Entergy

**Entergy Nuclear Northeast**
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249
Tel (914) 254-6700

**Lawrence Coyle**
Site Vice President

NL-16-043

April 28, 2016

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

SUBJECT: 2015 Annual Radioactive Effluent Release Report
Indian Point Nuclear Generating Unit Nos. 1, 2 and 3
Docket Nos. 50-003, 50-247 and 50-286
License Nos. DPR-5, DPR-26 and DPR-64

Dear Sir or Madam:

The enclosures to this letter provide Entergy Nuclear Operations, Inc.'s Annual Radioactive Effluent Release Report for 2015. Enclosure 1 provides the report while Enclosure 2 provides the Process Control Program which is discussed in Section G of the report. This report is submitted in accordance with Technical Specification 5.6.3 and Regulatory Guide 1.21.

There are no new commitments being made in this submittal. If you have any questions or require additional information, please contact Mr. Robert W. Walpole, Regulatory Assurance Manager at (914) 254-6710.

Sincerely,

LC/rl

Enclosure: 1) Radioactive Effluent Release Report: 2015
2) Process Control Program

IE48
NRR

cc: Mr. Daniel H. Dorman, Regional Administrator, NRC Region I
Mr. Douglas Pickett, NRC, Sr. Project Manager, Division of Reactor Licensing
Mr. Kimberly A. Conway, IPEC NRC Unit 1 Project Manager
NRC Resident Inspector's Office
Mr. John B. Rhodes, President and CEO, NYSERDA (w/o enclosure)
Ms. Bridget Frymire, New York State Department of Public Service (w/o enclosure)
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
Engineering Department, American Nuclear Insurers
Chief, Compliance Section, New York State DEC
Division of Water Regional Water Engineer, New York State DEC

ENCLOSURE 1 TO NL-16-043

# Radioactive Effluent Release Report: 2015

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3
DOCKET NOS. 50-003, 50-247 AND 50-286

# Radioactive Effluent Release Report: 2015

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 non-gamma activity (H-3, Ni-63, Fe-55, Sr-89/90 etc.), 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) for routine effluents, and procedural guidance for optimizing decay and treatment of liquid waste.

### 3. Average Energy

This information is no longer used. It is available on site.

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 dependent 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 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 (I-133, I-135) 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, Sr-89, and Sr-90 is used per the station ODCMs. An absence of any positive activity is identified as "-".

d) Carbon-14

C-14 release quantification details are discussed in Section E.

e) Liquid Effluents

A sample of each batch discharge is taken and an isotopic analysis is performed in compliance with requirements specified in the ODCM. Proportional composite samples of continuous discharges are taken and analyzed per the ODCM, 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 non-gamma emitters is used per the station ODCM (Gross Alpha, Sr-89, Sr-90, Fe-55 and Ni-63). When there has been no positive activity, "-" is entered.

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. Curie and dose data from unprocessed fluid is included in the following tables, along with all other liquid effluent, continuous or batch, processed or not. Processed and unprocessed water is differentiated only to prevent confusion with regard to measures undertaken to convert liquid to solid waste (resin cleanup). Therefore, volumes of processed and unprocessed liquid 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 | 2015 |
|---|---|---|---|---|---|---|
| Number of Batch Releases | | 60 | 66 | 69 | 65 | 260 |
| Total Time Period | (min) | 3760 | 3530 | 3350 | 3720 | 14400 |
| Maximum Time Period | (min) | 97 | 91 | 81 | 91 | 97 |
| Average Time Period | (min) | 62.7 | 53.4 | 48.5 | 57.2 | 55.2 |
| Minimum Time Period | (min) | 8 | 1 | 21 | 19 | 1 |

| Unit 3 Airborne Releases | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |
|---|---|---|---|---|---|---|
| Number of Batch Releases | | 56 | 26 | 44 | 28 | 154 |
| Total Time Period | (min) | 3250 | 2890 | 3840 | 3460 | 13400 |
| Maximum Time Period | (min) | 226 | 193 | 259 | 217 | 259 |
| Average Time Period | (min) | 58 | 111 | 87.3 | 123 | 87.2 |
| Minimum Time Period | (min) | 1 | 1 | 2 | 1 | 1 |

Liquid:

| Unit 1 and 2 Liquid Releases | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |
|---|---|---|---|---|---|---|
| Number of Batch Releases | | 12 | 4 | 12 | 17 | 45 |
| Total Time Period | (min) | 1100 | 371 | 1050 | 1590 | 4110 |
| Maximum Time Period | (min) | 105 | 107 | 105 | 112 | 112 |
| Average Time Period | (min) | 91.4 | 92.8 | 87.4 | 93.5 | 91.3 |
| Minimum Time Period | (min) | 79 | 84 | 38 | 69 | 38 |

| Unit 3 Liquid Releases | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |
|---|---|---|---|---|---|---|
| Number of Batch Releases | | 71 | 31 | 31 | 13 | 146 |
| Total Time Period | (min) | 8090 | 3500 | 3390 | 1410 | 16400 |
| Maximum Time Period | (min) | 136 | 128 | 118 | 122 | 136 |
| Average Time Period | (min) | 114 | 113 | 109 | 108 | 112 |
| Minimum Time Period | (min) | 99 | 98 | 103 | 73 | 73 |

Average Stream Flow:

Regulatory Guide 1.21 includes a section to report average stream flows. This data, for some plants, is used to determine dilution volume. However, at IPEC, the Hudson River stream flow is not applied to dilution calculations, in favor of the more conservative method of using only the dilution in the discharge canal, running north to south, parallel to the river, and servicing the plant.

This conservative dilution volume is determined quarterly, applied for liquid offsite dose calculations (and all other determinations of diluted effluent), and reported on Tables 2A, in Section B of this report.

Hudson River flow information remains available, however, from the Department of the Interior, United States Geological Survey (USGS), or from web sites such as:

http://ny.water.usgs.gov/projects/dialer_plots/Hudson_R_at_Poughkeepsie_Freshwater_Discharge.htm

6. Abnormal Releases

a) Liquid

General Groundwater

IPEC's groundwater quantification model involves a verification/calibration such that the annual release to the environment remains a function of annual precipitation and source term. The 2015 effluent dose was similar to that of 2014.

The offsite dose associated with the groundwater pathway remains small. The total routine liquid effluent inclusive of the groundwater pathway contributes <0.1% of the annual limit. Groundwater and storm water effluent flow rates and source term data are further described in Section H of this report. A breakdown of the total dose from the groundwater and storm water pathways is provided in Section E of this report (Radiological Impact on Man).

Elevated tritium levels were noted in several sentinel and down-gradient wells at Unit 2 throughout much of the year. As discussed in the 2014 report, the root cause of these increased levels was determined to be the overflow of draining of systems to floor drains inside the Primary Auxiliary Building (PAB) during the Unit 2 2014 refueling outage, with subsequent leakage to ground into gaps between the wall and floor of the PAB. As expected the general trend was decreasing tritium levels through most of 2015. However, a significant increase was noted on one well (MW-30-69) in early February. Entergy has attributed this increase to re-suspension of the 2014 release event. The dose consequences of these tritium levels was negligible and is included in the doses performed in Section E of this report.

b) Airborne - None

7. ODCM Reporting Requirements

ODCM Part I requires reporting of various conditions during the year. These include effluent monitoring equipment out of service for periods exceeding 30 consecutive days, notification of any changes in the land use census, changes in the Radiological Environmental Monitoring Program (REMP), any time total curie content limitations in outdoor tanks is exceeded, or any other changes in the ODCM or Process Control Program (PCP).

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 Containment Gas Monitor, R-42 | 4/27/15 to 6/3/15<br>37 days | R-42 detector failed transfer calibration during normal 2 year calibration surveillance procedure 2-PC-EM30. No functioning spare detectors were available on hand and therefore, there was delay in developing a success path for calibrating and returning the R-42 channel to service following the calibration. |
| Unit 2 Fan Cooler Unit Service Water Return, R-46 & R-53 and Steam Generator Blowdown, R-49 | 8/26/15 to 10/5/15<br>40 days | All three monitors placed in standby for repairs to leaks in the service water piping. The repair time was influenced by the extensive nature of these repairs. |

As required, compensatory sampling was performed for the above OOS monitors.

Other Reporting Criteria:

***Tank Curie Limits***

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

***Land Use Census***

During this reporting period, there were no changes to the Land Use Census.

***PCP changes:***

The Process Control Program document is a fleet procedure for Entergy. An editorial change to this procedure was completed in 2015. See details in the Enclosure.

***ODCM changes:***

During this reporting period, there were no changes to the ODCM.

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT RELEASE REPORT

B. GASEOUS EFFLUENTS

2015

TABLE 1A

INDIAN POINT 1 and 2 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 5.57E-02 | 6.07E-02 | 5.25E-02 | 5.51E-02 | 2.24E-01 | ± 25 |
| 2. Average release rate | uCi/sec | 7.16E-03 | 7.72E-03 | 6.60E-03 | 6.93E-03 | 7.10E-03 | |

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 | 3.63E+00 | 3.11E+00 | 2.19E+00 | 1.95E+00 | 1.09E+01 | ± 25 |
| 2. Average release rate | uCi/sec | 4.67E-01 | 3.96E-01 | 2.76E-01 | 2.45E-01 | 3.45E-01 | |

E. Carbon-14

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.78E+00 | 2.78E+00 | 2.78E+00 | 2.78E+00 | 1.11E+01 |
| 2. Average release rate | uCi/sec | 3.57E-01 | 3.53E-01 | 3.49E-01 | 3.49E-01 | 3.52E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |

- Indicates < MDA

TABLE 1C
INDIAN POINT 1 and 2 **CONTINUOUS** GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

Nuclides Released

**1) Fission Gases**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Xe-133 | Ci | - | - | - | - | 0.00E+00 |
| 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**

| | | | | | | |
|---|---|---|---|---|---|---|
| Co-58 | Ci | - | - | - | - | 0.00E+00 |
| | | | | | | |
| | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

- Indicates < MDA

TABLE 1C
INDIAN POINT 1 and 2 - **BATCH** GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

Nuclides Released

**1) Fission Gases**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Ar-41 | Ci | 3.84E-02 | 3.97E-02 | 4.55E-02 | 4.28E-02 | 1.66E-01 |
| Kr-85 | Ci | - | - | - | - | 0.00E+00 |
| Kr-85m | Ci | 1.35E-04 | 1.48E-04 | - | - | 2.83E-04 |
| Kr-87 | Ci | 9.62E-05 | 1.20E-04 | - | - | 2.16E-04 |
| Kr-88 | Ci | 2.30E-04 | 2.89E-04 | - | - | 5.19E-04 |
| Xe-131m | Ci | - | - | - | - | 0.00E+00 |
| Xe-133 | Ci | 1.42E-02 | 1.75E-02 | 7.06E-03 | 1.23E-02 | 5.11E-02 |
| Xe-133m | Ci | 1.83E-04 | 1.60E-06 | - | - | 1.85E-04 |
| Xe-135 | Ci | 2.18E-03 | 2.57E-03 | - | - | 4.75E-03 |
| Xe-135m | Ci | 1.81E-04 | 2.67E-04 | - | - | 4.48E-04 |
| Xe-138 | Ci | - | 7.17E-05 | - | - | 7.17E-05 |
| Total for Period | Ci | 5.56E-02 | 6.07E-02 | 5.26E-02 | 5.51E-02 | 2.24E-01 |

- indicates <MDA

**2) Iodines**

Not Applicable for Batch Releases

**3) Particulates**

Not Applicable for Batch Releases

TABLE 1A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 6.38E-01 | 2.33E-02 | 9.59E-02 | 2.71E-02 | 7.84E-01 | ± 25 |
| 2. Average release rate | uCi/sec | 8.20E-02 | 2.96E-03 | 1.21E-02 | 3.41E-03 | 2.49E-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 | 2.25E+00 | 2.95E+00 | 4.42E+00 | 3.38E+00 | 1.30E+01 | ± 25 |
| 2. Average release rate | uCi/sec | 2.89E-01 | 3.75E-01 | 5.56E-01 | 4.25E-01 | 4.12E-01 | |

E. Carbon-14

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.31E+00 | 2.31E+00 | 2.31E+00 | 2.31E+00 | 9.24E+00 |
| 2. Average release rate | uCi/sec | 2.97E-01 | 2.94E-01 | 2.91E-01 | 2.91E-01 | 2.93E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |

- Indicates < MDA

TABLE 1C
INDIAN POINT 3 - CONTINUOUS GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

Nuclides Released

**1) Fission Gases**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Ar-41 | Ci | - | - | - | - | 0.00E+00 |
| Xe-133 | Ci | - | - | - | - | 0.00E+00 |
| Xe-135 | Ci | - | - | - | - | 0.00E+00 |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

**2) Iodines**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| 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**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

- indicates < MDA

TABLE 1C
INDIAN POINT 3 - BATCH GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

Nuclides Released

**1) Fission Gases**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Ar-41 | Ci | 1.36E-01 | 1.55E-02 | 1.88E-02 | 2.26E-02 | 1.93E-01 |
| Kr-85 | Ci | - | - | - | - | 0.00E+00 |
| Kr-85m | Ci | 3.80E-03 | - | - | - | 3.80E-03 |
| Kr-87 | Ci | 1.83E-04 | - | - | - | 1.83E-04 |
| Kr-88 | Ci | 3.60E-03 | - | - | - | 3.60E-03 |
| Xe-131m | Ci | - | - | - | - | 0.00E+00 |
| Xe-133 | Ci | 4.18E-01 | 7.82E-03 | 7.61E-02 | 4.54E-03 | 5.06E-01 |
| Xe-133m | Ci | 1.08E-03 | - | - | - | 1.08E-03 |
| Xe-135 | Ci | 7.51E-02 | - | 9.81E-04 | - | 7.61E-02 |
| Xe-135m | Ci | - | - | - | - | 0.00E+00 |
| Total for Period | Ci | 6.38E-01 | 2.33E-02 | 9.59E-02 | 2.71E-02 | 7.84E-01 |

- Indicates < MDA

**2) Iodines**

Not Applicable for Batch Releases

**3) Particulates**

Not Applicable for Batch Releases

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT REPORT

C. LIQUID EFFLUENTS

2015

TABLE 2A

INDIAN POINT 1 and 2 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Products | Units | **Qtr 1** | **Qtr 2** | **Qtr 3** | **Qtr 4** | **Year 2015** | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release (not including Tritium, Gr Alpha, & Gases) | Ci | 6.35E-03 | 5.83E-03 | 8.72E-03 | 1.48E-02 | 3.57E-02 | ± 25 |
| 2. Average Diluted Conc | uCi/ml | 1.12E-11 | 8.62E-12 | 1.05E-11 | 1.90E-11 | 1.25E-11 | |

B. Tritium

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 1.24E+02 | 8.33E+01 | 1.71E+02 | 3.04E+02 | 6.82E+02 | ± 25 |
| 2. Average Diluted Conc | uCi/ml | 2.19E-07 | 1.23E-07 | 2.06E-07 | 3.91E-07 | 2.39E-07 | |

C. Dissolved & Entrained Gases

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | - | - | - | 3.78E-05 | 3.78E-05 | ± 25 |
| 2. AverageDiluted Conc | uCi/ml | - | - | - | 4.86E-14 | 1.33E-14 | |

D. Gross Alpha

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

E. Volume of Waste Released

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Processed Waste (LW & NCD) | liters | 2.16E+06 | 2.01E+06 | 2.52E+06 | 3.52E+06 | 1.02E+07 | ± 10 |
| 2. Unprocessed (SGBD, SFDS, U1FD) | liters | 4.33E+07 | 4.49E+07 | 4.32E+07 | 4.63E+07 | 1.78E+08 | ± 10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| F. Volume of Dilution Water | liters | 5.67E+11 | 6.76E+11 | 8.31E+11 | 7.78E+11 | 2.85E+12 | ± 10 |

- Indicates < MDA

TABLE 2B

INDIAN POINT 1 and 2 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

CONTINUOUS RADIOACTIVE EFFLUENT

| Nuclides Released | Units | **Qtr 1** | **Qtr 2** | **Qtr 3** | **Qtr 4** | **Year 2015** |
|---|---|---|---|---|---|---|
| Cs-137 | Ci | 5.04E-03 | 5.23E-03 | 6.49E-03 | 1.08E-02 | 2.76E-02 |
| Ni-63 | Ci | - | - | - | - | 0.00E+00 |
| Sr-89 | Ci | - | - | - | - | 0.00E+00 |
| Sr-90 | Ci | 4.69E-05 | 4.69E-05 | 3.51E-05 | 8.58E-05 | 2.15E-04 |
| Total for Period | Ci | 5.09E-03 | 5.28E-03 | 6.53E-03 | 1.09E-02 | 2.78E-02 |

| | | | | | | |
|---|---|---|---|---|---|---|
| H-3 (only) | Ci | 1.07E-01 | 1.19E-01 | 1.02E-01 | 1.20E-01 | 4.48E-01 |

- Indicates < MDA

TABLE 2B

INDIAN POINT 1 and 2 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

BATCH RADIOACTIVE EFFLUENT

| Nuclides Released | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 |
|---|---|---|---|---|---|---|
| Ag-110m | Ci | - | - | 7.15E-05 | - | 7.15E-05 |
| Co-58 | Ci | - | 5.84E-05 | 2.38E-05 | 3.13E-04 | 3.95E-04 |
| Co-60 | Ci | - | 1.97E-05 | 2.94E-04 | 3.84E-04 | 6.98E-04 |
| Cs-137 | Ci | - | - | - | - | 0.00E+00 |
| Fe-55 | Ci | 3.56E-04 | 1.91E-04 | - | - | 5.47E-04 |
| Mn-54 | Ci | - | - | - | - | 0.00E+00 |
| Ni-63 | Ci | - | 2.47E-04 | 1.70E-03 | 3.23E-03 | 5.18E-03 |
| Sb-125 | Ci | 9.02E-04 | 3.63E-05 | 9.98E-05 | 1.69E-05 | 1.06E-03 |
| Te-123m | Ci | - | - | - | - | 0.00E+00 |
| Te-125m | Ci | - | - | - | - | 0.00E+00 |
| Total for Period | Ci | 1.26E-03 | 5.52E-04 | 2.19E-03 | 3.94E-03 | **7.94E-03** |

Dissolved & Entrained Gas

| | | | | | | |
|---|---|---|---|---|---|---|
| Kr-85 | Ci | - | - | - | - | 0.00E+00 |
| Xe-133 | Ci | - | - | - | 3.78E-05 | 3.78E-05 |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.78E-05 | **3.78E-05** |

- Indicates < MDA

TABLE 2A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Products | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2015 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release (not including Tritium, Gr Alpha, & Gases) | Ci | 8.55E-03 | 1.78E-02 | 9.72E-03 | 4.86E-03 | 4.09E-02 | ± 25 |
| 2. Average Diluted Conc | uCi/ml | 1.51E-11 | 2.63E-11 | 1.17E-11 | 6.25E-12 | 1.44E-11 | |

B. Tritium

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 9.75E+02 | 7.98E+01 | 1.20E+02 | 1.13E+02 | 1.29E+03 | ± 25 |
| 2. Average Diluted Conc | uCi/ml | 1.72E-06 | 1.18E-07 | 1.44E-07 | 1.45E-07 | 4.52E-07 | |

C. Dissolved & Entrained Gases

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 1.10E-02 | 3.76E-04 | 4.85E-04 | 9.89E-05 | 1.20E-02 | ± 25 |
| 2. AverageDiluted Conc | uCi/ml | 1.94E-11 | 5.56E-13 | 5.84E-13 | 1.27E-13 | 4.19E-12 | |

D. Gross Alpha

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

E. Volume of Waste Released

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Processed Fluids (Mon Tanks) | liters | 1.85E+06 | 8.02E+05 | 8.03E+05 | 3.29E+05 | 3.78E+06 | ± 10 |
| 2. Unprocessed Fluids (SGs) | liters | 9.08E+06 | 5.95E+06 | 7.30E+06 | 3.19E+06 | 2.55E+07 | ± 10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| F. Volume of Dilution Water | liters | 5.67E+11 | 6.76E+11 | 8.31E+11 | 7.78E+11 | 2.85E+12 | ± 10 |

'- indicates < MDA

TABLE 2B
INDIAN POINT 3 LIQUID RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2015)
BATCH and CONTINUOUS RADIOACTIVE LIQUID EFFLUENT

*Batch Fission/Activation Products*

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2015 |
|---|---|---|---|---|---|---|
| Ag-110m | Ci | 1.25E-04 | 5.20E-04 | 1.22E-04 | 1.16E-04 | 8.83E-04 |
| Co-58 | Ci | 1.08E-04 | 3.25E-03 | 9.40E-04 | 2.71E-04 | 4.57E-03 |
| Co-60 | Ci | 1.62E-03 | 1.98E-03 | 4.72E-04 | 5.21E-04 | 4.59E-03 |
| Cr-51 | Ci | 1.29E-04 | 8.87E-04 | - | - | 1.02E-03 |
| Cs-134 | Ci | - | - | - | 6.83E-06 | 6.83E-06 |
| Cs-137 | Ci | 7.06E-06 | - | 6.43E-05 | 5.02E-04 | 5.73E-04 |
| Fe-55 | Ci | - | 9.55E-04 | - | 7.36E-04 | 1.69E-03 |
| I-132 | Ci | 8.11E-05 | - | - | - | 8.11E-05 |
| Mn-54 | Ci | 9.99E-06 | 3.23E-05 | - | - | 4.23E-05 |
| Nb-95 | Ci | 7.98E-06 | 9.51E-05 | 1.16E-06 | - | 1.04E-04 |
| Ni-63 | Ci | 1.53E-03 | 2.77E-03 | 3.47E-03 | 1.70E-03 | 9.47E-03 |
| Sb-124 | Ci | 2.69E-06 | 1.89E-04 | 6.34E-04 | 2.47E-05 | 8.50E-04 |
| Sb-125 | Ci | 1.03E-03 | 6.97E-04 | 3.91E-03 | 7.03E-04 | 6.34E-03 |
| Tc-99m | Ci | 1.66E-06 | - | - | - | 1.66E-06 |
| Te-123m | Ci | 7.11E-04 | 7.72E-04 | 1.11E-04 | 3.00E-05 | 1.62E-03 |
| Te-125m | Ci | 3.11E-03 | 5.61E-03 | - | 2.51E-04 | 8.97E-03 |
| Te-132 | Ci | 7.64E-05 | - | - | - | 7.64E-05 |
| Total for Period | Ci | 8.55E-03 | 1.78E-02 | 9.72E-03 | 4.86E-03 | 4.09E-02 |

*Dissolved and Entrained Gas (Batch)*

| | | | | | | |
|---|---|---|---|---|---|---|
| Xe-133 | Ci | 1.10E-02 | 3.76E-04 | 4.85E-04 | 9.89E-05 | 1.20E-02 |
| Xe-135 | Ci | 1.38E-05 | - | - | - | 1.38E-05 |
| Total for Period | Ci | 1.10E-02 | 3.76E-04 | 4.85E-04 | 9.89E-05 | 1.20E-02 |

*Continuous Releases (SG Blowdown)*

| | | | | | | |
|---|---|---|---|---|---|---|
| H-3 (only) | Ci | 5.45E-04 | 5.42E-03 | 3.30E-03 | 1.67E-03 | 1.09E-02 |

- indicates < mda

Indian Point Energy Center

(Units 1, 2, and 3)

RADIOACTIVE EFFLUENT REPORT

D. SOLID WASTE

2015

# Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0 (all identified isotopes are included)

Waste Stream: Resins, Filters, and Evap Bottoms

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 2.17E+02 | 6.14E+00 | 9.95E+00 | +/- 25% |
| B | 1.00E+02 | 2.83E+00 | 9.76E+01 | +/- 25% |
| C | 5.10E+01 | 1.44E+00 | 4.05E+01 | +/- 25% |
| All | 3.68E+02 | 1.04E+01 | 1.48E+02 | +/- 25% |

Waste Stream : Dry Active Waste

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 1.09E+04 | 3.09E+02 | 6.47E-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 | 1.09E+04 | 3.09E+02 | 6.47E-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

| 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

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 1.11E+04 | 3.15E+02 | 1.06E+01 | +/-25% |
| B | 1.00E+02 | 2.83E+00 | 9.76E+01 | +/-25% |
| C | 5.10E+01 | 1.44E+00 | 4.05E+01 | +/-25% |
| All | 1.13E+04 | 3.19E+02 | 1.49E+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 01/01/2015 to 12/31/2015

Percent Cutoff: 0

| Number of Shipments | Mode of Transportations | Destination |
|---|---|---|
| 2 | Hittman Transport | ALARON Services (Veolia) |
| 5 | Hittman Transport | Energy Solutions – Bear Creek |
| 8 | Hittman Transport | Energy Solutions – GRF |
| 1 | Hittman Transport | Erwin Resin Solutions LLC |
| 9 | Horwith Trucks | Energy Solutions – GRF |

Resins, Filters and Evaporator Bottoms
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.02% | 1.83E-03 |
| C-14 | 0.00% | 4.29E-04 |
| Mn-54 | 1.04% | 1.03E-01 |
| Fe-55 | 22.90% | 2.28E+00 |
| Co-57 | 0.17% | 1.68E-02 |
| Co-58 | 1.10% | 1.09E-01 |
| Co-60 | 49.72% | 4.95E+00 |
| Ni-59 | 0.17% | 1.72E-02 |
| Ni-63 | 20.71% | 2.06E+00 |
| Zn-65 | 0.23% | 2.26E-02 |
| Sr-89 | 0.00% | 2.65E-07 |
| Sr-90 | 0.00% | 4.44E-04 |
| Zr-95 | 0.01% | 1.21E-03 |
| Nb-95 | 0.00% | 7.21E-05 |
| Tc-99 | 0.16% | 1.58E-02 |
| Ag-110m | 0.70% | 6.95E-02 |
| Sn-113 | 0.02% | 2.15E-03 |
| Sb-125 | 2.40% | 2.39E-01 |
| I-129 | 0.00% | 3.77E-06 |
| Cs-134 | 0.00% | 2.40E-04 |
| Cs-137 | 0.58% | 5.75E-02 |
| Ce-144 | 0.01% | 6.17E-04 |
| Pu-238 | 0.00% | 6.23E-05 |
| Pu-239 | 0.00% | 1.27E-05 |
| Pu-241 | 0.04% | 4.36E-03 |
| Am-241 | 0.00% | 7.40E-05 |
| Cm-242 | 0.00% | 1.57E-06 |
| Cm-243 | 0.00% | 2.39E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Resins, Filters and Evaporator Bottoms
Waste Class B

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.00% | 4.71E-03 |
| C-14 | 0.00% | 5.96E-04 |
| Mn-54 | 1.36% | 1.33E+00 |
| Fe-55 | 12.09% | 1.18E+01 |
| Co-57 | 0.19% | 1.83E-01 |
| Co-58 | 0.37% | 3.62E-01 |
| Co-60 | 29.93% | 2.92E+01 |
| Ni-59 | 0.58% | 5.65E-01 |
| Ni-63 | 45.46% | 4.44E+01 |
| Zn-65 | 0.50% | 4.90E-01 |
| Sr-89 | 0.01% | 1.13E-02 |
| Sr-90 | 0.07% | 6.78E-02 |
| Tc-99 | 0.00% | 3.24E-03 |
| Sb-125 | 1.18% | 1.16E+00 |
| I-129 | 0.00% | 2.86E-04 |
| Cs-134 | 0.23% | 2.26E-01 |
| Cs-137 | 7.86% | 7.68E+00 |
| Ce-144 | 0.11% | 1.07E-01 |
| Pu-238 | 0.00% | 8.18E-04 |
| Pu-239 | 0.00% | 1.66E-04 |
| Pu-241 | 0.05% | 4.62E-02 |
| Am-241 | 0.00% | 1.17E-04 |
| Cm-242 | 0.00% | 8.86E-06 |
| Cm-243 | 0.00% | 1.97E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

# Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Resins, Filters and Evaporator Bottoms
Waste Class C

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.01% | 3.79E-03 |
| C-14 | 0.00% | 1.42E-03 |
| Mn-54 | 1.44% | 5.84E-01 |
| Fe-55 | 23.93% | 9.68E+00 |
| Co-57 | 0.25% | 1.01E-01 |
| Co-58 | 2.38% | 9.63E-01 |
| Co-60 | 48.47% | 1.96E+01 |
| Ni-59 | 0.16% | 6.33E-02 |
| Ni-63 | 18.78% | 7.60E+00 |
| Zn-65 | 0.36% | 1.44E-01 |
| Sr-89 | 0.00% | 1.75E-05 |
| Sr-90 | 0.00% | 1.32E-03 |
| Zr-95 | 0.10% | 4.06E-02 |
| Nb-95 | 0.05% | 2.05E-02 |
| Tc-99 | 0.14% | 5.83E-02 |
| Ag-110m | 1.08% | 4.36E-01 |
| Sn-113 | 0.06% | 2.56E-02 |
| Sb-125 | 2.28% | 9.25E-01 |
| I-129 | 0.00% | 4.05E-06 |
| Cs-137 | 0.46% | 1.87E-01 |
| Ce-144 | 0.00% | 1.98E-03 |
| Pu-238 | 0.00% | 2.25E-04 |
| Pu-239 | 0.00% | 4.60E-05 |
| Pu-241 | 0.04% | 1.61E-02 |
| Am-241 | 0.00% | 2.72E-04 |
| Cm-242 | 0.00% | 1.31E-05 |
| Cm-243 | 0.00% | 8.90E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Resins, Filters and Evaporator Bottoms
Total Combined

