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NL-20-037
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10 CFR 50.36a

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

Subject: 2019 Annual Radioactive Effluent Release Report
Indian Point Nuclear Generating Units 1, 2 and 3
Docket Nos. 50-003, 50-247 and 50-286
Facility Operating License No DPR-5
Renewed Facility Operating License Nos. DPR-26 and DPR-64

The enclosure to this letter provides the Entergy Nuclear Operations, Inc. (Entergy) Annual Radioactive Effluent Release Report for 2019. This report is submitted in accordance with Technical Specification 5.6.3 and Regulatory Guide 1.21.

If you have any questions or require additional information, please contact Mahvash Mirzai, Regulatory Assurance Manager, at (914) 254-7714.

There are no new commitments being made in this letter.

Respectfully,

Anthony J. Vitale

AJV/trj

Enclosure: Radioactive Effluent Release Report: 2019

cc: See next page

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ENCLOSURE

NL-20-037

Radioactive Effluent Release Report: 2019

Facility: Indian Point Energy Center	Page 1 of 65
	YEAR: 2019
Indian Point Units 1, 2 and 3	
Docket Nos.: 50-3, 50-247, & 50-286	
Entergy Nuclear Operations, Inc. (Entergy)	
Annual Radioactive Effluent Release Report	

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1.0 INTRODUCTION

This information is provided in accordance with the requirements of Regulatory Guide 1.21. 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. Liquid and gaseous effluents are released in accordance with the Offsite Dose Calculation Manual (ODCM). This report is a summary of the effluent data in accordance with Unit 2 Technical Specification (TS) 5.6.3 and Unit 2 TS 5.6.3.

2.0 SUPPLEMENTAL INFORMATION

2.1 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 (calculation methodologies) contains the details necessary to perform offsite dose calculations from the sampling and monitoring outlined in the RECS. The following are the limits required by the ODCM:

1. Fission and activation gases:
   a. Noble gases dose rate due to radioactive materials released in gaseous effluents from the areas at and beyond the site boundary shall be limited to the following:
      - Less than or equal to 500 mrem/year to the total body
      - Less than or equal to 3000 mrem/year to the skin

   b. Noble gas air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:
      - Quarterly: Less than or equal to 5 mrads gamma
        Less than or equal to 10 mrads beta
      - Yearly: Less than or equal to 10 mrads gamma
        Less than or equal to 20 mrads beta

2. Iodine, tritium, and all radionuclides in particulate form (with half-lives > 8 days).
   a. The dose rate for Iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:
      - Less than or equal to 1500 mrem/yr to any organ

   b. The dose to a MEMBER OF THE PUBLIC from Iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:
      - Quarterly: Less than or equal to 7.5 mrem to any organ
      - Yearly: Less than or equal to 15 mrem to any organ

3. Liquid Effluents Dose

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:

- Quarterly: Less than or equal to 1.5 mrem total body
  Less than or equal to 5 mrem critical organ
- Yearly: Less than or equal to 3 mrem total body
  Less than or equal to 10 mrem critical organ

4. Total Dose (40CFR190)

The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to the following:

- Less than or equal to 25 mrem, Total Body or any Organ except Thyroid.
- Less than or equal to 75 mrem, Thyroid

2.2 Maximum Permissible Concentrations

1. Airborne Effluents

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.

2. 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.

2.3 Average Energy

This information is no longer used. It is available onsite if required.

2.4 Measurements & Approximations of Total Radioactivity

The following provides the methods used to measure or approximate the total radioactivity in effluents and how radionuclide composition is determined.

1. Fission & 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.

2. Iodines and Particulates

Airborne 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 3-1 and Table 3-4. 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 ODCM. Absence of any positive activity is identified as "-".

3. Tritium

   Airborne tritium is collected by passing a known volume of the sample stream through a silica gel column. The collected samples are distilled and analyzed by liquid scintillation. The tritium released was calculated for each release point from the measured tritium concentration, the volume of the sample, the tritium collection efficiency, and the respective ventilation exhaust flow rates. As a check on the silica gel sampling, Chemistry performs a comparison of total curies evaporated from the spent fuel pool (the major H-3 source term) and adjusts the silica gel measurements, as necessary.

4. Carbon-14

   Airborne Carbon-14 release values were estimated using the methodology included in the EPRI Technical Report 1021106, using the normalized Carbon-14 production rate of 3.48 Ci/GW_{th}-EFPyear for Unit 2 and 3.47 Ci/GW_{th}-EFPyear for Unit 3, a gaseous release fraction of 100%, a Carbon-14 carbon dioxide fraction of 26%, a reactor power rating 3216 MW_{th} for Unit 2 and 3188 MW_{th} for Unit 3 and equivalent full power (EFP) operation of 344.04 days for Unit 2 and 333.92 days for Unit 3 for calendar year 2019. See Section 6 and Attachment 1 for more details concerning the Carbon 14 calculations.

5. 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 Tables 4-1 and 4-4 (Section 4) 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 Tables 4-1 and 4-4.

6. Estimated Total Error Present

   Estimates of measurement and analytical error for gaseous and liquid effluents are calculated as follows:

$$E_T = \sqrt{[(E_1)^2 + (E_2)^2 + \ldots (E_n)^2]}$$

   Where: E_T = total percent error
   $E_1 \ldots E_n$ = percent error due to calibration standards, Laboratory analysis, instruments, sample flow, etc.

2.5 Batch Releases:

1. Airborne

Table 2.5-1 - Airborne Batch Releases

Unit 1 and 2 Airborne Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2019
Number of Batch Releases		51	52	51	60	215
Total Time Period	(min)	2800	2750	2470	3300	11320
Maximum Time Period	(min)	85	101	85	173	173
Average Time Period	(min)	54.9	52.8	48.4	55	52.8
Minimum Time Period	(min)	20	3	20	12	3

Unit 3 Airborne Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2019
Number of Batch Releases		27	25	17	14	83
Total Time Period	(min)	2040	2400	2480	1850	8770
Maximum Time Period	(min)	168	193	542	223	542
Average Time Period	(min)	75.5	95.9	146	132	106
Minimum Time Period	(min)	5	4	1	1	1

2. Liquid

Table 2.5-2 – Liquid Batch Releases

Unit 1 and 2 Liquid Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2019
Number of Batch Releases		5	13	2	0	20
Total Time Period	(min)	481	1200	139	0	1820
Maximum Time Period	(min)	114	99	69.5	0	114
Average Time Period	(min)	96.2	92.3	96	0	90
Minimum Time Period	(min)	90	65	43	0	43

Unit 3 Liquid Releases		Qtr 1	Qtr 2	Qtr 3	Qtr 4	2019
Number of Batch Releases		40	29	28	5	102
Total Time Period	(min)	4470	3220	3100	555	11345
Maximum Time Period	(min)	119	124	117	115	124
Average Time Period	(min)	112	111	111	111	111
Minimum Time Period	(min)	107	105	107	108	105

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 to liquid offsite dose calculations (and all other determinations of diluted effluent), and reported on Tables 4-1 and 4-4, in Section 4 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:

https://www.usgs.gov/centers/ny-water/data-tools

2.6 Abnormal Releases

1. Liquid

   None

2. Gaseous

   None

2.7 Non-routine, Planned Discharges

Recovery Well – 1 (RW-1) was installed as a contingency for mitigation of spills affecting the area near the Unit 2 Fuel Storage Building. Due to the two abnormal releases that were discussed in the 2016 Radioactive Effluent Release Report it was determined necessary to operate this well to enhance the reduction of H-3 levels in groundwater. This was necessary to reduce the H-3 to levels that would enable the Site to detect any new leaks or spills of contaminated waters. Operation of this well is a continuous monitored release pathway for liquid effluents from Unit 2. Therefore, this well is sampled per procedure and monthly permits are performed for this liquid discharge pathway. For ease of tracking, the releases from this pathway are documented as non-routine batch releases that are discharged from Unit 2. The batch totals listed in Section 2.5.2 do not include these in the totals since this discharge pathway is a continuous release pathway. Note that only H-3 has been detected in the RW-1 releases and the levels are very low compared to the typical batch releases. This does not present a problem with the dose calculations since the dose assessment modeling does not differentiate between continuous and batch releases.

Another non-routine release is one that occurs when routine ventilation is out of service (OOS). Typically, this is only for a very short amount of time per procedure, such that these releases are insignificant. Typically, the most significant of these releases occurs when the Fuel Storage Building (FSB) ventilation is OOS. The use of H-3 curie balance for the Spent Fuel Pool (SFP) can be used to account for these releases (also see Section 2.4 -Tritium) since the major airborne source term from the FSB is the evaporation of the SFP water. Another method is to evaluate the SFP H-3 airborne activity and estimate the airborne release rate.

2.8 Radioactive Waste Treatment System Changes

There were no changes to the Radioactive Waste Treatment System.

2.9 Land Use Census Changes

No changes or modifications affecting receptors, receptor location or new (or changed) routes of exposure were identified as a result of the last Land Use Census.

2.10 Effluent Monitor Instrument Inoperability

1. Effluent Monitoring Equipment Inoperable > 30 Days

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

Instrument	Effected Interval	Details
Unit 3 Admin. Building Ventilation Noble Gas Effluent, R-46	1/23/19 to 2/25/19 33 days	This gaseous effluent monitor was taken out of service for unusual spiking. Subsequently, it was determined the detector needed to be replaced. At that time, a new detector was procured from the manufacturer. Procurement, available resources and calibration time contributed to exceeding the 30-day AOT.

2. Effluent Monitoring Equipment Sample Deviation

Unit 1 Stack vent effluent monitoring system was found de-energized following the loss of 13W94 feeder. The watch chemist re-energized the system and verified flows and readings were adequate. The monitoring for iodine/particulates was out of service for approximately 16.5 hours. This exceeds the DLCO 3.3.2 required action time of 8 hours to set up alternate samples. The system was returned to service upon discovery. Particulate and iodine are not normally detected for this effluent pathway.

2.11 Offsite Dose Calculation Manual Changes

During this report period there were no ODCM changes.

2.12 Process Control Program (PCP) Changes

There were no PCP changes during 2019.

2.13 Groundwater Monitoring and Program (NEI 07-07)

The Groundwater Monitoring Program is a voluntary program set up to assure timely effective management of situations involving inadvertent releases of licensed material to ground water. A major part of the IPEC's program is a groundwater quantification model that involves verification/calibration such that the annual release to the environment remains a function of the annual precipitation and source term.

No abnormal releases occurred in 2019 and conservative assessments of legacy events have determined that the doses resulting from these events were negligible. The groundwater monitoring program provides additional confirmation of these assessments. The groundwater monitoring program also includes a storm water monitoring program. Together these programs provide data for offsite dose evaluation. The subsurface water flow directions and rates are used to estimate the transport of abnormal releases of liquid effluents in groundwater.

The offsite dose associated with the groundwater pathway remains extremely small. The 2019 effluent dose was slightly lower than in 2018. The total routine liquid effluent dose 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 Attachment 2 of this report. A breakdown of the total dose from the groundwater and storm water pathways and detailed results from the samples obtained as part of this program are also provided in Attachment 2. Section 6 (Radiological Impact on Man) of this report provides a comparison of the groundwater and storm water doses to the other dose pathways.

2.14 Outside Tanks

During this period there were no curie limits exceed in the outdoor tanks.

2.15 Errata/Corrections to Previous ARERRs

1. The 2018 Indian Point Nuclear Generating Units 1, 2, and 3, Annual Radioactive Effluent Release Report, page 43 of 67, Table 6-1, has an incorrect Max Organ dose in the Routine Liquid Effluents row. The dose reported was 1.48E-03 mrem and should have been 2.55E-03 mrem. Also, Max Organ dose in the Total Dose row (last row in table) was reported as 8.89E-01 mrem and should have been 8.90E-01 mrem. The affected page with revision bars is included in Attachment 4.

2. The 2018 Indian Point Nuclear Generating Units 1, 2, and 3, Annual Radioactive Effluent Release Report, page 44 of 67, Table 6-2, has an incorrect Annual Liquid Organ Dose (first row on Section A, Liquid Doses). The annual dose reported was 1.48E-03 mrem and should have been 2.55E-03 mrem. The Percent of Limit was also corrected from 1.48E-02 to 2.55E-02. The affected page with revision bars is included in Attachment 4.

3.0 GASEOUS EFFLUENTS

Table 3-1 Gaseous Effluents – Summation of All Releases – Units 1 and 2

A. Fission & Activation Gase	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year	Total % Error
1. Total Release	Ci	4.10E-02	3.94E-02	2.99E-02	8.43E-02	1.95E-01	± 25
2. Average release rate	uCi/sec	5.27E-03	5.01E-03	3.76E-03	1.06E-02	6.17E-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	2.58E+00	2.07E+00	2.25E+00	1.67E+00	8.57E+00	± 25
2. Average release rate	uCi/sec	3.32E-01	2.63E-01	2.83E-01	2.10E-01	2.72E-01	

E. Carbon-14						
1. Total release	Ci	2.63E+00	2.63E+00	2.63E+00	2.63E+00	1.05E+01
2. Average release rate	uCi/sec	3.38E-01	3.34E-01	3.30E-01	3.30E-01	3.33E-01

- Indicates < MDA

% limit is located in Section 6, Tables 6-2 and 6-3

Table 3-2 Gaseous Effluents -- Batch Mode – Units 1 and 2

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
Ar-41	Ci	1.54E-02	1.66E-02	1.47E-02	2.34E-02	7.01E-02
Kr-85	Ci	-	-	-	-	0.00E+00
Kr-85m	Ci	-	2.15E-06	-	-	2.15E-06
Kr-87	Ci	-	1.80E-06	-	-	1.80E-06
Kr-88	Ci	-	3.99E-06	-	3.20E-06	7.19E-06
Xe-131m	Ci	-	2.48E-04	-	9.35E-05	3.42E-04
Xe-133	Ci	2.55E-02	2.21E-02	1.51E-02	5.95E-02	1.22E-01
Xe-133m	Ci	-	6.44E-05	-	4.63E-05	1.11E-04
Xe-135	Ci	1.14E-04	3.70E-04	2.23E-05	1.31E-03	1.82E-03
Xe-135m	Ci	-	3.52E-06	-	-	3.52E-06
Xe-138	Ci	-	6.60E-07	-	-	6.60E-07
Total for Period	Ci	4.10E-02	3.94E-02	2.98E-02	8.44E-02	1.95E-01

- indicates <MDA

2) Iodines

Not Applicable for Batch Releases

3) Particulates

Not Applicable for Batch Releases

Table 3-3 Gaseous Effluents –- Continuous Mode – Units 1 and 2

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
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 3-4 Gaseous Effluents – Summation of All Releases – Unit 3

A. Fission & Activation Gase	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year	Est. Total % Error
1. Total Release	Ci	1.52E-01	1.87E-02	1.99E-02	1.49E-02	2.06E-01	± 25
2. Average release rate	uCi/sec	1.95E-02	2.38E-03	2.50E-03	1.87E-03	6.52E-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	4.87E+00	6.99E+00	3.70E+00	3.26E+00	1.88E+01	± 25
2. Average release rate	uCi/sec	6.26E-01	8.89E-01	4.65E-01	4.10E-01	5.97E-01	

E. Carbon-14						
1. Total release	Ci	2.53E+00	2.53E+00	2.53E+00	2.53E+00	1.01E+01
2. Average release rate	uCi/sec	3.25E-01	3.21E-01	3.18E-01	3.18E-01	3.20E-01

- Indicates < MDA

% limit is located in Section 6, Tables 6-2 and 6-3

Table 3-5 Gaseous Effluents – Batch Mode – Unit 3

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
Ar-41	Ci	9.24E-03	1.20E-02	1.36E-02	9.91E-03	4.48E-02
Kr-85	Ci	-	-	-	-	0.00E+00
Kr-85m	Ci	-	-	-	-	0.00E+00
Kr-87	Ci	-	-	-	-	0.00E+00
Kr-88	Ci	-	-	-	-	0.00E+00
Xe-131m	Ci	-	-	-	-	0.00E+00
Xe-133	Ci	1.42E-01	6.66E-03	6.27E-03	4.95E-03	1.60E-01
Xe-133m	Ci	-	-	-	-	0.00E+00
Xe-135	Ci	1.13E-03	-	4.47E-05	-	1.17E-03
Xe-135m	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	1.52E-01	1.87E-02	1.99E-02	1.49E-02	2.06E-01

