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INDIAN POINT

OFFSITE DOSE CALCULATION MANUAL

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SECTION I

SECTION I

SET POINTS

1.0 This section provides equations and methodology used at this Indian Point Station for each alarm and trip set point on each effluent release point according to Specifications 3.3.3.8 and 3.3.3.9.

The alarm and control location monitor, monitor description, location, power source, scale, range and identification number and the effluent isolation control device, location power source and identification number are provided in Tables 1.1 and 1.2.

The equations used to determine set points are essentially those which exist in the Environmental Technical Specifications issued for the Indian Point Site on December 12, 1975. These limits are provided with objectives and bases in Attachment A to this section. These limits are implemented by a site procedure Administrative Procedure No. 11 (Appendix B to this section) and two memoranda of understanding between Con Edison and PASNY which is Attachment C to this section. These documents provide all of the bases and assumptions which are used in establishing these setpoints to assure compliance with Technical Specifications 3.3.3.8 and 3.3.3.9.

CHANNEL	MONITOR DESCRIPTION	LOCATION	ALARM & CONTROL LOC.	POWER SOURCE	EFFLUENT ISOLATION CONTROL DEVICE I.D.	LOCATION	POWER SOURCE
R 11	Containment Air Particulate Monitor	CCR-Rack D-2	ALARMS-LOC. at Monitor and CCR Safeguards Panel	125V AC INSTR Bus 34 CKT7	FCV 1170/SOV 1270 FCV 1172/SOV 1272 PCV 1190/SOV 1290 PCV 1191/SOV 1191 PCV 1192/SOV 1192	PAB-80' elev. PAB-80' elev. inside VC 46' elev outside VC 68' elev outside VC 68' elev	125VAC PNL 33CKT26 PNL 33CKT26 PNL 33CKT25 PNL 34CKT24 PNL 34CKT24
R 12	Containment Gas Monitor						
	Sample Collection Equipment/ Detector	PAB elev 68' Penetration area	Control-CCR Rack D-2	MCC-36B			
R 13	Plant Vent Particulate Monitor	CCR-Rack D-2	Alarms same as R 11	125VAC INSTR Bus 34 CKT7			
	Sample Collection/Detector	73' level of Fan House	Control-CCR Rack D-2	MCC-36B			
R-14	Plant Vent Radiogas Monitor	CCR-Rack D-2	Alarms-same as R 11 Remote alarm at WDS panel	125VAC INSTR. Bus 34 CKT7	RCV-014 Waste gas vent	PAB 15' elev. Near large gas decay tanks valving room	125VDC PNL 33 CKT14
R 15	Condenser Air ejector monitor	CCR-Rack D-2	local alarms same as R 11 Remote-Red light and buzzer at detector	125VAC INSR Bus 34 CKT7	PCV 1169/SOV 1169 AEJ Vent to VC PCV 113/SOV 1133 stm to condenser primary ejector	36' elev Turbine Hall 36' elev Turbine Hall	125 VDC PNL 32 Circuit 6 125 VDC PNL 31 CKT 3
R-18	Waste Disposal Liquid Effluent Monitor	CCR-Rack D-3	Alarm-local same as R 11 Remote at WDS PNL	125 VAC INSTR Bus #33 CKT 17	RCV 018 Waste disch to condenser circ water	PAB-36' elev in Waste Condensate tank room	125 VDC PNL 33 CKT 14

CHANNEL	MONITOR DESCRIPTION	LOCATION	ALARM & CONTROL LOC.	POWER SOURCE	EFFLUENT ISOLATION CONTROL DEVICE I.D.	LOCATION	POWER SOURCE
R 19	5/6 Sample & Blowdown monitor	CCR-Rack D-3	local alarm same as R 11 remote-red light & buzzer at detector	125VAC INSTR Bus 33 CKT 17	PCV 1223/SOV 1523 PCV 1224/SOV 1524 PCV 1225/SOV 1525 PCV 1226/SOV 1526	5/6 31-34 Sample Isolation Valves	125VDC PNL 31 CKT3
					PCV 1223A/PCV 1223A PCV 1224A/PCV 1524A PCV 1225A/PCV 1525A PCV 1226A/PCV 1526A	PAB piping penetration area 55' elevation	125VDC PNL 32 CKT6
					PCV 1214/SOV 1314 PCV 1215/SOV 1315 PCV 1216/SOV 1316 PCV 1217/SOV 1317		125VDC DNL 31 CKT3
					PCV 1214A/SOV 1214A PCV 1215A/SOV 1215A PCV 1216A/SOV 1216A PCV 1217A/SOV 1217A		125VDC PNL 32 CKT6
					PCV 1227/SOV 1527	46' elevation in blowdown tank room	125VDC PNL 31 CKT3
R 20	Waste Gas Analyzer	CCR-Rack D-3	Local alarms same as R 11 Remote alarm at WDS PNL		none		

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Questions for Each Noble Gas Gaseous Effluent Monitoring System

1) Location of the effluent monitor, working system (i.e., principal release point. building ventilation exhaust point)

R-12-Containment Gas Monitor
The detector and equipment is located in a cabinet on the 68' elevation of the penetration area. The sample is drawn from the intake of Containment Fan Coolers No. 32 and 35. The sample air is returned to Containment at the penetration approximately the 58' elevation near the RCP seal flow manifolds.

R-14-Plant Vent Radiogas Monitor
This monitor measures gaseous radioactivity in the Plant Vent Stack. The detectors are located in the Plant Vent at approximately the 105' elevation.

R-15-Condenser Air Ejector Monitor
This detector is located above the 33' elev. in the Turbine Hall Bldg. The discharge from the air ejector exhaust header of the condensers is monitored by this channel with an in-line detector for gaseous activity, which is indicative of a primary to secondary leak.

R-20-Waste Disposal System Gas Analyzer Monitor
This detector is located above the 15' elev. in the primary auxiliary building and monitors the waste gas decay tank activity. The detector is mounted in a special sampler and is in direct contact with the gas sample being monitored.

Radio-Iodine Monitors - Located in a cabinet on approximately the 90' elevation in the Fan Building.
The four channel system is hooked-up to the following locations.

Channel I - Plant Vent
Channel II - Containment
Channel III - Primary Auxiliary Bldg. Overhead
Channel IV - Steam Generator Blowdown Room

2) What detector is being used (e.g., G.M., plastic scintillator, NaI)

R-12-GM-Tube-The detector assembly is in a completly enclosed housing containing the G-M tube in a vessel. Lead shielding envelops the housing to reduce background level. The sample is constantly mixed in a fixed and shielded volume.

R-14-GM-Tube-The detector assembly consists of four G-M tubes which are electrically connected in parallel. The G-M tubes are oriented so as to assure a representative sample of the air flow is constantly monitored.

R-15-GM-Tube-The detector assembly consists of a G-M tube mounted into an in-line container which includes adequate shielding to reduce any possible background radiation.

R-20-Ionization Chamber-The detector is mounted in a special sampler, because of the extremely high level of radiation in the waste gas decay tanks.

Radioiodine Monitors - Scintillation detector - The gamma detector consists of a canned Thallium Activated Sodium Iodide Crystal optically coupled to the phototube.

3) Readout Range of the detector (minimum/maximum cpm)

R-12	$0\text{-}1x10^{6}$cpm
R-14	$0\text{-}1x10^{6}$cpm
R-15	$0\text{-}1x10^{6}$cpm
R-20	$0\text{-}1x10^{5}$mR/hr

Iodine Monitors

Channel I	$0 - 10^{8}$ cpm
Channel II	$0 - 10^{8}$ cpm
Channel III	$0 - 10^{8}$ cpm
Channel IV	$0 - 10^{8}$ cpm

4) Maximum release rate that can be detected on-scale by the detector (Ci/sec) is based on the maximum readout range of the detector, the calibration factor and the volume flow rate of the discharge.

$$\text{Ci/sec (max)} = \text{(max cpm)} \times \text{(uCi/cc/cpm)} \times \text{(cfm)} \times (4.72\text{x}10^{-4})$$

5) Calibration factor for system (cpm/uCi/cm^3) is determined by use of Procedure RE-CS-030.

6) Reference radionuclide used to calibrate system (e.g. ^{85}Kr, ^{133}Xe)

R-12-Primary Gas in Volume Control Tank - A mixture of Xenon & Krypton fission gases.

R-14-Primary Gas in Volume Control Tank - A mixture of Xenon & Krypton gases.

R-15-Gas Marinelli sample taken of Condenser Air Ejector and related to the R-15 meter reading.

R-20-None Available

Radioiodine Monitors -
Channel I
Channel II
Channel III
Channel IV

(Channels I–IV:) ^{133}Ba, ^{137}Cs (Mock iodine) or I-131, if available

7) Alarm setpoints for systems (cpm or uCi/cc) are calculated per AP-11, Radioactive Waste Release Permits.

For the radioiodine monitors, an alarm setpoint of 5,000 cpm Quarterly is used to assure compliance with the instantaneous and annual average limits for a sampler that is changed once per week.

8) Alarm function of system (e.g. isolation of purge, alarm in control room, etc.)
Each channel process monitor has a high and low level alarm on the channels power supply drawer. The low level alarm is used to indicate instrument failure. The high-level alarm functions at pre-set levels.

R-12-A) Containment evacuation alarm annunciates.
B) Alarms in CCR III, meter readout and recorder printout also available.
C) When R-12 alarms, Containment Ventilation isolation occurs (i.e. closure of the valves in the purge supply and exhaust lines, and the Pressure Relief Line. The containment isolation valves for the sample and return lines (PCV-1234 to PCV-1237) for channel R-11 and 12 are normally open and controlled from the Central Control Room's Containment Isolation Panel, and are also tripped closed by a Phase A Containment Isolation Signal. When these valves are closed the space between them is treated with Weld Channel air.

R-14-A) Alarm in CCR III, meter readout and recorder printout also.
B) On an alarm condition on Channel R-14 an alarm, "Stack Monitor Hi Radiation" is annunciated on the Waste Disposal System panel in the Primary Auxiliary Building.
When Channel R-14 alarms valve RCV-014 will trip shut, securing waste gas release, and the dilution fan will auto start.

R-15-A) Alarm in CCR III, meter readout and recorder printout also.
B) On an alarm condition on channels R-15, a red light and buzzer are energized at the detector.
C) Three separate controls are actuated to prevent excessive radiogas release to the environment.

1. This signal opens the containment isolation valves to allow venting the air ejector discharge to containment. Then SOV-1169 is de-energized and PCV-1169 changes position to vent the Air Ejector to Containment via the blower which is started by this signal.

2. PCV-1133 (Steam to Condenser Priming Ejectors) is closed if open and/or denied permission to be opened. This protects the detector from over-temperature and protects against an uncontrolled release since the priming ejector discharge is not monitored by this Channel R-15.

3. The Flash Evaporator is shut down by this signal to prevent activity from the extraction steam from getting to the atmosphere or contaminating the flash evaporator. This Channel R-15 will trip the brine recycle pumps, brine heater drain pumps, distillate pumps and the vacuum pump of the Flash Evaporator.

R-20-Waste Disposal System Gas Analyzer Monitor

A) Alarms in CCR III, meter readout and recorder print out also available.

B) On an alarm condition on Channel R-20 an alarm, "Gas Activity Monitor Hi Activity", is annunciated on the Waste Disposal System panel in the PAB.

Radioiodine Monitors:

A) Alarms in CCR III, meter readout also available.

B) On an alarm condition on Channel I - (Plant Vent) the Waste gas release valve 014 closes and Containment building purge supply and exhaust valves close and fans automatically shut-off.

C) On an alarm condition on Channel III (Primary Aux. Bldg. Overhead) and Channel IV (Steam Generator Blowdown room) the inlet dampers of the charcoal filters open and the by-passes close.

2.0 LIMITING CONDITIONS FOR OPERATION

2.4 RADIOACTIVE DISCHARGES

Objective

To define the limits and conditions for the controlled releases of radioactive materials in liquid and gaseous effluents to the environs to ensure that these releases are as low as practicable. These releases should not result in radiation exposures in unrestricted areas greater than a few percent of natural background exposures. The concentrations of radioactive materials in effluents shall be within the limits specified in 10 CFR Part 20.

To ensure that the release of radioactive material above background to unrestricted areas be as low as practicable, the following design objectives apply:

For liquid wastes:

a. The annual dose above background to the total body or any organ of an individual from all reactors at a site should not exceed 5 mrem in an unrestricted area.

b. The annual total quantity of radioactive materials in liquid waste, excluding tritium and dissolved gases, discharged from each reactor should not exceed 5 Ci.

3.0 MONITORING REQUIREMENTS

3.4 RADIOACTIVE DISCHARGES

Objective

To ensure that the releases of radioactive materials are as low as practicable and within allowable values.

<u>Objective</u> (Cont'd)

For gaseous wastes:

c. The annual total quantity of noble gases above background discharged from the plants should result in an air dose due to gamma radiation of less than 10 mrad, and an air dose to beta radiation of less than 20 mrad, at any location near ground level which could be occupied by individuals at or beyond the boundary of the site, and that no individual in an unrestricted area will receive an annual dose to the total body greater than 5 mrem or an annual skin dose greater than 15 mrem from this release quantity.

d. The annual total quantity of all radioiodines and radioactive material in particulate forms above background from all reactors at a site should not result in an annual dose to any organ of an individual in an unrestricted area from all pathways of exposure in excess of 15 mrem.

e. The annual total quantity of iodine-131 discharged from each reactor at a site should not exceed 1 Ci.

To estimate and control radioactive solid wastes in accordance with applicable regulations.

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2.4.1 Specifications for Liquid Waste Effluents

a. The concentration of radioactive materials released in liquid wastes from all reactors at the site shall not exceed the values specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for unrestricted areas.

b. The cumulative release of radioactive materials in liquid waste effluents, excluding tritium and dissolved gases, shall not exceed 10 Ci/reactor/calendar quarter.

c. The cumulative release of radioactive materials in liquid waste effluents, excluding tritium and dissolved gases, shall not exceed 20 Ci/reactor in any 12 consecutive months.

d. During releases of radioactive wastes, except as provided in Specification 3.4.1.h, the effluent control monitor shall be set to alarm and to initiate the automatic closure of each waste isolation valve prior to exceeding the limits specified in Specification 2.4.1.a above.

e. The operability of each automatic isolation valve in the liquid radwaste discharge lines shall be demonstrated quarterly.

f. The equipment installed in the liquid radioactive waste treatment system shall be maintained and shall be operated to process radioactive liquid wastes prior to their discharge when the projected cumulative release could exceed 1.25 Ci/reactor/calendar quarter, excluding tritium and dissolved gases.

g. The maximum radioactivity to be contained in any liquid radwaste tank

3.4.1 Specifications for Liquid Waste Sampling and Monitoring

a. Plant records shall be maintained of the radioactive concentration and volume before dilution of liquid waste intended for discharge and the average dilution flow and length of time over which each discharge occurred. Sample analysis results and other reports shall be submitted in accordance with Section 5.6.1.2 of these Specifications. Estimates of the sampling and analyses errors associated with each reported value shall be included.

b. Prior to release of each batch of liquid waste, a sample shall be taken from that batch and analyzed in accordance with Table 2.4-1 to demonstrate compliance with Specification 2.4-1 using the flow rate into which the waste is discharged during the period of discharge.

c. Sampling and analysis of liquid radioactive waste shall be performed in accordance with Table 2.4-1. Prior to taking samples from a monitoring tank, at least two tank volumes shall be recirculated. For Unit No. 1, a recirculation system shall be provided on the monitoring tanks by June 1, 1977. Prior to this date, Unit No. 1 representative samples will be taken from the tank drain tap after flushing the line with 5 times the sample line volume.

d. The radioactivity in liquid wastes shall be continuously monitored and recorded during release except as provided in Specification 3.4.1.h. Whenever these monitors are inoperable for a period not to exceed 72 hours, two independent samples of each tank

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2.0 LIMITING CONDITIONS FOR OPERATION

Specifications (Cont'd)

that can be discharged directly to the environs shall not exceed 10 Ci, excluding tritium and dissolved gases.

h. If the cumulative release of radioactive materials in liquid effluents, excluding tritium and dissolved gases, exceeds 2.5 Ci/reactor/calendar quarter, the licensee shall make an investigation to identify the causes for such release, define and initiate a program of action to reduce such release to the design objective levels listed in Section 2.4, and report these actions to the Commission within 30 days from the end of the quarter during which the release occurred.

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3.0 MONITORING REQUIREMENTS

Specifications (Cont'd)

to be discharged shall be analyzed and two plant personnel shall independently check valving prior to the discharge. If these monitors are inoperable for a period exceeding 72 hours, no releases from a liquid waste tank shall be made and any release in progress shall be terminated.

e. The flow rate of liquid radioactive waste effluents shall be continuously measured and recorded. For Unit No. 1 the tank level shall be checked and recorded at least once every two hours by plant personnel during release until the equipment specified in 3.4.1.h is installed.

f. All liquid effluent radiation monitors shall be calibrated at least quarterly by means of a radioactive source which has been calibrated to a National Bureau of Standards source. Each monitor shall also have a functional test monthly and an instrument check prior to making a release.

g. The radioactivity in the steam generator blowdown shall be continuously monitored and recorded. Whenever these monitors are inoperable, the blowdown flow shall be representatively sampled and analyzed at least once per watch or diverted to the waste management system and the direct release to the environment terminated.

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h. Unit No. 1 shall be provided with a continuous liquid effluent monitor including a recorder in accordance with Specification 3.4.1.d, an alarm and automatic closure of each waste isolation valve in accordance with Specification 2.4.1.d, and a continuous flow measurement device including a recorder in accordance with Specification 3.4.1.e by June 1, 1977. Prior to this date, all Unit No. 1 liquid effluent releases shall be batch releases in accordance with

Specifications (Cont'd)

Specification 3.4.1.b and any unplanned or uncontrolled offsite release of radioactive materials in liquid effluents in excess of 0.5 curies requires notification to the NRC in writing within 10 days, reporting the event, identifying the cause, and describing actions taken to prevent recurrence.

Bases

The release of radioactive materials in liquid waste effluent to unrestricted areas shall not exceed the concentration limits specified in 10 CFR Part 20 and should be as low as practicable in accordance with the requirements of 10 CFR Part 50.36a. These specifications provide reasonable assurance that the resulting annual dose to the total body or any organ of an individual in an unrestricted area will not exceed 5 mrem. At the same time, these Specifications permit the flexibility of operation, compatible with considerations of health and safety, to ensure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than the design objective levels but still within the concentration limits specified in 10 CFR Part 20. It is expected that by using this operational flexibility under unusual operating conditions, and exerting every effort to keep levels of radioactive material in liquid wastes as low as practicable, the annual

Bases

The sampling and monitoring requirements given under Specification 3.4.1 provide assurance that radioactive materials in liquid waste effluents are properly controlled and monitored in conformance with the requirements of Design Criteria 60 and 64 of Appendix A to 10 CFR Part 50. These requirements provide the data for the licensee and the Commission to evaluate the performance of the plants relative to radioactive liquid wastes released to the environment. Reports on the quantities of radioactive materials released in liquid waste effluents are furnished to the Commission according to Section 5.6.1 of these Technical Specifications in conformance with Regulatory Guide 1.21. On the basis of such reports and any additional information, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

The points of release to the environment to be monitored in Section 3.4.1 include all the monitored release points as provided for in Table 2.4-3.

