Entergy

Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, N.Y. 10511-0249
Tel (914) 734-6710

Robert Walpole
Licensing Manager

NL-10-045

April 29, 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

SUBJECT: 2009 Annual Radioactive Effluent Release Report
Docket No. 50-03, 50-247, 50-286
License Nos. DPR-5, DPR-26, DPR-64

Dear Sir or Madam:

Enclosure 1 to this letter provides Entergy Nuclear Operations, Inc.'s (ENO's) Annual Effluent and Waste Disposal Report for 2009. This report is submitted in accordance with Technical Specification 5.6.3 and Regulatory Guide 1.21.

There are no new commitments identified in this submittal. If you have any questions or require additional information, please contact my office at (914) 734-6710.

Sincerely,

RW/dmt

Enclosures:
1. 2009 Annual Radioactive Effluent Release Report
2. 2009 Offsite Dose Calculation Manual Changes and Justification Package

A009
IE48
NRR

cc: Mr. John P. Boska, NRC NRR Senior Project Manager
Mr. Samuel J. Collins, Regional Administrator, NRC Region I
IPEC NRC Senior Resident Inspectors Office
Mr. Ted Smith, NRC Unit 1 Project Manager
Mr. Francis J. Murray, President and CEO, NYSERDA (w/o attachment)
Mr. Paul Eddy, New York State Dept. of Public Service (w/o attachment)
Mr. Timothy Rice, Bureau of Hazardous Waste & Radiation Mgmt, NYSDEC
Mr. Robert Snyder, NYS Department of Health
Mr. Chuck Nieder, NYS Department of Environmental Conservation
Mr. Robert Oliveira, American Nuclear Insurers
Chief, Compliance Section, New York State DEC, Division of Water
Regional Water Engineer, New York State DEC

ENCLOSURE 1 TO NL-10-045

2009 Annual Radioactive Effluent Release Report

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 1, 2, AND 3
DOCKET NOS. 50-03, 50-247, AND 50-286
LICENSE NO. DPR-5, DPR-26, AND DPR-64

Radioactive Effluent Release Report: 2009

Facility Indian Point Energy Center (Indian Point Units 1, 2, and 3)

Licensee Entergy Nuclear Operations, Inc (Entergy)

This information is provided in accordance with the requirements of Regulatory Guide 1.21. The numbered sections of this report reference corresponding sections of the subject Guide, pages 10 to 12. This report includes effluent information from Indian Point units 1, 2, and 3. Units 1 and 2 share effluent processing equipment and Technical Specifications. In this site report, releases from Unit 1 are included with Unit 2, while Unit 3 releases are calculated and shown separately.

A. Supplemental Information

1. Regulatory Limits

Indian Point Energy Center is subject to limits on radioactive waste releases that are set forth in the Offsite Dose Calculation Manual (ODCM), Parts I and II, as defined in the Technical Specifications. ODCM Part I, also known as the Radiological Effluent Controls (or RECS) contains the specific requirements and controls, while ODCM Part II (calculational methodologies) contains the details necessary to perform offsite dose calculations from the sampling and monitoring outlined in the RECS.

2. Maximum Permissible Concentration

a) Airborne Releases

Maximum concentrations and compliance with 10CFR20 release rate limits are controlled by the application of Radiation Monitor setpoints, preliminary grab sampling, and conservative procedural guidance for batch and continuous releases. These measures, in conjunction with plant design, preclude approaching release rate limits, per the ODCM.

b) Liquid Effluents

Proximity to release rate and total release limits is controlled through the application of a calculated Allowed Diluted Concentration (ADC) and ALARA guidance with regard to dilution flow and maximum tank concentration. The ADC is used to determine a Radiation Monitor setpoint associated with an estimated amount of Beta activity, as well as the measured gamma activity. ADC is defined in the station ODCM as a means of assuring compliance with the release rate limits of 10CFR20, as defined by the application of ten times the Effluent Concentrations of the new 10CFR20.

Liquid effluents are further controlled by the application of proceduralized ALARA limits such as a MINIMUM dilution flow of 100,000 gpm required for batch discharges, a maximum gamma concentration of 5E-5 uCi/ml (without gas or tritium) for routine effluents, and procedural guidance for optimizing decay and treatment of liquid waste.

3. Average Energy

The average energies ($\bar{E}$) of the radionuclide mixtures in releases of fission and activation gases were as follows:

Units 1 and 2:

1st Quarter	$\bar{E}_\beta$ =	3.05E-01 Mev/dis	$\bar{E}_\gamma$ =	6.28E-01 Mev/dis
2nd Quarter	$\bar{E}_\beta$ =	3.20E-01 Mev/dis	$\bar{E}_\gamma$ =	7.25E-01 Mev/dis
3rd Quarter	$\bar{E}_\beta$ =	1.74E-01 Mev/dis	$\bar{E}_\gamma$ =	1.34E-01 Mev/dis
4th Quarter	$\bar{E}_\beta$ =	1.50E-01 Mev/dis	$\bar{E}_\gamma$ =	9.71E-02 Mev/dis

Unit 3:

1st Quarter	$\bar{E}_\beta$ =	2.04E-01 Mev/dis	$\bar{E}_\gamma$ =	1.43E-01 Mev/dis
2nd Quarter	$\bar{E}_\beta$ =	3.33E-01 Mev/dis	$\bar{E}_\gamma$ =	7.34E-01 Mev/dis
3rd Quarter	$\bar{E}_\beta$ =	4.36E-01 Mev/dis	$\bar{E}_\gamma$ =	1.18E+00 Mev/dis
4th Quarter	$\bar{E}_\beta$ =	4.38E-01 Mev/dis	$\bar{E}_\gamma$ =	1.19E+00 Mev/dis

4. Measurements and Approximations of Total Radioactivity

a) Fission and Activation Gases

Analyses of effluent gases are performed in compliance with the requirements of the RECS (ODCM Part I). In the case of isolated tanks (batch releases), the total activity discharged is based on an isotopic analysis of each batch with the volume of gas in the batch corrected to standard temperature and pressure.

Vapor containment purge and pressure relief (vent) discharges, which routinely total less than 150 hours/quarter in duration, have been treated as batch releases. However, both types of releases from the Vapor Containment are performed randomly with regard to time of day and duration (release periods were not dependant solely on time of day or atmospheric condition). Therefore, determination of doses due to Vapor Containment releases includes the use of annual average dispersion data, as defined in NUREG 0133, Section 3.3.

At least one complete isotopic concentration analysis of containment air is performed monthly and compared to a process monitor's reading. Pressure reliefs are quantified by scaling subsequent releases with the monitor's reading, applying the mixture from the grab sample. In this fashion, the base grab sample defines the mixture and the activity released. The monitor scales the release up or down and provides continuous indication of potential leaks.

Isotopic analyses for each vapor containment purge are taken prior to and during the purge. This information is combined with the volume of air in each discharge to calculate the quantity of activity released from these discharges.

The continuous building discharges are based on weekly samples of ventilation air analyzed for isotopic content. This information is combined with total air volume discharged and the process radiation monitor readings to determine the quantity of activity from continuous discharges.

b/c) Iodines and Particulates

Iodine-131 and particulate releases are quantified by collecting a continuous sample of ventilation air on a Triethylenediamine (TEDA) impregnated, activated charcoal cartridge and a glass-fiber filter paper. These samples are changed weekly as required in the RECS. The concentration of isotopes found by analysis of these samples is combined with the volume of air discharged during the sampling period to calculate the quantity of activity discharged.

If no I-131 is identified in weekly vent samples, "-" is entered in Table 1A. A typical Minimum Detectable Activity (MDA) for weekly I-131 analyses is 1.0E-13 uCi/cc, which is 100 times lower than ODCM requirements.

If I-131 is identified in any routine weekly sample, it is added to the table and other iodine isotopic concentrations are then determined on a 24-hour sample at least once per month. The concentration of each isotope is analytically determined by ratioing the activities with weekly media for I-131. This activity is combined with the volume of air discharged during the sampling period to calculate the quantity of activity discharged.

A compositing method of analyzing for gross alpha is used per the station ODCMs. An absence of any positive Gross Alpha value for the quarter is identified on Table 1A as "-". A typical MDA for gross alpha is 8.0E-14 uCi/cc, which is over 100 times lower than ODCM requirements.

d) Liquid Effluents

A sample of each batch discharge is taken and an isotopic analysis is performed in compliance with requirements specified in the RECS. Proportional composite samples of continuous discharges are taken and analyzed in compliance with the applicable RECS table, as well. Isotopic concentration data are combined with the information on volume discharged to determine the amount of each isotope discharged.

A compositing method of analyzing for gross alpha is used per the station ODCM. When there has been no positive Gross Alpha identified in a quarter, "-" is entered in Table 2A. A typical MDA value for Gross Alpha in liquids is 5E-8 uCi/ml, which is two times lower than ODCM requirements.

Liquid Effluent volumes of waste released on Table 2A are differentiated between processed fluids (routine liquid waste and Unit 1's North Curtain Drain), and water discharged through monitored pathways identified in the ODCM, but NOT processed (SG Blowdown and Unit 1's Sphere Foundation Drain Sump).

The unprocessed water may still contain trace levels of contamination (generally only tritium) and as such, is identified as liquid waste and included in total curie and dose summaries in the following tables, along with all other liquid effluent, continuous or batch, processed or not.

However, to prevent confusion with regard to measures undertaken to convert liquid to solid waste (resin cleanup), the volumes of processed and unprocessed waste are reported separately on Table 2A.