- Indicates < MDA

2) Iodines

Not Applicable for Batch Releases

3) Particulates

Not Applicable for Batch Releases

Table 3-6 Gaseous Effluents – Continuous Mode – Unit 3

Nuclides Released

1) Fission Gases

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
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

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

Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

- indicates < MDA

4.0 LIQUID EFFLUENTS

Table 4-1 Liquid Effluents - Summation of All Releases – Units 1 and 2

A. Fission & Activation Products	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year	Est. Total % Error
1. Total Release (not including Tritium, Gr Alpha, & Gases)	Ci	1.04E-02	5.12E-03	2.15E-03	3.11E-03	2.08E-02	± 25
2. Average Diluted Conc	uCi/ml	1.59E-11	6.91E-12	2.54E-12	3.84E-12	6.81E-12	

B. Tritium

1. Total Release	Ci	3.34E+01	3.92E+02	2.85E+01	6.77E-02	4.54E+02	± 25
2. Average Diluted Conc	uCi/ml	5.09E-08	5.29E-07	3.36E-08	8.37E-11	1.49E-07	

C. Dissolved & Entrained Gases

1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	± 25
2. AverageDiluted Conc	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

D. Gross Alpha

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

E. Volume of Waste Released

1. Processed Fluids (Mon Tanks)	liters	3.12E+06	2.45E+06	8.64E+05	1.62E+06	8.05E+06	± 10
2. Unprocessed Fluids (SGs and RW-1)	liters	4.99E+07	5.06E+07	4.67E+07	4.97E+07	1.97E+08	± 10

F. Volume of Dilution Water	liters	6.56E+11	7.41E+11	8.47E+11	8.09E+11	3.05E+12	± 10

- indicates < MDA

% limit is located in Section 6, Tables 6-2 and 6-3

Table 4-2 Liquid Effluents – Batch Mode - Units 1 and 2

Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
Ag-110m	Ci	1.39E-04	1.28E-05	-	-	1.52E-04
Co-58	Ci	2.11E-05	7.45E-06	-	-	2.86E-05
Co-60	Ci	9.05E-05	5.91E-05	5.62E-05	-	2.06E-04
Cr-51	Ci	-	-	-	-	0.00E+00
Cs-137	Ci	-	1.90E-04	1.99E-04	-	3.89E-04
Fe-55	Ci	1.74E-03	5.74E-04	7.76E-05	-	2.39E-03
Fe-59		-	-	-	-	0.00E+00
Mn-54	Ci	-	-	-	-	0.00E+00
Nb-95	Ci	-	-	-	-	0.00E+00
Ni-63	Ci	1.76E-04	-	5.27E-04	-	7.03E-04
Sb-125	Ci	1.55E-03	9.46E-04	4.99E-05	-	2.55E-03
Te-123m	Ci	-	-	-	-	0.00E+00
Te-125m	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	3.72E-03	1.79E-03	9.10E-04	0.00E+00	**6.42E-03**
Dissolved & Entrained Gas						
Kr-85	Ci	-	-	-	-	0.00E+00
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**

- Indicates < MDA

Table 4-3 Liquid Effluents – Continuous Mode - Units 1 and 2

Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
Cs-137	Ci	6.56E-03	3.31E-03	1.22E-03	3.04E-03	1.41E-02
Ni-63	Ci	-	-	-	-	0.00E+00
Sr-89	Ci	-	-	-	-	0.00E+00
Sr-90	Ci	1.02E-04	2.53E-05	2.02E-05	7.09E-05	2.18E-04
Total for Period	Ci	6.66E-03	3.33E-03	1.24E-03	3.11E-03	1.43E-02

H-3 (only)	Ci	1.25E-01	6.96E-02	4.90E-02	5.77E-02	3.01E-01

- Indicates < MDA

Table 4-4 Liquid Effluents -Summation of All Releases – Unit 3

A. Fission & Activation Products	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year	Est. Total % Error
1. Total Release (not including Tritium, Gr Alpha, & Gases)	Ci	7.68E-03	7.59E-03	2.79E-03	6.79E-05	1.81E-02	± 25
2. Average Diluted Conc	uCi/ml	1.17E-11	1.03E-11	3.29E-12	8.39E-14	5.94E-12	

B. Tritium							
1. Total Release	Ci	2.84E+02	5.38E+01	3.40E+01	6.14E+00	3.78E+02	± 25
2. Average Diluted Conc	uCi/ml	4.33E-07	7.27E-08	4.02E-08	7.59E-09	1.24E-07	

C. Dissolved & Entrained Gases							
1. Total Release	Ci	1.29E-03	-	2.21E-05	-	1.31E-03	± 25
2. AverageDiluted Conc	uCi/ml	1.97E-12	-	2.61E-14	-	4.30E-13	

D. Gross Alpha							
1. Total Release	Ci	-	-	-	-	0.00E+00	± 25

E. Volume of Waste Released							
1. Processed Fluids (Mon Tanks)	liters	1.04E+06	7.55E+05	7.02E+05	1.30E+05	2.62E+06	± 10
2. Unprocessed Fluids (SGs)	liters	1.41E+06	7.03E+06	6.80E+06	2.01E+06	1.72E+07	± 10

F. Volume of Dilution Water	liters	6.56E+11	7.41E+11	8.47E+11	8.09E+11	3.05E+12	± 10

- indicates < MDA

% limit is located in Section 6, Tables 6-2 and 6-3

Table 4-5 Liquid Effluents - Batch and Continuous Modes – Unit 3

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year
Ag-110m	Ci	5.42E-04	2.18E-04	2.44E-04	2.32E-06	1.01E-03
Co-58	Ci	1.92E-04	1.84E-03	1.35E-03	6.04E-05	3.44E-03
Co-60	Ci	2.43E-03	7.91E-04	4.14E-04	5.11E-06	3.64E-03
Cr-51	Ci	2.69E-04	9.81E-04	-	-	1.25E-03
Cs-134	Ci	-	-	-	-	0.00E+00
Cs-137	Ci	3.52E-06	7.98E-06	-	-	1.15E-05
Fe-55	Ci	1.90E-03	8.79E-04	-	-	2.78E-03
I-132	Ci	7.39E-06	-	-	-	7.39E-06
Mn-54	Ci	4.24E-05	3.46E-05	1.21E-05	-	8.91E-05
Nb-95	Ci	-	5.26E-04	6.33E-05	-	5.89E-04
Ni-63	Ci	9.05E-04	9.69E-05	6.41E-04	-	1.64E-03
Sb-124	Ci	8.97E-06	2.30E-04	-	-	2.39E-04
Sb-125	Ci	5.05E-04	1.08E-03	4.30E-05	-	1.63E-03
Tc-99m	Ci	-	-	-	-	0.00E+00
Te-123m	Ci	4.86E-05	1.79E-04	3.49E-06	-	2.31E-04
Te-125m	Ci	8.12E-04	4.81E-04	-	-	1.29E-03
Te-132	Ci	9.98E-06	-	-	-	9.98E-06
Zr-95	Ci	-	2.46E-04	1.28E-05	-	2.59E-04
Total for Period	Ci	7.68E-03	7.59E-03	2.78E-03	6.78E-05	1.81E-02

Dissolved and Entrained Gas (Batch)

Xe-133	Ci	1.29E-03	-	2.21E-05	-	1.31E-03
Xe-135	Ci	-	-	-	-	0.00E+00
Total for Period	Ci	1.29E-03	0.00E+00	2.21E-05	0.00E+00	1.31E-03

Continuous Releases (SG Blowdown)

H-3 (only)	Ci	-	-	-	1.96E-03	1.96E-03

- indicates < mda

5.0 SOLID WASTE SUMMARY

5.1 Units 1 & 2 Types of Solid Waste – Summary

Waste Stream: Resins, Filters, and Evap Bottoms

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.86E+02	5.26E+00	6.20E+00	+/- 25%
B	0.00E+00	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	0.00E+00	+/- 25%
All	1.86E+02	5.26E+00	6.20E+00	+/- 25%

Waste Stream : Dry Active Waste

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	4.04E+03	1.14E+02	4.38E-01	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	1.34E+02	3.79E+00	1.87E-03	+/-25%
All	4.17E+03	1.18E+02	4.40E-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	2.62E+02	7.42E+00	3.30E+01	+/-25%
All	2.62E+02	7.42E+00	3.30E+01	+/-25%

Waste Stream: Sum of All 4 Categories

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	4.23E+03	1.20E+02	6.64E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	3.96E+02	1.12E+01	3.30E+01	+/-25%
All	4.62E+03	1.31E+02	3.96E+01	+/-25%

5.2 Units 1 & 2 Solid Waste - Destination by Carrier

Number of Shipments	Mode of Transportations	Destination
1	Hittman Transport	Energy Solutions – Bear Creek
1	Hittman Transport	Energy Solutions – GRF
5	Hittman Transport	Energy Solutions – Bear Creek

5.3 Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Resins, Filters and Evaporator Bottoms
Waste Class A

Nuclide Name	Abundance	Activity (Ci)
H-3	0.16%	9.98E-03
C-14	0.00%	2.95E-04
Mn-54	2.69%	1.67E-01
Fe-55	11.59%	7.19E-01
Fe-59	0.06%	3.96E-03
Co-57	0.15%	9.20E-03
Co-58	6.82%	4.23E-01
Co-60	36.10%	2.24E+00
Ni-59	0.49%	3.06E-02
Ni-63	35.62%	2.21E+00
Zn-65	1.31%	8.12E-02
Sr-90	0.00%	2.32E-04
Zr-95	1.27%	7.87E-02
Nb-95	1.42%	8.80E-02
Tc-99	0.01%	7.01E-04
Sb-125	0.19%	1.20E-02
Cs-137	1.90%	1.18E-01
Ce-144	0.19%	1.19E-02
Pu-238	0.00%	6.31E-06
Pu-239	0.00%	1.42E-06
Pu-241	0.00%	7.28E-05
Am-241	0.00%	1.90E-04
Cm-242	0.00%	1.97E-05
Cm-243	0.01%	3.22E-04
Total	100.00%	6.20E+00

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Resins, Filters and Evaporator Bottoms
Total Combined

Nuclide Name	Percent Abundance	Curies
H-3	0.16%	9.98E-03
C-14	0.00%	2.95E-04
Mn-54	2.69%	1.67E-01
Fe-55	11.59%	7.19E-01
Fe-59	0.06%	3.96E-03
Co-57	0.15%	9.20E-03
Co-58	6.82%	4.23E-01
Co-60	36.10%	2.24E+00
Ni-59	0.49%	3.06E-02
Ni-63	35.62%	2.21E+00
Zn-65	1.31%	8.12E-02
Sr-90	0.00%	2.32E-04
Zr-95	1.27%	7.87E-02
Nb-95	1.42%	8.80E-02
Tc-99	0.01%	7.01E-04
Sb-125	0.19%	1.20E-02
Cs-137	1.90%	1.18E-01
Ce-144	0.19%	1.19E-02
Pu-238	0.00%	6.31E-06
Pu-239	0.00%	1.42E-06
Pu-241	0.00%	7.28E-05
Am-241	0.00%	1.90E-04
Cm-242	0.00%	1.97E-05
Cm-243	0.01%	3.22E-04
Total	100.00%	6.20E+00

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Dry Active Waste
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	5.30%	2.32E-02
Mn-54	0.42%	1.86E-03
Fe-55	12.36%	5.41E-02
Co-57	0.08%	3.64E-04
Co-58	5.67%	2.48E-02
Co-60	10.56%	4.62E-02
Ni-59	0.01%	2.44E-05
Ni-63	54.84%	2.40E-01
Zn-65	0.01%	3.44E-05
Zr-95	0.23%	1.02E-03
Nb-94	0.05%	2.40E-04
Nb-95	0.40%	1.73E-03
Tc-99	0.00%	7.04E-06
Ag-110m	0.02%	7.88E-05
Sn-113	0.01%	3.61E-05
Sb-125	1.18%	5.16E-03
Cs-137	8.87%	3.88E-02
Total	100.00%	4.38E-01

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Dry Active Waste
Waste Class C

Nuclide Name	Percent Abundance	Curies
H-3	0.07%	1.39E-06
Mn-54	0.39%	7.33E-06
Fe-55	9.18%	1.71E-04
Co-57	0.38%	7.12E-06
Co-58	72.02%	1.35E-03
Co-60	4.73%	8.84E-05
Ni-59	0.11%	1.99E-06
Ni-63	8.36%	1.56E-04
Zn-65	0.15%	2.80E-06
Zr-95	1.16%	2.17E-05
Nb-95	2.44%	4.56E-05
Tc-99	0.03%	5.75E-07
Ag-110m	0.34%	6.42E-06
Sn-113	0.16%	2.93E-06
Sb-125	0.42%	7.84E-06
Cs-137	0.06%	1.03E-06
Total	100.00%	1.87E-03

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Dry Active Waste
Total Combined

Nuclide Name	Percent Abundance	Curies
H-3	5.28%	2.32E-02
Mn-54	0.43%	1.87E-03
Fe-55	12.34%	5.42E-02
Co-57	0.08%	3.71E-04
Co-58	5.96%	2.62E-02
Co-60	10.54%	4.63E-02
Ni-59	0.01%	2.64E-05
Ni-63	54.63%	2.40E-01
Zn-65	0.01%	3.72E-05
Zr-95	0.24%	1.04E-03
Nb-94	0.05%	2.40E-04
Nb-95	0.41%	1.78E-03
Tc-99	0.00%	7.61E-06
Ag-110m	0.02%	8.52E-05
Sn-113	0.01%	3.90E-05
Sb-125	1.17%	5.16E-03
Cs-137	8.83%	3.88E-02
Total	100.00%	4.39E-01

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Other Waste
Waste Class C

Nuclide Name	Percent Abundance	Curies
H-3	0.00%	2.17E-06
Mn-54	0.00%	1.14E-05
Fe-55	0.29%	9.50E-02
Co-57	0.00%	1.11E-05
Co-58	0.01%	2.08E-03
Co-60	8.26%	2.73E+00
Ni-59	0.00%	3.10E-06
Ni-63	66.89%	2.21E+01
Zn-65	0.00%	4.36E-06
Sr-90	0.43%	1.41E-01
Zr-95	0.00%	3.35E-05
Nb-95	0.00%	7.06E-05
Tc-99	0.00%	8.95E-07
Ag-110m	0.00%	9.99E-06
Sn-113	0.00%	4.55E-06
Sb-125	0.00%	1.22E-05
Cs-137	24.12%	7.97E+00
Total	100.00%	3.30E+01

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Other Waste
Total

Nuclide Name	Percent Abundance	Curies
H-3	0.00%	2.17E-06
Mn-54	0.00%	1.14E-05
Fe-55	0.29%	9.50E-02
Co-57	0.00%	1.11E-05
Co-58	0.01%	2.08E-03
Co-60	8.26%	2.73E+00
Ni-59	0.00%	3.10E-06
Ni-63	66.89%	2.21E+01
Zn-65	0.00%	4.36E-06
Sr-90	0.43%	1.41E-01
Zr-95	0.00%	3.35E-05
Nb-95	0.00%	7.06E-05
Tc-99	0.00%	8.95E-07
Ag-110m	0.00%	9.99E-06
Sn-113	0.00%	4.55E-06
Sb-125	0.00%	1.22E-05
Cs-137	24.12%	7.97E+00
Total	100.00%	3.30E+01

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	0.50%	3.31E-02
C-14	0.00%	2.95E-04
Mn-54	2.53%	1.68E-01
Fe-55	11.63%	7.73E-01
Fe-59	0.06%	3.96E-03
Co-57	0.14%	9.56E-03
Co-58	6.74%	4.48E-01
Co-60	34.47%	2.29E+00
Ni-59	0.46%	3.06E-02
Ni-63	36.87%	2.45E+00
Zn-65	1.22%	8.13E-02
Sr-90	0.00%	2.32E-04
Zr-95	1.20%	7.97E-02
Nb-94	0.00%	2.40E-04
Nb-95	1.35%	8.98E-02
Tc-99	0.01%	7.08E-04
Ag-110m	0.00%	7.88E-05
Sn-113	0.00%	3.61E-05
Sb-125	0.26%	1.71E-02
Cs-137	2.35%	1.56E-01
Ce-144	0.18%	1.19E-02
Pu-238	0.00%	6.31E-06
Pu-239	0.00%	1.42E-06
Pu-241	0.00%	7.28E-05
Am-241	0.00%	1.90E-04
Cm-242	0.00%	1.97E-05
Cm-243	0.00%	3.22E-04
Total	100.00%	6.64E+00