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.01% | 1.03E-02 |
| C-14 | 0.00% | 2.45E-03 |
| Mn-54 | 1.36% | 2.02E+00 |
| Fe-55 | 16.05% | 2.38E+01 |
| Co-57 | 0.20% | 3.01E-01 |
| Co-58 | 0.97% | 1.43E+00 |
| Co-60 | 36.33% | 5.38E+01 |
| Ni-59 | 0.44% | 6.45E-01 |
| Ni-63 | 36.51% | 5.41E+01 |
| Zn-65 | 0.44% | 6.57E-01 |
| Sr-89 | 0.01% | 1.13E-02 |
| Sr-90 | 0.05% | 6.96E-02 |
| Zr-95 | 0.03% | 4.18E-02 |
| Nb-95 | 0.01% | 2.06E-02 |
| Tc-99 | 0.05% | 7.74E-02 |
| Ag-110m | 0.34% | 5.06E-01 |
| Sn-113 | 0.02% | 2.77E-02 |
| Sb-125 | 1.57% | 2.32E+00 |
| I-129 | 0.00% | 2.94E-04 |
| Cs-134 | 0.15% | 2.26E-01 |
| Cs-137 | 5.35% | 7.92E+00 |
| Ce-144 | 0.07% | 1.10E-01 |
| Pu-238 | 0.00% | 1.11E-03 |
| Pu-239 | 0.00% | 2.25E-04 |
| Pu-241 | 0.05% | 6.67E-02 |
| Am-241 | 0.00% | 4.63E-04 |
| Cm-242 | 0.00% | 2.35E-05 |
| Cm-243 | 0.00% | 1.33E-03 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Dry Active Waste
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 12.62% | 8.17E-02 |
| C-14 | 2.82% | 1.83E-02 |
| Mn-54 | 0.30% | 1.91E-03 |
| Fe-55 | 20.25% | 1.31E-01 |
| Co-57 | 0.07% | 4.32E-04 |
| Co-58 | 3.55% | 2.30E-02 |
| Co-60 | 22.60% | 1.46E-01 |
| Ni-63 | 8.34% | 5.40E-02 |
| Tc-99 | 25.36% | 1.64E-01 |
| Ag-110m | 0.98% | 6.34E-03 |
| Sb-125 | 1.86% | 1.21E-02 |
| I-129 | 0.07% | 4.61E-04 |
| Cs-137 | 1.05% | 6.79E-03 |
| Ce-144 | 0.11% | 6.96E-04 |
| Pu-238 | 0.00% | 4.57E-06 |
| Pu-239 | 0.00% | 1.38E-06 |
| Pu-241 | 0.02% | 1.38E-04 |
| Am-241 | 0.00% | 4.18E-06 |
| Cm-242 | 0.00% | 4.29E-07 |
| Cm-243 | 0.00% | 4.54E-06 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

## Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Dry Active Waste
Total Combined

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 12.62% | 8.17E-02 |
| C-14 | 2.82% | 1.83E-02 |
| Mn-54 | 0.30% | 1.91E-03 |
| Fe-55 | 20.25% | 1.31E-01 |
| Co-57 | 0.07% | 4.32E-04 |
| Co-58 | 3.55% | 2.30E-02 |
| Co-60 | 22.60% | 1.46E-01 |
| Ni-63 | 8.34% | 5.40E-02 |
| Tc-99 | 25.36% | 1.64E-01 |
| Ag-110m | 0.98% | 6.34E-03 |
| Sb-125 | 1.86% | 1.21E-02 |
| I-129 | 0.07% | 4.61E-04 |
| Cs-137 | 1.05% | 6.79E-03 |
| Ce-144 | 0.11% | 6.96E-04 |
| Pu-238 | 0.00% | 4.57E-06 |
| Pu-239 | 0.00% | 1.38E-06 |
| Pu-241 | 0.02% | 1.38E-04 |
| Am-241 | 0.00% | 4.18E-06 |
| Cm-242 | 0.00% | 4.29E-07 |
| Cm-243 | 0.00% | 4.54E-06 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.79% | 8.35E-02 |
| C-14 | 0.18% | 1.87E-02 |
| Mn-54 | 0.99% | 1.05E-01 |
| Fe-55 | 22.74% | 2.41E+00 |
| Co-57 | 0.16% | 1.73E-02 |
| Co-58 | 1.25% | 1.32E-01 |
| Co-60 | 48.06% | 5.09E+00 |
| Ni-59 | 0.16% | 1.72E-02 |
| Ni-63 | 19.96% | 2.12E+00 |
| Zn-65 | 0.21% | 2.26E-02 |
| Sr-89 | 0.00% | 2.65E-07 |
| Sr-90 | 0.00% | 4.44E-04 |
| Zr-95 | 0.01% | 1.21E-03 |
| Nb-95 | 0.00% | 7.21E-05 |
| Tc-99 | 1.70% | 1.80E-01 |
| Ag-110m | 0.72% | 7.58E-02 |
| Sn-113 | 0.02% | 2.15E-03 |
| Sb-125 | 2.37% | 2.51E-01 |
| I-129 | 0.00% | 4.64E-04 |
| Cs-134 | 0.00% | 2.40E-04 |
| Cs-137 | 0.61% | 6.42E-02 |
| Ce-144 | 0.01% | 1.31E-03 |
| Pu-238 | 0.00% | 6.69E-05 |
| Pu-239 | 0.00% | 1.41E-05 |
| Pu-241 | 0.04% | 4.50E-03 |
| Am-241 | 0.00% | 7.81E-05 |
| Cm-242 | 0.00% | 1.99E-06 |
| Cm-243 | 0.00% | 2.43E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

# Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class B

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.00% | 4.71E-03 |
| C-14 | 0.00% | 5.96E-04 |
| Mn-54 | 1.36% | 1.33E+00 |
| Fe-55 | 12.09% | 1.18E+01 |
| Co-57 | 0.19% | 1.83E-01 |
| Co-58 | 0.37% | 3.62E-01 |
| Co-60 | 29.93% | 2.92E+01 |
| Ni-59 | 0.58% | 5.65E-01 |
| Ni-63 | 45.46% | 4.44E+01 |
| Zn-65 | 0.50% | 4.90E-01 |
| Sr-89 | 0.01% | 1.13E-02 |
| Sr-90 | 0.07% | 6.78E-02 |
| Tc-99 | 0.00% | 3.24E-03 |
| Sb-125 | 1.18% | 1.16E+00 |
| I-129 | 0.00% | 2.86E-04 |
| Cs-134 | 0.23% | 2.26E-01 |
| Cs-137 | 7.86% | 7.68E+00 |
| Ce-144 | 0.11% | 1.07E-01 |
| Pu-238 | 0.00% | 8.18E-04 |
| Pu-239 | 0.00% | 1.66E-04 |
| Pu-241 | 0.05% | 4.62E-02 |
| Am-241 | 0.00% | 1.17E-04 |
| Cm-242 | 0.00% | 8.86E-06 |
| Cm-243 | 0.00% | 1.97E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class C

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.01% | 3.79E-03 |
| C-14 | 0.00% | 1.42E-03 |
| Mn-54 | 1.44% | 5.84E-01 |
| Fe-55 | 23.93% | 9.68E+00 |
| Co-57 | 0.25% | 1.01E-01 |
| Co-58 | 2.38% | 9.63E-01 |
| Co-60 | 48.47% | 1.96E+01 |
| Ni-59 | 0.16% | 6.33E-02 |
| Ni-63 | 18.78% | 7.60E+00 |
| Zn-65 | 0.36% | 1.44E-01 |
| Sr-89 | 0.00% | 1.75E-05 |
| Sr-90 | 0.00% | 1.32E-03 |
| Zr-95 | 0.10% | 4.06E-02 |
| Nb-95 | 0.05% | 2.05E-02 |
| Tc-99 | 0.14% | 5.83E-02 |
| Ag-110m | 1.08% | 4.36E-01 |
| Sn-113 | 0.06% | 2.56E-02 |
| Sb-125 | 2.28% | 9.25E-01 |
| I-129 | 0.00% | 4.05E-06 |
| Cs-137 | 0.46% | 1.87E-01 |
| Ce-144 | 0.00% | 1.98E-03 |
| Pu-238 | 0.00% | 2.25E-04 |
| Pu-239 | 0.00% | 4.60E-05 |
| Pu-241 | 0.04% | 1.61E-02 |
| Am-241 | 0.00% | 2.72E-04 |
| Cm-242 | 0.00% | 1.31E-05 |
| Cm-243 | 0.00% | 8.90E-04 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

**Units 1 and 2 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class All

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.06% | 9.20E-02 |
| C-14 | 0.01% | 2.07E-02 |
| Mn-54 | 1.36% | 2.02E+00 |
| Fe-55 | 16.07% | 2.39E+01 |
| Co-57 | 0.20% | 3.01E-01 |
| Co-58 | 0.98% | 1.46E+00 |
| Co-60 | 36.27% | 5.40E+01 |
| Ni-59 | 0.43% | 6.45E-01 |
| Ni-63 | 36.38% | 5.41E+01 |
| Zn-65 | 0.44% | 6.57E-01 |
| Sr-89 | 0.01% | 1.13E-02 |
| Sr-90 | 0.05% | 6.96E-02 |
| Zr-95 | 0.03% | 4.18E-02 |
| Nb-95 | 0.01% | 2.06E-02 |
| Tc-99 | 0.16% | 2.42E-01 |
| Ag-110m | 0.34% | 5.12E-01 |
| Sn-113 | 0.02% | 2.77E-02 |
| Sb-125 | 1.57% | 2.33E+00 |
| I-129 | 0.00% | 7.54E-04 |
| Cs-134 | 0.15% | 2.26E-01 |
| Cs-137 | 5.33% | 7.93E+00 |
| Ce-144 | 0.07% | 1.11E-01 |
| Pu-238 | 0.00% | 1.11E-03 |
| Pu-239 | 0.00% | 2.27E-04 |
| Pu-241 | 0.04% | 6.68E-02 |
| Am-241 | 0.00% | 4.67E-04 |
| Cm-242 | 0.00% | 2.39E-05 |
| Cm-243 | 0.00% | 1.33E-03 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report the amounts of curies shipped.

## Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0 (all identified isotopes are included)

Waste Stream : Resins, Filters, and Evaporator Bottoms

| Waste Class | Volume ft$^3$ | Volume m$^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 1.80E+02 | 5.10E+00 | 1.30E+00 | +/- 25% |
| B | 1.39E+02 | 3.94E+00 | 2.84E+01 | +/- 25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/- 25% |
| All | 3.19E+02 | 9.03E+00 | 2.97E+01 | +/- 25% |

Waste Stream : Dry Active Waste

| Waste Class | Volume ft$^3$ | Volume m$^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 2.02E+04 | 5.72E+02 | 1.12E+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 | 2.02E+04 | 5.72E+02 | 1.12E+00 | +/-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

| 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

| Waste Class | Volume ft$^3$ | Volume m$^3$ | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 2.04E+04 | 5.77E+02 | 2.42E+00 | +/-25% |
| B | 1.39E+02 | 3.94E+00 | 2.84E+01 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| All | 2.05E+04 | 5.81E+02 | 3.08E+01 | +/-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 01/01/2015 to 12/31/2015
Percent Cutoff: 0

| Number of Shipments | Mode of Transportations | Destination |
| --- | --- | --- |
| 14 | Hittman Transport | Energy Solutions Bear Creek<br>1560 Bear Creek Road |
| 1 | Hittman Transport | Erwin Resin Solutions LLC<br>151 T.C. Runion Road |

Resins, Filters and Evaporator Bottoms
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
| --- | --- | --- |
| H-3 | 0.17% | 2.16E-03 |
| C-14 | 1.72% | 2.23E-02 |
| Mn-54 | 0.44% | 5.78E-03 |
| Fe-55 | 13.96% | 1.81E-01 |
| Co-57 | 0.06% | 8.38E-04 |
| Co-58 | 0.11% | 1.49E-03 |
| Co-60 | 10.94% | 1.42E-01 |
| Ni-59 | 0.54% | 7.02E-03 |
| Ni-63 | 58.01% | 7.54E-01 |
| Zn-65 | 0.11% | 1.43E-03 |
| Sr-90 | 0.04% | 4.65E-04 |
| Tc-99 | 0.27% | 3.53E-03 |
| Sb-125 | 1.03% | 1.34E-02 |
| I-129 | 0.05% | 6.88E-04 |
| Cs-134 | 0.49% | 6.37E-03 |
| Cs-137 | 11.40% | 1.48E-01 |
| Ce-144 | 0.46% | 6.00E-03 |
| Pu-241 | 0.18% | 2.32E-03 |
| Am-241 | 0.00% | 1.08E-05 |
| Cm-243 | 0.00% | 5.50E-06 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

**Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Resins, Filters and Evaporator Bottoms
Waste Class B

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.01% | 3.36E-03 |
| C-14 | 0.45% | 1.26E-01 |
| Mn-54 | 2.29% | 6.49E-01 |
| Fe-55 | 15.79% | 4.48E+00 |
| Co-57 | 0.10% | 2.93E-02 |
| Co-58 | 0.18% | 5.06E-02 |
| Co-60 | 14.43% | 4.10E+00 |
| Ni-59 | 0.95% | 2.71E-01 |
| Ni-63 | 53.35% | 1.51E+01 |
| Sr-89 | 0.01% | 2.19E-03 |
| Sr-90 | 0.03% | 9.26E-03 |
| Nb-94 | 0.02% | 6.56E-03 |
| Nb-95 | 0.03% | 8.54E-03 |
| Tc-99 | 0.01% | 2.00E-03 |
| Ag-110m | 0.04% | 1.19E-02 |
| Sn-113 | 0.04% | 1.19E-02 |
| Sb-125 | 4.00% | 1.14E+00 |
| I-129 | 0.00% | 2.47E-04 |
| Cs-134 | 0.24% | 6.79E-02 |
| Cs-137 | 7.96% | 2.26E+00 |
| Ce-144 | 0.07% | 1.96E-02 |
| Pu-238 | 0.00% | 5.36E-05 |
| Pu-239 | 0.00% | 1.13E-05 |
| Pu-241 | 0.01% | 1.50E-03 |
| Am-241 | 0.00% | 2.57E-05 |
| Cm-242 | 0.00% | 9.55E-06 |
| Cm-243 | 0.00% | 3.15E-05 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

## Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Resins, Filters and Evaporator Bottoms
Waste Class Total Combined

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.02% | 5.52E-03 |
| C-14 | 0.50% | 1.49E-01 |
| Mn-54 | 2.21% | 6.54E-01 |
| Fe-55 | 15.71% | 4.66E+00 |
| Co-57 | 0.10% | 3.01E-02 |
| Co-58 | 0.18% | 5.21E-02 |
| Co-60 | 14.28% | 4.24E+00 |
| Ni-59 | 0.94% | 2.78E-01 |
| Ni-63 | 53.55% | 1.59E+01 |
| Zn-65 | 0.00% | 1.43E-03 |
| Sr-89 | 0.01% | 2.19E-03 |
| Sr-90 | 0.03% | 9.72E-03 |
| Nb-94 | 0.02% | 6.56E-03 |
| Nb-95 | 0.03% | 8.54E-03 |
| Tc-99 | 0.02% | 5.53E-03 |
| Ag-110m | 0.04% | 1.19E-02 |
| Sn-113 | 0.04% | 1.19E-02 |
| Sb-125 | 3.87% | 1.15E+00 |
| I-129 | 0.00% | 9.35E-04 |
| Cs-134 | 0.25% | 7.43E-02 |
| Cs-137 | 8.11% | 2.41E+00 |
| Ce-144 | 0.09% | 2.56E-02 |
| Pu-238 | 0.00% | 5.36E-05 |
| Pu-239 | 0.00% | 1.13E-05 |
| Pu-241 | 0.01% | 3.82E-03 |
| Am-241 | 0.00% | 3.65E-05 |
| Cm-242 | 0.00% | 9.55E-06 |
| Cm-243 | 0.00% | 3.70E-05 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

**Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Dry Active Waste
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 1.52% | 1.71E-02 |
| C-14 | 0.02% | 1.90E-04 |
| Cr-51 | 1.74% | 1.96E-02 |
| Mn-54 | 0.23% | 2.57E-03 |
| Fe-55 | 15.07% | 1.69E-01 |
| Co-57 | 0.08% | 8.74E-04 |
| Co-58 | 2.56% | 2.88E-02 |
| Co-60 | 24.94% | 2.80E-01 |
| Ni-59 | 0.66% | 7.38E-03 |
| Ni-63 | 40.57% | 4.56E-01 |
| Zr-95 | 2.77% | 3.11E-02 |
| Nb-94 | 0.16% | 1.84E-03 |
| Nb-95 | 4.28% | 4.82E-02 |
| Tc-99 | 0.09% | 1.06E-03 |
| Sn-113 | 0.14% | 1.57E-03 |
| Sb-125 | 2.52% | 2.84E-02 |
| I-129 | 0.02% | 2.11E-04 |
| Cs-137 | 2.63% | 2.96E-02 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

## Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Dry Active Waste
Waste Class Total Combined

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 1.52% | 1.71E-02 |
| C-14 | 0.02% | 1.90E-04 |
| Cr-51 | 1.74% | 1.96E-02 |
| Mn-54 | 0.23% | 2.57E-03 |
| Fe-55 | 15.07% | 1.69E-01 |
| Co-57 | 0.08% | 8.74E-04 |
| Co-58 | 2.56% | 2.88E-02 |
| Co-60 | 24.94% | 2.80E-01 |
| Ni-59 | 0.66% | 7.38E-03 |
| Ni-63 | 40.57% | 4.56E-01 |
| Zr-95 | 2.77% | 3.11E-02 |
| Nb-94 | 0.16% | 1.84E-03 |
| Nb-95 | 4.28% | 4.82E-02 |
| Tc-99 | 0.09% | 1.06E-03 |
| Sn-113 | 0.14% | 1.57E-03 |
| Sb-125 | 2.52% | 2.84E-02 |
| I-129 | 0.02% | 2.11E-04 |
| Cs-137 | 2.63% | 2.96E-02 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

**Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class A

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.79% | 1.92E-02 |
| C-14 | 0.93% | 2.25E-02 |
| Cr-51 | 0.81% | 1.96E-02 |
| Mn-54 | 0.34% | 8.35E-03 |
| Fe-55 | 14.47% | 3.51E-01 |
| Co-57 | 0.07% | 1.71E-03 |
| Co-58 | 1.25% | 3.03E-02 |
| Co-60 | 17.43% | 4.23E-01 |
| Ni-59 | 0.59% | 1.44E-02 |
| Ni-63 | 49.92% | 1.21E+00 |
| Zn-65 | 0.06% | 1.43E-03 |
| Sr-90 | 0.02% | 4.65E-04 |
| Zr-95 | 1.28% | 3.11E-02 |
| Nb-94 | 0.08% | 1.84E-03 |
| Nb-95 | 1.99% | 4.82E-02 |
| Tc-99 | 0.19% | 4.59E-03 |
| Sn-113 | 0.06% | 1.57E-03 |
| Sb-125 | 1.72% | 4.18E-02 |
| I-129 | 0.04% | 8.98E-04 |
| Cs-134 | 0.26% | 6.37E-03 |
| Cs-137 | 7.33% | 1.78E-01 |
| Ce-144 | 0.25% | 6.00E-03 |
| Pu-241 | 0.10% | 2.32E-03 |
| Am-241 | 0.00% | 1.08E-05 |
| Cm-243 | 0.00% | 5.50E-06 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

# Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015

Percent Cutoff: 0

Sum of All 4 Categories
Waste Class B

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.01% | 3.36E-03 |
| C-14 | 0.45% | 1.26E-01 |
| Mn-54 | 2.29% | 6.49E-01 |
| Fe-55 | 15.79% | 4.48E+00 |
| Co-57 | 0.10% | 2.93E-02 |
| Co-58 | 0.18% | 5.06E-02 |
| Co-60 | 14.43% | 4.10E+00 |
| Ni-59 | 0.95% | 2.71E-01 |
| Ni-63 | 53.35% | 1.51E+01 |
| Sr-89 | 0.01% | 2.19E-03 |
| Sr-90 | 0.03% | 9.26E-03 |
| Nb-94 | 0.02% | 6.56E-03 |
| Nb-95 | 0.03% | 8.54E-03 |
| Tc-99 | 0.01% | 2.00E-03 |
| Ag-110m | 0.04% | 1.19E-02 |
| Sn-113 | 0.04% | 1.19E-02 |
| Sb-125 | 4.00% | 1.14E+00 |
| I-129 | 0.00% | 2.47E-04 |
| Cs-134 | 0.24% | 6.79E-02 |
| Cs-137 | 7.96% | 2.26E+00 |
| Ce-144 | 0.07% | 1.96E-02 |
| Pu-238 | 0.00% | 5.36E-05 |
| Pu-239 | 0.00% | 1.13E-05 |
| Pu-241 | 0.01% | 1.50E-03 |
| Am-241 | 0.00% | 2.57E-05 |
| Cm-242 | 0.00% | 9.55E-06 |
| Cm-243 | 0.00% | 3.15E-05 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

**Unit 3 Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream 01/01/2015 to 12/31/2015**

Percent Cutoff: 0

Sum of All 4 Categories
Total Combined

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 0.07% | 2.26E-02 |
| C-14 | 0.48% | 1.49E-01 |
| Cr-51 | 0.06% | 1.96E-02 |
| Mn-54 | 2.13% | 6.57E-01 |
| Fe-55 | 15.68% | 4.83E+00 |
| Co-57 | 0.10% | 3.10E-02 |
| Co-58 | 0.26% | 8.08E-02 |
| Co-60 | 14.67% | 4.52E+00 |
| Ni-59 | 0.92% | 2.85E-01 |
| Ni-63 | 53.08% | 1.64E+01 |
| Zn-65 | 0.00% | 1.43E-03 |
| Sr-89 | 0.01% | 2.19E-03 |
| Sr-90 | 0.03% | 9.72E-03 |
| Zr-95 | 0.10% | 3.11E-02 |
| Nb-94 | 0.03% | 8.40E-03 |
| Nb-95 | 0.18% | 5.67E-02 |
| Tc-99 | 0.02% | 6.58E-03 |
| Ag-110m | 0.04% | 1.19E-02 |
| Sn-113 | 0.04% | 1.35E-02 |
| Sb-125 | 3.82% | 1.18E+00 |
| I-129 | 0.00% | 1.15E-03 |
| Cs-134 | 0.24% | 7.43E-02 |
| Cs-137 | 7.91% | 2.44E+00 |
| Ce-144 | 0.08% | 2.56E-02 |
| Pu-238 | 0.00% | 5.36E-05 |
| Pu-239 | 0.00% | 1.13E-05 |
| Pu-241 | 0.01% | 3.82E-03 |
| Am-241 | 0.00% | 3.65E-05 |
| Cm-242 | 0.00% | 9.55E-06 |
| Cm-243 | 0.00% | 3.70E-05 |

Note: For radionuclides H-3, C-14, Tc-99 and I-129 if value is <MDA then MDA is used to report curies shipped.

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

RADIOACTIVE EFFLUENT REPORT

# E. RADIOLOGICAL IMPACT ON MAN

Jan 1, 2015 - Dec 31, 2015

# 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 Regulatory 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 and information management. Site airborne effluent dose calculations include annual average dispersion and deposition factors, averaged from data collected over approximately 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 appropriate 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 were determined from sampling at Indian Point #3 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). The annual C-14 curies released, as determined from this study, were consistent with NUREG 0017, Rev. 1. Data was then normalized to a maximum expected annual total, based on rated electrical capacity, (approximately 1000 MW(e) maintained for the entire year). Once the curies released were established, dose calculations were performed per the station ODCM, which uses all C-14 released to determine inhalation doses, and 26% of the total (determined to be Carbon Dioxide form), to determine the ingestion doses, in accordance with Regulatory Guide 1.109.

In 2010, IPEC and other facilities combined historical data with the application of an EPRI model designed to estimate C-14 releases, given some key site-specific plant parameters (mass of the primary coolant, average thermal neutron cross section, rated MW, etc.). The estimates from this model, for IPEC, closely match the measured observations of 1982.

The maximum annual C-14 release information is as follows:

| **Maximum** (Bounding) Annual C-14 releases from IPEC | | **Unit 2** | **Unit 3** |
|---|---|---|---|
| Liquid Effluent $C^{14}$ Released | Curies | **0.07** | **0.07** |
| Total Airborne $C^{14}$ Released | Curies | **11.19** | **11.05** |
| Airborne $C^{14}$ as $CO_2$ | Curies | **2.91** | **2.87** |

| | | | |
|---|---|---|---|
| Airborne Effluent Child TB Dose, $C^{14}$ | mrem | **0.0690** | **0.0675** |
| Airborne Effluent Child Bone Dose, $C^{14}$ | mrem | **0.346** | **0.338** |
| Liquid Effluent Child TB Dose, $C^{14}$ | mrem | **0.00117** | **0.00116** |
| Liquid Effluent Child Bone Dose, $C^{14}$ | mrem | **0.00583** | **0.00577** |

The bounding values were then normalized with actual effective full power days (EFFD) to yield more accurate year to year annual airborne curies and mrem for each unit. A small liquid effluent component is maintained at IPEC as a result of data accumulated in the 1983 study (Kunz). Tables 1A (shown earlier) include the airborne curie data for the current year. The following section (Radiological Impact on Man) includes the dose information.

C-14 doses are grouped with "Iodine and Particulate" and reported in Table D in the following Radiological Impact on Man tables, for each unit. Table "C" provides doses from this category *excluding* C-14, to facilitate historical comparisons. However, since C-14 is grouped as a particulate, the total dose for this isotope needs to be added to all other Iodines and Particulates, for comparison of the singular dose limit for this category.

Therefore, table "D" includes dose from all categories of this group (Iodine, Particulate, Tritium, and Carbon-14), for appropriate comparison of the dose limits.

C-14 doses (alone) for the current year are provided (for information) in the following table:

| **Calculated** Annual C-14 releases from IPEC, **2015** | | **Unit 2** | **Unit 3** |
|---|---|---|---|
| Airborne Effluent Child TB Dose, $C^{14}$ | mrem | **0.0683** | **.0565** |
| Airborne Effluent Child Bone Dose, $C^{14}$ | mrem | **0.342** | **0.283** |

The airborne effluent dose from C-14 is distributed evenly over the year and applied to a total Iodine and Particulate dose in Table "D" following this section.

**Members of the Public:**

Members of the public visiting the site receive minimal dose as a result of onsite 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 **0.0009.**

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/hr =0.0333 hr; 0.0333 / 8760 = **3.8E-6.**

While onsite meteorological factors (dispersion and deposition) may be as high as a factor of ten higher than those used by the ODCM for routine effluents, these occupancy factors, when multiplied by doses calculated per the ODCM, demonstrate that dose to MEMBERS OF THE PUBLIC within the site boundary is negligible.

**Groundwater:**

Curies and dose contribution from activity discovered in onsite groundwater and storm drain pathways during the year are discussed in more detail in Section H. The offsite dose calculation involves multiple source term measurements, as well as computations 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 total offsite dose.

**Total Dose:**

Unit and pathway-specific dose data can be found on the Radiological Impact on Man tables following this discussion. For simplicity and to demonstrate compliance with 40CFR190, the following table indicates the maximum hypothetical Total Dose to an individual from operation of the facility, including any measured direct shine component from the site property:

| **Year: 2015** | | Total Body | Max Organ |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25 mrem** | **75 mrem** |
| **Routine Airborne Effluents**[1] | **Units 1 and 2** | **1.89E-03** | **1.89E-03** |
| **Routine Liquid Effluents** | **Units 1 and 2** | **9.40E-04** | **1.48E-03** |
| Liquid Releases of $C^{14}$ | Units 1 and 2 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Units 1 and 2 | 6.83E-02 | 3.42E-01 |
| **Routine Airborne Effluents**[1] | **Unit 3** | **2.23E-03** | **2.23E-03** |
| **Routine Liquid Effluents** | **Unit 3** | **3.07E-04** | **6.07E-04** |
| Liquid Releases of $C^{14}$ | Unit 3 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Unit 3 | 5.65E-02 | 2.83E-01 |
| **Ground Water & Storm Drain Totals** | **IPEC**[2] | **4.56E-05** | **1.84E-04** |
| **Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.** | **IPEC**[3] | **2.60E-01** | **2.60E-01** |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **3.93E-01** | **9.03E-01** |

Note 1: Routine airborne dose in this table is conservatively represented as a sum of Iodine, Particulate, and Tritium dose (excluding C-14, in mrem) with a mrem term added from noble gas gamma air energy (mrad, expressed as mrem). This 'addition' does not represent a real dose and is listed here solely to help demonstrate compliance with 40CFR190. (Doses by type of release and comparison to the specific limits of 10CFR50 Appendix I are summarized on the following pages.)