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Bases: (Cont'd)

release will not exceed a small fraction of the concentration limits specified in 10 CFR Part 20.

The design objectives have been developed based on operating experience taking into account a combination of variables including defective fuel, primary system leakage, primary to secondary system leakage, steam generator blowdown and the performance of the various waste treatment systems, and are consistent with 10 CFR Part 50.36a.

Specification 2.4.1.a requires the licensee to limit the concentration of radioactive materials in liquid waste effluents released from the site to levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for unrestricted areas. This Specification provides assurance that no member of the general public will be exposed to liquid-containing radioactive materials in excess of limits considered permissible under the Commission's Rules and Regulations.

Specifications 2.4.1.b and 2.4.1.c establish the upper limits for the release of radioactive materials in liquid effluents. The intent of these Specifications is to permit the licensee the flexibility of operation to ensure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than the levels normally achievable when the plants and the liquid waste treatment systems are functioning as designed. Releases of up to these limits

Bases: (Cont'd)

will result in concentrations of radioactive material in liquid waste effluents at small percentages of the limits in 10 CFR Part 20.

Specifications 2.4.1.d and 2.4.1.e require that suitable equipment to control and monitor the releases of radioactive materials in liquid wastes is operating during any period these releases are taking place and are consistent with the requirements of 10 CFR Part 50, Appendix A, Design Criterion 64.

Specification 2.4.1.f requires that the licensee maintain and operate the equipment installed in the liquid waste systems to reduce the release of radioactive material in liquid effluents to as low as practicable consistent with the requirements of 10 CFR Part 50.36a. Normal use and maintenance of installed equipment in the liquid waste system provide reasonable assurance that the quantity released will not exceed the design objective. In order to keep releases of radioactive materials as low as practicable, the Specification requires operation of equipment whenever it appears that the projected cumulative discharge rate will exceed one-fourth of this design objective annual quantity during any calendar quarter.

Specification 2.4.1.g limits the amount of radioactivity that could be inadvertently released to the environment to an amount that will not exceed the Technical Specification limit.

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Bases: (Cont'd)

In addition to limiting conditions for operation listed under Specifications 2.4.1.b and 2.4.1.c the reporting requirements of Specification 2.4.1.h delineate that the licensee shall identify the cause whenever the cumulative releases of radioactive materials in liquid waste effluent exceed one-half the design objective annual quantity during any calendar quarter and describe the proposed program of action to reduce such releases to design objective levels on a timely basis. The report must be filed with the Commission within 30 days following the calendar quarter in which the releases occurred.

2.4.2 Specifications for Gaseous Waste Effluents

The terms used in these Specifications are as follows:

subscripts v, refers to vent releases from Units Nos. 1, 2 and 3
s, refers to stack releases from Unit No. 1
i, refers to individual noble gas nuclide
(Refer to Table 2.4-5 for the noble gas nuclides considered)
numbers 1, 2, 3 refer to Units Nos. 1, 2 and 3, respectively.

Q_T = the total noble gas release rate (Ci/sec)

$= \sum_i Q_i$ = sum of the individual noble gas radionuclides determined to be present by isotopic analysis

3.4.2 Specifications for Gaseous Waste Sampling and Monitoring

a. Plant records shall be maintained and reports of the sampling and analysis results shall be submitted in accordance with Section 5.6.1 of these Specifications. Estimates of the sampling and analytical error associated with each reported value should be included.

b. Gaseous releases to the environment, except from the turbine building ventilation exhaust and as noted in Specification 3.4.2.c, shall be continuously monitored for gross radioactivity. The release rate in Specifications 2.4.2 shall be based on the measured flow rate or the determined flow rate of each operating vent or stack exhauster. A flow rate calibration of all

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2.4.2 Specifications (Cont'd)

Q_{T_s} = sum of the Unit No. 1 stack releases (Ci/sec)

$Q_{T_v} = Q_{T_{v_1}} + Q_{T_{v_2}} + Q_{T_{v_3}}$ = sum of the vent releases from Unit No. 1, Unit No. 2 and Unit No. 3, three measurements (Ci/sec)

$\bar{K}$ = the average total body dose factor due to gamma emission (rem/yr per Ci/sec)

$\bar{L}$ = the average skin dose factor due to beta emissions (rem/yr per Ci/sec)

$\bar{M}$ = the average air dose factor due to beta emissions (rad/yr per Ci/sec)

$\bar{N}$ = the average air dose factor due to gamma emissions (rad/yr per Ci/sec)

The values of $\bar{K}$, $\bar{L}$, $\bar{M}$ and $\bar{N}$ are to be determined each time isotopic analysis is required as delineated in Specification 3.4.2. Determine the following using the results of the noble gas radionuclide analysis:

$$\bar{K} = (1/Q_T) \sum_i Q_i K_i$$

$$\bar{L} = (1/Q_T) \sum_i Q_i L_i$$

$$\bar{M} = (1/Q_T) \sum_i Q_i M_i$$

$$\bar{N} = (1/Q_T) \sum_i Q_i N_i$$

3.4.2 Specifications (Cont'd)

exhausters in all operating modes shall be performed each 6 months and the damper position and exhauster operating condition shall be checked and recorded each shift. Damper position and exhauster operating conditions need not be checked for a system equipped with an instrument which is generally regarded as a continuous flow measuring device. Whenever these monitors are inoperable, grab samples shall be taken and analyzed daily for gross radioactivity. If these monitors are inoperable for more than seven days, these releases shall be terminated.

c. During the release of gaseous wastes from the primary system waste gas holdup system, the gross activity monitor, the iodine collection device, and the particulate collection device shall be operating. The waste gas decay tank effluents shall be monitored and tested prior to any release of radioactive gas from a decay tank.

d. All waste gas monitors shall be calibrated at least quarterly by means of a known radioactive source which has been calibrated to a National Bureau of Standard's source. The calibration procedure for the waste gas decay tank effluent monitors shall consist of exposing the detector to a referenced calibration source in a controlled reproducible geometry. The source and geometry shall be referenced to the original monitor calibration which provides the calibration curves. Each

2.4.2 Specifications (Cont'd)

where the values of K_i, L_i, M_i and N_i are provided in Table 2.4-5, and are site dependent gamma and beta dose factors

Q = the measured release rate of the radioiodines and radioactive materials in particulate forms with half-lives greater than eight days (Ci/sec).

a. (1) The release rate limit of noble gases from the site shall be such that

$$2.0\ [Q_{Tv}\bar{K}_v + Q_{Ts}\ \bar{K}_s] \leq 1$$

and

$$0.33\ [Q_{Tv}(\bar{L}_v + 1.1\bar{N}_v) + Q_{Ts}(\bar{L}_s + 1.1\bar{N}_s)] \leq 1$$

(2) The release rate limit of all radioiodines and radioactive materials in particulate form with half-lives greater than eight days, released to the environs as part of the gaseous wastes from the site shall be such that

$$2.9 \times 10^5\ Q_v + 6.2 \times 10^4\ Q_s \leq 1$$

b. (1) The average release rate of noble gases from the site during any calendar quarter shall be such that

$$13\ [Q_{Tv}\bar{N}_v + Q_{Ts}\bar{N}_s] \leq 1$$

and

$$6.3\ [Q_{Tv}\bar{M}_v + Q_{Ts}\bar{M}_s] \leq 1$$

(2) The average release rate of noble gases from the site during any 12 consecutive months shall be

3.4.2 Specifications (Cont'd)

monitor shall have a functional test at least monthly and instrument check at least daily.

e. Sampling and analysis of radioactive material in gaseous waste, particulate form, and radioiodine shall be performed in accordance with Table 2.4-2.

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2.4.2 Specifications (Cont'd)

$$25\ [Q_{Tv}\bar{N}_v + Q_{Ts}\bar{N}_s] \leq 1$$

and

$$13\ [Q_{Tv}\bar{M}_v + Q_{Ts}\bar{M}_s] \leq 1$$

(3) The average release rate per site of all radioiodines and radioactive materials in particulate form with half-lives greater than eight days during any calendar quarter shall be such that

$$13\ [2.9 \times 10^5\ Q_v + 6.2 \times 10^4\ Q_s] \leq 1$$

(4) The average release rate per site of all radioiodines and radioactive materials in particulate form with half-lives greater than eight days during any period of 12 consecutive months shall be such that

$$25\ [2.9 \times 10^5\ Q_v + 6.2 \times 10^4\ Q_s] \leq 1$$

(5) The amount of iodine-131 released during any calendar quarter shall not exceed 2 Ci/reactor.

(6) The amount of iodine-131 released during any period of 12 consecutive months shall not exceed 4 Ci/reactor.

c. Should any of the conditions of 2.4.3.c(1), (2) or (3) listed below exist, the licensee shall make an investigation to identify the causes of the release rates, define and initiate a program of action to reduce the release rates to design objective levels listed in Section 2.4 and report these actions

2.4.2 Specifications (Cont'd)

to the NRC within 30 days from the end of the quarter during which the releases occurred.

(1) If the average release rate of noble gases from the site during any calendar quarter is such that

$$50 \quad [Q_{Tv}\bar{N}_v + Q_{Ts}\bar{N}_s] \quad >1$$

or

$$25 \quad [Q_{Tv}\bar{M}_v + Q_{Ts}\bar{M}_s] \quad >1$$

(2) If the average release rate per site of all radioiodines and radioactive materials in particulate form with half-lives greater than eight days during any calendar quarter is such that

$$50 \quad [2.9 \times 10^5 \, Q_v \; + \; 6.2 \times 10^4 \, Q_s] \quad >1$$

(3) If the amount of iodine-131 released during any calendar quarter is greater than 0.5 Ci/reactor.

d. During the release of gaseous wastes from the primary system waste gas holdup system the effluent monitors listed in Table 2.4-4 shall be operating and set to alarm and to initiate the automatically closure of the waste gas discharge valve prior to exceeding the limits specified in 2.4.2.a above. The operability of each automatic isolation valve shall be demonstrated quarterly.

e. The maximum activity to be contained in one waste gas storage tank shall not exceed 6000 curies (considered as Xe-133).

2.4.2 Specifications (Cont'd)

f. An unplanned or uncontrolled offsite release of radioactive materials in gaseous effluents in excess of 5 curies of noble gas or 0.02 curie of radioiodine in gaseous form requires notification to the NRC in writing within 10 days, reporting the event, identifying the cause, and describing actions taken to prevent recurrence.

Bases

The release of radioactive materials in gaseous wastes to unrestricted areas shall not exceed the concentration limits specified in 10 CFR Part 20, and in accordance with the requirements of 10 CFR Part 50.36a.

These Specifications provide reasonable assurance that the resulting annual air dose due to gamma radiation will not exceed 10 mrad, and an annual air dose due to beta radiation will not exceed 20 mrad from noble gases, that no individual in an unrestricted area will receive an annual dose to the total body greater than 5 mrem or an annual skin dose greater than 15 mrem from fission product noble gases, and that the annual dose to any organ of an individual from iodines and particulates will not exceed 15 mrem per site. At the same time these Specifications permit the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided with a dependable source of power under unusual operating conditions which may temporarily result in releases higher than the design objective levels but still within the concentration limits specified in 10 CFR Part 20. It is

Bases

The sampling and monitoring requirements given under Specification 3.4.2 provide assurance that radioactive materials released in gaseous wastes are properly controlled and monitored in conformance with the requirements of Design Criteria 60 and 64 of Appendix A to 10 CFR Part 50. These requirements provide the data for the licensee and the Commission to evaluate the performance of the plants relative to radioactive waste effluents released to the environment. Reports on the quantities of radioactive materials released in gaseous effluents are furnished to the Commission on the basis of Section 5.6.1 of these Technical Specifications and in conformance with Regulatory Guide 1.21. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

The points of release to the environment to be monitored in Section 3.4.2 include all the monitored release points as provided for in Table 2.4-4.

2.4.2 Bases (Cont'd)

expected that using this operational flexibility under unusual operating conditions, and by exerting every effort to keep levels of radioactive material in gaseous waste effluents as low as practicable, the annual releases will not exceed a small fraction of the concentration limits specified in 10 CFR Part 20.

The design objectives have been developed based on operating experience taking into account a combination of system variables including defective fuel, primary system leakage, primary to secondary system leakage, steam generator blowdown and the performance of the various waste treatment systems.

Specification 2.4.2.a(1) limits the release rate of noble gases from the site so that the corresponding annual gamma and beta dose rate above background to an individual in an unrestricted area will not exceed 500 mrem to the total body or 3000 mrem to the skin in compliance with the limits of 10 CFR Part 20.

For Specification 2.4.2.a(1), gamma and beta dose factors for the individual noble gas radionuclides have been calculated for the plant gaseous release points and are provided in Table 2.4-5. The expressions used to calculate these dose factors are based on dose models derived in Section 7 of Meteorology and Atomic Energy-1968 and model techniques provided in Draft Regulatory Guide 1.AA.

Bases (Cont'd)

Specification 3.4.2.b excludes monitoring the turbine building ventilation exhaust since this release is expected to be a negligible release point. Many PWR reactors do not have turbine building enclosures. To be consistent in this requirement for all PWR reactors, the monitoring of gaseous releases from turbine buildings is not required.

Bases (Cont'd)

Dose calculations have been made to determine the site boundary location with the highest anticipated dose rate from noble gases using onsite meteorological data and the dose expressions provided in Draft Regulatory Guide 1.AA. The dose expression considers the release point location, building wake effects, and the physical characteristics of the radionuclides.

The offsite locations with the highest anticipated annual dose from released noble gases are provided in Table 2.4-5.

The release rate Specifications for a radioiodine and radioactive material in particulate form with half-lives greater than eight days are dependent on existing radionuclide pathways to man. The pathways which were examined for these Specifications are: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, and (3) deposition onto grassy areas where milch animal graze with consumption of the milk by man. Methods for estimating doses to the thyroid via these pathways are described in Draft Regulatory Guide 1.AA. The offsite location with the highest anticipated thyroid dose rate from radioiodines and radioactive material in particulate form with half - lives greater than eight days was determined using onsite meteorological data and the expressions described in Draft Regulatory Guide 1.AA.

<u>Bases</u> (Cont'd)

Specification 2.4.2a(2) limits the release rate of radioiodines and radioactive material in particulate form with half-lives greater than eight days so that the corresponding annual thyroid dose via the most restrictive pathway is less than 1500 mrem.

For radioiodines and radioactive material in particulate form with half-lives greater than eight days, the most restrictive location is a dairy farm located 11,260 meters in the SSW direction (vent X/Q = 2.4×10^{-7} sec/m^3; stack X/Q = 5.1×10^{-8} sec/m^3).

Specification 2.4.2.b establishes upper offsite levels for the release of noble gases and radioiodines and radioactive material in particulate form with half-lives greater than eight days at twice the design objective annual quantity during any calendar quarter, or four times the design objective annual quantity during any period of 12 consecutive months. In addition to the limiting conditions for operation of Specifications 2.4.2.a and 2.4.2.b, the reporting requirements of 2.4.2.c provide that the cause shall be identified whenever the release of gaseous effluents exceeds one-half the design objective annual quantity during any calendar quarter and that the proposed program of action to reduce such release rates to the design objectives shall be described.

Specification 2.4.2.d requires that suitable equipment to monitor and control the radioactive gaseous releases are operating during any period these releases are taking place.

Bases (Cont'd)

Specification 2.4.2.e limits the maximum quantity of radioactive gas that can be contained in a waste gas storage tank. The calculation of this quantity should assume instantaneous ground release, a X/Q based 5 percent meteorology, the average gross energy is 0.19 MeV per disintegration (considering Xe-133 to be the principal emitter) and exposure occurring at the minimum site boundary radius using a semi-infinite cloud model. The calculated quantity will limit the offsite dose above background to 0.5 rem or less, consistent with Commission guidelines.

Specification 2.4.2.f provides for reporting release events which, while below the limits of 10 CFR Part 20, could result in releases higher than the design objectives.

2.4.3 Specifications for Solid Waste Handling and Disposal

a. Measurements shall be made to determine or estimate the total curie quantity and principle radionuclide composition of all radioactive solid waste shipped offsite.

b. Reports of the radioactive solid waste shipments, volumes, principle radionuclides, and total curie quantity, shall be submitted in accordance with Section 5.6.1.2.

Bases

The requirements for solid radioactive waste handling and disposal given under Specification 2.4.3 provide assurance that solid radioactive materials stored at the plant and shipped offsite are packaged in conformance with 10 CFR Part 20, 10 CFR Part 71, and 49 CFR Parts 170-178.

Table 2.4-1 (sheet 1 of 2)

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS*

Liquid Source	Sampling Frequency	Type of Activity Analysis	Detectable Concentrations (μCi/ml)(3)
A. Monitor Tank Releases	Each Batch(2)	Principal Gamma Emitters(2)	5×10^{-7} (2)
	One Batch/Month	Dissolved Gases	10^{-5}
	Weekly Composite(1)	Ba-La-140, I-131	10^{-6}
	Monthly Composite(1)	H-3	10^{-5}
		Gross α	10^{-7}
	Quarterly Composite(2)	Sr-89, Sr-90	5×10^{-8}
B. Primary Coolant	Weekly (4)	I-131, I-133	10^{-6}
C. Steam Generator Blowdown	Weekly (5)(2)	Principal Gamma Emitters(2)	5×10^{-7} (2)
		Ba-La-140, I-131	10^{-6}
	One Sample/Month	Dissolved Gases	10^{-5}
	Monthly Composite(5)	H-3	10^{-5}
		Gross α	10^{-7}
	Quarterly Composite(5)	Sr-89, Sr-90	5×10^{-8}

*Note: this table will be superceded by Table 4.11-1 of the proposed Environmental Technical Specifications.

1-26a

TABLE 2.4-1 (Sheet 2 of 2)

(1) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged.

(2) For certain mixtures, 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 measured ratios with those radionuclides which are routinely identified and measured. Also, when operational or other limitations preclude specific gamma radionuclide analysis in batch releases, the provisions of Regulatory Guide 1.21, Revision (1), Appendix A, Section B,1,a, may be followed. Justification shall be documented for all batches for which specific gamma radionuclide analysis is not done. Refer to Regulatory Guide 1.21 Rev (1) June 1974, Section C.4 Gross Radioactive Measurements and Appendix A, Section B.

1-26b

(3) The detectability limits for activity analysis are based on the technical feasibility and on the potential significance in the environment of the quantities released. For some nuclides, lower detection limits may be readily achievable and when nuclides are measured below the stated limits, they should also be reported.

(4) The power level and cleanup or purification flow rate at the sample time shall also be reported.

(5) To be representative of the average quantities and concentrations of radioactive materials in liquid effluents, samples should be collected in proportion to the rate of flow of the effluent stream. Prior to analyses, all samples taken for the composite should be throughly mixed in order for the composite sample to be representative of the average effluent release.