5. Batch Releases

Airborne:

Unit 1 and 2 Airborne Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2009
Number of Batch Releases		43	49	62	64	218
Total Time Period	(min)	3280	3470	4340	4750	15800
Maximum Time Period	(min)	125	236	173	175	236
Average Time Period	(min)	76.3	70.9	70.0	74.2	72.7
Minimum Time Period	(min)	4.00	27.0	10.0	2.00	2.00

Unit 3 Airborne Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2009
Number of Batch Releases		21	35	35	40	131
Total Time Period	(min)	2520	3450	5100	6120	17200
Maximum Time Period	(min)	419	174	233	216	419
Average Time Period	(min)	120	98.5	146	153	131
Minimum Time Period	(min)	3.00	4.00	9.00	4.00	3.00

Liquid:

Unit 1 and 2 Liquid Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2009
Number of Batch Releases		5	4	11	11	31
Total Time Period	(min)	535	408	1120	1090	3160
Maximum Time Period	(min)	133	107	114	106	133
Average Time Period	(min)	107	102	102	99.2	102
Minimum Time Period	(min)	87.0	95.0	92.0	93.0	87.0

Unit 3 Liquid Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2009
Number of Batch Releases		38	33	23	7	101
Total Time Period	(min)	4780	3900	2500	782	12000
Maximum Time Period	(min)	256	272	118	117	272
Average Time Period	(min)	126	118	109	112	118
Minimum Time Period	(min)	106	77.0	92.0	103	77.0

Average Stream Flow :

Hudson River flow information is obtained from the Department of the Interior, United States Geological Survey (USGS). These data are received after review from the USGS, approximately 18 months after initial data collection. This information is included in the effluents report as the data becomes available.

Estimated Average Stream Flows of the Hudson River at Indian Point:

Year	Quarter	Flow (cfs)
2007	Fourth	53,970
2008	First	135,500
2008	Second	74,600
2008	Third	33,110

6. Abnormal Releases

a) Liquid

General Groundwater

IPEC's groundwater monitoring program and the process (model) for quantification of effluent remained unchanged in 2009, from that of 2008. The resulting offsite dose as a result of the station's continuing natural attenuation was very small, similar to 2008's totals. Groundwater doses are included in the total dose table of Section E, the Dose-To-Man section of this report. Details of the IPEC Radiological Groundwater Monitoring Program are provided in Section H of this report, and include the following:

1) an update on the current condition of IPEC's GW natural attenuation,

2) a discussion of the removal of fuel (source term) from Unit 1, and

3) per the ODCM and NEI 07-07, a summary table of all groundwater radio-analyses results in 2009.

Unit 1 Foundation Drain (80-10)

A new 80-10 release path was added to the IPEC sampling regime in 2008, and continued through 2009. Contributors to this drain line are primarily roof and footing drains near Unit 1, but since it showed occasional trace levels of Cs-137, a project was initiated to determine the source and minimize flow. The trace contaminants were determined to originate in the South Curtain Drain around Unit 1, seeping into footing drains, and into this pathway (rather than diverting to the North Curtain Drain).

Activities underway (through the corrective action program) include efforts to minimize inputs to the line, and improve flow rate determination methods. During dry periods, the line has been evaluated to transport less than 2 gpm to the canal. An inspection cover has been installed in an area to observe flow, and efforts continue with regard to flow measurement methodologies in various atmospheric conditions. Currently, only trace Cs-137 and H-3 have been identified in the system. Although this activity is included in monthly and annual effluent quantification, the integrated totals remain well below 80-10 or effluent threshold limits.

Storm Drain Contamination Event, March 2009

A small increase in routine levels of tritium was discovered in a storm drain well upstream of the Unit 3 effluent point, in March 2009. Investigation led to the most likely source being an episodic local spill of a small amount of primary water directly into the drain. An in-depth investigation and conclusions were captured in the corrective action program, including comparison and interface with the NEI 07-07 groundwater protection program. No contamination was observed downstream of the effected drain, with no measurable effluent impact. Nonetheless, the calculated micro-curies and offsite dose due to this tritium potentially being released to the canal were included in the monthly effluent report. The totals remain mathematically insignificant with regard to site totals, and less than one ten-millionth of effluent limits.

b) Gaseous

None.

7. ODCM Reporting Requirements

The ODCM (RECS) requires reporting of prolonged outages of effluent monitoring equipment. Also required in this report is notification of any changes in the land use census, the Radiological Environmental Monitoring Program (REMP), or exceeding the total curie content limitations in outdoor tanks.

During this reporting period, the following ODCM required effluent monitoring equipment was out of service (OOS) for periods greater than 30 consecutive days:

Instrument	Effected Interval	Details
Unit 2 liquid waste effluent flow rate meter, CT-971	09-18-09 15:51 to 12-16-09 09:45 (88.7 days)	Instrument failed regularly scheduled test. Parts were determined necessary. After arrival on site, it was determined that these parts were not precisely "like and kind". After investigation and procurement of correct parts, the instrument was successfully tested and placed back in service. During this interval, flow rate measurement was estimated per ODCM and lower tier requirements using level instruments.
Unit 2 Plant Vent flow rate meter, SV2-DPT	10-08-09 16:30 to 01-01-10 00:00 (84.3 days in 2009)	Instrument failed its routine calibration. Further testing was performed to compare this ODCM-required instrument with a redundant instrument that appeared to be working. Investigation ensued as to why the values were outside desirable tolerances with each other. Parts for the ODCM instrument were deemed necessary and ordered from vendor. Parts were not readily available. After parts arrived, re-calibration was scheduled but re-prioritized to approximately April, 2010. Compensatory measurements were made per the ODCM and lower tier procedures (and the redundant, non-ODCM instrument remains in service). Additionally, a manual measurement of vent flow rate was performed to increase confidence. The manually determined flow rate compared favorably with the corrected values from the non-ODCM instrument.
U3 Primary Water Storage Tank level instrument, LT-1131	12-19-09 21:53 to 01-01-10 00:00 (12.1 days in 2009, but 32.6 days total)	The level instrument failed due to a problem with freeze protection caused by a failure of an associated strip heater. The heater strip was replaced, but the level instrument failed its calibration retest. A new instrument was pursued but eventually determined not to be feasible. Instead, parts were procured, installed, and the instrument was successfully calibrated and returned to service on Jan 21, 2010 at 12:41. While out of service, compensatory measures (level estimates) were performed per the ODCM and lower tier procedures whenever water was moved into or out of the tank.

7. ODCM Reporting Requirements (continued)

Other Reporting Criteria:

Tank Curie Limits
During this reporting period, no tank curie limits in outdoor tanks were exceeded.

ODCM and PCP changes:
There was no change to the Process Control Program for IPEC.

The IPEC ODCM was updated to Revision 2, in July 2009, to include:

- a Monitoring Well at the Lafarge location, and to simultaneously reclassify two wells onsite as part of the Radiological Groundwater Monitoring Program (RGWMP) instead of the REMP.
- Some improvements in definition, controls, and details of the RGWMP in RECS Section 5.6 and Appendix J.
- Updates to the ODCM release point sketches (Appendices B & C), showing the effluent interface with programs like IE Bulletin 80-10, environmental, and groundwater.

See Section G of this report, and the Addendum covering the ODCM updates.

Lost ODCM airborne filter sample at vendor lab:

In August, 2009, a vendor lab accidently lost sample media from Unit 3's Plant Vent millifilter prior to testing for gross alpha and strontium. IPEC requests Gross Alpha and strontium activities from the vendor on a monthly basis, although, strontium is only required quarterly. The loss of sample was due to broken glassware at the vendor lab.

The filters are tested for gamma several times before they are shipped to the vendor, and no gamma contamination was identified. No alpha or strontium has been identified on these filters in several decades of testing.

Upon discovery of the breakage, an evaluation was performed at IPEC regarding any special operational or maintenance activities at Unit 3 (during the specified interval), to determine whether or not a potential, rare activity could have contributed to a positive gross alpha or strontium on these filters.

No unique activities were performed during this interval at Unit 3.

Therefore, "less than" values from the months before and after August 2009 were applied to the effluent report.

The vendor is NUPIC approved, with a good history of acceptable cross-checks and inter-comparisons. Because the lab quickly identified the error and does not have a history of these kinds of rare occurrences, no further action was initiated. However, this issue was captured in IPEC's corrective action program for tracking / trending.

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT RELEASE REPORT

B. GASEOUS EFFLUENTS

2009

TABLE 1A

INDIAN POINT 1 and 2 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

A. Fission & Activation Gases	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009	Est. Total % Error
1. Total Release	Ci	1.50E-01	5.14E-02	9.15E-01	7.25E-01	1.84E+00	± 25
2. Average release rate	uCi/sec	1.93E-02	6.54E-03	1.15E-01	9.13E-02	5.84E-02	

B. Iodines

1. Total Iodine-131	Ci	-	-	-	-	0.00E+00	± 25
2. Average release rate	uCi/sec	-	-	-	-	0.00E+00	

C. Particulates

1. Total Release, with half-life > 8 days	Ci	9.32E-06	-	-	-	9.32E-06	± 25
2. Average release rate	uCi/sec	1.20E-06	-	-	-	2.95E-07	
3. Gross Alpha	Ci	-	-	-	-	-	± 25

D. Tritium

1. Total release	Ci	2.15E+00	3.42E+00	3.69E+00	2.82E+00	1.21E+01	± 25
2. Average release rate	uCi/sec	2.76E-01	4.35E-01	4.64E-01	3.55E-01	3.83E-01	

- Indicates < MDA

TABLE 1C
INDIAN POINT 1 and 2 **CONTINUOUS** GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2) Iodines

I-131	Ci	-		-	-	0.00E+00
I-133	Ci	-	-	-	-	0.00E+00
I-135	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3) Particulates

Cs-137	Ci	9.32E-06	-	-	-	9.32E-06
Total for Period	Ci	9.32E-06	0.00E+00	0.00E+00	0.00E+00	9.32E-06

- Indicates < MDA

TABLE 1C
INDIAN POINT 1 and 2 - **BATCH** GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Ar-41	Ci	6.38E-02	2.79E-02	3.94E-02	2.94E-02	1.60E-01
Kr-85	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	Ci	9.04E-04	4.02E-05	3.59E-03	4.48E-05	4.58E-03
Kr-87	Ci	8.50E-04	0.00E+00	1.20E-03	2.79E-06	2.05E-03
Kr-88	Ci	1.77E-03	2.11E-05	4.31E-03	4.12E-05	6.14E-03
Xe-131m	Ci	4.88E-04	2.50E-04	4.12E-03	6.46E-03	1.13E-02
Xe-133	Ci	6.30E-02	2.13E-02	7.42E-01	6.80E-01	1.51E+00
Xe-133m	Ci	8.98E-04	3.02E-04	1.19E-02	5.70E-03	1.88E-02
Xe-135	Ci	1.60E-02	1.53E-03	1.05E-01	3.88E-03	1.27E-01
Xe-135m	Ci	2.27E-03	0.00E+00	2.34E-03	7.11E-06	4.63E-03
Xe-138	Ci	4.99E-04	0.00E+00	6.06E-04	1.57E-06	1.11E-03
Total for Period	Ci	1.50E-01	5.14E-02	9.15E-01	7.25E-01	1.84E+00

