: $(0.5)(8.0 \times 10^{+4}) = 4.0 \times 10^{+14}$ CPM

198 128

HP-R-226 (Particulate)

Location: Reactor Building Purge Exhaust B

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (SR-90 @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 10,000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec at an exhaust flowrate of 56,450 CFM and a meter error factor of 75%.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/cc)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)}{(1.18 \times 10^{+7}\ cc/sec)} = 10,600.0\ CPM$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, $1.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 5000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(1.0 \times 10^{+4}\ CPM)(0.5) = 5.0 \times 10^{+3}$ CPM

198 129

HP-R-226 (Iodine)

Location: Reactor Building Purge Exhaust B

Sensitivity: $3.895 \times 10^{+12}$ CPM/min-μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 200,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.3 μCi/sec is exceeded for 7 days assuming a ± 8.0 % error due (-8.0% most conservative) to flow variations and a meter error factor of 75%.

Ref: TMI-2 Tech Spec, Appendix B.

Calculation:

$$\frac{(0.5)(0.3\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min\text{-}\mu Ci/cc)(0.75\text{-}0.08)(10\ min)}{1.18 \times 10^{+7}\ cc/sec}$$

$= 3.3 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.0 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 100,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(2.0 \times 10^{+5}\ CPM)(0.5) = 1.0 \times 10^{+5}$ CPM

HP-R-226 (Gas)

Location: Reactor Building Purge Exhaust B

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 80,000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75% Xe-133 MPC is 3×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Specs, Appendix B, Section 2.3.2.a.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/\text{sec})(3.0 \times 10^{-7}\ \mu\text{Ci/cc})(3.55 \times 10^{+7}\ \text{CPM}/\mu\text{Ci/cc})(0.75)}{1.18 \times 10^{+1}\ M^3/\text{sec}}$$

$= 8.12 \times 10^{+4}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $8.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT: 40,000

Basis: 50% of High Alarm Setpoint

Calculation: $(0.5)(8.0 \times 10^{+4}) = 4.0 \times 10^{+14}$ CPM

198 131

HP-R-227 (Particulate)

Location: Reactor Building

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (Sr-90) @ 8.5 SCFM, 1 in/hr

HIGH ALARM SETPOINT: 5×10^{4} CPM

Basis: Alarm will activate at 25% of the equilibrium concentration of Kr-88 and Rb-88 in the Reactor Building due to a 1 gpm reactor coolant leak at 0.1% failed fuel. Reactor Building Volume: 5.95×10^{10}, Reactor Coolant Kr-88 activity: .28 μCi/cc. Kr-88 half-life: 2.8 hours. Fraction of Rb-88 filterables: 10% (due to unknown particle size).

Calculation: Production rate of Kr-88 at equilibrium:

$$1 \text{ gal/min} \times 63.3 \frac{\text{cc/sec}}{\text{gal/min}} \times 2.8 \text{ μCi/cc} \times 3.7 \times 10^{4} \text{ atoms/sec/μCi} \times \frac{2.8 \text{ hours} \times 3600 \text{ sec/hr}}{.693} = 9.54 \times 10^{9} \text{ atoms/sec}$$

At equilibrium production of Kr-88 = decay of Kr-88 = production of Rb-88 - decay of Rb-88.

9.54×10^{9} atoms/sec ÷ 3.7×10^{4} atoms/sec/μCi = 2.58×10^{5} μCu

2.58×10^{5} μCi/5.95×10^{10} cc = 4.336×10^{-6} μCi/cc

25% of 1.08×10^{-6} μCi/cc = 1.08×10^{-6} μCi/cc

10% of 1.08×10^{-6} μCi/cc = 1.08×10^{-7} μCi/cc

1.08×10^{-7} μCi/cc $\times 5.3 \times 10^{+11}$ CPM/μCi/cc = 5.274×10^{4} CPM.

NOTE: Since there is no meter graduation at this point, adjust setpoint to 5.0×10^{4} CPM.

ALERT SETPOINT: 2.5×10^{4} CPM

Basis: 50% of High Alarm Setpoint (Changing next lower meter graduation.

