

MONTHLY  
PROGRESS REPORT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

DAVIS-BESSE NUCLEAR POWER STATION  
OAK HARBOR, OHIO

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## 1.0 INTRODUCTION

The following constitutes the current 2019 Monthly Progress Report for the Radiological Environmental Monitoring Program conducted at the Davis-Besse Nuclear Power Station in Oak Harbor, Ohio. Results of completed analyses are presented in the attached tables.

All activities, except gross alpha and gross beta, are decay corrected to the time of collection.

All samples were collected within the scheduled period unless noted otherwise in the Listing of Missed Samples.

## 2.0 LISTING OF MISSED SAMPLES

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Sample Type	Location	Expected Collection Date	Reason
AP/AI	T-12	02-05-19	Pump lost power due to severe winter conditions.
AP/AI	T-12	08-27-19	Samples not collected due to multiple pump failures.
AP	T-07	10-22-19	Sample discarded per station request..
VE	T-37	10-30-19	No vegetation available.

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### 3.0 DATA TABULATIONS

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-1

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-19	218	0.030 ± 0.005	07-09-19	302	0.019 ± 0.003
01-15-19	275	0.022 ± 0.004	07-16-19	289	0.017 ± 0.003
01-22-19	303	0.018 ± 0.003	07-23-19	267	0.013 ± 0.004
01-29-19	268	0.028 ± 0.004	07-30-19	205	0.034 ± 0.005
02-05-19	126	0.073 ± 0.009 <sup>b</sup>	08-06-19	284	0.027 ± 0.004
02-12-19	122	0.043 ± 0.008 <sup>b</sup>	08-13-19	316	0.032 ± 0.004
02-19-19	252	0.028 ± 0.004	08-20-19	290	0.032 ± 0.004
02-26-19	258	0.038 ± 0.005	08-27-19	389	0.017 ± 0.003
			09-03-19	351	0.027 ± 0.003
03-05-19	315	0.028 ± 0.004			
03-12-19	325	0.035 ± 0.004	09-10-19	280	0.028 ± 0.004
03-19-19	285	0.028 ± 0.004	09-17-19	397	0.045 ± 0.004
03-26-19	281	0.017 ± 0.004	09-24-19	333	0.053 ± 0.004
04-02-19	294	0.012 ± 0.003	10-01-19	288	0.031 ± 0.004
1st Quarter Mean ± s.d.		0.031 ± 0.015	3rd Quarter Mean ± s.d.		0.029 ± 0.011
04-09-19	277	0.020 ± 0.004	10-08-19	283	0.018 ± 0.004
04-16-19	287	0.012 ± 0.003	10-15-19	324	0.021 ± 0.003
04-23-19	278	0.010 ± 0.003	10-22-19	304	0.026 ± 0.004
04-30-19	282	0.015 ± 0.004	10-29-19	306	0.018 ± 0.003
05-07-19	293	0.013 ± 0.003	11-05-19	305	0.015 ± 0.003
05-14-19	307	0.008 ± 0.003	11-12-19	304	0.020 ± 0.004
05-21-19	324	0.015 ± 0.003	11-19-19	301	0.026 ± 0.004
05-28-19	314	0.014 ± 0.003	11-26-19	291	0.026 ± 0.004
			12-03-19	289	0.014 ± 0.003
06-04-19	312	0.012 ± 0.003			
06-11-19	318	0.014 ± 0.003	12-10-19	287	0.024 ± 0.004
06-18-19	301	0.007 ± 0.003	12-17-19	292	0.033 ± 0.004
06-25-19	305	0.011 ± 0.003	12-23-19	251	0.035 ± 0.005
07-02-19	308	0.021 ± 0.003	12-31-19	321	0.030 ± 0.004
2nd Quarter Mean ± s.d.		0.013 ± 0.004	4th Quarter Mean ± s.d.		0.024 ± 0.007
Cumulative Average					0.024

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.<sup>b</sup> Pump lost power due to severe weather conditions.



Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-2

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m³)	Gross Beta	Date Collected	Volume (m³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	248	0.026 ± 0.004	07-09-19	219	0.008 ± 0.004
01-15-19	302	0.018 ± 0.004	07-16-19	285	0.011 ± 0.003
01-22-19	268	0.020 ± 0.004	07-23-19	274	0.016 ± 0.004
01-29-19	279	0.027 ± 0.004	07-30-19	288	0.029 ± 0.004
02-05-19	296	0.032 ± 0.004	08-06-19	157	0.036 ± 0.007
02-12-19	250	0.012 ± 0.004	08-13-19	266	0.027 ± 0.004
02-19-19	278	0.025 ± 0.004	08-20-19	292	0.032 ± 0.004
02-26-19	304	0.028 ± 0.004	08-27-19	314	0.016 ± 0.003
			09-03-19	419	0.024 ± 0.003
03-05-19	299	0.026 ± 0.004			
03-12-19	295	0.029 ± 0.004	09-10-19	262	0.013 ± 0.004
03-19-19	302	0.023 ± 0.004	09-17-19	297	0.026 ± 0.004
03-26-19	265	0.015 ± 0.004	09-24-19	314	0.032 ± 0.004
04-02-19	357	0.013 ± 0.003	10-01-19	317	0.023 ± 0.004
1st Quarter Mean ± s.d.		0.023 ± 0.006	3rd Quarter Mean ± s.d.		0.023 ± 0.009
04-09-19	345	0.016 ± 0.003	10-08-19	299	0.016 ± 0.003
04-16-19	296	0.011 ± 0.003	10-15-19	337	0.019 ± 0.003
04-23-19	306	0.009 ± 0.003	10-22-19	321	0.020 ± 0.003
04-30-19	308	0.012 ± 0.003	10-29-19	329	0.014 ± 0.003
05-07-19	286	0.011 ± 0.003	11-05-19	330	0.012 ± 0.003
05-14-19	272	0.008 ± 0.003	11-12-19	318	0.020 ± 0.003
05-21-19	262	0.012 ± 0.004	11-19-19	321	0.023 ± 0.003
05-28-19	284	0.010 ± 0.003	11-26-19	313	0.028 ± 0.004
			12-03-19	309	0.016 ± 0.003
06-04-19	283	0.011 ± 0.003			
06-11-19	292	0.014 ± 0.003	12-10-19	311	0.020 ± 0.003
06-18-19	287	0.011 ± 0.003	12-17-19	312	0.025 ± 0.004
06-25-19	298	0.010 ± 0.003	12-23-19	267	0.032 ± 0.004
07-02-19	292	0.012 ± 0.003	12-31-19	350	0.026 ± 0.004
2nd Quarter Mean ± s.d.		0.011 ± 0.002	4th Quarter Mean ± s.d.		0.021 ± 0.006
			Cumulative Average		
			0.019		

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.

<sup>b</sup> Pump found not working during the collection.

<sup>c</sup> Lower volume due to the pump malfunction.

Table 3. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-3

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	250	0.024 ± 0.004	07-09-19	259	0.025 ± 0.004
01-15-19	224	0.017 ± 0.004	07-16-19	245	0.024 ± 0.004
01-22-19	306	0.019 ± 0.003	07-23-19	316	0.014 ± 0.003
01-29-19	309	0.024 ± 0.004	07-30-19	317	0.026 ± 0.004
02-05-19	338	0.026 ± 0.003	08-06-19	281	0.020 ± 0.004
02-12-19	270	0.017 ± 0.004	08-13-19	285	0.018 ± 0.004
02-19-19	246	0.025 ± 0.004	08-20-19	289	0.017 ± 0.004
02-26-19	264	0.031 ± 0.004	08-27-19	287	0.011 ± 0.003
			09-03-19	277	0.017 ± 0.004
03-05-19	271	0.020 ± 0.004			
03-12-19	356	0.033 ± 0.004	09-10-19	276	0.015 ± 0.004
03-19-19	263	0.024 ± 0.004	09-17-19	277	0.028 ± 0.004
03-26-19	284	0.015 ± 0.003	09-24-19	274	0.026 ± 0.004
04-02-19	285	0.013 ± 0.004	10-01-19	269	0.020 ± 0.004
1st Quarter Mean ± s.d.		0.022 ± 0.006	3rd Quarter Mean ± s.d.		0.020 ± 0.005
04-09-19	297	0.016 ± 0.003	10-08-19	269	0.014 ± 0.004
04-16-19	292	0.011 ± 0.003	10-15-19	265	0.016 ± 0.004
04-23-19	298	0.008 ± 0.003	10-22-19	249	0.014 ± 0.004
04-30-19	242	0.016 ± 0.004	10-29-19	253	0.018 ± 0.004
05-07-19	299	0.010 ± 0.003	11-05-19	253	0.011 ± 0.004
05-14-19	284	0.009 ± 0.003	11-12-19	255	0.015 ± 0.004
05-21-19	302	0.018 ± 0.004	11-19-19	251	0.022 ± 0.004
05-28-19	453	0.016 ± 0.002	11-26-19	276	0.030 ± 0.004
			12-03-19	270	0.015 ± 0.004
06-04-19	450	0.018 ± 0.003			
06-11-19	302	0.022 ± 0.004	12-10-19	268	0.022 ± 0.004
06-18-19	293	0.015 ± 0.003	12-17-19	272	0.027 ± 0.004
06-25-19	286	0.018 ± 0.003	12-23-19	237	0.037 ± 0.005
07-02-19	257	0.030 ± 0.004	12-31-19	310	0.026 ± 0.004
2nd Quarter Mean ± s.d.		0.016 ± 0.006	4th Quarter Mean ± s.d.		0.021 ± 0.008
Cumulative Average					0.020

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.

Table 4. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-4

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m³)	Gross Beta	Date Collected	Volume (m³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	252	0.034 ± 0.005	07-09-19	298	0.023 ± 0.004
01-15-19	339	0.015 ± 0.003	07-16-19	302	0.019 ± 0.003
01-22-19	223	0.021 ± 0.005	07-23-19	300	0.015 ± 0.003
01-29-19	245	0.032 ± 0.005	07-30-19	303	0.030 ± 0.004
02-05-19	300	0.029 ± 0.004	08-06-19	295	0.027 ± 0.004
02-12-19	288	0.017 ± 0.003 <sup>b</sup>	08-13-19	323	0.016 ± 0.003
02-19-19	319	0.035 ± 0.004	08-20-19	363	0.017 ± 0.003
02-26-19	143	0.053 ± 0.008 <sup>c</sup>	08-27-19	294	0.013 ± 0.003
			09-03-19	271	0.013 ± 0.003
03-05-19	273	0.031 ± 0.005			
03-12-19	305	0.032 ± 0.004	09-10-19	267	0.012 ± 0.004
03-19-19	298	0.030 ± 0.004	09-17-19	254	0.025 ± 0.004
03-26-19	262	0.023 ± 0.004	09-24-19	269	0.026 ± 0.004
04-02-19	287	0.016 ± 0.004	10-01-19	255	0.017 ± 0.004
1st Quarter Mean ± s.d.		0.028 ± 0.010	3rd Quarter Mean ± s.d.		0.019 ± 0.006
04-09-19	273	0.024 ± 0.004	10-08-19	353	0.010 ± 0.003
04-16-19	282	0.015 ± 0.003	10-15-19	308	0.014 ± 0.003
04-23-19	259	0.012 ± 0.003	10-22-19	289	0.013 ± 0.003
04-30-19	298	0.018 ± 0.004	10-29-19	300	0.012 ± 0.003
05-07-19	265	0.017 ± 0.004	11-05-19	295	0.010 ± 0.003
05-14-19	263	0.013 ± 0.003	11-12-19	291	0.013 ± 0.003
05-21-19	263	0.025 ± 0.004	11-19-19	279	0.016 ± 0.003
05-28-19	276	0.016 ± 0.003	11-26-19	268	0.019 ± 0.004
			12-03-19	267	0.009 ± 0.003
06-04-19	276	0.021 ± 0.004			
06-11-19	289	0.024 ± 0.004	12-10-19	259	0.018 ± 0.004
06-18-19	287	0.018 ± 0.004	12-17-19	262	0.018 ± 0.004
06-25-19	286	0.018 ± 0.003	12-23-19	251	0.046 ± 0.005
07-02-19	299	0.026 ± 0.004	12-31-19	324	0.038 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.018 ± 0.011
			Cumulative Average		0.021

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.<sup>b</sup> Flow meter failure. Volume based on pump run time.<sup>c</sup> Pump lost power due to severe weather conditions.

Table 5. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-7

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	218	0.026 ± 0.005	07-09-19	251	0.026 ± 0.004
01-15-19	341	0.020 ± 0.003	07-16-19	342	0.027 ± 0.004
01-22-19	307	0.024 ± 0.004	07-23-19	351	0.021 ± 0.003
01-29-19	232	0.027 ± 0.005	07-30-19	271	0.038 ± 0.004
02-05-19	212	0.040 ± 0.005 <sup>b</sup>	08-06-19	306	0.033 ± 0.004
02-12-19	271	0.018 ± 0.004	08-13-19	276	0.032 ± 0.004
02-19-19	319	0.023 ± 0.003	08-20-19	260	0.030 ± 0.004
02-26-19	272	0.030 ± 0.004	08-27-19	240	0.025 ± 0.004
			09-03-19	290	0.033 ± 0.004
03-05-19	280	0.022 ± 0.004			
03-12-19	217	0.034 ± 0.005	09-10-19	292	0.030 ± 0.004
03-19-19	268	0.030 ± 0.004	09-17-19	353	0.048 ± 0.004
03-26-19	266	0.017 ± 0.004	09-24-19	302	0.055 ± 0.005
04-02-19	267	0.014 ± 0.004	10-01-19	295	0.040 ± 0.004
1st Quarter Mean ± s.d.		0.025 ± 0.007	3rd Quarter Mean ± s.d.		0.034 ± 0.010
04-09-19	262	0.023 ± 0.004	10-08-19	314	0.034 ± 0.004
04-16-19	256	0.012 ± 0.003	10-15-19	285	0.044 ± 0.005
04-23-19	250	0.005 ± 0.003	10-22-19		NS <sup>c</sup>
04-30-19	285	0.015 ± 0.004	10-29-19	321	0.024 ± 0.004
05-07-19	282	0.014 ± 0.003	11-05-19	321	0.018 ± 0.003
05-14-19	272	0.009 ± 0.003	11-12-19	279	0.024 ± 0.004
05-21-19	291	0.013 ± 0.003	11-19-19	259	0.039 ± 0.005
05-28-19	272	0.013 ± 0.003	11-26-19	262	0.053 ± 0.005
			12-03-19	258	0.020 ± 0.004
06-04-19	263	0.015 ± 0.003			
06-11-19	260	0.026 ± 0.004	12-10-19	259	0.034 ± 0.005
06-18-19	273	0.016 ± 0.004	12-17-19	271	0.046 ± 0.005
06-25-19	279	0.014 ± 0.003	12-23-19	248	0.044 ± 0.005
07-02-19	280	0.025 ± 0.004	12-31-19	305	0.040 ± 0.004
2nd Quarter Mean ± s.d.		0.015 ± 0.006	4th Quarter Mean ± s.d.		0.035 ± 0.011
Cumulative Average					0.027

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.<sup>b</sup> Lower volume possibly due to severe weather conditions.<sup>c</sup> No sample collected. See table 2.0, Listing Of Missed Samples.