2) Iodines

Not Applicable for Batch Releases

3) Particulates

Not Applicable for Batch Releases

- Indicates < MDA

TABLE 1A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

A. Fission & Activation Gases	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009	Est. Total % Error
1. Total Release	Ci	5.28E-01	6.30E-02	3.39E-02	5.09E-02	6.76E-01	± 25
2. Average release rate	uCi/sec	6.79E-02	8.01E-03	4.27E-03	6.40E-03	2.14E-02	

B. Iodines

1. Total Iodine-131	Ci	-	-	-	-	0.00E+00	± 25
2. Average release rate	uCi/sec	-	-	-	-	0.00E+00	

C. Particulates

1. Total Release, with half-life > 8 days	Ci	-	-	-	-	0.00E+00	+ 25
2. Average release rate	uCi/sec	-	-	-	-	0.00E+00	
3. Gross Alpha	Ci	-	-	-	-	0.00E+00	± 25

D. Tritium

1. Total release	Ci	3.58E+00	6.57E+00	4.96E+00	4.15E+00	1.93E+01	+ 25
2. Average release rate	uCi/sec	4.61E-01	8.35E-01	6.24E-01	5.22E-01	6.11E-01	

- Indicates < MDA

TABLE 1C
INDIAN POINT 3 - CONTINUOUS GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

Nuclides Released

1) Fission Gases	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Ar-41	Ci	0.00E+00	2.33E-02	0.00E+00	0.00E+00	2.33E-02
Xe-133	Ci	2.98E-01	0.00E+00	0.00E+00	0.00E+00	2.98E-01
Xe-135	Ci	1.76E-01	0.00E+00	0.00E+00	0.00E+00	1.76E-01
Total for Period	Ci	4.74E-01	2.33E-02	0.00E+00	0.00E+00	**4.97E-01**

2) Iodines						
I-131	Ci	-	-	-	-	0.00E+00
I-133	Ci	-	-	-	-	0.00E+00
I-135	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	-	-	-	-	0.00E+00

3) Particulates						
Total for Period	Ci	-	-	-	-	0.00E+00

- indicates < MDA

TABLE 1C
INDIAN POINT 3 - BATCH GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Ar-41	Ci	1.28E-02	1.16E-02	3.11E-02	4.69E-02	1.02E-01
Kr-85	Ci	2.24E-03	5.82E-03	-	-	8.05E-03
Kr-85m	Ci	-	7.94E-06	-	-	7.94E-06
Kr-87	Ci	-	-	-	-	0.00E+00
Kr-88	Ci	-	-	-	-	0.00E+00
Xe-131m	Ci	3.13E-05	-	-	-	3.13E-05
Xe-133	Ci	3.90E-02	2.01E-02	2.86E-03	3.96E-03	6.60E-02
Xe-133m	Ci	5.79E-05	3.62E-04	-	-	4.20E-04
Xe-135	Ci	7.84E-04	1.70E-03	2.54E-05	-	2.50E-03
Xe-135m	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	5.49E-02	3.96E-02	3.40E-02	5.09E-02	1.79E-01

2) Iodines

Not Applicable for Batch Releases

3) Particulates

Not Applicable for Batch Releases

- Indicates < MDA

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT REPORT

C. LIQUID EFFLUENTS

2009

TABLE 2A

INDIAN POINT 1 and 2 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

A. Fission & Activation Products	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009	Est. Total % Error
1. Total Release (not including Tritium, Gr Alpha, & Gases)	Ci	3.10E-03	1.17E-02	1.54E-02	7.11E-03	3.73E-02	±25
2. Average Diluted Conc	uCi/ml	6.56E-12	1.72E-11	1.79E-11	9.68E-12	1.36E-11	

B. Tritium

1. Total Release	Ci	1.14E+02	1.07E+02	2.77E+02	3.87E+02	8.86E+02	±25
2. Average Diluted Conc	uCi/ml	2.42E-07	1.57E-07	3.23E-07	5.28E-07	3.22E-07	

C. Dissolved & Entrained Gases

1. Total Release	Ci	0.00E+00	0.00E+00	3.34E-05	1.59E-04	1.92E-04	±25
2. AverageDiluted Conc	uCi/ml	0.00E+00	0.00E+00	3.89E-14	2.16E-13	6.99E-14	

D. Gross Alpha

1. Total Release	Ci	-	-	-	-	-	+25

E. Volume of Waste Released

1. Processed Waste (LW & NCD)	liters	1.05E+06	1.83E+06	2.19E+06	2.40E+06	7.46E+06	+10
2. Unprocessed (SGBD, SFDS, U1FD)	liters	4.49E+07	5.13E+07	4.49E+07	4.31E+07	1.84E+08	+10

F. Volume of Dilution Water	liters	4.73E+11	6.81E+11	8.59E+11	7.34E+11	2.75E+12	±10

- Indicates < MDA

TABLE 2B

INDIAN POINT 1 and 2 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

CONTINUOUS RADIOACTIVE EFFLUENT

Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Cs-137	Ci	1.02E-03	8.00E-03	4.58E-03	1.50E-03	1.51E-02
Ni-63	Ci	-	-	-	-	0.00E+00
Sr-89	Ci	-	-	-	-	0.00E+00
Sr-90	Ci	3.98E-04	5.23E-04	3.42E-04	3.02E-04	1.57E-03
Total for Period	Ci	1.42E-03	8.52E-03	4.92E-03	1.80E-03	1.67E-02

- Indicates < MDA

TABLE 2B

INDIAN POINT 1 and 2 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

BATCH RADIOACTIVE EFFLUENT

Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009
Ag-110m	Ci	-	-	-	-	0.00E+00
Co-58	Ci	4.21E-05	1.23E-05	1.18E-05	-	**6.62E-05**
Co-60	Ci	6.53E-05	3.80E-05	1.40E-04	6.83E-06	**2.50E-04**
Cr-51	Ci	-	-	-	-	0.00E+00
Cs-134	Ci	1.10E-05	4.52E-05	3.13E-04	-	**3.69E-04**
Cs-137	Ci	2.18E-04	4.70E-04	3.17E-03	4.94E-04	**4.35E-03**
Mn-54	Ci	-	-	-	-	0.00E+00
Ni-63	Ci	2.69E-04	2.10E-03	5.50E-03	1.51E-03	**9.37E-03**
Sb-124	Ci	-	-	-	-	0.00E+00
Sb-125	Ci	1.08E-03	5.14E-04	1.32E-03	3.30E-03	**6.21E-03**
Sr-90	Ci	-	-	-	-	0.00E+00
Te-123m	Ci	-	-	-	-	0.00E+00
Te-125m	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	1.69E-03	3.18E-03	1.05E-02	5.31E-03	**2.06E-02**

Dissolved & Entrained Gas

Kr-85	Ci	-	-	-	-	0.00E+00
Xe-133	Ci	-	-	3.34E-05	1.59E-04	1.92E-04
Total for Period	Ci	0.00E+00	0.00E+00	3.34E-05	1.59E-04	**1.92E-04**

- Indicates < MDA

TABLE 2A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

A. Fission & Activation Products	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year 2009	Est. Total % Error
1. Total Release (not including Tritium, Gr Alpha, & Gases)	Ci	3.87E-03	1.86E-02	2.35E-03	5.15E-04	2.53E-02	± 25
2. Average Diluted Conc	uCi/ml	8.19E-12	2.73E-11	2.74E-12	7.01E-13	9.22E-12	

B. Tritium

1. Total Release	Ci	7.20E+02	1.08E+02	1.33E+02	1.25E+01	9.73E+02	± 25
2. Average Diluted Conc	uCi/ml	1.52E-06	1.58E-07	1.55E-07	1.71E-08	3.54E-07	

C. Dissolved & Entrained Gases

1. Total Release	Ci	7.43E-03	6.35E-04	4.62E-04	4.50E-06	8.53E-03	± 25
2. AverageDiluted Conc	uCi/ml	1.57E-11	9.32E-13	5.37E-13	6.13E-15	3.10E-12	

D. Gross Alpha

1. Total Release	Ci	-	-	-	-	0.00E+00	+ 25

E. Volume of Waste Released

1. Processed Fluids (Mon Tanks)	liters	1.39E+06	8.48E+05	6.00E+05	1.80E+05	3.02E+06	± 10
2. Unprocessed Fluids (SGs)	liters	1.77E+06	1.35E+07	2.77E+06	1.64E+06	1.97E+07	+ 10

F. Volume of Dilution Water	liters	4.73E+11	6.81E+11	8.59E+11	7.34E+11	2.75E+12	± 10

'- indicates < MDA

TABLE 2B
INDIAN POINT 3 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2009)
BATCH and CONTINUOUS RADIOACTIVE LIQUID EFFLUENT

Batch Fission/Activation Products	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	2009
Ag-110m	Ci	9.70E-05	5.22E-05	3.83E-06	0.00E+00	1.53E-04
Co-58	Ci	0.00E+00	6.88E-04	4.08E-04	5.63E-05	1.15E-03
Co-60	Ci	1.87E-03	1.62E-03	3.90E-04	9.36E-05	3.97E-03
Cr-51	Ci	0.00E+00	3.36E-04	1.80E-05	0.00E+00	3.54E-04
Cs-137	Ci	9.91E-06	5.00E-05	9.98E-06	1.51E-05	8.50E-05
Fe-55	Ci	7.26E-04	0.00E+00	0.00E+00	0.00E+00	7.26E-04
Mn-54	Ci	1.93E-05	9.81E-06	0.00E+00	0.00E+00	2.91E-05
Nb-95	Ci	0.00E+00	1.81E-05	2.37E-06	0.00E+00	2.05E-05
Ni-63	Ci	9.93E-04	4.28E-04	7.31E-04	3.17E-04	2.47E-03
Rb-88	Ci	1.29E-04	0.00E+00	0.00E+00	0.00E+00	1.29E-04
Sb-124	Ci	0.00E+00	1.95E-04	1.68E-05	0.00E+00	2.12E-04
Sb-125	Ci	2.93E-05	6.71E-04	2.65E-04	3.25E-05	9.98E-04
Te-123m	Ci	0.00E+00	3.58E-04	3.20E-06	0.00E+00	3.61E-04
Te-125m	Ci	0.00E+00	1.42E-02	5.06E-04	0.00E+00	1.47E-02
Total for Period	Ci	3.87E-03	1.86E-02	2.35E-03	5.14E-04	2.54E-02