Table 2.4-2 (Sheet 1 of 2)

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

Gaseous Source	Sampling Frequency	Type of Activity Analysis	Detectable Concentrations (µCi/ml)(1)
A. Waste Gas Decay Tank Releases	Each Tank	Principal Gamma Emitters	10^{-4} (3)
		H-3	10^{-6}
B. Containment Purge Releases	Each Purge (Not Including Pressure Relief Purges)	Principal Gamma Emitters	10^{-4} (2)
		H-3	10^{-6}
C. Condenser Air Ejector	Monthly	Principal Gamma Emitters	10^{-4} (2) (3)
		H-3	10^{-6}
D. Environmental Release Points	Monthly (Gas Samples)	Principal Gamma Emitters	10^{-4} (2) (3)
	(Including Containment Pressure Relief Purges)	H-3	10^{-6}
	Weekly (Charcoal Sample)	I-131	10^{-12}
	Monthly (Charcoal Sample)	I-133, I-135	10^{-10}
	Weekly (Particulates)	Principal Gamma Emitters (at least for Ba-La-140, I-131)	10^{-11}
	Monthly Composite (4) (Particulates)	Gross α	10^{-11}
	Quarterly Composite (4) (Particulates)	Sr-89, Sr-90	10^{-11}

Table 2.4-2 (Sheet 2 of 2)

NOTES:

(1) The above detectability limits for activity analysis are based on technical feasibility and on the potential significance in the environment of the quantities released. For some nuclides, lower detection limits may be readily achievable and when nuclides are measured below the stated limits, they should also be reported.

(2) Analyses shall also be performed following each refueling, startup or similar operational occurrence which could alter the mixture of radionuclides.

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

26d (4) To be representative of the average quantities and concentrations of radioactive materials in particulate form released in gaseous effluents, samples should be collected in proportion to the rate of flow of the effluent stream.

TABLE 2.4-5 (Sheet 1 of 2)

GAMMA AND BETA DOSE FACTORS FOR
INDIAN POINT UNITS NOS. 1, 2 and 3

	$\chi/Q = 1.7\times10^{-5}$ sec/m^{-3} at 456 meters, SW				$\chi/Q = 3.5\times10^{-7}$ sec/m^{-3} at 3860 meters, N			
	Unit No. 1 Dose Factors for Vent				Unit No.1 Dose Factor for Stack			
oble Gas adionuclide	K_{iv} Total Body rem/yr / Ci/sec	L_{iv} Skin rem/yr / Ci/sec	M_{iv} Beta Air rad/yr / Ci/sec	N_{iv} Gamma Air rad/yr / Ci/sec	K_{is} Total Body rem/yr / Ci/sec	L_{is} Skin rem/yr / Ci/sec	M_{is} Beta Air rad/yr / Ci/sec	N_{is} Gamma Air rad/yr / Ci/sec
r-83m	6.3×10^{-4}	0	4.9	0.43	1.9×10^{-5}	0	0.1	0.0066
-85m	5.8	25	34	6.1	0.32	0.52	0.71	0.33
r-85	0.068	23	34	0.072	0.0043	0.47	0.71	0.0045
r-87	18	170	170	19	0.91	3.4	3.6	0.95
r-88	45	40	51	47	2.5	0.81	1.0	2.7
r-89	9.3	170	185	9.8	0.07	3.5	3.7	0.074
Xe-131m	2.1	8.2	19	2.8	0.11	0.17	0.39	0.13
Xe-133m	1.7	17	25	2.4	0.081	0.35	0.52	0.11
e-133	2.0	5.3	19	2.5	0.095	0.11	0.37	0.11
Xe-135m	8.4	12	13	9.0	0.22	0.25	0.26	0.23
Xe-135	8.5	32	42	9.0	0.5	0.67	0.86	0.52
e-137	1.2	210	210	1.3	0.012	4.3	4.4	0.012
Xe-138	20	71	82	21	0.49	1.4	1.7	0.51

TABLE 2.4-5 (Sheet 2 of 2)

GAMMA AND BETA DOSE FACTORS FOR
INDIAN POINT, UNITS Nos. 1, 2 and 3

Noble Gas Radionuclide	$\chi/Q = 1.1 \times 10^{-5}$ sec/m^3 at 520 meters, SW — Unit No. 2 Dose Factors for Vent: K_{iv} Total Body rem/yr / Ci/sec	L_{iv} Skin rem/yr / Ci/sec	M_{iv} Beta Air rad/yr / Ci/sec	N_{iv} Gamma Air rad/yr / Ci/sec	$\chi/Q = 2.6 \times 10^{-5}$ sec/m^3 at 330 meters, SW — Unit No. 3 Dose Factors for Vent: K_{is} Total Body rem/yr / Ci/sec	L_{is} Skin rem/yr / Ci/sec	M_{is} Beta Air rad/yr / Ci/sec	N_{is} Gamma Air rad/yr / Ci/sec
Kr-83m	5.3×10^{-4}	0	3.2	0.35	0.001	0	7.6	0.79
Kr-85m	5.0	16	22	5.3	8.8	38	52	9.3
Kr-85	0.058	15	22	0.062	0.1	35	52	0.11
Kr-87	16	110	110	16	28	260	260	30
Kr-88	38	26	33	40	68	61	78	71
Kr-89	6.8	110	120	7.2	21	260	280	22
Xe-131m	1.8	5.3	12	2.4	3.3	13	28	4.3
Xe-133m	1.4	11	16	2.0	2.6	26	38	3.7
Xe-133	1.7	3.4	12	2.1	3.0	8	28	3.8
Xe-135m	6.9	7.9	8.2	7.3	14	19	19	15
Xe-135	7.3	21	27	7.7	13	50	64	14
Xe-137	0.93	140	140	0.98	2.6	330	330	2.8
Xe-138	16	46	53	17	34	110	130	36

1-26f

...Y OF THE STATE OF NEW YORK
... NO. 3 NUCLEAR POWER PLANT

...ACHMENT B
Section I

AP-11 REV. 2

... WASTE RELEASE PERMITS

Written by: John Kelly

Reviewed by: [signature]

PORC Review [signature] Date 10-19-78

Approved by: [signature] Date 10/11/78

Effective Date 10/26/78

Radioactive Waste Release Permits

I. Purpose

To establish the Administrative Controls and Records necessary to assure compliance with the Radioactive Discharge Requirements of the Environmental Technical Specifications.

II. Discussion

The Physical aspects of radioactive discharge are covered in the following System Operating Procedures:

SOP-WDS-3	Solid Radioactive Waste Disposal
SOP-WDS-6	Liquid Waste Discharge Procedure
SOP-WDS-7	Gaseous Waste Discharge

Via Memoranda of Understanding Nos. 15 and 16 between the Power Authority and Con Edison, refer to AP-29, the site discharge limits have been apportioned between the Power Authority and Con Edison such that the Power Authoriy's apportionment is:

Liquid

Compliance with all instantaneous limits described in this document will be achieved by observance of discharge limits described. Monthly reports described in section IV will provide information necessary to comply with time average discharge limits.

The concentration of radioactive materials released in liquid wastes from IP3 shall not exceed the values specified in 10CFR20, Appendix B, Table 2, Column 2, for unrestricted areas based upon the circulating water flow from IP3.

The 10 Ci per calendar quarter and 20 Ci for any twelve consecutive months' cumulative release of radioactive materials in liquid waste effluents, excluding tritium and dissolved gases, limits of Section 2.4 of the Environmental Technical Specifications shall be met by IP3.

The projected cumulative liquid waste release, limit of 1.25 Ci, excluding tritium and dissolved gases, per calendar quarter specified in Section 2.4 of the Environmental Technical Specifications that requires operation of the equipment installed in the liquid radioactive waste treatment system shall be met by IP3.

The calendar quarter action limit of 2.5 Ci for cumulative release of radioactive materials in liquid effluent, excluding tritium and dissolved gases, which requires the licensee to make an investigation to identify the causes for such release, to find and initiate a program of action to reduce such releases to the design objective levels listed in Section 2.4 of the Environmental Technical Specifications, and report these actions to the Commission within thirty days from the end of the quarter during which the release occurred shall be met by IP3.

By written agreement of Con Edison's IP2 Watch Supervisor and the Power Authority's IP3 Shift Supervisor, one party can reduce or eliminate radioactive liquid waste discharges for a period of time to allow the other party to use the full site dilution flow, or a specified portion thereof, for a discharge when necessary.

IP3 will use its best efforts to limit the amount of liquid waste produced and subsequently transferred to the Con Edison storage facility.

The following are Environmental Technical Specification (ETS) requirements in addition to those stated above:

Recirculate two tank volumes before sampling of each isolated liquid waste tank prior to sampling for discharge.

Discharge line radiation monitor with automatic discharge line isolation valve control shall be operable for all liquid discharges. Radioactivity in liquid waste shall be continuously monitored and recorded during release. If monitor is inoperable, two independent samples are required prior to release. No release is allowed if the monitor is inoperable for more than 72 hours.

No more than 10 Ci of activity may be contained in a tank capable of being discharged directly to the river.

The flow rate of liquid radioactive waste effluents shall be continuously measured and recorded.

Radioactivity in steam generator blowdown shall be continuously monitored and recorded. If monitor is inoperable, blowdown flow will be diverted to waste management system or sampled once per watch.

Airborne

Compliance with all instantaneous limits described in this document will be achieved by observance of discharge limits described. Monthly reports described in Section IV will provide information necessary to comply with time average discharge limits.

One half of the allowable release limits of instantaneous noble gas and instantaneous radioiodines and radioactive materials in particulate form with half lives greater than eight days specified in Section 2.4 of the Environmental Technical Specifications, as measured in curies per second, are allotted to IP3.

One half of the allowable average calendar quarter and average twelve consecutive months release rates for noble gases and for radioiodines and radioactive materials in particulate form with half lives greater than eight days specified in Section 2.4 of the Environmental Technical Specifications, as measured in curies per second, are allotted to IP3.

The iodine 131 release per calendar quarter shall be less than 2 Ci for IP3 and releases per twelve consecutive months' shall be less than 4 Ci for IP3.

The calendar quarter action limits for average release rate of noble gas, average release rate of radioiodine and radioactive materials in particulate form with half lives greater than eight days and iodine 131 curies per reactor discharge specified in Section 2.4.2.C1, 2 & 3 of the ETS which require investigation into the cause, reduction of the release rate and NRC notification, will allow IP3 to release one half of the release rate limit as measured in curies per second for the noble gas and the radioiodines and radioactive materials in particulate form with half lives greater than eight days. The action limit for curies per reactor discharged will require action if IP3 exceeds .5 Ci of I-131 for the calendar quarter.

The unplanned or uncontrolled off-site release limits for noble gas for IP3 shall be 2.5 Ci and for radioiodine in gaseous form it shall be .01 Ci for IP3.

By written agreement of Con Edison's IP2 Watch Supervisor and the Power Authority's IP3 Shift Supervisor, either party may reduce or eliminate discharges for a period of time to allow the other party to use the full site permissible discharge rate or a specified portion thereof.

Gaseous releases to the environment, except for the turbine building ventilation exhaust shall be continuously monitored. If the monitors are inoperable, samples will be taken daily for up to seven days. Beyond that, the releases shall be terminated.

During release of gaseous waste from the waste gas holdup system, the gross activity monitor, the iodine collection device and the particulate collection device shall be operating and the tank shall be sampled and tested prior to discharge.

The maximum activity to be contained in one large gas decay tank shall not exceed 6000 Ci.

III. Procedure

A. Liquid Releases

A completed and properly authorized Liquid Radioactive Waste Release Permit shall be issued prior to the release of any radioactive waste from an isolated tank to the discharge canal. A permit is required for each tank to be discharged and must be retained for the life of the plant.

For any and all discharges, a minimum of 100,000 gpm of dilution flow should be available for the unit, and the total discharge canal concentration of discharges from all three units, both continuous and intermittent must be maintained at less than $1x10^{-7}$ uCi/cc exclusive of dissolved gas and tritium.

Assurance that combined liquid releases from Units 1, 2 and 3 do not exceed limits for the site is provided by administrative controls agreed to in the Memorandum of Understanding between Con Edison and the Power Authority concerning liquid discharges and the requirements of this Administrative Procedure and its Con Edison equivalent.

Prior to discharge, the tank contents shall be recirculated for two tank volumes. After this recirculation, and prior to discharge a sample shall be taken and analyzed for activity with a portion of the sample set aside for composite analysis. The measured activity shall be used for calculating permissible discharge rate and the alarm set point for the liquid waste discharge monitor. The chemistry technician will provide to the watch the concentration of radioactivity and the MPC_w for the sample taken and this information will be used to determine the permissible discharge rate and alarm set point as performed in Attachment A. 2

The radioactivity in liquid waste and the discharge flow rate of that waste shall be continuously monitored and recorded during release. If the radiation monitor is inoperable for up to 72 hours, two independent samples of each tank shall be taken and two plant personnel shall independently check valving prior to discharge. If the discharge radiation monitor is inoperable for more than 72 hours, that liquid discharge shall be stopped until the monitor is placed back in service.

The radioactivity in steam generator blowdown shall be continuously monitored and recorded. Whenever this monitor is inoperable the blowdown shall be sampled once per watch until the monitor is returned to service.

Unit No. 3 shall maintain a Liquid Radioactive Waste Release Permit Book. Only the dilution flow from Unit No. 3 should be used for calculating discharge canal concentration. The dilution flow available from the other units on site shall only be used for calculating discharge canal concentration with the approval of the Shift Supervisor, after he receives written concurrence from the Con Edison Watch Supervisor.

If there is any unplanned or uncontrolled off-site release of radioactive materials in liquid effluents in excess of 0.5 Ci, a Significant Occurrence Report shall be issued as required by AP-8.

Such a report shall also be issued by the Radiological and Environmental Services Superintendent (RESS) if more than 10 Ci of radioactivity excluding tritium and noble gas is found in a liquid radioactive waste tank that can be discharged directly to the river. A report shall also be issued by the RESS or his designee if cumulative releases of radioactive materials in liquid effluent, excluding tritium and dissolved gases exceeds 1.25 curies/reactor per calendar quarter.

The chemical content of liquid wastes will be monitored by the RESS who will advise the Superintendent of Power of compliance with regulatory limits on chemical discharges.

B. Liquid Waste Transfer

When liquid waste is transferred to Unit 1 for processing, the volume transferred should be determined and recorded. A sample should be obtained during the transfer in order to determine the chemical and radioactive content of the waste. The volume transferred and sample numbers associated with the transfer should be recorded with the date and time of transfer in a "WASTE TRANSFER" book to be maintained in the Unit 3 Control Room.

In the event that steam generator blowdown is being transferred, the blowdown rate being transferred, the time length of the transfer and a sample number should be recorded in the transfer book. A separate sample number and entry should be made for each day when blowdown is transferred.

C. Airborne Releases

An Airborne Radioactive Waste Release Permit shall be issued prior to the release of airborne activity from the waste gas holdup system containment purge and containment pressure relief. A waste release permit book shall be maintained in the control room of the Unit.

If the plant vent radiogas monitor (R-14) or the condenser air ejector monitor (R-15) becomes inoperable when the associated discharge path is in use, grab samples shall be taken daily for gross radioactivity and a release permit shall be issued for the 24 hour period using values obtained from this analysis. If either monitor has been inoperable for more than seven days, release by the associated path shall be terminated.

Prior to starting a release of airborne wastes from the primary waste gas holdup system, the plant vent radiogas monitor, the iodine collection device, and the particulate collection device shall be operating. A Waste Gas Decay Tank or containment purge shall be sampled and tested prior to release. For containment pressure relief the radioactive concentration indicated by the containment radiogas monitor may be used.

The limitations on airborne discharges are based on Section 2.4.2 of the E.T.S. A conservative calculation assuming all noble gas releases to be originating from gas stripped from the primary coolant results in the following limits for noble gas releases.

Limit	Permissible Discharge Rate Ci/sec
Thirty Day Report	5.0×10^{-4}
Annual Average	9.6×10^{-4}
Quarterly Average	2.0×10^{-3}
Instantaneous	2.4×10^{-2}

These limits assume a conservative noble gas isotopic mixture (analysis of undecayed primary coolant gas) and apportion one half of the site permissible discharge rate (Ci/sec.) to Indian Point 3. By using the noble gas discharge rate for control the limit on radioiodine releases will always be met if the noble gas concentration is 2×10^4 or more greater than the concentration of radioiodines and radioactive materials in particulate form with half-lives greater than eight days.

During normal operation without a primary to secondary leak the only vent referred to above is the Unit 3 main plant vent. However, in the event of a leak the blowdown flash tank vent and condenser air ejector releases shall be added to those from the plant vent.

The above annual average limits shall be used for calculating limitations on discharge. If these limits restrict operating flexibility, the quarterly average limit may be used by the Shift Supervisor as long as releases to date for the calendar month stay within the quarterly average and the Operations Superintendent is in agreement. The Shift Supervisor may use the instantaneous limit for a release if the Superintendent of Power is in agreement.

The Unit shall maintain its own Airborne Radioactive Waste Release Permit Book. Permits shall be prepared and a copy maintained for the life of the plant.

The limits on this page allow Indian Point No. 3 to use 0.7 of the site limit for gaseous waste effluents which equates to 0.5 of the site limits as measured in Ci/Sec.

As specified in Memorandum of Understanding No. 16 on Airborne Radioactive Discharges between Con Edison and the Power Authority, by mutual documented agreement of the Unit 2 and 3 Shift Supervisors, one unit can reduce or eliminate discharges for a period of time to allow the other Unit to use the full site permissible discharge rate.

If a release must be made at a rate that exceeds the instantaneous limits on page 4, a sample of that release shall be taken prior to starting the release, or in the case of an uncontrolled release, during the discharge. This sample shall be analyzed as soon as possible to determine if Technical Specification limits have been violated. If they have, an SOR shall be issued.

When the Unit is operating with a primary to secondary leak, the RESS or his designee shall provide information to the Shift Supervisor on radioactivity releases from all points on site and the limitations that these releases impose on discharges from the waste gas holdup and containment systems.

The site meteorology indicated in the control room shall be recorded on the Release Permit on an hourly basis during the discharge.

D. Solid Wastes

A monthly report shall be issued by the RESS. This report will document total volume, radioactivity content, number of shipments, mode of transportation, form and destination of all solid waste shipped offsite during the month.

IV. Reports Required

A liquid or gaseous waste release permit, as appropriate, will be issued as indicated above in III. A and III. C by an individual responsible for operating the unit making a radioactive release. The meteorological information for each release on the airborne release permit will be used to calculate site boundary dose for all releases. A monthly report on solid waste shipments as indicated in III. D above shall also be prepared by the RESS. The RESS shall issue a monthly report summarizing radioactive releases from the site for the preceding month. This report will provide information necessary to comply with quarterly and annual average limitations on discharge and will include information on ratio of noble gas to radioiodine and long-lived particulate activities. The semi-annual report on radioactive releases required by section 5.6.1.2.B of the ETS will be based on these permits and will be prepared under the direction of the RESS.