198 132

HP-R-227 (Iodine)

Location: Reactor Building

Sensitivity: $5.83 \times 10^{+11}$ CPM/min-μCi/cc (I-131) a 98% collection efficiency at 8.5 SCFM after 8 hours.

HIGH ALARM SETPOINT: 5×10^{3} CPM

Basis: Alarm will activate within four hours after the start of a 2 GPM reactor coolant leak rate with 0.1% failed fuel. Reactor Building Volume: 5.95×10^{10} cc. Reactor Coolant Iodine Activity: .33 μCi/cc. Fraction of Iodine available for collection: 82% Iodine Collection Efficiency: 78% Average Concentration: 50% of Maximum Concentration. Meter error factor: 75%. Ref: TMI-1 FSAR, Section II

Calculation:

2 gal/min X 3.8×10^{3} cc/gal X 1 min X .33 μCi/cc X .75 X .78 X .82 X .50 X 1 min X 5.83×10^{11} CPM/min/μCi/cc/5.95×10^{10} cc = 5894 CPM.

Choosing next lower meter graduation: 5×10^{3} CPM.

ALERT SETPOINT: 2.0×10^{3} CPM

Basis: 1/2 of High Alarm Setpoint (choosing next lower meter graduation.

198 133

HP-R-227 (Gas)

Location: Reactor Building

Sensitivity: 3.55×10^7 CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 2×10^4 CPM

Basis: Alarm will activate within four hours after the start of a 2 GPM reactor coolant leak, assuming 0.1% failed fuel. Volume of Reactor Building: 5.95×10^{10} cc. Reactor Coolant Xe-133 activity: 26 μCi/cc. Meter error factor: 75%.

Ref: TMI-1 FSAR, Section II.

Calculation:

$2 \text{ gal/min} \times 3.8 \times 10^3 \text{ cc/gal} \times 240 \text{ min} \times 26 \text{ μCi/cc} \times 75\% \times 3.55 \times 10^7 \text{ CPM/μCi/cc} \div 5.95 \times 10^{10} \text{ cc} = 2.12 \times 10^4 \text{ CPM}$

Choosing next lower meter graduation: 2×10^4 CPM.

ALERT SETPOINT: 1×10^4 CPM

Basis: 50% of High Alarm Setpoint

198 134

HP-R-228 (Particulate)

Location: Auxiliary Building Purge Air Exhaust Downstream of Filter

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (Sr-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 4000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/sec at an exhaust flowrate of 67,000 CFM and a meter error factor of 75%. In order to maintain isokinetic sampling sampler flowrate will be maintained at 6.5 scfm.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)(8.5 scfm)}{(3.9 \times 10^{+7}\ cc/sec)(6.5\ scfm)} = 4198$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $4.0 \times 10^{+3}$ CPM.

ALERT ALARM SETPOINT: 2000 CPM

Basis: 50% of High Alarm Setpoint

Calculation $(4.0 \times 10^{+3}\ CPM)\ (0.5) = 2.0 \times 10^{+3}$ CPM

198 135

HP-R-228 (Iodine)

Location: Reactor Building Purge Exhaust

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/μCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 100,000 CPM

Basis: Alarm will activate in 10 minutes if 50% of the Tech Spec release rate limit of 0.30 μCi/sec is exceeded for 7 days assuming a ± 8.0% error due (-8.0% most conservative) to flow variations and a meter error factor of 75%. In order to maintain isokinetic sampling, the sampler flowrate will be maintained at 6.5 scfm.

Ref: TMI-2 Tech Spec, Appendix B.

Calculation:

$$\frac{(0.5)(0.3\ \mu Ci/sec)(3.895 \times 10^{+12}\ CPM/min/\mu Ci/cc)(0.75-0.08)(10\ min)(8.5\ scfm)}{(3.9 \times 10^{+7}\ cc/sec)(6.5\ scfm)}$$

$= 1.3 \times 10^{+5}$ CPM

ALERT ALARM SETPOINT: 50,000 CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(1.0 \times 10^{+5}\ CPM)(0.5) = 5 \times 10^{+4}$ CPM

198 136

HP-R-228 (Gas)

Location: Reactor Building Purge Exhaust

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 20.000 CPM

Basis: Alarm will activate if the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75%. Xe-133 MPC is 3×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Spec, Appendix B, Section 2.3.2.