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
Waste Class C

Nuclide Name	Percent Abundance	Curies
H-3	0.00%	3.56E-06
Mn-54	0.00%	1.87E-05
Fe-55	0.29%	9.52E-02
Co-57	0.00%	1.82E-05
Co-58	0.01%	3.43E-03
Co-60	8.26%	2.73E+00
Ni-59	0.00%	5.10E-06
Ni-63	66.89%	2.21E+01
Zn-65	0.00%	7.16E-06
Sr-90	0.43%	1.41E-01
Zr-95	0.00%	5.52E-05
Nb-95	0.00%	1.16E-04
Tc-99	0.00%	1.47E-06
Ag-110m	0.00%	1.64E-05
Sn-113	0.00%	7.48E-06
Sb-125	0.00%	2.01E-05
Cs-137	24.12%	7.97E+00
Total	100.00%	3.30E+01

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

Units 1 & 2 Solid Waste – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
All Waste Classes

Nuclide Name	Percent Abundance	Curies
H-3	0.08%	3.31E-02
C-14	0.00%	2.95E-04
Mn-54	0.42%	1.68E-01
Fe-55	2.19%	8.68E-01
Fe-59	0.01%	3.96E-03
Co-57	0.02%	9.58E-03
Co-58	1.14%	4.52E-01
Co-60	12.61%	5.01E+00
Ni-59	0.08%	3.06E-02
Ni-63	61.93%	2.46E+01
Zn-65	0.20%	8.13E-02
Sr-90	0.36%	1.42E-01
Zr-95	0.20%	7.97E-02
Nb-94	0.00%	2.40E-04
Nb-95	0.23%	8.99E-02
Tc-99	0.00%	7.10E-04
Ag-110m	0.00%	9.52E-05
Sn-113	0.00%	4.35E-05
Sb-125	0.04%	1.71E-02
Cs-137	20.44%	8.12E+00
Ce-144	0.03%	1.19E-02
Pu-238	0.00%	6.31E-06
Pu-239	0.00%	1.42E-06
Pu-241	0.00%	7.28E-05
Am-241	0.00%	1.90E-04
Cm-242	0.00%	1.97E-05
Cm-243	0.00%	3.22E-04
Total	100.00%	3.97E+01

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

5.4 Unit 3 Types of Solid Waste - Summary

Waste Stream: Resins, Filters, and Evap Bottoms

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.70E+02	4.81E+00	2.48E-01	+/-25%
B	9.60E+01	2.72E+00	2.26E+01	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	2.66E+02	7.53E+00	2.28E+01	+/- 25%

Waste Stream : Dry Active Waste

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Ci)
A	1.50E+04	4.24E+02	3.08E-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	1.50E+04	4.25E+02	3.08E-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	1.52E+04	4.30E+02	5.56E-01	+/-25%
B	9.60E+01	2.72E+00	2.26E+01	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.53E+04	4.32E+02	2.32E+01	+/-25%

5.5 Unit 3 Solid Waste - Destination by Carrier

Number of Shipments	Mode of Transportations	Destination
9	Hittman Transport	Energy Solutions – Bear Creek
1	Hittman Transport	Erwin Resin Solutions LLC

5.6 Unit 3 Solid Waste – Major Nuclides by Waste Class and Stream

Resins, Filters and Evaporator Bottoms
Waste Class A

Nuclide Name	Abundance	Activity (Ci)
H-3	30.62%	7.60E-02
C-14	5.56%	1.38E-02
Cr-51	4.19%	1.04E-02
Mn-54	0.83%	2.05E-03
Fe-55	1.41%	3.51E-03
Co-57	0.09%	2.17E-04
Co-58	18.01%	4.47E-02
Co-60	3.54%	8.78E-03
Ni-59	0.48%	1.20E-03
Ni-63	25.14%	6.24E-02
Sr-89	0.03%	7.02E-05
Nb-95	0.06%	1.60E-04
Ag-110m	0.24%	6.08E-04
Sb-124	0.77%	1.90E-03
Sb-125	6.93%	1.72E-02
Te-123m	0.13%	3.32E-04
Cs-137	1.81%	4.50E-03
Ce-144	0.07%	1.62E-04
Pu-238	0.00%	4.16E-06
Pu-239	0.00%	9.83E-07
Pu-241	0.08%	1.93E-04
Am-241	0.00%	3.73E-06
Total	100.00%	2.48E-01

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 – Major Nuclides by Waste Class and Stream

Resins, Filters and Evaporator Bottoms
Waste Class B

Nuclide Name	Percent Abundance	Curies
H-3	0.04%	8.32E-03
C-14	0.73%	1.66E-01
Mn-54	5.17%	1.17E+00
Fe-55	5.31%	1.20E+00
Co-57	0.13%	2.89E-02
Co-58	1.61%	3.64E-01
Co-60	13.09%	2.96E+00
Ni-59	0.57%	1.30E-01
Ni-63	64.12%	1.45E+01
Sr-90	0.11%	2.58E-02
Nb-95	0.04%	8.97E-03
Tc-99	0.01%	2.63E-03
Sn-113	0.09%	1.99E-02
Sb-125	2.69%	6.09E-01
Cs-134	0.06%	1.44E-02
Cs-137	6.10%	1.38E+00
Ce-144	0.00%	9.03E-04
Pu-238	0.00%	9.79E-05
Pu-239	0.00%	2.38E-05
Pu-241	0.11%	2.56E-02
Am-241	0.00%	1.17E-04
Cm-242	0.00%	1.68E-05
Cm-243	0.00%	1.44E-04
Total	100.00%	2.26E+01

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 – Major Nuclides by Waste Class and Stream

Resins, Filters and Evaporator Bottoms
Total Combined

Nuclide Name	Percent Abundance	Curies
H-3	0.37%	8.43E-02
C-14	0.78%	1.79E-01
Cr-51	0.05%	1.04E-02
Mn-54	5.17%	1.18E+00
Fe-55	5.30%	1.21E+00
Co-57	0.13%	2.91E-02
Co-58	1.79%	4.09E-01
Co-60	13.02%	2.97E+00
Ni-59	0.57%	1.31E-01
Ni-63	63.57%	1.45E+01
Sr-89	0.00%	7.02E-05
Sr-90	0.11%	2.58E-02
Nb-95	0.04%	9.13E-03
Tc-99	0.01%	2.63E-03
Ag-110m	0.00%	6.08E-04
Sn-113	0.09%	1.99E-02
Sb-124	0.01%	1.90E-03
Sb-125	2.74%	6.26E-01
Te-123m	0.00%	3.32E-04
Cs-134	0.06%	1.44E-02
Cs-137	6.05%	1.38E+00
Ce-144	0.00%	1.07E-03
Pu-238	0.00%	1.02E-04
Pu-239	0.00%	2.48E-05
Pu-241	0.11%	2.58E-02
Am-241	0.00%	1.21E-04
Cm-242	0.00%	1.68E-05
Cm-243	0.00%	1.44E-04
Total	100.00%	2.28E+01

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

Units 3 Solid Waste – Major Nuclides by Waste Class and Stream

Dry Active Waste
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	5.55%	1.71E-02
Mn-54	0.49%	1.51E-03
Fe-55	13.01%	4.01E-02
Co-57	0.08%	2.40E-04
Co-58	2.75%	8.47E-03
Co-60	10.61%	3.27E-02
Ni-63	56.46%	1.74E-01
Zr-95	0.25%	7.78E-04
Nb-94	0.06%	1.75E-04
Nb-95	0.39%	1.21E-03
Sb-125	1.27%	3.90E-03
Cs-137	9.09%	2.80E-02
Total	100.00%	3.08E-01

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

Units 3 Solid Waste – Major Nuclides by Waste Class and Stream

Dry Active Waste
Total Combined

Nuclide Name	Percent Abundance	Curies
H-3	5.55%	1.71E-02
Mn-54	0.49%	1.51E-03
Fe-55	13.01%	4.01E-02
Co-57	0.08%	2.40E-04
Co-58	2.75%	8.47E-03
Co-60	10.61%	3.27E-02
Ni-63	56.46%	1.74E-01
Zr-95	0.25%	7.78E-04
Nb-94	0.06%	1.75E-04
Nb-95	0.39%	1.21E-03
Sb-125	1.27%	3.90E-03
Cs-137	9.09%	2.80E-02
Total	100.00%	3.08E-01

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 – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	16.71%	9.31E-02
C-14	2.48%	1.38E-02
Cr-51	1.87%	1.04E-02
Mn-54	0.64%	3.56E-03
Fe-55	7.83%	4.36E-02
Co-57	0.08%	4.57E-04
Co-58	9.55%	5.32E-02
Co-60	7.45%	4.15E-02
Ni-59	0.22%	1.20E-03
Ni-63	42.55%	2.37E-01
Sr-89	0.01%	7.02E-05
Zr-95	0.14%	7.78E-04
Nb-94	0.03%	1.75E-04
Nb-95	0.25%	1.37E-03
Ag-110m	0.11%	6.08E-04
Sb-124	0.34%	1.90E-03
Sb-125	3.79%	2.11E-02
Te-123m	0.06%	3.32E-04
Cs-137	5.83%	3.25E-02
Ce-144	0.03%	1.62E-04
Pu-238	0.00%	4.16E-06
Pu-239	0.00%	9.83E-07
Pu-241	0.03%	1.93E-04
Am-241	0.00%	3.73E-06
Total	100.00%	5.57E-01

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 - – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
Waste Class B

Nuclide Name	Percent Abundance	Curies
H-3	0.04%	8.32E-03
C-14	0.73%	1.66E-01
Mn-54	5.17%	1.17E+00
Fe-55	5.31%	1.20E+00
Co-57	0.13%	2.89E-02
Co-58	1.61%	3.64E-01
Co-60	13.09%	2.96E+00
Ni-59	0.57%	1.30E-01
Ni-63	64.12%	1.45E+01
Sr-90	0.11%	2.58E-02
Nb-95	0.04%	8.97E-03
Tc-99	0.01%	2.63E-03
Sn-113	0.09%	1.99E-02
Sb-125	2.69%	6.09E-01
Cs-134	0.06%	1.44E-02
Cs-137	6.10%	1.38E+00
Ce-144	0.00%	9.03E-04
Pu-238	0.00%	9.79E-05
Pu-239	0.00%	2.38E-05
Pu-241	0.11%	2.56E-02
Am-241	0.00%	1.17E-04
Cm-242	0.00%	1.68E-05
Cm-243	0.00%	1.44E-04
Total	100.00%	2.26E+01

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 – Major Nuclides by Waste Class and Stream

Sum All 4 Categories
All Waste Classes

Nuclide Name	Percent Abundance	Curies
H-3	0.44%	1.01E-01
C-14	0.77%	1.79E-01
Cr-51	0.04%	1.04E-02
Mn-54	5.10%	1.18E+00
Fe-55	5.40%	1.25E+00
Co-57	0.13%	2.93E-02
Co-58	1.81%	4.18E-01
Co-60	12.96%	3.00E+00
Ni-59	0.57%	1.31E-01
Ni-63	63.52%	1.47E+01
Sr-89	0.00%	7.02E-05
Sr-90	0.11%	2.58E-02
Zr-95	0.00%	7.78E-04
Nb-94	0.00%	1.75E-04
Nb-95	0.04%	1.03E-02
Tc-99	0.01%	2.63E-03
Ag-110m	0.00%	6.08E-04
Sn-113	0.09%	1.99E-02
Sb-124	0.01%	1.90E-03
Sb-125	2.72%	6.30E-01
Te-123m	0.00%	3.32E-04
Cs-134	0.06%	1.44E-02
Cs-137	6.09%	1.41E+00
Ce-144	0.00%	1.07E-03
Pu-238	0.00%	1.02E-04
Pu-239	0.00%	2.48E-05
Pu-241	0.11%	2.58E-02
Am-241	0.00%	1.21E-04
Cm-242	0.00%	1.68E-05
Cm-243	0.00%	1.44E-04
Total	100.00%	2.31E+01

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

6.0 RADIOLOGICAL IMPACT TO MAN

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. See the tables at the end of this section for the 10CFR50 Appendix I Dose Assessments.

6.1 Dose to Members of the Public Inside the Site Boundary

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 8-hour 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 stay time of 2 minutes per day. His occupancy factor is calculated as follows:
2 min/day * 250 days/year / 60 min/hr / 8760 hr/year = **0.0010**

6.2 Dose to a Member of the Public due to Release of Radioactive Material in Groundwater

Curies and dose contribution from activity discovered in onsite groundwater and storm drain pathways during the year are discussed in more detail in Attachment 2. 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 also provided in Attachment 2. The Summation of Dose Assessments (Table 6-1) below provides a means to compare ground water doses with those of other components making up the total offsite dose.

6.3 40CFR Part 190 Dose to Individual in the Unrestricted Area

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.

Table 6-1 Summation of Dose Assessments

Year: 2019		Total Body	Max Organ
40 CFR 190 limit ===→	IPEC	25 mrem	75 mrem
Routine Airborne Effluents[1]	Units 1 and 2	1.46E-03	1.46E-03
Routine Liquid Effluents	Units 1 and 2	5.08E-04	7.65E-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	6.51E-02	3.26E-01
Routine Airborne Effluents[1]	Unit 3	3.14E-03	3.14E-03
Routine Liquid Effluents	Unit 3	8.12E-05	2.79E-04
Liquid Releases of C^{14}	Unit 3	1.17E-03	5.83E-03
Airborne Releases of C^{14}	Unit 3	6.18E-02	3.10E-01
Ground Water & Storm Drain Totals	IPEC[2]	5.69E-05	2.30E-04
Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.	IPEC[3]	3.00E-01	3.00E-01
Indian Point Energy Center Total Dose, per 40 CFR 190	IPEC	4.34E-01	9.54E-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 Attachment 2.

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 each year's dose evaluation are available on site.