On a quarterly basis the RESS will provide a report to the Operations Superintendent of the current calibration factor for the process radiation monitors (PRM's) (R-11, R-12, R-13, R-14, R-18) and the four channel radioiodine monitors (C1, C2, C3, C4) with recommendations for alarm set points for these monitors.

When and if radioactivity is seen in other PRM's (R-15, R-19) calibration and set point information will be provided for them also.

Attachment A
Attachment B
Attachment C
Attachment D

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

LIQUID RADIOACTIVE WASTE RELEASE PERMIT

No. ________

Tank ____________________

Isolated ________ / ________
Time Date

Volume ____________________
(Gallons)

Recirculation ____________ * ____________ ____________
Rate (gpm) (Start Time) (End Time)

*determined from pump curve when flow meter not available.

Radioanalysis ____________ at ____________ on ____________ showed and
(Sample No.) (time) (date)

activity of ____________.
uCi/cc

Dilution flow is ____________ from this unit.
(gpm)

Other simultaneous releases from this unit result in discharge canal concentration of ____________.
uCi/cc

Permissible Discharge Rate ____________.
gpm

Discharge Radiation Monitor Operable ________ Yes ________ No.

If No:

1. Monitor our of service ________ on ________. (max. 72 hrs.).
(time) (date)
2. Discharge valve lineup checked by ____________ and ____________
(name) (name)
3. Second sample taken by ____________________.
(name)

Discharge Flow Meter and Recorder Operable ________ Yes ________ No.

Discharge Authorized by ____________________.

Discharge Initiated ________ on ________.
(time) (date)

Discharge terminated ________ on ________.
(time) (date)

Calculations for Liquid Radioactive Waste Release Permit

1. Record tank identification, time of isolation, volume to be discharged; start tank recirculation, recording rate, start time, and end time (latter calculated in 2 below).

2. Assure that at least two tank volumes have been recirculated as follows:

$$T = \frac{(2) \quad (V)}{R}$$

where T = minimum for recirculation (minutes)

V = volume in tank (gallons)

R = recirculation rate (gpm)

Example:

$$T = \frac{2\ (3740)}{100} = 75 \text{ minutes}$$

End Time = T + start time

3. After recirculation, have the tank sampled and obtain the radioactive concentration and the MPC_w for the sample. Record this and the total dilution flow from this Unit on the Permit. 2

4. Determine if other liquid radioactive discharges are being made from this Unit and obtain the radioactive concentration and discharge rate.

5. Calculate the permissible discharge rate for the isolated tank as follows:

$$D = \frac{(MPC_w) \quad (B)}{C}$$ 2

where:

D = maximum permissible discharge rate (gpm) 2

B = dilution flow available from unit (gpm) 2

C = radioactive concentration in tank for discharge (uCi/cc) 2

6. If D is greater than the maximum capacity of the discharge pump being used then the maximum capacity should be used for D in the rest of this calculation. If D is less than the pump capacity then use D for the balance of the calculations.

7. Calculate the permissible alarm set point for the discharge monitor as follows:

$$R = \frac{(MPC_w) \quad (B)}{(F)\,(D)}$$

where:

MPC_w	=	value obtained in step 3 above (uCi/cc)
B	=	dilution flow available from unit (gpm)
D	=	discharge rate (gpm)
F	=	calibration factor for discharge monitor (uCi/cc/cpm)
R	=	alarm set point (cpm) (above background)

8. Record the discharge rate and the alarm set point used on the discharge permit.

9. The value of background for the monitor (cpm) is subject to wide variations. Before each discharge the background should be obtained by noting the computer value for the monitor reading with the monitor either empty or filled with demineralized clean water.

Example:

a) A Unit 3 waste condensate tank contains 1000 gallons of 4.0×10^{-4} uCi/cc waste with an MPC_w of 1×10^{-7} uCi/cc.

b) The dilution flow available is 640,000 gpm.

c) To calculate the alarm set point:

$$R = \frac{(1 \times 10^{-7}) \quad 640{,}000}{(1.8 \times 10^{-8} \quad)\ (20)}$$

$$= 178{,}000 \text{ cpm}$$

d) The alarm should now be set on the R-18 monitor at 178,000 cpm above the previously obtained monitor background and the background and alarm set point used for the discharge should be recorded on the discharge permit.

e) Calculations involved in the discharge should be kept with each discharge permit.

f) If a discharge must be made in conjunction with activity in blowdown the RESS will provide guidance on further calculations required.

g) If the alarm set point calculated is less than 20% above background, the monitor will have to be decontaminated or discharge conditions must be changed to result in the alarm being more than 20% above background.

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

AIRBORNE RADIOACTIVE WASTE RELEASE PERMIT

No. ________

At ________ (time) on ________ (date) the ______________ (name) system was isolated.

The system contained ________ (ft^3) at ________ (psig). Radioanalysis ________ (No.) showed the noble gas activity to be ________ (uCi/cc). The total activity in this system is ________ Ci. (Maximum 6000 Ci).

Discharge monitor ______________ (identification) in service ________ yes/no with an alarm set point of ________ cpm is used to monitor the discharge which is performed to keep the monitor from exceeding the set point. If the monitor is out of service, the date out of service is ______________ and the vent

Sample ________ No. at ________ (time) on ________ (date) showed an activity of ________ uCi/cc with average flow rate of ________ CFM.

Discharge Authorized by ______________

Discharge start ________ (time) finish ________ (time).

Final pressure on tank ________ psig.

Meteorology

Time	Wind Speed	Wind Direction	Stability Class

Calculation of Limit on Airborne

Radioactive Discharge

1. The time and date of tank isolation should be recorded with the system name volume and pressure on an Airborne Radioactive Waste Release Permit.

2. The system should be sample for radioactive content and the total gas activity in the tank should be calculated as follows:

   $A = 1.89x10^{-3}$ (C) (V) (P)

   where:

   A = activity in isolated tank (Ci)

   C = concentration of radioactivity in tank (uCi/cc)

   V = volume of tank (ft^3)

   P = pressure of tank (psig)

   Example:

   $A = 1.89x10^{-3}$ (2.0) (525) (115)

   = 228 curies

3. Obtain the background, calibration factor, alarm set point, and current reading of the main plant vent radiogas monitor, and the flow rate in the plant vent and calculate the permissible discharge rate as follows:

   $D = (R)(E)(F)(4.72x10^{-4})$

   where:

   D = discharge rate (Ci/sec.)

   R = difference between alarm set point and current reading (cpm)

   E = monitor calibration factor (uCi/cc/cpm)

   F = vent duct flow rate (cfm)

   Example:

   $D = (1.0x10^4 - 1x10^3)(2x10^{-9})(1x10^5)(4.72x10^{-4}) = 8.5x10^{-4}$

4. The time required to make the discharge using the existing alarm set point can then be calculated as follows:

$$T = \frac{A}{D} (.0167)$$

where:

T = time for discharge (min.)

A and D as defined in 2 and 3 above

Example:

$$T = \frac{228\ (.0167)}{8.5\times10^{-4}} = 4.5\times10^{3} \text{ min.}$$

this time is over 3 days and is impractical requiring a change of the set point to the quarterly limit or higher for the duration of the discharge.

5. A new alarm set point based on the quarterly average discharge rate, and the time required for this discharge can be calculated as follows:

$$S = \frac{D}{(E)(F)(4.72\times10^{-4})}$$

where:

S = alarm set point (cpm)

D = discharge rate, quarterly average limit (Ci/sec)

E and F as defined in 3 above.

Example:

$$S = \frac{2.0\times10^{-3}}{(1\times10^{-9})(1.14\times10^{5})(4.72\times10^{-4})} = 4.2\times10^{4} \text{ cpm}$$

6. The permissible discharge rate for the tank can now be calculated as in 3 above.

Example:

$$D = (4.2\times10^{4} - 1\times10^{3})(2\times10^{-9})(1.0\times10^{5})(4.72\times10^{-4}) = 3.87\times10^{-3} \text{ Ci/sec}$$

MEMORANDUM OF UNDERSTANDING

No. 15 Rev. 0 Date 1/20/78

RULES GOVERNING THE RECEIPT, PROCESSING AND DISCHARGE OF LIQUID WASTE BY CONSOLIDATED EDISON AND THE POWER AUTHORITY

I. Effective the date of transfer of the operating responsibilities for Indian Point Unit No. 3 from Con Edison to the Power Authority, the following rules shall govern the receipt, processing and discharge of non-radioactive liquid chemical waste:

A. Chlorination

1. Chlorination of either party's circulating water system shall be coordinated between Con Edison's Chemistry Supervisor and the Power Authority's Chemistry Supervisor in order to assure compliance with Section 2.3.1 of the Environmental Technical Specifications and the applicable National Pollutants Discharge Eliminatation System Limits.

B. Corrosion Inhibitors

1. Each party shall be responsible for maintain the concentration of corrosion inhibitor discharged from its respective unit within the requirements of Section 2.3.2 of the Environmental Technical Specifications based upon its own circulating water flow and each party shall be allowed fifty per cent of the total annual discharge specified in Section 2.3.2 of the Environmental Technical Specifications.

C. Other Chemicals Which Affect Water Quality

1. Each party will maintain the release rates of process chemicals from its respective unit within the concentration limits of Table 2.3-1 of the Environmental Technical Specifications, based upon their own circulating water flow, and will maintain the total daily release within the requirements of Table 2.3-2 of the Environmental Technical Specifications. It should be noted that when Con Edison is providing a service for the Power Authority, via this or another Memorandum of Understanding, and said service results in the discharge of chemicals listed within Tables 2.3-1 and 2.3-2 of the Environmental Technical Specifications, the Power Authority will apportion their discharge limit to Con Edison in the same proportion that Con Edison is providing the service to the Power Authority. Said apportionment shall be as mutually agreed to by Con Edison's Manager - Nuclear Power Generation Department and the Power Authority's IP3 Resident Manager

D. Monitoring

1. Con Edison will perform all of the monitoring requirements of Table 2.3-1 of the Environmental Technical Specifications as well as those of the NPDES permit and the 401 Certificate. All data collection and analyses performed by Con Edison will be subject to audit by the Power Authority. Con Edison will provide the Power Authority with record copies of all data collected and the results of analyses performed in accordance with the requirements of this paragraph.

E. Sharing of Discharge Limits

1. By written agreement of Con Edison's IP2 Watch Supervisor and the Power Authority's IP3 Shift Supervisor, one party may allocate unused portions of its chemical discharges for a period of time to allow the other party to use the full site dilution flow or a specified portion thereof for a chemical discharge, when necessary.

2. Con Edison and the Power Authority will each prepare administrative documents which will evidence compliance with the requirements of this paragraph E, as well as Paragraphs A through D above.

II. Effective the date of transfer of the operating responsibilities for Indian Point Unit No. 3 from Consolidated Edison to the Power Authority, Con Edison will accept, process and dispose of radioactive steam generator blowdown effluent from the Indian Point Unit No. 3 Steam Generators, subject to the following:

A. As committed during the licensing process for Indian Point Unit No. 3, once the steam generator blowdown activity reaches 3×10^{-5} µCi/cc (gross activity), said blowdown shall be processed through the secondary boiler blowdown purification system.

B. The transfer of steam generator blowdown from Indian Point Unit No. 3 to the secondary boiler blowdown purification system shall be arranged between the Power Authority's IP3 Shift Supervisor and Con Edison's IP2 Watch Supervisor. Said transfer shall formally be documented on a transfer permit which will denote the quantity being transferred by the Power Authority and acceptance of same by Con Edison.

C. The Power Authority will provide a monthly report to Con Edison documenting the volume and isotopic content of radioactive steam generator blowdown transferred to Con Edison for processing.

D. Only fluid whose temperature is in excess of the saturation temperature for the operating pressure of the system, 75 psig, may be transferred. The transfer rate is limited by steam generator pressure.

E. In the event that the source of any of the above services can not meet the demand, the services shall be supplied in a ratio of forty-seven (47%) per cent to Unit 3 and fifty three (53%) per cent to Unit 2.

F. Con Edison will notify the Power Authority prior to performing maintenance on the secondary boiler blowdown purification system or associated valves and piping that are needed to comply with the requirements of this Memorandum of Understanding.

III. Effective the date of transfer of the operating responsibilities for Indian Point Unit No. 3 from Con Edison to the Power Authority, the following rules shall govern the release of radioactive liquid waste from the Indian Point Site:

A. Each party shall maintain the concentration of radioactive materials released in liquid wastes from its respective unit such that they do not exceed the values specified in 10 CFR 20, Appendix B, Table 2, Column 2, for unrestricted areas based upon the circulating water flow from their respective units.

B. The calendar quarter and any twelve consecutive months' cumulative release of radioactive materials in liquid waste effluents, excluding tritium and dissolved gases, per reactor limits of Section 2.4 of the Environmental Technical Specifications will be apportioned on the basis of the number of reactors owned by each party.

C. The projected cumulative liquid waste release, excluding tritium and dissolved gases, per reactor per calendar quarter specified in Section 2.4 of the Environmental Technical Specifications that requires operation of the equipment installed in the liquid radioactive waste treatment system shall be apportioned on the basis of the number of reactors owned by each party.

D. The calendar quarter action limits for cumulative release of radioactive materials in liquid effluent, excluding tritium and dissolved gases, per reactor which require the licensee to make an investigation to identify the causes for such release, to find and initiate a program of action to reduce such releases to the design objective levels listed in Section 2.4 of the Environmental Technical Specifications, and report these actions to the Commission within thirty days from the end of the quarter during which the release occurred shall be apportioned in accordance with the number of reactors owned by each party.

E. By written agreement of Con Edison's IP2 Watch Supervisor and the Power Authority's IP3 Shift Supervisor, one party may allocate unused portions of its radioactive waste discharges for a period of time to allow the other aprty to use the full site dilution flow, or a specified portion thereof, for a discharge when necessary.

F. Con Edison and the Power Authority will each prepare an administrative document which will assure compliance with the requirements of Paragraphs A through E above.

G. It should be noted that when Con Edison is providing a service for the Power Authority, via this or another Memorandum of Understanding, and said service results in the discharge of radioactive liquid waste the Power Authority will apportion its discharge limit to Con Edison in the same proportion that Con Edison is providing the service to the Power Authority. Said apportionment shall be as mutually agreed to by Con Edison's Manager - Nuclear Power Generation Department and the Power Authority's IP3 Resident Manager.

IV. Effective the date of the transfer of the operating responsibilities for Indian Point Unit No. 3 from Con Edison to the Power Authority, Con Edison will accept and store, process and dispose of radioactive liquid wastes produced as a result of the operation of Indian Point 3, subject to the following conditions:

A. The Power Authority will use its best efforts to limit the amount of liquid waste produced and subsequently transferred to the Con Edison storage facility.

B. The transfer of radioactive liquid waste from the Power Authority's facilities to the Con Edison facilities will be arranged between the Power Authority's IP3 Shift Supervisor and Con Edison's IP2 Watch Supervisor. Said transfer shall formally be documented on a transfer permit which will denote the quantity being transferred by the Power Authority and acceptance of the same by Con Edison.

C. The Power Authority will provide a monthly report to Con Edison documenting the volume and isotopic content of radioactive liquid wastes transferred to Con Edison for processing and discharge.

D. In the event that the source of any of the above services can not meet the demand, the services shall be supplied in a ratio of forty-seven (47%) per cent to Unit 3 and fifty-three (53%) per cent to Unit 2.

E. The Power Authority will install and maintain instrumentation and a recorder to monitor flow in the liquid waste transfer line. The installation of the instrumentation and recorder will be done in a timely manner.

F. Con Edison will provide to the Power Authority a monthly report of prorated Unit 3 discharges to allow separate semi-annual waste discharge reports to be prepared. The method of calculating this prorated release will be a documented procedure approved by Con Edison's Manager - Nuclear Power Generation Department and the Power Authority's IP3 Resident Manager. Calculations and data used in this procedure are subject to audit by the Power Authority.

G. The Power Authority will limit the chemical composition of the waste as necessary so that it will not cause damage to the waste processing facility or so that it would preclude processing or solidification.

In the event a site limit or authorized portion thereof is exceeded, Con Edison and Power Authority personnel shall follow the requirements of Memorandum of Understanding No. 17 in order to determine responsibility and reporting requirements.

This Memorandum of Understanding is subject to the termination stipulations detailed in Memorandum of Understanding No. 32.

Costs incurred by either party as a result of this Memorandum of Understanding shall be determined and billed as per Memorandum of Understanding No. 33.

J P Bayne 2/16/78
Resident Manager - IP3 - PASNY

Eugene R. McGrath 2/16/73
Manager - Nuclear Power Generation
Department - Consolidated Edison

Attachment C

MEMORANDUM OF UNDERSTANDING

No. 16 Rev. 0 Date 3/9/78

RULES GOVERNING THE DISCHARGE OF GASEOUS WASTE BY CONSOLIDATED EDISON AND THE POWER AUTHORITY

Effective the date of transfer of the operating responsibilities for Indian Point Unit No. 3 from Con Edison to the Power Authority, the following rules shall govern the discharge of radioactive gaseous waste:

A. Except as otherwise provided in Paragraph B:

(1) The site release limits of instantaneous noble gas and instantaneous radioiodines and radioactive materials in particulate form with half lives greater than eight days specified in Section 2.4 of the Environmental Technical Specifications will be apportioned so as to allow each party to release one half of the allowable amount, as measured in curies per second.

(2) The average calendar quarter and average twelve consecutive months release rates for noble gases and for radioiodines and radioactive materials in particulate form with half lives greater than eight days specified in Section 2.4 of the Environmental Technical Specifications will be apportioned so as to allow each party to release one half of the allowable, as measured in curies per second.

(3) The iodine 131 calendar quarter and twelve consecutive months' curies per reactor limit specified in Section 2.4 of the Environmental Technical Specifications will be apportioned on the basis of the number of reactors owned by each party.

(4) The calendar quarter action limits for average release rate of noble gas, average release rate of radioiodine and radioactive materials in particulate form with half lives greater than eight days and iodine 131 curies per reactor discharge specified in Section 2.4 of the Environmental Technical Specifications, which require investigation into the cause, reduction of the release rate and NRC

notification, will be apportioned so as to allow each party to release one half of the release rate limit as measured in curies per second for the noble gas and the radioiodines and radioactive materials in particulate form with half lives greater than eight days. The action limit for curies per reactor discharged will be apportioned in accordance with the number of reactors owned by each party.

B. By written agreement of Con Edison's IP2 Watch Supervisor and the Power Authority's IP3 Shift Supervisor, one party may allocate unused portions of its discharge of gaseous waste for a period of time to allow the other party to use the full site limit or a specified portion thereof when necessary.

C. Con Edison and the Power Authority will each prepare administrative documents which will assure compliance with the requirements of Paragraphs A through B, above.

D. In the event a site limit or authorized portion thereof is exceeded, Con Edison and Power Authority personnel shall follow the requirements of Memorandum of Understanding No. 17 in order to determine responsibility and reporting requirements.