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

Note 3: 40CFR190 requires the reporting of total dose, including that of direct shine. Direct shine dose from sources other than dry cask are indistinguishable from background. Direct shine dose is determined from measured doses on the dry casks and extrapolated to the site boundary, and then corrected with occupancy factors to determine a bounding, worst case assessment of direct shine dose to a real individual. These doses are slightly higher than those of the previous year due to additional storage on the Independent Spent fuel Storage Installation (ISFSI). Details of each year's dose evaluation are available on site from Radiation Protection.

# INDIAN POINT UNITS 1 and 2 NUCLEAR POWER PLANTS
## RADIOLOGICAL IMPACT ON MAN
## JANUARY - DECEMBER 2015

Maximum exposed individual doses in mrem or mrad

### A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 3.16E-04 | 2.73E-04 | 3.18E-04 | 5.85E-04 | **1.48E-03** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 6.32E-03 | 5.46E-03 | 6.36E-03 | 1.17E-02 | 1.48E-02 |
| Age Group | | Teen | Child | Child | Child | Child |
| Critical Organ | | Liver | Bone | Bone | Bone | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 2.16E-04 | 1.81E-04 | 1.94E-04 | 3.49E-04 | **9.40E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 1.44E-02 | 1.21E-02 | 1.29E-02 | 2.33E-02 | 3.13E-02 |

### B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 1.56E-05 | 1.62E-05 | 1.77E-05 | 1.68E-05 | **6.63E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 3.12E-04 | 3.24E-04 | 3.54E-04 | 3.36E-04 | 6.63E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 1.05E-05 | 1.11E-05 | 1.10E-05 | 1.08E-05 | **4.34E-05** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 1.05E-04 | 1.11E-04 | 1.10E-04 | 1.08E-04 | 2.17E-04 |

### C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | 6.07E-04 | 5.21E-04 | 3.67E-04 | 3.27E-04 | **1.82E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 8.09E-03 | 6.95E-03 | 4.89E-03 | 4.36E-03 | 1.21E-02 |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

### D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | 1.77E-02 | 1.76E-02 | 1.74E-02 | 1.74E-02 | **7.01E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 2.36E-01 | 2.35E-01 | 2.33E-01 | 2.32E-01 | 4.67E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 8.55E-02 | 8.55E-02 | 8.55E-02 | 8.55E-02 | **3.42E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.14E+00 | 1.14E+00 | 1.14E+00 | 1.14E+00 | 2.28E+00 |

# INDIAN POINT 3 NUCLEAR POWER PLANT
# RADIOLOGICAL IMPACT ON MAN
# JANUARY - DECEMBER 2015

Maximum exposed individual doses in mrem or mrad

## A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 3.07E-04 | 1.95E-04 | 1.30E-04 | 1.06E-04 | **6.07E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 6.14E-03 | 3.90E-03 | 2.60E-03 | 2.12E-03 | 6.07E-03 |
| Age Group | | Adult | Adult | Child | Child | Adult |
| Critical Organ | | GiLLi | GiLLi | Bone | Bone | GiLLi |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 2.17E-04 | 2.91E-05 | 2.43E-05 | 3.68E-05 | **3.07E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 1.45E-02 | 1.94E-03 | 1.62E-03 | 2.45E-03 | 1.02E-02 |

## B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 6.24E-05 | 4.60E-06 | 7.63E-06 | 6.51E-06 | **8.11E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 1.25E-03 | 9.20E-05 | 1.53E-04 | 1.30E-04 | 8.11E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 1.55E-04 | 8.38E-06 | 2.04E-05 | 1.12E-05 | **1.95E-04** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 1.55E-03 | 8.38E-05 | 2.04E-04 | 1.12E-04 | 9.75E-04 |

## C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | 3.72E-04 | 4.87E-04 | 7.31E-04 | 5.58E-04 | **2.15E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 4.96E-03 | 6.49E-03 | 9.75E-03 | 7.44E-03 | 1.43E-02 |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

## D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | 1.45E-02 | 1.46E-02 | 1.49E-02 | 1.47E-02 | **5.86E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.93E-01 | 1.95E-01 | 1.98E-01 | 1.96E-01 | 3.91E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 7.08E-02 | 7.08E-02 | 7.08E-02 | 7.08E-02 | **2.83E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 9.43E-01 | 9.43E-01 | 9.43E-01 | 9.43E-01 | 1.89E+00 |

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

RADIOLOGICAL EFFLUENT REPORT

F. METEOROLOGICAL DATA

Jan 1, 2015 - Dec 31, 2015

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

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

RADIOACTIVE EFFLUENT REPORT

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

2015

**There were no changes to the REMP Sampling Locations in 2015.**

**There were no changes in the Land Use Census in 2015.**

**The Process Control Program (PCP) was updated in 2015**

An editorial change was made to this procedure. See details in the Enclosure.

**There were no changes to the IPEC ODCM in 2015**

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

RADIOACTIVE EFFLUENT REPORT

H. GROUNDWATER and STORM WATER REPORT

ACTIVITY ON SITE and OFFSITE DOSE CALCULATION

FOR THE PERIOD:

Jan 1, 2015 - Dec 31, 2015

# Summary of IPEC Groundwater and Storm Water Activity, 2015

The precipitation mass balance model applied in previous years was applied for offsite dose calculations in 2015, with some minor calibration updates performed by the contractor with regard to the distribution of groundwater flow through the site. Groundwater elevation readings continued to validate the model throughout the year.

As defined in the ODCM, a conservative method of source term selection is used for determining offsite dose from Groundwater and Storm Water. If a result is *below MDC* (whether positive or negative) it is *not* included in the computed average. This computed average is therefore biased high (more conservative from a dose computation perspective) relative to an average computed using all of the data (many of which indicate no activity). In cases where all the sampling locations assigned to a given stream tube provided results below the MDC, then an average activity value of zero was assigned to the effected portion of the stream tube. (This mathematically allows the calculation to proceed in the absence of positive detections).

Historical average precipitation at IPEC has been approximately 3 feet per year. In 2011, precipitation was unusually high (over 6 feet). In 2015, precipitation was measured at 3.29 feet per year (or inches per month, as an average). Doses from Groundwater/Storm water are dependent on two factors: source term and precipitation during the effected year.

**Results of 2015 Groundwater and Storm water offsite dose evaluation**

The results of the assessment are shown on the following table. These dose values are 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).

Groundwater (GW) and storm water tritium released from IPEC in 2015 totaled approximately 0.16 curies, resulting in a total body dose of significantly less than 0.1 mrem. It is evident that tritium alone, whether from ground water or routine effluents, does not arithmetically contribute to integrated offsite dose.

Sampling near the effluent points identified only trace levels of Tritium and Strontium-90. These data, as part of the Monitored Natural Attenuation analyses, show a continuation of the decreasing trends established with the termination of the identified Unit 2 SFP leaks (tritium plume) and the defueling and draining of Unit 1 SFPs (strontium plume). Strontium-90, a legacy isotope from Unit 1, contributed approximately 0.000023 curies to site effluent from the groundwater pathway. Combined GW releases from IPEC in 2015 (all radionuclides) resulted in a calculated annual dose of less than 0.0018% of the annual limits for whole body and critical organ:

**IPEC Groundwater and Storm Water Effluent Dose, 2015**

| | |
|---|---|
| **0.0000456 mrem to the total body** | **(0.0015% limit)** |
| **0.000184 mrem to the critical organ, adult bone** | **(0.0018% limit)** |

The annual dose from combined groundwater and storm water pathways remains well below applicable limits. When combined with routine liquid effluents (Section E), the total dose also remains significantly below ALARA limits of 3 mrem total body, and 10 mrem to the critical organ.

**IPEC Summary for Storm & Ground Water releases (H-3, Co-60, Ni-63, Sr-90, and Cs-137)** 2015 year

**Northern Clean Zone** Adult Doses,in mrem

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 3.87E+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 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 4.33E-09 | 3.87E+02 |

**Unit 2 North**

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 1.06E+05 |
| 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 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 3.25E-08 | 1.06E+05 |

**Unit 1/2**

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 2.06E+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 | 1.84E-04 | 0.00E+00 | 4.52E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.31E-06 | 2.29E+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 | 1.84E-04 | 1.10E-07 | 4.53E-05 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 5.42E-06 | 2.06E+04 |

**Unit 3 North**

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.26E+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 | 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 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.24E-07 | 1.26E+04 |

**Unit 3 South**

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 1.60E+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 | 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 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 4.78E-08 | 1.60E+04 |

**Southern Clean Zone**

| ISOTOPE | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | uCi |
|---|---|---|---|---|---|---|---|---|
| H-3 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 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 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Totals:** Adult Doses, in mrem

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| H-3 only | 0.00E+00 | 3.18E-07 | 3.18E-07 | 3.18E-07 | 3.18E-07 | 3.18E-07 | 3.18E-07 | Total uCis | |
| | BONE | LIVER | TOT BODY | THYROID | KIDNEY | LUNG | GI-LLI | 1.56E+05 | H3 |
| all isotopes | **1.84E-04** | 3.18E-07 | **4.56E-05** | 3.18E-07 | 3.18E-07 | 3.18E-07 | 5.63E-06 | 0.00E+00 | Co |
| | | | | | | | | 0.00E+00 | Ni |
| Adult Doses | | | | | | | | 2.29E+01 | Sr |
| % Annual Limit | 0.00184 | 0.000 | 0.00152 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00E+00 | Cs |

# INDIAN POINT
# RADIOLOGICAL GROUNDWATER
# MONITORING PROGRAM

2015

Summary of Results

The following pages represent the isotopic radio-analytical data for all onsite groundwater testing performed at Indian Point in 2015, as required per the ODCM and NEI 07-07.