Table 6. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-9 (C)

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m³)	Gross Beta	Date Collected	Volume (m³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	224	0.029 ± 0.005	07-09-19	303	0.013 ± 0.003
01-15-19	336	0.019 ± 0.003	07-16-19	308	0.015 ± 0.003
01-22-19	318	0.020 ± 0.003	07-23-19	305	0.010 ± 0.003
01-29-19	281	0.024 ± 0.004	07-30-19	307	0.022 ± 0.003
02-05-19	261	0.034 ± 0.004	08-06-19	286	0.019 ± 0.004
02-12-19	302	0.015 ± 0.003	08-13-19		ND <sup>b</sup>
02-19-19	277	0.026 ± 0.004	08-20-19	98	0.028 ± 0.009 <sup>c</sup>
02-26-19	286	0.035 ± 0.004	08-27-19	223	0.022 ± 0.005
			09-03-19	310	0.026 ± 0.004
03-05-19	312	0.021 ± 0.004			
03-12-19	304	0.031 ± 0.004	09-10-19	310	0.019 ± 0.004
03-19-19	274	0.029 ± 0.004	09-17-19	329	0.036 ± 0.004
03-26-19	284	0.019 ± 0.004	09-24-19	307	0.040 ± 0.004
04-02-19	312	0.022 ± 0.004	10-01-19	286	0.026 ± 0.004
1st Quarter Mean ± s.d.		0.025 ± 0.006	3rd Quarter Mean ± s.d.		0.023 ± 0.009
04-09-19	325	0.023 ± 0.004	10-08-19	277	0.022 ± 0.004
04-16-19	231	0.014 ± 0.004	10-15-19	298	0.029 ± 0.004
04-23-19	256	0.013 ± 0.003	10-22-19	287	0.027 ± 0.004
04-30-19	349	0.016 ± 0.003	10-29-19	312	0.024 ± 0.004
05-07-19	284	0.016 ± 0.003	11-05-19	300	0.019 ± 0.004
05-14-19	446	0.009 ± 0.002	11-12-19	296	0.023 ± 0.004
05-21-19	223	0.024 ± 0.005	11-19-19	294	0.034 ± 0.004
05-28-19	372	0.013 ± 0.003	11-26-19	280	0.034 ± 0.004
			12-03-19	301	0.017 ± 0.004
06-04-19	281	0.013 ± 0.003			
06-11-19	304	0.017 ± 0.003	12-10-19	292	0.029 ± 0.004
06-18-19	314	0.012 ± 0.003	12-17-19	292	0.042 ± 0.005
06-25-19	272	0.016 ± 0.003	12-23-19	244	0.043 ± 0.005
07-02-19	311	0.024 ± 0.004	12-31-19	325	0.036 ± 0.004
2nd Quarter Mean ± s.d.		0.016 ± 0.005	4th Quarter Mean ± s.d.		0.029 ± 0.008
Cumulative Average					0.023

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.

<sup>b</sup> Very low volume due to the pump malfunction; sample discarded per station request.

<sup>c</sup> Low volume due to the pump malfunction.

Table 7. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-11 (C)

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m³)	Gross Beta	Date Collected	Volume (m³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	260	0.037 ± 0.005	07-09-19	288	0.015 ± 0.003
01-15-19	353	0.023 ± 0.003	07-16-19	303	0.013 ± 0.003
01-22-19	248	0.021 ± 0.004	07-23-19	241	0.018 ± 0.004
01-29-19	262	0.031 ± 0.004	07-30-19	242	0.031 ± 0.005
02-05-19	43	0.050 ± 0.019 <sup>b</sup>	08-06-19	279	0.025 ± 0.004
02-12-19	381	0.012 ± 0.003	08-13-19	290	0.027 ± 0.004
02-19-19	262	0.019 ± 0.004	08-20-19	282	0.033 ± 0.004
02-26-19	278	0.027 ± 0.004	08-27-19	263	0.019 ± 0.004
			09-03-19	270	0.026 ± 0.004
03-05-19	321	0.021 ± 0.004			
03-12-19	291	0.028 ± 0.004	09-10-19	279	0.024 ± 0.004
03-19-19	313	0.022 ± 0.003	09-17-19	265	0.040 ± 0.005
03-26-19	302	0.014 ± 0.003	09-24-19	275	0.041 ± 0.005
04-02-19	287	0.016 ± 0.004	10-01-19	311	0.026 ± 0.004
1st Quarter Mean ± s.d.		0.025 ± 0.010	3rd Quarter Mean ± s.d.		0.026 ± 0.009
04-09-19	319	0.024 ± 0.004	10-08-19	309	0.024 ± 0.004
04-16-19	197	0.010 ± 0.004 <sup>c</sup>	10-15-19	309	0.025 ± 0.004
04-23-19	310	0.011 ± 0.003	10-22-19	302	0.026 ± 0.004
04-30-19	205	0.017 ± 0.005	10-29-19	302	0.023 ± 0.004
05-07-19	337	0.013 ± 0.003	11-05-19	302	0.020 ± 0.004
05-14-19	191	0.015 ± 0.005	11-12-19	296	0.024 ± 0.004
05-21-19	353	0.014 ± 0.003	11-19-19	290	0.032 ± 0.004
05-28-19	314	0.012 ± 0.003	11-26-19	283	0.035 ± 0.004
			12-03-19	274	0.017 ± 0.004
06-04-19	270	0.017 ± 0.004			
06-11-19	244	0.021 ± 0.004	12-10-19	274	0.035 ± 0.005
06-18-19	346	0.012 ± 0.003	12-17-19	272	0.041 ± 0.005
06-25-19	329	0.012 ± 0.003	12-23-19	238	0.041 ± 0.005
07-02-19	230	0.023 ± 0.004	12-31-19	306	0.038 ± 0.004
2nd Quarter Mean ± s.d.		0.015 ± 0.005	4th Quarter Mean ± s.d.		0.029 ± 0.008
Cumulative Average					0.024

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.

<sup>b</sup> Low volume due to the power outage. I-131 result < 0.07 pCi/m<sup>3</sup>.

<sup>c</sup> Pump found off.

Table 8. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-12 (C)

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	264	0.023 ± 0.004	07-09-19	324	0.024 ± 0.004
01-15-19	295	0.013 ± 0.003	07-16-19	281	0.023 ± 0.004
01-22-19	304	0.017 ± 0.003	07-23-19	277	0.018 ± 0.004
01-29-19	245	0.028 ± 0.005 <sup>b</sup>	07-30-19	273	0.028 ± 0.004
02-05-19		NS <sup>c</sup>	08-06-19	301	0.029 ± 0.004
02-12-19	124	0.017 ± 0.007 <sup>d</sup>	08-13-19	363	0.023 ± 0.003
02-19-19	259	0.037 ± 0.005	08-20-19	262	0.025 ± 0.004
02-26-19	308	0.033 ± 0.004	08-27-19		NS <sup>f</sup>
			09-03-19	353	0.027 ± 0.003
03-05-19	280	0.027 ± 0.004			
03-12-19	296	0.030 ± 0.004	09-10-19	330	0.022 ± 0.004
03-19-19	283	0.034 ± 0.004	09-17-19	292	0.037 ± 0.004
03-26-19	305	0.020 ± 0.003	09-24-19	351	0.041 ± 0.004
04-02-19	273	0.017 ± 0.004	10-01-19	342	0.025 ± 0.003
1st Quarter Mean ± s.d.		0.025 ± 0.008	3rd Quarter Mean ± s.d.		0.027 ± 0.006
04-09-19	295	0.023 ± 0.004	10-08-19	343	0.016 ± 0.003
04-16-19	304	0.011 ± 0.003	10-15-19	285	0.024 ± 0.004
04-23-19	266	0.015 ± 0.003	10-22-19	293	0.029 ± 0.004
04-30-19	401	0.015 ± 0.003	10-29-19	301	0.022 ± 0.004
05-07-19	274	0.018 ± 0.004	11-05-19	299	0.020 ± 0.004
05-14-19	325	0.009 ± 0.003	11-12-19	302	0.024 ± 0.004
05-21-19	245	0.012 ± 0.004	11-19-19	304	0.032 ± 0.004
05-28-19	351	0.012 ± 0.003	11-26-19	295	0.033 ± 0.004
			12-03-19	294	0.016 ± 0.004
06-04-19	286	0.003 ± 0.003 <sup>e</sup>			
06-11-19	239	0.022 ± 0.004	12-10-19	294	0.028 ± 0.004
06-18-19	315	0.014 ± 0.003	12-17-19	296	0.037 ± 0.004
06-25-19	320	0.018 ± 0.003	12-23-19	256	0.049 ± 0.005
07-02-19	239	0.025 ± 0.004	12-31-19	338	0.046 ± 0.004
2nd Quarter Mean ± s.d.		0.015 ± 0.006	4th Quarter Mean ± s.d.		0.029 ± 0.010
Cumulative Average					0.024

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.<sup>b</sup> Pump found not working during the collection.<sup>c</sup> Power failure due to severe weather conditions. Indicated volume 12.1 f<sup>3</sup>.<sup>d</sup> Lower volume due to severe weather conditons.<sup>e</sup> Low activity possibly caused by the pomp failure.<sup>f</sup> No sample collected. See table 2.0, Listing Of Missed Samples.

Table 9. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131<sup>a</sup>.

Location: T-27 (C)

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m³)	Gross Beta	Date Collected	Volume (m³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-19	243	0.033 ± 0.005	07-09-19	301	0.017 ± 0.003
01-15-19	274	0.027 ± 0.004	07-16-19	294	0.019 ± 0.004
01-22-19	265	0.028 ± 0.004	07-23-19	324	0.014 ± 0.003
01-29-19	291	0.037 ± 0.004	07-30-19	283	0.024 ± 0.004
02-05-19	302	0.038 ± 0.004	08-06-19	378	0.024 ± 0.003
02-12-19	284	0.019 ± 0.004	08-13-19		NS <sup>b</sup>
02-19-19	283	0.034 ± 0.004	08-20-19	340	0.023 ± 0.003
02-26-19	256	0.045 ± 0.005	08-27-19	371	0.012 ± 0.003
			09-03-19	315	0.018 ± 0.003
03-05-19	279	0.031 ± 0.004			
03-12-19	282	0.035 ± 0.004	09-10-19	328	0.020 ± 0.003
03-19-19	282	0.033 ± 0.004	09-17-19	339	0.033 ± 0.004
03-26-19	284	0.022 ± 0.004	09-24-19	300	0.031 ± 0.004
04-02-19	291	0.018 ± 0.004	10-01-19	292	0.019 ± 0.004
1st Quarter Mean ± s.d.		0.031 ± 0.008	3rd Quarter Mean ± s.d.		0.021 ± 0.006
04-09-19	276	0.027 ± 0.004	10-08-19	290	0.015 ± 0.003
04-16-19	264	0.017 ± 0.004	10-15-19	286	0.021 ± 0.004
04-23-19	268	0.016 ± 0.003	10-22-19	268	0.016 ± 0.004
04-30-19	282	0.016 ± 0.004	10-29-19	272	0.017 ± 0.004
05-07-19	284	0.013 ± 0.003	11-05-19	268	0.013 ± 0.004
05-14-19	268	0.012 ± 0.003	11-12-19	264	0.018 ± 0.004
05-21-19	225	0.024 ± 0.005	11-19-19	257	0.030 ± 0.004
05-28-19	423	0.014 ± 0.002	11-26-19	257	0.029 ± 0.004
			12-03-19	251	0.015 ± 0.004
06-04-19	291	0.012 ± 0.003			
06-11-19	230	0.020 ± 0.004	12-10-19	284	0.026 ± 0.004
06-18-19	319	0.018 ± 0.003	12-17-19	283	0.029 ± 0.004
06-25-19	278	0.016 ± 0.003	12-23-19	241	0.036 ± 0.005
07-02-19	274	0.031 ± 0.004	12-31-19	325	0.028 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.006	4th Quarter Mean ± s.d.		0.023 ± 0.007
Cumulative Average					0.023

<sup>a</sup> Iodine-131 concentrations are < 0.07 pCi/m<sup>3</sup> unless noted otherwise.

<sup>b</sup> Very low volume due to the pump failure. Sample discarded per station request.



Table 10-1. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima.

January				April			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.023	0.019	0.029	T-9	0.017	0.013	0.023
T-11	0.028	0.021	0.037	T-11	0.016	0.010	0.024
T-12	0.020	0.013	0.028	T-12	0.016	0.011	0.023
T-27	0.031	0.027	0.037	T-27	0.019	0.016	0.027
Controls	0.026	0.013	0.037	Controls	0.017	0.010	0.027
T-1	0.025	0.018	0.030	T-1	0.014	0.010	0.020
T-2	0.023	0.018	0.027	T-2	0.012	0.009	0.016
T-3	0.021	0.017	0.024	T-3	0.013	0.008	0.016
T-4	0.026	0.015	0.034	T-4	0.017	0.012	0.024
T-7	0.024	0.020	0.027	T-7	0.014	0.005	0.023
Indicators	0.024	0.015	0.034	Indicators	0.014	0.005	0.024

  

February				May			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.028	0.015	0.035	T-9	0.016	0.009	0.024
T-11	0.027	0.012	0.050	T-11	0.014	0.012	0.015
T-12	0.029	0.017	0.037	T-12	0.013	0.009	0.018
T-27	0.034	0.019	0.045	T-27	0.016	0.012	0.024
Controls	0.030	0.012	0.050	Controls	0.015	0.009	0.024
T-1	0.046	0.028	0.073	T-1	0.013	0.008	0.015
T-2	0.024	0.012	0.032	T-2	0.010	0.008	0.012
T-3	0.025	0.017	0.031	T-3	0.013	0.009	0.018
T-4	0.034	0.017	0.053	T-4	0.018	0.013	0.025
T-7	0.028	0.018	0.040	T-7	0.012	0.009	0.014
Indicators	0.031	0.012	0.073	Indicators	0.013	0.008	0.025

  

March				June			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.024	0.019	0.031	T-9	0.016	0.012	0.024
T-11	0.020	0.014	0.028	T-11	0.017	0.012	0.023
T-12	0.026	0.017	0.034	T-12	0.016	0.003	0.025
T-27	0.028	0.018	0.035	T-27	0.019	0.012	0.031
Controls	0.025	0.014	0.035	Controls	0.017	0.003	0.031
T-1	0.024	0.012	0.035	T-1	0.013	0.007	0.021
T-2	0.021	0.013	0.029	T-2	0.012	0.010	0.014
T-3	0.021	0.013	0.033	T-3	0.021	0.015	0.030
T-4	0.026	0.016	0.032	T-4	0.021	0.018	0.026
T-7	0.023	0.014	0.034	T-7	0.019	0.014	0.026
Indicators	0.023	0.012	0.035	Indicators	0.017	0.007	0.030

Note: Unless otherwise specified, samples collected on the first, second or third day of the month are grouped with data from the previous month.

Table 10-1. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima.