Table 6-2 Unit 2 Appendix I Dose Assessment

A. LIQUID DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Organ Dose	(mrem)	4.04E-04	2.24E-04	7.88E-05	1.51E-04	7.65E-04
Applicable Limit	(mrem)	5	5	5	5	10
Percent of Limit	(%)	8.07E-03	4.48E-03	1.58E-03	3.01E-03	7.65E-03
Age Group		Child	Adult	Child	Child	Child
Critical Organ		Bone	Liver	Bone	Bone	Bone
Adult Total Body	(mrem)	2.29E-04	1.68E-04	4.17E-05	9.36E-05	5.08E-04
Applicable Limit	(mrem)	1.5	1.5	1.5	1.5	3.0
Percent of Limit	(%)	1.52E-02	1.12E-02	2.78E-03	6.24E-03	1.69E-02

Note: Liquid Annual dose is the Dose Analysis for the year, it is not a sum of the quarters

B. AIRBORNE NOBLE GAS DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Gamma Air	(mrad)	6.51E-06	6.94E-06	6.01E-06	1.05E-05	3.00E-05
Applicable Limit	(mrad)	5	5	5	5	10
Percent of Limit	(%)	1.30E-04	1.39E-04	1.20E-04	2.10E-04	3.00E-04
Beta Air	(mrad)	5.46E-06	5.56E-06	4.52E-06	1.00E-05	2.55E-05
Applicable Limit	(mrad)	10	10	10	10	20
Percent of Limit	(%)	5.46E-05	5.56E-05	4.52E-05	1.00E-04	1.28E-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)	4.31E-04	3.47E-04	3.76E-04	2.80E-04	**1.43E-03**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	5.75E-03	4.63E-03	5.01E-03	3.73E-03	9.56E-03
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)	1.67E-02	1.66E-02	1.67E-02	1.66E-02	**6.65E-02**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	2.23E-01	2.22E-01	2.22E-01	2.21E-01	4.44E-01
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Child Bone Dose	(mrem)	8.15E-02	8.15E-02	8.15E-02	8.15E-02	**3.26E-01**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	1.09E+00	1.09E+00	1.09E+00	1.09E+00	2.17E+00

Table 6-3 Unit 3 Appendix I Dose Assessment

A. LIQUID DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Organ Dose	(mrem)	1.86E-04	7.24E-05	4.08E-05	1.58E-06	2.79E-04
Applicable Limit	(mrem)	5	5	5	5	10
Percent of Limit	(%)	3.72E-03	1.45E-03	8.16E-04	3.17E-05	2.79E-03
Age Group		Adult	Adult	Adult	Adult	Adult
Critical Organ		GI-LLI	GI-LLI	GI-LLI	GI-LLI	GI-LLI
Adult Total Body	(mrem)	6.62E-05	1.50E-05	7.11E-06	9.92E-07	8.12E-05
Applicable Limit	(mrem)	1.5	1.5	1.5	1.5	3.0
Percent of Limit	(%)	4.42E-03	1.00E-03	4.74E-04	6.61E-05	2.71E-03

Note: Liquid Annual dose is the Dose Analysis for the year, it is not a sum of the quarters

B. AIRBORNE NOBLE GAS DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Gamma Air	(mrad)	8.15E-06	5.29E-06	5.95E-06	4.35E-06	**2.37E-05**
Applicable Limit	(mrad)	5	5	5	5	10
Percent of Limit	(%)	1.63E-04	1.06E-04	1.19E-04	8.70E-05	2.37E-04
Beta Air	(mrad)	2.58E-05	6.58E-06	7.27E-06	5.35E-06	**4.50E-05**
Applicable Limit	(mrad)	10	10	10	10	20
Percent of Limit	(%)	2.58E-04	6.58E-05	7.27E-05	5.35E-05	2.25E-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)	8.06E-04	1.16E-03	6.12E-04	5.39E-04	**3.12E-03**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	1.07E-02	1.55E-02	8.16E-03	7.19E-03	2.08E-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)	1.63E-02	1.66E-02	1.61E-02	1.60E-02	**6.49E-02**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	2.17E-01	2.21E-01	2.14E-01	2.13E-01	4.33E-01
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Child Bone Dose	(mrem)	7.75E-02	7.75E-02	7.75E-02	7.75E-02	**3.10E-01**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	1.03E+00	1.03E+00	1.03E+00	1.03E+00	2.07E+00

7.0 METEOROLOGICAL DATA

The site meteorological data is maintained on-site and available for review.

Attachment 1 – Carbon-14 Discussion

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 3-1 and 3-4 (shown earlier) include the airborne curie data for the current year. Section 6.0 (Radiological Impact on Man) includes the dose information.

C-14 doses are grouped with "Iodine and Particulate" and reported in Section D of Tables 6-2 and 6-3. Section C of these tables 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 the doses from iodine, particulate and H-3 doses for comparison to the singular dose limit for this category. Therefore, Tables 6-2 and 6-3 include 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, **2019**		Unit 2	Unit 3
Airborne Effluent Child TB Dose, C^{14}	mrem	**0.0651**	**.0618**
Airborne Effluent Child Bone Dose, C^{14}	mrem	**0.326**	**0.310**

The airborne effluent dose from C-14 is distributed evenly over the year and applied to a total Iodine and Particulate dose in Tables 6-1, 6-2 and 6-3.

Attachment 2 – Groundwater Monitoring Program Results

Summary of IPEC Groundwater and Storm Water Activity, 2019

The precipitation mass balance model applied in previous years was applied for offsite dose calculations in 2019, with some minor calibration updates performed in 2009 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 2019, precipitation was measured at 4.41 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 2019 Groundwater and Storm water offsite dose evaluation

The results of the assessment are shown below. 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 Radiological Impact to Man section of this report (Section 6).

Groundwater (GW) and storm water tritium released from IPEC in 2019 totaled approximately 0.09 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 0.000034 curies to site effluent from the groundwater pathway. Combined GW releases from IPEC in 2019 (all radionuclides) resulted in a calculated annual dose of less than 0.003 % of the annual limits for whole body and critical organ:

IPEC Groundwater and Storm Water Effluent Dose, 2019

0.0000569 mrem to the total body	(0.0019% limit)
0.000230 mrem to the critical organ, adult bone	(0.0023% limit)

The annual dose from combined groundwater and storm water pathways remains well below applicable limits. When combined with routine liquid effluents (Section 6), 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

2019

Northern Clean Zone

Adult Doses, in mrem

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	5.80E-09	5.80E-09	5.80E-09	5.80E-09	5.80E-09	5.80E-09	*5.19E+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*
Sb-125	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	5.80E-09	5.80E-09	5.80E-09	5.80E-09	5.80E-09	5.80E-09	***5.19E+02***

Unit 2 North

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	4.15E-08	4.15E-08	4.15E-08	4.15E-08	4.15E-08	4.15E-08	*3.15E+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*
Sb-125	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	4.15E-08	4.15E-08	4.15E-08	4.15E-08	4.15E-08	4.15E-08	***3.15E+04***

Unit 1/2

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	*3.38E+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	2.30E-04	0.00E+00	5.65E-05	0.00E+00	0.00E+00	0.00E+00	6.63E-06	*3.35E+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*
Sb-125	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	2.30E-04	2.20E-07	5.67E-05	2.20E-07	2.20E-07	2.20E-07	6.85E-06	***3.38E+04***

Unit 3 North

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	1.42E-07	1.42E-07	1.42E-07	1.42E-07	1.42E-07	1.42E-07	*1.48E+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*
Sb-125	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	1.42E-07	1.42E-07	1.42E-07	1.42E-07	1.42E-07	1.42E-07	***1.48E+04***

Unit 3 South

ISOTOPE	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	uCi
H-3	0.00E+00	3.00E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08	*1.05E+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*
Sb-125	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	3.00E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08	***1.05E+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*
Sb-125	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

								Total uCis	
H-3 only	0.00E+00	4.39E-07	4.39E-07	4.39E-07	4.39E-07	4.39E-07	4.39E-07	*9.12E+04*	H3
	BONE	LIVER	TOT BODY	THYROID	KIDNEY	LUNG	GI-LLI	*0.00E+00*	Co
all isotopes	**2.30E-04**	4.39E-07	**5.69E-05**	4.39E-07	4.39E-07	4.39E-07	7.07E-06	*0.00E+00*	Ni
								3.35E+01	Sr
Adult Doses								*0.00E+00*	Cs
% Annual Limit	***0.00230***	*0.000*	***0.00190***	*0.000*	*0.000*	*0.000*	*0.000*	*0.00E+00*	Sb

Attachment 3 – Laboratory Analytical Results

The following pages list the results of the 2019 groundwater samples. Note that the positive results are shown in bold print.

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
I-2	5/20/2019	2.82E+02	3.72E+02	0.1	1.6	4.0	5.9	1.4	6.1			7.3	16.7
MH-5 VCFD	1/17/2019	**2.50E+03**											
MH-5 VCFD	2/13/2019	**5.40E+03**											
MH-5 VCFD	3/18/2019	**4.63E+03**	7.08E+02	-0.2	1.4	3.3	9.3	1.6	4.6			-0.4	13.8
MH-5 VCFD	4/15/2019	**5.90E+03**											
MH-5 VCFD	5/13/2019	**6.12E+03**	7.44E+02	1.4	1.7	-1.4	7.4	0.0	6.3			10.2	16.6
MH-5 VCFD	6/10/2019	<MDA											
MH-5 VCFD	7/8/2019	**7.00E+02**											
MH-5 VCFD	8/8/2019	**3.17E+03**	6.48E+02	1.8	1.9	1.6	7.1	1.5	7.5			5.6	17.5
MH-5 VCFD	9/3/2019	**5.47E+02**	4.35E+02	-1.1	1.3	-0.5	4.0	-1.9	4.1			5.0	10.4
MH-5 VCFD	10/21/2019	<MDA											
MH-5 VCFD	11/22/2019	**6.08E+02**	4.41E+02	-0.7	1.5	1.3	4.5	2.7	4.9			2.4	11.0
MW-107	4/29/2019	1.25E+02	4.26E+02	1.0	1.3	-0.9	4.5	-2.4	4.1			11.4	13.0
MW-111	1/7/2019	**5.40E+03**											
MW-111	1/14/2019	**1.39E+04**	1.26E+03	1.1	1.4	-0.2	5.8	0.4	4.8			2.4	14.3
MW-111	1/29/2019	**1.30E+03**											
MW-111	2/11/2019	**2.40E+03**											
MW-111	2/25/2019	**2.40E+03**											
MW-111	3/11/2019	**2.22E+03**	5.19E+02	-0.5	1.4	0.9	6.4	0.2	4.7			4.7	12.4
MW-111	3/25/2019	**1.10E+03**											
MW-111	4/15/2019	**7.10E+03**											
MW-111	5/13/2019	**2.41E+03**	5.76E+02	-0.1	0.9	1.0	5.5	-0.3	6.8			-5.0	12.9
MW-111	6/10/2019	**1.51E+04**											
MW-111	7/8/2019	**4.40E+03**											
MW-111	8/5/2019	**3.50E+03**											
MW-111	9/3/2019	**6.30E+03**											
MW-111	10/21/2019	**7.20E+03**											
MW-111	11/4/2019	**5.49E+03**	7.47E+02	0.3	1.6	0.1	4.6	3.2	4.7			-1.4	10.5
MW-30-69	4/17/2019	**5.30E+04**	1.86E+03	0.4	0.9	2.4	6.4	0.9	6.3			0.8	15.9
MW-30-71	1/16/2019	**1.12E+05**	3.39E+03	0.2	1.5	0.2	6.3	5.9	8.6			4.9	16.9
MW-30-71	3/6/2019	**8.36E+04**	2.45E+03	0.9	1.6	2.8	5.6	1.0	6.3	3.6	18.5	8.9	15.9
MW-30-71	5/24/2019	**5.16E+04**	1.91E+03	0.5	1.1	-3.1	5.3	2.0	4.9			5.3	12.3
MW-30-71	6/17/2019	**7.38E+04**	2.42E+03	0.3	1.4	-2.2	6.7	1.7	5.4			2.7	12.8
MW-30-71	8/1/2019	**7.81E+04**	2.46E+03	0.1	1.0	1.6	5.2	-0.6	4.5			6.0	11.7
MW-30-71	10/22/2019	**9.06E+04**											
MW-30-84	3/6/2019	**9.41E+04**	2.85E+03	-0.2	1.4	0.4	6.2	-0.5	6.2			1.1	14.3
MW-30-84	5/24/2019	**8.20E+04**	2.49E+03	0.3	1.1	0.5	4.7	0.0	4.8			7.5	19.4
MW-30-84	8/1/2019	**8.84E+04**	2.69E+03	0.7	1.1	-1.9	6.4	-0.6	4.4			-4.5	12.6
MW-30-84	10/22/2019	**7.37E+04**	2.52E+03	0.6	1.6	2.3	4.6	-0.4	4.7			-7.8	13.5
MW-30-84	12/5/2019	**8.13E+04**	2.51E+03	0.7	1.5	0.1	5.3	-2.4	9.5			1.2	14.3

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-31-49	3/7/2019	1.67E+02	4.23E+02	0.1	0.8	-3.2	6.0	-3.4	5.2			-5.3	13.1
MW-31-49	5/16/2019	9.84E+01	3.90E+02	0.5	1.3	2.4	7.0	1.8	9.5			6.0	15.6
MW-31-49	8/2/2019	**1.46E+04**	1.12E+03	-0.2	1.2	2.9	5.8	0.6	5.8			3.9	19.1
MW-31-49	10/21/2019	**1.42E+04**	9.81E+02	0.1	0.9	-6.4	7.7	-3.1	6.9			11.6	16.8
MW-31-49	11/5/2019	**4.18E+02**	3.60E+02	0.1	1.4	-5.5	7.0	1.1	8.0			18.4	26.5
MW-31-63	1/16/2019	**1.36E+04**	9.54E+02	-0.9	1.2	0.3	5.0	-0.9	4.1			**43.2**	20.7
MW-31-63	2/11/2019	**2.84E+04**	1.33E+03	0.0	1.3	-2.2	4.4	0.1	4.6			**37.1**	33.3
MW-31-63	3/7/2019	**2.04E+04**	1.33E+03	0.2	1.1	0.1	5.4	2.4	4.7			**44.8**	31.8
MW-31-63	4/18/2019	**2.51E+04**	1.38E+03	-0.4	0.9	1.6	5.3	0.3	4.6			0.0	22.2
MW-31-63	5/16/2019	**1.41E+04**	9.90E+02	-0.6	0.9	-2.0	6.4	1.4	5.9			0.0	38.1
MW-31-63	6/18/2019	**2.68E+04**	1.45E+03	1.6	1.8	0.0	4.7	-0.8	6.0			**33.9**	19.3
MW-31-63	7/9/2019	**3.23E+04**	1.58E+03	0.9	1.7	**10.8**	8.3	1.3	5.0			**32.3**	29.1
MW-31-63	8/2/2019	**3.74E+04**	1.70E+03	-0.4	1.1	0.0	13.1	2.0	5.1			**34.3**	24.4
MW-31-63	9/4/2019	**3.92E+04**	1.71E+03	1.1	1.8	-0.4	6.5	0.2	6.9			33.4	40.5
MW-31-63	10/21/2019	**3.70E+04**	1.51E+03	-0.6	0.9	0.1	5.4	2.2	4.3			**33.8**	27.7
MW-31-63	11/5/2019	**4.14E+04**	1.85E+03	0.1	1.6	1.9	6.7	3.7	6.7			20.0	21.7
MW-31-63	12/5/2019	**4.33E+04**	1.92E+03	0.5	1.6	0.0	5.8	1.1	4.9			28.9	29.7
MW-31-85	3/7/2019	**1.20E+03**	5.13E+02	-0.4	1.0	1.4	4.7	5.0	5.2			4.6	12.5
MW-31-85	5/16/2019	**1.32E+03**	4.71E+02	-0.6	0.9	3.5	5.8	0.8	6.2			8.8	15.4
MW-31-85	8/2/2019	**5.70E+03**	7.68E+02	0.8	1.5	0.5	5.0	0.3	5.7			3.8	14.9
MW-31-85	10/21/2019	**3.24E+03**	5.52E+02	-0.1	1.2	-1.0	6.2	-1.2	7.4			3.1	16.5
MW-31-85	11/5/2019	**2.27E+03**	5.52E+02	0.7	1.7	1.4	4.3	-0.9	5.3			0.2	10.6
MW-32-149	3/7/2019	2.75E+02	4.44E+02	-0.3	1.6	4.3	5.9	-1.1	5.3			11.2	17.9
MW-32-149	5/16/2019	3.37E+02	4.14E+02	0.8	1.6	-0.9	5.1	-2.4	4.3			0.0	10.9
MW-32-149	8/2/2019	3.57E+02	3.81E+02	0.6	1.7	1.3	6.2	-2.4	9.1			-0.6	16.3
MW-32-149	12/18/2019	3.44E+02	4.38E+02	-0.2	1.4	1.1	5.3	4.4	5.8			-4.9	16.2
MW-32-173	3/7/2019	1.93E+02	4.35E+02	-0.1	0.8	-6.0	7.6	1.1	6.6			7.8	16.0
MW-32-173	5/16/2019	1.08E+02	4.08E+02	-0.3	1.1	-0.1	7.7	1.9	5.9			-5.2	15.3
MW-32-173	8/2/2019	3.34E+02	3.66E+02	-0.6	1.4	2.4	4.9	3.4	4.9			5.6	13.4
MW-32-173	12/18/2019	3.38E+02	3.72E+02	0.4	1.6	-3.5	6.6	-1.4	6.5			3.8	14.9
MW-32-190	3/7/2019	1.66E+02	4.20E+02	-0.1	0.6	0.7	5.9	0.2	6.8			-6.4	15.6
MW-32-190	5/16/2019	2.91E+02	4.44E+02	-0.1	1.2	-1.6	5.3	3.2	6.4			0.2	12.6
MW-32-190	8/2/2019	**7.62E+02**	4.14E+02	0.7	1.3	0.0	6.8	-1.0	5.7			0.6	16.5
MW-32-190	12/18/2019	**6.06E+02**	4.02E+02	0.9	1.6	-0.8	5.8	1.0	4.6			-1.1	12.6
MW-32-59	1/17/2019	**1.55E+04**	1.01E+03	-1.2	1.3	2.6	4.1	1.6	4.5			**24.5**	14.0
MW-32-59	2/14/2019	**1.11E+04**	8.58E+02	-0.4	1.2	-1.2	4.2	2.1	5.2			**22.9**	21.0
MW-32-59	3/7/2019	**5.80E+03**	7.95E+02	1.2	1.8	2.2	5.2	-1.1	5.4			19.1	21.9
MW-32-59	4/17/2019	**7.28E+03**	7.83E+02	0.4	1.2	-2.4	6.5	0.2	8.4			**42.1**	32.1
MW-32-59	5/16/2019	**1.30E+03**	5.01E+02	-0.5	0.9	-1.0	6.6	-1.7	5.8			11.5	17.1