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| B-6 | 5/29/15 | 2.07E+02 | 4.32E+02 | 0.1 | 1.1 | 6.7 | 7.3 | 1.3 | 6.5 | | |
| B-6 | 8/10/15 | -1.48E+02 | 3.63E+02 | 1.5 | 1.6 | -1.8 | 6.0 | 1.3 | 6.2 | | |
| B-6 | 11/6/15 | 1.99E+02 | 3.81E+02 | 0.8 | 1.5 | 0.9 | 4.5 | -3.1 | 5.9 | | |
| I-2 | 1/16/15 | -1.19E+02 | 3.48E+02 | -0.3 | 1.3 | 0.3 | 5.9 | -0.2 | 7.2 | | |
| I-2 | 5/12/15 | 2.22E+02 | 4.08E+02 | -0.1 | 0.7 | -2.0 | 7.6 | 2.1 | 7.0 | | |
| I-2 | 8/12/15 | -3.76E+01 | 3.63E+02 | 0.2 | 1.5 | -1.6 | 6.5 | -1.6 | 7.3 | | |
| I-2 | 11/3/15 | -1.19E+02 | 3.51E+02 | 0.4 | 1.4 | 2.2 | 6.8 | 4.5 | 6.8 | | |
| LAF-002 | 5/5/15 | -1.45E+02 | 3.66E+02 | 0.6 | 1.0 | -0.9 | 6.7 | -1.4 | 7.1 | -11.4 | 22. |
| LAF-002 | 11/5/15 | 1.51E+02 | 3.39E+02 | -0.6 | 1.0 | 3.5 | 5.6 | -0.7 | 5.2 | -0.9 | 13. |
| MH-5 | 1/8/15 | 3.94E+03 | 7.32E+02 | 0.9 | 1.4 | -2.8 | 9.0 | 0.4 | 7.4 | | |
| MH-5 | 4/24/15 | 1.06E+04 | 8.94E+02 | -0.2 | 0.7 | -0.3 | 7.8 | -1.3 | 5.0 | | |
| MH-5 | 7/9/15 | 5.45E+03 | 6.63E+02 | 0.0 | 1.3 | -3.7 | 5.6 | -2.9 | 7.4 | | |
| MH-5 | 10/22/15 | 1.38E+03 | 3.78E+02 | 1.0 | 1.8 | 2.5 | 7.7 | 1.3 | 5.7 | | |
| MW-107 | 5/1/15 | 3.38E+02 | 3.93E+02 | 0.9 | 1.3 | 1.7 | 4.7 | 0.3 | 4.7 | | |
| MW-111 | 1/15/15 | 7.52E+03 | 9.24E+02 | 0.7 | 1.1 | -2.7 | 6.5 | 0.1 | 7.5 | | |
| MW-111 | 2/27/15 | 6.20E+03 | | | | | | | | | |
| MW-111 | 3/11/15 | 1.90E+03 | | | | | | | | | |
| MW-111 | 4/17/15 | 7.33E+03 | 8.49E+02 | 0.1 | 0.8 | -6.8 | 10.3 | 0.9 | 8.4 | | |
| MW-111 | 5/29/15 | 1.17E+04 | | | | | | | | | |
| MW-111 | 6/24/15 | 1.32E+04 | | | | | | | | | |
| MW-111 | 7/17/15 | 1.69E+04 | 1.06E+03 | 0.5 | 1.6 | 0.8 | 6.5 | 0.0 | 7.3 | | |
| MW-111 | 8/17/15 | 3.46E+04 | | | | | | | | | |
| MW-111 | 9/24/15 | 3.31E+04 | | | | | | | | | |
| MW-111 | 10/19/15 | 3.30E+04 | | | | | | | | | |
| MW-111 | 11/4/15 | 2.70E+04 | 1.38E+03 | -0.5 | 0.9 | 2.5 | 5.6 | -1.2 | 8.1 | | |
| MW-111 | 12/16/15 | 3.37E+04 | | | | | | | | | |
| MW-30-69 | 1/6/15 | 4.26E+05 | 1.28E+04 | -0.5 | 1.4 | 1.6 | 7.1 | 0.7 | 6.9 | | |
| MW-30-69 | 1/14/15 | 5.02E+05 | | | | | | | | | |
| MW-30-69 | 1/21/15 | 3.29E+05 | | | | | | | | | |
| MW-30-69 | 1/26/15 | 4.30E+05 | | | | | | | | | |
| MW-30-69 | 2/5/15 | 9.39E+05 | | | | | | | | | |
| MW-30-69 | 2/9/15 | 4.70E+05 | | | | | | | | | |
| MW-30-69 | 2/17/15 | 4.91E+05 | | | | | | | | | |
| MW-30-69 | 2/24/15 | 7.30E+05 | | | | | | | | | |
| MW-30-69 | 3/3/15 | 5.50E+05 | | | | | | | | | |
| MW-30-69 | 3/9/15 | 4.32E+05 | | | | | | | | | |
| MW-30-69 | 3/16/15 | 2.39E+05 | | | | | | | | | |
| MW-30-69 | 3/23/15 | 2.38E+05 | | | | | | | | | |
| MW-30-69 | 4/1/15 | 2.27E+05 | | | | | | | | | |
| MW-30-69 | 4/8/15 | 2.84E+05 | | | | | | | | | |
| MW-30-69 | 4/15/15 | 3.90E+05 | | | | | | | | | |
| MW-30-69 | 4/22/15 | 3.20E+05 | 5.07E+03 | -0.2 | 0.9 | 2.4 | 7.0 | -1.7 | 7.1 | | |
| MW-30-69 | 4/29/15 | 3.07E+05 | | | | | | | | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-30-69 | 5/4/15 | 4.48E+05 | | | | | | | | | |
| MW-30-69 | 5/18/15 | 4.86E+05 | | | | | | | | | |
| MW-30-69 | 6/8/15 | 2.26E+05 | | | | | | | | | |
| MW-30-69 | 7/6/15 | 2.64E+05 | 8.76E+03 | -0.5 | 1.2 | 1.8 | 4.8 | 3.6 | 6.7 | | |
| MW-30-69 | 8/3/15 | 4.27E+05 | | | | | | | | | |
| MW-30-69 | 8/20/15 | 4.91E+05 | | | | | | | | | |
| MW-30-69 | 9/21/15 | 2.89E+05 | | | | | | | | | |
| MW-30-69 | 10/14/15 | 3.33E+05 | 8.37E+03 | -0.7 | 1.0 | 1.6 | 6.3 | 5.0 | 6.3 | | |
| MW-30-69 | 11/12/15 | 4.19E+05 | | | | | | | | | |
| MW-30-69 | 12/7/15 | 4.57E+05 | | | | | | | | | |
| MW-30-84 | 1/6/15 | 2.53E+04 | 1.56E+03 | 0.1 | 1.1 | -1.5 | 7.3 | -5.6 | 8.7 | | |
| MW-30-84 | 4/22/15 | 2.12E+05 | 3.72E+03 | -0.7 | 1.3 | -4.2 | 8.7 | 3.3 | 6.8 | | |
| MW-30-84 | 7/6/15 | 1.75E+05 | 5.85E+03 | -0.1 | 0.6 | 1.4 | 6.0 | 3.9 | 5.9 | | |
| MW-30-84 | 8/20/15 | 9.10E+04 | | | | | | | | | |
| MW-30-84 | 9/21/15 | 5.23E+04 | | | | | | | | | |
| MW-30-84 | 10/14/15 | 4.36E+04 | 1.86E+03 | -0.2 | 1.0 | -0.4 | 5.8 | 0.6 | 5.3 | | |
| MW-30-84 | 11/12/15 | 2.71E+04 | | | | | | | | | |
| MW-30-84 | 12/7/15 | 2.47E+04 | | | | | | | | | |
| MW-31-49 | 1/6/15 | 8.48E+03 | 9.27E+02 | 1.4 | 1.4 | 1.7 | 5.4 | 2.2 | 6.4 | | |
| MW-31-49 | 1/14/15 | 6.05E+04 | | | | | | | | | |
| MW-31-49 | 1/21/15 | 6.60E+03 | | | | | | | | | |
| MW-31-49 | 1/26/15 | 3.79E+04 | | | | | | | | | |
| MW-31-49 | 2/5/15 | 3.79E+04 | | | | | | | | | |
| MW-31-49 | 2/9/15 | 2.53E+04 | | | | | | | | | |
| MW-31-49 | 2/17/15 | 1.86E+04 | | | | | | | | | |
| MW-31-49 | 2/24/15 | 1.56E+04 | | | | | | | | | |
| MW-31-49 | 3/3/15 | 1.81E+04 | | | | | | | | | |
| MW-31-49 | 3/9/15 | 6.21E+04 | | | | | | | | | |
| MW-31-49 | 3/16/15 | 1.90E+03 | | | | | | | | | |
| MW-31-49 | 3/23/15 | 9.00E+02 | | | | | | | | | |
| MW-31-49 | 4/1/15 | 6.90E+03 | | | | | | | | | |
| MW-31-49 | 4/8/15 | 2.25E+04 | | | | | | | | | |
| MW-31-49 | 4/15/15 | 2.74E+04 | | | | | | | | | |
| MW-31-49 | 4/22/15 | 9.91E+03 | 8.94E+02 | 0.6 | 1.3 | 0.7 | 7.1 | 1.4 | 5.9 | | |
| MW-31-49 | 4/29/15 | 6.60E+03 | | | | | | | | | |
| MW-31-49 | 5/4/15 | 2.94E+04 | | | | | | | | | |
| MW-31-49 | 5/18/15 | 3.21E+04 | | | | | | | | | |
| MW-31-49 | 6/8/15 | 7.00E+02 | | | | | | | | | |
| MW-31-49 | 7/9/15 | 5.86E+02 | 3.48E+02 | 0.0 | 1.2 | 3.3 | 10.3 | -2.9 | 7.1 | | |
| MW-31-49 | 8/3/15 | 2.00E+03 | | | | | | | | | |
| MW-31-49 | 8/20/15 | 7.00E+02 | | | | | | | | | |
| MW-31-49 | 9/21/15 | 3.00E+02 | | | | | | | | | |
| MW-31-49 | 10/15/15 | 1.12E+03 | 4.38E+02 | 0.5 | 1.6 | -1.2 | 6.4 | 1.8 | 5.6 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-31-49 | 11/12/15 | 7.00E+02 | | | | | | | | | |
| MW-31-49 | 12/7/15 | 6.00E+03 | | | | | | | | | |
| MW-31-63 | 1/6/15 | 1.22E+05 | 3.45E+03 | -0.3 | 1.0 | -3.0 | 6.1 | 2.0 | 6.0 | | |
| MW-31-63 | 1/14/15 | 1.16E+05 | | | | | | | | | |
| MW-31-63 | 1/21/15 | 1.18E+05 | | | | | | | | | |
| MW-31-63 | 1/26/15 | 1.19E+05 | | | | | | | | | |
| MW-31-63 | 2/5/15 | 1.36E+05 | | | | | | | | | |
| MW-31-63 | 2/9/15 | 1.30E+05 | | | | | | | | | |
| MW-31-63 | 2/17/15 | 7.84E+04 | | | | | | | | | |
| MW-31-63 | 2/24/15 | 1.06E+05 | | | | | | | | | |
| MW-31-63 | 3/3/15 | 1.07E+05 | | | | | | | | | |
| MW-31-63 | 3/9/15 | 1.00E+05 | | | | | | | | | |
| MW-31-63 | 3/16/15 | 1.09E+05 | | | | | | | | | |
| MW-31-63 | 3/23/15 | 1.13E+05 | | | | | | | | | |
| MW-31-63 | 4/1/15 | 1.03E+05 | | | | | | | | | |
| MW-31-63 | 4/8/15 | 9.23E+04 | | | | | | | | | |
| MW-31-63 | 4/15/15 | 8.45E+04 | | | | | | | | | |
| MW-31-63 | 4/22/15 | 7.32E+04 | 2.24E+03 | 0.6 | 0.7 | -3.7 | 6.0 | -1.6 | 5.8 | | |
| MW-31-63 | 4/29/15 | 6.80E+04 | | | | | | | | | |
| MW-31-63 | 5/4/15 | 6.62E+04 | | | | | | | | | |
| MW-31-63 | 5/18/15 | 6.12E+04 | | | | | | | | | |
| MW-31-63 | 6/8/15 | 6.14E+04 | | | | | | | | | |
| MW-31-63 | 7/9/15 | 5.30E+04 | 1.78E+03 | -0.6 | 0.7 | -0.1 | 6.4 | 5.4 | 7.0 | | |
| MW-31-63 | 8/3/15 | 3.88E+04 | | | | | | | | | |
| MW-31-63 | 8/20/15 | 4.25E+04 | | | | | | | | | |
| MW-31-63 | 9/21/15 | 4.20E+04 | | | | | | | | | |
| MW-31-63 | 10/15/15 | 2.86E+04 | 1.46E+03 | 0.0 | 1.6 | 1.6 | 5.6 | -0.5 | 5.7 | | |
| MW-31-63 | 11/12/15 | 2.74E+04 | | | | | | | | | |
| MW-31-63 | 12/7/15 | 2.40E+04 | | | | | | | | | |
| MW-31-85 | 1/6/15 | 4.07E+04 | 2.02E+03 | 0.3 | 1.0 | 2.1 | 5.3 | -3.5 | 12.2 | | |
| MW-31-85 | 4/22/15 | 1.30E+04 | 9.84E+02 | 0.1 | 1.0 | 2.1 | 7.3 | -1.3 | 10.7 | | |
| MW-31-85 | 7/9/15 | 1.34E+03 | 4.32E+02 | 1.0 | 1.1 | 1.0 | 11.5 | 0.5 | 7.7 | | |
| MW-31-85 | 10/15/15 | 5.43E+02 | 4.23E+02 | -0.7 | 1.4 | 0.4 | 6.3 | 0.9 | 8.2 | | |
| MW-32-149 | 1/6/15 | 5.12E+00 | 4.26E+02 | 0.7 | 1.4 | -2.7 | 6.2 | 0.7 | 5.7 | | |
| MW-32-149 | 4/23/15 | 2.41E+02 | 3.51E+02 | -0.2 | 1.0 | 0.5 | 7.4 | -0.7 | 9.4 | | |
| MW-32-149 | 7/6/15 | 3.94E+02 | 3.96E+02 | -0.7 | 1.5 | -2.3 | 7.7 | -2.9 | 8.1 | | |
| MW-32-149 | 10/15/15 | 7.83E+01 | 2.79E+02 | 0.1 | 1.2 | 1.0 | 7.4 | -4.8 | 6.8 | | |
| MW-32-173 | 1/6/15 | 3.14E+02 | 4.35E+02 | 0.2 | 1.3 | 4.5 | 7.6 | 1.7 | 7.8 | | |
| MW-32-173 | 4/23/15 | 2.08E+02 | 3.45E+02 | 0.3 | 0.9 | 3.2 | 8.1 | 2.7 | 8.3 | | |
| MW-32-173 | 7/6/15 | 1.19E+02 | 3.69E+02 | 0.4 | 1.7 | 0.3 | 6.8 | 9.8 | 6.2 | | |
| MW-32-173 | 10/15/15 | 5.20E+01 | 2.73E+02 | 0.2 | 1.3 | 5.4 | 7.1 | -2.1 | 6.6 | | |
| MW-32-190 | 1/6/15 | 8.22E+02 | 4.11E+02 | -0.9 | 1.1 | -1.3 | 7.7 | -1.3 | 7.7 | | |
| MW-32-190 | 4/23/15 | 6.14E+02 | 3.90E+02 | 0.1 | 0.8 | 1.9 | 8.7 | -2.7 | 8.7 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-32-190 | 7/6/15 | 7.02E+02 | 4.23E+02 | -0.2 | 1.2 | 4.0 | 6.1 | 7.3 | 8.6 | | |
| MW-32-190 | 10/15/15 | 4.19E+02 | 3.30E+02 | -0.1 | 1.2 | -6.5 | 12.2 | -8.0 | 9.2 | | |
| MW-32-59 | 1/6/15 | 1.86E+05 | 5.91E+03 | 0.4 | 1.5 | -0.5 | 9.2 | 5.2 | 7.9 | | |
| MW-32-59 | 1/14/15 | 3.84E+04 | | | | | | | | | |
| MW-32-59 | 1/21/15 | 1.12E+05 | | | | | | | | | |
| MW-32-59 | 1/26/15 | 2.39E+05 | | | | | | | | | |
| MW-32-59 | 2/5/15 | 2.56E+05 | | | | | | | | | |
| MW-32-59 | 2/9/15 | 2.55E+05 | | | | | | | | | |
| MW-32-59 | 2/17/15 | 3.19E+05 | | | | | | | | | |
| MW-32-59 | 2/24/15 | 3.43E+05 | | | | | | | | | |
| MW-32-59 | 3/3/15 | 3.69E+05 | | | | | | | | | |
| MW-32-59 | 3/9/15 | 4.87E+05 | | | | | | | | | |
| MW-32-59 | 3/16/15 | 7.36E+04 | | | | | | | | | |
| MW-32-59 | 3/23/15 | 8.52E+04 | | | | | | | | | |
| MW-32-59 | 4/1/15 | 3.85E+04 | | | | | | | | | |
| MW-32-59 | 4/8/15 | 9.30E+04 | | | | | | | | | |
| MW-32-59 | 4/15/15 | 1.36E+05 | | | | | | | | | |
| MW-32-59 | 4/22/15 | 8.79E+04 | 2.35E+03 | 0.9 | 1.0 | 4.5 | 6.9 | -0.5 | 7.3 | | |
| MW-32-59 | 4/29/15 | 3.95E+04 | | | | | | | | | |
| MW-32-59 | 5/4/15 | 1.47E+05 | | | | | | | | | |
| MW-32-59 | 5/18/15 | 1.06E+05 | | | | | | | | | |
| MW-32-59 | 6/8/15 | 1.62E+04 | | | | | | | | | |
| MW-32-59 | 7/6/15 | 8.98E+03 | 7.98E+02 | 0.1 | 1.3 | 3.8 | 8.0 | 0.7 | 5.6 | | |
| MW-32-59 | 8/3/15 | 3.96E+04 | | | | | | | | | |
| MW-32-59 | 8/20/15 | 4.67E+04 | | | | | | | | | |
| MW-32-59 | 9/21/15 | 2.44E+04 | | | | | | | | | |
| MW-32-59 | 10/15/15 | 1.03E+04 | 1.13E+03 | 0.4 | 1.4 | -0.1 | 5.3 | -0.5 | 5.6 | | |
| MW-32-59 | 11/12/15 | 1.71E+04 | | | | | | | | | |
| MW-32-59 | 12/7/15 | 9.50E+03 | | | | | | | | | |
| MW-32-85 | 1/6/15 | 3.76E+04 | 1.95E+03 | -1.0 | 1.0 | -1.3 | 5.7 | 3.0 | 7.7 | | |
| MW-32-85 | 4/22/15 | 3.47E+04 | 1.61E+03 | 0.8 | 1.0 | -8.5 | 9.8 | 0.5 | 8.8 | | |
| MW-32-85 | 7/6/15 | 3.18E+04 | 1.61E+03 | -0.8 | 1.2 | 1.6 | 4.6 | -0.5 | 3.8 | | |
| MW-32-85 | 10/15/15 | 1.89E+04 | 1.16E+03 | -0.6 | 1.2 | 4.7 | 5.5 | 4.4 | 3.5 | | |
| MW-33 | 1/15/15 | 2.05E+04 | 1.46E+03 | 1.4 | 1.7 | -2.2 | 6.6 | -4.8 | 9.3 | | |
| MW-33 | 2/27/15 | 2.52E+04 | | | | | | | | | |
| MW-33 | 3/11/15 | 2.73E+04 | | | | | | | | | |
| MW-33 | 4/17/15 | 2.30E+04 | 1.41E+03 | 0.4 | 1.3 | 4.0 | 6.7 | -1.0 | 7.8 | | |
| MW-33 | 5/29/15 | 2.08E+04 | | | | | | | | | |
| MW-33 | 6/24/15 | 3.42E+04 | | | | | | | | | |
| MW-33 | 7/17/15 | 4.82E+04 | | | | | | | | | |
| MW-33 | 8/17/15 | 7.94E+04 | | | | | | | | | |
| MW-33 | 9/24/15 | 7.79E+04 | | | | | | | | | |
| MW-33 | 10/19/15 | 9.37E+04 | | | | | | | | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-33 | 11/4/15 | 8.21E+04 | 2.46E+03 | 0.3 | 1.4 | -0.3 | 8.4 | -1.5 | 6.5 | | |
| MW-33 | 12/16/15 | 2.64E+04 | | | | | | | | | |
| MW-35 | 1/15/15 | 5.16E+03 | 8.34E+02 | 0.7 | 1.7 | 0.9 | 9.0 | -0.7 | 9.2 | | |
| MW-35 | 2/28/15 | 5.40E+03 | | | | | | | | | |
| MW-35 | 3/11/15 | 3.10E+03 | | | | | | | | | |
| MW-35 | 4/17/15 | 4.71E+03 | 7.02E+02 | -0.2 | 0.8 | 1.4 | 6.6 | -4.2 | 6.1 | | |
| MW-35 | 5/29/15 | 7.70E+03 | | | | | | | | | |
| MW-35 | 6/24/15 | 4.70E+03 | | | | | | | | | |
| MW-35 | 7/17/15 | 4.60E+03 | | | | | | | | | |
| MW-35 | 8/17/15 | 5.00E+03 | | | | | | | | | |
| MW-35 | 9/24/15 | 4.00E+03 | | | | | | | | | |
| MW-35 | 10/19/15 | 3.30E+03 | | | | | | | | | |
| MW-35 | 11/4/15 | 2.35E+03 | 5.04E+02 | -0.2 | 1.1 | -1.1 | 6.7 | 3.8 | 6.2 | | |
| MW-35 | 12/16/15 | 6.10E+03 | | | | | | | | | |
| MW-36-24 | 1/8/15 | 4.75E+03 | 7.74E+02 | 0.4 | 1.0 | 1.5 | 5.2 | 2.0 | 7.8 | | |
| MW-36-24 | 4/20/15 | 9.28E+03 | 8.55E+02 | -0.3 | 0.9 | -1.5 | 7.3 | 1.9 | 5.9 | | |
| MW-36-24 | 7/28/15 | 1.99E+03 | 6.75E+02 | -0.2 | 1.3 | -0.8 | 6.9 | -2.5 | 5.9 | | |
| MW-36-24 | 10/23/15 | 3.28E+02 | 4.14E+02 | 0.8 | 1.5 | 1.8 | 6.2 | 1.4 | 6.2 | | |
| MW-36-41 | 1/8/15 | 8.72E+03 | 9.48E+02 | 2.4 | 1.5 | 1.4 | 7.2 | 1.9 | 7.2 | | |
| MW-36-41 | 3/2/15 | 1.12E+04 | | | | | | | | | |
| MW-36-41 | 3/25/15 | 9.70E+03 | | | | | | | | | |
| MW-36-41 | 4/20/15 | 1.00E+04 | 9.75E+02 | 4.6 | 1.9 | 0.0 | 13.6 | 3.0 | 6.3 | | |
| MW-36-41 | 6/1/15 | 1.14E+04 | | | | | | | | | |
| MW-36-41 | 6/25/15 | 1.04E+04 | | | | | | | | | |
| MW-36-41 | 7/28/15 | 9.16E+03 | 9.03E+02 | 3.1 | 1.8 | -4.4 | 8.0 | -2.2 | 6.2 | | |
| MW-36-41 | 8/11/15 | 7.70E+03 | | | | | | | | | |
| MW-36-41 | 9/30/15 | 7.50E+03 | | | | | | | | | |
| MW-36-41 | 10/23/15 | 7.83E+03 | 7.65E+02 | 4.6 | 2.2 | -0.3 | 6.6 | -0.6 | 12.1 | | |
| MW-36-41 | 11/11/15 | 1.03E+04 | | | | | | | | | |
| MW-36-41 | 12/17/15 | 1.08E+04 | | | | | | | | | |
| MW-36-52 | 1/8/15 | 4.93E+03 | 7.59E+02 | 2.3 | 1.7 | 1.6 | 7.2 | -5.6 | 7.3 | | |
| MW-36-52 | 4/20/15 | 5.29E+03 | 7.47E+02 | 2.0 | 1.7 | -0.3 | 6.9 | 1.1 | 7.3 | | |
| MW-36-52 | 7/28/15 | 5.21E+03 | 7.32E+02 | 2.6 | 1.8 | 0.0 | 5.7 | -0.4 | 6.2 | | |
| MW-36-52 | 10/23/15 | 4.67E+03 | 6.33E+02 | 4.0 | 1.8 | 0.3 | 6.1 | 1.1 | 5.7 | | |
| MW-37-22 | 1/8/15 | 4.31E+03 | 7.08E+02 | 7.8 | 2.3 | -4.6 | 7.8 | -2.8 | 7.7 | | |
| MW-37-22 | 4/29/15 | 5.60E+03 | 8.73E+02 | 7.9 | 2.2 | 1.5 | 8.0 | 1.5 | 6.1 | | |
| MW-37-22 | 8/4/15 | 5.26E+03 | 7.86E+02 | 8.0 | 1.8 | -3.0 | 9.1 | -0.4 | 6.5 | | |
| MW-37-22 | 11/5/15 | 2.41E+03 | 5.28E+02 | 10.0 | 3.0 | -1.4 | 5.7 | 1.7 | 5.2 | | |
| MW-37-32 | 1/8/15 | 6.93E+03 | 8.97E+02 | 11.4 | 2.7 | 0.4 | 6.2 | -4.7 | 7.9 | | |
| MW-37-32 | 5/26/15 | 7.47E+03 | 9.54E+02 | 15.8 | 3.0 | 4.5 | 9.4 | 2.3 | 9.1 | | |
| MW-37-32 | 8/4/15 | 3.96E+03 | 9.12E+02 | 18.2 | 2.6 | -0.6 | 10.3 | 0.4 | 8.7 | | |
| MW-37-32 | 11/5/15 | 2.27E+03 | 5.13E+02 | 10.6 | 2.6 | -1.2 | 12.3 | -5.3 | 11.4 | | |
| MW-37-40 | 1/8/15 | 6.02E+03 | 8.46E+02 | 15.4 | 3.0 | 3.3 | 8.4 | 1.3 | 5.5 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-37-40 | 5/26/15 | 6.71E+03 | 9.18E+02 | 15.9 | 3.1 | -1.5 | 5.4 | 0.4 | 5.8 | | |
| MW-37-40 | 8/4/15 | 6.49E+03 | 8.76E+02 | 21.6 | 2.8 | 1.9 | 7.8 | 1.9 | 7.1 | | |
| MW-37-40 | 11/5/15 | 6.24E+03 | 7.14E+02 | 19.1 | 3.6 | -2.1 | 5.3 | 2.1 | 6.3 | | |
| MW-37-57 | 1/8/15 | 6.38E+03 | 8.64E+02 | 14.4 | 2.9 | 6.0 | 7.1 | 0.9 | 5.9 | | |
| MW-37-57 | 5/26/15 | 7.08E+03 | 9.39E+02 | 15.8 | 3.0 | -1.4 | 9.0 | 1.5 | 6.8 | | |
| MW-37-57 | 8/4/15 | 6.38E+03 | 7.89E+02 | 17.9 | 2.6 | -1.3 | 6.5 | 0.0 | 6.0 | | |
| MW-37-57 | 11/5/15 | 6.07E+03 | 7.05E+02 | 18.6 | 3.8 | 2.0 | 6.2 | -0.1 | 5.4 | | |
| MW-39-102 | 5/8/15 | 1.45E+02 | 3.99E+02 | 0.0 | 1.1 | 1.2 | 6.2 | -2.9 | 6.2 | | |
| MW-39-102 | 11/2/15 | 5.05E+01 | 3.63E+02 | 0.0 | 1.5 | 0.2 | 5.3 | 0.7 | 5.3 | | |
| MW-39-124 | 5/8/15 | 1.04E+02 | 3.93E+02 | 0.3 | 1.0 | 3.8 | 7.7 | -0.4 | 7.5 | | |
| MW-39-124 | 11/2/15 | 6.65E+01 | 3.66E+02 | 1.0 | 1.6 | -0.9 | 6.3 | 0.6 | 7.0 | | |
| MW-39-183 | 5/8/15 | 2.84E+02 | 4.14E+02 | 0.3 | 1.2 | 2.7 | 8.3 | -6.3 | 7.7 | | |
| MW-39-183 | 11/2/15 | 5.71E+01 | 3.69E+02 | -0.3 | 1.2 | 1.0 | 5.9 | -1.4 | 6.2 | | |
| MW-39-195 | 5/8/15 | -2.56E+02 | 3.60E+02 | 0.7 | 1.1 | -1.5 | 6.5 | 1.8 | 7.8 | | |
| MW-39-195 | 11/2/15 | 3.19E+01 | 3.63E+02 | 0.1 | 1.3 | 0.0 | 7.3 | -2.5 | 8.6 | | |
| MW-39-67 | 5/8/15 | 3.56E+02 | 4.20E+02 | 1.1 | 1.1 | -4.3 | 8.3 | -0.8 | 5.9 | | |
| MW-39-67 | 11/2/15 | 1.84E+02 | 3.78E+02 | 0.8 | 1.7 | -0.5 | 8.2 | -0.8 | 6.3 | | |
| MW-39-84 | 5/8/15 | 8.15E+01 | 3.96E+02 | 0.9 | 1.3 | 1.4 | 5.7 | 1.0 | 5.6 | | |
| MW-39-84 | 11/2/15 | 8.76E+01 | 3.69E+02 | 0.2 | 1.3 | 3.0 | 6.5 | 2.0 | 6.0 | | |
| MW-40-100 | 2/11/15 | 4.05E+02 | 4.05E+02 | 0.9 | 1.3 | 2.2 | 7.4 | 3.3 | 7.2 | | |
| MW-40-100 | 4/30/15 | 3.34E+02 | 4.05E+02 | -0.3 | 0.8 | 2.5 | 6.0 | 2.0 | 6.9 | | |
| MW-40-100 | 8/6/15 | 1.06E+02 | 2.44E+02 | 0.6 | 0.7 | 1.9 | 7.2 | 4.4 | 9.0 | | |
| MW-40-100 | 11/9/15 | 2.22E+02 | 3.42E+02 | -0.1 | 1.1 | 2.2 | 5.3 | 1.0 | 4.8 | | |
| MW-40-127 | 2/11/15 | 3.28E+02 | 4.14E+02 | 0.1 | 0.9 | 2.8 | 6.5 | -4.3 | 7.8 | | |
| MW-40-127 | 4/30/15 | 3.70E+02 | 4.17E+02 | 0.2 | 1.5 | -0.6 | 6.5 | -1.3 | 7.4 | | |
| MW-40-127 | 8/6/15 | 4.70E+01 | 2.23E+02 | 1.2 | 1.6 | 1.9 | 8.2 | -0.5 | 7.0 | | |
| MW-40-127 | 11/9/15 | 1.36E+02 | 3.27E+02 | 0.2 | 1.2 | 5.6 | 6.9 | 0.5 | 5.5 | | |
| MW-40-162 | 2/11/15 | 8.56E+01 | 3.30E+02 | -0.1 | 1.0 | 2.6 | 7.2 | 1.4 | 8.8 | | |
| MW-40-162 | 4/30/15 | 2.32E+02 | 4.23E+02 | -0.1 | 1.6 | 0.1 | 6.6 | -0.4 | 5.6 | | |
| MW-40-162 | 8/6/15 | 1.63E+02 | 2.60E+02 | -0.3 | 0.7 | 2.9 | 8.1 | 1.3 | 7.1 | | |
| MW-40-162 | 11/9/15 | 2.26E+02 | 3.30E+02 | -0.9 | 1.0 | 1.8 | 11.3 | -2.0 | 5.6 | | |
| MW-40-27 | 2/11/15 | 3.95E+02 | 4.08E+02 | 0.7 | 1.6 | 4.5 | 8.0 | -0.5 | 6.3 | | |
| MW-40-27 | 4/30/15 | 3.32E+02 | 4.47E+02 | 0.3 | 1.3 | 2.1 | 7.1 | -0.4 | 7.4 | | |
| MW-40-27 | 8/6/15 | 1.77E+02 | 2.56E+02 | -0.6 | 1.5 | 0.0 | 24.0 | 0.4 | 9.3 | | |
| MW-40-27 | 11/9/15 | 3.24E+02 | 3.48E+02 | 0.4 | 1.2 | 4.2 | 8.6 | 0.6 | 4.7 | | |
| MW-40-46 | 2/11/15 | 2.69E+02 | 4.02E+02 | -0.9 | 1.5 | 0.8 | 6.0 | 5.3 | 6.7 | | |
| MW-40-46 | 4/30/15 | 3.83E+02 | 4.35E+02 | 0.3 | 1.4 | -0.4 | 6.7 | -0.5 | 8.0 | | |
| MW-40-46 | 8/6/15 | 9.97E+01 | 2.38E+02 | 0.9 | 1.1 | 1.0 | 6.8 | 3.4 | 8.4 | | |
| MW-40-46 | 11/9/15 | 1.92E+02 | 3.27E+02 | -0.7 | 1.1 | -2.5 | 6.7 | -1.4 | 6.8 | | |
| MW-40-81 | 2/11/15 | 2.63E+02 | 4.14E+02 | -0.7 | 1.0 | 4.6 | 9.0 | -0.5 | 9.8 | | |
| MW-40-81 | 4/30/15 | 3.18E+02 | 4.11E+02 | 0.1 | 1.6 | 5.7 | 10.5 | 2.4 | 6.0 | | |
| MW-40-81 | 8/6/15 | 1.33E+02 | 3.66E+02 | -0.2 | 0.6 | -2.6 | 6.0 | 1.1 | 5.9 | | |
| MW-40-81 | 11/9/15 | 7.85E+01 | 3.54E+02 | -0.6 | 1.2 | -7.3 | 11.5 | -6.9 | 9.4 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-41-40 | 2/3/15 | 2.78E+02 | 4.50E+02 | 0.6 | 1.4 | 4.7 | 7.5 | -0.7 | 4.7 | | |
| MW-41-40 | 3/18/15 | 4.47E+02 | 4.38E+02 | 3.9 | 2.1 | 3.7 | 8.0 | -1.2 | 9.1 | | |
| MW-41-40 | 5/12/15 | 6.13E+01 | 3.60E+02 | 1.7 | 1.4 | 0.1 | 5.1 | -0.3 | 5.0 | | |
| MW-41-40 | 7/29/15 | 2.94E+02 | 3.81E+02 | 0.6 | 1.5 | 3.6 | 5.8 | -2.1 | 6.4 | | |
| MW-41-40 | 10/26/15 | 4.25E+03 | 6.12E+02 | 0.9 | 1.6 | 2.5 | 5.1 | 0.6 | 4.4 | | |
| MW-41-63 | 2/3/15 | 4.14E+02 | 4.62E+02 | 1.3 | 1.4 | 0.0 | 7.8 | -2.6 | 6.0 | | |
| MW-41-63 | 3/18/15 | 4.19E+02 | 4.44E+02 | 1.1 | 1.6 | 0.5 | 7.2 | 0.1 | 6.9 | | |
| MW-41-63 | 5/12/15 | 5.35E+02 | 4.62E+02 | 2.1 | 1.0 | 0.8 | 6.5 | 1.2 | 7.0 | | |
| MW-41-63 | 7/29/15 | 4.49E+02 | 4.05E+02 | 1.4 | 0.9 | -2.2 | 6.9 | -3.9 | 7.1 | | |
| MW-41-63 | 10/26/15 | 4.47E+02 | 3.66E+02 | 2.6 | 2.0 | -0.8 | 5.1 | -3.7 | 5.4 | | |
| MW-42-49 | 1/22/15 | 5.77E+02 | 4.20E+02 | 15.6 | 3.5 | 60550.0 | 375.0 | 0.9 | 7.1 | 481.5 | 38. |
| MW-42-49 | 5/11/15 | 1.07E+03 | 4.08E+02 | 46.0 | 4.7 | 91800.0 | 531.0 | 3.2 | 7.5 | 783.0 | 39. |
| MW-42-49 | 7/22/15 | 1.14E+03 | 6.42E+02 | 11.7 | 3.2 | 34500.0 | 273.9 | 1.3 | 4.3 | 477.0 | 24. |
| MW-42-49 | 10/27/15 | 9.37E+02 | 4.05E+02 | 10.4 | 2.8 | 30000.0 | 232.8 | -2.6 | 5.9 | 394.0 | 29. |
| MW-42-78 | 1/22/15 | 1.37E+03 | 5.43E+02 | 0.1 | 1.1 | 2.4 | 9.2 | -1.9 | 8.2 | -0.6 | 11. |
| MW-42-78 | 5/11/15 | 6.83E+02 | 3.96E+02 | 0.2 | 1.2 | -8.5 | 7.6 | 1.4 | 5.7 | -7.3 | 19. |
| MW-42-78 | 7/22/15 | 4.55E+02 | 3.51E+02 | 0.4 | 1.1 | 2.8 | 6.7 | -2.0 | 9.1 | 5.6 | 17. |
| MW-42-78 | 10/27/15 | 2.14E+02 | 3.45E+02 | 0.1 | 1.3 | 1.2 | 6.5 | -1.4 | 6.4 | 5.3 | 16. |
| MW-43-28 | 2/6/15 | 3.26E+02 | 3.63E+02 | 0.3 | 1.3 | 0.5 | 7.3 | 3.7 | 7.3 | | |
| MW-43-28 | 5/5/15 | 1.72E+02 | 4.02E+02 | -0.5 | 1.5 | 3.5 | 9.1 | 2.6 | 6.4 | | |
| MW-43-28 | 7/30/15 | 4.11E+02 | 3.96E+02 | 0.1 | 1.1 | -0.1 | 9.9 | 0.0 | 8.9 | | |
| MW-43-28 | 11/3/15 | 1.64E+02 | 3.78E+02 | -0.7 | 1.1 | -2.0 | 6.3 | -0.6 | 7.1 | | |
| MW-43-62 | 2/6/15 | 1.38E+02 | 3.63E+02 | 0.6 | 1.4 | 0.4 | 5.6 | 0.5 | 5.3 | | |
| MW-43-62 | 5/5/15 | 6.05E+01 | 3.87E+02 | 1.3 | 1.6 | -0.3 | 5.9 | 1.9 | 6.0 | | |
| MW-43-62 | 7/30/15 | 3.37E+02 | 3.93E+02 | 0.5 | 0.8 | 1.9 | 6.3 | 0.0 | 5.2 | | |
| MW-43-62 | 11/3/15 | 4.68E+01 | 3.66E+02 | -0.7 | 1.2 | 2.7 | 6.6 | 1.3 | 6.8 | | |
| MW-44-102 | 1/30/15 | 3.86E+02 | 3.69E+02 | 0.1 | 1.0 | 0.3 | 9.0 | 0.2 | 7.5 | | |
| MW-44-102 | 5/8/15 | 3.31E+02 | 4.17E+02 | 0.3 | 0.9 | 3.5 | 5.8 | 1.4 | 5.9 | | |
| MW-44-102 | 7/30/15 | 3.06E+02 | 3.90E+02 | 0.1 | 0.8 | -0.2 | 8.4 | -1.1 | 7.2 | | |
| MW-44-102 | 11/2/15 | 2.01E+02 | 3.81E+02 | 0.3 | 1.3 | 0.0 | 4.8 | -0.7 | 6.3 | | |
| MW-44-66 | 1/30/15 | 4.24E+02 | 3.57E+02 | -0.1 | 0.9 | 0.4 | 5.4 | 0.1 | 7.1 | | |
| MW-44-66 | 5/8/15 | 2.00E+02 | 3.99E+02 | 0.2 | 1.0 | 0.4 | 5.9 | 2.9 | 5.1 | | |
| MW-45-42 | 2/6/15 | 7.51E+02 | 3.87E+02 | 0.2 | 1.4 | -3.4 | 8.5 | -0.8 | 6.7 | | |
| MW-45-42 | 3/18/15 | 7.73E+02 | 4.65E+02 | -0.4 | 1.5 | -2.4 | 7.4 | -1.2 | 6.0 | | |
| MW-45-42 | 5/13/15 | 1.29E+03 | 4.44E+02 | -0.6 | 0.9 | 0.0 | 10.0 | 0.8 | 7.5 | | |
| MW-45-42 | 7/29/15 | 1.26E+02 | 3.21E+02 | -0.1 | 0.6 | -1.4 | 8.3 | -4.3 | 6.4 | | |
| MW-45-42 | 10/26/15 | 3.44E+02 | 3.60E+02 | -0.6 | 1.2 | -1.2 | 7.4 | 3.2 | 4.7 | | |
| MW-45-61 | 2/6/15 | 1.06E+03 | 4.65E+02 | 0.3 | 0.8 | 0.0 | 5.5 | -1.6 | 8.1 | | |
| MW-45-61 | 3/17/15 | 1.11E+03 | 4.95E+02 | -0.1 | 1.6 | -0.3 | 8.6 | -3.5 | 7.1 | | |
| MW-45-61 | 5/12/15 | 7.76E+02 | 4.20E+02 | -0.3 | 1.3 | 1.8 | 5.4 | 0.4 | 5.4 | | |
| MW-45-61 | 7/29/15 | 9.62E+02 | 4.41E+02 | 0.1 | 1.2 | 0.3 | 7.4 | 2.0 | 5.8 | | |
| MW-45-61 | 10/26/15 | 9.78E+02 | 4.14E+02 | -1.2 | 0.8 | 2.5 | 6.9 | -0.5 | 5.7 | | |
| MW-46 | 2/4/15 | 1.08E+03 | 5.43E+02 | 0.6 | 1.4 | 1.4 | 6.2 | -0.8 | 5.8 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-46 | 6/3/15 | 1.16E+03 | 4.86E+02 | -1.1 | 1.5 | -0.1 | 4.7 | -0.9 | 6.3 | | |
| MW-46 | 8/5/15 | 1.10E+03 | 4.05E+02 | 0.1 | 0.8 | -4.2 | 7.1 | 5.6 | 8.9 | | |
| MW-46 | 11/18/15 | 1.03E+03 | 4.17E+02 | 1.1 | 1.7 | 3.0 | 5.3 | 0.9 | 4.9 | | |
| MW-47-56 | 5/13/15 | 6.42E+02 | 3.39E+02 | 0.6 | 1.2 | 1.5 | 5.5 | 3.7 | 6.7 | | |
| MW-47-56 | 8/19/15 | 5.00E+02 | | | | | | | | | |
| MW-47-80 | 5/13/15 | 5.06E+03 | 8.40E+02 | 0.6 | 1.3 | 0.3 | 6.7 | -1.8 | 6.8 | | |
| MW-47-80 | 8/19/15 | 3.70E+03 | | | | | | | | | |
| MW-49-26 | 1/16/15 | 2.62E+03 | 5.94E+02 | 15.9 | 3.0 | 0.6 | 6.7 | -2.1 | 6.9 | -2.1 | 13. |
| MW-49-26 | 4/23/15 | 2.86E+03 | 5.28E+02 | 11.5 | 2.2 | -0.7 | 9.0 | -3.0 | 8.7 | 4.0 | 17. |
| MW-49-26 | 7/14/15 | 3.06E+03 | 6.03E+02 | 11.8 | 2.7 | 2.3 | 6.4 | -1.1 | 7.7 | 2.8 | 16. |
| MW-49-26 | 10/30/15 | 3.07E+03 | 5.73E+02 | 14.8 | 3.7 | 2.4 | 5.0 | 6.3 | 4.1 | 2.5 | 16. |
| MW-49-42 | 1/16/15 | 4.67E+03 | 7.38E+02 | 13.6 | 2.9 | 0.9 | 7.7 | -1.1 | 8.1 | -3.1 | 14. |
| MW-49-42 | 4/23/15 | 4.64E+03 | 6.48E+02 | 13.7 | 2.4 | -0.3 | 7.7 | 3.7 | 7.4 | 2.4 | 19. |
| MW-49-42 | 7/14/15 | 4.85E+03 | 6.36E+02 | 12.1 | 3.1 | -0.8 | 8.0 | 2.4 | 5.8 | -3.0 | 16. |
| MW-49-42 | 10/30/15 | 4.26E+03 | 6.03E+02 | 17.1 | 3.5 | 1.4 | 8.1 | 2.4 | 9.5 | -0.1 | 15. |
| MW-49-65 | 1/16/15 | 4.54E+03 | 7.29E+02 | 6.4 | 2.0 | 4.9 | 5.9 | -2.5 | 7.2 | 0.2 | 13. |
| MW-49-65 | 4/23/15 | 4.05E+03 | 6.24E+02 | 7.5 | 1.8 | 2.2 | 8.6 | -2.6 | 7.4 | 0.9 | 15. |
| MW-49-65 | 7/14/15 | 4.00E+03 | 6.60E+02 | 8.7 | 2.7 | -3.6 | 7.9 | -2.0 | 8.2 | -4.9 | 17. |
| MW-49-65 | 10/30/15 | 4.23E+03 | 6.36E+02 | 9.2 | 2.9 | 2.7 | 8.6 | -0.7 | 6.1 | -6.0 | 14. |
| MW-50-42 | 1/7/15 | 5.88E+03 | 8.52E+02 | 10.4 | 2.7 | 0.0 | 10.2 | -2.3 | 7.2 | 0.3 | 14. |
| MW-50-42 | 3/2/15 | 2.40E+03 | | | | | | | | | |
| MW-50-42 | 3/18/15 | 3.50E+03 | | | | | | | | | |
| MW-50-42 | 4/20/15 | 4.64E+03 | 7.17E+02 | 10.9 | 2.2 | 0.7 | 7.1 | -5.9 | 10.3 | 1.8 | 17. |
| MW-50-42 | 6/1/15 | 5.00E+03 | | | | | | | | | |
| MW-50-42 | 6/25/15 | 3.10E+03 | | | | | | | | | |
| MW-50-42 | 7/28/15 | 1.63E+03 | 6.03E+02 | 7.6 | 2.4 | -0.5 | 5.4 | 1.3 | 7.2 | -12.2 | 16. |
| MW-50-42 | 8/11/15 | 3.00E+02 | | | | | | | | | |
| MW-50-42 | 9/30/15 | 3.00E+02 | | | | | | | | | |
| MW-50-42 | 10/23/15 | 8.50E+01 | 3.84E+02 | 7.5 | 2.3 | 0.0 | 5.4 | 0.6 | 5.2 | -1.1 | 15. |
| MW-50-42 | 11/11/15 | 3.00E+02 | | | | | | | | | |
| MW-50-42 | 12/17/15 | 3.00E+02 | | | | | | | | | |
| MW-50-66 | 1/7/15 | 6.86E+03 | 8.88E+02 | 20.1 | 3.4 | 2.2 | 5.8 | 1.8 | 7.4 | 1.4 | 15. |
| MW-50-66 | 4/20/15 | 6.49E+03 | 8.22E+02 | 17.8 | 2.7 | 2.0 | 7.4 | 1.2 | 6.2 | 10.8 | 17. |
| MW-50-66 | 7/28/15 | 6.29E+03 | 7.83E+02 | 15.1 | 3.2 | -1.5 | 5.6 | -0.3 | 5.9 | -3.5 | 17. |
| MW-50-66 | 10/23/15 | 5.40E+03 | 6.75E+02 | 25.0 | 3.9 | 2.1 | 8.9 | 1.9 | 9.8 | -0.4 | 14. |
| MW-51-104 | 2/12/15 | 1.89E+02 | 3.66E+02 | 1.1 | 1.6 | 2.0 | 11.3 | 0.0 | 5.5 | | |
| MW-51-104 | 5/1/15 | 4.65E+01 | 3.93E+02 | 1.1 | 1.2 | 2.1 | 7.1 | 1.5 | 6.6 | | |
| MW-51-104 | 8/7/15 | 1.03E+02 | 3.75E+02 | -0.5 | 0.8 | 0.2 | 8.1 | -3.4 | 9.8 | | |
| MW-51-104 | 11/10/15 | 1.24E+01 | 3.36E+02 | -0.5 | 1.1 | -3.1 | 5.7 | -1.7 | 6.0 | | |
| MW-51-135 | 2/12/15 | 2.30E+02 | 3.84E+02 | 0.1 | 1.3 | 1.5 | 9.2 | 7.7 | 6.3 | | |
| MW-51-135 | 5/1/15 | 2.83E+01 | 3.84E+02 | 0.3 | 1.1 | 0.1 | 6.1 | -2.3 | 7.4 | | |
| MW-51-135 | 8/7/15 | -5.58E+01 | 3.63E+02 | 0.2 | 0.6 | 1.1 | 5.8 | 0.5 | 6.4 | | |
| MW-51-135 | 11/10/15 | 1.01E+02 | 3.39E+02 | -1.0 | 1.2 | -3.6 | 6.1 | -0.1 | 5.9 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-51-163 | 2/12/15 | 2.72E+02 | 3.63E+02 | -0.1 | 1.5 | -2.4 | 6.5 | -1.8 | 5.6 | | |
| MW-51-163 | 5/1/15 | -7.45E+01 | 3.60E+02 | 0.6 | 1.5 | 2.2 | 8.0 | 0.4 | 7.6 | | |
| MW-51-163 | 8/7/15 | -1.42E+02 | 3.63E+02 | -0.2 | 0.6 | 2.2 | 5.8 | 4.7 | 5.4 | | |
| MW-51-163 | 11/10/15 | 7.88E+00 | 3.39E+02 | -0.5 | 1.3 | -0.4 | 7.1 | -3.5 | 6.7 | | |
| MW-51-189 | 2/12/15 | 2.00E+01 | 3.42E+02 | 0.7 | 1.5 | 1.3 | 8.4 | -1.0 | 7.0 | | |
| MW-51-189 | 5/1/15 | -1.87E+02 | 3.63E+02 | -0.1 | 0.8 | -1.6 | 6.1 | -2.3 | 6.2 | | |
| MW-51-189 | 8/7/15 | -7.58E+01 | 3.72E+02 | -0.2 | 0.5 | 0.4 | 5.9 | 2.2 | 5.3 | | |
| MW-51-189 | 11/10/15 | 3.42E+01 | 3.39E+02 | -1.3 | 1.4 | 3.9 | 7.1 | 0.3 | 7.3 | | |
| MW-51-40 | 2/12/15 | 2.55E+02 | 4.53E+02 | -0.1 | 0.8 | -2.1 | 6.7 | -2.8 | 7.2 | | |
| MW-51-40 | 5/1/15 | 1.41E+02 | 3.93E+02 | 0.2 | 1.1 | -1.5 | 6.9 | -0.1 | 6.0 | | |
| MW-51-40 | 8/7/15 | 6.96E+01 | 3.93E+02 | 0.0 | 0.6 | 0.1 | 7.1 | 2.1 | 7.6 | | |
| MW-51-40 | 11/10/15 | 1.60E+02 | 3.48E+02 | -0.2 | 1.0 | 0.5 | 4.8 | 0.3 | 4.9 | | |
| MW-51-79 | 2/12/15 | 1.59E+02 | 3.54E+02 | 0.8 | 1.4 | -4.2 | 9.3 | -0.8 | 7.3 | | |
| MW-51-79 | 5/1/15 | -1.38E+02 | 3.75E+02 | -0.3 | 0.8 | 1.9 | 7.6 | 4.1 | 9.0 | | |
| MW-51-79 | 8/7/15 | -1.45E+02 | 3.72E+02 | 0.6 | 0.9 | -2.7 | 6.8 | 1.9 | 6.8 | | |
| MW-51-79 | 11/10/15 | -1.87E+02 | 3.18E+02 | -0.5 | 1.5 | -2.9 | 8.2 | 0.5 | 6.3 | | |
| MW-52-122 | 6/24/15 | 6.04E+01 | 4.02E+02 | 0.2 | 1.3 | 6.2 | 7.8 | 0.0 | 7.9 | | |
| MW-52-162 | 6/24/15 | 3.02E+02 | 4.17E+02 | -0.3 | 1.2 | 4.1 | 12.0 | -1.4 | 7.0 | | |
| MW-52-18 | 6/24/15 | 8.08E+01 | 3.99E+02 | 0.2 | 1.2 | 1.9 | 8.9 | 6.2 | 9.6 | | |
| MW-52-181 | 6/24/15 | 3.03E+02 | 4.20E+02 | 0.4 | 1.3 | -0.1 | 9.5 | 0.0 | 7.7 | | |
| MW-52-48 | 6/24/15 | 4.16E+02 | 4.32E+02 | -0.9 | 1.1 | 2.4 | 6.0 | -2.8 | 7.1 | | |
| MW-52-64 | 6/24/15 | 1.69E+01 | 3.93E+02 | -0.2 | 1.2 | -0.8 | 5.8 | 4.8 | 5.6 | | |
| MW-53-120 | 1/22/15 | 4.86E+03 | 7.44E+02 | 24.6 | 3.6 | -1.6 | 8.3 | 0.9 | 10.3 | 7.9 | 15. |
| MW-53-120 | 5/11/15 | 5.29E+03 | 7.05E+02 | 24.8 | 3.4 | 0.0 | 5.2 | -0.2 | 6.5 | 2.6 | 21. |
| MW-53-120 | 7/20/15 | 4.69E+03 | 6.27E+02 | 23.3 | 4.0 | -1.8 | 6.2 | 2.1 | 7.1 | 3.9 | 18. |
| MW-53-120 | 10/27/15 | 5.16E+03 | 6.78E+02 | 21.6 | 3.9 | -1.9 | 5.3 | -0.2 | 5.6 | 0.4 | 20. |
| MW-53-82 | 1/22/15 | 8.43E+02 | 4.23E+02 | 0.3 | 1.5 | 3.3 | 7.7 | -0.9 | 7.2 | -3.8 | 16. |
| MW-53-82 | 5/11/15 | 3.69E+03 | 6.09E+02 | 0.9 | 1.6 | 0.0 | 8.7 | 1.4 | 6.1 | 2.8 | 20. |
| MW-53-82 | 7/20/15 | 1.43E+03 | 4.14E+02 | 0.7 | 1.3 | 4.7 | 6.8 | -0.7 | 4.9 | 1.4 | 17. |
| MW-53-82 | 10/27/15 | 3.95E+03 | 6.15E+02 | 0.7 | 1.6 | -5.2 | 13.5 | -3.7 | 10.1 | -3.8 | 16. |
| MW-54-123 | 1/29/15 | 7.40E+03 | 9.33E+02 | 0.8 | 1.4 | -0.3 | 7.1 | 2.2 | 6.9 | -1.2 | 17. |
| MW-54-123 | 5/14/15 | 5.65E+03 | 7.20E+02 | 1.0 | 1.7 | 0.1 | 6.1 | 0.1 | 6.8 | -0.3 | 20. |
| MW-54-123 | 7/27/15 | 6.13E+03 | 7.71E+02 | -0.4 | 1.1 | -1.8 | 5.5 | -1.0 | 6.6 | -3.1 | 18. |
| MW-54-123 | 10/28/15 | 5.79E+03 | 6.99E+02 | -0.4 | 1.3 | 4.4 | 6.5 | -3.4 | 6.9 | 0.5 | 15. |
| MW-54-144 | 1/29/15 | 6.24E+03 | 8.79E+02 | 7.5 | 2.4 | 2.5 | 11.6 | 4.6 | 6.2 | 1.1 | 18. |
| MW-54-144 | 5/14/15 | 4.92E+03 | 6.93E+02 | 6.9 | 2.5 | 1.1 | 6.9 | 4.8 | 5.4 | 1.7 | 20. |
| MW-54-144 | 7/27/15 | 5.22E+03 | 7.23E+02 | 6.5 | 2.3 | 0.0 | 8.6 | 2.2 | 4.8 | -5.1 | 17. |
| MW-54-144 | 10/28/15 | 4.92E+03 | 6.54E+02 | 6.8 | 2.6 | 5.5 | 8.2 | 2.6 | 7.1 | 7.6 | 14. |
| MW-54-173 | 1/29/15 | 5.04E+03 | 8.01E+02 | 4.1 | 1.8 | 1.8 | 5.7 | -1.3 | 8.8 | -3.7 | 18. |
| MW-54-173 | 5/14/15 | 4.72E+03 | 6.72E+02 | 3.1 | 2.0 | -0.3 | 6.3 | -0.6 | 6.2 | 12.0 | 20. |
| MW-54-173 | 7/27/15 | 4.91E+03 | 7.05E+02 | 3.6 | 2.0 | 0.8 | 5.3 | -1.2 | 5.3 | -9.2 | 17. |
| MW-54-173 | 10/28/15 | 4.81E+03 | 6.48E+02 | 2.4 | 1.8 | -1.6 | 5.2 | 0.4 | 6.1 | -0.9 | 15. |
| MW-54-190 | 1/29/15 | 5.33E+03 | 8.04E+02 | 15.5 | 3.2 | 2.8 | 6.1 | -1.4 | 5.4 | -1.8 | 18. |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-54-190 | 5/14/15 | 4.44E+03 | 6.57E+02 | 14.5 | 3.5 | 2.2 | 8.4 | -0.8 | 6.7 | -11.6 | 20. |
| MW-54-190 | 7/27/15 | 4.57E+03 | 6.87E+02 | 10.0 | 2.7 | -0.3 | 5.1 | -0.7 | 6.9 | -3.6 | 17. |
| MW-54-190 | 10/28/15 | 4.70E+03 | 6.42E+02 | 13.9 | 3.3 | 7.7 | 9.4 | 0.4 | 5.7 | -5.0 | 15. |
| MW-54-37 | 1/29/15 | 2.89E+03 | 6.66E+02 | 4.3 | 2.2 | -2.0 | 6.6 | 0.5 | 7.6 | 3.1 | 16. |
| MW-54-37 | 5/14/15 | 2.96E+03 | 5.73E+02 | 3.2 | 2.3 | 0.0 | 8.8 | -3.0 | 6.0 | 1.1 | 20. |
| MW-54-37 | 7/27/15 | 3.04E+03 | 5.97E+02 | 3.3 | 2.0 | -1.9 | 5.8 | 3.5 | 5.6 | -1.8 | 17. |
| MW-54-37 | 10/28/15 | 2.96E+03 | 5.46E+02 | 3.6 | 2.1 | 1.2 | 5.1 | 0.9 | 5.9 | 5.2 | 16. |
| MW-54-58 | 1/29/15 | 6.01E+03 | 8.73E+02 | 0.7 | 1.0 | -2.0 | 8.8 | -1.0 | 7.5 | 5.1 | 18. |
| MW-54-58 | 5/14/15 | 5.55E+03 | 7.20E+02 | 1.5 | 1.6 | 0.0 | 11.8 | -1.2 | 7.2 | -9.8 | 25. |
| MW-54-58 | 7/27/15 | 5.13E+03 | 7.17E+02 | 0.4 | 1.4 | 2.4 | 7.6 | -1.2 | 8.3 | -0.9 | 17. |
| MW-54-58 | 10/28/15 | 4.69E+03 | 6.48E+02 | 0.0 | 1.4 | -4.3 | 5.9 | -2.9 | 8.4 | -3.3 | 15. |
| MW-55-24 | 1/28/15 | 5.69E+03 | 7.89E+02 | 17.2 | 3.2 | -0.9 | 9.2 | -1.9 | 5.9 | 4.0 | 17. |
| MW-55-24 | 4/17/15 | 5.02E+03 | 7.38E+02 | 24.3 | 3.6 | -0.1 | 8.3 | -3.0 | 6.3 | -1.0 | 16. |
| MW-55-24 | 7/17/15 | 4.95E+03 | 6.39E+02 | 25.6 | 4.4 | 0.7 | 6.1 | -2.0 | 5.7 | 2.9 | 16. |
| MW-55-24 | 10/19/15 | 4.29E+03 | 7.35E+02 | 24.9 | 4.4 | -2.5 | 6.6 | -3.7 | 8.1 | 3.0 | 16. |
| MW-55-35 | 1/28/15 | 6.28E+03 | 8.37E+02 | 18.4 | 3.4 | -2.7 | 6.7 | -1.8 | 5.3 | 1.9 | 18. |
| MW-55-35 | 4/17/15 | 5.76E+03 | 7.77E+02 | 28.2 | 2.9 | 0.6 | 9.5 | -1.6 | 9.2 | 0.8 | 17. |
| MW-55-35 | 7/17/15 | 5.25E+03 | 6.54E+02 | 35.4 | 5.3 | 5.2 | 10.9 | 1.5 | 5.8 | 7.2 | 17. |
| MW-55-35 | 10/19/15 | 5.05E+03 | 7.95E+02 | 28.0 | 4.7 | -0.9 | 6.3 | -2.7 | 5.8 | 11.4 | 15. |
| MW-55-54 | 1/28/15 | 1.02E+04 | 1.03E+03 | 10.3 | 2.6 | 3.4 | 8.0 | -0.7 | 6.0 | -3.2 | 20. |
| MW-55-54 | 3/11/15 | 1.13E+04 | | | | | | | | | |
| MW-55-54 | 4/17/15 | 9.24E+03 | 9.27E+02 | 15.3 | 2.2 | -0.8 | 8.6 | 1.0 | 7.6 | 2.7 | 16. |
| MW-55-54 | 5/29/15 | 9.50E+03 | | | | | | | | | |
| MW-55-54 | 6/24/15 | 9.60E+03 | | | | | | | | | |
| MW-55-54 | 7/17/15 | 7.99E+03 | 7.71E+02 | 15.0 | 3.1 | 2.8 | 9.8 | -5.3 | 8.7 | 11.4 | 18. |
| MW-55-54 | 8/17/15 | 8.50E+03 | | | | | | | | | |
| MW-55-54 | 9/24/15 | 8.90E+03 | | | | | | | | | |
| MW-55-54 | 10/19/15 | 7.90E+03 | 9.45E+02 | 14.9 | 3.6 | -2.0 | 6.7 | -0.9 | 5.2 | 4.3 | 15. |
| MW-55-54 | 11/4/15 | 8.20E+03 | | | | | | | | | |
| MW-55-54 | 12/16/15 | 1.21E+04 | | | | | | | | | |
| MW-56-53 | 5/13/15 | 9.31E+03 | 8.55E+02 | -0.2 | 1.2 | 2.3 | 5.1 | -1.5 | 4.1 | | |
| MW-56-53 | 8/19/15 | 4.40E+03 | | | | | | | | | |
| MW-56-53 | 11/5/15 | 1.05E+03 | 4.32E+02 | 0.1 | 1.2 | 2.1 | 6.2 | 0.3 | 5.4 | | |
| MW-56-83 | 5/13/15 | 2.59E+03 | 5.55E+02 | 0.8 | 1.7 | 4.8 | 8.5 | -2.0 | 7.7 | | |
| MW-56-83 | 8/19/15 | 2.48E+03 | | | | | | | | | |
| MW-56-83 | 11/5/15 | 2.60E+03 | 5.19E+02 | 0.9 | 1.4 | -3.6 | 6.7 | 2.0 | 6.4 | | |
| MW-57-11 | 5/22/15 | 6.80E+03 | 9.21E+02 | 20.7 | 3.2 | 2.4 | 9.1 | -0.1 | 6.0 | -2.2 | 14. |
| MW-57-20 | 5/22/15 | 2.87E+03 | 7.05E+02 | 0.9 | 1.2 | 1.4 | 6.3 | 0.7 | 7.3 | -11.4 | 19. |
| MW-57-45 | 5/22/15 | 2.53E+03 | 6.75E+02 | -0.1 | 1.1 | 1.6 | 5.5 | 2.4 | 4.7 | -2.0 | 20. |
| MW-58-26 | 5/15/15 | 5.41E+02 | 3.27E+02 | -0.2 | 1.2 | 2.1 | 7.8 | -2.0 | 7.6 | | |
| MW-58-26 | 10/30/15 | 5.20E+02 | 3.99E+02 | -0.4 | 1.0 | -3.1 | 6.6 | -5.0 | 8.4 | | |
| MW-58-65 | 5/15/15 | 5.57E+02 | 3.33E+02 | 0.0 | 1.2 | 5.9 | 8.0 | 0.7 | 6.2 | | |
| MW-58-65 | 10/30/15 | 5.29E+02 | 4.14E+02 | -0.6 | 1.2 | 1.1 | 6.0 | 1.3 | 5.9 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-60-135 | 2/10/15 | 2.42E+02 | 3.54E+02 | -0.8 | 1.0 | 1.0 | 11.1 | 2.0 | 6.6 | | |
| MW-60-135 | 4/28/15 | 4.12E+02 | 4.26E+02 | 0.8 | 1.3 | 0.2 | 7.6 | -3.3 | 7.7 | | |
| MW-60-135 | 7/21/15 | 1.02E+02 | 3.15E+02 | -0.1 | 0.7 | -1.8 | 8.2 | 0.5 | 6.4 | | |
| MW-60-135 | 10/20/15 | 4.81E+02 | 4.20E+02 | 0.5 | 1.5 | -0.3 | 6.5 | 0.5 | 5.7 | | |
| MW-60-154 | 2/10/15 | 4.67E+02 | 3.36E+02 | 0.4 | 1.1 | -1.4 | 5.7 | -2.2 | 6.3 | | |
| MW-60-154 | 4/28/15 | 5.54E+02 | 4.41E+02 | 0.4 | 1.3 | 2.5 | 6.8 | -1.2 | 7.3 | | |
| MW-60-154 | 7/21/15 | 6.67E+02 | 3.75E+02 | 0.3 | 0.8 | -2.2 | 5.6 | 1.4 | 6.0 | | |
| MW-60-154 | 10/20/15 | 5.76E+02 | 3.63E+02 | -0.3 | 1.2 | 6.0 | 10.1 | -0.1 | 5.5 | | |
| MW-60-176 | 2/10/15 | 8.63E+02 | 4.95E+02 | 0.4 | 1.1 | -0.3 | 6.6 | -0.5 | 5.6 | | |
| MW-60-176 | 4/28/15 | 1.35E+03 | 4.98E+02 | -0.1 | 1.2 | 0.3 | 7.8 | -0.3 | 6.0 | | |
| MW-60-176 | 7/21/15 | 1.28E+03 | 4.17E+02 | 0.3 | 0.7 | 0.0 | 6.2 | 0.4 | 7.7 | | |
| MW-60-176 | 10/20/15 | 8.12E+02 | 3.93E+02 | -1.2 | 1.2 | -1.6 | 4.8 | 0.4 | 4.8 | | |
| MW-60-35 | 2/10/15 | 2.18E+01 | 4.11E+02 | 0.2 | 1.0 | 4.7 | 4.1 | 2.8 | 6.7 | | |
| MW-60-35 | 4/28/15 | 2.62E+02 | 4.32E+02 | 0.1 | 1.0 | -3.1 | 7.9 | 2.8 | 3.6 | | |
| MW-60-35 | 7/21/15 | 2.61E+02 | 3.30E+02 | 0.2 | 1.5 | -0.4 | 5.4 | -0.9 | 7.2 | | |
| MW-60-35 | 10/20/15 | -3.63E+01 | 2.55E+02 | -0.3 | 0.9 | -0.6 | 4.6 | -0.5 | 5.8 | | |
| MW-60-53 | 2/10/15 | -1.14E+02 | 3.93E+02 | -0.5 | 0.7 | 0.1 | 6.4 | 3.4 | 4.0 | -6.0 | 17. |
| MW-60-53 | 4/28/15 | 2.08E+02 | 4.08E+02 | -0.3 | 0.9 | -1.9 | 6.3 | -1.4 | 5.7 | | |
| MW-60-53 | 7/21/15 | 1.56E+02 | 3.33E+02 | -0.4 | 0.8 | -0.4 | 6.2 | -0.7 | 5.7 | | |
| MW-60-53 | 10/20/15 | 2.44E+02 | 3.09E+02 | 0.3 | 1.7 | -0.2 | 6.5 | -3.3 | 8.3 | | |
| MW-60-72 | 2/10/15 | 6.93E+01 | 4.26E+02 | -0.2 | 1.0 | -4.9 | 6.2 | -3.7 | 6.2 | | |
| MW-60-72 | 4/28/15 | 2.08E+02 | 4.11E+02 | 0.4 | 1.2 | -3.1 | 6.2 | 2.1 | 6.0 | | |
| MW-60-72 | 7/21/15 | 2.56E+02 | 3.33E+02 | -0.7 | 0.8 | -2.0 | 5.7 | 2.6 | 5.4 | | |
| MW-60-72 | 10/20/15 | 1.50E+02 | 3.90E+02 | -0.6 | 0.9 | 0.4 | 8.1 | -6.3 | 6.9 | | |
| MW-62-138 | 1/20/15 | 2.22E+03 | 5.28E+02 | -0.2 | 1.2 | -3.2 | 8.8 | 0.9 | 5.7 | | |
| MW-62-138 | 3/4/15 | 1.90E+03 | | | | | | | | | |
| MW-62-138 | 3/18/15 | 1.60E+03 | | | | | | | | | |
| MW-62-138 | 4/24/15 | 2.79E+03 | 5.07E+02 | 0.8 | 1.2 | -5.8 | 8.3 | -1.4 | 7.5 | | |
| MW-62-138 | 5/7/15 | 1.60E+03 | | | | | | | | | |
| MW-62-138 | 6/25/15 | 1.90E+03 | | | | | | | | | |
| MW-62-138 | 7/15/15 | 2.00E+03 | 4.77E+02 | 0.7 | 1.3 | 2.0 | 6.0 | -0.7 | 7.4 | | |
| MW-62-138 | 8/13/15 | 1.80E+03 | | | | | | | | | |
| MW-62-138 | 9/28/15 | 1.60E+03 | | | | | | | | | |
| MW-62-138 | 10/13/15 | 1.79E+03 | 6.96E+02 | 0.9 | 1.6 | -3.4 | 6.3 | 1.9 | 5.6 | | |
| MW-62-138 | 11/13/15 | 3.80E+03 | | | | | | | | | |
| MW-62-138 | 12/16/15 | 1.80E+03 | | | | | | | | | |
| MW-62-18 | 1/20/15 | 1.45E+02 | 3.60E+02 | -1.0 | 1.0 | 3.7 | 8.4 | -1.3 | 6.6 | | |
| MW-62-18 | 4/24/15 | 2.85E+02 | 3.63E+02 | 0.5 | 0.9 | -4.5 | 7.7 | 3.0 | 7.0 | | |
| MW-62-18 | 7/15/15 | 3.07E+02 | 3.84E+02 | 0.9 | 1.7 | -0.9 | 5.6 | 1.4 | 7.0 | | |
| MW-62-18 | 10/13/15 | 3.12E+02 | 3.78E+02 | 1.1 | 1.6 | 3.5 | 6.1 | 1.2 | 4.5 | | |
| MW-62-182 | 1/20/15 | 1.55E+03 | 4.86E+02 | -0.3 | 1.2 | 2.5 | 6.3 | -3.5 | 6.9 | | |
| MW-62-182 | 4/24/15 | 1.65E+03 | 4.62E+02 | 0.2 | 0.8 | 0.7 | 8.6 | -4.3 | 11.6 | | |
| MW-62-182 | 7/15/15 | 1.67E+03 | 4.53E+02 | 0.1 | 1.2 | 0.2 | 7.3 | -4.3 | 7.5 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-62-182 | 10/13/15 | 1.25E+03 | 5.91E+02 | 0.2 | 1.5 | 4.0 | 6.5 | 0.9 | 5.5 | | |
| MW-62-37 | 1/20/15 | 7.06E+02 | 4.02E+02 | 0.1 | 1.2 | -1.5 | 7.1 | 2.2 | 7.0 | | |
| MW-62-37 | 4/24/15 | 1.09E+03 | 4.26E+02 | -0.1 | 1.0 | -6.4 | 9.2 | 0.3 | 8.1 | | |
| MW-62-37 | 7/15/15 | 1.22E+03 | 4.74E+02 | -0.7 | 1.4 | 2.8 | 7.4 | 2.9 | 7.6 | | |
| MW-62-37 | 10/13/15 | 1.25E+03 | 4.38E+02 | -0.2 | 1.1 | 3.4 | 6.7 | 4.9 | 6.8 | | |
| MW-62-53 | 1/20/15 | 1.24E+03 | 4.44E+02 | 1.2 | 1.8 | 6.0 | 10.4 | -0.9 | 7.2 | | |
| MW-62-53 | 4/24/15 | 1.31E+03 | 4.38E+02 | 0.6 | 0.8 | 1.4 | 6.0 | -0.5 | 5.6 | | |
| MW-62-53 | 7/15/15 | 1.20E+03 | 4.17E+02 | 0.0 | 1.3 | 1.2 | 8.7 | 1.8 | 8.3 | | |
| MW-62-53 | 10/13/15 | 1.15E+03 | 5.85E+02 | 0.5 | 1.6 | -1.3 | 6.2 | 2.8 | 4.8 | | |
| MW-62-71 | 1/20/15 | 1.66E+03 | 4.98E+02 | 1.4 | 1.9 | 1.2 | 9.9 | -1.7 | 7.4 | | |
| MW-62-71 | 4/24/15 | 2.36E+03 | 5.25E+02 | 0.0 | 0.7 | 4.0 | 7.1 | 2.7 | 7.4 | | |
| MW-62-71 | 7/15/15 | 1.73E+03 | 4.56E+02 | -0.5 | 1.0 | 1.6 | 7.0 | 1.8 | 7.4 | | |
| MW-62-71 | 10/13/15 | 1.70E+03 | 6.60E+02 | 0.6 | 1.4 | -3.8 | 8.0 | 4.9 | 9.0 | | |
| MW-62-92 | 1/20/15 | 3.59E+03 | 5.04E+02 | 0.0 | 1.3 | 1.6 | 7.6 | -1.7 | 7.0 | | |
| MW-62-92 | 3/4/15 | 1.50E+03 | | | | | | | | | |
| MW-62-92 | 3/18/15 | 1.60E+03 | | | | | | | | | |
| MW-62-92 | 4/24/15 | 1.81E+03 | 4.83E+02 | -0.1 | 0.8 | -1.4 | 7.2 | 0.2 | 8.0 | | |
| MW-62-92 | 5/7/15 | 1.60E+03 | | | | | | | | | |
| MW-62-92 | 6/25/15 | 1.90E+03 | | | | | | | | | |
| MW-62-92 | 7/15/15 | 1.67E+03 | 4.56E+02 | -0.1 | 1.3 | 1.6 | 6.0 | 1.5 | 8.9 | | |
| MW-62-92 | 8/13/15 | 2.10E+03 | | | | | | | | | |
| MW-62-92 | 9/28/15 | 1.70E+03 | | | | | | | | | |
| MW-62-92 | 10/13/15 | 1.68E+03 | 6.57E+02 | 0.1 | 1.1 | -0.5 | 5.8 | -1.4 | 5.8 | | |
| MW-62-92 | 11/13/15 | 1.70E+03 | | | | | | | | | |
| MW-62-92 | 12/16/15 | 1.60E+03 | | | | | | | | | |
| MW-63-112 | 1/23/15 | 1.62E+03 | 4.71E+02 | -0.1 | 1.6 | 4.7 | 7.5 | -0.3 | 7.1 | | |
| MW-63-112 | 4/27/15 | 1.54E+03 | 5.19E+02 | 0.4 | 1.0 | -0.7 | 5.7 | 2.1 | 6.5 | | |
| MW-63-112 | 7/13/15 | 1.22E+03 | 4.68E+02 | 1.3 | 1.8 | -0.4 | 7.1 | -1.5 | 6.8 | | |
| MW-63-112 | 10/22/15 | 1.19E+03 | 4.26E+02 | 0.5 | 1.7 | 2.1 | 8.2 | -2.7 | 7.1 | | |
| MW-63-121 | 1/23/15 | 1.74E+03 | 4.83E+02 | 1.0 | 1.7 | 2.4 | 8.3 | -2.1 | 5.3 | | |
| MW-63-121 | 4/27/15 | 1.91E+03 | 5.46E+02 | 0.3 | 0.9 | 1.3 | 5.6 | 3.1 | 5.6 | | |
| MW-63-121 | 7/13/15 | 1.26E+03 | 4.02E+02 | 0.0 | 1.6 | -2.2 | 6.7 | 0.1 | 6.0 | | |
| MW-63-121 | 10/22/15 | 1.25E+03 | 4.29E+02 | -0.2 | 1.0 | 1.7 | 5.9 | 0.7 | 5.2 | | |
| MW-63-163 | 1/23/15 | 1.17E+03 | 4.35E+02 | 0.6 | 1.6 | 3.3 | 9.2 | 6.3 | 10.2 | | |
| MW-63-163 | 4/27/15 | 1.16E+03 | 4.92E+02 | 0.3 | 1.2 | 0.4 | 5.9 | -0.3 | 5.6 | | |
| MW-63-163 | 7/13/15 | 1.07E+03 | 4.53E+02 | 0.8 | 1.8 | 3.5 | 10.7 | 0.5 | 5.7 | | |
| MW-63-163 | 10/22/15 | 1.05E+03 | 4.14E+02 | -0.9 | 1.1 | 0.2 | 8.1 | 3.1 | 5.9 | | |
| MW-63-174 | 1/23/15 | 8.46E+02 | 4.11E+02 | -0.4 | 1.4 | 0.0 | 5.7 | 1.0 | 6.3 | | |
| MW-63-174 | 4/27/15 | 1.03E+03 | 4.77E+02 | -0.4 | 0.9 | 1.3 | 5.2 | 1.0 | 6.1 | | |
| MW-63-174 | 7/13/15 | 1.21E+03 | 4.68E+02 | 1.0 | 1.8 | -0.9 | 5.5 | 0.2 | 6.2 | | |
| MW-63-174 | 10/22/15 | 1.27E+03 | 4.32E+02 | 1.0 | 1.5 | -4.9 | 7.4 | -3.2 | 6.9 | | |
| MW-63-18 | 1/23/15 | 6.41E+02 | 4.80E+02 | 0.9 | 1.2 | 5.4 | 9.4 | -2.7 | 7.8 | | |
| MW-63-18 | 4/27/15 | 5.08E+02 | 3.72E+02 | -0.1 | 1.0 | 2.9 | 9.2 | 0.5 | 6.9 | | |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-63-18 | 7/13/15 | 2.91E+02 | 3.84E+02 | 1.1 | 1.7 | 1.0 | 8.2 | -0.8 | 9.2 | | |
| MW-63-18 | 10/22/15 | 7.40E+02 | 3.72E+02 | 0.4 | 1.4 | 3.3 | 6.8 | 1.2 | 7.7 | | |
| MW-63-34 | 1/23/15 | 6.55E+02 | 4.11E+02 | -0.5 | 0.8 | 0.0 | 9.8 | -0.7 | 5.8 | | |
| MW-63-34 | 4/27/15 | 1.05E+03 | 4.95E+02 | 0.1 | 0.8 | -3.4 | 8.9 | 1.2 | 6.1 | | |
| MW-63-34 | 7/13/15 | 5.50E+02 | 4.08E+02 | -0.7 | 1.1 | 1.5 | 9.8 | -3.0 | 7.2 | | |
| MW-63-34 | 10/22/15 | 6.29E+02 | 3.81E+02 | -1.1 | 1.3 | -0.6 | 6.2 | -0.1 | 5.6 | | |
| MW-63-50 | 1/23/15 | 8.69E+02 | 4.29E+02 | 0.1 | 1.1 | -0.7 | 6.7 | 3.3 | 6.6 | | |
| MW-63-50 | 4/27/15 | 1.31E+03 | 5.01E+02 | -0.3 | 0.8 | 0.7 | 5.2 | 1.3 | 5.3 | | |
| MW-63-50 | 7/13/15 | 7.28E+02 | 4.23E+02 | 0.0 | 1.4 | 2.3 | 6.5 | 3.8 | 5.5 | | |
| MW-63-50 | 10/22/15 | 5.98E+02 | 3.78E+02 | -0.2 | 1.6 | 0.6 | 8.1 | 1.0 | 6.8 | | |
| MW-63-93 | 1/23/15 | 8.60E+02 | 4.23E+02 | 0.1 | 1.5 | -1.0 | 7.1 | -1.7 | 6.2 | | |
| MW-63-93 | 4/27/15 | 1.13E+03 | 4.83E+02 | -0.2 | 0.8 | -0.9 | 6.2 | -0.8 | 5.8 | | |
| MW-63-93 | 7/13/15 | 6.37E+02 | 4.20E+02 | 0.9 | 1.3 | 0.4 | 7.7 | 2.4 | 7.0 | | |
| MW-63-93 | 10/22/15 | 5.84E+02 | 3.75E+02 | -0.4 | 1.1 | 3.0 | 6.7 | -2.6 | 6.4 | | |
| MW-66-21 | 1/16/15 | 5.73E+02 | 4.77E+02 | 0.4 | 0.8 | 3.4 | 6.0 | -2.0 | 5.3 | -1.6 | 16. |
| MW-66-21 | 5/21/15 | 1.55E+02 | 3.48E+02 | 1.2 | 1.5 | 5.1 | 10.7 | -2.3 | 7.0 | -10.1 | 19. |
| MW-66-21 | 7/14/15 | 1.31E+03 | 4.05E+02 | -0.7 | 1.1 | 1.7 | 8.9 | 6.6 | 6.2 | 0.8 | 17. |
| MW-66-21 | 10/13/15 | 7.21E+02 | 3.75E+02 | -0.2 | 1.4 | -1.4 | 7.9 | -4.1 | 6.8 | 3.7 | 15. |
| MW-66-36 | 1/16/15 | 1.02E+03 | 4.29E+02 | 11.1 | 2.8 | 0.4 | 6.0 | -0.2 | 9.4 | -0.2 | 13. |
| MW-66-36 | 5/21/15 | 7.24E+02 | 4.11E+02 | 6.9 | 2.1 | 0.0 | 9.7 | 0.5 | 8.1 | -6.0 | 18. |
| MW-66-36 | 7/14/15 | 1.22E+03 | 4.71E+02 | 8.1 | 2.4 | -1.0 | 10.2 | 5.5 | 9.9 | 5.9 | 18. |
| MW-66-36 | 10/13/15 | 1.07E+03 | 5.67E+02 | 4.9 | 2.3 | -0.8 | 7.3 | 2.0 | 5.3 | 3.0 | 15. |
| MW-67-105 | 1/19/15 | 3.23E+03 | 5.70E+02 | -1.0 | 1.0 | -2.4 | 8.6 | 1.1 | 6.4 | -0.9 | 12. |
| MW-67-105 | 3/4/15 | 2.50E+03 | | | | | | | | | |
| MW-67-105 | 3/17/15 | 2.90E+03 | | | | | | | | | |
| MW-67-105 | 4/21/15 | 2.84E+03 | 5.94E+02 | 1.0 | 1.2 | -1.0 | 7.6 | 0.5 | 6.7 | 10.1 | 17. |
| MW-67-105 | 5/7/15 | 2.80E+03 | | | | | | | | | |
| MW-67-105 | 6/25/15 | 2.60E+03 | | | | | | | | | |
| MW-67-105 | 7/16/15 | 2.71E+03 | 5.19E+02 | -0.4 | 1.3 | 0.0 | 7.0 | 5.4 | 5.3 | 12.8 | 19. |
| MW-67-105 | 8/13/15 | 9.00E+02 | | | | | | | | | |
| MW-67-105 | 9/28/15 | 2.40E+03 | | | | | | | | | |
| MW-67-105 | 10/12/15 | 2.42E+03 | 7.50E+02 | 0.3 | 1.1 | 1.8 | 5.8 | -1.4 | 6.5 | -0.7 | 15. |
| MW-67-105 | 11/13/15 | 2.50E+03 | | | | | | | | | |
| MW-67-105 | 12/16/15 | 2.20E+03 | | | | | | | | | |
| MW-67-173 | 1/19/15 | 7.96E+02 | 4.08E+02 | -0.2 | 0.7 | 2.8 | 7.2 | 3.7 | 7.2 | 3.4 | 11. |
| MW-67-173 | 4/21/15 | 6.96E+02 | 4.32E+02 | -0.1 | 1.4 | -1.9 | 7.6 | -3.1 | 10.0 | 12.6 | 17. |
| MW-67-173 | 7/16/15 | 1.09E+03 | 4.08E+02 | -0.8 | 1.0 | -1.9 | 7.6 | -0.4 | 7.3 | 7.8 | 16. |
| MW-67-173 | 10/12/15 | 1.05E+03 | 5.52E+02 | -0.3 | 1.1 | -3.0 | 7.5 | 0.5 | 5.9 | 13.6 | 22. |
| MW-67-219 | 1/19/15 | 1.07E+03 | 5.19E+02 | -0.7 | 1.2 | 1.4 | 8.2 | -0.6 | 6.0 | 5.9 | 14. |
| MW-67-219 | 4/21/15 | 1.16E+03 | 4.89E+02 | -0.3 | 0.9 | 2.1 | 7.2 | -1.2 | 6.4 | 9.3 | 19. |
| MW-67-219 | 7/16/15 | 1.03E+03 | 4.02E+02 | 0.1 | 1.4 | 5.1 | 8.0 | 3.5 | 7.2 | 2.0 | 18. |
| MW-67-219 | 10/12/15 | 8.69E+02 | 5.25E+02 | 0.4 | 1.2 | 2.7 | 6.5 | 0.5 | 6.4 | 15.8 | 16. |
| MW-67-276 | 1/19/15 | 9.72E+02 | 5.07E+02 | 0.4 | 1.6 | 6.0 | 7.5 | -1.6 | 7.3 | 2.9 | 13. |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| MW-67-276 | 4/21/15 | 1.28E+03 | 4.98E+02 | -0.1 | 1.2 | -1.9 | 6.6 | 0.8 | 6.5 | 4.6 | 19. |
| MW-67-276 | 7/16/15 | 6.18E+02 | 3.69E+02 | 0.5 | 1.1 | 0.7 | 6.2 | 0.5 | 6.8 | -4.6 | 18. |
| MW-67-276 | 10/12/15 | 7.67E+02 | 5.25E+02 | 0.1 | 1.0 | -0.6 | 6.0 | 0.4 | 6.4 | 4.0 | 15. |
| MW-67-323 | 1/19/15 | 2.21E+02 | 4.32E+02 | -0.1 | 1.6 | 5.2 | 8.3 | -0.4 | 5.7 | -1.3 | 18. |
| MW-67-340 | 1/19/15 | 5.00E+02 | 4.77E+02 | 1.0 | 1.7 | 3.5 | 6.0 | -1.1 | 5.2 | 4.3 | 14. |
| MW-67-340 | 4/21/15 | 5.09E+02 | 4.29E+02 | 1.0 | 1.3 | 0.3 | 6.2 | -3.1 | 6.8 | -3.2 | 16. |
| MW-67-340 | 7/16/15 | 4.47E+02 | 3.51E+02 | -0.5 | 1.2 | -1.4 | 7.5 | 1.3 | 7.1 | 7.8 | 13. |
| MW-67-340 | 10/12/15 | 6.01E+02 | 3.69E+02 | 0.7 | 1.2 | 2.9 | 11.2 | 2.0 | 6.6 | 4.2 | 11. |
| MW-67-39 | 1/19/15 | 5.94E+02 | 4.74E+02 | 7.3 | 2.6 | 1.8 | 5.7 | -3.4 | 7.4 | -2.6 | 12. |
| MW-67-39 | 3/4/15 | 3.00E+02 | | | | | | | | | |
| MW-67-39 | 3/17/15 | 3.00E+03 | | | | | | | | | |
| MW-67-39 | 4/21/15 | 7.68E+02 | 4.50E+02 | 7.2 | 2.0 | 2.4 | 6.1 | -1.5 | 5.5 | 9.0 | 18. |
| MW-67-39 | 5/7/15 | 6.00E+02 | | | | | | | | | |
| MW-67-39 | 6/25/15 | 3.00E+02 | | | | | | | | | |
| MW-67-39 | 7/16/15 | 5.78E+02 | 3.72E+02 | 3.9 | 1.8 | -2.7 | 5.8 | -5.5 | 9.4 | 3.5 | 17. |
| MW-67-39 | 8/13/15 | 3.10E+03 | | | | | | | | | |
| MW-67-39 | 9/28/15 | 1.00E+03 | | | | | | | | | |
| MW-67-39 | 10/12/15 | 1.26E+03 | 5.55E+02 | 6.0 | 2.0 | 0.4 | 6.2 | -2.5 | 5.7 | 1.0 | 18. |
| MW-67-39 | 11/13/15 | 1.40E+03 | | | | | | | | | |
| MW-67-39 | 12/16/15 | 1.30E+03 | | | | | | | | | |
| MW-68-103 | 2/4/15 | 2.01E+03 | 5.94E+02 | 0.6 | 1.1 | 3.3 | 7.1 | 1.9 | 6.2 | | |
| MW-68-103 | 5/27/15 | 1.99E+03 | 6.48E+02 | 0.8 | 1.2 | 7.5 | 13.5 | 0.1 | 6.4 | | |
| MW-68-103 | 8/5/15 | 1.54E+03 | 4.68E+02 | 0.8 | 1.1 | -2.8 | 7.6 | 3.4 | 7.5 | | |
| MW-68-103 | 10/29/15 | 1.25E+03 | 4.35E+02 | 1.1 | 1.5 | -1.5 | 6.4 | 1.9 | 5.6 | | |
| MW-68-132 | 2/4/15 | 1.55E+03 | 5.49E+02 | -0.2 | 1.5 | -2.2 | 5.3 | -1.1 | 6.2 | | |
| MW-68-132 | 5/27/15 | 1.78E+03 | 6.27E+02 | -0.4 | 1.1 | 3.9 | 6.4 | 0.0 | 7.4 | | |
| MW-68-132 | 8/5/15 | 1.35E+03 | 4.44E+02 | -0.3 | 0.7 | -0.5 | 6.8 | 0.6 | 5.3 | | |
| MW-68-132 | 10/29/15 | 1.40E+03 | 4.44E+02 | -0.1 | 1.3 | -2.4 | 5.5 | 0.3 | 4.8 | | |
| MW-68-19 | 2/4/15 | 2.26E+03 | 6.06E+02 | 1.2 | 1.7 | 4.3 | 9.2 | 1.0 | 6.2 | | |
| MW-68-19 | 5/27/15 | 2.12E+03 | 6.51E+02 | 1.0 | 1.3 | 1.0 | 6.2 | 1.9 | 7.1 | | |
| MW-68-19 | 8/5/15 | 2.34E+03 | 5.43E+02 | 0.6 | 1.1 | 5.5 | 7.4 | 1.8 | 6.5 | | |
| MW-68-19 | 10/29/15 | 1.52E+03 | 4.77E+02 | 1.0 | 1.6 | 4.1 | 6.5 | 0.8 | 6.2 | | |
| MW-68-29 | 2/4/15 | 8.94E+02 | 4.92E+02 | 0.3 | 1.4 | 0.8 | 6.0 | -2.5 | 7.0 | | |
| MW-68-29 | 5/27/15 | 1.85E+03 | 6.33E+02 | 1.4 | 1.5 | 0.7 | 5.5 | -0.2 | 5.9 | | |
| MW-68-29 | 8/5/15 | 1.24E+03 | 4.32E+02 | 0.8 | 0.8 | -2.8 | 6.2 | 0.1 | 8.0 | | |
| MW-68-29 | 10/29/15 | 1.31E+03 | 4.41E+02 | -0.1 | 1.2 | -1.8 | 5.6 | -1.0 | 6.6 | | |
| MW-68-57 | 2/4/15 | 1.27E+03 | 5.37E+02 | 0.3 | 1.2 | -0.4 | 7.1 | 0.3 | 6.7 | | |
| MW-68-57 | 5/27/15 | 1.93E+03 | 6.45E+02 | 0.8 | 0.9 | -0.8 | 7.1 | -0.3 | 7.0 | | |
| MW-68-57 | 8/5/15 | 1.52E+03 | 4.59E+02 | 0.6 | 1.1 | 1.3 | 6.3 | -4.9 | 5.9 | | |
| MW-68-57 | 10/29/15 | 1.59E+03 | 4.86E+02 | 0.1 | 1.3 | -0.5 | 5.3 | 0.7 | 6.8 | | |
| U1-CSS | 1/29/15 | 2.55E+03 | 6.93E+02 | 4.8 | 2.0 | 0.8 | 3.1 | 2.2 | 2.7 | -4.8 | 13. |
| U1-CSS | 5/14/15 | 3.89E+03 | 6.06E+02 | 21.9 | 3.8 | -1.2 | 7.5 | 0.5 | 7.3 | -7.9 | 17. |
| U1-CSS | 10/28/15 | 5.00E+03 | 6.69E+02 | 21.6 | 4.0 | 3.2 | 8.3 | 4.8 | 6.5 | -5.6 | 16. |