July				October			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.015	0.010	0.022	T-9	0.026	0.022	0.029
T-11	0.019	0.013	0.031	T-11	0.025	0.023	0.026
T-12	0.023	0.018	0.028	T-12	0.023	0.016	0.029
T-27	0.019	0.014	0.024	T-27	0.017	0.015	0.021
Controls	0.019	0.010	0.031	Controls	0.023	0.015	0.029
T-1	0.021	0.013	0.034	T-1	0.021	0.018	0.026
T-2	0.016	0.008	0.029	T-2	0.017	0.014	0.020
T-3	0.022	0.014	0.026	T-3	0.016	0.014	0.018
T-4	0.022	0.015	0.030	T-4	0.012	0.010	0.014
T-7	0.028	0.021	0.038	T-7	0.034	0.024	0.044
Indicators	0.022	0.008	0.038	Indicators	0.020	0.010	0.044

  

August				November			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.024	0.019	0.028	T-9	0.025	0.017	0.034
T-11	0.026	0.019	0.033	T-11	0.026	0.017	0.035
T-12	0.026	0.023	0.029	T-12	0.025	0.016	0.033
T-27	0.019	0.012	0.024	T-27	0.021	0.013	0.030
Controls	0.024	0.012	0.033	Controls	0.024	0.013	0.035
T-1	0.027	0.017	0.032	T-1	0.020	0.014	0.026
T-2	0.027	0.016	0.036	T-2	0.020	0.012	0.028
T-3	0.017	0.011	0.020	T-3	0.019	0.011	0.030
T-4	0.017	0.013	0.027	T-4	0.013	0.009	0.019
T-7	0.031	0.025	0.033	T-7	0.031	0.018	0.053
Indicators	0.024	0.011	0.036	Indicators	0.021	0.009	0.053

  

September				December			
Location	Average	Minima	Maxima	Location	Average	Minima	Maxima
T-9	0.030	0.019	0.040	T-9	0.038	0.029	0.043
T-11	0.033	0.024	0.041	T-11	0.039	0.035	0.041
T-12	0.031	0.022	0.041	T-12	0.040	0.028	0.049
T-27	0.026	0.019	0.033	T-27	0.030	0.026	0.036
Controls	0.030	0.019	0.041	Controls	0.037	0.026	0.049
T-1	0.039	0.028	0.053	T-1	0.031	0.024	0.035
T-2	0.024	0.013	0.032	T-2	0.026	0.020	0.032
T-3	0.022	0.015	0.028	T-3	0.028	0.022	0.037
T-4	0.020	0.012	0.026	T-4	0.030	0.018	0.046
T-7	0.043	0.030	0.055	T-7	0.041	0.034	0.046
Indicators	0.030	0.012	0.055	Indicators	0.031	0.018	0.046

Note: Unless otherwise specified, samples collected on the first, second or third day of the month are grouped with data from the previous month.

Table 11. Airborne particulates, analyses for strontium-89, strontium-90 and gamma-emitting isotopes.  
Collection: Quarterly Composite  
Units: pCi/m<sup>3</sup>

T-1				
Location				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1238	TAP- 2656	TAP- 3903	TAP- 5027
Volume (m <sup>3</sup> )	3322	3906	3991	3858
Sr-89	< 0.0014	< 0.0008	< 0.0005	< 0.0005
Sr-90	< 0.0009	< 0.0006	< 0.0003	< 0.0004
Be-7	0.107 ± 0.017	0.069 ± 0.011	0.113 ± 0.017	0.046 ± 0.011
K-40	< 0.023	< 0.025	< 0.018	< 0.015
Nb-95	< 0.0009	< 0.0010	< 0.0008	< 0.0022
Zr-95	< 0.0007	< 0.0014	< 0.0011	< 0.0020
Ru-103	< 0.0006	< 0.0009	< 0.0010	< 0.0010
Ru-106	< 0.0065	< 0.0065	< 0.0053	< 0.0041
Cs-134	< 0.0010	< 0.0008	< 0.0008	< 0.0011
Cs-137	< 0.0007	< 0.0006	< 0.0007	< 0.0005
Ce-141	< 0.0014	< 0.0015	< 0.0010	< 0.0012
Ce-144	< 0.0043	< 0.0055	< 0.0034	< 0.0048

  

T-2				
Location				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1239	TAP- 2657	TAP- 3904	TAP- 5028
Volume (m <sup>3</sup> )	3743	3811	3704	4117
Sr-89	< 0.0012	< 0.0010	< 0.0008	< 0.0005
Sr-90	< 0.0008	< 0.0008	< 0.0004	< 0.0004
Be-7	0.075 ± 0.014	0.059 ± 0.016	0.086 ± 0.017	0.059 ± 0.013
K-40	< 0.017	< 0.015	< 0.019	< 0.018
Nb-95	< 0.0006	< 0.0006	< 0.0007	< 0.0009
Zr-95	< 0.0009	< 0.0009	< 0.0016	< 0.0013
Ru-103	< 0.0004	< 0.0009	< 0.0011	< 0.0011
Ru-106	< 0.0066	< 0.0051	< 0.0057	< 0.0073
Cs-134	< 0.0009	< 0.0007	< 0.0010	< 0.0008
Cs-137	< 0.0008	< 0.0005	< 0.0008	< 0.0005
Ce-141	< 0.0008	< 0.0008	< 0.0017	< 0.0015
Ce-144	< 0.0043	< 0.0039	< 0.0029	< 0.0041

Table 11. Airborne particulates, analyses for strontium-89, strontium-90 and gamma-emitting isotopes.  
Collection: Quarterly Composite  
Units: pCi/m<sup>3</sup>

Location T-3				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1240	TAP- 2658	TAP- 3905	TAP- 5029
Volume (m <sup>3</sup> )	3666	4055	3652	3428
Sr-89	< 0.0010	< 0.0008	< 0.0005	< 0.0005
Sr-90	< 0.0007	< 0.0006	< 0.0004	< 0.0004
Be-7	0.076 ± 0.012	0.091 ± 0.017	0.066 ± 0.015	0.060 ± 0.014
K-40	< 0.021	< 0.017	0.026 ± 0.009	< 0.028
Nb-95	< 0.0013	< 0.0012	< 0.0007	< 0.0013
Zr-95	< 0.0011	< 0.0015	< 0.0009	< 0.0015
Ru-103	< 0.0010	< 0.0006	< 0.0011	< 0.0005
Ru-106	< 0.0077	< 0.0070	< 0.0068	< 0.0078
Cs-134	< 0.0008	< 0.0010	< 0.0009	< 0.0010
Cs-137	< 0.0007	< 0.0008	< 0.0006	< 0.0011
Ce-141	< 0.0016	< 0.0017	< 0.0012	< 0.0020
Ce-144	< 0.0032	< 0.0045	< 0.0046	< 0.0036

  

Location T-4				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1241	TAP- 2659	TAP- 3906	TAP- 5030
Volume (m <sup>3</sup> )	3534	3616	3794	3746
Sr-89	< 0.0020	< 0.0009	< 0.0005	< 0.0005
Sr-90	< 0.0013	< 0.0006	< 0.0003	< 0.0003
Be-7	0.108 ± 0.020	0.095 ± 0.018	0.072 ± 0.013	0.064 ± 0.027
K-40	< 0.030	< 0.023	< 0.015	< 0.032
Nb-95	< 0.0028	< 0.0013	< 0.0003	< 0.0040
Zr-95	< 0.0035	< 0.0013	< 0.0011	< 0.0033
Ru-103	< 0.0010	< 0.0007	< 0.0008	< 0.0021
Ru-106	< 0.0100	< 0.0073	< 0.0066	< 0.0141
Cs-134	< 0.0016	< 0.0011	< 0.0008	< 0.0018
Cs-137	< 0.0018	< 0.0011	< 0.0004	< 0.0018
Ce-141	< 0.0023	< 0.0020	< 0.0012	< 0.0035
Ce-144	< 0.0057	< 0.0040	< 0.0034	< 0.0078

Table 11. Airborne particulates, analyses for strontium-89, strontium-90 and gamma-emitting isotopes.

Collection: Quarterly Composite

Units: pCi/m<sup>3</sup>

Location T-7				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1243	TAP- 2660	TAP- 3907	TAP- 5031
Volume (m <sup>3</sup> )	3470	3525	3829	3382
Sr-89	< 0.0011	< 0.0009	< 0.0004	< 0.0005
Sr-90	< 0.0008	< 0.0008	< 0.0003	< 0.0004
Be-7	0.088 ± 0.018	0.087 ± 0.014	0.126 ± 0.018	0.098 ± 0.016
K-40	< 0.019	< 0.024	< 0.019	< 0.023
Nb-95	< 0.0008	< 0.0009	< 0.0009	< 0.0010
Zr-95	< 0.0013	< 0.0011	< 0.0011	< 0.0019
Ru-103	< 0.0008	< 0.0012	< 0.0009	< 0.0012
Ru-106	< 0.0078	< 0.0064	< 0.0076	< 0.0065
Cs-134	< 0.0012	< 0.0009	< 0.0010	< 0.0010
Cs-137	< 0.0006	< 0.0009	< 0.0011	< 0.0005
Ce-141	< 0.0010	< 0.0017	< 0.0014	< 0.0022
Ce-144	< 0.0030	< 0.0041	< 0.0046	< 0.0056

  

Location T-9 (C)				
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1244	TAP- 2661	TAP- 3908	TAP- 5032
Volume (m <sup>3</sup> )	3771	3968	3372	3798
Sr-89	< 0.0012	< 0.0010	< 0.0005	< 0.0005
Sr-90	< 0.0008	< 0.0008	< 0.0004	< 0.0004
Be-7	0.095 ± 0.017	0.084 ± 0.013	0.091 ± 0.017	0.080 ± 0.015
K-40	< 0.023	< 0.020	< 0.028	< 0.015
Nb-95	< 0.0008	< 0.0008	< 0.0010	< 0.0014
Zr-95	< 0.0012	< 0.0013	< 0.0016	< 0.0012
Ru-103	< 0.0010	< 0.0009	< 0.0014	< 0.0011
Ru-106	< 0.0089	< 0.0069	< 0.0056	< 0.0056
Cs-134	< 0.0012	< 0.0008	< 0.0011	< 0.0008
Cs-137	< 0.0011	< 0.0006	< 0.0008	< 0.0007
Ce-141	< 0.0014	< 0.0015	< 0.0013	< 0.0019
Ce-144	< 0.0041	< 0.0043	< 0.0063	< 0.0044

Table 11. Airborne particulates, analyses for strontium-89, strontium-90 and gamma-emitting isotopes.  
Collection: Quarterly Composite  
Units: pCi/m<sup>3</sup>

Location		T-11 (C)			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Lab Code	TAP- 1245	TAP- 2662	TAP- 3909	TAP- 5033	
Volume (m <sup>3</sup> )	3601	3645	3588	3757	
Sr-89	< 0.0011	< 0.0010	< 0.0005	< 0.0006	
Sr-90	< 0.0008	< 0.0008	< 0.0004	< 0.0004	
Be-7	0.089 ± 0.015	0.077 ± 0.015	0.089 ± 0.018	0.079 ± 0.014	
K-40	< 0.023	< 0.017	0.030 ± 0.016	< 0.021	
Nb-95	< 0.0008	< 0.0007	< 0.0010	< 0.0007	
Zr-95	< 0.0008	< 0.0011	< 0.0012	< 0.0013	
Ru-103	< 0.0010	< 0.0007	< 0.0006	< 0.0011	
Ru-106	< 0.0076	< 0.0038	< 0.0044	< 0.0050	
Cs-134	< 0.0009	< 0.0009	< 0.0009	< 0.0010	
Cs-137	< 0.0008	< 0.0009	< 0.0007	< 0.0011	
Ce-141	< 0.0017	< 0.0016	< 0.0011	< 0.0017	
Ce-144	< 0.0046	< 0.0032	< 0.0038	< 0.0056	

  

Location		T-12 (C)			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Lab Code	TAP- 1246	TAP- 2663	TAP- 3910	TAP- 5034	
Volume (m <sup>3</sup> )	3236	3860	3749	3900	
Sr-89	< 0.0011	< 0.0009	< 0.0005	< 0.0004	
Sr-90	< 0.0007	< 0.0007	< 0.0004	< 0.0003	
Be-7	0.101 ± 0.017	0.097 ± 0.017	0.094 ± 0.013	0.076 ± 0.017	
K-40	< 0.021	< 0.018	< 0.015	< 0.024	
Nb-95	< 0.0009	< 0.0014	< 0.0007	< 0.0021	
Zr-95	< 0.0019	< 0.0019	< 0.0014	< 0.0014	
Ru-103	< 0.0010	< 0.0010	< 0.0007	< 0.0009	
Ru-106	< 0.0069	< 0.0085	< 0.0033	< 0.0071	
Cs-134	< 0.0010	< 0.0010	< 0.0007	< 0.0013	
Cs-137	< 0.0005	< 0.0008	< 0.0004	< 0.0010	
Ce-141	< 0.0010	< 0.0018	< 0.0010	< 0.0017	
Ce-144	< 0.0050	< 0.0032	< 0.0027	< 0.0053	

Table 11. Airborne particulates, analyses for strontium-89, strontium-90 and gamma-emitting isotopes.  
Collection: Quarterly Composite  
Units: pCi/m<sup>3</sup>

Location	T-27 (C)			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	TAP- 1247	TAP- 2664	TAP- 3911	TAP- 5035
Volume (m <sup>3</sup> )	3616	3682	3865	3546
Sr-89	< 0.0009	< 0.0008	< 0.0005	< 0.0004
Sr-90	< 0.0007	< 0.0006	< 0.0004	< 0.0003
Be-7	0.110 ± 0.022	0.091 ± 0.015	0.075 ± 0.015	0.065 ± 0.016
K-40	< 0.029	< 0.024	< 0.021	< 0.020
Nb-95	< 0.0022	< 0.0011	< 0.0010	< 0.0009
Zr-95	< 0.0015	< 0.0013	< 0.0013	< 0.0017
Ru-103	< 0.0012	< 0.0008	< 0.0010	< 0.0011
Ru-106	< 0.0088	< 0.0054	< 0.0073	< 0.0075
Cs-134	< 0.0014	< 0.0007	< 0.0009	< 0.0011
Cs-137	< 0.0011	< 0.0009	< 0.0009	< 0.0008
Ce-141	< 0.0032	< 0.0018	< 0.0015	< 0.0020
Ce-144	< 0.0061	< 0.0029	< 0.0045	< 0.0048

Table 12. Area monitors (TLD), Quarterly.  
Units: mR/91 days

<u>Indicator</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
T-1	12.1 ± 1.2	10.6 ± 0.8	10.7 ± 1.1	12.8 ± 0.8
T-2	10.5 ± 0.7	11.4 ± 0.8	10.2 ± 0.8	12.9 ± 0.8
T-3	10.6 ± 1.2	10.3 ± 0.9	10.1 ± 1.2	12.3 ± 1.0
T-4	11.3 ± 0.7	12.4 ± 0.6	11.2 ± 0.7	14.1 ± 0.7
T-5	12.9 ± 0.8	14.1 ± 1.1	12.7 ± 0.6	16.1 ± 0.9
T-6	10.8 ± 1.0	9.9 ± 0.6	11.4 ± 1.3	12.2 ± 0.7
T-7	16.6 ± 0.7	16.6 ± 0.6	16.6 ± 0.9	17.0 ± 1.0
T-10	14.6 ± 0.8	14.9 ± 0.7	15.3 ± 0.8	16.9 ± 0.9
T-38	10.7 ± 0.8	11.4 ± 1.3	11.2 ± 0.8	12.6 ± 1.4
T-40	9.8 ± 0.8	11.3 ± 1.0	9.7 ± 0.6	12.7 ± 1.0
T-41	10.0 ± 0.9	9.8 ± 0.6	10.7 ± 1.0	11.7 ± 0.7
T-42	10.6 ± 1.0	10.9 ± 0.9	11.1 ± 1.3	12.6 ± 1.0
T-43	13.7 ± 1.8	13.8 ± 0.8	13.6 ± 1.1	15.7 ± 0.8
T-44	17.9 ± 0.9	18.9 ± 1.2	20.1 ± 1.3	22.0 ± 1.1
T-45	17.1 ± 0.6	17.0 ± 1.2	17.9 ± 0.8	19.5 ± 1.5
T-46	11.4 ± 0.7	12.0 ± 0.8	11.9 ± 1.2	13.6 ± 0.9
T-47	9.2 ± 1.0	8.8 ± 0.8	9.7 ± 1.1	10.3 ± 0.9
T-48	10.3 ± 1.0	11.0 ± 0.8	10.8 ± 0.6	12.6 ± 0.8
T-49	8.9 ± 0.8	10.2 ± 1.2	9.2 ± 0.8	10.3 ± 1.4
T-51	18.5 ± 1.3	17.6 ± 1.4	19.3 ± 1.3	19.2 ± 1.4
T-52	16.8 ± 1.7	17.3 ± 0.7	17.9 ± 2.0	18.6 ± 0.8
T-54	18.0 ± 1.3	18.4 ± 1.2	19.1 ± 1.1	21.1 ± 1.3
T-55	11.6 ± 1.4	10.9 ± 1.1	11.6 ± 1.4	11.9 ± 1.1
T-60	12.9 ± 1.1	13.0 ± 1.5	15.2 ± 1.4	14.9 ± 1.6
T-62	8.8 ± 0.4	9.0 ± 0.9	10.5 ± 0.3	10.2 ± 0.9
T-67	15.3 ± 1.0	16.5 ± 1.1	17.8 ± 0.8	19.4 ± 1.2
T-68	14.0 ± 1.3	13.3 ± 0.9	17.3 ± 0.5	15.1 ± 0.8
T-69	15.1 ± 0.7	19.7 ± 1.3	17.9 ± 0.8	18.4 ± 0.8
T-71	8.7 ± 0.3	10.4 ± 0.9	11.7 ± 0.2	12.0 ± 1.0
T-73	14.8 ± 1.1	16.8 ± 1.2	17.4 ± 0.8	18.3 ± 1.4
T-74	13.8 ± 0.5	14.4 ± 0.9	16.3 ± 0.6	15.9 ± 1.4