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-32-59	6/17/2019	**2.83E+04**	1.51E+03	0.6	1.4	1.2	4.1	2.8	5.2			**62.4**	31.5
MW-32-59	7/9/2019	**4.12E+04**	1.79E+03	-0.3	1.2	4.7	7.0	0.0	5.2			**48.9**	29.5
MW-32-59	8/2/2019	**4.30E+04**	1.82E+03	1.1	1.6	2.9	4.7	1.0	4.7			**48.7**	30.0
MW-32-59	9/4/2019	**4.86E+04**	2.11E+03	0.0	1.7	1.8	6.4	1.9	6.7			**83.1**	29.8
MW-32-59	10/22/2019	**4.53E+04**	2.03E+03	0.3	1.6	1.3	5.3	1.0	4.9			**39.3**	23.1
MW-32-59	12/18/2019	**1.19E+03**	5.01E+02	0.0	1.4	-3.3	6.7	2.1	5.6			7.3	13.7
MW-32-85	1/17/2019	**3.73E+04**	1.60E+03	-1.1	1.2	2.8	4.1	1.2	5.0			-0.4	10.8
MW-32-85	2/14/2019	**3.79E+04**	1.49E+03	-0.3	1.5	1.3	5.9	2.5	6.2			-1.3	15.0
MW-32-85	3/7/2019	**3.45E+04**	1.64E+03	0.4	1.2	1.7	7.6	2.4	8.0			-1.6	16.0
MW-32-85	4/17/2019	**2.67E+04**	1.31E+03	0.5	1.2	0.3	10.1	1.6	5.4			-4.1	13.1
MW-32-85	5/16/2019	**3.40E+04**	1.50E+03	0.2	1.1	-0.6	5.2	-1.0	6.6			-8.9	12.9
MW-32-85	6/17/2019	**3.60E+04**	1.70E+03	0.5	1.1	-0.8	6.7	1.6	7.4			-7.9	14.8
MW-32-85	7/9/2019	**2.76E+04**	1.49E+03	0.7	1.6	0.5	5.7	-3.0	4.8			2.1	13.0
MW-32-85	8/2/2019	**2.78E+04**	1.48E+03	0.6	1.5	1.6	5.3	-1.6	5.6			1.4	13.0
MW-32-85	9/4/2019	**2.47E+04**	1.52E+03	0.1	1.4	1.1	5.5	4.0	5.7			0.6	13.3
MW-32-85	10/22/2019	**2.33E+04**	1.46E+03	0.7	1.7	0.1	4.3	-1.3	3.4			-1.0	10.5
MW-32-85	12/18/2019	**2.57E+04**	1.47E+03	0.2	1.5	2.0	5.7	-1.6	7.2			-3.9	14.8
MW-33	1/7/2019	**6.33E+04**											
MW-33	1/14/2019	**5.00E+04**											
MW-33	1/29/2019	**3.41E+04**											
MW-33	2/11/2019	**2.35E+04**											
MW-33	2/25/2019	**1.66E+04**	1.16E+03	0.3	1.3	0.3	5.7	-0.4	5.7			3.1	14.2
MW-33	3/11/2019	**1.14E+04**	8.79E+02	-0.1	1.5	2.2	4.2	1.7	4.7			0.0	13.1
MW-33	3/25/2019	**1.14E+04**	9.72E+02	0.1	0.6	3.5	6.0	-0.7	7.9	5.8	18.8	6.4	14.7
MW-33	4/15/2019	**1.63E+04**	1.23E+03	0.4	1.3	-7.1	8.5	3.8	5.6			13.6	29.8
MW-33	5/13/2019	**3.63E+04**	1.55E+03	-0.7	1.3	1.0	5.5	0.7	5.0			-5.8	15.2
MW-33	5/29/2019	**2.97E+04**	1.34E+03	0.3	1.4	1.6	4.9	-0.2	6.0			-0.8	11.9
MW-33	6/10/2019	**3.35E+04**	1.54E+03										
MW-33	7/8/2019	**4.98E+03**	7.53E+02	1.1	1.7	4.2	11.4	0.8	4.4			0.5	12.5
MW-33	8/5/2019	**2.93E+03**	6.33E+02	0.3	1.3	3.7	5.4	1.1	5.7			-8.7	12.8
MW-33	9/3/2019	**3.16E+03**	6.81E+02	-0.3	1.5	0.9	4.9	6.3	7.7			-4.7	11.9
MW-33	10/21/2019	**1.36E+04**	9.63E+02	-0.1	1.4	0.6	5.0	-0.6	4.6			-0.6	12.5
MW-33	11/4/2019	**8.10E+03**	8.52E+02	-0.9	1.2	3.7	6.1	-2.5	5.0			3.6	14.8
MW-34	1/7/2019	**2.90E+03**											
MW-34	1/14/2019	**2.80E+03**											
MW-34	1/29/2019	**2.70E+03**											
MW-34	2/11/2019	**1.80E+03**											
MW-34	2/25/2019	**1.40E+03**											
MW-34	3/11/2019	<MDA											
MW-34	3/25/2019	**1.20E+03**											

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-35	1/7/2019	**3.73E+03**	5.88E+02	-0.7	1.4	0.8	5.7	-2.7	6.3			3.5	15.9
MW-35	1/14/2019	**4.00E+03**											
MW-35	1/29/2019	**3.20E+03**											
MW-35	2/11/2019	**2.31E+03**	4.92E+02	-0.4	1.2	2.2	5.7	1.7	5.1			-5.3	12.4
MW-35	2/25/2019	**1.40E+03**											
MW-35	3/11/2019	**1.92E+03**	4.92E+02	-1.0	1.4	-2.6	4.7	1.3	5.0			4.2	10.4
MW-35	3/25/2019	**2.20E+03**											
MW-35	4/15/2019	**1.80E+03**	5.37E+02	0.4	1.5	3.1	9.0	3.7	7.4			3.9	15.2
MW-35	5/13/2019	**1.58E+03**	4.80E+02	0.3	1.3	1.3	4.7	0.6	5.1			1.8	11.5
MW-35	6/10/2019	**2.35E+03**	5.31E+02	-0.4	1.0	1.5	6.2	-1.0	5.9			9.3	17.3
MW-35	7/8/2019	**2.19E+03**	5.49E+02	0.4	1.4	1.2	6.0	-3.1	6.8			4.6	14.6
MW-35	8/5/2019	**2.19E+03**	5.37E+02	-0.5	1.1	-0.5	4.6	0.1	4.4			-0.5	11.1
MW-35	9/3/2019	**1.74E+03**	5.40E+02	-0.4	1.5	-0.1	4.9	2.0	5.2			1.3	11.1
MW-35	10/21/2019	**8.13E+02**	3.69E+02	-0.1	1.6	1.7	5.9	1.1	4.5			6.3	12.8
MW-35	11/4/2019	**7.50E+02**	4.26E+02	0.4	1.6	4.2	7.1	2.9	4.8			2.5	11.2
MW-35	12/16/2019	**9.18E+02**	4.23E+02	-0.9	1.1	1.1	7.0	-3.1	8.5			-7.6	17.1
MW-36-24	3/5/2019	3.35E+02	3.75E+02	-0.3	1.4	-1.8	5.6	1.0	3.9			-1.8	11.6
MW-36-24	5/21/2019	**1.85E+03**	4.89E+02	-0.8	1.0	0.2	4.9	-1.2	4.6			-5.4	12.7
MW-36-24	8/12/2019	-2.62E+02	3.78E+02	1.4	1.7	-0.5	5.5	-1.7	5.4			1.0	14.3
MW-36-24	11/5/2019	2.74E+02	3.48E+02	-0.6	1.3	0.6	5.5	0.7	6.3			-7.2	14.9
MW-36-41	1/17/2019	**6.90E+03**											
MW-36-41	3/5/2019	**8.73E+03**	8.64E+02	**2.8**	2.0	-1.6	4.6	2.3	5.4			-0.4	12.4
MW-36-41	5/21/2019	**9.52E+03**	8.67E+02	**5.3**	2.4	2.1	7.8	-1.1	6.3			-11.6	19.1
MW-36-41	6/11/2019	**6.00E+03**											
MW-36-41	8/12/2019	**5.74E+03**	7.08E+02	**5.0**	2.0	2.1	5.9	-0.5	6.2			6.1	15.3
MW-36-41	11/5/2019	**3.97E+03**	6.30E+02	**2.1**	2.0	-0.5	5.3	0.8	5.5			5.3	12.5
MW-36-52	3/5/2019	**1.16E+03**	4.14E+02	-0.5	1.1	-1.2	5.3	0.6	5.0			7.5	10.6
MW-36-52	5/21/2019	**7.09E+03**	7.74E+02	**3.1**	1.9	-2.9	8.6	1.4	6.2			-5.1	17.2
MW-36-52	8/12/2019	**4.57E+03**	6.45E+02	**2.5**	1.8	1.0	6.1	-4.8	7.5			3.0	15.9
MW-36-52	11/5/2019	**5.06E+03**	7.20E+02	**3.5**	2.2	1.3	6.1	1.7	4.8			-0.5	11.9
MW-37-22	5/21/2019	**3.90E+03**	6.21E+02	**3.5**	2.0	0.5	5.2	-4.5	6.5			2.8	15.5
MW-37-22	11/5/2019	**1.80E+03**	5.01E+02	**4.9**	2.3	-0.7	5.6	2.6	5.6			-1.2	13.2
MW-37-32	5/21/2019	**7.23E+03**	7.86E+02	**11.1**	2.9	-5.2	6.2	2.7	5.8			-2.8	11.7
MW-37-32	11/5/2019	**3.09E+03**	6.03E+02	**4.7**	2.2	0.6	5.1	1.2	4.6			2.6	12.5
MW-37-40	5/21/2019	**6.89E+03**	7.74E+02	**13.5**	3.2	-1.1	6.2	1.3	6.9			-2.1	15.9
MW-37-40	11/5/2019	**4.70E+03**	7.11E+02	**15.5**	3.6	2.9	7.1	2.8	5.5			11.3	15.8
MW-37-57	5/21/2019	**8.73E+03**	8.73E+02	**10.4**	3.1	1.8	7.3	-1.8	6.9			-0.7	17.8
MW-37-57	11/5/2019	**5.92E+03**	7.65E+02	**10.6**	2.6	-2.0	5.2	2.1	6.9			-2.1	12.1
MW-39-102	5/23/2019	2.73E+02	3.72E+02	0.2	1.2	0.3	5.5	2.9	5.7			1.9	12.0
MW-39-102	11/26/2019	3.59E+02	4.38E+02	0.4	1.2	2.0	9.1	-6.0	9.2			-3.8	16.8

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-39-183	5/23/2019	1.52E+02	3.63E+02	-0.1	1.2	-0.2	5.9	0.9	5.4			-1.7	15.4
MW-39-183	11/26/2019	-4.09E+01	3.99E+02	1.2	1.5	1.3	7.0	2.4	7.7			12.9	32.4
MW-39-195	5/23/2019	7.72E+01	3.54E+02	0.2	1.4	-2.2	6.6	-3.3	8.0			3.1	15.4
MW-39-195	11/26/2019	6.74E+01	4.17E+02	0.4	1.4	0.5	6.4	-1.7	5.6			-3.6	18.1
MW-39-67	5/23/2019	1.95E+02	3.51E+02	1.2	1.5	2.4	5.0	3.2	6.1			-6.2	13.1
MW-39-67	11/26/2019	3.33E+02	4.38E+02	0.5	1.7	-1.3	5.4	3.2	5.7			4.6	14.5
MW-39-84	5/23/2019	1.58E+02	4.02E+02	1.1	1.2	-0.3	5.8	-1.0	5.9			1.2	11.7
MW-39-84	11/26/2019	6.34E+01	3.90E+02	0.9	1.4	4.5	6.2	-0.3	5.5			-3.4	13.1
MW-40-100	4/29/2019	-8.69E+01	3.96E+02	0.5	1.3	1.8	4.7	-2.1	5.8			4.5	12.2
MW-40-127	4/29/2019	-1.59E+02	4.05E+02	1.1	1.3	-2.2	8.8	1.2	7.6			0.0	17.6
MW-40-162	4/29/2019	1.19E+01	4.23E+02	0.4	1.6	-1.1	8.3	-2.5	8.7			-0.8	15.8
MW-40-27	4/29/2019	-1.04E+01	4.17E+02	0.6	1.5	1.8	8.1	1.8	5.4			-10.5	13.9
MW-40-46	4/29/2019	-1.89E+01	4.05E+02	0.0	1.2	-1.5	4.1	4.4	7.3			-3.3	11.3
MW-40-81	4/29/2019	-5.47E+01	3.96E+02	-0.9	1.4	4.2	6.2	1.7	5.4			5.8	17.1
MW-41-40	1/7/2019	**6.10E+02**	3.93E+02	1.0	1.6	-1.0	5.1	-1.7	4.4			-0.8	13.0
MW-41-40	2/12/2019	**4.97E+02**	3.69E+02	-0.2	1.3	1.4	5.0	4.9	6.4			-3.9	11.0
MW-41-40	3/13/2019	**5.34E+02**	4.47E+02	0.9	1.7	0.0	4.8	0.7	4.7			6.7	10.3
MW-41-40	4/18/2019	1.89E+02	4.11E+02	0.5	1.1	-0.5	5.0	0.0	6.8			-0.8	15.6
MW-41-40	5/14/2019	**4.46E+02**	3.84E+02	0.4	1.7	-2.6	5.1	3.7	5.0			-3.1	12.9
MW-41-40	8/7/2019	**5.41E+02**	4.41E+02	0.7	1.7	0.0	5.2	-1.7	5.1			4.9	12.8
MW-41-40	12/12/2019	**6.34E+02**	4.17E+02	-0.6	1.0	0.8	5.3	-1.9	5.0			5.6	12.9
MW-41-63	3/14/2019	2.51E+02	4.26E+02	0.6	1.3	0.1	4.9	2.5	5.6			2.8	11.0
MW-41-63	5/15/2019	3.04E+02	4.20E+02	0.6	0.9	-1.7	6.0	1.2	7.6	6.3	18.8	-1.0	14.7
MW-41-63	8/7/2019	3.74E+02	4.35E+02	0.0	1.2	2.5	4.3	2.9	5.0			1.4	10.4
MW-41-63	12/12/2019	**5.56E+02**	4.02E+02	0.3	1.4	0.0	7.4	0.4	5.8			-5.3	12.2
MW-42-49	1/15/2019	**5.89E+02**	3.54E+02	**3.2**	2.0	**12500**	141	-1.1	5.2	**220**	33	14.5	52.8
MW-42-49	2/4/2019	**5.72E+02**	3.69E+02	**5.5**	2.2	**22800**	203	-0.4	5.5	**435**	38	-6.6	85.2
MW-42-49	3/15/2019	**7.33E+02**	4.50E+02	**15.1**	3.1	**38900**	306	1.2	5.5	**579**	44	73.7	128.4
MW-42-49	4/19/2019	**5.92E+02**	4.05E+02	**10.3**	2.9	**40700**	281	2.2	5.5	**477**	42	-13.7	112.2
MW-42-49	5/15/2019	**6.80E+02**	3.93E+02	1.4	1.8	**26200**	256	0.4	5.9	**283**	31	49.0	129.0
MW-42-49	6/12/2019	**4.96E+02**	3.51E+02	**17.2**	2.8	**30400**	303	4.9	6.5	**547**	38	-40.1	128.7
MW-42-49	9/4/2019	1.91E+02	3.90E+02	**25.2**	3.6	**32000**	266	1.6	6.4	**644**	39	56.6	115.8
MW-42-49	10/22/2019	2.49E+02	4.20E+02	**25.3**	4.2	**48300**	309	-0.9	5.3	**701**	41	0.8	120.9
MW-42-49	11/12/2019	2.41E+02	3.99E+02	**13.9**	3.6	**34100**	272	-0.9	5.4	**539**	35	-35.2	108.6
MW-42-78	3/15/2019	**7.33E+02**	3.96E+02	-0.5	1.4	-1.6	5.9	-2.3	4.8	-2.8	17.3	3.7	11.9
MW-42-78	5/15/2019	**7.55E+02**	4.41E+02	-0.3	1.2	1.9	4.7	2.7	4.9	-3.2	16.5	4.6	11.8
MW-42-78	8/6/2019	4.58E+02	4.44E+02	-1.1	1.3	5.3	6.3	0.4	6.5	1.1	13.1	-0.6	14.3
MW-42-79	11/12/2019	**7.74E+02**	4.50E+02	-1.3	1.4	1.2	4.4	0.9	3.7	0.0	19.7	5.5	10.7
MW-43-28	5/29/2019	4.94E+00	3.15E+02	-0.4	1.1	3.2	5.3	1.3	5.6			-0.4	12.8
MW-43-62	5/29/2019	1.80E+02	3.30E+02	0.6	1.6	-1.1	5.3	1.5	4.7			-2.3	12.2