Dissolved and Entrained Gas (Batch)						
Xe-133	Ci	7.42E-03	6.33E-04	4.62E-04	4.50E-06	8.52E-03
Xe-133m	Ci	7.57E-06	0.00E+00	0.00E+00	0.00E+00	7.57E-06
Xe-135	Ci	1.99E-06	2.19E-06	0.00E+00	0.00E+00	4.18E-06
Total for Period	Ci	7.43E-03	6.35E-04	4.62E-04	4.50E-06	8.53E-03

Continuous Releases (SG Blowdown)						
H-3 (only)	Ci	1.78E-03	0.00E+00	1.45E-03	3.91E-03	7.14E-03

'- indicates < mda

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT REPORT

D. SOLID WASTE

2009

Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2009 to 12/31/2009

Percent Cutoff: 0 (all identified isotopes are included)

Waste Stream : Resins, Filters, and Evap Bottoms — Cartidge Filters
LWS Resin — Plant Resin 8-120 — U1 West Pool 8-120

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Ci)
A	1.79E+02	5.07E+00	2.85E+00	+/- 25%
B	1.80E+02	5.10E+00	1.69E+02	+/- 25%
C	2.46E+01	6.97E-01	1.15E+01	+/- 25%
All	3.84E+02	1.09E+01	1.84E+02	+/- 25%

Waste Stream : Dry Active Waste — DAW / Metals

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Ci)
A	5.00E+01	1.42E+00	1.46E-05	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	5.00E+01	1.42E+00	1.46E-05	+/-25%

Waste Stream : Irradiated Components

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Waste Stream: Other Waste

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Waste Stream : Sum of All 4 Categories — Combined Packages:
Cartridge Filters — U1 West Pool 8-120 — LWS Resin
DAW / Metals — Plant Resin 8-120

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Ci)
A	2.29E+02	6.48E+00	2.85E+00	+/-25%
B	1.80E+02	5.10E+00	1.69E+02	+/-25%
C	2.46E+01	6.97E-01	1.15E+01	+/-25%
All	4.34E+02	1.23E+01	1.84E+02	+/-25%

Combined Waste Type Shipment, Major Volume Waste Type Shown

Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2009 to 12/31/2009

Percent Cutoff: 0

Number of Shipments	Mode of Transportation	Destination
1	Hittman Transport	Energy Solutions - Bear Creek
1	R & R Trucking Inc	Studsvik Processing – Memphis
3	Hittman Transport	Studsvik Processing Facility

Resins, Filters, and Evap Bottoms
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	0.066%	1.88E-03
Mn-54	0.474%	1.35E-02
Fe-55	15.690%	4.47E-01
Co-58	0.288%	8.20E-03
Co-60	5.686%	1.62E-01
Ni-63	21.727%	6.19E-01
Sr-90	0.082%	2.35E-03
Cs-134	9.302%	2.65E-01
Cs-137	46.684%	1.33E+00
	Total	**2.85E+00**

Resins, Filters, and Evap Bottoms
Waste Class B

Nuclide Name	Percent Abundance	Curies
H-3	0.019%	3.18E-02
Mn-54	0.014%	2.39E-02
Fe-55	0.417%	7.06E-01
Co-57	0.015%	2.47E-02
Co-60	4.334%	7.34E+00
Ni-63	52.488%	8.89E+01
Sr-89	0.001%	1.79E-03
Sr-90	8.325%	1.41E+01
Sb-125	0.348%	5.89E-01
Cs-134	2.539%	4.30E+00
Cs-137	31.292%	5.30E+01
Ce-144	0.168%	2.84E-01
Pu-238	0.002%	2.61E-03
Pu-239	0.001%	1.15E-03
Pu-241	0.037%	6.19E-02
Am-241	0.002%	2.72E-03
Cm-242	0.000%	4.71E-05
Cm-243	0.001%	1.20E-03
	Total	**1.69E+02**

Resins, Filters, and Evap Bottoms
Waste Class C

Nuclide Name	Percent Abundance	Curies
H-3	0.041%	4.75E-03
Mn-54	0.020%	2.35E-03
Fe-55	0.815%	9.37E-02
Co-57	0.020%	2.27E-03
Co-60	7.746%	8.91E-01
Ni-63	61.725%	7.10E+00
Sr-89	0.000%	5.64E-05
Sr-90	0.775%	8.91E-02
Sb-125	0.682%	7.85E-02
Cs-134	4.738%	5.45E-01
Cs-137	23.299%	2.68E+00
Ce-144	0.073%	8.36E-03
Pu-238	0.003%	3.00E-04
Pu-239	0.001%	6.59E-05
Pu-241	0.061%	7.00E-03
Am-241	0.000%	5.10E-05
Cm-242	0.000%	3.27E-06
Cm-243	0.001%	1.57E-04
	Total	**1.15E+01**

Resins, Filters, and Evap Bottoms
Waste Class All

Nuclide Name	Percent Abundance	Curies
H-3	0.021%	3.84E-02
Mn-54	0.022%	3.98E-02
Fe-55	0.680%	1.25E+00
Co-57	0.015%	2.69E-02
Co-58	0.004%	8.20E-03
Co-60	4.567%	8.39E+00
Ni-63	52.585%	9.66E+01
Sr-89	0.001%	1.85E-03
Sr-90	7.730%	1.42E+01
Sb-125	0.363%	6.67E-01
Cs-134	2.782%	5.11E+00
Cs-137	31.029%	5.70E+01
Ce-144	0.159%	2.92E-01
Pu-238	0.002%	2.91E-03
Pu-239	0.001%	1.22E-03
Pu-241	0.038%	6.89E-02
Am-241	0.002%	2.77E-03
Cm-242	0.000%	5.04E-05
Cm-243	0.001%	1.35E-03
	Total	**1.84E+02**

Dry Active Waste
Waste Class A

Nuclide Name	Percent Abundance	Curies
Co-60	1.188%	1.73E-07
Ni-63	45.996%	6.70E-06
Sr-90	14.554%	2.12E-06
Cs-137	38.032%	5.54E-06
Ce-144	0.210%	3.06E-08
Pu-238	0.001%	1.05E-10
Pu-239	0.001%	1.14E-10
Pu-241	0.016%	2.40E-09
Am-241	0.003%	3.75E-10
Cm-243	0.000%	2.62E-11
	Total	**1.46E-05**

Dry Active Waste
Waste Class All

Nuclide Name	Percent Abundance	Curies
Co-60	1.188%	1.73E-07
Ni-63	45.996%	6.70E-06
Sr-90	14.554%	2.12E-06
Cs-137	38.032%	5.54E-06
Ce-144	0.210%	3.06E-08
Pu-238	0.001%	1.05E-10
Pu-239	0.001%	1.14E-10
Pu-241	0.016%	2.40E-09
Am-241	0.003%	3.75E-10
Cm-243	0.000%	2.62E-11
	Total	**1.46E-05**

Sum of All 4 Categories
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	0.066%	1.88E-03
Mn-54	0.474%	1.35E-02
Fe-55	15.690%	4.47E-01
Co-58	0.288%	8.20E-03
Co-60	5.686%	1.62E-01
Ni-63	21.727%	6.19E-01
Sr-90	0.083%	2.36E-03
Cs-134	9.302%	2.65E-01
Cs-137	46.684%	1.33E+00
Ce-144	0.000%	3.06E-08
Pu-238	0.000%	1.05E-10
Pu-239	0.000%	1.14E-10
Pu-241	0.000%	2.40E-09
Am-241	0.000%	3.75E-10
Cm-243	0.000%	2.62E-11
	Total	**2.85E+00**

Sum of All 4 Categories
Waste Class B

Nuclide Name	Percent Abundance	Curies
H-3	0.019%	3.18E-02
Mn-54	0.014%	2.39E-02
Fe-55	0.417%	7.06E-01
Co-57	0.015%	2.47E-02
Co-60	4.334%	7.34E+00
Ni-63	52.488%	8.89E+01
Sr-89	0.001%	1.79E-03
Sr-90	8.325%	1.41E+01
Sb-125	0.348%	5.89E-01
Cs-134	2.539%	4.30E+00
Cs-137	31.292%	5.30E+01
Ce-144	0.168%	2.84E-01
Pu-238	0.002%	2.61E-03
Pu-239	0.001%	1.15E-03
Pu-241	0.037%	6.19E-02
Am-241	0.002%	2.72E-03
Cm-242	0.000%	4.71E-05
Cm-243	0.001%	1.20E-03
	Total	**1.69E+02**

Sum of All 4 Categories
Waste Class C

Nuclide Name	Percent Abundance	Curies
H-3	0.041%	4.75E-03
Mn-54	0.020%	2.35E-03
Fe-55	0.815%	9.37E-02
Co-57	0.020%	2.27E-03
Co-60	7.746%	8.91E-01
Ni-63	61.725%	7.10E+00
Sr-89	0.000%	5.64E-05
Sr-90	0.775%	8.91E-02
Sb-125	0.682%	7.85E-02
Cs-134	4.738%	5.45E-01
Cs-137	23.299%	2.68E+00
Ce-144	0.073%	8.36E-03
Pu-238	0.003%	3.00E-04
Pu-239	0.001%	6.59E-05
Pu-241	0.061%	7.00E-03
Am-241	0.000%	5.10E-05
Cm-242	0.000%	3.27E-06
Cm-243	0.001%	1.57E-04
	Total	**1.15E+01**