E. Con Edison will prepare the semi-annual radiological release report required by the Environmental Technical Specifications in Section 5.6.1.2.B for the period ending December 31, 1977. For subsequent periods the Authority and Con Edison will prepare separate reports to the Commission, which will use the limits agreed to above for calculating the percent of permissible discharge rate for airborne discharges. This data will be used to calculate doses to man separately for each licensee's plants. Con Edison will perform dose calculations for all plant releases for inclusion in the Authority's report. The Authority can take over responsibility for calculation of doses for Indian Point 3 upon giving six months written notification to Con Edison.

This Memorandum of Understanding is subject to the termination stipulations detailed in Memorandum of Understanding No. 32.

Costs incurred by either party as a result of this Memorandum of Understanding shall be determined and billed as per Memorandum of Understanding No. 33.

J. P. Bayne 3/9/78
Resident Manager - IP3 - PASNY

Eugene R. McGrath 3/9/78
Manager - Nuclear Power Generation Department - Consolidated Edison

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

RADIOLOGICAL AND ENVIRONMENTAL SERVICES PROCEDURES

Procedure No. RE - CS - 030 Rev. 1

Title: RADIATION MONITOR - CALIBRATION FACTOR VERIFICATION

Directed To:

Radiological And Environmental Services Sup't	(x)
Health Physics Supervisor	(x)
Health Physics Technicians	( )
Radiological Engineer	(x)
Asst. To Radiological And Environmental Services Supt.	(x)
Self-Monitoring Personnel	( )
Chemistry Supervisor	(x)
Chemistry Technicians	(x)

Written By: [signature]
Signature/Date

Reviewed By: D. Quinn / 4-30-79
Signature/Date

Approved By: [signature] 5/1/79
RESS/Date

PORC Review: [signature] 5/24/79
Date

Approved By: [signature] 5/29/79
Res. Mgr./Date

Process Radiation Monitor - Calibration Factor Verification Program

1.0 OBJECTIVE

To provide a procedure for the determination of Process Radiation Monitor accuracy and factor verification.

2.0 PRECAUTIONS AND LIMITATIONS

2.1 All Health Physics rules and regulations shall be observed at all times.

2.2 The Senior Reactor Operator shall be notified prior to testing R-11, R-12, R-13, and R-14.

2.3 Health Physics personnel shall be notified prior to testing.

2.4 Immediately prior to testing, the alarm setpoints are to be raised to maximum. This is to avoid tripping any fans that may be in service.

2.5 This procedure shall be followed, after the I&C quarterly calibration periodic tests.

3.0 PROCEDURE

This section is divided into four parts;

3.1 R-11 containment particulate, and R-13 plant vent particulate.

3.2 R-12 containment radiogas, and R-14 plant vent radiogas.

3.3 Radioiodine stations 1, 2, 3, and 4.

3.4 Liquid release monitors.

3.1 Particulate Monitors R-11 and R-13

3.1.1 Obtain 2 smear samples from the H.P. These smears should contain ~40,000 DPM, and ~100,000 DPM respectively.

3.1.2 Perform a radiochemical analysis of each smear using Nuclear Data System, and when the wt/vol. is called for use 1. This will convert the Type-out total individual Isotopic uCi.

3.1.3 Add together the uCi of the individual positively identified isotopes with errors less than 50%.

3.1.4 Using the uCi from Step 3.1.3, calculate the equivalent CPM for R-11 and R-13 by:

$$CPM = (uCi)\left(2.22E6\ \frac{DPM}{uCi}\right)\left(.06\ \frac{CPM}{DPM}\right)$$

3.1.5 Purge R-11 and R-12 by placing the CCR switch to purge, when the indicator for R-12 attains a steady low value, shut down the pump. Then advance the filter paper until the indicator for R-11 reaches a steady low value.

3.1.6 Notify the individual at the monitor location, to remove the paper and place one smear on the crystal.

3.1.7 Wait 5 minutes.

3.1.8 Record the CPM from the indicator associated with R-11.

3.1.9 Repeat steps 3.1.6 thru 3.1.8 for the second smear.

3.1.10 Replace all associated apparatus and CCR switches back in service.

3.1.11 Calculations

$$\frac{\text{EQUIV. CPM}}{\text{ACTUAL CPM}}$$

If the above comparison is within the stated criteria, the monitor factor remains the same.

3.1.12 If the above is within 0.75 to 1.25, the monitor factor remains the same.

$$\text{New Monitor Factor} = \frac{\text{Current Monitor Factor}}{\text{3.1.11 Comparison}}$$

3.1.13 Repeat steps 3.1.6 thru 3.1.12 for R-13.

3.2 Radiogas Monitors R-12 and R-14

3.2.1 Periodically sample the containment cooling monitor R-12 for gross gas activity. Find the gross noble gas activity by performing R KBAR.

3.2.2 Knowing the activity of the sample and the count rate on the monitor calculate a factor (uCi/cc/cpm). 1

3.2.3 If the above is within 0.75 to 1.25, the monitor factor remains the same.

3.2.4 If the comparison is outside the stated limits, use the new factor.

3.2.5 Following the release of the waste gas system, integrate the R-14 chart for the average CPM for the release period.

3.2.6 Obtain the total time from the associated Airborne Release Permit for that release.

3.2.7 Calculate the R-14 indicated curies by:

Curies = (T) (CPM) (F) (M) $(2.83E^{-2})$

T = total time from (3.2.6)
CPM = integrated R-14 CPM (3.2.5)
F = vent duct flow
M = current calibration factor R-14

3.2.8 Calculate the actual curies released by:

Curies = 1.89E-3 (C) (V) (P)

C = concentrations of radioactivity in tank (uCi/cc)
V = volume of tank (Ft^3)
P = (initial tank pressure - final tank pressure) psig

3.2.9 Compare the [illegible] curies to R-14 curies by:

$$\frac{\text{Curies Step 3.2.7}}{\text{Curies Step 3.2.8}}$$

3.2.10 If the above is within 0.75 to 1.25, the monitor factor remains the same.

3.2.11 If the comparison is outside the stated limits, calculate the new factor by:

$$\text{New Factor} = \frac{\text{Current Factor}}{\text{3.2.9 Comparison}}$$

3.3 Radioiodine Monitoring Systems R-1, R-2, R-3, & R-4

3.3.1 Use a recent I-131 charcoal or Ba-133 charcoal sample and count using the appropriate job stream. For sample quantity entry use "1".

3.3.2 Calculate the equivalent radioiodine monitor CPM by:

$$CPM = (uCi\ I\text{-}131\ (2.22E6\ \frac{DPM}{uCi})\ (.032\ \frac{CPM}{DPM})$$

3.3.3 Remove the existing charcoal cartridge from the field R-1 module, place the cartridge from step 3.3.1 into the module.

3.3.4 Record the counts from the control room digital meter after 3 minutes.

3.3.5 Repeat 3.3.3 and 3.3.4 for R-2, R-3, and R-4.

3.3.6 Compare the

$$\frac{\text{Monitor Counts}}{\text{Step 3.3.2}}$$

3.3.7 If the above is within 0.75 to 1.25, the monitor factor remains the same.

3.3.8 If the comparison is outside the state limits, the I&C technician shall adjust the window to span the energy peak until the stated criteria is met.

3.4 Liquid Release Monitors

3.4.1 Obtain a sample of the tank to be discharged. Insure the tank has been recirculated 2 volumes.

3.4.2 Perform an isotopic analysis using the appropriate job stream.

3.4.3 Record total uCi/cc <u>including</u> dissolved noble gases.

3.4.4 <u>During</u> the discharge of the tank, record the monitor CPM.

3.4.5 Compare by:

$$\frac{\text{(Monitor CPM) (Current Monitor Factor)}}{\text{Sample uCi/ml (Step 3.4.3)}}$$

3.4.6 If the above is within 0.50 to 1.50, the monitor factor remains the same. When the above is greater than 2, request that the monitor be decontaminated or recalibrated electronically.

3.4.7 In any case, the alarm and valve isolation setpoints are not to raise above the 10CFR 20 diluted concentration equivalent of 1×10^{-7} uCi/cc (100,000 gpm circulation water flow). If a discharge monitor reads above that setpoint, it must be declared inoperable and repaired or decontaminated.

4.0 REPORTS

Following the completed quarterly verification program, a report is to be sent to the RESS.

SECTION II

SECTION II

LIQUID EFFLUENT CONCENTRATION

2.0 This section provides a description of the means that will be used to demonstrate compliance with Technical Specification 3.11.1.1.

The assumptions used for manual and automatic termination of releases are provided in the Attachment A and B to section No. 1. Prerelease and post release analyses that will be performed for liquid discharges are described in Table 4.11-1 of the Technical Specifications. This table also includes information on surveillance requirements, sampling analysis program, detection limitations and the need for representative sampling.

TABLE 4.11-1

ADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (uCi/ml)[a]
Batch Waste Release Tanks[e]	P Each Batch	P Each Batch	Principal Gamma Emitters[g,h]	5×10^{-7}[b]
	P Each Batch	W Composite	I-131	1×10^{-6}
	P One Batch/M	M	Dissolved and Entrained Gases	1×10^{-5}
	P Each Batch	M Composite[c]	H-3 Gross alpha P-32*	1×10^{-5} 1×10^{-7} 1×10^{-6}
	P Each Batch	Q Composite[c]	Sr-89, Sr-90 Fe-55*	5×10^{-8} 1×10^{-6}
Plant Continuous Releases[f]	Continous[d]	W Composite[d]	Principal Gamma Emitters[g] I-131	5×10^{-7}[b] 1×10^{-6}
	M Grab Sample	M	Dissolved and Entrained Gases	1×10^{-5}
	Continous[d]	M Composite[d]	H-3 Gross alpha P-32*	1×10^{-5} 1×10^{-7} 1×10^{-6}
	Continuous[d]	Q Composite[d]	Sr-89, Sr-90 Fe-55*	5×10^{-8} 1×10^{-6}

TABLE 4.11-1 (Continued)

TABLE NOTATION

*These analyses will be performed for a one-year period, and a decision made by the licensee as to the need to continue these analyses based on a review detailed in the Semi-annual Radioactive Effluent Release Report.

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 radio-chemical separation):

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

where

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

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

E is the counting efficiency (as counts per transformation);

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

2.22 is the number of transformations per minute per picocurie;

Y is the fractional radiochemical yield (when applicable);

λ is the radioactive decay constant for the particular radionuclide;

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

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. For isotopic measurements using gamma spectroscopy, the background count rate is calculated from the background counts that are determined to be within ± one full-width at half-maximum energy band about the energy of the gamma ray peak used for the quantitative analysis for that radionuclide. Typical values of L, V, Y, and Δt should be used in the calculation.

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

b. For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near the LLD. Under these circumstances, the LLD may be increased inversely proportionally to the magnitude of the gamma yield (i.e., $5 \times 10^{-7}/I$, where I is the photon abundance expressed as a decimal fraction).

c. 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.

d. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected in proportion to the rate of flow of the effluent stream. Prior to analyses, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release. Composite samplers must be engineered and backfit and will not be operational until September 1, 1981.

e. A batch release is the discharge of liquid wastes of a discrete volume.

f. A continuous release is the discharge of liquid wastes of a non-discrete volume; e.g., from a volume of system that has an input flow during the continuous release. (i.e. steam generator during a primary to secondary leak)

g. The principal gamma emitters for which the LLD specification will apply are exclusively 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 should not be reported as being present at the LLD level. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the semiannual Radioactive Effluent Release Report.

h. When operational or other limitations preclude specific gamma radioiodine analysis in batch releases, the provisions of Regulatory Guide 1.21 (Revision 1) Appendix A Section B.1, may be followed. Refer to R.G. 1.21 Section C.4 and Appendix A, Section B.

SECTION III

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3.0 GASEOUS EFFLUENT DOSE RATE

3.1 Technical Specification 3.11.2.1, Dose Rate Limits

This section is to be used to insure compliance with the following Technical Specification:

LIMITING CONDITION FOR OPERATION

3.11.2.1 The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

a. The dose rate limit for noble gas shall be <500 mrem/yr to the total body and <3000 mrem/yr to the skin.

b. The dose rate limit for all radioiodines and radioactive materials in particulate form and radionuclides other than noble gases with half lives greater than 8 days shall be <1500 mrem/yr to any organ.

3.1.1 Method I

3.1.1.1 Dose Rate Due to Noble Gases

3.1.1.1.1 Dose Rate to the Total Body

The total body dose rate due to noble gases can be determined as follows:

$$D_{tb}\left(\frac{mrem}{yr}\right) = 1.0\text{x}10^{-3}\left[Q_{tv}\,\overline{K}_v + Q_{T_s}\,\overline{K}_s\right]$$

where:

all units defined below.

3.1.1.1.2 Dose Rate to the Skin

$$D_{skin}\ (mrad) = 1.0\times10^{-3}\left[Q_{T_V}(\overline{L}_V + 1.1\overline{N}_V) + Q_{T_S}(\overline{L}_S + 1.1\overline{N}_S)\right]$$

where:

all units are defined after 3.1.1.2

3.1.1.2 Dose Rate to Critical Organ due to Radioiodines and Particulates

The dose rate to the critical organ can be determined as follows:

$$D_{thyroid}\ \frac{(mrem)}{yr} = 1.93\times10^{2}\ Q_V + 4.13\ Q_S$$

Specifications for Gaseous Waste Effluents

The terms used in these Specifications are as follows:

subscripts v, refers to vent releases from Units No.s 1, 2 and 3
s, refers to stack releases from Unit No. 1
i, refers to individual noble gas nuclide
(Refer to Tables 3.1 & 3.2 for the noble gas nuclides considered)
numbers 1, 2, 3 refer to the Units Nos. 1, 2 and 3, respectively.

Q_T = the total noble gas release rate (Ci/sec)

$= \Sigma Q_i =$ sum of the individual noble gas radionuclides determined to be present by isotopic analysis

Q_{T_S} = sum of the Unit No. 1 stack releases (Ci/sec)

$Q_{T_V} = Q_{T_{V1}} + Q_{T_{V2}} + Q_{T_{V3}}$ = sum of the vent releases from Unit No. 1, Unit No. 2 and Unit No. 3, three measurements (Ci/sec)

$\overline{K}$ = the average total body dose factor due to gamma emission (rem/yr per Ci/sec)

$\overline{L}$ = the average skin dose factor due to beta emissions (rem/yr per Ci/sec)

$\overline{M}$ = the average air dose factor due to beta emissions (rad/yr per Ci/sec)

$\overline{N}$ = the average air dose factor due to gamma emissions (rad/yr per Ci/sec)

The values of $\overline{K}$, $\overline{L}$, $\overline{M}$ and $\overline{N}$ are to be determined each time isotopic analysis is required. Determine the following using the results of the noble gas radionuclide analysis:

$$\overline{K} = (1/Q_T) \sum_i Q_i K_i$$

$$\overline{L} = (1/Q_T) \sum_i Q_i L_i$$

$$\overline{M} = (1/Q_T) \sum_i Q_i M_i$$

$$\overline{N} = (1/Q_T) \sum_i Q_i N_i$$

where the values of K_i, L_i, M_i and N_i are provided in Tables 3.1 and 3.2 and are site dependent gamma and beta dose factors

Q = the measured release rate of the radioiodines and radioactive materials in particulate forms with half-lives greater than eight days (Ci/sec).

3.1.1.3 Application of Method I

Step 1. Determine the release rate in Ci/sec (Curies per second) for Iodine-131 and for each noble gas radionuclide detected.

Step 2. Find the dose rates by multiplying release rates by the dose factors determined from Table 3.1 and 3.2.

Step 3. Find the gamma contribution to the skin dose by multiplying each noble gas release rate by its designated dose factor from Table 3.1 and 3.2 and solve the equation. Similarly, to find the Beta contribution to skin dose, multiply each noble gas release rate by its dose factors from Table 3.1 and 3.2 and solve the equation.

Step 4. Find the dose rate to the critical organ by multiplying the Iodine-131 release rates by the appropriate factors.

3.1.2 Method II

The dose rates calculated will follow the guidance presented in Regulatory Guide 1.109 using site specific parameters applicable during the period of the release.

TABLE 3.1

GAMMA AND BETA DOSE FACTORS FOR INDIAN POINT UNITS NOS. 1, 2 and 3

Noble Gas Radionuclide	$\chi/Q = 1.7\times10^{-5}$ sec/m^{-3} at 456 meters, SW — Unit No. 1 Dose Factors for Vent				$\chi/Q = 3.5\times10^{-7}$ sec/m^{-3} at 3860 meters, N — Unit No.1 Dose Factor for Stack			
	K_{iv} Total Body (rem/yr)/(Ci/sec)	L_{iv} Skin (rem/yr)/(Ci/sec)	M_{iv} Beta Air (rad/yr)/(Ci/sec)	N_{iv} Gamma Air (rad/yr)/(Ci/sec)	K_{is} Total Body (rem/yr)/(Ci/sec)	L_{is} Skin (rem/yr)/(Ci/sec)	M_{is} Beta Air (rad/yr)/(Ci/sec)	N_{is} Gamma Air (rad/yr)/(Ci/sec)
Kr-83m	6.3×10^{-4}	0	4.9	0.43	1.9×10^{-5}	0	0.1	0.0066
Kr-85m	5.8	25	34	6.1	0.32	0.52	0.71	0.33
Kr-85	0.068	23	34	0.072	0.0043	0.47	0.71	0.0045
Kr-87	18	170	170	19	0.91	3.4	3.6	0.96
Kr-88	45	40	51	47	2.5	0.81	1.0	2.7
Kr-89	9.3	170	185	9.8	0.07	3.5	3.7	0.074
Xe-131m	2.1	8.2	19	2.8	0.11	0.17	0.39	0.13
Xe-133m	1.7	17	25	2.4	0.081	0.35	0.52	0.11
Xe-133	2.0	5.3	19	2.5	0.095	0.11	0.37	0.11
Xe-135m	8.4	12	13	9.0	0.22	0.25	0.26	0.23
Xe-135	8.5	32	42	9.0	0.5	0.67	0.86	0.52
Xe-137	1.2	210	210	1.3	0.012	4.3	4.4	0.012
Xe-138	20	71	82	21	0.49	1.4	1.7	0.51

TABLE 3.2

GAMMA AND BETA DOSE FACTORS FOR
INDIAN POINT UNITS Nos. 1, 2 and 3

Noble Gas Radionuclide	$\chi/Q = 1.1\times10^{-5}$ sec/m^3 at 520 meters, SW — Unit No. 2 Dose Factors for Vent				$\chi/Q = 2.6\times10^{-5}$ sec/m^3 at 330 meters, SW — Unit No. 3 Dose Factors for Vent			
	K_{iv} Total Body rem/yr / Ci/sec	L_{iv} Skin rem/yr / Ci/sec	M_{iv} Beta Air rad/yr / Ci/sec	N_{iv} Gamma Air rad/yr / Ci/sec	K_{is} Total Body rem/yr / Ci/sec	L_{is} Skin rem/yr / Ci/sec	M_{is} Beta Air rad/yr / Ci/sec	N_{is} Gamma Air rad/yr / Ci/sec
Kr-83m	5.3×10^{-4}	0	3.2	0.35	0.001	0	7.6	0.79
Kr-85m	5.0	16	22	5.3	8.8	38	52	9.3
Kr-85	0.058	15	22	0.062	0.1	35	52	0.11
Kr-87	16	110	110	16	28	260	260	30
Kr-88	38	26	33	40	68	61	78	71
Kr-89	6.8	110	120	7.2	21	260	280	22
Xe-131m	1.8	5.3	12	2.4	3.3	13	28	4.3
Xe-133m	1.4	11	16	2.0	2.6	26	38	3.7
Xe-133	1.7	3.4	12	2.1	3.0	8	28	3.8
Xe-135m	6.9	7.9	8.2	7.3	14	19	19	15
Xe-135	7.3	21	27	7.7	13	50	64	14
Xe-137	0.93	140	140	0.98	2.6	330	330	2.8
Xe-138	16	46	53	17	34	110	130	36

SECTION IV

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4.0 LIQUID EFFLUENT DOSE CALCULATIONS

4.1 Technical Specification 3.11.1.2, Dose to an Individual

This section is to be used to insure compliance with the following Technical Specification:

LIMITING CONDITION FOR OPERATION

3.11.1.2 The dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

a. During any calendar quarter to $\leq$1.5 mrem to the total body and to <5 mrem to any organ.