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-44-102	5/23/2019	2.83E+01	3.54E+02	-0.6	1.0	4.8	12.0	1.0	6.1			3.1	14.2
MW-44-102	12/12/2019	4.17E+01	4.20E+02	-0.1	1.4	4.1	5.5	1.7	4.9			3.2	15.3
MW-44-66	5/23/2019	3.44E+02	4.02E+02	0.1	1.3	1.7	4.9	-3.5	6.2			1.6	11.9
MW-44-66	12/12/2019	3.84E+02	3.72E+02	0.4	1.1	0.3	4.1	-0.9	4.4			5.7	11.2
MW-45-42	1/7/2019	**9.63E+02**	4.20E+02	0.5	1.4	0.0	6.0	1.3	5.5			-3.5	16.6
MW-45-42	2/12/2019	**5.79E+02**	3.60E+02	0.1	1.5	-0.9	4.8	0.3	4.1			2.7	12.7
MW-45-42	3/13/2019	**8.40E+02**	4.77E+02	0.0	1.6	2.4	5.2	1.7	5.4			8.5	15.3
MW-45-42	4/18/2019	**7.32E+02**	3.96E+02	-0.6	1.3	2.6	7.6	2.9	8.2			-1.2	15.3
MW-45-42	5/14/2019	**9.49E+02**	4.41E+02	0.4	1.6	0.3	6.3	-0.2	4.7			9.3	13.3
MW-45-42	8/7/2019	**1.48E+03**	4.92E+02	0.4	1.3	0.3	5.0	-1.1	5.1			3.5	12.8
MW-45-42	12/12/2019	**1.02E+03**	4.35E+02	0.6	1.5	-0.8	4.7	-1.5	6.9			2.3	12.1
MW-45-61	3/13/2019	**7.68E+02**	4.41E+02	0.0	1.6	0.0	6.5	5.3	5.7			2.9	16.8
MW-45-61	5/14/2019	**1.15E+03**	4.53E+02	-0.1	1.3	1.2	5.6	2.4	4.8			-5.8	13.6
MW-45-61	8/7/2019	**1.12E+03**	4.59E+02	-0.2	1.6	2.1	7.7	-1.1	6.3			-2.2	16.0
MW-45-61	12/12/2019	**1.00E+03**	4.41E+02	-0.1	1.4	1.1	6.7	2.4	6.3			-0.7	17.3
MW-46	1/7/2019	1.56E+02	3.27E+02	-0.9	1.1	-0.8	5.9	0.4	5.4			-5.0	16.1
MW-46	2/13/2019	**6.51E+02**	3.99E+02	0.2	1.4	-0.6	4.1	-0.9	4.5			0.3	9.2
MW-46	3/14/2019	1.14E+02	4.17E+02	-0.5	0.7	-1.1	5.2	3.3	6.0			-3.3	15.2
MW-46	4/16/2019	5.51E+01	3.93E+02	0.1	1.5	-1.7	5.6	-2.2	6.1			5.3	14.6
MW-46	5/17/2019	2.10E+02	3.48E+02	0.1	1.0	1.1	5.2	5.3	8.9			-3.8	15.9
MW-46	8/13/2019	2.30E+02	3.42E+02	1.8	1.9	5.9	5.2	-0.3	4.3			-2.4	12.0
MW-46	12/9/2019	**4.55E+02**	4.11E+02	0.8	1.5	0.9	4.6	0.3	5.3			11.1	16.3
MW-46	12/26/2019	**4.80E+02**	3.48E+02	0.2	1.6	1.4	5.5	-1.8	6.3			-2.7	13.9
MW-49-26	5/9/2019	**6.68E+03**	7.56E+02	**6.9**	2.1	-0.4	6.9	-1.3	7.0	2.5	18.8	2.4	15.2
MW-49-26	11/13/2019	**5.11E+03**	7.62E+02	**9.3**	2.5	-2.2	5.3	-0.2	5.8	-4.8	18.1	6.4	12.8
MW-49-42	5/9/2019	**6.96E+03**	7.83E+02	**10.3**	2.2	1.9	6.0	-1.8	5.4	4.3	19.0	5.6	15.0
MW-49-42	11/13/2019	**4.53E+03**	7.35E+02	**11.2**	2.5	0.0	9.7	1.4	4.2	-0.9	18.1	1.0	12.8
MW-49-65	5/9/2019	**4.64E+03**	6.51E+02	**7.1**	2.1	0.0	11.8	-2.1	4.8	1.9	19.2	12.0	12.5
MW-49-65	11/13/2019	**3.46E+03**	6.66E+02	**6.1**	2.3	2.7	5.9	5.4	7.0	-6.7	19.0	0.9	14.6
MW-50-42	3/8/2019	**7.81E+02**	4.41E+02	-0.3	1.1	-2.1	4.6	3.7	5.0	3.8	17.2	-0.5	10.8
MW-50-42	5/6/2019	**1.24E+03**	4.92E+02	**6.3**	2.5	-2.9	4.9	-2.2	5.1	1.4	17.4	-0.3	13.0
MW-50-42	8/14/2019	3.33E+01	3.21E+02	-0.8	1.4	0.4	6.3	0.1	7.7	-0.6	18.4	-1.0	14.5
MW-50-42	11/6/2019	3.40E+02	4.17E+02	0.3	1.3	-1.7	7.5	-0.2	7.4	0.9	17.1	-4.0	15.2
MW-50-66	1/17/2019	**8.40E+03**											
MW-50-66	3/8/2019	**7.69E+03**	8.67E+02	**11.5**	2.8	0.4	4.7	3.1	7.9	3.6	18.1	8.7	12.1
MW-50-66	5/6/2019	**7.90E+03**	7.95E+02	**17.6**	3.2	-2.7	7.7	2.6	6.8	-2.5	17.2	3.8	14.7
MW-50-66	6/11/2019	**6.20E+03**											
MW-50-66	8/14/2019	**5.16E+03**	6.84E+02	**17.1**	3.6	2.1	6.2	1.1	6.6	-3.9	18.7	-1.3	13.7
MW-50-66	11/6/2019	**1.77E+03**	5.46E+02	**15.1**	3.3	3.0	6.0	0.6	5.0	-5.7	17.1	-7.2	14.6
MW-51-104	3/12/2019	-8.89E+01	3.33E+02	1.8	1.8	0.7	7.1	0.7	6.8			-3.5	14.3

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-51-135	3/12/2019	-6.77E+00	3.48E+02	-0.6	1.5	0.1	5.7	1.3	4.9			13.7	13.7
MW-51-163	3/12/2019	1.65E+02	4.32E+02	0.1	0.4	-0.5	7.0	1.6	5.2			-1.7	11.9
MW-51-189	3/12/2019	1.18E+02	4.26E+02	-0.2	0.6	-1.7	6.4	-1.5	6.0			-1.8	16.4
MW-51-40	3/12/2019	6.75E+01	3.51E+02	0.1	1.6	-4.5	8.0	-1.3	6.2			-3.5	15.3
MW-51-79	3/12/2019	-7.41E+01	3.42E+02	-0.9	1.5	-3.3	6.9	0.0	6.9			3.6	15.4
MW-52-118	5/20/2019	2.17E+02	3.60E+02	0.1	1.6	-2.8	5.3	0.6	5.2			3.6	11.4
MW-52-162	5/20/2019	3.08E+02	3.54E+02	1.1	1.8	-0.9	4.3	1.7	8.4			-5.3	12.5
MW-52-18	5/20/2019	2.12E+02	3.57E+02	0.0	1.3	2.4	5.9	2.5	5.3			13.5	24.7
MW-52-181	5/20/2019	3.48E+02	3.63E+02	-0.1	1.2	-0.5	4.4	0.8	6.1			8.4	11.2
MW-52-48	5/20/2019	3.25E+02	3.84E+02	-0.5	1.5	-0.1	4.9	-1.7	3.6			5.2	10.1
MW-52-64	5/20/2019	1.66E+02	3.57E+02	-1.2	1.4	3.7	6.7	3.1	6.9			-9.5	20.9
MW-53-120	1/15/2019	**1.40E+04**	9.93E+02	**20.6**	3.5	-0.5	7.6	0.2	5.0	11.4	21.9	2.6	12.4
MW-53-120	2/4/2019	**1.45E+04**	9.81E+02	**28.1**	4.2	0.0	10.7	0.9	4.7	-1.5	20.9	-3.6	12.2
MW-53-120	3/15/2019	**1.33E+04**	1.01E+03	**22.9**	4.0	0.1	6.3	0.2	6.0	12.4	18.7	-1.6	18.7
MW-53-120	4/19/2019	**1.40E+04**	1.07E+03	**28.4**	4.2	-0.6	5.3	-0.9	5.9	-0.1	17.9	-4.8	15.7
MW-53-120	5/15/2019	**1.49E+04**	1.02E+03	**21.2**	4.1	2.2	5.4	0.7	5.1	-0.8	16.3	5.5	13.4
MW-53-120	6/12/2019	**1.40E+04**	9.90E+02	**20.6**	3.3	-3.8	10.3	-0.3	9.3	1.8	16.9	-7.9	25.4
MW-53-120	7/9/2019	**1.42E+04**	1.10E+03	**23.8**	4.0	3.7	6.5	-0.2	6.1	15.1	15.7	-2.5	14.9
MW-53-120	8/6/2019	**1.19E+04**	9.99E+02	**21.6**	4.2	2.6	5.8	2.1	5.9	4.8	14.2	3.5	12.4
MW-53-120	9/4/2019	**1.12E+04**	1.07E+03	**23.6**	3.5	-1.4	5.5	1.0	4.3	6.3	17.8	0.4	12.8
MW-53-120	10/22/2019	**1.21E+04**	9.24E+02	**14.4**	3.2	-2.7	4.7	0.5	5.3			-1.5	17.0
MW-53-120	11/12/2019	**1.16E+04**	1.07E+03	**22.4**	3.5	-1.5	6.1	0.7	7.4	6.6	17.9	-7.0	17.5
MW-53-82	3/15/2019	**4.03E+02**	3.81E+02	-0.6	1.5	-0.5	6.3	2.2	4.9	3.5	15.1	7.3	11.6
MW-53-82	5/15/2019	3.09E+02	4.26E+02	0.9	1.3	1.5	5.6	-0.7	7.3	-6.3	15.5	-1.7	13.8
MW-53-82	8/6/2019	3.07E+01	4.05E+02	0.6	1.5	-3.5	5.5	-1.7	5.5	2.5	13.1	-1.5	14.9
MW-53-82	11/12/2019	1.83E+02	3.96E+02	1.0	1.7	0.0	4.0	-0.3	4.3	-8.4	17.9	8.0	11.4
MW-54-123	3/5/2019	**2.55E+03**	5.19E+02	0.6	1.4	-2.1	6.1	2.1	6.2	1.3	16.0	-1.3	12.5
MW-54-123	5/10/2019	**2.38E+03**	5.37E+02	0.7	1.5	0.9	5.3	0.6	5.0	-1.2	19.4	-4.5	14.7
MW-54-123	8/9/2019	**2.23E+03**	5.58E+02	1.7	1.8	3.1	5.9	-1.7	4.5	-4.1	18.7	2.1	17.7
MW-54-123	11/27/2019	**1.83E+03**	5.31E+02	-0.6	1.6	3.5	5.2	3.0	4.8	-5.3	14.7	3.5	11.8
MW-54-144	3/5/2019	**3.17E+03**	5.97E+02	**5.5**	2.3	1.1	6.0	-0.2	5.5	-1.4	15.7	-5.6	12.7
MW-54-144	5/10/2019	**2.70E+03**	5.46E+02	**4.1**	1.8	0.3	4.4	1.9	4.8	5.4	18.9	2.0	10.4
MW-54-144	8/9/2019	**2.48E+03**	5.79E+02	**7.2**	2.1	-1.2	4.9	-0.2	4.5	0.6	19.7	0.3	13.7
MW-54-144	11/27/2019	**2.19E+03**	5.85E+02	**7.8**	2.5	5.8	5.3	0.2	5.2	0.5	14.8	1.5	12.3
MW-54-173	3/5/2019	**7.66E+03**	8.43E+02	**2.5**	1.9	1.1	5.2	0.3	6.4	-1.0	16.3	-3.3	14.3
MW-54-173	5/10/2019	**6.64E+03**	7.50E+02	**2.3**	1.4	1.6	5.0	-2.1	4.9	-1.1	20.0	-2.2	14.5
MW-54-173	8/9/2019	**6.06E+03**	7.95E+02	**3.0**	1.5	-3.5	5.6	-3.7	7.5	-10.2	18.7	4.8	14.7
MW-54-173	11/27/2019	**5.18E+03**	7.53E+02	**4.0**	1.7	-1.2	5.9	1.5	5.2	0.5	14.8	3.8	9.8