Sum of All 4 Categories
Waste Class All

Nuclide Name	Percent Abundance		Curies
H-3	0.021%		3.84E-02
Mn-54	0.022%		3.98E-02
Fe-55	0.680%		1.25E+00
Co-57	0.015%		2.69E-02
Co-58	0.004%		8.20E-03
Co-60	4.567%		8.39E+00
Ni-63	52.585%		9.66E+01
Sr-89	0.001%		1.85E-03
Sr-90	7.730%		1.42E+01
Sb-125	0.363%		6.67E-01
Cs-134	2.782%		5.11E+00
Cs-137	31.029%		5.70E+01
Ce-144	0.159%		2.92E-01
Pu-238	0.002%		2.91E-03
Pu-239	0.001%		1.22E-03
Pu-241	0.038%		6.89E-02
Am-241	0.002%		2.77E-03
Cm-242	0.000%		5.04E-05
Cm-243	0.001%		1.35E-03
		Total	**1.84E+02**

Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2009 to 12/31/2009

Percent Cutoff: 0 (all identified isotopes are included)

Waste Stream : Resins, Filters, and Evap Bottoms
LWS Resin 14-170

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.35E+02	3.82E+00	1.62E+00	+/- 25%
B	0.00E+00	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	0.00E+00	+/- 25%
All	1.35E+02	3.82E+00	1.62E+00	+/- 25%

Waste Stream : Dry Active Waste U3 DAW B-25 Soil/Debris B-25
Unit 3 DAW-20' Sealand 20' Intermodal Soil DAW 20' Shielded SeaLand

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.26E+04	3.57E+02	8.49E-01	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.26E+04	3.57E+02	8.49E-01	+/-25%

Waste Stream : Irradiated Components

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Waste Stream : Other Waste Combined Packages

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Waste Stream : Sum of All 4 Categories
Unit 3 DAW B-25 Soil/Debris B-25 LWS Resin 14-170
20' Intermodal Soil DAW 20' Shielded SeaLand

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.27E+04	3.60E+02	2.47E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.27E+04	3.60E+02	2.47E+00	+/-25%

Combined Waste Type Shipment, Major Volume Waste Type Shown

Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2009 to 12/31/2009

Percent Cutoff: 0

Number of Shipments	Mode of Transportation	Destination
8	Hittman Transport	Energy Solutions Bear Creek
3	R & R Trucking Inc	Studsvik Processing Facility

Resins, Filters, and Evap Bottoms
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	15.346%	2.48E-01
Mn-54	0.167%	2.70E-03
Fe-55	18.254%	2.95E-01
Co-57	0.074%	1.19E-03
Co-58	0.043%	7.03E-04
Co-60	17.635%	2.85E-01
Ni-63	36.074%	5.83E-01
Sr-90	0.003%	5.30E-05
Sb-125	2.525%	4.08E-02
Cs-134	2.358%	3.81E-02
Cs-137	7.116%	1.15E-01
Ce-144	0.325%	5.26E-03
Pu-238	0.002%	3.78E-05
Pu-239	0.001%	9.73E-06
Pu-241	0.072%	1.17E-03
Am-241	0.002%	2.57E-05
Cm-242	0.000%	1.29E-06
Cm-243	0.003%	5.43E-05
	Total	**1.62E+00**

Resins, Filters, and Evap Bottoms
Waste Class All

Nuclide Name	Percent Abundance	Curies
H-3	15.346%	2.48E-01
Mn-54	0.167%	2.70E-03
Fe-55	18.254%	2.95E-01
Co-57	0.074%	1.19E-03
Co-58	0.043%	7.03E-04
Co-60	17.635%	2.85E-01
Ni-63	36.074%	5.83E-01
Sr-90	0.003%	5.30E-05
Sb-125	2.525%	4.08E-02
Cs-134	2.358%	3.81E-02
Cs-137	7.116%	1.15E-01
Ce-144	0.325%	5.26E-03
Pu-238	0.002%	3.78E-05

Pu-239	0.001%		9.73E-06
Pu-241	0.072%		1.17E-03
Am-241	0.002%		2.57E-05
Cm-242	0.000%		1.29E-06
Cm-243	0.003%		5.43E-05
		Total	**1.62E+00**

Dry Active Waste
Waste Class A

Nuclide Name	**Percent Abundance**		**Curies**
H-3	0.483%		4.10E-03
C-14	0.031%		2.59E-04
Mn-54	0.397%		3.37E-03
Fe-55	27.691%		2.35E-01
Co-57	0.141%		1.20E-03
Co-58	30.754%		2.61E-01
Co-60	18.028%		1.53E-01
Ni-63	20.856%		1.77E-01
Sr-90	0.015%		1.28E-04
Nb-95	0.016%		1.35E-04
Sb-124	0.033%		2.83E-04
Sb-125	0.109%		9.21E-04
Cs-134	0.197%		1.67E-03
Cs-137	1.249%		1.06E-02
		Total	**8.49E-01**

Dry Active Waste
Waste Class All

Nuclide Name	**Percent Abundance**		**Curies**
H-3	0.483%		4.10E-03
C-14	0.031%		2.59E-04
Mn-54	0.397%		3.37E-03
Fe-55	27.691%		2.35E-01
Co-57	0.141%		1.20E-03
Co-58	30.754%		2.61E-01
Co-60	18.028%		1.53E-01
Ni-63	20.856%		1.77E-01
Sr-90	0.015%		1.28E-04
Nb-95	0.016%		1.35E-04
Sb-124	0.033%		2.83E-04
Sb-125	0.109%		9.21E-04
Cs-134	0.197%		1.67E-03
Cs-137	1.249%		1.06E-02
		Total	**8.49E-01**

Sum of All 4 Categories
Waste Class A

Nuclide Name	Percent Abundance		Curies
H-3	10.226%		2.52E-01
C-14	0.011%		2.59E-04
Mn-54	0.246%		6.07E-03
Fe-55	21.506%		5.30E-01
Co-57	0.097%		2.39E-03
Co-58	10.631%		2.62E-01
Co-60	17.773%		4.38E-01
Ni-63	30.839%		7.60E-01
Sr-90	0.007%		1.81E-04
Nb-95	0.005%		1.35E-04
Sb-124	0.011%		2.83E-04
Sb-125	1.692%		4.17E-02
Cs-134	1.615%		3.98E-02
Cs-137	5.072%		1.25E-01
Ce-144	0.213%		5.26E-03
Pu-238	0.002%		3.78E-05
Pu-239	0.000%		9.73E-06
Pu-241	0.047%		1.17E-03
Am-241	0.001%		2.57E-05
Cm-242	0.000%		1.29E-06
Cm-243	0.002%		5.43E-05
		Total	**2.46E+00**

Sum of All 4 Categories
Waste Class All

Nuclide Name	Percent Abundance		Curies
H-3	10.226%		2.52E-01
C-14	0.011%		2.59E-04
Mn-54	0.246%		6.07E-03
Fe-55	21.506%		5.30E-01
Co-57	0.097%		2.39E-03
Co-58	10.631%		2.62E-01
Co-60	17.773%		4.38E-01
Ni-63	30.839%		7.60E-01
Sr-90	0.007%		1.81E-04
Nb-95	0.005%		1.35E-04
Sb-124	0.011%		2.83E-04
Sb-125	1.692%		4.17E-02
Cs-134	1.615%		3.98E-02
Cs-137	5.072%		1.25E-01
Ce-144	0.213%		5.26E-03
Pu-238	0.002%		3.78E-05
Pu-239	0.000%		9.73E-06
Pu-241	0.047%		1.17E-03
Am-241	0.001%		2.57E-05
Cm-242	0.000%		1.29E-06
Cm-243	0.002%		5.43E-05
		Total	**2.46E+00**

Indian Point Energy Center
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RADIOACTIVE EFFLUENT REPORT

E. RADIOLOGICAL IMPACT ON MAN

Jan 1, 2009 - Dec 31, 2009

RADIOLOGICAL IMPACT ON MAN

Routine Effluent Dose Calculations:

The Radiological Impact on Man due to radioactive effluent from the site is determined from NRC approved modeling, per Reg Guide 1.109 and NUREG 0133. Calculations are divided into 3 categories: Noble Gases, Particulates and Iodine, and Liquid Releases (fish and invertebrate consumption). This modeling involves conservative dose calculations to Adult, Teen, Child, and Infant age groups. Furthermore, dose modeling is performed for six separate organs as well as the total body dose. This well-established industry model provides doses (as a result of plant effluent) to a hypothetical maximally exposed individual offsite. While ALL age groups and organs are considered, it is this ***maximum value*** that is provided in the tables that follow.

An approved computer code is used to perform liquid and gaseous dose calculations according to the models and parameters presented in the Indian Point Offsite Dose Calculation Manual (ODCM). This information is stored in a database on site to enhance dose tracking information and management. Site airborne effluent dose calculations include annual average dispersion and deposition factors, averaged from data collected over approximate ten year periods. When new data is averaged (approximately every ten years) the modeling is updated and used in subsequent airborne effluent calculations.

Liquid offsite dose calculations involve fish and invertebrate consumption pathways only, as determined in the ODCM. While the ODCM identified some site-specific dose factors, the bulk of this information is obtained directly from Regulatory Guide 1.109 and NUREG 0133. Details of the calculations, site-specific data, and their bases are presented in the ODCM.

Carbon-14 (C-14):

Concentrations and offsite dose from C-14 have been determined from data generated at IP3 from August 1980 to June 1982, during a study conducted by the NY State Department of Health (C. Kunz, later published and incorporated into NCRP 81). These estimates are consistent with NUREG 0017, Rev. 1. The maximum expected annual dose from C-14 releases at IP2 and IP3 have been calculated using rated electrical capacity, approximately 1000 MW(e) maintained for the entire year, and the given curies determined from the experiment, corrected for the fraction of C-14 determined to be in the Carbon Dioxide form, as doses are not expected from other forms (methane, etc). The resultant offsite doses are based upon this source term and the dose calculations described in Reg Guide 1.109 and the ODCM.

The annual dose to the maximally exposed individual (child) from gaseous releases of C-14 at IPEC (units 2 and 3) is 0.508 mrem to the critical organ (bone) and 0.102 mrem to the total body. The annual dose to the maximally exposed individual (child) from typical liquid releases of C-14 is 0.0117 mrem to the critical organ (bone) and 0.00234 mrem to the total body. Due to the unique nature of C-14, and the extremely conservative bounding measurements performed, the combined offsite dose attributable to C-14 alone (liquid and airborne) is reported on the Dose to Man section cover page (and not in the tables that follow), specifically to avoid confusion.