Calculation:

$$\frac{(1.2 \times 10^{+5}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(3.9 \times 10^{+1}\ M^3/sec)}$$

$= 2.45 \times 10^{+4}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to $2.0 \times 10^{+4}$ CPM.

ALERT ALARM SETPOINT:

Basis: 50% of High Alarm Setpoint.

Calculation: $(0.5)\ (2.0 \times 10^{+4}) = 1.0 \times 10^{+4}$ CPM).

198 137

HP-R-229 (Particulate)

Location: Reactor Building Hydrogen Purge Exhaust

Sensitivity: $5.3 \times 10^{+11}$ CPM/μCi/cc (SR-90) @ 8.5 SCFM, 1 in/hr.

HIGH ALARM SETPOINT: 160,000 CPM

Basis: Alarm will activate if 50% of the Tech Spec release rate limit of 0.63 μCi/Sec at an exhaust flowrate of 150 CFM and a meter factor of 75%.

Calculation:

$$\frac{(0.50)(0.63\ \mu Ci/Sec)(5.3 \times 10^{+11}\ CPM/\mu Ci/cc)(0.75)}{(7.08 \times 10^{+4}\ cc/sec)} = 1.768 \times 10^{+5}\ CPM$$

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next meter graduation, $1.6 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 80,000 CPM

Basis: 50% of high alarm setpoint

Calculation: $(1.6 \times 10^{+5}\ CPM)(0.5) = 8 \times 10^{+4}\ CPM$.

198 138

HP-R-229 (Iodine)

Location: Reactor Building Hydrogen Purge Exhaust

Sensitivity: $3.895 \times 10^{+12}$ CPM/min/uCi/cc (I-131) assuming a 77% collection efficiency after 8 hours at 8.5 SCFM.

HIGH ALARM SETPOINT: 400,000 CPM

Basis: Alarm will activate in 1 minute if 0.5% of the Tech Spec release rate limit of 0.30 uCi/sec is exceeded for 7 days assuming a ± 8.0% error due (-8.0% most conservative) to flow variations and a meter error factor of 75%.

Ref: TMI-2 Tech Spec, Appendix B, Section 2.3.2.b

Calculation:

$$\frac{(0.005)(0.30 \text{ uCi/sec})(3.895 \times 10^{+12} \text{ CPM/min/uCi/cc})(0.75-0.08)(1 \text{ min})}{7.08 \times 10^{+4} \text{ cc/sec}}$$

$= 5.5 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point adjust the setpoint to $4.0 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 200,000 CPM

Basis: 50% of high alarm setpoint

Calculation: $(4.0 \times 10^{+5} \text{ CPM})(0.5) = 2.0 \times 10^{+4}$ CPM

198 139

HP-R-229 (Gas)

Location: Reactor Building Hydrogen Purge Exhaust

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 120,000 CPM

Basis: Alarm will activate if 1% of the Tech Spec limit of $1.2 \times 10^{+5}$ M^3/sec for gross gaseous activity and a meter error factor of 75%. Xe-133 MPC is 3×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Spec, Appendix B, Section 2.3.2.a

Calculation:

$$\frac{(0.01)(1.2 \times 10^{+5}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(7.08 \times 10^{-2}\ M^3/sec)}$$

$= 1.35 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point adjust the setpoint to $1.2 \times 10^{+5}$ CPM.

ALERT ALARM SETPOINT: 60,000 CPM

Basis: 50% of high alarm setpoint.

Calculation: $(0.5)(1.2 \times 10^{+5}\ CPM) = 6.0 \times 10^{+5}$ CPM.

WDG-R-1480 (Gas)

Location: Waste Gas Discharge

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: $4.0 \times 10^{+5}$ CPM

Basis: Tech Spec Release Rate Limit of $2.4 \times 10^{+3}$ M^3/sec for gas decay tanks with less than 45 days hold up time. Maximum design flow rate of 100 SCFM (4.72×10^{-2} M^3/sec) is assumed. A meter error factor of 75% is assumed, and the MPC_a for Xe-133 is 3×10^{-7} μCi/cc.