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-54-190	3/5/2019	**4.20E+03**	6.84E+02	**10.5**	2.7	0.2	7.6	2.4	6.0	4.4	17.2	-3.1	14.7
MW-54-190	5/10/2019	**3.44E+03**	5.85E+02	**7.7**	2.3	1.0	7.1	-2.3	8.4	-5.2	18.5	-4.3	16.9
MW-54-190	8/9/2019	**2.79E+03**	6.06E+02	**10.8**	3.0	2.2	5.7	1.5	5.4	8.4	18.6	-5.5	11.6
MW-54-190	11/27/2019	**2.26E+03**	4.59E+02	**9.7**	2.6	4.1	9.0	-0.8	4.8	5.8	15.8	-4.7	12.9
MW-54-37	1/17/2019	**9.00E+02**											
MW-54-37	3/5/2019	**1.26E+03**	4.59E+02	**2.6**	1.8	-1.4	6.2	1.2	5.1	2.8	16.1	-1.5	11.2
MW-54-37	5/10/2019	**1.33E+03**	4.50E+02	**2.2**	1.8	1.1	6.9	-0.2	5.4	-0.5	19.1	-2.2	16.0
MW-54-37	6/11/2019	**8.00E+02**											
MW-54-37	8/9/2019	**7.94E+02**	4.71E+02	**2.4**	1.7	-0.4	4.4	0.8	4.9	-0.8	19.0	1.2	11.5
MW-54-37	11/27/2019	**8.18E+02**	4.74E+02	**2.4**	1.6	0.8	5.2	-0.2	4.7	-5.5	13.5	-0.6	14.1
MW-54-58	3/5/2019	**2.42E+03**	5.49E+02	1.4	1.8	-0.3	4.2	2.6	5.0	-5.1	15.7	-2.9	12.2
MW-54-58	5/10/2019	**2.15E+03**	5.07E+02	0.5	1.3	-1.1	4.4	-0.2	4.1	-0.1	19.4	6.9	10.7
MW-54-58	8/9/2019	**1.84E+03**	5.37E+02	1.3	1.5	1.1	5.2	2.2	4.7	-6.4	18.8	10.4	17.8
MW-54-58	11/27/2019	**1.52E+03**	5.19E+02	0.6	1.7	-1.8	4.9	1.6	5.9	-5.0	14.2	-5.7	11.5
MW-55-24	3/18/2019	**4.04E+03**	6.48E+02	**17.2**	3.5	5.5	7.4	3.8	6.4	-7.8	16.1	0.5	15.5
MW-55-24	5/13/2019	**3.24E+03**	5.82E+02	**16.2**	3.1	-1.1	8.1	0.9	4.9	-7.5	19.6	10.2	16.4
MW-55-24	8/5/2019	**2.89E+03**	5.79E+02	**13.7**	3.2	1.0	5.3	0.3	4.9	4.5	14.7	0.2	14.2
MW-55-24	11/6/2019	**4.44E+03**	7.26E+02	**5.9**	2.3	-1.0	6.8	0.0	5.7			-6.6	16.0
MW-55-35	3/18/2019	**5.84E+03**	7.41E+02	**17.3**	3.8	-3.8	8.1	-1.1	6.8	-3.8	21.2	2.3	13.0
MW-55-35	5/13/2019	**4.91E+03**	6.75E+02	**23.4**	3.8	2.3	5.0	0.9	4.8	-7.6	18.7	-2.7	12.2
MW-55-35	8/5/2019	**4.75E+03**	6.99E+02	**26.6**	4.3	0.8	4.2	-0.3	4.0	7.4	14.7	0.8	10.6
MW-55-35	11/6/2019	**3.42E+03**	6.66E+02	**15.1**	3.6	-0.8	5.5	0.7	6.0			-0.8	12.5
MW-55-54	3/18/2019	**9.16E+03**	9.12E+02	**12.5**	2.9	0.5	5.6	-0.4	6.2	-9.3	16.5	-3.1	15.3
MW-55-54	5/13/2019	**6.82E+03**	7.59E+02	**11.7**	3.3	-2.3	4.8	-0.3	4.6	-2.1	18.5	1.7	13.4
MW-55-54	8/5/2019	**6.01E+03**	7.71E+02	**9.3**	2.8	-2.1	6.5	-2.2	4.9	-1.1	13.6	-4.6	13.3
MW-55-54	11/6/2019	**4.39E+03**	7.20E+02	**8.4**	2.5	0.4	4.8	-0.1	5.1			5.0	12.4
MW-56-53	5/29/2019	**1.88E+03**	4.77E+02	0.5	1.2	-0.4	5.0	-1.2	4.9			5.7	11.6
MW-56-53	11/26/2019	4.09E+02	4.02E+02	0.2	1.6	-1.7	4.8	4.6	5.9			-0.7	12.7
MW-56-83	5/29/2019	**9.71E+02**	3.96E+02	0.1	1.1	0.7	4.8	0.7	5.0			2.9	12.6
MW-56-83	11/26/2019	**1.36E+03**	5.07E+02	1.1	1.8	0.4	6.8	-1.7	6.3			-2.0	17.0
MW-57-11	1/17/2019	**3.30E+03**											
MW-57-11	5/22/2019	**1.64E+03**	4.83E+02	**10.0**	2.8	0.7	7.0	-3.4	6.2	3.8	17.6	7.5	16.1
MW-57-11	6/11/2019	**1.80E+03**											
MW-57-20	5/22/2019	**1.10E+03**	4.47E+02	1.6	1.6	2.5	6.9	1.2	5.8	0.4	17.0	-6.9	15.2
MW-57-45	5/22/2019	**9.54E+02**	4.17E+02	1.0	1.7	-0.4	5.1	1.3	4.8	-1.0	17.3	1.4	14.0
MW-58-26	5/8/2019	**5.29E+02**	3.93E+02	1.3	1.7	-0.2	3.8	-1.3	4.6			-3.8	10.9
MW-58-26	11/19/2019	**3.25E+02**	3.09E+02	-0.4	1.3	-0.5	4.8	-1.1	5.4			-2.1	12.8
MW-58-65	5/8/2019	2.95E+02	3.78E+02	0.2	1.3	-2.8	6.1	-3.0	6.8			-3.9	18.0
MW-58-65	11/19/2019	**4.26E+02**	3.27E+02	-1.0	1.3	2.8	11.2	0.9	5.9			-1.7	12.2

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-60-135	5/6/2019	**6.22E+02**	4.50E+02	0.7	1.2	-0.2	4.6	0.7	5.8			-0.8	11.3
MW-60-176	5/6/2019	**9.06E+02**	4.71E+02	0.7	1.4	3.0	4.9	2.4	5.2			0.7	10.2
MW-60-35	5/6/2019	1.22E+02	4.20E+02	0.2	1.3	-1.6	7.9	0.9	5.8			5.9	13.3
MW-60-55	5/7/2019	1.38E+02	4.29E+02	-0.9	1.0	-0.2	4.8	-1.9	4.8			-3.4	12.9
MW-60-72	5/6/2019	2.14E+02	4.14E+02	0.5	1.2	0.1	6.1	-2.6	7.1			-3.8	15.7
MW-62-138	3/8/2019	**8.88E+02**	4.38E+02	-0.1	1.5	2.8	5.7	-1.9	6.6			-0.5	13.3
MW-62-138	5/9/2019	**8.14E+02**	3.72E+02	0.2	0.8	-0.8	5.6	1.5	4.3			5.1	15.2
MW-62-138	8/14/2019	**4.65E+02**	3.45E+02	0.8	1.4	2.4	6.5	0.4	6.1			17.8	30.6
MW-62-138	12/2/2019	**9.13E+02**	3.72E+02	1.2	1.7	-1.4	6.2	0.6	6.8			1.4	12.9
MW-62-18	3/8/2019	1.89E+02	3.81E+02	0.4	1.3	3.3	5.9	0.4	6.7			-0.6	16.2
MW-62-18	5/9/2019	1.54E+02	3.09E+02	-0.7	1.2	-1.9	6.1	-2.1	9.7			-4.8	16.3
MW-62-18	8/14/2019	3.31E+02	3.63E+02	0.1	1.7	1.5	4.9	-0.4	6.8			4.7	13.0
MW-62-18	12/2/2019	3.31E+02	3.24E+02	0.8	1.6	1.4	4.9	-1.1	5.3			-3.3	13.3
MW-62-182	3/8/2019	**1.31E+03**	4.86E+02	0.2	1.0	1.1	7.3	7.0	9.7			-4.1	16.1
MW-62-182	5/9/2019	**1.38E+03**	4.23E+02	-0.3	0.9	-2.7	6.5	-3.8	6.0			3.3	16.5
MW-62-182	8/14/2019	**1.10E+03**	4.32E+02	0.7	1.3	-0.3	5.7	-1.0	6.9			-3.3	18.4
MW-62-182	12/2/2019	**9.36E+02**	3.69E+02	-0.1	1.6	-1.1	6.5	-1.6	7.0			1.2	14.5
MW-62-37	3/8/2019	**7.62E+02**	4.23E+02	0.1	1.1	3.9	8.2	0.5	6.3			0.0	51.0
MW-62-37	5/9/2019	**9.78E+02**	3.90E+02	-0.1	1.2	1.1	10.7	0.5	5.3			-2.9	12.2
MW-62-37	8/14/2019	**7.15E+02**	3.90E+02	0.5	1.7	-1.3	6.6	0.2	5.3			5.7	12.5
MW-62-37	12/2/2019	**1.03E+03**	3.87E+02	-0.2	1.6	-0.9	5.5	-0.6	4.1			-2.7	13.5
MW-62-53	3/8/2019	**1.07E+03**	4.65E+02	-0.6	1.2	2.7	5.7	1.0	3.8			-6.0	15.6
MW-62-53	5/9/2019	**1.21E+03**	4.17E+02	-0.1	1.4	-1.3	4.6	2.2	5.6			-3.2	11.5
MW-62-53	8/14/2019	**8.20E+02**	4.05E+02	-1.0	1.5	3.2	6.0	2.7	4.5			5.4	14.0
MW-62-53	12/2/2019	**1.34E+03**	4.08E+02	-0.1	1.6	0.2	6.2	0.8	5.2			-0.8	10.7
MW-62-71	3/8/2019	**1.31E+03**	4.92E+02	1.0	1.1	-0.2	4.9	2.3	6.1			0.6	18.7
MW-62-71	5/9/2019	**1.02E+03**	3.93E+02	0.5	1.0	-1.7	5.2	-0.7	4.8			-4.6	14.2
MW-62-71	8/14/2019	**9.56E+02**	4.20E+02	0.8	1.5	1.9	5.3	0.0	5.2			-1.3	12.9
MW-62-71	12/2/2019	**1.02E+03**	3.96E+02	-0.5	1.5	0.1	5.1	-1.6	4.8			6.6	14.2
MW-62-92	3/8/2019	**1.59E+03**	5.07E+02	-0.2	1.0	2.8	4.8	-0.5	6.0			4.1	14.0
MW-62-92	5/9/2019	**1.20E+03**	4.11E+02	-0.2	1.0	2.5	6.0	-1.2	6.2			-3.2	15.3
MW-62-92	8/14/2019	**1.15E+03**	4.17E+02	0.0	1.1	3.6	5.8	4.1	4.4			-3.5	16.3
MW-62-92	12/2/2019	**1.32E+03**	4.17E+02	0.8	1.7	1.0	5.8	-0.5	5.2			2.8	12.6
MW-63-112	5/8/2019	**6.80E+02**	3.60E+02	0.9	1.6	-0.8	5.0	-2.1	6.2			2.0	15.5
MW-63-112	11/19/2019	**6.46E+02**	3.78E+02	0.4	1.6	0.6	5.3	-2.1	5.9			-0.1	14.6
MW-63-121	5/8/2019	**6.25E+02**	2.12E+02	-0.1	1.6	-2.2	7.0	-1.9	5.2			4.7	12.9
MW-63-121	11/19/2019	**6.28E+02**	3.78E+02	-0.9	1.4	3.4	5.6	-1.6	4.7			7.9	11.6
MW-63-163	5/8/2019	**7.16E+02**	3.78E+02	0.4	0.9	2.2	5.1	0.8	4.9			-1.5	13.9
MW-63-163	11/19/2019	**6.33E+02**	3.69E+02	-0.2	1.4	1.7	7.1	-0.2	6.0			1.9	15.7

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-63-174	5/8/2019	**6.13E+02**	3.45E+02	0.5	1.1	-0.3	8.7	3.3	10.0			5.4	15.0
MW-63-174	11/19/2019	**5.01E+02**	3.66E+02	1.1	1.6	-3.1	5.3	-2.9	5.4			-3.9	11.4
MW-63-18	5/8/2019	**3.25E+02**	2.01E+02	0.8	0.9	0.0	10.2	-1.2	6.7			7.3	18.0
MW-63-18	11/19/2019	2.46E+02	3.09E+02	-0.5	1.2	1.2	5.8	-1.1	6.3			8.6	14.6
MW-63-34	5/8/2019	**4.92E+02**	2.08E+02	0.9	1.2	-1.4	6.6	0.0	6.4			-2.9	20.9
MW-63-34	11/19/2019	**4.10E+02**	3.57E+02	0.8	1.7	0.3	6.6	2.4	6.9			-1.7	16.7
MW-63-50	5/8/2019	**3.70E+02**	1.96E+02	0.7	1.4	-0.7	5.9	1.0	6.8			0.9	13.7
MW-63-50	11/19/2019	**5.12E+02**	3.66E+02	0.2	1.1	-3.9	6.2	0.7	4.7			-3.8	11.8
MW-63-93	5/8/2019	**3.35E+02**	3.21E+02	-0.2	1.0	1.7	4.7	-0.7	5.0			3.2	10.5
MW-63-93	11/19/2019	**4.78E+02**	3.39E+02	0.0	1.1	1.3	5.0	0.0	6.0			6.0	19.0
MW-66-21	3/19/2019	**4.50E+02**	3.90E+02	0.8	1.7	-3.8	5.4	0.3	5.2	3.2	19.9	-0.4	12.3
MW-66-21	5/7/2019	**1.00E+03**	4.80E+02	0.6	1.2	-1.2	5.3	2.3	5.1			-1.5	12.3
MW-66-21	8/8/2019	**1.49E+03**	4.89E+02	1.0	1.8	-2.0	5.5	-0.5	5.5	9.5	14.9	5.9	14.2
MW-66-21	11/13/2019	**1.08E+03**	4.80E+02	0.8	1.5	1.0	5.7	0.6	5.1	-0.5	18.8	3.8	15.2
MW-66-36	1/15/2019	**7.10E+03**											
MW-66-36	3/19/2019	**6.25E+03**	7.38E+02	**3.9**	2.3	-1.5	5.9	2.3	5.5	3.2	18.5	-6.0	15.7
MW-66-36	5/7/2019	**5.08E+03**	7.17E+02	**4.8**	2.0	0.4	6.7	3.4	6.6			-12.0	21.0
MW-66-36	8/8/2019	**5.77E+03**	7.41E+02	**3.7**	1.9	0.8	5.0	4.8	11.3	7.2	14.9	-2.2	12.9
MW-66-36	9/23/2019	**4.40E+03**											
MW-66-36	11/13/2019	**5.08E+03**	7.59E+02	**3.0**	1.9	-0.8	5.5	-2.4	5.8	-5.8	16.3	-3.4	12.8
MW-66-36	12/16/2019	**4.70E+03**											
MW-67-105	1/15/2019	**2.50E+03**											
MW-67-105	3/19/2019	**2.15E+03**	5.19E+02	1.2	1.8	1.5	4.8	-2.3	6.3	-0.7	19.4	-1.7	12.5
MW-67-105	5/7/2019	**1.75E+03**	5.13E+02	0.7	1.1	-3.2	5.4	1.7	6.8	-7.7	21.4	-2.3	15.1
MW-67-105	6/18/2019	**2.30E+03**											
MW-67-105	8/8/2019	**2.26E+03**	5.73E+02	0.8	1.6	-0.6	6.1	-0.1	7.0	1.1	14.0	-0.6	17.1
MW-67-105	9/23/2019	**1.10E+03**											
MW-67-105	12/4/2019	**2.38E+03**	4.92E+02	1.0	1.6	-3.5	7.1	-0.7	6.1	3.0	14.9	-0.1	16.2
MW-67-105	12/20/2019	**1.10E+03**											
MW-67-173	3/19/2019	**6.41E+02**	4.05E+02	-0.7	1.3	-0.2	6.7	-0.6	5.3	9.7	18.2	2.4	14.9
MW-67-173	5/7/2019	**9.21E+02**	4.77E+02	0.0	1.2	-1.4	6.9	1.6	5.9	-16.2	24.2	2.0	15.9
MW-67-173	8/8/2019	**8.83E+02**	4.65E+02	-0.6	1.4	1.0	4.9	3.9	5.2	-12.4	22.7	-2.4	13.4
MW-67-173	12/4/2019	**6.18E+02**	3.51E+02	-0.4	1.2	3.2	7.5	-0.9	6.3	-6.2	22.9	-1.2	16.7
MW-67-219	3/19/2019	**1.28E+03**	4.86E+02	-0.1	1.6	-1.3	5.1	3.4	5.5	-0.6	16.6	-4.2	14.2
MW-67-219	5/7/2019	**1.27E+03**	5.07E+02	0.0	1.6	0.0	19.1	1.6	6.4	-0.2	20.0	7.2	15.3
MW-67-219	8/8/2019	**1.03E+03**	4.68E+02	-0.3	0.9	-1.1	5.8	-0.7	6.7	4.2	13.6	1.4	14.3
MW-67-219	12/4/2019	**1.24E+03**	4.14E+02	-0.7	1.2	-1.4	6.0	1.5	6.1	-4.6	14.7	-4.2	13.4