Table 12. Area monitors (TLD), Quarterly.  
Units: mR/91 days

<u>Indicator</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
T-125	15.8 ± 0.9	14.5 ± 0.9	18.6 ± 1.0	14.6 ± 1.0
T-126	14.6 ± 0.7	17.2 ± 1.0	17.8 ± 0.8	17.4 ± 1.0
T-127	17.8 ± 1.0	17.6 ± 1.2	21.3 ± 0.8	20.8 ± 1.5
T-128	15.4 ± 1.5	16.7 ± 0.9	18.3 ± 1.6	20.6 ± 1.2
T-142	41.7 ± 0.7	10.4 ± 1.2	10.8 ± 0.8	11.6 ± 1.3
T-150	12.2 ± 0.9	12.3 ± 1.2	12.9 ± 0.8	15.0 ± 1.2
T-154	16.5 ± 0.6	20.4 ± 1.5	20.2 ± 0.6	23.4 ± 1.7
T-201	12.6 ± 0.6	13.9 ± 0.5	13.2 ± 0.5	14.5 ± 0.5
T-203	14.4 ± 0.6	15.6 ± 1.5	17.2 ± 0.8	13.9 ± 1.0
T-206	9.9 ± 0.6	11.2 ± 0.4	9.8 ± 0.5	11.4 ± 0.6
T-208	8.3 ± 0.7	10.8 ± 0.8	9.6 ± 0.7	11.6 ± 0.8
T-211	8.2 ± 0.6	7.2 ± 0.7	9.9 ± 0.9	7.8 ± 1.0
T-212	8.4 ± 0.7	9.9 ± 0.8	9.6 ± 0.4	10.5 ± 1.1
T-217	15.2 ± 1.6	15.3 ± 1.3	18.2 ± 1.3	16.5 ± 1.6
T-218	17.7 ± 0.8	18.4 ± 1.3	21.1 ± 0.8	19.9 ± 1.4
T-219	12.5 ± 1.1	14.6 ± 1.4	14.8 ± 1.0	15.8 ± 1.6
T-220	15.1 ± 1.1	14.0 ± 1.1	15.6 ± 0.7	16.5 ± 1.3
T-222	8.3 ± 0.8	11.4 ± 1.2	12.4 ± 0.7	13.6 ± 1.6
T-224	7.6 ± 0.9	9.9 ± 0.8	11.9 ± 0.5	10.5 ± 1.0
Mean ± s.d.	13.4 ± 5.2	13.5 ± 3.3	14.2 ± 3.7	15.0 ± 3.6

Table 12. Area monitors (TLD), Quarterly.

Units: mR/91 days

	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
<u>Control</u>				
T-9	13.4 ± 1.4	12.7 ± 0.8	13.4 ± 0.8	14.4 ± 0.8
T-11	12.6 ± 0.6	12.7 ± 0.8	11.8 ± 0.7	14.1 ± 0.7
T-12	15.6 ± 1.0	16.1 ± 1.2	16.0 ± 0.9	18.7 ± 1.5
T-27	17.0 ± 1.3	18.6 ± 1.2	18.0 ± 1.3	20.8 ± 0.9
Mean ± s.d.	14.7 ± 2.0	15.0 ± 2.9	14.8 ± 2.7	17.0 ± 3.3
T-100	13.8 ± 1.5	14.5 ± 1.2	16.5 ± 1.0	16.9 ± 1.4
T-124	17.7 ± 1.2	19.3 ± 1.0	20.5 ± 1.1	19.8 ± 1.0
T-155	14.3 ± 0.7	14.0 ± 1.0	16.3 ± 0.7	16.4 ± 1.4
T-221	14.7 ± 0.8	18.4 ± 1.0	20.6 ± 0.8	19.9 ± 0.9
Mean ± s.d.	15.1 ± 1.8	16.6 ± 2.7	18.5 ± 2.4	18.3 ± 1.9
<u>QC</u>				
T-80	8.0 ± 0.8	9.7 ± 1.0	10.8 ± 0.7	11.0 ± 0.9
T-83	8.6 ± 0.7	9.9 ± 1.5	10.9 ± 0.7	10.6 ± 1.2
T-84	11.0 ± 0.8	11.7 ± 0.9	11.8 ± 0.7	12.2 ± 0.8
T-113	17.0 ± 0.4	17.6 ± 1.1	20.6 ± 0.5	18.4 ± 1.1
T-200	8.7 ± 0.6	11.4 ± 0.9	10.2 ± 0.6	12.2 ± 0.7
Mean ± s.d.	10.7 ± 3.7	12.1 ± 3.2	12.9 ± 4.4	12.9 ± 3.2
<u>Shield</u>				
T-87	5.7 ± 0.9	8.1 ± 1.1	6.8 ± 0.5	6.7 ± 0.9

Table 13. Milk, analyses for strontium-89, strontium-90, iodine-131, gamma emitting isotopes, calcium and stable potassium.

Monthly collections, location T-24

Units: pCi/L

Date Collected	01-29-19	02-26-19	04-03-19	05-01-19
Lab Code	TMI- 286	TMI- 536	TMI- 1006	TMI- 1489
I-131	< 0.5	< 0.3	< 0.5	< 0.3
Sr-89	< 0.6	< 0.7	< 0.7	< 0.5
Sr-90	< 0.6	< 0.7	< 0.6	< 0.5
K-40	1311 ± 119	1363 ± 120	1290 ± 120	1333 ± 110
Cs-134	< 4.6	< 3.7	< 4.0	< 4.1
Cs-137	< 2.4	< 2.9	< 2.1	< 2.9
Ba-La-140	< 3.0	< 2.9	< 2.1	< 2.1
Ca (g/L)	1.06	1.08	0.96	0.92
Sr-90/g Ca	< 0.57	< 0.65	< 0.63	< 0.54
K (g/L)	1.60 ± 0.15	1.66 ± 0.15	1.57 ± 0.15	1.63 ± 0.13
Cs-137/g K	< 1.50	< 1.75	< 1.34	< 1.78

Milk Sampling Discontinued

Table 14. Ground water samples, analyses for gross beta, tritium, strontium-89, strontium-90 and gamma-emitting isotopes.

Collection: Quarterly

Units: pCi/L

Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Location	T-27A (C)				
Lab Code	TWW- 1010		TWW- 2847	TWW- 3912	Req. LLD
Date Collected	03-13-19	NS <sup>a</sup>	07-11-19	10-08-19	
Gross beta	2.8 ± 1.3		< 3.8	3.8	4.0
H-3	< 330		< 330	< 330	330
Sr-89	< 0.8		< 1.6	< 0.6	
Sr-90	< 0.5		< 0.9	< 0.5	
Mn-54	< 3.5		< 3.3	< 2.2	15
Fe-59	< 6.7		< 6.4	< 5.3	30
Co-58	< 2.0		< 1.8	< 2.0	15
Co-60	< 1.7		< 1.7	< 1.5	15
Zn-65	< 3.5		< 3.7	< 3.3	30
Zr-Nb-95	< 5.6		< 3.8	< 4.3	15
Cs-134	< 4.2		< 3.8	< 3.1	15
Cs-137	< 3.4		< 3.5	< 3.1	18
Ba-La-140	< 5.2		< 8.2	< 5.4	15

<sup>a</sup> No sample sent.

Table 17. Green leafy vegetables, analyses for strontium-89, strontium-90, iodine-131 and other gamma-emitting isotopes.

Collection: Monthly, in season

Units: pCi/g wet

Location		T-17 (I)		
Lab Code	TVE- 3643	TVE- 4163	TVE- 4562	
Date Collected	09-25-19	10-30-19	11-27-19	
Sample Type	Cabbage	Cabbage	Cabbage	
Sr-89	< 0.011	< 0.011	< 0.005	
Sr-90	< 0.007	< 0.008	< 0.004	
I-131	< 0.026	< 0.023	< 0.018	
K-40	2.78 ± 0.29	2.91 ± 0.31	2.28 ± 0.24	
Nb-95	< 0.009	< 0.008	< 0.007	
Zr-95	< 0.014	< 0.022	< 0.008	
Cs-134	< 0.010	< 0.009	< 0.008	
Cs-137	< 0.011	< 0.011	< 0.009	
Ce-141	< 0.019	< 0.012	< 0.018	
Ce-144	< 0.053	< 0.055	< 0.049	

Location		T-19 (I)			
		19C			
Lab Code	TVE- 3281	TVE- 3644	TVE- 4164	TVE- 4564	
Date Collected	08-28-19	09-25-19	10-30-19	11-27-19	
Sample Type	Cabbage	Cabbage	Cabbage	Cabbage	
Sr-89	< 0.005	< 0.007	< 0.004	< 0.004	
Sr-90	< 0.003	< 0.004	< 0.002	< 0.003	
I-131	< 0.021	< 0.029	< 0.026	< 0.027	
K-40	2.44 ± 0.24	2.07 ± 0.27	2.17 ± 0.29	2.51 ± 0.29	
Nb-95	< 0.007	< 0.011	< 0.020	< 0.020	
Zr-95	< 0.008	< 0.017	< 0.021	< 0.013	
Cs-134	< 0.008	< 0.012	< 0.017	< 0.011	
Cs-137	< 0.007	< 0.008	< 0.013	< 0.013	
Ce-141	< 0.019	< 0.016	< 0.034	< 0.027	
Ce-144	< 0.068	< 0.079	< 0.119	< 0.077	

Location		T-19 (I)				
		19K				
Lab Code	TVE- 2840	TVE- 3282	TVE- 3646	TVE- 4165	TVE- 4563	
Date Collected	07-31-19	08-28-19	09-25-19	10-30-19	11-27-19	
Sample Type	Kale	Kale	Kale	Kale	Kale	
Sr-89	< 0.028	< 0.025	< 0.032	< 0.019	< 0.015	
Sr-90	< 0.022	< 0.015	< 0.020	< 0.015	< 0.010	
I-131	< 0.042	< 0.042	< 0.024	< 0.024	< 0.028	
K-40	3.99 ± 0.47	3.86 ± 0.35	4.57 ± 0.39	2.77 ± 0.33	5.00 ± 0.45	
Nb-95	< 0.019	< 0.011	< 0.016	< 0.013	< 0.018	
Zr-95	< 0.033	< 0.015	< 0.017	< 0.017	< 0.029	
Cs-134	< 0.021	< 0.012	< 0.011	< 0.013	< 0.015	
Cs-137	< 0.018	< 0.013	< 0.009	< 0.014	< 0.013	
Ce-141	< 0.044	< 0.031	< 0.014	< 0.024	< 0.021	
Ce-144	< 0.104	< 0.083	< 0.075	< 0.075	< 0.096	

Table 17. Green leafy vegetables, analyses for strontium-89, strontium-90, iodine-131 and other gamma-emitting isotopes.

Collection: Monthly, in season

Units: pCi/g wet

Location	T-30			
Lab Code	TVE- 2842	TVE- 3283	TVE- 3647	TVE- 3647
Date Collected	07-31-19	08-28-19	09-25-19	09-25-19
Sample Type	Kale	Kale	Kale	Kale
Sr-89	< 0.030	< 0.019	< 0.039	< 0.039
Sr-90	< 0.023	< 0.012	< 0.026	< 0.026
I-131	< 0.018	< 0.035	< 0.036	< 0.036
K-40	4.51 ± 0.43	3.25 ± 0.37	4.64 ± 0.39	4.64 ± 0.39
Nb-95	< 0.009	< 0.010	< 0.009	< 0.009
Zr-95	< 0.014	< 0.014	< 0.021	< 0.021
Cs-134	< 0.015	< 0.012	< 0.014	< 0.014
Cs-137	< 0.018	< 0.011	< 0.008	< 0.008
Ce-141	< 0.032	< 0.021	< 0.027	< 0.027
Ce-144	< 0.122	< 0.075	< 0.099	< 0.099

Location	T-37 (C)		
Lab Code	TVE- 3284	TVE- 3648	
Date Collected	08-28-19	09-24-19	10-29-19
Sample Type	Cabbage	Cabbage	
Sr-89	< 0.006	< 0.006	NS <sup>a</sup>
Sr-90	< 0.004	< 0.004	
I-131	< 0.034	< 0.019	
K-40	1.89 ± 0.24	1.67 ± 0.21	
Nb-95	< 0.015	< 0.009	
Zr-95	< 0.022	< 0.018	
Cs-134	< 0.012	< 0.009	
Cs-137	< 0.006	< 0.008	
Ce-141	< 0.027	< 0.012	
Ce-144	< 0.079	< 0.043	

<sup>a</sup> NS - No sample collected. See table 2.0, Listing Of Missed Samples

Table 17. Green leafy vegetables, analyses for strontium-89, strontium-90, iodine-131 and other gamma-emitting isotopes.