Ref: 10 CRF Part 20, Appendix B

TMI-2 Tech Spec, Appendix B, Specification 2.3.2.e

Calculation:

$$\frac{(2.4 \times 10^{+3}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(4.72 \times 10^{-2}\ M^3/sec)}$$

$= 4.06 \times 10^{5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, 4.0×10^{5} CPM.

ALERT ALARM SETPOINT: 2.0×10^{5} CPM

Basis: 50% of High Alarm Setpoint

WDG-R-1485 (Gas)

Location: Waste Gas Decay Tank 1A Discharge

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 3.0×10^{5} CPM.

Basis: The Waste Gas Filter, WDG-F-1 has a collection efficiency of 99.87% for particles larger than 0.3 micron and 99.9% for radioactive iodine in air. For this calculation we will use a 90% overall collection efficiency for the filter. The Tech Spec Release Rate Limit of $2.4 \times 10^{+3}$ M^3/sec for gas decay tanks with less than 45 days holdup time. Maximum design flow rate of 100 SCFM (4.72×10^{-2} M^3/sec is assumed. A meter error factor of 75% is assumed and the MPC_a for Xe-133 is 3.0×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.

TMI-2 Tech Specs, Appendix B, Specification 2.3.2.e

Basis of WDG-R-1480 setpoint

Calculation:

$$\frac{(2.4 \times 10^{+3} M^3/\text{sec})(3.0 \times 10^{-7} \mu\text{Ci/cc})\ (3.55 \times 10^{+7}\ \text{CPM}/\mu\text{Ci/cc})(0.75)(0.9)}{(4.72 \times 10^{-2}\ M^3/\text{sec})}$$

$= 3.65 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust lower meter graduation at 3.0×10^{5} CPM.

ALERT ALARM SETPOINT: 1.5×10^{5} CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(3.0 \times 10^{5}\ \text{CPM})(0.50) = 1.5 \times 10^{5}$ CPM

198 142

WDG-R-1486 (Gas)

Location: Waste Gas Decay Tank 1B Discharge

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 3.0×10^{5} CPM.

Basis: The Waste Gas Filter, WDG-F-1 has a collection efficiency of 99.87% for particles larger than 0.3 micron and 99.9% for radioactive iodine in air. For this calculation we will use a 90% overall collection efficiency for the filter. The Tech Spec Release Rate Limit of $2.4 \times 10^{+3}$ M^3/sec for gas decay tanks with less than 45 days holdup time. Maximum design flow rate of 100 SCFM (4.72×10^{-2} M^3/sec is assumed. A meter error factor of 75% is assumed and the MPC_a for Xe-133 is 3.0×10^{-7} μCi/cc.

Ref: 10 CFR Part 20, Appendix B.
TMI-2 Tech Specs, Appendix B, Specification 2.3.2.e
Basis of WDG-R-1480 setpoint

Calculation:

$$\frac{(2.4 \times 10^{+3}\ M^3/sec)(3.0 \times 10^{-7}\ \mu Ci/cc)\ (3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)(0.9)}{(4.72 \times 10^{-2}\ M^3/sec)}$$

$= 3.65 \times 10^{+5}$ CPM

NOTE: Since there is no meter graduation at this point, adjust lower meter graduation at 3.0×10^{5} CPM.

ALERT ALARM SETPOINT: 1.5×10^{5} CPM

Basis: 50% of High Alarm Setpoint

Calculation: $(3.0 \times 10^{5}\ CPM)(0.50) = 1.5 \times 10^{5}$ CPM

198 143

VA-R-748 (Gas)

Location: Condenser Vacuum Pump Exhaust

Sensitivity: $3.55 \times 10^{+7}$ CPM/μCi/cc (Xe-133)

HIGH ALARM SETPOINT: 2000 CPM

Basis: Alarm will activate at a release rate of 0.024 μCi/sec of I-131 (Quarterly average Tech Spec Limit requiring a 30 day letter to the NRC). Xe-133 to I-131 ratio with failed fuel assumed to be 80, vacuum pump flow rate is 1.88×10^{4} cc/sec and a meter error factor of 75% is included. Ref: TMI-2 Tech Spec, Appendix B, Specification 2.3.2.h.