| Well ID | Date | 2015 Laboratory Analytical Results | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | H3 (pCi/L) | | Sr-90 (pCi/L) | | Cs-137 (pCi/L) | | Co-60 (pCi/L) | | Ni-63 (pCi/L) | |
| | | Result | 3 σ | Result | 3 σ | Result | 3 σ | Result | 3 σ | Resul | 3 σ |
| U1-NCD | 2/2/15 | 1.03E+04 | 3.41E+02 | 49.3 | 6.3 | 24100.0 | 246.3 | 1.3 | 10.6 | 497.0 | 34. |
| U1-NCD | 4/28/15 | 6.41E+03 | 8.16E+02 | 46.5 | 3.8 | 19600.0 | 19.9 | -2.6 | 6.3 | 356.0 | 22. |
| U1-NCD | 7/24/15 | 3.50E+03 | 5.70E+02 | 24.7 | 4.2 | 13600.0 | 195.9 | -1.4 | 7.2 | 241.0 | 20. |
| U1-NCD | 10/19/15 | 5.97E+03 | 7.11E+02 | 16.4 | 3.7 | 14200.0 | 160.8 | -0.4 | 5.7 | 215.0 | 40. |
| U1-SFDS | 2/4/15 | 1.18E+02 | 4.17E+02 | 3.3 | 1.8 | 2.9 | 8.3 | 0.4 | 6.4 | -10.2 | 19. |
| U1-SFDS | 4/29/15 | 8.02E+01 | 3.93E+02 | 5.2 | 1.7 | 0.4 | 8.0 | 0.8 | 7.1 | 2.5 | 22. |
| U1-SFDS | 7/22/15 | 4.12E+02 | 3.96E+02 | 3.1 | 1.8 | 4.4 | 7.4 | -0.2 | 6.3 | 9.6 | 19. |
| U1-SFDS | 10/22/15 | 9.77E+01 | 3.42E+02 | 3.7 | 2.1 | 5.0 | 5.9 | 0.4 | 4.7 | | |
| U3-4D | 1/30/15 | 9.26E+02 | 3.84E+02 | -0.3 | 1.1 | -2.3 | 7.3 | 3.0 | 8.3 | | |
| U3-4D | 5/5/15 | 7.65E+02 | 4.50E+02 | -1.0 | 1.1 | -1.1 | 5.9 | -0.1 | 5.0 | | |
| U3-4D | 7/23/15 | 6.87E+02 | 4.14E+02 | 0.1 | 1.5 | 0.8 | 5.7 | 0.0 | 6.9 | | |
| U3-4D | 11/6/15 | 5.54E+02 | 3.75E+02 | -0.4 | 1.5 | 0.3 | 5.1 | 1.2 | 4.9 | | |
| U3-4S | 1/30/15 | 6.54E+02 | 4.59E+02 | 0.1 | 1.0 | -1.1 | 5.6 | -0.7 | 6.3 | | |
| U3-4S | 5/5/15 | 1.07E+02 | 3.54E+02 | -0.7 | 1.0 | 1.5 | 6.3 | 2.4 | 4.5 | | |
| U3-4S | 7/23/15 | 3.81E+02 | 3.87E+02 | -0.8 | 1.0 | 0.0 | 7.8 | -1.3 | 7.1 | | |
| U3-4S | 11/6/15 | 2.92E+02 | 3.48E+02 | 0.0 | 1.4 | 1.4 | 6.0 | -1.8 | 4.9 | | |
| U3-T1 | 1/28/15 | 1.67E+03 | 5.58E+02 | 0.0 | 1.1 | 0.0 | 7.5 | 1.6 | 5.3 | | |
| U3-T1 | 5/25/15 | 6.81E+02 | 3.39E+02 | 0.7 | 1.2 | -2.1 | 7.2 | 8.0 | 6.1 | | |
| U3-T1 | 8/10/15 | 6.25E+02 | 4.14E+02 | 0.9 | 1.1 | -1.4 | 8.2 | 1.4 | 7.4 | | |
| U3-T1 | 11/6/15 | 1.14E+03 | 4.38E+02 | -0.2 | 1.2 | 1.3 | 6.5 | -2.7 | 7.9 | | |
| U3-T2 | 1/28/15 | 1.46E+03 | 5.37E+02 | -0.4 | 1.1 | -0.5 | 6.5 | -1.8 | 6.2 | | |
| U3-T2 | 5/25/15 | 1.53E+03 | 6.15E+02 | 0.0 | 1.1 | -0.3 | 5.6 | -2.2 | 5.8 | | |
| U3-T2 | 8/11/15 | 1.37E+03 | 4.80E+02 | 0.3 | 0.9 | 0.8 | 5.3 | 3.7 | 7.4 | | |
| U3-T2 | 11/6/15 | 1.64E+03 | 4.77E+02 | -0.1 | 1.3 | 1.5 | 7.7 | -0.2 | 6.3 | | |