Collection: Monthly, in season

Units: pCi/g wet

Location		T-227 (I)		
Lab Code	TVE- 3285	TVE- 3649	TVE- 4167	TVE- 4565
Date Collected	08-28-19	09-25-19	10-30-19	11-27-19
Sample Type	Cabbage	Cabbage	Cabbage	Cabbage
Sr-89	< 0.006	< 0.013	< 0.004	< 0.003
Sr-90	< 0.005	< 0.007	< 0.004	< 0.002
I-131	< 0.023	< 0.040	< 0.031	< 0.022
K-40	1.87 ± 0.23	2.26 ± 0.28	2.34 ± 0.27	2.31 ± 0.27
Nb-95	< 0.012	< 0.008	< 0.007	< 0.013
Zr-95	< 0.008	< 0.016	< 0.017	< 0.020
Cs-134	< 0.009	< 0.010	< 0.010	< 0.012
Cs-137	< 0.007	< 0.010	< 0.013	< 0.008
Ce-141	< 0.016	< 0.024	< 0.021	< 0.017
Ce-144	< 0.059	< 0.068	< 0.081	< 0.094

Table 21. Treated surface water samples, analyses for gross beta.  
Collection: Monthly composites of weekly grab samples  
Units: pCi/L

T-11 (C)			T-22		
Lab Code	Date Collected	Gross Beta	Lab Code	Date Collected	Gross Beta
TSWT- 298	01-29-19	1.8 ± 0.6	TSWT- 299	01-29-19	1.3 ± 0.6
TSWT- 537	02-26-19	< 0.9	TSWT- 538	02-26-19	1.1 ± 0.5
TSWT- 1007	04-02-19	1.3 ± 0.6	TSWT- 1008	04-02-19	1.4 ± 0.6
TSWT- 1492	04-30-19	1.0 ± 0.5	TSWT- 1493	04-30-19	1.4 ± 0.6
TSWT- 1882	05-28-19	< 0.9	TSWT- 1883	05-28-19	< 0.9
TSWT- 2353	06-25-19	1.7 ± 0.6	TSWT- 2354	06-25-19	1.7 ± 0.6
TSWT- 2837	07-30-19	< 0.9	TSWT- 2838	07-30-19	1.4 ± 0.6
TSWT- 3286	09-03-19	1.0 ± 0.5	TSWT- 3287	09-03-19	0.9 ± 0.5
TSWT- 3650	10-01-19	1.4 ± 0.6	TSWT- 3651	10-01-19	1.0 ± 0.5
TSWT- 4168	10-29-19	< 0.8	TSWT- 4169	10-29-19	< 0.9
TSWT- 4597	11-26-19	1.9 ± 0.6	TSWT- 4598	11-26-19	1.1 ± 0.5
TSWT- 4890	12-31-19	1.1 ± 0.6	TSWT- 4892	12-31-19	2.3 ± 0.6

  

T-143 (QC)		
Lab Code	Date Collected	Gross Beta
TSWT- 300	01-29-19	< 0.9
TSWT- 539	02-26-19	1.5 ± 0.6
TSWT- 1009	04-02-19	1.9 ± 0.6
TSWT- 1494	04-30-19	1.0 ± 0.5
TSWT- 1884	05-28-19	1.3 ± 0.6
TSWT- 2355	06-25-19	1.2 ± 0.6
TSWT- 2839	07-30-19	1.4 ± 0.6
TSWT- 3288	09-03-19	1.7 ± 0.6
TSWT- 3652	10-01-19	< 0.9
TSWT- 4170	10-29-19	1.2 ± 0.5
TSWT- 4600	11-26-19	1.0 ± 0.5
TSWT- 4893	12-31-19	< 0.9



Table 22. Treated surface water samples, analyses for tritium, strontium-89, strontium-90 and gamma-emitting isotopes.  
Collection: Quarterly composites of weekly grab samples  
Units: pCi/L

Location T-11 (C)					
Period Lab Code	1st Qtr. TSWT- 1011	2nd Qtr. TSWT- 2374	3rd Qtr. TSWT- 3689	4th Qtr. TSWT- 4910	Req. LLD
H-3	< 330	< 330	< 330	< 330	330
Sr-89	< 0.7	< 0.6	< 0.6	< 0.7	
Sr-90	< 0.5	< 0.4	< 0.5	< 0.5	
Mn-54	< 2.2	< 2.6	< 2.4	< 3.0	15
Fe-59	< 3.6	< 6.4	< 5.4	< 4.4	30
Co-58	< 2.1	< 2.2	< 3.2	< 3.0	15
Co-60	< 1.8	< 2.5	< 2.0	< 3.0	15
Zn-65	< 1.8	< 7.3	< 7.4	< 1.8	30
Zr-Nb-95	< 4.5	< 4.9	< 4.7	< 3.3	15
Cs-134	< 4.2	< 3.9	< 4.1	< 3.9	10
Cs-137	< 2.3	< 3.3	< 2.5	< 2.1	18
Ba-La-140	< 2.6	< 8.0	< 2.3	< 3.5	15

  

Location T-22					
Period Lab Code	1st Qtr. TSWT- 1012	2nd Qtr. TSWT- 2375	3rd Qtr. TSWT- 3690	4th Qtr. TSWT- 4911	Req. LLD
H-3	< 330	< 330	< 330	336 ± 91	330
Sr-89	< 0.6	< 0.6	< 0.6	< 0.8	
Sr-90	< 0.5	< 0.4	< 0.5	< 0.5	
Mn-54	< 3.2	< 3.8	< 2.6	< 2.8	15
Fe-59	< 4.0	< 7.5	< 5.4	< 3.1	30
Co-58	< 1.5	< 3.5	< 2.4	< 1.4	15
Co-60	< 1.5	< 2.6	< 2.0	< 2.0	15
Zn-65	< 6.4	< 5.5	< 4.2	< 2.7	30
Zr-Nb-95	< 3.4	< 5.5	< 2.0	< 4.6	15
Cs-134	< 3.8	< 3.4	< 3.6	< 3.8	10
Cs-137	< 2.5	< 3.3	< 3.9	< 2.2	18
Ba-La-140	< 2.6	< 10.4	< 2.8	< 4.2	15

Table 23. Untreated surface water, analyses for gross beta, tritium and gamma emitting isotopes.  
Location: T-3  
Collection: Monthly composites of weekly grab samples  
Units: pCi/L

Lab Code	TSWU- 301	TSWU- 540	TSWU- 1013	TSWU- 1495	
Date Collected	01-29-19	02-26-19	04-02-19	04-30-19	Req. LLD
Gross beta	2.9 ± 0.7	1.7 ± 0.6	2.8 ± 0.7	2.4 ± 0.7	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 2.7	< 2.7	< 2.6	< 2.2	15
Fe-59	< 4.0	< 4.6	< 2.0	< 3.6	30
Co-58	< 1.9	< 2.5	< 3.7	< 2.6	15
Co-60	< 2.4	< 2.5	< 1.3	< 1.2	15
Zn-65	< 7.9	< 2.9	< 4.5	< 5.5	30
Zr-Nb-95	< 3.3	< 1.7	< 2.7	< 4.5	15
Cs-134	< 4.1	< 3.2	< 3.8	< 3.9	10
Cs-137	< 3.5	< 2.9	< 3.2	< 3.0	18
Ba-La-140	< 5.1	< 3.5	< 3.1	< 4.4	15

  

Lab Code	TSWU- 1885	TSWU- 2358	TSWU- 2843	TSWU- 3289	
Date Collected	05-28-19	06-25-19	07-30-19	09-03-19	Req. LLD
Gross beta	2.3 ± 0.7	2.4 ± 1.1	1.6 ± 0.6	2.3 ± 0.6	4.0
H-3	< 330	< 330	< 330	430 ± 95	330
Mn-54	< 4.1	< 2.9	< 4.1	< 2.6	15
Fe-59	< 5.9	< 5.2	< 8.3	< 4.2	30
Co-58	< 3.6	< 2.8	< 2.4	< 3.8	15
Co-60	< 4.7	< 2.3	< 1.7	< 2.8	15
Zn-65	< 10.4	< 1.9	< 5.6	< 6.1	30
Zr-Nb-95	< 6.7	< 3.5	< 5.0	< 3.0	15
Cs-134	< 5.4	< 4.1	< 4.8	< 3.1	10
Cs-137	< 5.7	< 4.5	< 3.6	< 1.5	18
Ba-La-140	< 9.3	< 7.3	< 7.4	< 2.5	15

  

Lab Code	TSWU- 3653	TSWU- 4171	TSWU- 4591	TSWU- 4894	
Date Collected	10-01-19	10-29-19	11-26-19	12-31-19	Req. LLD
Gross beta	1.1 ± 0.5	2.0 ± 0.6	1.7 ± 0.6	2.8 ± 0.7	4.0
H-3	515 ± 98	431 ± 94	< 330	< 330	330
Mn-54	3.1	< 6.6	< 3.9	< 2.7	15
Fe-59	6.0	< 10.0	< 7.5	< 3.0	30
Co-58	3.6	< 4.8	< 5.2	< 1.6	15
Co-60	1.9	< 5.9	< 4.5	< 2.6	15
Zn-65	4.5	< 17.3	< 3.8	< 3.2	30
Zr-Nb-95	2.7	< 9.6	< 7.0	< 2.8	15
Cs-134	4.4	< 6.2	< 6.6	< 3.4	10
Cs-137	4.9	< 6.0	< 3.4	< 2.1	18
Ba-La-140	3.1	< 7.7	< 8.0	< 3.1	15

Table 23. Untreated surface water, analyses for gross beta, tritium and gamma emitting isotopes.  
Location: T-11 (C)  
Collection: Monthly composites of weekly grab samples  
Units: pCi/L

Lab Code	TSWU- 302	TSWU- 541	TSWU- 1014	TSWU- 1496	
Date Collected	01-29-19	02-26-19	04-02-19	04-30-19	Req. LLD
Gross beta	1.7 ± 0.6	1.5 ± 0.6	1.2 ± 0.6	1.5 ± 0.6	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 3.7	< 3.4	< 2.7	< 3.3	15
Fe-59	< 6.2	< 4.3	< 5.0	< 3.2	30
Co-58	< 2.7	< 2.4	< 3.6	< 2.1	15
Co-60	< 1.1	< 2.1	< 1.3	< 2.7	15
Zn-65	< 3.8	< 5.5	< 2.8	< 4.5	30
Zr-Nb-95	< 4.2	< 2.8	< 2.7	< 3.3	15
Cs-134	< 4.4	< 4.5	< 3.9	< 3.2	10
Cs-137	< 3.8	< 2.4	< 3.8	< 3.6	18
Ba-La-140	< 2.9	< 1.8	< 2.1	< 5.5	15

  

Lab Code	TSWU- 1886	TSWU- 2359	TSWU- 2844	TSWU- 3290	
Date Collected	05-28-19	06-25-19	07-30-19	09-03-19	Req. LLD
Gross beta	1.2 ± 0.6	1.8 ± 0.6	1.3 ± 0.5	1.5 ± 0.6	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 4.0	< 2.2	< 2.9	< 2.8	15
Fe-59	< 7.5	< 5.7	< 5.0	< 3.7	30
Co-58	< 3.9	< 3.0	< 4.3	< 3.3	15
Co-60	< 4.7	< 1.7	< 1.2	< 1.6	15
Zn-65	< 3.7	< 2.6	< 3.0	< 3.3	30
Zr-Nb-95	< 6.4	< 2.5	< 4.6	< 2.4	15
Cs-134	< 4.5	< 3.7	< 4.7	< 3.1	10
Cs-137	< 5.2	< 2.7	< 3.3	< 3.2	18
Ba-La-140	< 3.1	< 4.0	< 6.1	< 4.3	15

  

Lab Code	TSWU- 3655	TSWU- 4172	TSWU- 4592	TSWU- 4895	
Date Collected	10-01-19	10-29-19	11-26-19	12-31-19	Req. LLD
Gross beta	0.9 ± 0.5	0.9 ± 0.5	< 1.8	1.2 ± 0.6	4.0
H-3	< 330	< 330	367 ± 91	< 330	330
Mn-54	< 4.5	< 4.2	< 3.5	< 2.7	15
Fe-59	< 4.6	< 6.2	< 3.5	< 5.2	30
Co-58	< 3.9	< 3.5	< 2.7	< 2.2	15
Co-60	< 3.9	< 3.6	< 3.3	< 2.2	15
Zn-65	< 8.1	< 5.5	< 5.2	< 3.5	30
Zr-Nb-95	< 4.3	< 3.0	< 4.3	< 3.0	15
Cs-134	< 5.1	< 4.7	< 3.2	< 3.3	10
Cs-137	< 4.0	< 4.3	< 3.3	< 3.7	18
Ba-La-140	< 4.1	< 3.5	< 6.7	< 3.9	15

Table 23. Untreated surface water, analyses for gross beta, tritium and gamma emitting isotopes.

Location: T-22

Collection: Monthly composites of weekly grab samples

Units: pCi/L

Lab Code	TSWU- 303 <sup>a</sup>	TSWU- 542	TSWU- 1015	TSWU- 1497	
Date Collected	01-29-19	02-26-19	04-02-19	04-30-19	Req. LLD
Gross beta	2.3 ± 0.7	1.7 ± 0.6	1.6 ± 0.6	1.9 ± 0.6	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 4.4	< 4.7	< 2.4	< 2.5	15
Fe-59	< 7.1	< 8.5	< 3.9	< 6.2	30
Co-58	< 3.8	< 5.5	< 1.9	< 1.4	15
Co-60	< 2.1	< 3.2	< 2.1	< 2.6	15
Zn-65	< 4.5	< 14.9	< 4.1	< 1.7	30
Zr-Nb-95	< 4.5	< 9.5	< 3.0	< 4.1	15
Cs-134	< 3.6	< 6.6	< 2.9	< 3.0	10
Cs-137	< 4.1	< 5.5	< 3.3	< 2.3	18
Ba-La-140	< 1.9	< 6.8	< 3.7	< 4.8	15
Lab Code	TSWU- 1887	TSWU- 2360	TSWU- 2845	TSWU- 3291	
Date Collected	05-28-19	06-25-19	07-30-19	09-03-19	Req. LLD
Gross beta	1.9 ± 0.6	1.9 ± 0.6	1.4 ± 0.6	1.3 ± 0.6	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 2.9	< 3.0	< 3.3	< 3.3	15
Fe-59	< 4.2	< 4.3	< 9.3	< 4.4	30
Co-58	< 2.9	< 2.0	< 4.0	< 2.5	15
Co-60	< 2.7	< 3.2	< 1.3	< 2.4	15
Zn-65	< 4.0	< 4.0	< 4.6	< 4.5	30
Zr-Nb-95	< 3.1	< 4.1	< 3.7	< 2.9	15
Cs-134	< 3.3	< 3.3	< 5.1	< 3.9	10
Cs-137	< 4.0	< 1.7	< 3.3	< 2.1	18
Ba-La-140	< 5.4	< 5.9	< 4.3	< 7.9	15
Lab Code	TSWU- 3657	TSWU- 4173	TSWU- 4593	TSWU- 4896	
Date Collected	10-01-19	10-29-19	11-26-19	12-31-19	Req. LLD
Gross beta	1.0 ± 0.5	1.1 ± 0.6	1.5 ± 0.6	1.3 ± 0.6	4.0
H-3	546 ± 99	480 ± 96	< 330	< 330	330
Mn-54	< 1.6	< 3.1	< 2.8	< 2.6	15
Fe-59	< 4.4	< 3.2	< 4.4	< 4.2	30
Co-58	< 1.2	< 2.8	< 1.2	< 2.7	15
Co-60	< 1.9	< 2.0	< 2.8	< 1.7	15
Zn-65	< 3.6	< 3.4	< 5.8	< 2.3	30
Zr-Nb-95	< 2.3	< 2.4	< 2.6	< 2.9	15
Cs-134	< 3.5	< 3.0	< 3.4	< 2.9	10
Cs-137	< 3.0	< 3.1	< 3.5	< 2.0	18
Ba-La-140	< 3.1	< 2.8	< 4.4	< 3.9	15

<sup>a</sup> Sample leaked during transportation. Only 1 liter tested for gamma.