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-67-276	1/15/2019	**8.00E+02**											
MW-67-276	3/19/2019	**1.35E+03**	4.38E+02	-1.0	1.3	2.6	6.6	2.5	5.9	6.0	18.8	3.6	11.5
MW-67-276	5/7/2019	**7.33E+02**	4.62E+02	-0.7	0.8	-1.5	5.3	4.1	6.2	0.5	20.6	3.0	12.9
MW-67-276	6/18/2019	**8.00E+02**											
MW-67-276	8/8/2019	**6.95E+02**	4.71E+02	0.2	1.5	-4.6	7.0	0.4	5.0	8.4	12.9	8.4	12.5
MW-67-276	9/23/2019	<MDA											
MW-67-276	12/4/2019	**9.48E+02**	3.75E+02	0.1	1.3	-3.0	5.4	3.9	5.6	1.4	14.0	-6.2	13.2
MW-67-276	12/20/2019	<MDA											
MW-67-340	3/19/2019	1.87E+02	3.78E+02	-1.0	1.3	2.9	6.9	1.1	5.4	1.4	17.0	-8.6	17.6
MW-67-340	5/7/2019	1.89E+02	4.02E+02	-0.3	1.1	0.5	5.6	-0.1	5.7	-0.1	15.0	-0.7	11.9
MW-67-340	8/8/2019	2.44E+02	4.20E+02	-0.2	1.4	-0.1	7.4	-2.3	6.0	2.1	11.6	4.7	14.9
MW-67-340	12/4/2019	**3.60E+02**	3.30E+02	0.5	1.4	-2.3	9.2	-4.8	8.4	5.0	14.8	-1.0	16.6
MW-67-39	1/15/2019	**7.90E+03**											
MW-67-39	3/19/2019	**5.42E+03**	7.02E+02	**7.5**	2.6	-2.6	6.1	6.8	7.0	1.0	17.8	-0.2	12.8
MW-67-39	5/7/2019	**5.14E+03**	7.41E+02	**6.1**	2.2	0.3	5.9	1.9	6.0	-7.6	16.6	-4.1	14.3
MW-67-39	6/18/2019	**5.90E+03**											
MW-67-39	8/8/2019	**5.46E+03**	7.23E+02	**5.9**	2.2	0.5	4.6	1.5	4.1	6.9	15.2	-5.2	10.8
MW-67-39	9/23/2019	**3.00E+03**											
MW-67-39	12/4/2019	**4.74E+03**	6.18E+02	**5.0**	2.2	-0.4	4.9	1.5	5.0	1.2	14.3	4.0	12.6
MW-67-39	12/20/2019	**3.20E+03**											
MW-68-103	3/14/2019	**4.80E+02**	3.87E+02	-0.7	1.3	1.2	5.9	0.0	3.6			6.1	14.8
MW-68-103	5/17/2019	**6.48E+02**	4.17E+02	0.2	1.3	0.3	5.5	-1.2	5.2			-4.8	13.9
MW-68-103	8/13/2019	2.14E+02	3.27E+02	0.5	1.3	0.3	4.5	0.7	5.7			7.3	12.5
MW-68-103	12/9/2019	4.44E+02	4.41E+02	0.1	1.6	-1.1	4.9	-2.4	5.3			5.9	13.7
MW-68-132	3/14/2019	**6.79E+02**	4.11E+02	0.0	1.5	-3.0	7.2	0.5	4.4			4.9	11.3
MW-68-132	5/17/2019	9.64E+01	3.81E+02	-1.0	1.3	0.6	4.9	-0.2	4.4			-6.1	13.5
MW-68-132	8/13/2019	1.41E+02	3.06E+02	0.2	1.3	-1.1	4.7	-1.4	4.6			5.5	16.4
MW-68-132	12/9/2019	2.29E+02	4.20E+02	0.9	1.8	-2.2	4.7	0.5	5.3			4.4	9.9
MW-68-19	1/7/2019	**8.95E+02**	3.96E+02	0.7	1.4	1.4	7.1	-1.2	6.9			6.7	15.7
MW-68-19	2/13/2019	**1.06E+03**	4.23E+02	0.4	1.3	-0.7	5.1	-1.4	6.4			-0.3	11.9
MW-68-19	3/14/2019	**9.83E+02**	5.01E+02	0.5	0.9	-1.7	6.4	2.2	6.5			1.0	14.5
MW-68-19	4/16/2019	**5.77E+02**	4.32E+02	0.7	1.2	2.7	4.6	-0.8	5.0			-1.7	10.8
MW-68-19	5/17/2019	**5.89E+02**	3.81E+02	0.4	1.5	0.1	5.1	-0.8	7.6			2.9	13.7
MW-68-19	8/13/2019	**6.36E+02**	3.99E+02	-0.5	1.5	-3.0	7.2	-0.2	5.7			8.3	13.3
MW-68-19	12/9/2019	**8.11E+02**	4.77E+02	0.5	1.6	0.1	5.4	-1.4	5.7			0.0	16.3
MW-68-19	12/26/2019	3.73E+02	3.75E+02	1.7	1.8	0.8	5.6	-2.3	4.9			-3.2	12.6

Well ID	Sample Date	2019 Laboratory Analytical Results											
		H-3 Result (pCi/L)	H-3 3 Sigma (Std. Dev.)	Sr-90 Result (pCi/L)	Sr-90 3 Sigma (Std. Dev.)	Cs-137 Result (pCi/L)	Cs-137 3 Sigma (Std. Dev.)	Co-60 Result (pCi/L)	Co-60 3 Sigma (Std. Dev.)	Ni-63 Result (pCi/L)	Ni-63 3 Sigma (Std. Dev.)	Sb-125 Result (pCi/L)	Sb-125 3 Sigma (Std. Dev.)
MW-68-29	1/7/2019	**3.83E+02**	3.48E+02	0.4	1.4	2.9	7.3	1.0	8.3			0.6	16.4
MW-68-29	2/13/2019	**5.98E+02**	3.72E+02	0.6	1.6	2.3	6.2	0.0	5.9			0.4	17.6
MW-68-29	3/14/2019	**7.05E+02**	3.84E+02	1.7	1.9	0.0	9.4	0.4	5.2			3.2	12.7
MW-68-29	4/16/2019	**5.70E+02**	4.44E+02	0.4	1.3	-0.5	4.8	0.1	5.2			2.8	12.0
MW-68-29	5/17/2019	**5.51E+02**	3.99E+02	1.3	1.5	-1.8	6.3	1.6	6.3			-3.8	14.1
MW-68-29	8/13/2019	**5.94E+02**	3.99E+02	1.7	1.7	-1.4	4.8	3.6	8.0			1.3	10.6
MW-68-29	12/9/2019	**5.79E+02**	4.62E+02	0.8	1.7	-4.6	7.3	1.5	5.6			4.8	15.3
MW-68-29	12/26/2019	**4.77E+02**	3.51E+02	1.1	1.7	1.0	4.8	0.3	4.8			-3.3	12.0
MW-68-57	1/7/2019	**6.57E+02**	3.78E+02	1.1	1.3	-0.1	4.7	-1.3	5.7			2.2	12.3
MW-68-57	2/13/2019	**6.13E+02**	3.78E+02	0.6	1.6	1.1	5.4	0.3	4.9			-2.3	14.1
MW-68-57	3/14/2019	**7.30E+02**	4.74E+02	-0.4	0.8	0.8	5.3	3.4	5.3			0.5	13.2
MW-68-57	4/16/2019	**6.16E+02**	4.47E+02	0.5	1.5	0.7	8.5	0.7	5.7			2.8	14.1
MW-68-57	5/17/2019	**5.94E+02**	4.02E+02	1.2	1.5	4.2	8.9	0.3	5.4			5.8	21.8
MW-68-57	8/13/2019	**6.76E+02**	3.87E+02	0.2	1.5	-0.8	5.1	0.9	5.3			-1.3	11.6
MW-68-57	12/9/2019	**9.18E+02**	4.65E+02	0.0	1.6	0.2	5.3	-0.6	7.1			-2.7	11.0
MW-68-57	12/26/2019	**5.64E+02**	3.51E+02	0.5	1.2	-0.3	4.6	1.3	4.9			10.2	13.1
MW-73	12/27/2019	2.61E+02	3.36E+02	-0.5	1.6	1.5	5.9	2.0	5.9			0.0	13.3
U1-CSS	3/22/2019	**9.65E+02**	4.74E+02	**5.5**	1.8	2.3	7.9	-1.8	6.0	5.9	17.8	2.5	16.1
U1-CSS	5/10/2019	**1.46E+03**	4.44E+02	**4.3**	1.9	-0.3	6.4	2.8	5.7	-5.2	19.5	1.0	17.1
U1-CSS	12/16/2019	**1.00E+03**	4.29E+02	**3.1**	2.0	-0.9	7.4	-1.8	5.5	-16.7	21.2	-0.7	13.7
U1-NCD	1/7/2019	**1.08E+03**	4.56E+02	**2.9**	2.0	**6180**	118	-0.3	5.0	**133**	28	-26.6	48.6
U1-NCD	4/3/2019	**2.10E+03**	5.22E+02	**18.5**	4.2	**20600**	212	-1.6	5.2	**310**	35	-49.2	83.7
U1-NCD	6/25/2019	**1.54E+03**	4.80E+02	**11.6**	2.0	**14300**	112	2.7	3.5	**121**	39	25.2	50.4
U1-NCD	9/16/2019	**3.08E+03**	5.76E+02	**37.7**	3.2	**16900**	193	0.0	5.2	**411**	53	-5.6	72.3
U1-NCD	12/9/2019	**2.78E+03**	4.86E+02	**23.3**	4.1	**30700**	259	6.2	8.9	**581**	33	-1.8	102.9
U1-SFDS	1/9/2019	1.93E+02	3.27E+02	**2.6**	1.5	2.5	7.5	2.2	5.1	-3.2	20.4	-1.5	11.6
U1-SFDS	4/3/2019	2.59E+02	3.15E+02	**3.6**	1.2	0.0	12.2	-1.7	7.1	-7.6	18.1	3.3	20.8
U1-SFDS	6/26/2019	1.77E+02	3.90E+02	**2.8**	1.3	**5.8**	4.8	-1.6	3.8	2.3	21.7	1.5	7.8
U1-SFDS	9/18/2019	3.07E+02	3.90E+02	**4.2**	1.2	7.6	8.2	1.6	6.8	3.8	22.6	-2.6	14.0
U1-SFDS	12/11/2019	2.36E+02	4.08E+02	1.4	1.8	2.0	6.5	0.5	4.6	-1.1	14.9	4.3	11.4
U3-4D	3/20/2019	1.90E+02	3.84E+02	0.4	1.5	2.7	6.0	0.4	6.6			1.0	14.4
U3-4D	5/28/2019	2.95E+02	3.42E+02	0.4	1.7	1.7	5.8	-1.7	6.6			-3.0	13.4
U3-4D	8/12/2019	3.23E+01	3.03E+02	-0.9	1.4	3.4	6.5	0.5	6.4			3.9	19.8
U3-4D	11/20/2019	1.90E+02	3.36E+02	0.1	1.5	-1.1	8.4	-5.8	7.5			7.7	15.4
U3-4S	5/28/2019	1.49E+01	3.21E+02	-1.2	1.4	-0.7	6.0	3.1	4.9			-3.4	13.5
U3-4S	11/20/2019	1.30E+02	3.33E+02	-0.7	1.4	0.3	3.8	2.3	7.1			-6.5	12.4
U3-T1	3/20/2019	**5.35E+02**	4.17E+02	-0.3	1.4	-3.7	6.6	-0.1	6.1			-5.4	16.1
U3-T1	5/28/2019	**9.41E+02**	4.17E+02	-0.3	1.1	0.3	5.6	-1.0	4.7			7.3	13.1
U3-T1	8/12/2019	**1.22E+03**	4.41E+02	0.4	1.4	1.8	4.1	2.2	5.0			-3.3	11.7
U3-T1	11/20/2019	**9.16E+02**	3.99E+02	-0.8	1.2	0.5	5.6	-2.3	5.7			-4.7	15.5
U3-T1	12/27/2019	**8.50E+02**	3.87E+02	0.3	1.3	2.5	4.9	-1.8	4.9			8.2	12.1
U3-T2	3/20/2019	**1.01E+03**	4.50E+02	-0.8	0.8	0.3	5.9	0.5	2.9			-4.6	12.2
U3-T2	5/28/2019	**4.06E+02**	3.45E+02	0.0	1.6	-5.5	6.7	-2.0	7.4			-1.5	17.1
U3-T2	8/12/2019	3.44E+02	3.60E+02	1.3	1.4	1.0	5.9	2.0	6.2			-3.6	14.2
U3-T2	11/20/2019	**8.19E+02**	3.69E+02	-0.6	1.4	0.0	5.9	3.5	6.2			-3.9	13.6
U3-T2	12/27/2019	**8.05E+02**	3.81E+02	-0.5	1.3	0.8	6.2	-0.4	6.7			-1.9	15.1

Attachment 4 – Errata for 2018 Annual Radioactive Effluent Release Report

6.3 40CFR Part 190 Dose to Individual in the Unrestricted Area

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.

Table 6-1 Summation of Dose Assessments

Year: 2018		Total Body	Max Organ
40 CFR 190 limit ===➔	IPEC	25 mrem	75 mrem
Routine Airborne Effluents[1]	Units 1 and 2	1.21E-03	1.21E-03
Routine Liquid Effluents	Units 1 and 2	1.64E-03	2.55E-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	6.21E-02	3.11E-01
Routine Airborne Effluents[1]	Unit 3	2.49E-03	2.49E-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	6.19E-02	3.10E-01
Ground Water & Storm Drain Totals	IPEC[2]	9.08E-05	3.67E-04
Direct Shine from areas such as dry cask storage, radwaste storage, SG Mausoleum, etc.	IPEC[3]	2.50E-01	2.50E-01
Indian Point Energy Center Total Dose, per 40 CFR 190	IPEC	3.82E-01	8.90E-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 III.

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 each year's dose evaluation are available on site.

Table 6-2 Unit 2 Appendix I Dose Assessment

A. LIQUID DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Organ Dose	(mrem)	4.55E-04	5.91E-04	6.23E-04	8.81E-04	**2.55E-03**
Applicable Limit	(mrem)	5	5	5	5	10
Percent of Limit	(%)	9.09E-03	1.18E-02	1.25E-02	1.76E-02	2.55E-02
Age Group		Child	Teen	Child	Child	Child
Critical Organ		Bone	Liver	Bone	Bone	Bone
Adult Total Body	(mrem)	3.00E-04	3.83E-04	3.98E-04	5.60E-04	**1.64E-03**
Applicable Limit	(mrem)	1.5	1.5	1.5	1.5	3.0
Percent of Limit	(%)	2.00E-02	2.55E-02	2.66E-02	3.73E-02	5.47E-02

B. AIRBORNE NOBLE GAS DOSES

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Gamma Air	(mrad)	2.26E-05	7.75E-06	7.21E-06	6.15E-06	**4.37E-05**
Applicable Limit	(mrad)	5	5	5	5	10
Percent of Limit	(%)	4.52E-04	1.55E-04	1.44E-04	1.23E-04	4.37E-04
Beta Air	(mrad)	2.71E-05	5.89E-06	5.70E-06	4.47E-06	**4.32E-05**
Applicable Limit	(mrad)	10	10	10	10	20
Percent of Limit	(%)	2.71E-04	5.89E-05	5.70E-05	4.47E-05	2.16E-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)	1.56E-04	2.45E-04	3.53E-04	4.11E-04	**1.17E-03**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	2.08E-03	3.27E-03	4.71E-03	5.48E-03	7.77E-03
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)	1.57E-02	1.58E-02	1.59E-02	1.59E-02	**6.33E-02**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	2.09E-01	2.10E-01	2.12E-01	2.12E-01	4.22E-01
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	ANNUAL
Child Bone Dose	(mrem)	7.78E-02	7.78E-02	7.78E-02	7.78E-02	**3.11E-01**
Applicable Limit	(mrem)	7.5	7.5	7.5	7.5	15
Percent of Limit	(%)	1.04E+00	1.04E+00	1.04E+00	1.04E+00	2.07E+00