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

RADIOACTIVE EFFLUENT REPORT

I. Addenda

Errata for Previous Reports

# ADDENDA

## Summary

## Unit 2, 2014 (Errata 1)

In the first quarter of 2014 the volumes for several batch gaseous release permits were entered incorrectly. On 2/27/14, Permit # 140053, two Large Gas Decay Tanks that contained Xe-133 (4.64E-4 uCi/cc) and Xe-135 (7.52E-5 uCi/cc) were released. The volume entered was 3000 cubic feet instead of 6000 cubic feet for both tanks. Also, on 3/16/2014, Permit #140064, two Large Gas Decay Tanks that contained Xe-133 (2.14E-5 uCi/cc) were released. The volume entered was 3040 cubic feet instead of 6070 cubic feet for both tanks. As a result the Curies reported for gaseous batch releases in the 1st quarter of 2014 were corrected. This also resulted in an increase in maximum exposed individual gamma air dose from 3.21E-5 mrad to 3.33E-5 mrad and an increase in beta air dose from 3.86E-5 mrad to 4.20E-5 mrad. Both are a small fraction of the applicable limits of 5 mrad and 10 mrad, respectively. Page 8, 10 and 39 of the 2014 Annual Radioactive Effluent Release Report are attached below and the changes are shaded in gray with bold lettering.

## Unit 3, 2008-2013 (Errata 2)

On 4/12/14 the flow rate reading on the Unit 3 Plan Vent flow monitor, R-27, increased by approximately 15% to 20%. The increased reading was a result of repairs of a degraded lug on one of the wires associated with the R-27 flow monitor, reference CR-IP3-2014-1723 and CR-IP3-2015-0113. Based on historical data reviews the flow from R-27, including a comparison to a redundant flow monitor, the flow rate may have been biased low by 10% to 20%. Therefore, the radionuclides released via the Unit 3 Plant Vent that used the R-27 flow meter reading were recalculated from 2008 – 2013 (Ref. WTIPC-2014-00215 CA-8). Changes to the 2008 – 2013 Annual Radioactive Effluent Release Report are attached below and the changes are shaded in gray with bold lettering.

## Abnormal Releases 2014 (Errata 3)

An increase in tritium levels was noted in several sentinel wells at Unit 2 in late March of 2014. These levels continued throughout the year with levels also elevated in several of the down-gradient wells. A thorough investigation was performed to determine the cause of these increased levels. The root cause was determine to be the overflow of draining of systems to floor drains inside the Primary Auxiliary Building (PAB) with subsequent leakage to ground into gaps between the wall and floor of the PAB. The dose consequence was negligible and is included in the doses performed in Section E of this report. Changes to the 2014 Annual Radioactive Effluent Release Report are attached below and the changes are shaded in gray with bold lettering.

# Errata 1

Page 8 of the 2014 Indian Point ARERR

TABLE 1A
INDIAN POINT 1 and 2 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2014)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2014 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | **3.90E-01** | 3.97E-02 | 6.11E-02 | 6.04E-02 | **5.51E-01** | ± 25 |
| 2. Average release rate | uCi/sec | **5.02E-02** | 5.05E-03 | 7.69E-03 | 7.60E-03 | **1.75E-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 | 2.93E+00 | 4.39E+00 | 4.56E+00 | 3.46E+00 | 1.53E+01 | ± 25 |
| 2. Average release rate | uCi/sec | 3.77E-01 | 5.58E-01 | 5.74E-01 | 4.35E-01 | 4.86E-01 | |

E. Carbon-14

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.60E+00 | 2.60E+00 | 2.60E+00 | 2.60E+00 | 1.04E+01 |
| 2. Average release rate | uCi/sec | 3.34E-01 | 3.31E-01 | 3.27E-01 | 3.27E-01 | 3.30E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2014 |

- Indicates < MDA

# Errata 1

Page 10 of the 2014 Indian Point ARERR

TABLE 1C
INDIAN POINT 1 and 2 - **BATCH** GASEOUS EFFLUENTS
RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2014)

Nuclides Released

**1) Fission Gases**

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2014 |
|---|---|---|---|---|---|---|
| Ar-41 | Ci | 5.84E-02 | 3.18E-02 | 3.49E-02 | 4.31E-02 | 1.68E-01 |
| Kr-85 | Ci | - | - | - | - | 0.00E+00 |
| Kr-85m | Ci | 2.20E-04 | - | 1.45E-04 | 2.98E-04 | 6.63E-04 |
| Kr-87 | Ci | 1.75E-04 | - | 9.52E-05 | 2.23E-04 | 4.93E-04 |
| Kr-88 | Ci | 3.87E-04 | - | 2.40E-04 | 5.43E-04 | 1.17E-03 |
| Xe-131m | Ci | 2.37E-04 | - | - | - | 2.37E-04 |
| Xe-133 | Ci | **2.91E-01** | 7.92E-03 | 2.32E-02 | 1.15E-02 | **3.34E-01** |
| Xe-133m | Ci | 2.00E-04 | - | - | - | 2.00E-04 |
| Xe-135 | Ci | **3.85E-02** | - | 2.32E-03 | 4.17E-03 | **4.50E-02** |
| Xe-135m | Ci | 4.84E-04 | - | 2.08E-04 | 5.50E-04 | 1.24E-03 |
| Xe-138 | Ci | - | - | - | 1.16E-04 | 1.16E-04 |
| Total for Period | Ci | **3.90E-01** | 3.97E-02 | 6.11E-02 | 6.05E-02 | **5.51E-01** |

**2) Iodines**

Not Applicable for Batch Releases

- indicates < MDA

**3) Particulates**

Not Applicable for Batch Releases

# Errata 1

Page 39 of the 2014 Indian Point ARERR

INDIAN POINT UNITS 1 and 2 NUCLEAR POWER PLANTS

RADIOLOGICAL IMPACT ON MAN

JANUARY - DECEMBER 2014

Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 2.92E-04 | 3.27E-04 | 8.39E-05 | 2.27E-04 | **9.30E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 5.83E-03 | 6.54E-03 | 1.68E-03 | 4.54E-03 | 9.30E-03 |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Bone | bone | Bone | Bone | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 2.06E-04 | 8.15E-05 | 4.64E-05 | 8.48E-05 | **4.18E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 1.37E-02 | 5.43E-03 | 3.09E-03 | 5.66E-03 | 1.39E-02 |

B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | **3.33E-05** | 1.24E-05 | 1.44E-05 | 1.78E-05 | **7.79E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | **6.66E-04** | 2.48E-04 | 2.88E-04 | 3.56E-04 | **7.79E-04** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | **4.20E-05** | 7.92E-06 | 1.03E-05 | 1.19E-05 | **7.21E-05** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | **4.20E-04** | 7.92E-05 | 1.03E-04 | 1.19E-04 | **3.61E-04** |

C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | 4.92E-04 | 7.35E-04 | 7.64E-04 | 5.79E-04 | **2.57E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 6.56E-03 | 9.80E-03 | 1.02E-02 | 7.72E-03 | 1.71E-02 |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | 1.65E-02 | 1.68E-02 | 1.68E-02 | 1.66E-02 | **6.68E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 2.21E-01 | 2.24E-01 | 2.24E-01 | 2.22E-01 | 4.45E-01 |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 8.05E-02 | 8.05E-02 | 8.05E-02 | 8.05E-02 | **3.22E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 2.15E+00 |

# Errata 2

Page 13 of the 2008 Indian Point ARERR

TABLE 1A
INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2008)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2008 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 1.54E-02 | 1.67E-02 | 1.96E-02 | 1.96E-02 | 7.12E-02 | ± 25 |
| 2. Average release rate | uCi/sec | 1.96E-03 | 2.12E-03 | 2.46E-03 | 2.46E-03 | 2.25E-03 | |

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 | 3.65E+00 | 3.60E+00 | 4.12E+00 | 3.08E+00 | 1.44E+01 | ± 25 |
| 2. Average release rate | uCi/sec | 4.63E-01 | 4.58E-01 | 5.17E-01 | 3.89E-01 | 4.57E-01 | |

\- Indicates < MDA

## Errata 2

Page 35 of the 2008 Indian Point ARERR

**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 2008:

| | | Whole Body (mrem) | Max Organ (mrem) |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25** | **75** |
| Routine Airborne Effluents | Units 1 and 2 | 2.07E-3 | 2.67E-3 |
| Routine Liquid Effluents | Units 1 and 2 | 6.11E-4 | 1.47E-3 |
| Routine Airborne Effluents | Unit 3 | **2.39E-03** | **2.39E-03** |
| Routine Liquid Effluents | Unit 3 | 1.56E-4 | 2.83E-4 |
| Carbon-14 Liquid & Airborne Totals | IPEC | 5.20E-02 | 2.60E-01 |
| Ground Water & Storm Drain Totals | IPEC[1] | 2.86E-04 | 9.35E-04 |
| Direct Shine from ISFSI, Radwaste Storage, SG Mausoleum, etc. | IPEC[2] | 6 | 6 |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **6.057E+00** | **6.267E+00** |

Note 1: Groundwater curie and dose calculations are provided in Section H.

Note 2: 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.

# Errata 2

Page 37 of the 2008 Indian Point ARERR

## INDIAN POINT 3 NUCLEAR POWER PLANT
## RADIOLOGICAL IMPACT ON MAN
## JANUARY - DECEMBER 2008

Maximum exposed individual doses in mrem or mrad

### A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 7.84E-06 | 3.99E-05 | 1.07E-04 | 1.32E-04 | 2.83E-04 |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 1.57E-04 | 7.98E-04 | 2.14E-03 | 2.63E-03 | 2.83E-03 |
| Age Group | | Child | Adult | Child | Child | Child |
| Critical Organ | | Bone | GILLI | Bone | Bone | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 4.26E-06 | 1.64E-05 | 2.96E-05 | 1.06E-04 | 1.56E-04 |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3 |
| Percent of Limit | (%) | 2.84E-04 | 1.10E-03 | 1.97E-03 | 7.07E-03 | 5.21E-03 |

### B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 4.29E-06 | 5.01E-06 | 5.07E-06 | 5.00E-06 | 1.94E-05 |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 8.58E-05 | 1.00E-04 | 1.01E-04 | 1.00E-04 | 1.94E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 7.08E-06 | 8.26E-06 | 8.53E-06 | 8.38E-06 | 3.23E-05 |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 7.08E-05 | 8.26E-05 | 8.53E-05 | 8.38E-05 | 1.61E-04 |

### C. AIRBORNE IODINE and PARTICULATE DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | **6.02E-04** | **5.95E-04** | **6.80E-04** | **5.10E-04** | **2.39E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **8.03E-03** | **7.94E-03** | **9.07E-03** | **6.80E-03** | **1.59E-02** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

# Errata 2

Page 12 of the 2009 Indian Point ARERR

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 | **4.12E+00** | **7.56E+00** | **5.70E+00** | **4.77E+00** | **2.21E+01** | ± 25 |
| 2. Average release rate | uCi/sec | **5.30E-01** | **9.60E-01** | **7.18E-01** | **6.00E-01** | **7.02E-01** | |

\- Indicates < MDA

# Errata 2

Page 35 of the 2009 Indian Point ARERR

## 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 | **3.83E-03** | **3.83E-03** |
| 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.