Table 23. Untreated surface water, analyses for gross beta, tritium and gamma emitting isotopes.  
Location: T-145 (QC)  
Collection: Monthly composites of weekly grab samples  
Units: pCi/L

Lab Code	TSWU- 305	TSWU- 543	TSWU- 1016	TSWU- 1498	
Date Collected	01-29-19	02-26-19	04-02-19	04-30-19	Req. LLD
Gross beta	1.6 ± 0.6	1.4 ± 0.6	1.2 ± 0.5	2.0 ± 0.6	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 2.0	< 2.1	< 1.8	< 2.7	15
Fe-59	< 3.7	< 4.6	< 2.7	< 5.1	30
Co-58	< 2.4	< 1.8	< 2.4	< 2.1	15
Co-60	< 2.5	< 1.4	< 2.7	< 2.7	15
Zn-65	< 7.2	< 2.7	< 4.1	< 4.2	30
Zr-Nb-95	< 2.5	< 2.9	< 1.9	< 1.8	15
Cs-134	< 3.2	< 3.3	< 2.2	< 3.3	10
Cs-137	< 3.4	< 3.9	< 3.0	< 3.6	18
Ba-La-140	< 1.6	< 2.7	< 2.0	< 3.0	15

  

Lab Code	TSWU- 1888	TSWU- 2361	TSWU- 2846	TSWU- 3292	
Date Collected	05-28-19	06-25-19	07-30-19	09-03-19	Req. LLD
Gross beta	1.1 ± 0.5	1.8 ± 0.6	1.1 ± 0.5	< 0.8	4.0
H-3	< 330	< 330	< 330	< 330	330
Mn-54	< 2.3	< 2.8	< 3.4	< 2.0	15
Fe-59	< 4.8	< 7.1	< 7.0	< 6.6	30
Co-58	< 1.9	< 2.1	< 4.3	< 3.7	15
Co-60	< 3.7	< 1.9	< 2.6	< 1.9	15
Zn-65	< 3.5	< 1.8	< 4.3	< 4.5	30
Zr-Nb-95	< 4.8	< 2.1	< 3.0	< 5.2	15
Cs-134	< 3.6	< 2.8	< 4.7	< 3.3	10
Cs-137	< 2.7	< 2.5	< 5.6	< 3.7	18
Ba-La-140	< 8.1	< 6.7	< 4.2	< 3.2	15

  

Lab Code	TSWU- 3658	TSWU- 4174	TSWU- 4594	TSWU- 4897	
Date Collected	10-01-19	10-29-19	11-26-19	12-31-19	Req. LLD
Gross beta	1.4 ± 0.6	1.2 ± 0.5	< 1.7	1.1 ± 0.5	4.0
H-3	< 330	561 ± 100	< 330	< 330	330
Mn-54	< 3.4	< 2.6	< 2.7	< 2.0	15
Fe-59	< 4.8	< 3.9	< 5.9	< 2.6	30
Co-58	< 2.7	< 1.6	< 2.8	< 2.3	15
Co-60	< 2.0	< 2.5	< 3.4	< 2.5	15
Zn-65	< 6.1	< 7.9	< 8.0	< 5.1	30
Zr-Nb-95	< 4.0	< 2.7	< 4.6	< 2.4	15
Cs-134	< 3.0	< 3.6	< 4.4	< 2.9	10
Cs-137	< 4.1	< 3.0	< 2.8	< 3.3	18
Ba-La-140	< 4.2	< 2.8	< 4.3	< 1.5	15

Table 24. Untreated surface water samples, analyses for strontium-89 and strontium-90.  
Collection: Quarterly composites of weekly grab samples  
Units: pCi/L

Location T-3				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	TSWU- 1137	TSWU- 2566	TSWU- 3854	TSWU- 4923
Sr-89	< 0.6	< 0.7	< 0.7	< 0.6
Sr-90	< 0.5	< 0.5	< 0.6	< 0.5

  

Location T-11 (C)				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	TSWU- 1138	TSWU- 2567	TSWU- 3855	TSWU- 4924
Sr-89	< 0.6	< 0.8	< 0.7	< 0.6
Sr-90	< 0.5	< 0.5	< 0.6	< 0.5

  

Location T-22				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	TSWU- 1139	TSWU- 2568	TSWU- 3856	TSWU- 4925
Sr-89	< 0.5	< 0.6	< 0.6	< 0.6
Sr-90	< 0.5	< 0.4	< 0.5	< 0.5

Table 25. Fish samples, analyses for gross beta and gamma-emitting isotopes.

Collection: Annually

Units: pCi/g wet

Location		T-33 (Lake Erie, 1.5 mi. NE of Station)	
Lab Code	TF- 3381	TF- 3382	
Date Collected	04-07-19	05-25-19	
Sample Type	Walleye	White Perch; White Bass	
Gross Beta	3.52 ± 0.11	3.33 ± 0.11	
K-40	3.65 ± 0.31	3.22 ± 0.52	
Mn-54	< 0.011	< 0.028	
Fe-59	< 0.242	< 0.136	
Co-58	< 0.034	< 0.069	
Co-60	< 0.013	< 0.016	
Zn-65	< 0.031	< 0.073	
Cs-134	< 0.014	< 0.025	
Cs-137	< 0.016	< 0.021	
Location		T-35	
Lab Code	TF- 3383	TF- 3384	
Date Collected	04-07-19	06-10-19	
Sample Type	Walleye	White Perch; White Bass	
Gross Beta	4.38 ± 0.12	3.80 ± 0.12	
K-40	4.02 ± 0.33	3.78 ± 0.68	
Mn-54	< 0.018	< 0.040	
Fe-59	< 0.254	< 0.229	
Co-58	< 0.035	< 0.062	
Co-60	< 0.008	< 0.027	
Zn-65	< 0.045	< 0.073	
Cs-134	< 0.016	< 0.036	
Cs-137	< 0.012	< 0.032	

Table 26. Shoreline sediment samples, analyses for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/g dry

Location		T-3	T-11
Lab Code	TSS- 1490		TSS- 1491
Date Collected	04-03-19		04-03-19
K-40	9.44 ± 0.46		12.19 ± 0.55
Mn-54	< 0.016		< 0.015
Co-58	< 0.019		< 0.017
Co-60	< 0.009		< 0.012
Cs-134	< 0.011		< 0.011
Cs-137	< 0.009		< 0.010
Lab Code	TSS- 3900		TSS- 3902
Date Collected	10-15-19		10-15-19
K-40	12.06 ± 0.57		11.67 ± 0.56
Mn-54	< 0.014		< 0.017
Co-58	< 0.010		< 0.023
Co-60	< 0.018		< 0.018
Cs-134	< 0.010		< 0.012
Cs-137	< 0.013		< 0.013



## APPENDIX A

### INTERLABORATORY AND INTRALABORATORY COMPARISON PROGRAM RESULTS

**NOTE:** Appendix A is updated four times a year. The complete appendix is included in March, June, September and December monthly progress reports only.

October, 2018 through September, 2019

## Appendix A

### Interlaboratory/ Intralaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 lists analytical results from the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Complete analytical data for duplicate analyses is available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-7 were obtained through participation in the MRAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory acceptance criteria for various analyses.

Out-of-limit results are explained directly below the result.

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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Analysis	Ratio of lab result to known value.
Gamma Emitters	0.8 to 1.2
Strontium-89, Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226, Radium-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-129, Iodine-131	0.8 to 1.2
Nickel-63, Technetium-99, Uranium-238	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

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TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)<sup>a</sup>.

RAD study						
Lab Code	Date	Analysis	Concentration (pCi/L)			
			Laboratory Result	ERA Result	Control Limits	Acceptance
ERW-71	1/7/2019	Ba-133	97.9 ± 4.5	99.5	84.1 - 109	Pass
ERW-71	1/7/2019	Cs-134	45.4 ± 3.1	49.1	39.5 - 54.0	Pass
ERW-71	1/7/2019	Cs-137	129 ± 6	125	112 - 140	Pass
ERW-71	1/7/2019	Co-60	98.1 ± 4.1	96.4	86.8 - 108	Pass
ERW-71	1/7/2019	Zn-65	80.4 ± 7.8	77.4	69.5 ± 93.2	Pass
ERW-73	1/7/2019	Gr. Alpha	22.2 ± 1.6	21.8	10.9 - 29.5	Pass
ERW-73	1/7/2019	Gr. Beta	46.4 ± 1.4	55.7	38.1 - 62.6	Pass
ERW-75	1/7/2019	Ra-226	7.19 ± 0.30	7.37	5.55 ± 8.72	Pass
ERW-75	1/7/2019	Ra-228	4.02 ± 0.70	4.28	2.48 - 5.89	Pass
ERW-75	1/7/2019	Uranium	50.2 ± 2.9	68.2	55.7 - 75.0	Fail <sup>b</sup>
ERW-77	1/7/2019	H-3	2,129 ± 158	2,110	1,740 - 2,340	Pass
ERW-397	2/11/2019	I-131	27.2 ± 1.0	25.9	25.1 - 30.6	Pass
ERW-1141	4/8/2019	Ra-226	7.58 ± 0.53	7.15	5.39 - 8.48	Pass
ERW-1141	4/8/2019	Ra-228	2.64 ± 0.79	2.94	1.54 - 4.35	Pass
ERW-1141	4/8/2019	Uranium	67.0 ± 0.9	55.9	45.6 - 61.5	Fail <sup>c</sup>
ERW-2471	7/8/2019	Ba-133	66.5 ± 4.0	66.9	55.8 - 73.6	Pass
ERW-2471	7/8/2019	Cs-134	29.6 ± 2.6	32.0	25.1 - 35.2	Pass
ERW-2471	7/8/2019	Cs-137	21.3 ± 3.6	21.4	17.6 - 26.7	Pass
ERW-2471	7/8/2019	Co-60	99.9 ± 4.4	95.1	85.6 - 107.0	Pass
ERW-2471	7/8/2019	Zn-65	43.7 ± 6.2	41.2	35.3 - 51.4	Pass
ERW-2473	7/8/2019	Gr. Alpha	41.7 ± 2.1	70.6	37.1 - 87.1	Pass
ERW-2473	7/8/2019	Gr. Beta	57.0 ± 1.6	63.9	44.2 - 70.5	Pass
ERW-2477	7/8/2019	Ra-226	16.2 ± 0.5	18.5	13.8 - 21.1	Pass
ERW-2477	7/8/2019	Ra-228	6.2 ± 0.8	8.2	5.2 - 10.3	Pass
ERW-2477	7/8/2019	Uranium	63.8 ± 3.6	68.3	55.8 - 75.1	Pass
ERW-2479	7/8/2019	H-3	8,630 ± 200	16,700	14,600 - 18,400	Fail <sup>d</sup>
ERW-2475	7/8/2019	I-131	33.6 ± 1.3	29.6	24.6 - 34.6	Pass

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resource Associates (ERA).

<sup>b</sup> In order to get to the root cause of the above "Fail" resolution the U-232 tracer was standardized using a known concentration of NIST U-238 solution. A duplicate analysis was performed and the results obtained were well within the acceptance range (Known value for Total Uranium=68.2 pCi/L, acceptance range of (55.7-75 pCi/L). The results obtained were 63.3 pCi/L and 66.0 pCi/L respectively.

<sup>c</sup> The standardized U-232 value utilized on ERA sample ERW-75 (see footnote "b" above) was found to be estimated high due to interferences in the U-238 solution causing the ERW-1141 Uranium PT failure above. After performing U-isotopic chemistry on the NIST-Uranium solution to remove interferences a more accurate U-232 tracer concentration was obtained. The subsequent ERA PT study was acceptable. See ERW-2477 Uranium result above.

<sup>d</sup> H-3 analysis was performed using the ERA provided blank sample. Pairing the ERA supplied blank and the lab routine blank with standard vials created confusion and resulted in the standard total count time being mistalled by half. The resulting batch efficiency was overstated by a factor of two and the reported ERA results were understated by half. The result of reanalysis, (17,400 pCi/L), is within the control limits for the study.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO<sub>4</sub>: Dy Cards).<sup>a</sup>

mrem						
Lab Code	Irradiation		Delivered	Reported <sup>b</sup>	Performance <sup>c</sup>	
	Date	Description	Dose	Dose	Quotient (P)	
<u>Environmental, Inc.</u>		Group 1				
2018-1	11/15/2018	Spike 1	97.0	81.6	-0.16	
2018-1	11/15/2018	Spike 2	97.0	88.5	-0.09	
2018-1	11/15/2018	Spike 3	97.0	87.9	-0.09	
2018-1	11/15/2018	Spike 4	97.0	85.6	-0.12	
2018-1	11/15/2018	Spike 5	97.0	86.5	-0.11	
2018-1	11/15/2018	Spike 6	97.0	89.0	-0.08	
2018-1	11/15/2018	Spike 7	97.0	85.1	-0.12	
2018-1	11/15/2018	Spike 8	97.0	90.6	-0.07	
2018-1	11/15/2018	Spike 9	97.0	91.3	-0.06	
2018-1	11/15/2018	Spike 10	97.0	84.5	-0.13	
2018-1	11/15/2018	Spike 11	97.0	90.8	-0.06	
2018-1	11/15/2018	Spike 12	97.0	93.8	-0.03	
2018-1	11/15/2018	Spike 13	97.0	85.3	-0.12	
2018-1	11/15/2018	Spike 14	97.0	85.5	-0.12	
2018-1	11/15/2018	Spike 15	97.0	86.9	-0.10	
2018-1	11/15/2018	Spike 16	97.0	88.6	-0.09	
2018-1	11/15/2018	Spike 17	97.0	83.1	-0.14	
2018-1	11/15/2018	Spike 18	97.0	85.4	-0.12	
2018-1	11/15/2018	Spike 19	97.0	83.3	-0.14	
2018-1	11/15/2018	Spike 20	97.0	85.5	-0.12	
Mean (Spike 1-20)				86.9	-0.10	Pass <sup>d</sup>
Standard Deviation (Spike 1-20)				3.1	0.03	Pass <sup>d</sup>

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point  $H^*(10)K_a = 1.20$  . mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO<sub>4</sub>: Dy Cards).<sup>a</sup>

mrem						
Lab Code	Irradiation		Delivered	Reported <sup>b</sup>	Performance <sup>c</sup>	
	Date	Description	Dose	Dose	Quotient (P)	
<u>Environmental, Inc.</u>		Group 2				
2018-2	11/15/2018	Spike 21	143.0	130.3	-0.09	
2018-2	11/15/2018	Spike 22	143.0	128.1	-0.10	
2018-2	11/15/2018	Spike 23	143.0	134.4	-0.06	
2018-2	11/15/2018	Spike 24	143.0	129.0	-0.10	
2018-2	11/15/2018	Spike 25	143.0	132.5	-0.07	
2018-2	11/15/2018	Spike 26	143.0	126.1	-0.12	
2018-2	11/15/2018	Spike 27	143.0	126.2	-0.12	
2018-2	11/15/2018	Spike 28	143.0	122.4	-0.14	
2018-2	11/15/2018	Spike 29	143.0	118.8	-0.17	
2018-2	11/15/2018	Spike 30	143.0	123.2	-0.14	
2018-2	11/15/2018	Spike 31	143.0	137.2	-0.04	
2018-2	11/15/2018	Spike 32	143.0	144.4	0.01	
2018-2	11/15/2018	Spike 33	143.0	137.8	-0.04	
2018-2	11/15/2018	Spike 34	143.0	140.2	-0.02	
2018-2	11/15/2018	Spike 35	143.0	143.8	0.01	
2018-2	11/15/2018	Spike 36	143.0	146.7	0.03	
2018-2	11/15/2018	Spike 37	143.0	150.0	0.05	
2018-2	11/15/2018	Spike 38	143.0	126.1	-0.12	
2018-2	11/15/2018	Spike 39	143.0	136.2	-0.05	
2018-2	11/15/2018	Spike 40	143.0	144.8	0.01	
Mean (Spike 21-40)				133.9	-0.06	Pass <sup>d</sup>
Standard Deviation (Spike 21-40)				9.0	0.06	Pass <sup>d</sup>