Groundwater:

Curies and dose contribution from activity discovered in onsite ground water and storm drain pathways during the year are discussed in detail in Section H. The offsite dose calculation involves multiple source term measurements, as well as determinations for release and dilution flow. A summary of the quantification methodology, and the resulting calculated doses, is provided at the end of Section H. The Total Dose table below provides a means to compare ground water doses with those of other components making up the site's total dose.

Members of the Public:

Members of the public visiting the site receive minimal dose as a result of airborne and liquid releases because of the relatively insignificant total amount of time they are on site, as well as the immeasurably low levels of dose at the critical receptors. Their doses can be calculated from standard ODCM methodology, with typical occupancy factors employed. These factors are determined by comparing a conservative assumption for their expected hours on site, to 8760 hours (the number of hours in a year, used in calculations in the ODCM).

example 1: Several students visit the site for an 8-hour guided tour.
Their occupancy factor is: 8 / 8760 or **.0009**.

example 2: A man drives his wife to work and drops her off at the security gate each morning, with a total stay-time on site for 2 minutes per day. His occupancy factor is calculated as follows:
2 min/60 min per hour =.0333 hr; 0.0333 / 8760 = **3.8E-6**

These factors, when multiplied by doses calculated per the ODCM, demonstrate that dose to MEMBERS OF THE PUBLIC within the site boundary is negligible, despite a potential reduction in the atmospheric dispersion.

Total Dose:

In compliance with 40CFR190, the following table indicates the Total Dose, including any measured direct shine component from the site property for 2009:

		Whole Body	Max Organ
40 CFR 190 limit ===→	**IPEC**	**25 mrem**	**75 mrem**
Routine Airborne Effluents[1]	Units 1 and 2	2.28E-3	2.28E-3
Routine Liquid Effluents	Units 1 and 2	9.00E-4	1.71E-3
Routine Airborne Effluents[1]	Unit 3	3.36E-3	3.36E-3
Routine Liquid Effluents	Unit 3	2.49E-4	4.59E-4
Carbon-14 Totals (Liquid & Airborne releases from IPEC Units 1, 2, & 3)	IPEC	1.04E-1	5.20E-1
Ground Water & Storm Drain Totals	IPEC[2]	2.56E-4	1.03E-3
Direct Shine from ISFSI, Radwaste Storage, SG Mausoleum, etc.	IPEC[3]	5	5
Indian Point Energy Center Total Dose, per 40 CFR 190	**IPEC**	**5.11**	**5.53**

Note 1: Airborne dose in this table is conservatively represented as a sum of Iodine/Particulate Dose (mrem) and noble gas beta air energy (mrad, expressed as mrem) at the highest site boundary location, for purposes of demonstrating 40CFR190 compliance only.

Note 2: Groundwater curie and dose calculations are provided in Section H.

Note 3: The direct shine component from sources other than ISFSI are indistinguishable from background. ISFSI doses were determined from net integrated quarterly TLD readings at the identified critical site boundary locations, and comparing these values with ISFSI boundary and REMP TLDs. No occupancy factors were applied for this conservative assessment. Details of this evaluation are available on site.

INDIAN POINT UNITS 1 and 2 NUCLEAR POWER PLANTS
RADIOLOGICAL IMPACT ON MAN
JANUARY - DECEMBER 2009

Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Organ Dose	(mrem)	3.02E-04	6.40E-04	5.70E-04	2.34E-04	**1.71E-03**
Applicable Limit	(mrem)	5	5	5	5	10
Percent of Limit	(%)	6.04E-03	1.28E-02	1.14E-02	4.68E-03	1.71E-02
Age Group		Adult	Child	Child	Child	Child
Critical Organ		Bone	Bone	Bone	Bone	Bone

Adult Total Body	(mrem)	1.41E-04	3.33E-04	2.74E-04	1.52E-04	**9.00E-04**
Applicable Limit	(mrem)	1.5	1.5	1.5	1.5	3.0
Percent of Limit	(%)	9.40E-03	2.22E-02	1.83E-02	1.01E-02	3.00E-02

B. AIRBORNE NOBLE GAS DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Gamma Air	(mrad)	2.95E-05	1.14E-05	4.62E-05	2.69E-05	**1.14E-04**
Applicable Limit	(mrad)	5	5	5	5	10
Percent of Limit	(%)	5.90E-04	2.28E-04	9.24E-04	5.38E-04	1.14E-03

Beta Air	(mrad)	2.36E-05	8.35E-06	8.63E-05	5.88E-05	**1.77E-04**
Applicable Limit	(mrad)	10	10	10	10	20
Percent of Limit	(%)	2.36E-04	8.35E-05	8.63E-04	5.88E-04	8.85E-04

C. AIRBORNE IODINE and PARTICULATE DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Iodine/Part	(mrem)	4.34E-04	5.73E-04	6.18E-04	4.72E-04	**2.10E-03**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	5.79E-03	7.64E-03	8.24E-03	6.29E-03	1.40E-02

Age Group		Child	Child	Child	Child	Child
Critical Organ		Liver	Liver	Liver	Liver	Liver

INDIAN POINT 3 NUCLEAR POWER PLANT
RADIOLOGICAL IMPACT ON MAN
JANUARY - DECEMBER 2009

Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Organ Dose	(mrem)	2.57E-04	1.67E-04	3.12E-05	1.37E-05	**4.59E-04**
Applicable Limit	(mrem)	5	5	5	5	10
Percent of Limit	(%)	5.14E-03	3.34E-03	6.24E-04	2.74E-04	4.59E-03
Age Group		Adult	Adult	Adult	Child	Adult
Critical Organ		GI-LLI	GI-LLI	GI-LLI	Bone	GI-LLI

Adult Total Body	(mrem)	1.96E-04	2.89E-05	2.12E-05	3.10E-06	**2.49E-04**
Applicable Limit	(mrem)	1.5	1.5	1.5	1.5	3.0
Percent of Limit	(%)	1.31E-02	1.93E-03	1.41E-03	2.07E-04	8.31E-03

B. AIRBORNE NOBLE GAS DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Gamma Air	(mrad)	3.52E-05	1.07E-05	8.85E-06	1.34E-05	**6.82E-05**
Applicable Limit	(mrad)	5	5	5	5	10
Percent of Limit	(%)	7.04E-04	2.14E-04	1.77E-04	2.68E-04	6.82E-04

Beta Air	(mrad)	1.18E-04	2.15E-05	1.49E-05	2.24E-05	**1.77E-04**
Applicable Limit	(mrad)	10	10	10	10	20
Percent of Limit	(%)	1.18E-03	2.15E-04	1.49E-04	2.24E-04	8.84E-04

C. AIRBORNE IODINE and PARTICULATE DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Iodine/Part	(mrem)	5.92E-04	1.08E-03	8.20E-04	6.86E-04	**3.18E-03**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	7.89E-03	1.44E-02	1.09E-02	9.15E-03	2.12E-02

Age Group		Child	Child	Child	Child	Child
Critical Organ		Liver	Liver	Liver	Liver	Liver

Indian Point Energy Center
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RADIOLOGICAL EFFLUENT REPORT

F. METEOROLOGICAL DATA

Jan 1, 2009 - Dec 31, 2009

This data is stored onsite and is available in printed or electronic form.

Indian Point Energy Center
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RADIOACTIVE EFFLUENT REPORT

G. OFFSITE DOSE CALCULATION MANUAL, REMP SAMPLING LOCATIONS, PROCESS CONTROL PROGRAM, OR LAND USE CENSUS LOCATION CHANGES

2009

There was an additional GW well added to the REMP sampling locations, and two wells were reclassified as part of the Radiological Groundwater Monitoring Program in year 2009.

Details of the changes in the REMP are included in the ODCM and justification package, provided as an Addendum to this report.

There were no changes to the Land Use Census in year 2009.

There were no changes to the Process Control Program (PCP) in 2009.

There was one ODCM update in 2009.

In July, 2009 the station ODCM was upgraded to revision 2.

A complete copy of the revised IPEC ODCM, as well as the Rev 2 justification package, are provided in an Addendum to this report.

Indian Point Energy Center
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RADIOACTIVE EFFLUENT REPORT

H. GROUNDWATER and STORM WATER REPORT

ACTIVITY ON SITE and OFFSITE DOSE CALCULATION

FOR THE PERIOD:

Jan 1, 2009 - Dec 31, 2009

Summary of IPEC Groundwater and Storm Water Activity, 2009

The Unit 1 Spent Fuel, which had been considered the source of most of the groundwater contamination, was removed in 2008, to integrated spent fuel storage. This process demanded pool levels to be increased in April, 2008, for the defueling operation. During this evolution, the pool water was continuously demineralized and carefully monitored. After defueling, the pools were further processed with additional cleanup. For dewatering, two sets of composite samplers were installed, and the slow, permitted release was carefully integrated. Resin-specific cleanup systems were added during the pump down to the routine liquid effluent release line. The empty pools were then cleaned, closed, and covered.

As a result of aggressive processing before, during, and after the defueling operation, the effluent release from draining the pools (Sep, 2008) resulted in curies and mrem consistent with or slightly lower than routine monthly effluent. Stontium-90 releases, in particular, were essentially non-existent, because the pool water had been cleaned up for months prior draining.

Because the pool levels had to be increased for a time in 2008 (as mentioned above), some increases in groundwater contamination were expected through 2009. Wells near the Unit 1 pools did in fact start to show somewhat elevated activity in 2009, but by the end of the year, a clear downward trend was visible. Monitored Natural Attenuation is expected to continue.

The precipitation mass balance model applied in 2007 and 2008 was applied for offsite dose calculations in 2009. Hydraulic conductivity readings continued to validate the model throughout the year, and the USGS, as well as IPEC local MET data verified annual precipitation averaging 2.68 feet per year. No changes to the model were required.

Results of 2009 Groundwater and Storm water offsite dose evaluation

The results of the assessment are shown on the following table. These dose values are again a small portion of the annual limits (<0.1%), and were added to the Total Dose table in the opening summary of the Dose to Man section of this report (Section E).

Based on the above analysis, the total GW and storm water Tritium released from IPEC was approximately 0.07 Curies in 2009, resulting in a total body dose of significantly less than 0.1 mrem (1.4E-7 mrem). It is evident that tritium alone, whether from ground water or routine effluents, does not arithmetically contribute to integrated offsite dose.