Calculation:

$$\frac{(0.024\ \mu Ci/sec)(80)(3.55 \times 10^{+7}\ CPM/\mu Ci/cc)(0.75)}{(1.88 \times 10^{4}\ cc/sec)}$$

= 2719 CPM

NOTE: Since there is no meter graduation at this point, adjust the setpoint to the next lower meter graduation, 2000 CPM.

ALERT ALARM SETPOINT: 1000 CPM

Basis: 50% of High Alarm Setpoint

MU-R-720 Primary Coolant Letdown (Gross)

Location: Makeup Tank Corridor

Sensitivity: 1.02×10^8 CPM/μCi/cc

HIGH ALARM SETPOINT: 5.0×10^5 CPM

Basis: Total activity of primary coolant at 1% failed fuel is 360 μCi/cc.

Calculation: (360 μCi/cc)(1.02×10^8 CPM/μCi/cc) = 3.67×10^{10} CPM

NOTE: Since this is above the range of the monitor, conservatively set the setpoint at 5.0×10^5 CPM.

ALERT ALARM SETPOINT: 2.5×10^5 CPM.

Basis: Based on Tech Spec Limit of 130 $\bar{E}$ μCi/cc which will insure that a whole body dose of less than 0.5 REM will occur at the site boundary should a steam generator tube rupture accident occur (assuming $\bar{E}$ = 1 Mev)

Calculation: (130 μCi/cc)(1.02×10^8 CPM/μCi/cc) = 1.32×10^{10} CPM

NOTE: Since this is above the range of the monitor, conservatively set the setpoint at 2.5×10^5 CPM.

198 145

MU-R-720 Primary Coolant Letdown (Analyze)

Location: Makeup Tank Corridor

Sensitivity: 8.2×10^5 CPM/μCi/cc

HIGH ALARM SETPOINT: 5.0×10^5 CPM

Basis: Total activity of primary coolant at 1% failed fuel is 360 μCi/cc.

Calculation: $(360\ \mu Ci/cc)(8.2 \times 10^5\ CPM/\mu Ci/cc) = 2.95 \times 10^{+8}$ CPM

NOTE: Since this is above the range of the monitor, conservatively set the setpoint at 5.0×10^5 CPM.

ALERT ALARM SETPOINT: 2.5×10^5 CPM.

Basis: Based on Tech Spec Limit of 130 $\bar{E}$ μCi/cc which will insure that a whole body dose of less than 0.5 REM will occur at the site boundary should a steam generator tube rupture accident occur (assuming $\bar{E}$ = 1 Mev)

Calculation: $(130\ \mu Ci/cc)(8.2 \times 10^5\ CPM/\mu Ci/cc) = 1.06 \times 10^8$ CPM

NOTE: Since this is above the range of the monitor, conservatively set the setpoint at 2.5×10^5 CPM.

198 146

IC-R-1091

Location: Intermediate Cooling Water Letdown Cooler MU-C-1B.

Sensitivity: $9.03 \times 10^{+7}$ CPM/(μCi/cc) (Cs^{137})

HIGH ALARM SETPOINT: 5000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 500 CPM)

Calculation: (10) (500 CPM) = 5000 CPM

Alarm Concentration: $$\frac{500 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu\text{Ci/cc})} = 5.53 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 1000 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation (2) (500 CPM = 1000 CPM)

Alarm Concentration: $$\frac{1000 \text{ CPM}}{9.03 \times 17 \text{ CPM}/(\mu\text{Ci/cc})} = 1.107 \times 10^{-5} \ \mu\text{Ci/cc}$$

IC-R-1092

Location: Intermediate Cooling Water Letdown Cooler MU-C-1A

Sensitivity: $9.03 \times 10^{+7}$ CPM/(μCi/cc) (Cs^{137})

HIH ALARM SETPOINT: 5000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 500 CPM).