Pass<sup>d</sup>Pass<sup>d</sup>

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point  $H^*(10)K_a = 1.20$ . mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-3. In-House "Spiked" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>				Ratio Lab/Known
			Laboratory results 2s, n=1 <sup>c</sup>	Known Activity	Control Limits <sup>d</sup>	Acceptance	
SPW-3991	10/1/2018	H-3	15,614 ± 369	16,507	13,206 - 19,808	Pass	0.95
SPW-4105	10/5/2018	H-3	15,669 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-101118	4/29/2016	Cs-134	33.5 ± 3.1	36.2	29.0 - 43.4	Pass	0.92
W-101118	4/29/2016	Cs-137	79.7 ± 3.2	71.9	57.5 - 86.3	Pass	1.11
SPW-4205	10/12/2018	H-3	15,821 ± 372	16,507	13,206 - 19,808	Pass	0.96
SPW-4274	10/17/2018	H-3	15,575 ± 369	16,507	11,555 - 21,459	Pass	0.94
SPW-4596	10/31/2018	H-3	15,650 ± 369	16,507	13,206 - 19,808	Pass	0.95
SPW-4682	11/1/2018	H-3	15,742 ± 371	16,507	13,206 - 19,808	Pass	0.95
SPW-4684	11/1/2018	Sr-90	19.1 ± 1.2	17.9	14.3 - 21.5	Pass	1.07
SPW-4790	11/9/2018	H-3	15,887 ± 373	16,507	13,206 - 19,808	Pass	0.96
SPW-4839	11/13/2018	Ni-63	381 ± 43	465	326 - 605	Pass	0.82
SPW-4863	11/16/2018	H-3	15,610 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-111618	4/29/2016	Cs-134	38.0 ± 12.4	36.2	25.3 - 47.1	Pass	1.05
W-111618	4/29/2016	Cs-137	83.8 ± 13.8	71.9	57.5 - 86.3	Pass	1.17
SPW-5049	11/30/2018	H-3	15,370 ± 366	16,507	13,206 - 19,808	Pass	0.93
SPW-5148	12/7/2018	H-3	15,522 ± 368	16,507	13,206 - 19,808	Pass	0.94
W-121118	4/29/2016	Cs-134	39.4 ± 7.9	36.2	29.0 - 43.4	Pass	1.09
W-121118	4/29/2016	Cs-137	78.5 ± 7.7	71.9	57.5 - 86.3	Pass	1.09
W-121218	4/29/2016	Cs-134	42.0 ± 13.8	36.2	25.3 - 47.1	Pass	1.16
W-121218	4/29/2016	Cs-137	79.2 ± 13.1	71.9	57.5 - 86.3	Pass	1.10
W-121318	4/29/2016	Cs-134	35.1 ± 7.8	36.2	25.3 - 47.1	Pass	0.97
W-121318	4/29/2016	Cs-137	77.5 ± 8.4	71.9	50.3 - 93.5	Pass	1.08
SPW-5279	12/14/2018	H-3	15,686 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-121418	4/29/2016	Cs-134	34.5 ± 8.2	36.2	29.0 - 43.4	Pass	0.95
W-121418	4/29/2016	Cs-137	82.7 ± 8.0	71.9	57.5 - 86.3	Pass	1.15
W-121718	4/29/2016	Cs-134	34.9 ± 10.5	36.2	29.0 - 43.4	Pass	0.96
W-121718	4/29/2016	Cs-137	80.3 ± 8.1	71.9	57.5 - 86.3	Pass	1.12
SPW-5351	12/19/2018	H-3	15,855 ± 375	16,507	13,206 - 19,808	Pass	0.96
SPW-5404	12/31/2018	H-3	15,179 ± 365	16,507	13,206 - 19,808	Pass	0.92
SPW-5450	12/31/2018	Gr. Alpha	56.5 ± 2.6	72.4	36.2 - 108.6	Pass	0.78
SPW-5450	12/31/2018	Gr. Beta	45.1 ± 1.4	54.8	43.8 - 65.8	Pass	0.82
SPW-5615	12/31/2018	Fe-55	831.0 ± 43.5	732.6	586.0 - 879.1	Pass	1.13
SPW-5619	12/31/2018	Tc-99	99.0 ± 1.7	107.8	86.2 - 129.4	Pass	0.92
SPW-61	11/5/2018	Ra-226	13.4 ± 0.4	12.3	8.6 - 16.0	Pass	1.09
SPW-118	1/14/2019	H-3	15,463 ± 369	16,507	13,206 - 19,808	Pass	0.94
SPW-178	1/16/2019	Ra-228	17.7 ± 2.1	15.1	10.58 - 19.66	Pass	1.17
SPW-199	1/18/2019	Sr-90	17.6 ± 1.2	17.9	14.3 - 21.5	Pass	0.98
SPW-250	1/24/2019	Ni-63	356.3 ± 44.5	465	326 - 605	Pass	0.77
SPW-256	1/15/2019	Ra-226	12.0 ± 0.4	12.3	8.6 - 16.0	Pass	0.98
SPW-271	3/18/2019	H-3	22,035 ± 450	21,700	17,360 - 26,040	Pass	1.02
SPW-281	1/25/2019	Ra-226	11.6 ± 0.4	12.3	8.6 - 16.0	Pass	0.94
W-012119	4/29/2016	Cs-134	37.3 ± 10.6	36.2	29.0 - 43.4	Pass	1.03
W-012119	4/29/2016	Cs-137	82.7 ± 8.0	71.9	57.5 - 86.3	Pass	1.15
W-012319	4/29/2016	Cs-134	33.4 ± 10.1	36.2	25.3 - 47.1	Pass	0.92
W-012319	4/29/2016	Cs-137	79.1 ± 9.6	71.9	57.5 - 86.3	Pass	1.10
W-012519	4/29/2016	Cs-134	35.0 ± 7.7	36.2	29.0 - 43.4	Pass	0.97
W-012519	4/29/2016	Cs-137	79.2 ± 7.9	71.9	57.5 - 86.3	Pass	1.10
W-012919	4/29/2016	Cs-134	32.3 ± 8.3	36.2	29.0 - 43.4	Pass	0.89
W-012919	4/29/2016	Cs-137	82.3 ± 8.3	71.9	57.5 - 86.3	Pass	1.14

TABLE A-3. In-House "Spiked" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>				Ratio Lab/Known
			Laboratory results 2s, n=1 <sup>c</sup>	Known Activity	Control Limits <sup>d</sup>	Acceptance	
SPW-370	3/19/2019	H-3	21,689 ± 444	21,700	17,360 - 26,040	Pass	1.00
SPW-400	1/31/2019	Ra-226	11.6 ± 0.4	12.3	8.6 - 16.0	Pass	0.95
SPW-461	2/12/2019	Ra-226	11.1 ± 0.4	12.3	8.6 - 16.0	Pass	0.90
W-020619	4/26/2016	Cs-134	35.0 ± 14.9	36.2	29.0 - 43.4	Pass	0.97
W-020619	4/29/2016	Cs-137	72.8 ± 8.9	71.9	57.5 - 86.3	Pass	1.01
W-020819	4/26/2016	Cs-134	36.7 ± 8.6	36.2	29.0 - 43.4	Pass	1.01
W-020819	4/29/2016	Cs-137	76.7 ± 8.7	71.9	57.5 - 86.3	Pass	1.07
SPW-568	2/21/2019	Ra-226	10.3 ± 0.3	12.3	8.6 - 16.0	Pass	0.84
W-021319	4/29/2016	Cs-134	37.7 ± 11.5	36.2	29.0 - 43.4	Pass	1.04
W-021319	4/26/2016	Cs-137	75.8 ± 9.6	71.9	57.5 - 86.3	Pass	1.05
SPW-469	3/19/2019	H-3	21,696 ± 447	21,700	17,360 - 26,040	Pass	1.00
SPW-600	3/6/2019	H-3	20,710 ± 425	21,700	17,360 - 26,040	Pass	0.95
SPW-837	3/21/2019	Ra-228	11.7 ± 1.5	15.1	10.58 - 19.66	Pass	0.78
SPW-709	3/19/2019	H-3	20,369 ± 421	21,700	17,360 - 26,040	Pass	0.94
SPW-818	3/19/2019	H-3	20,457 ± 424	21,700	17,360 - 26,040	Pass	0.94
SPW-844	3/22/2019	U-234	15.1 ± 0.5	13.6	9.5 - 17.7	Pass	1.11
SPW-844	3/22/2019	U-238	15.3 ± 0.5	13.1	9.2 - 17.0	Pass	1.17
SPW-934	3/19/2019	H-3	20,487 ± 421	21,700	17,360 - 26,040	Pass	0.94
SPW-1061	3/1/2019	Ra-226	10.6 ± 0.3	12.3	8.6 - 16.0	Pass	0.86
SPW-1091	4/10/2019	H-3	20,323 ± 421	21,700	17,360 - 26,040	Pass	0.94
SPW-1093	4/8/2019	Ra-228	14.9 ± 1.9	15.1	10.6 - 19.6	Pass	0.98
SPW-1267	4/16/2019	H-3	20,302 ± 421	21,700	17,360 - 26,040	Pass	0.94
SPW-1339	4/18/2019	H-3	19,924 ± 417	21,700	17,360 - 26,040	Pass	0.92
SPW-1403 <sup>e</sup>	4/25/2019	Gr. Alpha	56.7 ± 2.6	72.4	36.2 - 108.6	Pass	0.78
SPW-1403 <sup>e</sup>	4/25/2019	Gr. Beta	43.2 ± 1.4	54.8	43.8 - 65.8	Fail	0.79
SPW-1427	4/26/2019	H-3	20,119 ± 418	21,700	15,190 - 28,210	Pass	0.93
SPW-1537	5/6/2019	Sr-90	19.9 ± 1.2	17.9	14.3 - 21.5	Pass	1.11
W-050719	4/29/2016	Cs-134	38.5 ± 9.0	36.2	29.0 - 43.4	Pass	1.06
W-050719	4/26/2016	Cs-137	85.2 ± 8.5	71.9	57.5 - 86.3	Pass	1.18
SPW-1582	5/9/2019	H-3	20,492 ± 423	21,700	15,190 - 28,210	Pass	0.94
W-050919	4/29/2016	Cs-134	37.4 ± 8.9	36.2	29.0 - 43.4	Pass	1.03
W-050919	4/26/2016	Cs-137	81.5 ± 7.8	71.9	57.5 - 86.3	Pass	1.13
SPW-1596	5/8/2019	Ra-228	14.1 ± 1.7	15.1	10.6 - 19.6	Pass	0.94
W-051419	4/29/2016	Cs-134	36.2 ± 11.7	36.2	29.0 - 43.4	Pass	1.00
W-051419	4/26/2016	Cs-137	75.8 ± 10.0	71.9	57.5 - 86.3	Pass	1.05
SPW-1676	5/17/2019	H-3	20,233 ± 420	21,700	15,190 - 28,210	Pass	0.93
SPW-1799	5/20/2019	H-3	20,428 ± 422	21,700	15,190 - 28,210	Pass	0.94
SPW-1858	5/28/2019	H-3	20,367 ± 522	21,700	15,190 - 28,210	Pass	0.94
SPW-1890	5/30/2019	H-3	20,206 ± 419	21,700	15,190 - 28,210	Pass	0.93
SPW-2014	5/31/2019	Ra-226	11.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
SPW-2030	6/12/2019	Ni-63	377 ± 45	464.8	325 - 604	Pass	0.81
SPW-2093	6/18/2019	H-3	20,158 ± 418	21,700	15,190 - 28,210	Pass	0.93
W-062419	4/29/2016	Cs-134	33.0 ± 12.4	36.2	29.0 - 43.4	Pass	0.91
W-062419	4/26/2016	Cs-137	66.0 ± 10.4	71.9	57.5 - 86.3	Pass	0.92
SPW-2338	6/26/2019	H-3	20,032 ± 417	21,700	15,190 - 28,210	Pass	0.92



TABLE A-3. In-House "Spiked" Samples

Lab Code <sup>b</sup>	Date	Concentration <sup>a</sup>					Ratio Lab/Known
		Analysis	Laboratory results 2s, n=1 <sup>c</sup>	Known Activity	Control Limits <sup>d</sup>	Acceptance	
W-072619	4/29/2016	Cs-134	36.3 ± 9.2	36.2	29.0 - 43.4	Pass	1.00
W-072619	4/26/2016	Cs-137	79.7 ± 7.6	71.9	57.5 - 86.3	Pass	1.11
SPW-3188	7/30/2019	Ra-226	11.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
SPW-2925	8/6/2019	Sr-90	10.7 ± 1.0				
SPW-2947	8/9/2019	H-3	20,128 ± 425	21,700	15,190 - 28,210	Pass	0.93
SPW-3003	8/14/2019	H-3	20,588 ± 435	21,700	15,190 - 28,210	Pass	0.95
W-081519	4/26/2019	Cs-134	36.2 ± 9.2	36.2	29.0 - 43.4	Pass	1.00
W-081519	4/26/2019	Cs-137	78.1 ± 8.4	71.9	57.5 - 86.3	Pass	1.09
W-082119	4/26/2019	Cs-134	32.8 ± 9.1	36.2	29.0 - 43.4	Pass	0.91
W-082119	4/26/2019	Cs-137	79.1 ± 7.9	71.9	57.5 - 86.3	Pass	1.10
SPW-3151	8/26/2019	H-3	20,329 ± 428	21,700	15,190 - 28,210	Pass	0.94
W-082619	4/26/2019	Cs-134	33.3 ± 17.8	36.2	29.0 - 43.4	Pass	0.92
W-082619	4/26/2019	Cs-137	82.6 ± 13.2	71.9	57.5 - 86.3	Pass	1.15
W-082719	4/26/2019	Cs-134	33.9 ± 7.0	36.2	29.0 - 43.4	Pass	0.94
W-082719	4/26/2019	Cs-137	81.4 ± 6.0	71.9	57.5 - 86.3	Pass	1.13
SPW-3359	8/30/2019	Gr. Alpha	54.2 ± 0.3	72.4	36.2 - 108.6	Pass	0.75
SPW-3359	8/30/2019	Gr. Beta	59.7 ± 0.2	54.8	43.8 - 65.8	Pass	1.09
SPW-3323	9/6/2019	Ra-228	12.7 ± 1.8	15.1	10.6 - 19.6	Pass	0.84
W-091019	4/26/2019	Cs-134	31.0 ± 11.3	36.2	29.0 - 43.4	Pass	0.86
W-091019	4/26/2019	Cs-137	80.5 ± 10.0	71.9	57.5 - 86.3	Pass	1.12
SPW-3349	9/10/2019	H-3	19,851 ± 422	21,700	15,190 - 28,210	Pass	0.91
SPW-3410	9/13/2019	H-3	20,267 ± 431	21,700	15,190 - 28,210	Pass	0.93
W-091719	4/26/2019	Cs-134	39.3 ± 12.6	36.2	29.0 - 43.4	Pass	1.09
W-091719	4/26/2019	Cs-137	81.1 ± 9.9	71.9	57.5 - 86.3	Pass	1.13
SPW-3450	9/17/2019	H-3	20,036 ± 427	21,700	15,190 - 28,210	Pass	0.92
W-091919	9/19/2019	Cs-134	40.0 ± 10.7	36.2	29.0 - 43.4	Pass	1.10
W-091919	9/19/2019	Cs-137	71.0 ± 8.7	71.9	57.5 - 86.3	Pass	0.99
SPW-3569	8/28/2019	Ra-226	11.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
SPW-3571	9/27/2019	H-3	21,026 ± 440	21,700	15,190 - 28,210	Pass	0.97

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> Results are based on single determinations.

<sup>d</sup> Control limits are listed in Attachment A of this report.

<sup>e</sup> The LCS sample was prepared from an Environmental Resource Associates (ERA) sample of known activity. While the analysis did satisfy the acceptance criteria of the ERA study from which it was sourced, it did not satisfy EIML's internal LCS acceptance criteria. All of the original solution had been consumed in the analysis. Subsequent gross alpha and beta PT and LCS sample results were acceptable.

NOTE: For fish, gelatin is used for the spike matrix. For vegetation, cabbage is used for the spike matrix.