Strontium-90, Cesium-137, and Co-60 collectively contributed approximately 0.00025 curies to site effluent from the groundwater pathway. Combined groundwater releases from IPEC in 2009 (all radionuclides) resulted in a calculated annual dose of significantly less than 0.1% of the annual limits for whole body and critical organ, as follows:

IPEC Groundwater and Storm Water Effluent Dose, 2009

0.000256 mrem to the total body,	(0.0085% limit)
0.00103 mrem to the critical organ, adult bone	(0.0103% limit)

The annual dose from combined groundwater and storm water pathways remains well below applicable limits. When combined with routine liquid effluents, the total dose also remains significantly below ALARA limits of 3 mrem total body, and 10 mrem to the critical organ. This comparison is provided in the opening discussion of Section E, Radiological Impact on Man.

IPEC Summary for Storm & Ground Water releases (H-3, Co-60, Ni-63, Sr-90, and Cs-137)

2009
year

Northern Clean Zone

Adult Doses,in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.15E+02
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
totals	0.00E+00	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	**4.15E+02**

Unit 2 North

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	4.63E+04
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	8.96E-06	1.23E-05	8.03E-06	0.00E+00	4.16E-06	1.38E-06	2.37E-07	4.26E+00
totals	8.96E-06	1.23E-05	8.04E-06	1.12E-08	4.17E-06	1.39E-06	2.48E-07	**4.63E+04**

Unit 1/2

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	6.75E-08	6.75E-08	6.75E-08	6.75E-08	6.75E-08	6.75E-08	9.57E+03
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	2.86E-04	1.99E-05	9.61E-06	0.00E+00	0.00E+00	0.00E+00	4.14E-06	1.45E+02
Sr-90	4.62E-04	0.00E+00	1.13E-04	0.00E+00	0.00E+00	0.00E+00	1.33E-05	2.91E+01
Cs-137	8.54E-05	1.17E-04	7.65E-05	0.00E+00	3.96E-05	1.32E-05	2.26E-06	4.44E+01
totals	8.34E-04	1.37E-04	2.00E-04	6.75E-08	3.97E-05	1.32E-05	1.98E-05	**9.74E+03**

Unit 3 North

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.94E+03
Co-60	0.00E+00	5.98E-07	1.32E-06	0.00E+00	0.00E+00	0.00E+00	1.12E-05	1.02E+01
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	8.15E-05	0.00E+00	2.00E-05	0.00E+00	0.00E+00	0.00E+00	2.35E-06	4.94E+00
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
totals	8.15E-05	6.10E-07	2.13E-05	1.13E-08	1.13E-08	1.13E-08	1.36E-05	**1.96E+03**

Unit 3 South

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	1.22E-08	1.22E-08	1.22E-08	1.22E-08	1.22E-08	1.22E-08	7.04E+03
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	1.09E-04	0.00E+00	2.67E-05	0.00E+00	0.00E+00	0.00E+00	3.14E-06	1.14E+01
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
totals	1.09E-04	1.22E-08	2.67E-05	1.22E-08	1.22E-08	1.22E-08	3.15E-06	**7.06E+03**

Southern Clean Zone

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.66E+03
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
totals	0.00E+00	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	**2.66E+03**

Totals:

Adult Doses, in mrem

	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	Total uCis	
H-3 only	0.00E+00	1.37E-07	1.37E-07	1.37E-07	1.37E-07	1.37E-07	1.37E-07	6.79E+04	H3
all isotopes	**1.03E-03**	1.50E-04	**2.56E-04**	1.37E-07	4.39E-05	1.47E-05	3.68E-05	1.02E+01	Co
								1.45E+02	Ni
Adult Doses								4.54E+01	Sr
% Annual Limit	*0.01033*	*0.001*	*0.00852*	*0.000*	*0.000*	*0.000*	*0.000*	4.87E+01	Cs

INDIAN POINT
RADIOLOGICAL GROUNDWATER
MONITORING PROGRAM

2009

Summary of Results

The following pages represent a summary of isotopic radio-analytical data for all onsite groundwater testing performed at Indian Point in 2009, as required per the ODCM and NEI 07-07.

Tritium Summary

Well Name	# Samples in 2009	# Positive H-3 Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
B-1	1	1	8.81E+02	8.81E+02	8.81E+02
LAF-002	2	1	1.80E+02	1.80E+02	1.80E+02
MH-5	3	3	1.11E+03	6.28E+02	1.50E+03
MW-107	1	1	1.96E+02	1.96E+02	1.96E+02
MW-111	2	2	3.08E+04	2.26E+04	3.89E+04
MW-30-69	6	6	1.07E+05	8.20E+04	1.64E+05
MW-30-84	6	6	6.11E+03	4.69E+03	7.76E+03
MW-31-49	7	7	2.14E+04	7.36E+02	4.84E+04
MW-31-63	7	7	1.99E+04	1.28E+04	3.24E+04
MW-31-85	7	7	7.31E+03	2.96E+03	1.88E+04
MW-32-149	7	7	3.07E+02	1.99E+02	4.57E+02
MW-32-173	7	7	7.48E+02	4.31E+02	1.72E+03
MW-32-190	7	7	2.11E+03	1.63E+03	2.69E+03
MW-32-59	7	7	1.71E+04	8.85E+02	6.43E+04
MW-32-85	7	7	8.16E+03	6.54E+03	9.16E+03
MW-33	1	1	3.44E+04	3.44E+04	3.44E+04
MW-35	1	1	1.46E+03	1.46E+03	1.46E+03
MW-36-24	4	4	1.28E+03	2.37E+02	2.92E+03
MW-36-41	3	3	1.05E+04	1.01E+04	1.13E+04
MW-36-52	4	4	7.42E+03	6.06E+03	8.61E+03
MW-37-22	4	4	4.60E+03	3.85E+03	5.27E+03
MW-37-32	4	4	4.66E+03	3.76E+03	5.48E+03
MW-37-40	4	4	4.51E+03	4.22E+03	4.91E+03
MW-37-57	4	4	4.81E+03	4.05E+03	5.94E+03
MW-39-102	2	2	2.44E+02	2.20E+02	2.67E+02
MW-39-124	2	2	2.33E+02	1.98E+02	2.68E+02
MW-39-183	2	1	9.85E+01	9.85E+01	9.85E+01
MW-39-195	2	1	1.09E+02	1.09E+02	1.09E+02
MW-39-67	2	2	3.90E+02	3.38E+02	4.41E+02
MW-39-84	2	2	2.14E+02	1.85E+02	2.42E+02
MW-40-100	4	1	2.62E+02	2.62E+02	2.62E+02
MW-40-127	4	2	1.28E+02	1.04E+02	1.52E+02
MW-40-162	4	1	1.42E+02	1.42E+02	1.42E+02
MW-40-27	4	2	1.58E+02	1.17E+02	1.98E+02
MW-40-46	4	1	1.52E+02	1.52E+02	1.52E+02
MW-40-81	4	4	1.74E+02	9.11E+01	2.31E+02
MW-41-40	3	3	5.01E+02	3.15E+02	6.17E+02
MW-41-63	3	3	4.72E+02	4.40E+02	5.26E+02
MW-42-49	5	5	1.58E+04	1.28E+03	7.22E+04
MW-42-78	4	4	4.27E+02	2.74E+02	5.51E+02
MW-43-28	3	2	2.44E+02	1.73E+02	3.14E+02
MW-43-62	3	1	1.96E+02	1.96E+02	1.96E+02
MW-44-102	4	4	4.34E+02	2.57E+02	5.15E+02
MW-44-66	4	4	4.94E+02	2.06E+02	7.44E+02
MW-45-42	4	4	2.95E+03	1.41E+03	5.99E+03

Tritium Summary

Well Name	# Samples in 2009	# Positive H-3 Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-45-61	4	4	1.33E+03	1.11E+03	1.46E+03
MW-46	4	4	9.22E+02	7.56E+02	1.10E+03
MW-49-26	4	4	3.26E+03	3.10E+03	3.56E+03
MW-49-42	4	4	2.49E+03	2.25E+03	2.68E+03
MW-49-65	4	4	1.52E+03	1.34E+03	1.66E+03
MW-50-42	4	4	5.19E+02	2.15E+02	1.06E+03
MW-50-66	5	5	2.95E+03	2.30E+03	3.45E+03
MW-51-104	4	2	2.18E+02	1.44E+02	2.91E+02
MW-51-40	4	3	2.08E+02	1.55E+02	2.67E+02
MW-51-79	4	1	1.99E+02	1.99E+02	1.99E+02
MW-52-11	1	1	5.19E+02	5.19E+02	5.19E+02
MW-52-122	1	1	1.15E+02	1.15E+02	1.15E+02
MW-52-162	1	1	4.92E+02	4.92E+02	4.92E+02
MW-52-18	1	1	2.29E+02	2.29E+02	2.29E+02
MW-52-181	1	1	1.47E+02	1.47E+02	1.47E+02
MW-52-48	1	1	1.43E+02	1.43E+02	1.43E+02
MW-53-120	5	5	5.25E+03	5.05E+03	5.65E+03
MW-53-82	4	4	1.91E+03	6.64E+02	4.26E+03
MW-54-123	4	4	6.51E+02	5.31E+02	7.49E+02
MW-54-144	4	4	1.32E+03	1.13E+03	1.45E+03
MW-54-173	4	4	1.81E+03	1.57E+03	1.98E+03
MW-54-190	4	4	1.75E+03	1.43E+03	2.01E+03
MW-54-37	4	4	1.36E+03	1.16E+03	1.60E+03
MW-54-58	4	4	7.40E+02	6.58E+02	8.38E+02
MW-55-24	4	4	1.29E+03	1.04E+03	1.59E+03
MW-55-35	4	4	2.19E+03	8.53E+02	2.83E+03
MW-55-54	4	4	6.41E+03	5.47E+03	7.33E+03
MW-56-53	2	2	5.93E+02	5.00E+02	6.86E+02
MW-56-83	2	2	3.20E+03	3.15E+03	3.24E+03
MW-57-11	1	1	4.22E+03	4.22E+03	4.22E+03
MW-57-20	1	1	1.52E+03	1.52E+03	1.52E+03
MW-57-45	1	1	1.19E+03	1.19E+03	1.19E+03
MW-58-26	3	3	4.52E+02	4.13E+02	5.19E+02
MW-58-65	3	3	2.48E+02	2.33E+02	2.75E+02
MW-60-135	4	4	3.41E+02	3.17E+02	3.83E+02
MW-60-154	4	4	4.44E+02	4.09E+02	5.13E+02
MW-60-176	4	4	1.00E+03	9.16E+02	1.04E+03
MW-60-35	4	3	2.30E+02	2.00E+02	2.60E+02
MW-60-53	4	2	3.51E+02	2.03E+02	4.99E+02
MW-60-72	4	3	1.71E+02	1.67E+02	1.73E+02
MW-62-138	4	4	6.51E+02	5.76E+02	7.72E+02
MW-62-18	4	4	3.60E+02	2.36E+02	4.64E+02
MW-62-182	4	4	5.53E+02	4.66E+02	7.36E+02
MW-62-37	4	4	3.56E+02	2.17E+02	4.87E+02
MW-62-53	4	4	3.28E+02	2.40E+02	4.33E+02