Calculation: (10) (500 CPM) = 5000 CPM

Alarm Concentration: $$\frac{5000 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu C/cc)} = 5.53 \times 10^{-5} \ \mu Ci/cc$$

ALERT ALARM SETPOINT: 1000 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation: (2) (500 CPM) = 1000 CPM

Alarm Concentration: $$\frac{1000 \text{ CPM}}{9.03 \times 10^{17} \text{ CPM}/(\mu Ci/ci)} = 1.107 \times 10^{-5} \ \mu Ci/cc$$

IC-P-1093

Location: Intermediate Cooling Water Cooler Outlet

Sensitivity: $9.03 \times 10^{+7}$ CPM/ (μCi/cc) (Cs^{157})

HIGH ALARM SETPOINT: 2000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 200 CPM).

Calculation: (10) (200 CPM) = 2000 CPM

Alarm Concentration: $$\frac{2000 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu\text{Ci/cc})} = 2.215 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 4000 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation: (2) (200 CPM) = 400 CPM

Alarm Concentration: $$\frac{4000 \text{ CPM}}{4.03 \times 10^{-7} \text{ CPM}/(\mu\text{Ci/cc})} = 4.429 \times 10^{-6} \ \mu \text{ Ci/cc}$$

WDL-R-1311

Location: Liquid Effluent Plant No. 2.

Sensitivity: 9.23×10^{7} CPM/μc/cc. (Based on ^{137}Cs)

During Release see H.P.P. 1621.2 Releasing Radioactive Liquid Waste, for determination of setpoints.

NOTE: Setpoint will vary depending on conentrations to be discharged.

During Periods of Non-Release.

HIGH ALARM SETPOINT: 9000 CPM

Basis: MPC for Iodine-131, 3×10^{-7} μ Ci/cc minimum dilution factor of 50 GPM release rate 17100 GPM MDCT flow.

Calculation: 3×10^{-7} μCi/μ $\times 9.23 \times 10^{+7} \frac{\text{CPM}}{\mu\text{Ci/cc}} \times \frac{17100 \text{ GPM}}{50 \text{ GPM}} = 9469$ CPM

Since there is no meter graduation at 9469 CPM 9000 CPM is the setpoint.

ALERT SETPOINT: 1800 CPM

Basis: Maximum allowable count rate due to contamination before decontaimination is necessary.

198 150

DO-R-3399

Location: Decay Heat Closed Cooling Water Loop A.

Sensitivity: $9.03 \times 10^{+7}$ CPM/(μCi/cc) (Cs^{137})

HIGH ALARM SETPOINT: 2000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 200 CPM)

Calculation: (10) (200 CPM) = 2000 CPM

Alarm Concentration: $$\frac{2000 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu\text{Ci/cc})} = 2.215 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 400 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation (2) (200 CPM = 400 CPM)

Alarm Concentration: $$\frac{400 \text{ CPM}}{9.03 \times 17 \text{ CPM}/(\mu\text{Ci/Ci})} = 4.429 \times 10^{-6} \ \mu\text{Ci/cc}$$

DC-R-3400

Location: Decay Heat Closed Cooling Water Loop B.

Sensitivity: $9.03 \times 10^{+7}$ CPM/(μCi/cc) (Cs^{137})

HIGH ALARM SETPOINT: 2000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 200 CPM)

Calculation: (10) (200 CPM) = 5000 CPM

Alarm Concentration $\dfrac{2000 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu\text{Ci/cc})} = 2.215 \times 10^{-5}$ μCi/cc

ALERT ALARM SETPOINT: 400 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation (2) (200 CPM = 400 CPM)

Alarm Concentration: $\dfrac{400 \text{ CPM}}{9.03 \times 17 \text{ CPM}/(\mu\text{Ci/cc})} = 4.429 \times 10^{-6}$ μCi/cc

198 152

NS-R-3401

Location: Nuclear Services Closed Cooling Water.

Sensitivity: $9.03 \times 10^{+7}$ CPM/(μCi/cc) (Cs^{137})

HIGH ALARM SETPOINT: 2000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 500 CPM)

Calculation: (10) (200 CPM) = 2000 CPM

Alarm Concentration: $$\frac{2000 \text{ CPM}}{9.03 \times 10^{+7} \text{ CPM}/(\mu\text{Ci/cc})} = 2.215 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 400 CPM

Basis: 2 times background to provide early detection of leakage.