The dose commitment to any individual from liquid releases is proportional to the quantity (curies) to which that individual is exposed. The following equations shall be used to calculate the dose commitment resulting from a liquid release (in curies) from Indian Point. The specification requires a monthly evaluation, however the following equations can be applied for any duration of release.

4.1.1 Method 1

4.1.1.1 Dose to the Total Body

The dose to the total body is:

$$D_{tb}(\text{mrem}) = 150(Q_{137Cs} + Q_{134Cs})$$

where:

Q_{137Cs} = Cesium-137 Release (Ci)

Q_{134Cs} = Cesium-134 Release (Ci)

4.1.1.2 Dose to the Critical Organ

The whole body dose will always be more limiting than a critical organ dose for Cesium-137 and Cesium-134 liquid releases from IP.

4.1.1.3 Application of Method I

Step 1. Determine the number of curies of Cesium 137 and Cesium 134 released during the period.

Step 2. Perform the above multiplications to obtain the total body dose for the period.

Step 3. Record the total body dose and maintain a cumulative dose for the annual and quarterly periods.

Step 4. If releases for any quarter exceed 20 curies exclusive of tritium and dissolved noble gases doses will be estimated by Method II.

4.1.3 Method II

The dose calculated shall be in conformance with Regulatory Guide 1.109 using site specific parameters applicable during the period of release.

Section 4

APPENDIX A

Basis for the Dose Calculation Methods

A. Liquid Release Dose Calculations

There are two methods for calculating the doses resulting from liquid releases. Method I provides a simple assessment of the doses resulting from normal operation of the Indian Point Plant while Method II is a complete evaluation of the resulting doses using the models of Regulatory Guide 1.109 with the parameters applicable during the time of release.

Method I has been developed from a model obtained from radioecological studies of the Hudson River. Since 1963 radioecological studies of the Hudson River estuary have been conducted by the Laboratory for Environmental Studies of the Department of Environmental Medicine of New York University Medical Center. The long term goal of these studies has been to understand the ecological cycling of radionuclides introduced to the Hudson with a view to predicting the pathways and magnitudes of radiation dose to man and biota.

Estimates from these studies of the radiation dose to man associated with reactor discharges to the estuary indicate that fish consumption is the critical dose pathway and Cs-137 and Cs-134 are the critical nuclides. The studies have also demonstrated that conventional dose models applied to the Hudson environment by the NRC have overestimated the dose from fish consumption by a factor of ten.

External exposure from radionuclides deposited on or near the shoreline has also been implicated as a potentially important exposure pathway.

The studies have shown that an annual release of 80 Ci of activity (consisting of 38Ci of radiocesium) would result in a total body dose of about 0.2 mRem/yr. Based on these same studies, it is estimated that to deliver a dose of 5 mrem/yr from Indian Point liquid wastes would require an annual release of about 1500 Ci of activity. This dose relationship has been used to develop Method I for liquid waste dose calculations.

Method II is based on Regulatory Guide 1.109 and uses the computer code LADTAP provided by the NRC in conjunction with this Guide. Dose calculations associated with the Semi-Annual Regulatory Guide 1.21 Effluent Reports for Indian Point have used this meteorology.

SECTION V

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5.1 Gaseous Effluent Dose

This section is to be used to insure compliance with the following Technical Specification:

LIMITING CONDITION FOR OPERATION

3.11.2.2 The air dose in unrestricted areas due to noble gases released in gaseous effluents shall be limited to the following:

a. During any calendar quarter to ≤ 5 mrad for gamma radiation, and <10 mrad for beta radiation; and

b. During any calendar year, ≤ 10 mrad for gamma radiation, and ≤ 20 mrad for beta radiation.

5.2.1 Method I

5.1.1.1 Air Dose Due to Gamma Radiation

$$D_{air}^{\gamma}\left(\frac{mrad}{yr}\right) = 1.0\times10^{-3}\left[Q_{T_V}\,\overline{N}_V + Q_{T_S}\,\overline{N}_S\right]$$

factors are as defined in 3.1.1.2

5.1.1.2 Air Dose Due to Beta Radiation

$$D_{air}^{\beta}\left(\frac{mrad}{yr}\right) = 1\times10^{-3}\left[Q_{T_V}\,\overline{M}_V + Q_{T_S}\,\overline{M}_S\right]$$

factors are as defined in 3.1.1.2

5.1.1.3 Application of Method I

Step 1. Determine the number of curies released during the period for each noble gas detected.

Step 2. Find the dose to air due to gamma radiation by solving the equation in section 3.2.1.1.

Step 3. Find the dose to air due to beta radiation by solving the equation in section 3.2.1.2.

5.1.2 Method II

The dose calculated shall follow the guidance of Regulatory Guide 1.109 using the meteorological dispersion parameters applicable during the periods of release.

5.2 Technical Specification 3.11.2.3, Dose to an Individual

This section is to be used to insure compliance with the following Technical Specification:

LIMITING CONDITION FOR OPERATION

3.11.2.3 The dose commitment to an individual from radioiodines, radioactive materials in particulate form and radionuclides with half-lives greater than 8 days other than noble gases in gaseous effluent released to unrestricted areas shall be limited to the following:

a. During any calendar quarter $\leq$7.5 mrem, and

b. During any calendar year $\leq$15 mrem

5.2.1 Method I

To insure that the dose limit to any organ is met; it is necessary to calculate the dose to the thyroid.

5.2.1.1 Dose to the Thyroid

$$D_{thyroid}\ \frac{(mrem)}{yr} = 1.93\times10^{2} Q_v + 4.13\ Q_s$$

factors are as defined in 3.1.1.2

5.2.1.2 Application of Method I

Step 1. Based on present measurements, determine the number of curies of Iodine-131 and particulates with half-lives greater than eight days released during the period.

Step 2. Find the thyroid dose by performing the above multiplications.

Step 3. Record the thyroid dose and maintain a cumulative record for the quarterly and annual periods.

5.2.2 Method II

The dose calculated shall be in conformance with Regulatory Guide 1.109 using the meteorological parameters applicable during the periods of release.

Section 5

APPENDIX A

B. Airborne Release Dose Calculations

The dose calculations from gaseous discharges described in section 3 of this manual have been based on the methodology used by the NRC in Appendix B to Facility Operating License for Consolidated Edison Company of New York, Inc., Indian Point Nuclear Generating Units Numbers 1, 2 and 3, Docket Numbers 50-3, 50-247 and 50-286 Environmental Technical Specification (ETS) Requirements for Once Through Cooling dated Dec. 12, 1975 as ammended.

The beta and gamma dose factors provided in Table I and Table II are taken directly from the ETS and are based on meteorological dilution factors and site boundary points identified in these Tables.

For Method 3.1.1, gamma and beta dose factors for the individual noble gas radionuclides have been calculated for the plant gaseous release points and are provided in Tables 3.1 and 3.2. The expressions used to calculate these dose factors are based on dose models derived in Section 7 of Meteorology and Atomic Energy-1968 and model techniques provided in Draft Regulatory Guide 1.AA.

Dose calculations have been made to determine the site boundary location with the highest anticipated dose rate from noble gases using onsite meteorological data and the dose expressions provided in Draft Regulatory Guide 1.AA. The dose expression considers the release point location, building wake effects, and the physical characteristics of the radionuclides.

The offsite locations with the highest anticipated annual dose from release noble gases are provided in Table 3.1 and 3.2.

The methodology in 3.1.1.2 for a radioiodine and radioactive material in particulate form with half-lives greater than eight days are dependent on existing radionuclide pathways to man. The pathways which were examined for these Specifications are: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, and (3) deposition onto grassy areas where milch animal graze with consumption of the milk by man. Methods for estimating doses to the thyroid via these pathways are described in Draft Regulatory Guide 1.AA. The offsite location with the highest anticipated thyroid dose rate from radioiodines and radioactive material in particulate form with half-lives greater than eight days was determined using onsite meteorological data and the expressions described in Draft Regulatory Guide 1.AA.

For radioiodines and radioactive material in particulate form with half-lives greater than eight days, the most restrictive location is a dairy farm located 11,260 meters in the SSW direction (vent X/Q = 2.4 x 10^{-7} sec/m^3; stack X/Q = 5.1 x 10^{-8} sec/m^3). This dairy farm is no longer operational; however, since all other dairy farms are in a less restrictive location, this location is still used for the sake of conservation in calculations.

Method 3.2 establishes methods for calculating dose levels for release of noble gases and radioiodines and radioactive material in particulate form with half-lives greater than eight days at the design objective annual quantity during any calendar quarter.

SECTION VI

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SECTION VI

PROJECTED DOSES

6.0 In sections 3, 4 and 5 a dose calculation method has been provided to determine a total dose in millirem per year or millirad per year for releases over a period of time. On a routine basis these methodologies will be incorporated into a site procedure RE-CS-039, Attachment A to this section. In this methodology the equations in section 3, 4 and 5 of this ODCM will be used to calculate the dose for a month from the releases from the site during the preceding month. These doses will be projections over the period of a year for releases from the preceding month. The actual dose calculated by these methods from the releases for the month would be 1/12 of that which has been calculated in sections 3, 4 and 5.

The methods in sections 3, 4 and 5 therefore, are used for projecting doses into the future based on past releases.

POWER AUTHORITY OF THE STATE OF NEW YORK

INDIAN POINT NO. 3 NUCLEAR POWER PLANT

CHEMICAL ANALYSIS PROCEDURES

Procedure No. RE CS 039 Rev. 0

Title: Determination of Plant Compliance with Regulatory Limits on Airborne Radioactive Discharges from Indian Point

Directed To: Radiological And Environmental Services Sup't ( )
Chemical Supervisor ( )
Chemical Technicians ( )

Written By: J. J. KELLY 8/6/77
Signature/Date

Reviewed By: 8/10/77
Signature/Date

Approved By 11/11/
RESS/Date

Approved By: 2/28/7
~~DMC/Date~~

Reviewed by PORC
JW Kilduff 2/17/7

Determination of Plant Compliance with Regulatory Limits on Airborne Radioactive Discharges from Unit No. 3

1.0 Objective

To provide a means to perform calculations necessary to comply with sections 2.4.2, 5.4 and 5.6.1.2.B of Appendix B to Facility Operating License for Power Authority of the State of New York, Indian Point Nuclear Unit Number 3, Environmental Technical Specification Requirements.

2.0 Precautions and Limitations

2.1 All samples must have been taken and analyzed as specified in RE-CS-022 and Table 2.4-2 of the above referenced Environmental Technical Specifications and as listed in Table 1 of this procedure.

2.2 All releases must have been made according to the conditions of AP-11 and a release permit issued for each release.

2.3 The results of analysis of each sample specified in 2.1 above shall be entered on a form similar to that specified in Table 2.

3.0 Procedure

3.1 On a monthly basis collect the analytical results for samples listed in Table 1 and enter data as in Table 2 with a separate sheet for each sample.

3.2 The values of K, L, M and N is then determined for each (Table I, No. 1, 2, 3, 4, 5 and 6) isotopic mixture identified in 3.1 as follows:

$$C_T = Ci$$

$$K = (1/C_T) \sum_{i=1}^{n} K_i C_i$$

$$L = (1/C_T) \sum_{i=1}^{n} L_i C_i$$

$$M = (1/C_T) \sum_{i=1}^{n} M_i C_i$$

$$N = (1/C_T) \sum_{i=1}^{n} N_i C_i i$$

where C_i = concentration of isotope i (uCi/cc)

n = number of isotopes identified in the sample

K_i = dose factor for isotope i as listed in Table 3 or 4

L_i = dose factor for isotope i as listed in Table 3 or 4

M_i = dose factor for isotope i as listed in Table 3 or 4

N_i = dose factor for isotope i as listed in Table 3 or 4

3.3 The calculation listed in step 3.2 will normally be performed by use of the TN-11 computor sequence X 1976, a copy of which is attached as Table 5.*

3.4 Enter in Table 6, information on batch releases obtained from waste release permits and 3.3 above.

3.5 The results of the analyses performed for Table 1 should be entered in Table 7 after combination with information on samples and release point flow rates.

3.6 Calculate the noble gas discharges for each unit source for each month by use of Table 8 or by program 3148 in the control room computer (copy attached) of Unit 3.*

3.7 Review all data from all sources in Tables 6, 7 and 8 and select the site combination which results in the highest noble gas discharge rate (Ci/sec.) from Unit 3. Calculate the weighted average K, L, M, N for the mixture as follows:

$$Q = {}_{i}\; C_{T_i} \; (V)$$

$$K = (1/C\ ) \quad K_i C_{T_i}$$

$$L = (1/C\ ) \;{}_{i}\; L_i C_{T_i}$$

$$M = (1/C\ ) \;{}_{i}\; M_i C_{T_i}$$

$$N = (1/C\ ) \;{}_{i}\; N_i C_{T_i}$$

*Note: not attached in ODCM

where C_{T_i} for each source is calculated in 3.2.

K_i for each source is calculated in 3.2.

L_i for each source is calculated in 3.2.

M_i for each source is calculated in 3.2.

N_i for each source is calculated in 3.2.

V = discharge rate (cc/sec.).

The K_i, L_i, M_i and N_i used should be those measured for the samples listed in Table 1 which are most representative of the discharge sources.

3.8 Using the values obtained in 3.7, perform the following calculations:

$$2.0\ Q \quad K = A$$

$$0.33\ Q \quad (L + 1.1\ N) = B$$

where Q, K, L and N have been calculated in 3.7.

3.9 Select the larger of the 2 values, A and B, and record this in Table 9 as the fraction of permissible discharge rate for noble gases.

3.10 Determine the total amount of noble gases (Curies) released from vents and/or stack of each unit by use of Table 8 or the Unit CCR computer program, subtract the batch releases listed in Table 7 for that Unit. Obtain the K, L, M, N from Table 2 which is associated with the sample listed in Table 1 (item 4, 5 or 6) that represents the net amount of activity calculated above and obtain the M and N calculated in Table 2 for each of the batch releases subtracted. Obtain a new time average M and N by the technique listed in 3.7 by the use of total curies of each release combined with their respective M, N values.

3.11 Obtain the monthly time average fraction of the quarterly permissible discharge rate as follows:

$$C = 13\ Q_T\ N$$

and

$$D = 6.3\ Q_T\ M$$

where: Q = total curies discharged from the site M, N = are as defined above.

3.12 Record the higher of the two values, C or D, as A.2 in Table 9.

3.13 To obtain the monthly time average fraction of the annual permissible discharge rate, obtain the total curies and M, N from 3.10 above and calculate as follows:

$$E = 25\, Q_T\, N$$

and

$$F = 13\, Q_T\, \frac{M}{V}$$

3.14 Record the higher of the two values, E or F, as A.3 in Table 9.

3.15 To obtain the monthly time average fraction of the quarterly average reporting level, obtain the total curies and M, N from 3.10 above and calculate as follows:

$$G = 50\, Q_T\, N$$

and

$$H = 25\, Q_T\, M$$

3.16 Record the higher of the two values, G and H, as A.4 in Table 9.

3.17 The data obtained in steps 3.8 through 3.16 above will be used in providing the monthly report required in AP-11 to the Chief Operations Engineer. For the purpose of reporting required by Regulatory Guide 1.21 the monthly time averages in steps 3.10 through 3.16 will be combined as weighted (with total curies for each month) averages to obtain a fraction of quarterly limits and annual limits. The highest value listed in Table 9.A.1 for the 3 months in each quarter will also be used for Regulatory Guide 1.21 reporting.

3.18 To determine the fraction of permissible discharge rate for radioiodine and particulates with half-life greater than eight days obtain the results of analyses of samples required for items 7 through 12 in Table 1. Add together the I-131 and particulates with half life greater than 8 days for each release point for each sampling period (weekly - see Table 7). Calculate the fraction of permissible as follows:

$$I = (2.9 \times 10^5)\, Q_V + (6.2 \times 10^4)\, Q_S$$

where Q_V = sum of iodine 131 and particulates with t 1/2 8 days released from Plant vent (Ci/sec.)

Q_S = the iodine 131 and particulates with t 1/2 8 days released from the Unit 1 stack (Ci/sec.)

3.19 Record the calculated value of I as B.1 in Table 9.

3.20 The weekly values listed above Q_V and Q_S in 3.17 will then be averaged over each calendar month again prorating when weekly time periods overlap the monthly periods. The monthly average fraction of the quarterly limit will then be calculated as follows:

$$J = 13\ (2.9 \times 10^5)\ \bar{Q}_V + (6.2 \times 10^4)\ \bar{Q}_S$$

where $\bar{Q}_V$ and $\bar{Q}_S$ are the monthly time averages of the weekly values defined in 3.17 above (Ci/sec.).

3.21 The value of J should then be recorded in B.2 of Table 9.

3.22 The monthly average fraction of the annual average limit on particulate and iodine 131 releases is then calculated as follows:

$$P = 25\ (2.9 \times 10^5)\ \bar{Q}_V + (6.2 \times 10^4)\ \bar{Q}_S$$

where $\bar{Q}_V$ and $\bar{Q}_S$ are as defined in 3.20.

3.23 The value of J should be recorded in B.3 of Table 9.

3.24 The monthly average fraction of the 30 day report limit for iodines and particulates can then be determined as follows:

$$R = 2P$$

where P is defined in step 3.22.

3.25 Record the value of R in B.4 of Table 9.

3.26 Obtain the amount of Iodine-131 released from the reactor by summing the I-131 released from the vents on that unit as recorded in Table 7. Where sampling times overlap monthly periods, the totals should be prorated to correspond to the calendar monthly period. The total curies for the Unit should than be recorded in B.5 of Table 9.

3.27 The information in Table 9 will be submitted to the Chief Operations Engineer on a monthly basis in accordance with the reporting requirements of AP-107. Where periodic review of release permits and release samples indicate that the monthly time averages for the above parameters may exceed the quarterly or annual limits, an immediate report of this condition will be provided to the Chief Operations Engineer.