## Errata 2

Page 37 of the 2009 Indian Point ARERR

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) | **6.81E-04** | **1.24E-03** | **9.43E-04** | **7.89E-04** | **3.65E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **9.08E-03** | **1.66E-02** | **1.26E-02** | **1.05E-02** | **2.44E-02** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

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TABLE 1A
INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2010)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2010 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 4.65E-02 | 5.42E-02 | 6.03E-02 | 4.98E-02 | 2.11E-01 | ± 25 |
| 2. Average release rate | uCi/sec | 5.98E-03 | 6.90E-03 | 7.59E-03 | 6.27E-03 | 6.69E-03 | |

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 | **5.29E+00** | **4.81E+00** | **5.71E+00** | **4.02E+00** | **1.98E+01** | ± 25 |
| 2. Average release rate | uCi/sec | **6.81E-01** | **6.12E-01** | **7.18E-01** | **5.05E-01** | **6.29E-01** | |

E. Carbon-14

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.78E+00 | 2.78E+00 | 2.78E+00 | 2.78E+00 | 1.11E+01 |
| 2. Average release rate | uCi/sec | 3.57E-01 | 3.53E-01 | 3.49E-01 | 3.49E-01 | 3.52E-01 |
| | | **Qtr 1** | **Qtr 2** | **Qtr 3** | **Qtr 4** | **2010** |

- Indicates < MDA

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**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.

**Total Dose:**

Unit and pathway-specific dose data can be found on the Radiological Impact on Man tables following this discussion. For simplicity and to demonstrate compliance with 40CFR190, the following table indicates the maximum hypothetical Total Dose to an individual from operation of the facility, including any measured direct shine component from the site property for 2010:

| | | Whole Body | Max Organ |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25 mrem** | **75 mrem** |
| Routine Airborne Effluents[1] | Units 1 and 2 | 0.00276 | 0.00276 |
| Routine Liquid Effluents | Units 1 and 2 | 0.000518 | 0.00109 |
| Liquid Releases of $C^{14}$ | Units 1 and 2 | 0.00117 | 0.00583 |
| Airborne Releases of $C^{14}$ | Units 1 and 2 | 0.0566 | 0.284 |
| Routine Airborne Effluents[1] | Unit 3 | **0.00557** | **0.00557** |
| Routine Liquid Effluents | Unit 3 | 0.000170 | 0.000973 |
| Liquid Releases of $C^{14}$ | Unit 3 | 0.00117 | 0.00583 |
| Airborne Releases of $C^{14}$ | Unit 3 | 0.0665 | 0.333 |
| Ground Water & Storm Drain Totals | IPEC[2] | 0.000173 | 0.000706 |
| **Direct Shine from areas such as dry cask storage, radwaste storage, SG** | **IPEC[3]** | **0.061** | **0.061** |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **0.195** | **0.700** |

Note 1: Routine airborne dose in this table is conservatively represented as a sum of Iodine, Particulate, and Tritium dose (excluding C-14, in mrem) with a mrem term added from noble gas beta air energy (mrad, expressed as mrem). This 'addition' does not represent a real dose and is listed here solely to help demonstrate compliance with 40CFR190. (Doses by type of release and comparison to the specific limits of 10CFR50 Appendix I are summarized on the following pages.)

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

Note 3: 40CFR190 requires the reporting of total dose, including that of direct shine. Direct shine dose from sources other than dry cask are indistinguishable from background. Direct shine dose is determined from TLDs near the dry cask area and site boundary, compared with REMP TLDs and historical values, and corrected with occupancy factors to determine a bounding, worst case assessment of direct shine dose to a real individual. Details of this evaluation are available on site from Radiation Protection.

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# INDIAN POINT 3 NUCLEAR POWER PLANT
# RADIOLOGICAL IMPACT ON MAN
# JANUARY - DECEMBER 2010

A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 1.06E-04 | 6.35E-05 | 1.39E-04 | 1.01E-04 | **9.73E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 2.12E-03 | 1.27E-03 | 2.78E-03 | 2.02E-03 | 9.73E-03 |
| Age Group | | Child | Child | Child | Adult | Child |
| Critical Organ | | Bone | Bone | Bone | Liver | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 3.40E-05 | 2.11E-05 | 1.84E-05 | 9.61E-05 | **1.70E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 2.27E-03 | 1.41E-03 | 1.23E-03 | 6.41E-03 | 5.65E-03 |

B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 1.20E-05 | 1.39E-05 | 1.26E-05 | 1.27E-05 | **5.12E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 2.40E-04 | 2.78E-04 | 2.52E-04 | 2.54E-04 | 5.12E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 2.03E-05 | 2.35E-05 | 2.41E-05 | 2.15E-05 | **8.94E-05** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 2.03E-04 | 2.35E-04 | 2.41E-04 | 2.15E-04 | 4.47E-04 |

C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | **8.75E-04** | **1.30E-03** | **1.80E-03** | **1.51E-03** | **5.48E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **1.17E-02** | **1.73E-02** | **2.41E-02** | **2.01E-02** | **3.66E-02** |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Total Body Dose | (mrem) | **1.75E-02** | **1.79E-02** | **1.84E-02** | **1.81E-02** | **7.20E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **2.33E-01** | **2.39E-01** | **2.46E-01** | **2.42E-01** | **4.80E-01** |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 8.45E-02 | 8.45E-02 | 8.45E-02 | 8.45E-02 | **3.38E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.13E+00 | 1.13E+00 | 1.13E+00 | 1.13E+00 | 2.25E+00 |

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TABLE 1A
INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2011)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2011 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 4.24E-01 | 2.00E-02 | 1.48E-02 | 1.41E-02 | 4.73E-01 | ± 25 |
| 2. Average release rate | uCi/sec | 5.45E-02 | 2.54E-03 | 1.86E-03 | 1.77E-03 | 1.50E-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 | **2.96E+00** | **1.32E+00** | **3.66E+00** | **4.47E+00** | **1.24E+01** | ± 25 |
| 2. Average release rate | uCi/sec | **3.81E-01** | **1.67E-01** | **4.61E-01** | **5.62E-01** | **3.93E-01** | |

E. Carbon-14

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2011 |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.49E+00 | 2.49E+00 | 2.49E+00 | 2.49E+00 | 9.94E+00 |
| 2. Average release rate | uCi/sec | 3.20E-01 | 3.16E-01 | 3.13E-01 | 3.13E-01 | 3.15E-01 |

- Indicates < MDA

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**Groundwater:**

Curies and dose contribution from activity discovered in onsite groundwater and storm drain pathways during the year are discussed in more detail in Section H. The offsite dose calculation involves multiple source term measurements, as well as computations 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 total offsite dose.

**Total Dose:**

Unit and pathway-specific dose data can be found on the Radiological Impact on Man tables following this discussion. For simplicity and to demonstrate compliance with 40CFR190, the following table indicates the maximum hypothetical Total Dose to an individual from operation of the facility, including any measured direct shine component from the site property:

| **Year: 2011** | | Whole Body | Max Organ |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25 mrem** | **75 mrem** |
| **Routine Airborne Effluents[1]** | **Units 1 and 2** | **0.00267** | **0.00267** |
| **Routine Liquid Effluents** | **Units 1 and 2** | **0.000498** | **0.00103** |
| *Liquid Releases of $C^{14}$* | *Units 1 and 2* | *0.00117* | *0.00583* |
| *Airborne Releases of $C^{14}$* | *Units 1 and 2* | *0.0677* | *0.339* |
| **Routine Airborne Effluents[1]** | **Unit 3** | **0.00294** | **0.00294** |
| **Routine Liquid Effluents** | **Unit 3** | **0.000250** | **0.000521** |
| *Liquid Releases of $C^{14}$* | *Unit 3* | *0.00117* | *0.00583* |
| *Airborne Releases of $C^{14}$* | *Unit 3* | *0.0607* | *0.304* |
| **Ground Water & Storm Drain Totals** | **IPEC[2]** | **0.000451** | **0.00183** |
| **Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.** | **IPEC[3]** | **0.082** | **0.082** |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **0.219** | **0.745** |

Note 1: Routine airborne dose in this table is conservatively represented as a sum of Iodine, Particulate, and Tritium dose (excluding C-14, in mrem) with a mrem term added from noble gas beta air energy (mrad, expressed as mrem). This 'addition' does not represent a real dose and is listed here solely to help demonstrate compliance with 40CFR190. (Doses by type of release and comparison to the specific limits of 10CFR50 Appendix I are summarized on the following pages.)

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

Note 3: 40CFR190 requires the reporting of total dose, including that of direct shine. Direct shine dose from sources other than dry cask are indistinguishable from background. Direct shine dose is determined from TLDs near the dry cask area and site boundary, compared with REMP TLDs and historical values, and corrected with occupancy factors to determine a bounding, worst case assessment of direct shine dose to a real individual. Details of this evaluation are available on site from Radiation Protection.

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INDIAN POINT 3 NUCLEAR POWER PLANT
RADIOLOGICAL IMPACT ON MAN
JANUARY - DECEMBER 2011
Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 4.35E-04 | 7.12E-05 | 9.60E-06 | 1.84E-05 | **5.21E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 8.70E-03 | 1.42E-03 | 1.92E-04 | 3.68E-04 | 5.21E-03 |
| Age Group | | Adult | Adult | Child | Child | Child |
| Critical Organ | | GILLI | GILLI | Bone | Bone | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 2.30E-04 | 1.26E-05 | 4.51E-06 | 2.81E-06 | **2.50E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 1.53E-02 | 8.40E-04 | 3.01E-04 | 1.87E-04 | 8.33E-03 |

B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 2.72E-05 | 3.83E-06 | 3.89E-06 | 3.71E-06 | **3.86E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 5.44E-04 | 7.66E-05 | 7.78E-05 | 7.42E-05 | 3.86E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 8.49E-05 | 7.03E-06 | 6.52E-06 | 6.22E-06 | **1.05E-04** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 8.49E-04 | 7.03E-05 | 6.52E-05 | 6.22E-05 | 5.23E-04 |

C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | **7.00E-04** | **6.51E-04** | **7.39E-04** | **7.38E-04** | **2.83E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **9.33E-03** | **8.68E-03** | **9.86E-03** | **9.84E-03** | **1.89E-02** |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | **1.59E-02** | **1.58E-02** | **1.59E-02** | **1.59E-02** | **6.35E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **2.12E-01** | **2.11E-01** | **2.12E-01** | **2.12E-01** | **4.24E-01** |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 7.60E-02 | 7.60E-02 | 7.60E-02 | 7.60E-02 | **3.04E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 2.03E+00 |

# Errata 2

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TABLE 1A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2012)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2012 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 1.30E-02 | 2.01E-02 | 1.88E-02 | 3.02E-02 | 8.22E-02 | ± 25 |
| 2. Average release rate | uCi/sec | 1.66E-03 | 2.56E-03 | 2.37E-03 | 3.80E-03 | 2.60E-03 | |

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 | **4.09E+00** | **3.48E+00** | **4.37E+00** | **5.04E+00** | **1.70E+01** | ± 25 |
| 2. Average release rate | uCi/sec | **5.21E-01** | **4.43E-01** | **5.50E-01** | **6.34E-01** | **5.37E-01** | |

E. Carbon-14

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2012 |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 1.08E+01 |
| 2. Average release rate | uCi/sec | 3.43E-01 | 3.43E-01 | 3.40E-01 | 3.40E-01 | 3.42E-01 |

- Indicates < MDA

# Errata 2

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**Groundwater:**

Curies and dose contribution from activity discovered in onsite groundwater and storm drain pathways during the year are discussed in more detail in Section H. The offsite dose calculation involves multiple source term measurements, as well as computations 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 total offsite dose.

**Total Dose:**

Unit and pathway-specific dose data can be found on the Radiological Impact on Man tables following this discussion. For simplicity and to demonstrate compliance with 40CFR190, the following table indicates the maximum hypothetical Total Dose to an individual from operation of the facility, including any measured direct shine component from the site property:

| Year: 2012 | | Total Body | Max Organ |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25 mrem** | **75 mrem** |
| **Routine Airborne Effluents[1]** | **Units 1 and 2** | **2.69E-03** | **2.69E-03** |
| **Routine Liquid Effluents** | **Units 1 and 2** | **3.12E-04** | **3.60E-04** |
| Liquid Releases of $C^{14}$ | Units 1 and 2 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Units 1 and 2 | 6.13E-02 | 3.07E-01 |
| **Routine Airborne Effluents[1]** | **Unit 3** | **2.83E-03** | **2.83E-03** |
| **Routine Liquid Effluents** | **Unit 3** | **2.64E-04** | **4.32E-04** |
| Liquid Releases of $C^{14}$ | Unit 3 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Unit 3 | 6.63E-02 | 3.32E-01 |
| Ground Water & Storm Drain Totals | IPEC[2] | 7.11E-05 | 2.89E-04 |
| **Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.** | **IPEC[3]** | **1.06E-01** | **1.06E-01** |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **2.42E-01** | **7.63E-01** |

Note 1: Routine airborne dose in this table is conservatively represented as a sum of Iodine, Particulate, and Tritium dose (excluding C-14, in mrem) with a mrem term added from noble gas beta air energy (mrad, expressed as mrem). This 'addition' does not represent a real dose and is listed here solely to help demonstrate compliance with 40CFR190. (Doses by type of release and comparison to the specific limits of 10CFR50 Appendix I are summarized on the following pages.)

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

Note 3: 40CFR190 requires the reporting of total dose, including that of direct shine. Direct shine dose from sources other than dry cask are indistinguishable from background. Direct shine dose is determined from TLDs near the dry cask area and site boundary, compared with REMP TLDs and historical values, and corrected with occupancy factors to determine a bounding, worst case assessment of direct shine dose to a real individual. These doses are slightly higher than those of the previous year due to additional storage on the Independent Spent fuel Storage Installation (ISFSI). Details of each year's dose evaluation are available on site from Radiation Protection.

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INDIAN POINT 3 NUCLEAR POWER PLANT
RADIOLOGICAL IMPACT ON MAN
JANUARY - DECEMBER 2012

Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 1.18E-04 | 4.01E-05 | 1.69E-04 | 1.92E-04 | **4.32E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 2.36E-03 | 8.02E-04 | 3.38E-03 | 3.84E-03 | 4.32E-03 |
| Age Group | | Adult | Child | Child | Adult | Child |
| Critical Organ | | GILLI | Bone | Bone | GILLI | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 1.08E-04 | 3.55E-05 | 1.42E-05 | 1.06E-04 | **2.64E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 7.20E-03 | 2.37E-03 | 9.47E-04 | 7.07E-03 | 8.79E-03 |

B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 3.17E-06 | 4.67E-06 | 3.75E-06 | 4.80E-06 | **1.64E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 6.34E-05 | 9.34E-05 | 7.50E-05 | 9.60E-05 | 1.64E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 5.43E-06 | 8.10E-06 | 6.80E-06 | 9.39E-06 | **2.97E-05** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 5.43E-05 | 8.10E-05 | 6.80E-05 | 9.39E-05 | 1.49E-04 |

C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | **6.76E-04** | **5.75E-04** | **7.21E-04** | **8.31E-04** | **2.80E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **9.02E-03** | **7.67E-03** | **9.61E-03** | **1.11E-02** | **1.87E-02** |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | **1.73E-02** | **1.72E-02** | **1.73E-02** | **1.74E-02** | **6.91E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **2.30E-01** | **2.29E-01** | **2.31E-01** | **2.32E-01** | **4.61E-01** |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 8.30E-02 | 8.30E-02 | 8.30E-02 | 8.30E-02 | **3.32E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.11E+00 | 1.11E+00 | 1.11E+00 | 1.11E+00 | 2.21E+00 |

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TABLE 1A

INDIAN POINT 3 RADIOACTIVE EFFLUENT REPORT (Jan - Dec 2013)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

| A. Fission & Activation Gases | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year 2013 | Est. Total % Error |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 2.99E-01 | 2.11E-02 | 1.70E-02 | 1.45E-02 | 3.52E-01 | ± 25 |
| 2. Average release rate | uCi/sec | 3.85E-02 | 2.68E-03 | 2.14E-03 | 1.82E-03 | 1.11E-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 | **4.08E+00** | **3.78E+00** | **3.77E+00** | **3.62E+00** | **1.53E+01** | ± 25 |
| 2. Average release rate | uCi/sec | **5.26E-01** | **4.81E-01** | **4.75E-01** | **4.55E-01** | **4.84E-01** | |

E. Carbon-14

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | 2013 |
|---|---|---|---|---|---|---|
| 1. Total release | Ci | 2.50E+00 | 2.50E+00 | 2.50E+00 | 2.50E+00 | 1.00E+01 |
| 2. Average release rate | uCi/sec | 3.22E-01 | 3.18E-01 | 3.15E-01 | 3.15E-01 | 3.17E-01 |

- Indicates < MDA

# Errata 2

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## Groundwater:

Curies and dose contribution from activity discovered in onsite groundwater and storm drain pathways during the year are discussed in more detail in Section H. The offsite dose calculation involves multiple source term measurements, as well as computations 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 total offsite dose.

## Total Dose:

Unit and pathway-specific dose data can be found on the Radiological Impact on Man tables following this discussion. For simplicity and to demonstrate compliance with 40CFR190, the following table indicates the maximum hypothetical Total Dose to an individual from operation of the facility, including any measured direct shine component from the site property:

| Year: 2013 | | Total Body | Max Organ |
|---|---|---|---|
| **40 CFR 190 limit ===➔** | **IPEC** | **25 mrem** | **75 mrem** |
| **Routine Airborne Effluents[1]** | **Units 1 and 2** | **2.26E-03** | **2.26E-03** |
| **Routine Liquid Effluents** | **Units 1 and 2** | **1.17E-03** | **1.90E-03** |
| Liquid Releases of $C^{14}$ | Units 1 and 2 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Units 1 and 2 | 6.76E-02 | 3.39E-01 |
| **Routine Airborne Effluents[1]** | **Unit 3** | **2.57E-03** | **2.57E-03** |
| **Routine Liquid Effluents** | **Unit 3** | **2.05E-04** | **4.45E-04** |
| Liquid Releases of $C^{14}$ | Unit 3 | 1.17E-03 | 5.83E-03 |
| Airborne Releases of $C^{14}$ | Unit 3 | 6.11E-02 | 3.06E-01 |
| **Ground Water & Storm Drain Totals** | **IPEC[2]** | **7.78E-05** | **3.15E-04** |
| **Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.** | **IPEC[3]** | **1.30E-01** | **1.30E-01** |
| **Indian Point Energy Center Total Dose, per 40 CFR 190** | **IPEC** | **2.67E-01** | **7.94E-01** |

Note 1: Routine airborne dose in this table is conservatively represented as a sum of Iodine, Particulate, and Tritium dose (excluding C-14, in mrem) with a mrem term added from noble gas gamma air energy (mrad, expressed as mrem). This 'addition' does not represent a real dose and is listed here solely to help demonstrate compliance with 40CFR190. (Doses by type of release and comparison to the specific limits of 10CFR50 Appendix I are summarized on the following pages.)

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

Note 3: 40CFR190 requires the reporting of total dose, including that of direct shine. Direct shine dose from sources other than dry cask are indistinguishable from background. Direct shine dose is determined from TLDs near the dry cask area and site boundary, compared with REMP TLDs and historical values, and corrected with occupancy factors to determine a bounding, worst case assessment of direct shine dose to a real individual. These doses are slightly higher than those of the previous year due to additional storage on the Independent Spent fuel Storage Installation (ISFSI). Details of each year's dose evaluation are available on site from Radiation Protection.

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INDIAN POINT 3 NUCLEAR POWER PLANT

RADIOLOGICAL IMPACT ON MAN

JANUARY - DECEMBER 2013

Maximum exposed individual doses in mrem or mrad

A. LIQUID DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Organ Dose | (mrem) | 2.63E-04 | 5.22E-05 | 5.90E-05 | 7.38E-05 | **4.45E-04** |
| Applicable Limit | (mrem) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 5.26E-03 | 1.04E-03 | 1.18E-03 | 1.48E-03 | 4.45E-03 |
| Age Group | | Child | Adult | Child | Child | Child |
| Critical Organ | | Bone | GILLI | Bone | Bone | Bone |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adult Total Body | (mrem) | 1.59E-04 | 1.42E-05 | 3.26E-06 | 2.86E-05 | **2.05E-04** |
| Applicable Limit | (mrem) | 1.5 | 1.5 | 1.5 | 1.5 | 3.0 |
| Percent of Limit | (%) | 1.06E-02 | 9.47E-04 | 2.17E-04 | 1.91E-03 | 6.84E-03 |

B. AIRBORNE NOBLE GAS DOSES

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Gamma Air | (mrad) | 3.71E-05 | 3.52E-06 | 3.89E-06 | 3.44E-06 | **4.80E-05** |
| Applicable Limit | (mrad) | 5 | 5 | 5 | 5 | 10 |
| Percent of Limit | (%) | 7.42E-04 | 7.04E-05 | 7.78E-05 | 6.88E-05 | 4.80E-04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Beta Air | (mrad) | 8.02E-05 | 6.86E-06 | 6.78E-06 | 5.92E-06 | **9.98E-05** |
| Applicable Limit | (mrad) | 10 | 10 | 10 | 10 | 20 |
| Percent of Limit | (%) | 8.02E-04 | 6.86E-05 | 6.78E-05 | 5.92E-05 | 4.99E-04 |

C. AIRBORNE IODINE, PARTICULATE, & TRITIUM DOSES (excluding C-14, for info only)

| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
|---|---|---|---|---|---|---|
| Iodine/Part | (mrem) | 6.75E-04 | 6.26E-04 | 6.24E-04 | 5.99E-04 | **2.52E-03** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **9.00E-03** | **8.34E-03** | **8.33E-03** | **7.99E-03** | **1.68E-02** |
| Age Group | | Child | Child | Child | Child | Child |
| Critical Organ | | Liver | Liver | Liver | Liver | Liver |

D. AIRBORNE IODINE, PARTICULATE, TRITIUM, and CARBON-14 DOSES

| | | | | | | |
|---|---|---|---|---|---|---|
| Child TB Dose | (mrem) | **1.60E-02** | **1.59E-02** | **1.59E-02** | **1.59E-02** | **6.36E-02** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | **2.13E-01** | **2.12E-01** | **2.12E-01** | **2.12E-01** | **4.24E-01** |
| | | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ANNUAL |
| Child Bone Dose | (mrem) | 7.65E-02 | 7.65E-02 | 7.65E-02 | 7.65E-02 | **3.06E-01** |
| Applicable Limit | (mrem) | 7.5 | 7.5 | 7.5 | 7.5 | 15 |
| Percent of Limit | (%) | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 2.04E+00 |

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6. Abnormal Releases

a) Liquid

General Groundwater

IPEC's groundwater quantification model involves a verification/calibration such that the annual release to the environment remains a function of annual precipitation and source term. The 2014 effluent dose was similar to that of 2013.

The offsite dose associated with the groundwater pathway remains small. The total routine liquid effluent inclusive of the groundwater pathway contributes <0.1% of the annual limit. Groundwater and storm water effluent flow rates and source term data are further described in Section H of this report. A breakdown of the total dose from the groundwater and storm water pathways is provided in Section E of this report (Radiological Impact on Man).

**An increase in tritium levels was noted in several sentinel wells at Unit 2 in late March. These levels continued throughout the year with levels also elevated in several of the down-gradient wells. A thorough investigation was performed to determine the cause of these increased levels. The root cause was determine to be the overflow of draining of systems to floor drains inside the Primary Auxiliary Building (PAB) with subsequent leakage to ground into gaps between the wall and floor of the PAB. The dose consequence was negligible and is included in the doses performed in Section E of this report.**

Site Sewage System

On 2/13/14, as part of routine monitoring, water containing H-3 was detected in the site sewer system. Although this event did involve the release of radiologically contaminated liquid indirectly into the environment, it was not an unmonitored release. The source was due to a leak in the liquid waste distillate system piping. This leakage was collected in the utility tunnel sump which had been previously rerouted to sewage to address an issue with sump pump operation. As soon as this problem with rerouting was discovered, it was promptly addressed and input to the sewage system terminated. Both the sewage and the utility tunnel sump are monitored points and part of the NRC IE 80-10 program. The estimated total number of curies of H-3 released was 3.8 Curies (from 1/13/14 to 2/26/14) with an estimated dose consequence of approximately 0.00004 mRem.

b) Airborne - None

ENCLOSURE 2 TO NL-16-043

# Process Control Program

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3
DOCKET NOS. 50-003, 50-247 AND 50-286

# PROCESS CONTROL PROGRAM

| | |
|---|---|
| **Procedure Contains NMM ECH eB REFLIB Forms:** YES ☐ NO ☒ | |
| **Procedure Revision Type:** New ☐ NON-Editorial ☒ Editorial ☐ TC ☐ Cancellation ☐ | |

| HQN Effective Date | Procedure Owner:<br>Title:<br>Site: | Donnie Marvel<br>Manager, RP<br>ANO | Governance Owner:<br>Title:<br>Site: | Reid Tagliamonte<br>Manager, Fleet RP<br>HQN |
|---|---|---|---|---|
| 8/27/15 | | | | |

| Site | Site Procedure Champion | Title |
|---|---|---|
| ANO | Donnie Marvel | Manager, RP |
| BRP | N/A | N/A |
| CNS | Chris Sunderman | Manager, RP |
| GGNS | Roy Miller | Manager, RP |
| IPEC | Frank Mitchell | Manager, RP |
| JAF | Robert Heath | Manager, RP |
| PLP | David Nestle | Manager, RP |
| PNPS | Alan Zelie | Manager, RP |
| RBS | Shannon Peterkin | Manager, RP |
| W3 | Daniel Frey | Manager, RP |
| HQN | Reid Tagliamonte | Manager, Fleet RP |

**For site implementation dates see ECH eB REFLIB using site tree view (Navigation panel).**

**Site and NMM Procedures Canceled or Superseded By This Revision**

None

**Process Applicability Exclusion:** All Sites: ☐

Specific Sites: ANO ☐ BRP ☐ CNS ☐ GGNS ☒ IPEC ☐ JAF ☐ PLP ☐ PNPS ☐ RBS ☐ W3 ☐

**Change Statement**

The primary purpose of this revision is to incorporate GGNS Temp Change in response to CR-GGN-2015-1277. Specifically:

- Step 5.1[1](b) added the words "owned by Entergy"
- Added new step 5.9[2] (same as step 5.1[1](b))

Other changes:

- Removed VY from coversheet and deleted step 5.8[4](e) as fleet procedures no longer apply to VY.
- Reformatted table in section 8 for compliance with EN-AD-101-01, updated the table and deleted VY entries from the table. Updated cross references to section 8 within the body of the procedure.
- Deleted reference to VY commitments from step 5.8[3]

| | |
|---|---|
| **Associated PRHQN #:** 2015-00273 | **Procedure Writer:** Ron Schwartz |
| **Contains Proprietary Information:** YES ☐ NO ☒ | |

# TABLE OF CONTENTS

## 1.0 PURPOSE

The Process Control Program (PCP) requires formulas, sampling, analyses, test and determinations to be made to ensure that the processing and packing of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61 and 71, State Regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste. The scope of a PCP is to assure that radioactive waste will be handled, shipped, and disposed of in a safe manner in accordance with approved site or vendor procedures, whichever is applicable. [GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 1]

1.1 The purpose of this document is to provide a description of the solid radioactive waste Process Control Program (PCP) at all the Entergy fleet sites. The PCP describes the methods used for processing, classification and packaging low-level wet radioactive waste into a form acceptable for interim on-site storage, shipping and disposal, in accordance with 10 CFR Part 61 and current disposal site criteria.

1.2 To ensure the safe operation of the solid radwaste system, the solid radwaste system will be used in accordance with this Process Control Program to process radioactive wastes to meet interim on-site storage, shipping and burial ground requirements.

1.3 This document addresses the process control program in the context of disposal criteria, on-site processing and vendor processing requirements.

1.4 The Process Control Program implements the requirements of 10CFR50.36a and General Design Criteria 60 of Appendix A to 10CFR Part 50. The process parameters included in the Process Control Program may include but are not limited to waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, and mixing and curing times.

1.5 This document does NOT address the requirements for 10CFR Part 61.56 (waste characteristics) for material sent to intermediate processors, because the final treatment and packaging is performed at the vendor facilities.