Tritium Summary

Well Name	# Samples in 2009	# Positive H-3 Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-62-71	4	4	3.99E+02	2.99E+02	4.78E+02
MW-62-92	4	4	4.74E+02	2.80E+02	6.08E+02
MW-63-112	4	4	4.60E+02	4.37E+02	4.96E+02
MW-63-121	4	4	5.32E+02	4.66E+02	6.23E+02
MW-63-163	4	4	5.59E+02	4.36E+02	6.96E+02
MW-63-174	4	4	4.67E+02	4.22E+02	4.98E+02
MW-63-18	4	2	2.89E+02	1.97E+02	3.80E+02
MW-63-34	4	4	3.48E+02	3.10E+02	4.20E+02
MW-63-50	4	4	3.31E+02	2.98E+02	3.60E+02
MW-63-93	4	4	2.68E+02	1.66E+02	3.40E+02
MW-66-21	5	4	6.66E+02	4.29E+02	9.51E+02
MW-66-36	4	4	3.85E+03	3.05E+03	4.39E+03
MW-67-105	4	4	1.96E+03	1.77E+03	2.12E+03
MW-67-173	5	5	8.07E+02	6.73E+02	1.05E+03
MW-67-219	4	4	1.13E+03	9.22E+02	1.44E+03
MW-67-276	4	4	1.00E+03	9.17E+02	1.10E+03
MW-67-323	4	4	3.94E+02	3.65E+02	4.21E+02
MW-67-340	4	4	5.07E+02	4.70E+02	5.37E+02
MW-67-39	4	4	3.26E+03	2.69E+03	3.88E+03
U1-CSS	3	3	2.59E+03	1.57E+03	3.28E+03
U3-4D	4	4	4.55E+02	3.82E+02	4.82E+02
U3-T1	4	4	4.45E+02	3.28E+02	6.75E+02
U3-T2	4	4	1.04E+03	8.94E+02	1.12E+03

Note 1: All results are in pCi/L

Note 2: A total of 431 samples were analyzed for H-3 in 2009 with 385 positive results.

Note 3: A sample is positive if the result is greater than or equal to 3 times the 1 sigma uncertainty. The target MDC is 200 pCi/L.

Cobalt-60 Summary

Well Name	# Samples in 2009	# Positive Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-42-49	5	1	5.23E+00	5.23E+00	5.23E+00
MW-44-66	4	1	3.09E+00	3.09E+00	3.09E+00
MW-63-163	4	1	6.80E+00	6.80E+00	6.80E+00

Note 1: All results are in pCi/L

Note 2: A total of 431 samples were analyzed for Co-60 in 2009 with 3 positive results.

Note 3: A sample is positive if the result is greater than or equal to 3 times the 1 sigma uncertainty. The target MDC is 15 pCi/L.

Nickel-63 Summary

Well Name	# Samples in 2009	# Positive Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-42-49	5	5	6.49E+02	7.46E+01	1.16E+03
MW-49-26	4	1	2.31E+01	2.31E+01	2.31E+01
MW-67-173	5	1	8.40E+01	8.40E+01	8.40E+01
MW-67-276	4	1	2.21E+01	2.21E+01	2.21E+01

Note 1: All results are in pCi/L

Note 2: A total of 176 samples were analyzed for Ni-63 in 2009 with 8 positive results.

Note 3: A sample is positive if the result is greater than or equal to 3 times the 1 sigma uncertainty. The target MDC is 30 pCi/L.

Strontium-90 Summary

Well Name	# Samples in 2009	# Positive Sr-90 Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-111	2	2	1.51E+00	8.46E-01	2.17E+00
MW-31-49	7	1	5.58E-01	5.58E-01	5.58E-01
MW-31-63	7	3	7.67E-01	5.59E-01	1.10E+00
MW-32-85	7	1	8.00E-01	8.00E-01	8.00E-01
MW-36-41	3	3	5.43E+00	4.03E+00	7.12E+00
MW-36-52	4	4	3.50E+00	2.40E+00	4.70E+00
MW-37-22	4	4	1.07E+01	8.81E+00	1.24E+01
MW-37-32	4	4	1.85E+01	1.11E+01	2.38E+01
MW-37-40	4	4	8.35E+00	1.11E+00	1.69E+01
MW-37-57	4	4	2.63E+01	1.99E+01	3.17E+01
MW-39-102	2	2	1.82E+00	1.24E+00	2.40E+00
MW-39-124	2	2	1.39E+00	9.16E-01	1.87E+00
MW-39-195	2	1	6.89E-01	6.89E-01	6.89E-01
MW-39-67	2	2	2.86E+00	2.37E+00	3.35E+00
MW-39-84	2	2	1.58E+00	1.11E+00	2.05E+00
MW-41-40	3	3	4.56E+00	4.00E+00	5.38E+00
MW-41-63	3	3	3.54E+00	2.67E+00	4.08E+00
MW-42-49	5	5	3.09E+02	4.83E+00	6.77E+02
MW-43-62	3	3	9.36E-01	6.85E-01	1.24E+00
MW-44-102	4	1	7.80E-01	7.80E-01	7.80E-01
MW-46	4	1	8.60E-01	8.60E-01	8.60E-01
MW-49-26	4	4	1.36E+01	1.23E+01	1.50E+01
MW-49-42	4	4	1.83E+01	1.74E+01	2.07E+01
MW-49-65	4	4	1.35E+01	1.14E+01	1.73E+01
MW-50-42	4	4	4.10E+00	1.96E+00	6.73E+00
MW-50-66	5	5	2.78E+01	2.42E+01	3.00E+01
MW-53-120	5	4	2.77E+01	2.37E+01	3.10E+01
MW-53-82	4	1	2.30E+00	2.30E+00	2.30E+00
MW-54-123	4	4	4.54E+00	3.77E+00	5.91E+00
MW-54-144	4	4	1.46E+01	1.43E+01	1.51E+01
MW-54-173	4	4	8.85E+00	7.42E+00	1.02E+01
MW-54-190	4	4	1.96E+01	1.90E+01	1.98E+01
MW-54-37	4	4	5.90E+00	5.53E+00	6.35E+00
MW-54-58	4	4	1.83E+00	1.41E+00	2.00E+00
MW-55-24	4	4	2.06E+01	1.55E+01	3.07E+01
MW-55-35	4	4	3.06E+01	1.71E+01	4.14E+01
MW-55-54	4	4	2.64E+01	2.11E+01	3.27E+01
MW-56-83	2	2	2.75E+00	2.71E+00	2.78E+00
MW-57-11	1	1	4.72E+01	4.72E+01	4.72E+01
MW-57-20	1	1	2.77E+00	2.77E+00	2.77E+00
MW-57-45	1	1	2.25E+00	2.25E+00	2.25E+00
MW-58-65	3	1	6.33E-01	6.33E-01	6.33E-01
MW-62-138	4	4	2.10E+00	1.31E+00	2.83E+00
MW-62-18	4	1	1.09E+00	1.09E+00	1.09E+00

Strontium-90 Summary

Well Name	# Samples in 2009	# Positive Sr-90 Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-63-121	4	1	7.30E-01	7.30E-01	7.30E-01
MW-63-93	4	1	5.44E-01	5.44E-01	5.44E-01
MW-66-36	4	4	9.31E+00	6.82E+00	1.22E+01
MW-67-105	4	2	6.91E-01	5.33E-01	8.49E-01
MW-67-39	4	4	1.13E+01	6.37E+00	1.42E+01
U1-CSS	3	3	2.24E+01	1.41E+01	3.56E+01
U3-T1	4	1	1.04E+00	1.04E+00	1.04E+00
U3-T2	4	1	1.76E+00	1.76E+00	1.76E+00

Note 1: All results are in pCi/L

Note 2: A total of 431 samples were analyzed for Sr-90 in 2009 with 145 positive results.

Note 3: A sample is positive if the result is greater than or equal to 3 times the 1 sigma uncertainty. The target MDC is 1 pCi/L.

Cesium-137 Summary

Well Name	# Samples in 2009	# Positive Samples in 2009	Avg Pos Act	Min Pos Act	Max Pos Act
MW-30-84	6	1	8.97E+00	8.97E+00	8.97E+00
MW-41-40	3	1	4.26E+00	4.26E+00	4.26E+00
MW-42-49	5	5	6.73E+04	5.42E+03	1.40E+05
MW-43-62	3	1	1.18E+01	1.18E+01	1.18E+01
MW-53-82	4	1	7.76E+00	7.76E+00	7.76E+00
MW-55-24	4	1	1.03E+01	1.03E+01	1.03E+01
MW-57-11	1	1	3.89E+00	3.89E+00	3.89E+00
MW-60-154	4	1	1.34E+01	1.34E+01	1.34E+01
MW-66-21	5	1	8.99E+00	8.99E+00	8.99E+00
MW-67-173	5	1	1.34E+01	1.34E+01	1.34E+01

Note 1: All results are in pCi/L

Note 2: A total of 431 samples were analyzed for Cs-137 in 2009 with 14 positive results.

Note 3: A sample is positive if the result is greater than or equal to 3 times the 1 sigma uncertainty. The target MDC is 18 pCi/L.