<u>Table I</u>

	Analysis	System	Frequency
1.	Gamma Emitters	Gas Decay Tank	Each Release
2.	Gamma Emitters	Containment Atmosphere	Each Purge
3.	Gamma Emitters	Containment	One Pressure Relief Monthly
4.	Gamma Emitters	Condenser Air Ejector	Monthly
5.	Gamma Emitters	Plant Vent	Monthly
6.	Gamma Emitters	BDFTV	Monthly (During Tube Leak)
7.	Particulate Gamma Emitters	Plant Vent	Weekly
8.	Particulate Gamma Emitters	BDFTV	Weekly (During Tube Leak)
9.	Particulate Sr-89, 90	Plant Vent	Monthly Comp.
10.	Particulate Sr-89, 90	BDFTV	Monthly Comp. (During Tube Leak)
11.	Iodine-131	Plant Vent	Weekly
12.	Iodine-131	BDFTV	Weekly
13.	Gamma Emitters	Uncontrolled Release	As Needed

TABLE 2

PGM: X 1976 KLMN - BAR DETERMINATION

Unit No. ____________

Date ____________

Time ____________

Sample No. ____________

Permit No. ____________

Heading ____________

ISOTOPE	CONCENTRATION uCi/cc
KR-83m	E
KR-85m	E
KR-85	E
KR-87	E
KR-88	E
KR-89	E
XE-131m	E
XE-133m	E
XE-133	E
XE-135m	E
XE-135	E
XE-137	E
XE-138	E

K ____________

L ____________

M ____________

N ____________

TABLE 3

GAMMA AND BETA DOSE FACTORS FOR
INDIAN POINT UNIT NO. 3

$X/Q = 2.6 \times 10^{-5}$ sec/m^3 at 330 meters, SW

Unit No. 3 Dose Factors for Vent

Noble Gas Radionuclide	K_{is} Total Body rem/yr / Ci/sec	L_{is} Skin rem/yr / Ci/sec	M_{is} Beta Air rad/yr / Ci/sec	N_{is} Gamma Air rad/yr / Ci/sec
Kr-83m	0.001	0	7.6	0.79
Kr-85m	8.8	38	52	9.3
Kr-85	0.1	35	52	0.11
Kr-87	28	260	260	30
Kr-88	68	61	78	71
Kr-89	21	260	280	22
Xe-131m	3.3	13	28	4.3
Xe-133m	2.6	26	38	3.7
Xe-133	3.0	8	28	3.8
Xe-135m	14	19	19	15
Xe-135	13	50	64	14
Xe-137	2.6	330	330	2.8
Xe-138	34	110	130	36

Month________ Year 19________ TABLE 6 Page________ of ________

Sample Point	Release Permit Number	Sample Number	Activity (uCi/cc)	Date	Release Start Time	Release Finish Time	K BAR	L BAR	M BAR	N BAR	Curies Released	Relea Rate Ci/Se

7

TABLE 7

AIRBORNE DISCHARGES

UNIT ________ YEAR ________ MONTH ____________ POINT ________

PARAMETERS	UNITS	DATE FROM ____ TO	DATE FROM ____ TO	DATE FROM ____ TO	DATE FROM ____ TO
Sample time	(min)				
VOLUME OF: Tritium	(scc)				
Part.-I	(scc)				
Vent Avg.	(cfm)				
Vent Sum	(scc)				
I - 131	(Ci)				
I - 133	(Ci)				
I - 135	(Ci)				
I - Sum	(Ci)				
Particulate: Sr - 89	(Ci)				
Sr - 90	(Ci)				
Cs - 134	(Ci)				
Cs - 137	(Ci)				
I - 131	(Ci)				
SUM of	(Ci)				
Gross Alpha	(Ci)				
Noble Gas: Kr - 83M	(Ci)				
Kr - 85M	(Ci)				
Kr - 85	(Ci)				
Kr - 87	(Ci)				
Kr - 88	(Ci)				
Kr - 89	(Ci)				
Xe -131M	(Ci)				
Xe -133M	(Ci)				
Xe -133	(Ci)				
Xe -135M	(Ci)				
Xe -135	(Ci)				
Xe -137	(Ci)				
Xe -138	(Ci)				
SUM of	(Ci)				
H^3	(Ci)				

Table 8

Determination of Gross Noble Gas Releases

Sample Point: Auxiliary Building Vent Exhaust (Continuous)*
Condenser Air Ejector Exhaust
Steam Generator Blowdown Tank Vent

Date: __________ to __________

Day	PRM Gross Count Rate (CPM)	PRM Background Count Rate (CPM)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
Monthly Average		

Monthly Average Net Count Rate R = __________ cpm

Gross Counting Efficiency Eg = __________ cpm/uCi/cc

Monthly Average Gross Noble Gas Concentration C = R/Eg = __________ uCi/cc

Vent Volume Discharged During Month V = __________ cc

Total Noble Gases Released During Month 10^{-6} VC = __________ Ci

Table 9

Fraction of Permissible Discharge Rates

Month ____________________ Year ____________________

A. Noble Gas Limits

1. Fraction of Permissible Discharge Rate (2.4.2.a.1) ____________
2. Monthly Time Average Fraction of Quarterly Permissible Discharge Rate (2.4.2.b.1) ____________
3. Monthly Time Average Fraction of Annual Permissible Discharge Rate (2.4.2.b.2) ____________
4. Monthly Time Average Fraction of Annual Discharge Rate Requiring 30 Day Report (2.4.2.c.1) ____________

B. Radio-iodines and Particulates (t 1/2 8 Days)

1. Fraction of Permissible Discharge Rate (2.4.2.a.2) ____________
2. Monthly Time Average Fraction of Quarterly Permissible Discharge Rate (2.4.2.b.4) ____________
3. Monthly Time Average Fraction of Annual Permissible Discharge Rate (2.4.2.b.4) ____________
4. Monthly Time Average Fraction of Annual Discharge Rate Requiring 30 Day Report (2.4.2.C.2) ____________
5. Amount of Iodine-131 Released from each Reactor During the Month

   Unit 1 ____________ Ci

   Unit 2 ____________ Ci

   Unit 3 ____________ Ci

SECTION VII

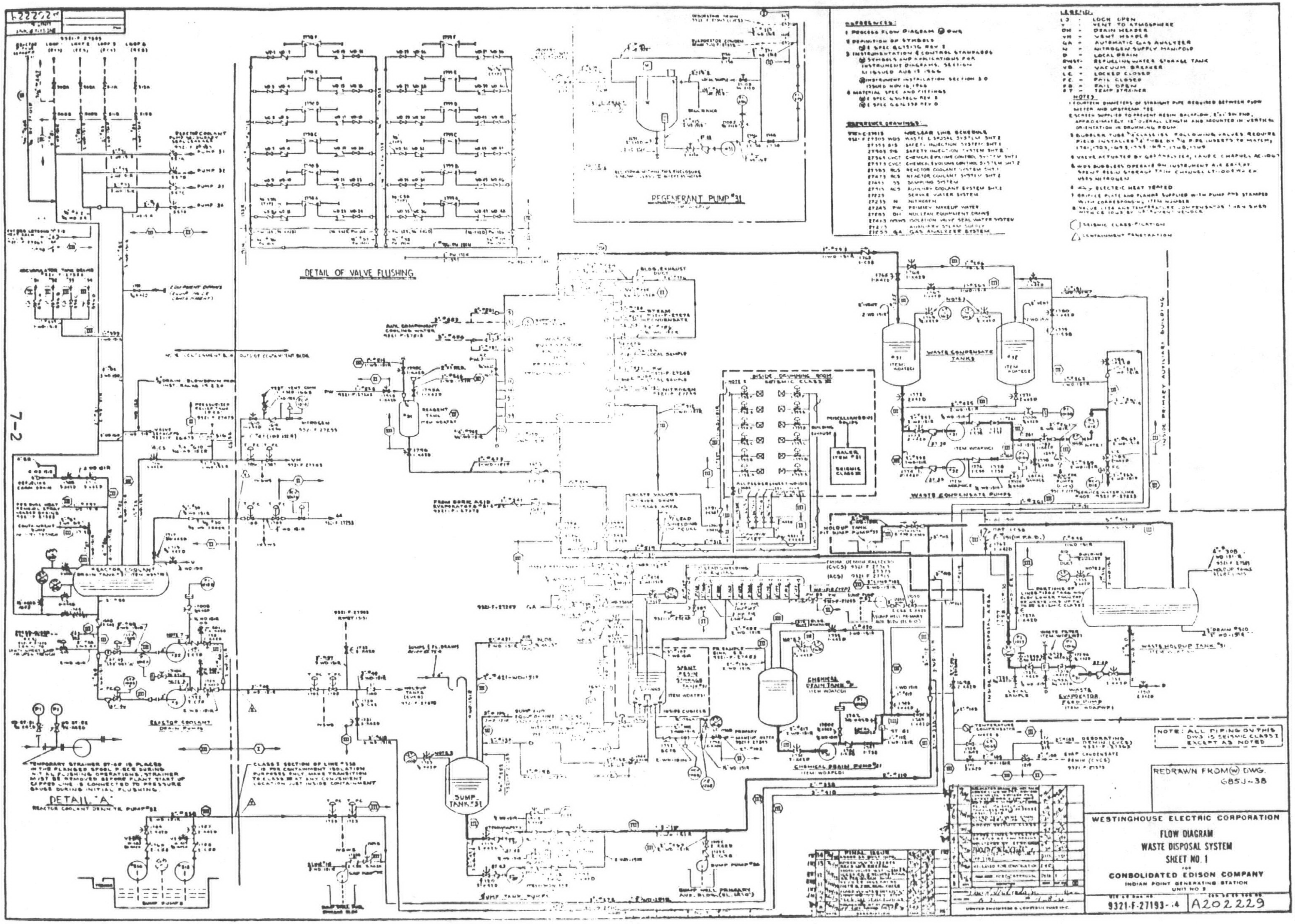
SECTION VII

OPERABILITY OF EQUIPMENT

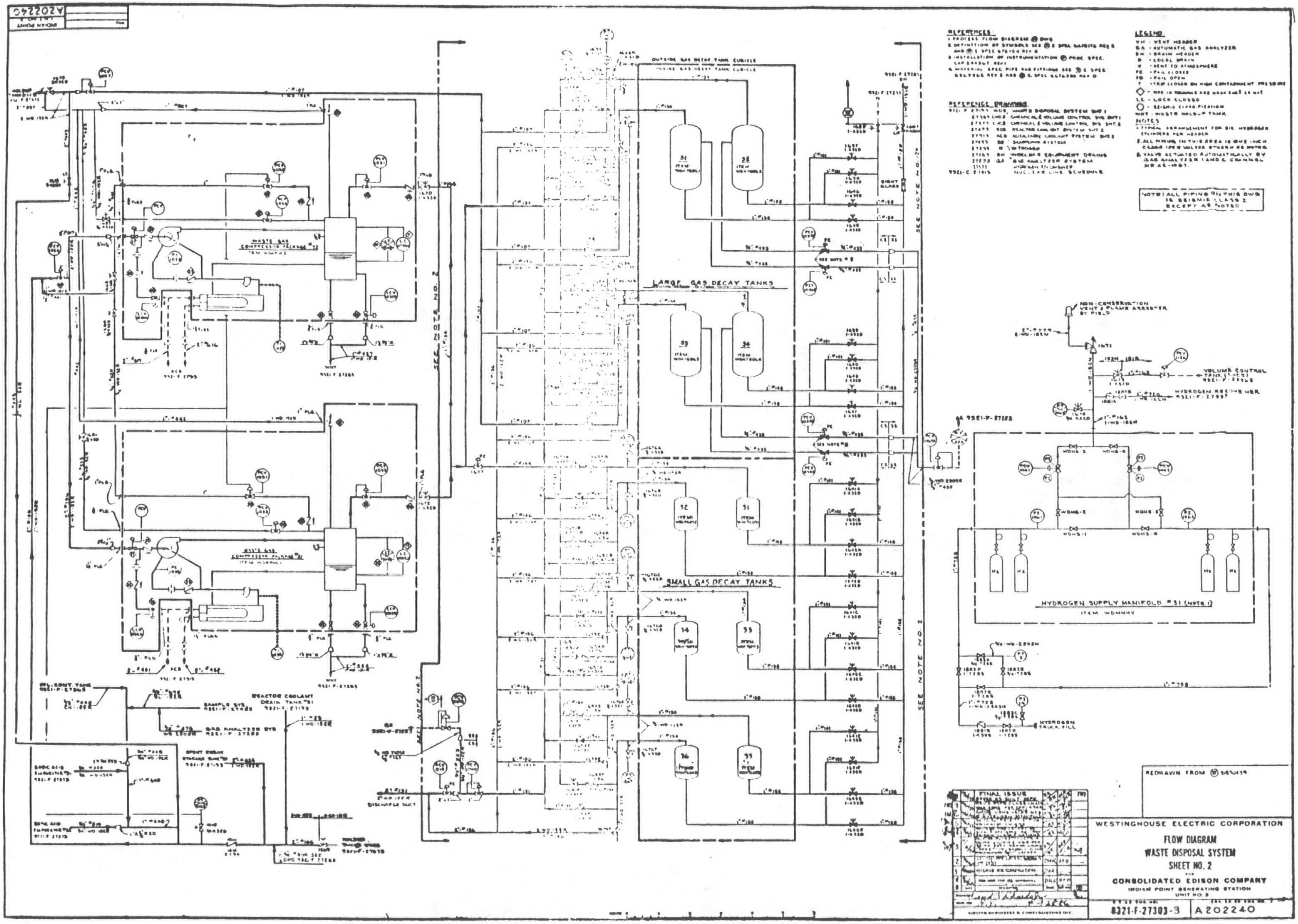
7.0 This section includes flow diagrams defining the treatment paths and the components of the radioactive liquid, gaseous and solid waste management systems at Indian Point 3. These systems are maintained and used pursuant to requirements of 10CFR50.36a, to meet Technical Specifications 3.11.1.3, 3.11.2.4 and 3.11.3.1. The drawings are taken from the final Safety Analysis Report for Indian Point 3 and from the plant manual.

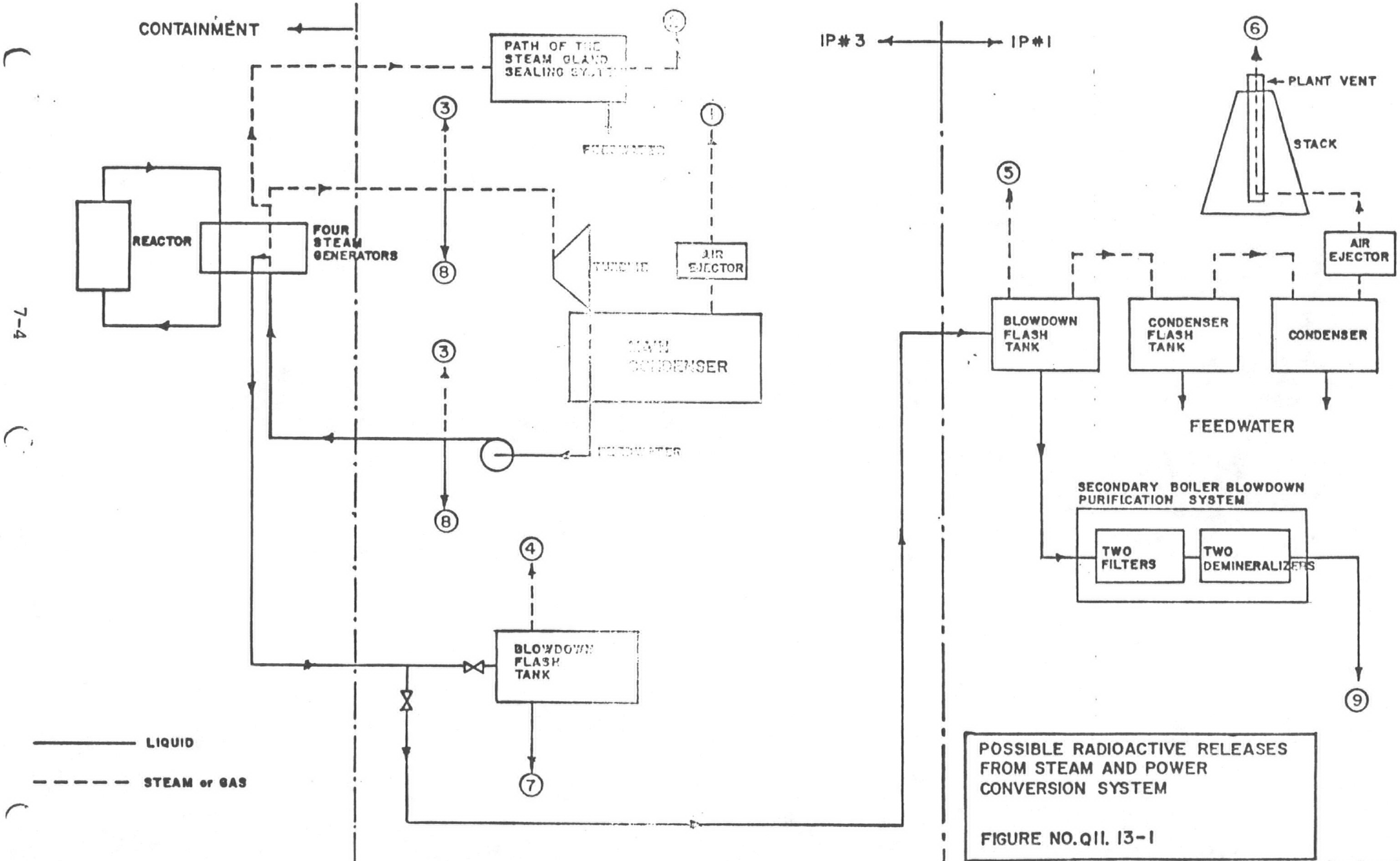
Figure 7.1 is a flow diagram of the Indian Point 3 radioactive liquid waste disposal system. Figure 7.2 is a flow diagram of the Indian Point 3 gaseous radioactive waste disposal system. Figure 7.1 also provides information on the solid waste handling system for evaporator bottoms and bailing of solids at Indian Point 3.

Figure 7.3 is a description of the intertie between the Unit No. 3 steam generator blowdown and the blowdown purification system which is physically installed in the Indian Point 1 facility. During periods of steam generator tube leakage the blowdown from the leaking steam generator is diverted to the Unit No. 1 system in order to reduce radioactive releases to the environment through the blowdown pathway. In addition, further redundance in liquid waste processing capability is provided by a line which allows for transfer of liquid waste from the Indian Point 3 waste holdup tank No. 31 shown on drawing 7.1 to the liquid waste handling system of the Indian Point 1 facility.