Calculation (2) (200 CPM = 400 CPM)

Alarm Concentration: $$\frac{400 \text{ CPM}}{9.03 \times ^{+7} \text{ CPM}_{(\mu\text{Ci/Ci})}} = 4.429 \times 10^{-6} \ \mu\text{Ci/cc}$$

198 153

SF-R-3402 (Spent Fuel Cooling)

Location: Spent Fuel Cooling Room

Sensitivity: $1.05 \times 10^{+9}$ CPM/μCi/cc

HIGH ALARM SETPOINT: 1.0×10^{4}

Basis: 5 times background to provide positive identification of leakage (Backgound 2000)

Calculation: $5 \times 2000 \text{ CPM} = 1.0 \times 10^{4} \text{ CPM}$

$$\frac{1.0 \times 10^{4} \text{ CPM}}{1.05 \times 10^{9} \text{ CPM}/\mu\text{Ci/cc}} = 9.52 \times 10^{-6} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: $4.0 \times 10^{+3}$

Basis: 2 times background to provide positive identification of leakage (Background 2000 CPM).

Calculation: $2 \times 2000 = 4.0 \times 10^{+3}$ CPM

$$\frac{4.0 \times 10^{+3} \text{ CPM}}{1.05 \times 10^{9} \text{ CPM}/\mu\text{Ci/cc}} = 3.8 \times \_\_\_\_\_$$

198 154

WT-R-3894

Location: Water Treatment and Condensate Polishing

Sensitivity: $1.05 \times 10^{+8}$ CPM/μCi/cc (I-131)

HIGH ALARM SETPOINT: 2000 CPM

Basis: 10 times background to provide positive identification of leakage. (Background = 200 CPM)

Calculation: (200 CPM) (10) = 2000 CPM

Alarm Concentration: $$\frac{2000 \text{ CPM}}{1.05 \times 10^{+8} \text{ CPM}/(\mu\text{Ci/cc})} = 1.9 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 1000 CPM

Basis: 50% of High Alarm Setpoint.

Calculation: (2000 CPM) (0.5) = 1000 CPM

Alarm Concentration: $$\frac{1000 \text{ CPM}}{1.05 \times 10^{+8} \text{ CPM}/(\mu\text{Ci/cc})} = 9.52 \times 10^{-6} \ \mu\text{Ci/cc}$$

198 155

WT-R-3895

Location: Water Treatment and Condensate Polishing.

Sensitivity: $1.05 \times 10^{+8}$ CPM/μCi/cc (I-131)

HIGH ALARM SETPOINT: 1500 CPM

Basis: MPO water for I-131 (3×10^{-7} μCi/cc) assuming a maximum discharge (400 gpm) and minimum MDCT (17, 100 gpm) flow plus background.

(Background = 200 cpm)

Reference: 10 CFR 20, Appendix B, Table II.

Calculation: $(3 \times 10^{-7}$ μ Ci/cc) {(17,100 gpm)/(400 gpm)} =

1.28×10^{-5} μCi/cc

$(1.28 \times 10^{-5}$ μCi/cc) $(1.05 \times 10^{+8}$ CPM/μCi/cc)

= 1344 CPM

1344 CPM + 200 CPM = 1544 CPM = 1.544×10^{3} CPM

Alarm Concentration: Since the meter can not be graduated to the calculated setpoint, the high alarm will be set at 1500 CPM, which is more conservative.

$$\frac{1500 \text{ CPM}}{1.05 \times 10^{+8} \text{ CPM}/\mu\text{Ci/cc}} = 1.43 \times 10^{-5} \ \mu\text{Ci/cc}$$

ALERT ALARM SETPOINT: 750 CPM

Basis: 50% of High Alarm Setpoint.

Calculation: (1500 CPM) (0.5) = 750 CPM

Alarm Concentation:
$$\frac{750 \text{ CPM}}{1.05 \times 10^{+8} \text{ CPM}/(\mu\text{Ci/cc})} = 7.143. \times 10^{-6} \ \mu\text{Ci/cc}$$

TMI DOCUMENTS

DOCUMENT NO: TM-0400

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Wilda R. Mullinix, NRC

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