## 2.0 REFERENCES

[1] EN-QV-104, "Entergy Quality Assurance Program Manual Control"

[2] Title 49, Code of Federal Regulations

[3] Title 10, Code of Federal Regulations, Part 20

*2.0 continued*

[4] Title 10, Code of Federal Regulations, Part 61

[5] Title 10, Code of Federal Regulations, Part 71, Appendix H [QAPM, Section A.1.c]

[6] Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification, 11 May 1983

[7] Disposal Site Criteria and License

[8] Waste Processor Acceptance Criteria

[9] EN-LI-100, "Process Applicability Determination"

[10] NRC Information and Enforcement Bulletins

- NRC Information Notice 79-19: Packaging of Low-Level Radioactive Waste for Transport and Burial.
- NRC Information Notice 80-24: Low-Level Radioactive Waste Burial Criteria.
- NRC Information Notice 80-32: Clarification of Certain Requirements for Exclusive-Use Shipments of Radioactive Materials.
- NRC Information Notice 80-32, Rev. 1: Clarification of Certain Requirements for Exclusive-Use Shipments of Radioactive Materials.
- NRC Information Notice 83-05: Obtaining Approval for Disposing of Very-Low-Level Radioactive Waste - 10CFR Section 20.302.
- NRC Information Notice 83-10: Clarification of Several Aspects Relating to Use of NRC-Certified Transport Packages.
- NRC Information Notice 83-33: Non-Representative Sampling of Contaminated Oil.
- NRC Information Notice 84-50: Clarification of Scope of Quality Assurance Programs for Transport Packages Pursuant to 10CFR 50 Appendix B.
- NRC Information Notice 84-72: Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation.
- NRC Information Notice 85-92: Surveys of Wastes Before Disposal from Nuclear Reactor Facilities.
- NRC Information Notice 86-20: Low-Level Radioactive Waste Scaling Factors, 10CFR 61.
- NRC Information Notice 86-90: Requests to Dispose of Very Low-Level Radioactive Waste Pursuant 10CFR 20.302

*2.0[10], continued*

- NRC Information Notice 87-03: Segregation of Hazardous and Low-Level Radioactive Wastes
- NRC Information Notice 87-07: Quality Control of On-Site Dewatering/ Solidification Operations by Outside Contractors

[11] NRC Information and Enforcement Bulletins (continued)

- NRC Information Notice 89-27: Limitations on the Use of Waste Forms and High Integrity Containers for the Disposal of Low-Level Radioactive Waste
- NRC Information Notice 92-62: Emergency Response Information Requirements for Radioactive Material Shipments
- NRC Information Notice 92-72: Employee Training and Shipper Registration Requirements for Transporting Radioactive Materials
- NRC Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program".

[12] Nureg-0800 Standard Review Plan Section 11.4 Revision 2, Solid Waste Management Systems.

[13] NRC Waste Form Technical Position, Revision 1 Jan 24 1991.

[14] NRC SECY 94-198 Review of Existing Guidance Concerning the Extended Storage of Low-Level Radioactive Waste.

[15] EPRI TR-106925 Rev-1, Interim On-Site Storage of Low Level Waste: Guidelines for Extended Storage - October1996

[16] NRC Branch Technical Position On Concentration Averaging And Encapsulation Jan 17 1995

[17] Commitment Documents (U-2 and U-3)

- IPN-99-079, "Supplement to Proposed Changes to Technical Specifications Incorporating Recommendations of Generic Letter 89-01 and the Revised 10 CFR Part 20 and 10 CFR Part 50.36a.
- Appendix B Technical Specifications, Section 4.5 [IP, RECS ODCM Part 1]

## 3.0 DEFINITIONS

[1] **Batch** – A quantity of waste to be processed having essentially consistent physical and chemical characteristics as determined through past experience or system operation knowledge by the Radwaste Shipping Specialist. A batch could be a waste tank, several waste tanks grouped together or a designated time period such as between outages as with the DAW waste stream. An isolated quantity of feed waste to be processed having essentially constant physical and chemical characteristics. (The addition or removal of water will not be considered to create a new batch).

[2] **Certificate of Compliance** - Document issued by the USNRC regulating use of a NRC licensed cask or issued by (SCDHEC) South Carolina Department of Health and Environmental Conservation regulating a High Integrity Container.

[3] **Chelating Agents** - EDTA, DTPA, hydroxy-carboxylic acids, citric acid, carbolic acid and glucinic acid.

[4] **Compaction** - The process of volume reducing solid waste by applying external pressure.

[5] **Confirmatory Analysis** - The practice of verifying that gross radioactivity measurements using MCA are reasonably consistent with independent laboratory sample data.

[6] **Dewatered Waste** - Wet waste that has been processed by means other than solidification, encapsulation, or absorption to meet the free standing liquid requirements of 10CFR Part 61.56 (a)(3) and (b)(2).

[7] **De-watering** - The removal of water or liquid from a waste form, usually by gravity or pumping.

[8] **Dilution Factor** - The RADMAN computer code factor to account for the non-radioactive binder added to the waste stream in the final product when waste is solidified.

[9] **Dry Waste** - Radioactive waste which exist primarily in a non-liquid form and includes such items as dry materials, metals, resins, filter media and sludges.

[10] **Encapsulation** - Encapsulation is a means of providing stability for certain types of waste by surrounding the waste by an appropriate encapsulation media.

[11] **Gamma-Spectral-Analysis** - Also known as IG, MCA, Ge/Li and gamma spectroscopy.

[12] **Gross Radioactivity Measurements** - More commonly known as dose to curie conversion for packaged waste characterization and classification.

*3.0 continued*

[13] **Homogeneous** - Of the same kind or nature; essentially alike. Most Volumetric waste streams are considered homogeneous for purposes of waste classification.

[14] **Incineration** – The process of burning a combustible material to reduce its volume and yield an ash residue.

[15] **Liquid Waste** - Radioactive waste that exist primarily in a liquid form and is contained in other than installed plant systems, to include such items as oil, EHC fluid, and other liquids. This waste is normally processed off-site.

[16] **Low-Level Radioactive Waste (LLW)** - Those wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

[17] **Measurement of Specific Radionuclides** - More commonly known as direct sample or container sample using MCA data for packaged waste characterization and classification.

[18] **Operable** - A system, subsystem, train, component or device SHALL be OPERABLE or have OPERABILITY when it is capable of performing its specified functions(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

[19] **Prequalification Program** - The testing program implemented to demonstrate that the proposed method of wet waste processing will result in a waste form acceptable to the land disposal facility and the NRC.

[20] **Processing** - Changing, modifying, and/or packaging radioactive waste into a form that is acceptable to a disposal facility.

[21] **Quality Assurance/Quality Control** - As used in this document, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material structure, component, or system to predetermined requirements.

*3.0, continued*

[22] **Reportable Quantity Radionuclides (RQ)** - Any radionuclide listed in column (1) of Table 2 of 49CFR Part 172.101 which is present in quantities as listed in column (3) of Table 2 of 49CFR Part 172.101.

[23] **Sampling Plan** - A program to ensure that representative samples from the feed waste and the final waste form are obtained and tested for conformance with parameters stated in the PCP and waste form acceptance criteria.

[24] **Scaling Factor** - A dimensionless number which relates the concentration of an easy to measure radionuclide (gamma emitter) to one which is difficult to measure (beta and/or alpha emitters).

[25] **Significant Quantity** - For purposes of waste classification all the following radionuclide values SHALL be considered significant and must be reported on the disposal manifest.

- Any value (real or LLD) for radionuclides listed in Appendix G to 10CFR20 (H-3, C-14, I-129, Tc-99).
- Greater than or equal to 1 percent of the concentration limits as listed in 10CFR Part 61.55 Table 1.
- Greater than or equal to 1 percent of the Class A concentration limits listed in 10CFR Part 61.55 Table 2.
- Greater than or equal to 1 percent of the total activity.
- Greater than or equal to 1 percent of the Reportable Quantity limits listed on 49CFR Part 172.101 Table 2.

[26] **Solidification** - The conversion of wet waste into a free-standing monolith by the addition of an agent so that the waste meets the stability and free-standing liquid requirements of the disposal site.

[27] **Special Radionuclides** - The RADMAN computer code term for radionuclides listed in Appendix G to 10CFR20 (i.e., H-3, C-14, I-129 & Tc-99)

[28] **Stability** – Structural stability per 10CFR61.2, Waste Form Technical Position, and Waste Form Technical Position Revision 1. This can be provided by the waste form, or by placing the waste in a disposal container or structure that provides stability after disposal. Stability requires that the waste form maintain its structural integrity under the expected disposal conditions.

*3.0, continued*

[29] **Training** - A systematic program that ensures a person has knowledge of hazardous materials and hazardous materials regulations.

[30] **Type A Package** - Is the packaging together with its radioactive contents limited to A1 or A2 as appropriate that meets the requirements of 49CFR Part 173.410 and Part 173.412, and is designed to retain the integrity of containment and shielding under normal conditions of transport as demonstrated by the tests set forth in 49CFR Part 173.465 or Part 173.466 as appropriate.

[31] **Type B Package** - Is the packaging together with its radioactive contents that is designed to retain the integrity of containment and shielding when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10CFR Part 71.

[32] **Volume Reduction** – any process that reduces the volume of waste. This includes but is not limited to, compaction and incineration.

[33] **Waste Container** - A vessel of any shape, size, and composition used to contain the waste media.

[34] **Waste Form** - Waste in a waste container acceptable for disposal at a licensed disposal facility.

[35] **Waste Stream** - A Plant specific and constant source of waste with a distinct radionuclide content and distribution.

[36] **Waste Type** – A single packaging configuration and waste form tied to a specific waste stream.

## 4.0 RESPONSIBILITIES

[1] The **Vice President Operations Support (VPOS)** is responsible for the implementation of this procedure.

[2] Each site **Senior Nuclear Executive (SNE)** is responsible for ensuring that necessary site staff implements this procedure.

[3] The **Low Level RadWaste (LLRW) Focus Group** is responsible for evaluating and recommending changes and revisions to this procedure.

*4.0, continued*

[4] Each site **RP Department – Radwaste Supervisor / Specialist** (title may vary at the site's respectively) has the overall responsibility for implementing the PCP and is responsible for processing and transportation is tasked with the day-to-day responsibilities for the following:

- Implementing the requirements of this document.
- Ensuring that radioactive waste is characterized and classified in accordance with 10CFR Part 61.55 and Part 61.56.
- Ensuring that radioactive waste is characterized and classified in accordance with volume reduction facility and disposal site licenses and other requirements.
- Designating other approved procedures (if required) to be implemented in the packaging of any specific batch of waste.
- Providing a designated regulatory point of contact between the Plant and the NRC, volume reduction facility or disposal site.
- Maintaining records of on-site and off-site waste stream sample analysis and Plant evaluations.
- Suspending shipments of defectively processed or defectively packaged radioactive wastes from the site when the provisions of this process control program are not satisfied.

## 5.0 DETAILS

An isotopic analysis SHALL be performed on every batch for each waste stream so that the waste can be classified in accordance with 10CFR61. The isotopic and curie content of each shipping container SHALL be determined in accordance with 49CFR packaging requirements. The total activity in the container may be determined by either isotopic analysis or by dose-rate-to-curie conversion.

### 5.1. Precautions and Limitations

[1] Precautions

(a) Radioactive materials SHALL be handled in accordance with applicable radiation protection procedures.

(b) All radioactive waste owned by Entergy processed on-site **OR** off-site by vendors must be processed or packaged to meet the minimum requirements listed in 10CFR Part 61.56 (a) (1) through (8).

*5.1[1], continued*

(c) If the provisions of the Process Control Program are not satisfied, suspend shipment of the defectively processed or defectively packaged waste from the site. Shipment may be accomplished when the waste is processed / packaged in accordance with the Process Control Program.

(d) The generation of combustible gases is dependent on the waste form, radioactive concentration and accumulated dose in the waste. Changes to organic inputs (e.g. oil) to waste stream may change biogas generation rates.

[2] Limitations

(a) Only qualified personnel will characterize OR package radioactive waste OR radioactive materials for transportation or disposal.

(b) All site personnel that have any involvement with radioactive waste management computer software SHALL be familiar with its functions, operation and maintenance.

## 5.2. Waste Management Practices

[1] Waste processing methods include the following:

(a) Present and planned practice is NOT to solidify or encapsulate any waste streams.

(b) Waste being shipped directly for burial in a HIC (High Integrity Container) is dewatered to less than 1 percent by volume prior to shipment.

(c) Waste being shipped directly for burial in a container other than a HIC is dewatered to less than 0.5 percent by volume prior to shipment.

(d) IF solidification is required in the future, THEN at least one representative test specimen from at least every 10th batch of each type of radioactive waste will be checked to verify solidification.

(1) IF any specimen fails to verify solidification, THEN the solidification of the batch under test SHALL be suspended until such time as additional test specimens can be obtained, alternative solidification parameters can be determined, and a subsequent test verifies solidification. If alternative parameters are determined, the subsequent tests shall be verified using the alternative parameters determined.

*5.2[1](d), continued*

(2) IF the initial test specimen from a batch of waste fails to verify solidification, THEN provide for the collection and testing of representative test specimens from each consecutive batch of the same type of waste until at least 3 consecutive initial test specimens demonstrates solidification. The process SHALL be modified as required to assure solidification of subsequent batches of waste.

[2] Operation and maintenance of dewatering systems and equipment include the following:

(a) Present and planned practice is to utilize plant personnel supplemented by vendor personnel or contracted vendor personnel, to operate AND maintain dewatering systems and equipment (as needed to meet disposal site requirements).

(b) All disposal liners are manufactured by and purchased from QA-approved vendors.

[3] ALARA considerations are addressed in all phases of the processes involving handling, packaging AND transfer of any type OR form of radioactive waste (dewatered or dry). Resin, charcoal media, spent filter cartridges AND sludges are typically processed within shields. Sluiceable demineralizers are shielded when in service. Radiation exposure and other health physics requirements are controlled by the issuance of a Radiation Work Permit (RWP) for each task.

## 5.3. Waste Stream Sampling Methods and Frequency

[1] The following general requirements apply to Plant waste stream sampling:

(a) Treat each waste stream separately for classification purposes.

(b) Ensure samples are representative of or can be correlated to the final waste form.

(c) Determine the density for each new waste stream initially or as needed (not applicable for DAW and filters).

(d) Perform an in-house analysis for gamma-emitting radionuclides for each sample sent to an independent laboratory.

(e) Periodically perform in-house analysis for gamma emitting radionuclides for comparison to the current data base values for gamma emitters. (The current database is usually based on the most recent independent laboratory results.)

(f) Resolve any discrepancies between in-house results AND the independent laboratory results for the same or replicate sample as soon as possible.

(g) Maintain records of on-site and off-site waste stream sample analysis and evaluations.

*5.3, continued*

[2] When required, waste stream samples should be analyzed, re-evaluated and if necessary, shipped to a vendor laboratory for additional analysis. The same is true when there is a reason to believe that an equipment or process change has significantly altered the previously determined scaling factors by a factor of 10.

Specific examples include but are not limited to:

- Changes in oxidation reduction methods such as zinc, injection, hydrogen water chemistry,
- Changes in purification methods including media specialization, media distribution, ion/cation ratios,
- Changes in fuel performance criteria including fuel leaks
- Other changes in reactor coolant chemistry.
- Sustained, unexplained, changes in the routinely monitored Beta/Alpha ratios, as determined by Radiation Protection,
- When there is an extended reactor shutdown (> 90 days).
- When there are changes to liquid waste processing, such as bypassing filters, utilizing filters or a change in ion exchange media.
- When there are changes to the waste stream that could change the biogas generation rate.

[3] The following requirements apply to infrequent or abnormal waste types:

(a) Infrequent **<u>OR</u>** abnormal waste types that may be generated must be evaluated on a case-by-case basis.

(b) The RP Department Supervisor / Specialist responsible for processing <u>AND</u> shipping will determine if the waste can be correlated to an existing waste stream.

(c) <u>IF</u> the radioactive waste cannot be correlated to an existing waste stream, <u>THEN</u> the RP Department Supervisor / Specialist responsible for processing and shipping SHALL determine specific off-site sampling and analysis requirements necessary to properly classify the material.

[4] Specific sampling methods and data evaluation criteria are detailed in EN-RW-104 for specific waste streams.

## 5.4. Waste Classification

[1] General requirements for scaling factors include the following:

(a) The Plant has established an inferential measurement program whereby concentrations of radionuclides which cannot be readily measured are estimated through ratio-ing with radionuclides which can be readily measured.

(b) Scaling factor relationships are developed on a waste stream-specific basis. These relationships are periodically revised to reflect current independent lab data from direct measurement of samples. The scaling factor relationships currently used by the sites are as follows:

- Hard to detect ACTIVATION product radionuclides and C-14 are estimated by using scaling factors with measured Co-60 activities.
- Hard to detect FISSION product radionuclides and H-3, Tc-99 and I-129 are estimated by using scaling factors with measured Cs-137 activities.
- Hard to detect TRANSURANIC radionuclides are estimated by using scaling factors with measured Ce-144 activities. Where Ce-144 cannot be readily measured, transuranics are estimated by using scaling factors with measured Cs-137 activities. Second order scaling of transuranics is acceptable when Cs-137 and Ce-144 are not readily measurable.

[2] General requirements for the determination of total activity and radionuclide concentrations include the following:

(a) The activity for the waste streams is estimated by using either Gross Radioactivity Measurement OR Direct Measurement of Radionuclides. Current specific practices are as follows:

- DAW - Gross radioactivity measurement in conjunction with the RADMAN computer codes, other approved computer codes or hand calculation.
- Filters - Gross radioactivity measurement in conjunction with the FILTRK computer code, other approved computer codes or hand calculation.
- All Other Waste Streams - Direct measurement of radionuclides in conjunction with the RADMAN computer codes, other approved computer codes or hand calculation.

(b) Determination of the NRC waste classification is performed by comparing the measured or calculated concentrations of significant radionuclides in the final waste form to those listed in 10CFR Part 61.55.

## 5.5. Quality Control

[1] The RADMAN computer code provides a mechanism to assist the Plant in conducting a quality control program in accordance with the waste classification requirements listed in 10CFR Part 61.55. All waste stream sample data changes are written to a computer data file for future review and reference.

[2] Audits and Management Review includes the following:

(a) Appendix G to 10CFR20 requires conduct of a QC program which must include management review of audits.

(b) Management audits of the Plant Sampling and Classification Program SHALL be periodically performed to verify the adequacy of maintenance sampling and analysis.

(c) Audits and assessments are performed and documented by any of the following:

- Radiation Protection Department
- Quality Assurance Department
- Qualified Vendors

(d) Certain elements of the Entergy Quality Assurance Program Manual are applied to the Process Control Program. [QAPM, Section A.1.c]

## 5.6. Dewatering Operations

[1] Processing requirements during dewatering operations include the following:

(a) All dewatering operations are performed per approved Plant or vendor operating procedures and instructions.

(b) Dewatering limitations and capabilities are verified by vendor Topical Reports or Operating and Testing Procedures.

[2] Dewatered resin activity limitations include the following:

(a) Dewatered resins will not be shipped off-site that have activities which will produce greater than 1.0E+8 rads total accumulated dose over 300 years. This is usually verified by comparing the container specific activity at the time of shipment to the following concentration limits for radionuclides with a half-life greater than five years:

- 10 Ci (0.37 TBq) per cubic foot.
- 350 uCi (12.95 MBq) per cubic centimeter

## 5.7. Waste Packaging

Waste in final form will be packaged in accordance with Title 10 and Title 49 of the Code of federal regulations and in accordance with current burial site criteria as is detailed in EN-RW-102.

## 5.8. Administrative Controls

[1] Information on solid radioactive waste shipped off-site is reported annually to the Nuclear Regulatory Commission in the Annual Radioactive Effluent Release Report as specified by the Offsite Dose Calculation Manual (ODCM) or Technical Specification. [ANO1 Technical Specifications - 5.6.3] [ANO2 Technical Specifications – 6.6.3] [WF3 Technical Specifications – 6.9.18] [GGNS ODCM – 5.6.3.c] [JAF Technical Specifications – 5.6.3] [JAF ODCM 6.2.1] [PLP ODCM, Appendix A – IV. A].

[2] All changes to the PCP SHALL be documented. All records of reviews performed SHALL be retained as required by the Quality Assurance Program. The documentation of the changes SHALL [GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]:

(a) Contain sufficient information to support the change with appropriate analyses or evaluations justifying the change.

(b) Include a determination that the change will maintain the overall conformance of the solidified waste product (if applicable) to existing requirements of Federal, State or other applicable regulations.

[3] All changes in the Process Control Program and supporting documentation are included in each site's next Annual Radiological Effluent Release Report to the Nuclear Regulatory Commission. [ANO ODCM - L3.2.1.C] [RBS Technical Requirements 5.5.14.1]

[4] The changes to EN-RW-105 SHALL become effective upon review and acceptance by the site's General Plant Manager (equivalent title at Palisades is Plant Superintendent) except as listed below: [PLP Technical Specifications 5.5.15]

(a) For Grand Gulf Nuclear Station, the changes to RW-105 SHALL be accomplished as specified in Grand Gulf Nuclear Station Technical Requirements Manual (TRM) Section 7.6.3.8. The changes SHALL become effective upon review and acceptance by the On-site Safety Review Committee (OSRC) **AND** the approval of the GGNS Plant General Manager. [GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]

*5.8[4], continued*

(b) For River Bend Nuclear Station, the procedure approval along with changes to RW-105 SHALL be accomplished per the River Bend Nuclear Station Technical Requirements, Section 5.5.14.1. The changes SHALL become effective upon review and acceptance by approval from the River Bend Nuclear Station Plant Manager or Radiation Protection Manager. [RBS Technical Requirements – 5.5.14.1, 5.5.14.2 & 5.8.2]

(c) For Waterford 3, the procedure approval along with changes to RW-105 SHALL be accomplished per Waterford 3 Technical Specifications 6.13.2. The changes SHALL become effective upon review and acceptance by the Waterford 3 General Plant Manager. [WF3 Technical Specifications – 6.13.2.b]

(d) For James A. FitzPatrick Nuclear Station, the procedure approval along with changes to EN-RW-105 SHALL be accomplished per the James A. FitzPatrick Station Technical Specifications, Section 5.6.3. The changes SHALL become effective upon review and acceptance through approval from the James A. FitzPatrick Nuclear Station On-Site Safety Review Committee. [JAF FSAR 11.3.5, 13.10.1.1]

(e) For IPEC, Changes to the Process Control Program SHALL become effective after final review and acceptance by the On-Site Safety Review Committee (OSRC).

**5.9. <u>Vendor Requirements</u>**

[1] Vendors performing radwaste services under 10CFR61 and 10CFR71 requirements will be on the Entergy Qualified Supplier's List (QSL). [QAPM, Section A.1.c]

[2] All radioactive waste owned by Entergy processed off-site by vendors must be processed or packaged to meet the minimum requirements listed in 10CFR Part 61.56 (a) (1) through (8) and any applicable burial site criteria.

[3] Vendors performing radwaste services on-site are to comply with the following:

(a) Dewatering and solidification services SHALL have a NRC-approved Topical Report or other form of certification documenting NRC approval of the processes and associated equipment/containers. [GGNS FSAR 11.4.4.S2, 11.4.2.3AS7]

*5.9[2], continued*

(b) All vendor procedures utilized for performing on-site radwaste processing services (to assure compliance with 10 CFR Parts 20, 61 and 71, State Regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste) will be reviewed per the requirements of EN-LI-100, technically by the applicable site's Radiation Protection organization and only be accepted per the approvals specified in Section 5.8 [4].

(c) All changes to vendor procedures for ongoing on-site radwaste services will be reviewed technically by the site's Radiation Protection organization and screened per the requirements of EN-LI-100. Significant procedural changes will require the approvals specified in Section 5.8 [4]. During screening, the level of significance for procedural changes on equipment and process parameters may warrant the full 10CFR50.59 documentation and approval process.

(d) Plant management SHALL review vendor(s) topical reports and test procedures per applicable requirements in Section 5.8.

**NOTE**

The PCP does not have to include the vendor's Topical Report if it has NRC approval, or has been previously submitted to the NRC.

(e) Plant management review will assure that the vendor's operations and requirements are compatible with the responsibilities and operation of the Plant.

(f) Training requirements and records listed in Section 5.10 also apply to contracted vendors.

## 5.10. Miscellaneous

[1] Special tools and equipment

(a) Frequency of Use and Descriptions

Required tools and equipment will vary depending on the specific process and waste container that is used. The various tools and equipment which may be required are detailed in specific procedures developed to govern activities described in this document.

*5.10, continued*

[2] Pre-requisites

(a) Maintenance of Regulatory Material

Ensure that a current set of DOT, NRC, EPA and applicable State regulations, vendor processing facility and disposal site regulations and requirements are maintained at the site and are readily available for reference. The use of web based regulations is acceptable.

(b) Representative Radionuclide Sample Data

Ensure that representative radionuclide sample data is on file for each active waste stream. Unless operation conditions or changes in processing methods require increased sample frequency, data is considered to be current if it meets the requirements of EN-RW-104.

(c) Initial and Cyclic Training

- A training program SHALL be developed, implemented and maintained for all personnel involved in processing, packaging, handling and transportation of radioactive waste to ensure radwaste operations are performed within the requirements of NRC Information Bulletin 79-19 and 49CFR Part 172.700 through Part 172.704.
- Training requirements and documentation also apply to contracted on-site vendors.

**NOTE**

Cyclic training is defined as within three years for DOT, and two years for IATA

(d) Specific employee training is required for each person who performs the following job functions [172.702(b)].

- Classifies hazardous materials.
- Packages hazardous materials.
- Fills, loads and/or closes packages.
- Marks and labels packages containing hazardous materials.
- Prepares shipping papers for hazardous materials.
- Offers or accepts hazardous materials for transportation.

*5.10[2](d), continued*

- Handles hazardous materials.
- Marks or placards transport vehicles.
- Operates transport vehicles.
- Works in a transportation facility and performs functions in proximity to hazardous materials which are to be transported.
- Inspects or tests packages.

(e) Cyclic training is defined as within three years for DOT & within two years for IATA.

Copies of training records are required for as long as a person is employed and 90 days thereafter. The records should include, as a minimum, the following:

- Trainee's name and signature
- Training dates
- Training material or source reference
- Trainer's information

## 6.0 INTERFACES

[1] EN-LI-100, "Process Applicability Determination"

[2] EN-RW-104, "Scaling Factors"

[3] EN-QV-104, "Entergy Quality Assurance Program Manual Control"

## 7.0 RECORDS

[1] Documentation of pertinent data required to classify waste and verify solidification will be maintained on each batch of processed waste as required by approved procedures.

[2] Documentation will also be maintained to ensure that containers, shipping casks, and methods of packaging wastes meet applicable Federal regulations and disposal site criteria. The records of reviews performed and documents associated with these reviews will be maintained as QA records.

## 8.0 SITE SPECIFIC COMMITMENTS

| Site | Document | Commitment Number or Reference | NMM Procedure Section/Step |
|---|---|---|---|
| ANO | ANO ODCM | L3.2.1.C | 5.8 [3] |
| ANO | ANO1 Technical Specifications | 5.6.3 | 5.8 [1] |
| ANO | ANO2 Technical Specifications | 6.6.3 | 5.8 [1] |
| RBS | RBS Technical Requirements | 5.5.14 | * |
| RBS | RBS Technical Requirements | 5.5.14.1 | 5.8 [3]<br>5.8 [4] (b) |
| RBS | RBS Technical Requirements | 5.5.14.2 | 5.8 [4] (b) |
| RBS | RBS Technical Requirements | 5.8.2 | 5.8 [4] (b) |
| WF3 | WF3 Technical Specifications | 1.22 | * |
| WF3 | WF3 Technical Specifications | 6.9.18 | 5.8 [1] |
| WF3 | WF3 Technical Specifications | 6.13.2.b | 5.8 [4] (c) |
| JAF | JAF ODCM | 6.2.1 | 5.8 [1] |
| JAF | JAF Technical Specifications | 5.6.3 | 5.8 [1], 5.8 [4](d) |
| JAF | JAF FSAR | 11.3.5, 13.10.1 | 5.8 [4](d) |
| WF3 | 11759 – NRC IN 79-19 | All | * |
| GGNS | GGNS UFSAR, Chapter 16B.1 / TRM | 7.6.3.8 paragraph 1 | 1.0 |
| GGNS | GGNS ODCM | 5.6.3.c | 5.8 [1] |
| GGNS | GGNS FSAR | 11.4.5.S2 | 5.9 [3](a) |
| GGNS | GGNS FSAR | 11.4.2.3AS7 | 5.9 [3](a) |
| IPEC | IPN-99-079 | All | * |
| IPEC | Appendix B Technical Specifications | Section 4.5, RECS ODCM Part 1 | * |
| PLP | PLP Technical Specifications | 5.5.15 | 5.8 [4] |
| PLP | PLP ODCM | Appendix A – IV. A | 5.8 [1] |
| PNPS | NRC Letter 1.98.091 | All | * |
| PNPS | NRC Letter 1.88.078 | All | * |
| All | QAPM | Section A.1.c | * |

* Covered by directive as a whole or by various paragraphs of the directive.

## 9.0 ATTACHMENTS

None