DETAIL OF VALVE FLUSHING
REGENERANT PUMP #31
REACTOR COOLANT DRAIN TANK
REACTOR COOLANT DRAIN PUMPS
DETAIL "A"
SUMP TANK #31
SUMP TANK PUMPS
SUMP PUMPS
WASTE CONDENSATE TANKS
WASTE CONDENSATE PUMPS
INSIDE DRUMMING ROOM
MISCELLANEOUS PUMPS
BALER
CHEMICAL DRAIN TANK
CHEMICAL DRAIN PUMP #31
SPENT RESIN STORAGE TANK
WASTE HOLDUP TANK #31
WASTE EVAPORATOR FEED PUMP
SUMP PUMP #36
NOTE: ALL PIPING ON THIS DWG IS SEISMIC CLASS I EXCEPT AS NOTED
REDRAWN FROM (W) DWG. 685J-38
WESTINGHOUSE ELECTRIC CORPORATION
FLOW DIAGRAM
WASTE DISPOSAL SYSTEM
SHEET NO. 1
CONSOLIDATED EDISON COMPANY
INDIAN POINT GENERATING STATION
9321-F-27193-4
A202229


A202240
INDIAN POINT
REFERENCES
REFERENCE DRAWINGS
LEGEND
NOTES
NOTE: ALL PIPING ON THIS DWG IS SEISMIC CLASS I EXCEPT AS NOTED
OUTSIDE GAS DECAY TANK CUBICLE
INSIDE GAS DECAY TANK CUBICLE
LARGE GAS DECAY TANKS
SMALL GAS DECAY TANKS
WASTE GAS COMPRESSOR PACKAGE #31
WASTE GAS COMPRESSOR PACKAGE #32
SEE NOTE NO. 2
NON-CONSERVATION VENT & FLAME ARRESTER BY FIELD
VOLUME CONTROL TANK
HYDROGEN RECOMBINER
HYDROGEN SUPPLY MANIFOLD #31 (NOTE 1)
HYDROGEN TRUCK FILL
REACTOR COOLANT DRAIN TANK #31
SAMPLE SYS.
GAS ANALYZER SYS
SPENT RESIN STORAGE TANK
DISCHARGE DUCT
REDRAWN FROM
FINAL ISSUE
WESTINGHOUSE ELECTRIC CORPORATION
FLOW DIAGRAM
WASTE DISPOSAL SYSTEM
SHEET NO. 2
FOR
CONSOLIDATED EDISON COMPANY
INDIAN POINT GENERATING STATION
UNIT NO. 3
9321-F-27303-3
A202240



POSSIBLE RADIOACTIVE RELEASES FROM STEAM AND POWER CONVERSION SYSTEM

FIGURE NO. Q11. 13-1

SECTION VIII

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Section 8

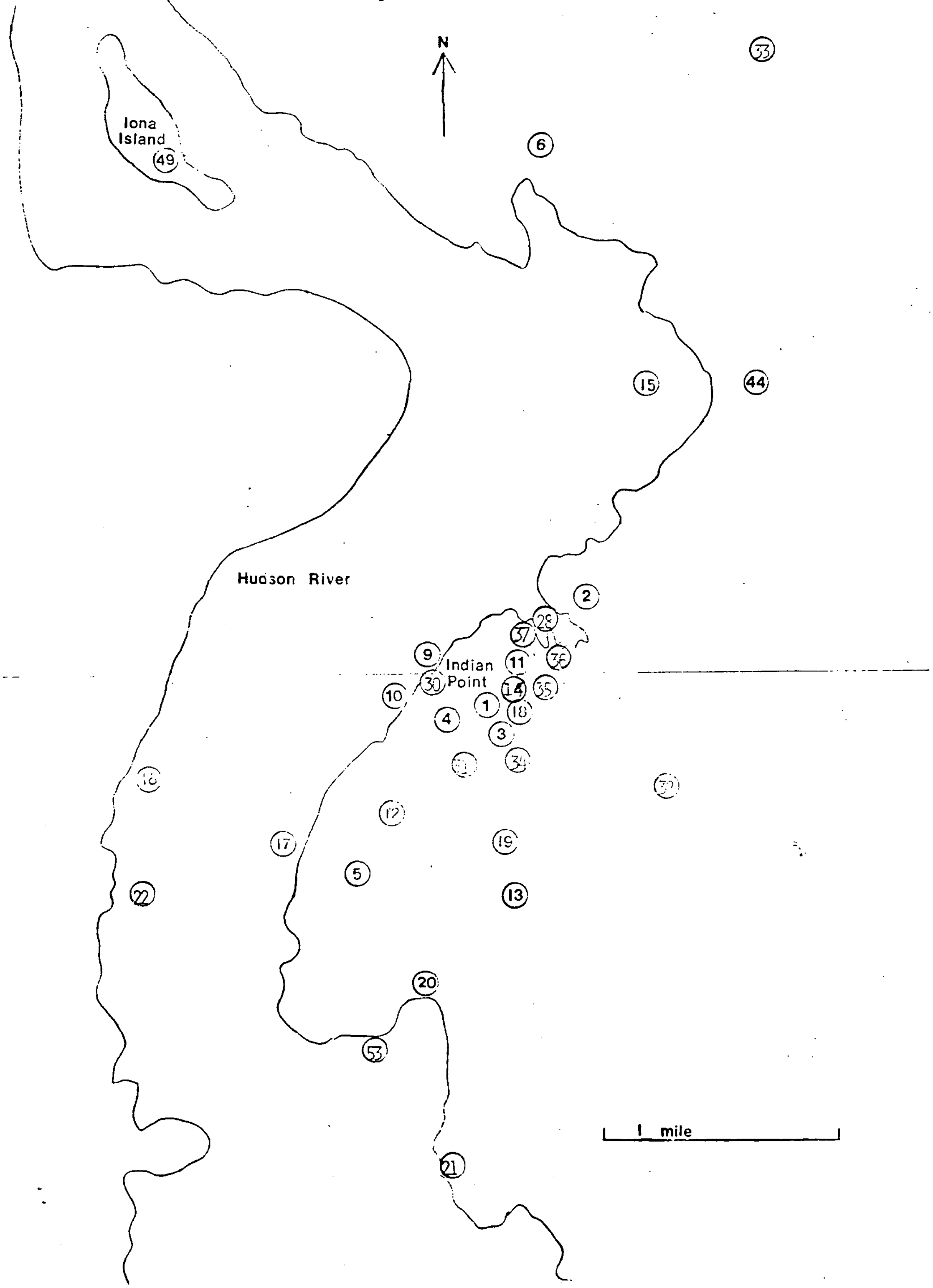
Sample Locations

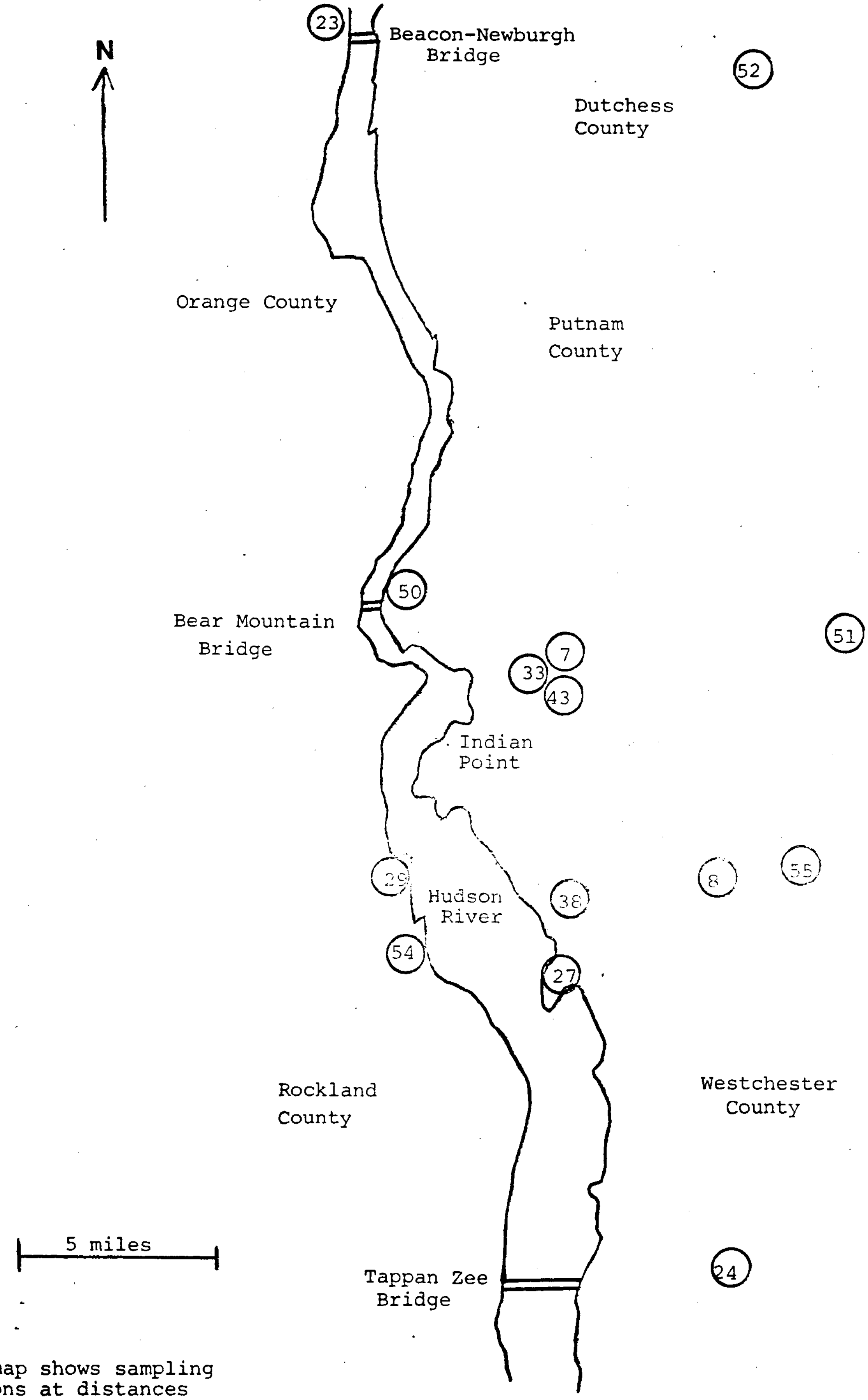
Figure 8.1 is a map which shows the location of environmental sampling points within 2.5 miles of the Indian Point Plant and Figure 8.2 is a map providing the same information for points at greater distances from the plant.

Table 8.1 provides a description of environmental sampling locations and the sample types collected at each of these locations. Table 8.2 provides information on methods of sample collection, sampling frequency and types of analysis performed.

Table 8.3 provides information on limits of detection for each type of analysis performed.

Figure 8.1


N
Iona Island
49
33
6
15
44
Hudson River
2
28
37
36
9
Indian Point
11
30
14
35
10
1
18
4
3
34
12
17
19
5
22
13
20
53
21
1 mile



Note: this map shows sampling stations at distances greater than 2.5 miles from Indian Point

TABLE 8.1 (1 of 4)

INDIAN POINT STATION - LOCATION OF SAMPLING STATION POINTS

Sample Station Points	Location/Distance	Sample Types
1	Environmental Laboratory, Onsite - SSE	Fallout Air Particulate Radioiodine Direct Gamma Soil
2	Standard Brands, 0.6 mi - NNE	Air Particulate Radioiodine Direct Gamma Soil
3	Service Building, Onsite - SSE	Air Particulate Radioiodine Direct Gamma Soil
4.	Algonquin Gas Line, 0.25 mi - S	Air Particulate Radioiodine Direct Gamma Soil
5	NYU Tower, 1 mi - SSE	Air Particulate Radioiodine Direct Gamma Soil
6	Camp Smith, 2.5 mi - NNE	Well Water Soil
7	Camp Field Reservoir, 3.5 mi - NE	Drinking Water
8	New Croton Reservoir, 7 mi - ESE	Drinking Water
9	Inlet pipe into plants - NNE	HR* Water
10	Discharge Canal, Onsite - SW	HR Water HR Bottom Sediment
11	Iroquois Lake, Onsite - E	Surface Lake Water
12	Trap Rock Lake, 0.75 mi - SSE	Surface Lake Water
13	Lake Meahagh, 1 mi - SSE	Surface Lake Water

*HR = Hudson River

TABLE 8.1 (2 of 4)

INDIAN POINT STATION - LOCATION OF SAMPLING STATION POINTS

Sample Station Points	Location/Distance	Sample Types
14	Water Meter House, Onsite - E	Direct Gamma
15	Peekskill Bay, 1.5 mi - NE	Shoreline Soil HR Bottom Sediment
16	Tompkins Cove, 1.5 mi - WSW	HR Bottom Sediment
17	Off Verplanck, 1 mi - SSW	Shoreline Soil HR Bottom Sediment
18	Indian Point, Onsite - SE	Soil Well Water
19	St. Mary's Cemetery, 0.75 - SSE	Soil
20	Montrose Marina, 1.5 mi - S	Soil
	George's Island, 2.5 mi - SSE	Soil
22	Lovett, 1.5 mi - WSW	HR Bottom Sediment
23	Roseton**, 20 mi - N	Fallout Air Particulate Radioiodine Direct Gamma
24	Eastview, 15 mi - SE	Fallout
25	Where available near site	Fish
26	New York City Aqueduct, Onsite (tap water)	Drinking Water
27	Croton Point, 7.5 mi - SSE	Air Particulate Radioiodine Direct Gamma Fallout
28	Lent's Cove, 0.5 mi - NE	**Bottom Sediment Direct Gamma

**Control Station

TABLE 8.1 (3 of 4)

INDIAN POINT STATION - LOCATION OF SAMPLING STATION POINTS

Sample Station Points	Location/Distance	Sample Types
29	Grassy Point, 3 mi - S	Air Particulate Radioiodine Direct Gamma Fallout
30	Dock, Onsite - W	Direct Gamma Soil
31	Onsite Pole - S	Direct Gamma
32	Factory St. SS, 1 mi - ESE	Direct Gamma
33	Hamilton St. SS, 3 mi - NNE	Direct Gamma
34	SE Corner Onsite - SE	Direct Gamma
35	Bleakley & Broadway, Onsite - E	Direct Gamma
36	Old Dump, 0.5 mi - ENE	Direct Gamma
[illegible]	NE Corner, Onsite - NE	Direct Gamma
38	Furnace Dock, 3.5 mi - SE	Air Particulate Radioiodine Direct Gamma Fallout
41	Appropriate locations in critical wind sections	Food Products (leafy green vegetables)
43	Oregon Road, 3.4 mi - NE	Air Particulate Radioiodine
44	Gas Holder Bldg., 1.75 mi - NE	Air Particulate Radioiodine
49	Iona Island, 2.5 mi - NNW	HR Bottom Sediment Shoreline Soil
50	Manitou Inlet**, 4.5 mi - NNW	HR Bottom Sediment Shoreline Soil

**Control Station

INDIAN POINT STATION - LOCATION OF SAMPLING STATION POINTS

Sample Station Points	Location/Distance	Sample Types
51	Windsor Farms, 10 mi - ENE	Milk
52	Shenandoah Farms**, 19.6 mi - NNE	Milk
53	White Beach, 0.9 mi - SSW (East side HR, below Ind. Pt.)	Shoreline Soil
54	Haverstraw Beach, 4 mi - SSW	Shoreline Soil
55	Hilltop Hanover Farms, 8.9 mi - ESE	Milk

**Control Stations

TABLE 8.2 (1 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE:			
a. Radioiodine and Particulates	Locations 1, 2, 3, 4, 5, 23, 27, 29, 38, 43, 44.	Continuous operation of sampler with sample collection as required by dust loading but at least once per 7 days.	Radioiodine canister. Analyze at least once per 7 days for I-131. Particulate sampler. Analyze for gross beta radioactivity ≥ 24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is > 10 times the mean of control sample. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.
2. DIRECT RADIATION:	Locations 1, 2, 3, 4, 5, 23, 27 through 38.	At least once per 31 days.	Gamma dose. At least once per 31 days.

**Sample locations are shown on Figures 8.1 and 8.2.

TABLE 8.2 (2 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE:			
a. Surface (River)	Locations 9, 10	Composite* sample collected over a period of ≤ 31 days.	Gamma Isotopic analysis of each sample by location. Tritium analysis of composite*** sample at least once per 92 days.
b. Surface (Lake)	Locations 11, 12, 13.	Grab sample at least once per 31 days.	Gamma isotopic analysis of each sample by location. Tritium analysis of composite**** sample at least once per 92 days.
c. Ground	Locations 6, 18.	Grab Sample at least once per 31 days.	Gamma isotopic analysis of each sample. Tritium analysis of composite posite**** sample at least once per 92 days.

* Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.
** Sample locations are shown on Figures 8.1 and 8.2
*** Composite of aliquots of monthly samples.
**** Composite of monthly grab samples.

TABLE 8.2 (3 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
d. Fallout (Rainwater)	Locations 1, 23, 24, 27, 29, 38.	Composite* sample collected over a period of ≤ 31 days.	Gamma isotopic and tritium analyses of each sample.
e. Drinking	Locations 7, 8, 26.	Grab sample at least once per 31 days.	I-131 analysis of each sample required if calculated dose for water consumption is > 1 mrem/yr. and Gamma isotopic analysis of each sample. Tritium analysis of composite**** sample at least once per 92 days.
f. Bottom Sediment	Locations 10, 15, 16, 17, 22, 28, 49, 50.	Once each in the spring and in the summer.	Gamma isotopic analysis of each sample.
g. Sediment from Shoreline	Locations 15, 17, 49, 50, 53, 54.	Once each in the spring and in the summer.	Gamma isotopic analysis of each sample.

* Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.

** Sample locations are shown on Figures 8.1 and 8.2.

**** Composite of monthly grab samples.

TABLE 8.2 (4 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION:			
a. Milk	Locations 51, 52, 55.	When animals are on pasture at least once per 31 days or at least once per 15 days when the calculated dose is greater than 15 mrem/yr.	Gamma isotopic and I-131 analysis of each sample.
b. Fish and Invertebrates	Location 25.	One sample in season, or at least once per 184 days if not seasonal.	Gamma isotopic analysis on edible portions.
c. Food Products	Location 41.	At time of harvest, grab sample of leafy green vegetables grown within 10 miles of the site.	Gamma isotopic and I-131 analysis on edible portion
d. Soil	Locations 1, 2, 3, 4, 5, 6, 18, 19, 20, 21, 31.	Grab sample at least once per 3 years.	Gamma isotopic analysis.

**Sample locations are shown on Figures 8.1 and 8.2.

TABLE 8.3 (1 of 3)

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

Analysis	Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg,wet)	Milk (pCi/l)	Food Products (pCi/kg,wet)	Sediment (pCi/kg,dry)
gross beta	4[b]	1×10^{-2}				
^{3}H	2000(1000[b])					
^{54}Mn	15		130			
$^{58, 60}Co$	15		130			
$^{95}Zr\text{-}Nb$	15					
^{131}I	1	7×10^{-2}		1	60[c]	
$^{134, 137}Cs$	15(10[b]), 18	1×10^{-2}	130	15	80	150
$^{140}Ba\text{-}La$	15			15		

TABLE NOTATION

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 radio-chemical separation):

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

where:

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

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

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

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

2.22 is the number of transformations per minute per picocurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide,

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

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 (e.g., potassium-40 in milk samples).

TABLE NOTATION

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

b - LLD for drinking water.

c - LLD for leafy vegetables.