TABLE A-4. In-House "Blank" Samples

Lab Code <sup>b</sup>	Sample Type	Date	Analysis <sup>c</sup>	Concentration <sup>a</sup>		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66σ)		
				LLD	Activity <sup>d</sup>	
SPW-3990	Water	10/1/2018	H-3	153	-6 ± 71	200
SPW-4105	Water	10/5/2018	H-3	150	7 ± 71	200
SPW-4565	Water	10/11/2018	Ra-228	0.86	-0.26 ± 0.36	2
SPW-4205	Water	10/12/2018	H-3	154	-9 ± 71	200
SPW-4273	Water	10/17/2018	H-3	153	67 ± 76	200
SPW-4595	Water	10/30/2018	H-3	150	75 ± 74	200
SPW-4681	Water	11/1/2018	H-3	152	19 ± 72	200
SPW-4683	Water	11/1/2018	Sr-89	0.64	0.25 ± 0.45	5
SPW-4683	Water	11/1/2018	Sr-90	0.51	-0.10 ± 0.22	1
SPW-4789	Water	11/9/2018	H-3	148	27 ± 73	200
SPW-4799	Water	11/9/2018	I-131	0.43	-0.01 ± 0.20	1
SPW-4838	Water	11/13/2018	Ni-63	62	34 ± 38	200
SPW-4862	Water	11/16/2018	H-3	154	15 ± 77	200
SPW-5028	Water	11/19/2018	Ra-226	0.04	-0.14 ± 0.03	2
SPW-5028	Water	11/19/2018	Ra-228	0.96	-0.11 ± 0.43	2
SPW-5048	Water	11/30/2018	H-3	151	-6 ± 69	200
SPW-5147	Water	12/7/2018	H-3	151	14 ± 71	200
SPW-5278	Water	12/14/2018	H-3	153	83 ± 76	200
SPW-5350	Water	12/19/2018	H-3	153	71 ± 75	200
SPW-5403	Water	12/31/2018	H-3	156	51 ± 75	200
SPW-5614	Water	12/31/2018	Fe-55	612	-68 ± 368	1000
SPW-5618	Water	12/31/2018	Tc-99	11	7 ± 7	100
SPW-34	Water	1/7/2019	I-131	0.36	0.13 ± 0.18	1
SPW-60	Water	11/5/2019	Ra-226	0.03	0.15 ± 0.03	2
SPW-119	Water	1/14/2019	H-3	148	42 ± 80	200
SPW-177	Water	1/16/2019	Ra-228	0.93	-0.10 ± 0.42	2
SPW-198	Water	1/18/2019	Sr-89	0.67	0.25 ± 0.50	5
SPW-198	Water	1/18/2019	Sr-90	0.67	-0.16 ± 0.29	1
SPW-249	Water	1/24/2019	Ni-63	67	31 ± 41	200
SPW-255	Water	1/15/2019	Ra-226	0.04	0.16 ± 0.03	2
SPW-280	Water	1/25/2019	Ra-226	0.06	-0.09 ± 0.14	2
SPW-399	Water	1/31/2019	Ra-226	0.03	0.15 ± 0.03	2
SPW-460	Water	2/12/2019	Ra-226	0.03	0.15 ± 0.02	2
SPW-567	Water	2/21/2019	Ra-226	0.03	0.13 ± 0.02	2
SPW-844	Water	3/22/2019	U-234	0.19	0.04 ± 0.14	1
SPW-844	Water	3/22/2019	U-238	0.19	0.00 ± 0.11	1
SPW-836	Water	3/21/2019	Ra-228	0.74	0.53 ± 0.41	2
SPW-1060	Water	3/31/2019	Ra-226	0.04	-0.02 ± 0.03	2

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters (pCi/m<sup>3</sup>), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> I-131(G); iodine-131 as analyzed by gamma spectroscopy.

<sup>d</sup> Activity reported is a net activity result.

TABLE A-4. In-House "Blank" Samples

Lab Code <sup>b</sup>	Sample Type	Date	Analysis <sup>c</sup>	Concentration <sup>a</sup>		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66σ)		
				LLD	Activity <sup>d</sup>	
SPW-1090	Water	4/10/2019	H-3	155	-14 ± 72	200
SPW-1092	Water	4/8/2019	Ra-228	0.82	0.75 ± 0.46	2
SPW-1266	Water	4/16/2019	H-3	152	67 ± 74	200
SPW-1338	Water	4/18/2019	H-3	152	66 ± 79	200
SPW-1386	Water	4/8/2019	Ra-226	0.03	0.09 ± 0.03	2
SPW-1426	Water	4/26/2019	H-3	156	34 ± 75	200
SPW-1536	Water	5/6/2019	Sr-89	0.66	-0.07 ± 0.45	5
SPW-1536	Water	5/6/2019	Sr-90	0.59	-0.10 ± 0.26	1
SPW-1581	Water	5/9/2019	H-3	147	73 ± 77	200
SPW-1644	Water	4/22/2019	Ra-226	0.02	0.15 ± 0.02	2
SPW-1675	Water	5/17/2019	H-3	154	-30 ± 71	200
SPW-1798	Water	5/20/2019	H-3	149	24 ± 73	200
SPW-1857	Water	5/28/2019	H-3	150	54 ± 74	200
SPW-1889	Water	5/30/2019	H-3	152	45 ± 73	200
SPW-2013	Water	5/31/2019	Ra-226	0.01	0.13 ± 0.02	2
SPW-2029	Water	6/12/2019	Ni-63	66	10 ± 40	200
SPW-2092	Water	6/18/2019	H-3	154	-42 ± 70	200
SPW-2237	Water	6/26/2019	H-3	150	-9 ± 69	200
SPW-2107	Water	6/18/2019	I-131	0.16	0.04 ± 0.09	1
SPW-2152	Water	6/19/2019	I-131	0.16	0.04 ± 0.09	1
SPW-3187	Water	7/30/2019	Ra-226	0.02	0.17 ± 0.02	2
SPW-2924	Water	8/6/2019	Sr-89	0.71	-0.06 ± 0.57	5
SPW-2924	Water	8/6/2019	Sr-90	0.59	0.08 ± 0.28	1
SPW-2946	Water	8/9/2019	H-3	152	33 ± 72	200
SPW-3002	Water	8/14/2019	H-3	152	-22 ± 74	200
SPW-3150	Water	8/26/2019	H-3	151	115 ± 77	200
SPW-3358	Water	8/30/2019	Gr. Alpha	0.44	-0.08 ± 0.30	2
SPW-3358	Water	8/30/2019	Gr. Beta	0.72	-0.31 ± 0.49	4
SPW-3568	Water	8/28/2019	Ra-226	0.03	0.16 ± 0.03	2
SPW-3348	Water	9/10/2019	H-3	150	107 ± 76	200
SPW-3409	Water	9/13/2019	H-3	154	133 ± 79	200
SPW-3449	Water	9/17/2019	H-3	147	102 ± 79	200
SPW-3570	Water	9/27/2019	H-3	151	70 ± 77	200

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters ( pCi/m<sup>3</sup>), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> I-131(G); iodine-131 as analyzed by gamma spectroscopy.

<sup>d</sup> Activity reported is a net activity result.

TABLE A-5. In-House "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
DW-90173,90174	10/24/2018	Ra-226	1.13 ± 0.15	1.38 ± 0.17	1.26 ± 0.11	Pass
DW-90173,90174	10/24/2018	Ra-228	5.09 ± 0.84	6.59 ± 0.89	5.84 ± 0.61	Pass
SW-4782,4783	11/7/2018	H-3	192 ± 82	238 ± 84	215 ± 59	Pass
WW-4959,4960	11/13/2018	H-3	330 ± 88	286 ± 86	308 ± 61	Pass
SG-4850,4851	11/14/2018	Pb-214	15.0 ± 0.4	14.7 ± 0.4	14.9 ± 0.3	Pass
SG-4850,4851	11/14/2018	Ac-228	17.5 ± 0.7	16.7 ± 0.6	17.1 ± 0.5	Pass
VE-4917,4918	11/20/2018	K-40	4.54 ± 0.45	4.05 ± 0.46	4.30 ± 0.32	Pass
VE-4917,4918	11/20/2018	Be-7	9.42 ± 0.45	9.42 ± 0.46	9.42 ± 0.32	Pass
SO-5024,5025	11/14/2018	K-40	6.60 ± 0.54	6.26 ± 0.58	6.43 ± 0.40	Pass
SG-5046,5047	11/21/2018	K-40	8.65 ± 1.18	9.12 ± 1.02	8.88 ± 0.78	Pass
SG-5046,5047	11/21/2018	Cs-137	0.18 ± 0.06	0.10 ± 0.05	0.14 ± 0.04	Pass
SG-5046,5047	11/21/2018	Gr. Alpha	22.8 ± 5.6	17.5 ± 4.8	20.2 ± 3.7	Pass
SG-5046,5047	11/21/2018	Gr. Beta	31.8 ± 3.5	26.8 ± 3.1	29.3 ± 2.4	Pass
SG-6286,6287	12/1/2018	Pb-214	11.3 ± 0.4	10.7 ± 0.5	11.0 ± 0.3	Pass
SG-6286,6287	12/1/2018	Ac-228	13.5 ± 0.9	13.2 ± 1.0	13.4 ± 0.7	Pass
SWU-5132,5133	12/4/2018	H-3	159 ± 82	204 ± 80	181 ± 57	Pass
SWU-5132,5133	12/4/2018	Gr. Beta	1.32 ± 0.56	1.33 ± 0.57	1.32 ± 0.40	Pass
AP-5499,5500	1/2/2019	Fe-55	941 ± 220	1027 ± 226	984 ± 158	Pass
AP-5499,5500	1/2/2019	Sr-89	20.2 ± 7.3	14.9 ± 5.7	17.5 ± 4.7	Pass
AP-5499,5500	1/2/2019	Ni-63	12.1 ± 8.5	15.6 ± 8.5	13.8 ± 6.0	Pass
CF-20,21	1/2/2019	Gr. Beta	10.0 ± 0.2	10.7 ± 0.2	10.3 ± 0.2	Pass
CF-20,21	1/2/2019	Sr-90	0.005 ± 0.002	0.005 ± 0.002	0.005 ± 0.001	Pass
CF-20,21	1/2/2019	Be-7	0.27 ± 0.09	0.29 ± 0.08	0.28 ± 0.06	Pass
CF-20,21	1/2/2019	K-40	6.69 ± 0.34	6.83 ± 0.34	6.76 ± 0.24	Pass
SG-211,212	1/21/2019	Ra-226	7.94 ± 1.15	8.50 ± 1.11	9.79 ± 0.19	Pass
SG-211,212	1/21/2019	Ac-228	4.46 ± 0.37	4.63 ± 0.43	4.55 ± 0.28	Pass
WW-324,325	2/4/2019	Gr. Alpha	0.68 ± 0.44	0.49 ± 0.46	0.59 ± 0.32	Pass
WW-324,325	2/4/2019	Gr. Beta	1.80 ± 0.55	2.95 ± 0.63	2.37 ± 0.42	Pass
W-345,346	2/4/2019	H-3	245 ± 84	277 ± 85	261 ± 60	Pass
WW-797,798	3/5/2019	H-3	165 ± 80	222 ± 83	193 ± 58	Pass
WW-648,649	3/8/2019	H-3	587 ± 101	630 ± 102	608 ± 72	Pass
SW-713,714	3/14/2019	H-3	326 ± 90	254 ± 86	290 ± 62	Pass
AP-1241,1242	4/2/2019	Be-7	0.097 ± 0.018	0.108 ± 0.020	0.103 ± 0.013	Pass
AP-1285,1286	4/3/2019	Be-7	0.080 ± 0.014	0.078 ± 0.012	0.079 ± 0.009	Pass
AP-1306,1307	4/3/2019	Be-7	0.085 ± 0.009	0.096 ± 0.011	0.090 ± 0.007	Pass
AP-1327,1328	4/3/2019	Be-7	0.078 ± 0.010	0.079 ± 0.011	0.078 ± 0.007	Pass
AP-1327,1328	4/3/2019	K-40	0.012 ± 0.007	0.021 ± 0.010	0.017 ± 0.006	Pass
AP-2119,2120	4/3/2019	Be-7	0.276 ± 0.098	0.265 ± 0.116	0.270 ± 0.076	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
AP-2225,2226	4/3/2019	Be-7	0.231 ± 0.128	0.208 ± 0.123	0.220 ± 0.089	Pass
CF-820,821	4/3/2019	K-40	6.39 ± 0.30	6.63 ± 0.37	6.51 ± 0.24	Pass
WW-648,649	4/5/2019	H-3	587 ± 101	630 ± 102	608 ± 72	Pass
WW-1043,1044	4/5/2019	H-3	666 ± 121	662 ± 121	664 ± 86	Pass
SW-1087,1088	4/8/2019	H-3	9,997 ± 300	10,330 ± 305	10,164 ± 214	Pass
WW-1198,1199	4/9/2019	H-3	562 ± 99	640 ± 102	601 ± 71	Pass
LW-1503,1504	4/25/2019	Gr. Beta	1.09 ± 0.55	1.46 ± 0.57	1.27 ± 0.39	Pass
WW-1789,1790	5/7/2019	H-3	366 ± 90	400 ± 92	383 ± 64	Pass
SG-2269,2270	5/7/2019	Pb-214	39.1 ± 0.5	40.3 ± 0.5	39.7 ± 0.4	Pass
SG-2269,2270	5/7/2019	Ac-228	53.2 ± 1.0	57.1 ± 1.0	55.2 ± 0.7	Pass
DW-10049,10050	5/7/2019	Ra-226	1.31 ± 0.13	1.66 ± 0.15	1.49 ± 0.10	Pass
DW-10049,10050	5/7/2019	Ra-228	1.24 ± 0.52	1.33 ± 0.53	1.29 ± 0.37	Pass
WW-1690A,B	5/8/2019	H-3	325 ± 89	303 ± 93	314 ± 64	Pass
S-1812,1813	5/16/2019	K-40	21.95 ± 0.92	23.26 ± 0.95	22.61 ± 0.66	Pass
S-1812,1813	5/16/2019	Cs-137	0.05 ± 0.03	0.07 ± 0.04	0.06 ± 0.02	Pass
DW-10053,10054	5/22/2019	Gr. Alpha	0.93 ± 0.63	1.14 ± 0.72	1.04 ± 0.48	Pass
DW-10053,10054	5/22/2019	Gr. Beta	1.43 ± 0.62	1.13 ± 0.59	1.28 ± 0.43	Pass
W-2053,2054	5/29/2019	H-3	1572 ± 135	1470 ± 131	1521 ± 94	Pass
G-1989,1990	6/3/2019	Be-7	0.80 ± 0.18	0.72 ± 0.15	0.76 ± 0.12	Pass
G-1989,1990	6/3/2019	K-40	6.15 ± 0.51	5.98 ± 0.46	6.065 ± 0.34	Pass
G-1989,1990	6/3/2019	Gr. Beta	7.24 ± 0.19	7.00 ± 0.19	7.12 ± 0.13	Pass
WW-2204,2205	6/6/2019	H-3	3861 ± 194	3722 ± 191	3792 ± 136	Pass
S-2031,2032	6/10/2019	Pb-214	5.16 ± 0.19	4.75 ± 0.22	4.96 ± 0.15	Pass
S-2031,2032	6/10/2019	Ac-228	3.81 ± 0.31	3.63 ± 0.33	3.72 ± 0.23	Pass
S-2010,2011	6/10/2019	Pb-214	1.48 ± 0.10	1.05 ± 0.11	1.27 ± 0.07	Pass
F-2140,2141	6/12/2019	K-40	1.01 ± 0.28	1.39 ± 0.32	1.20 ± 0.21	Pass
S-2162,2163	6/12/2019	Pb-214	0.65 ± 0.06	0.54 ± 0.05	0.60 ± 0.04	Pass
S-2162,2163	6/12/2019	Ac-228	0.46 ± 0.10	0.44 ± 0.08	0.45 ± 0.07	Pass
S-2162,2163	6/12/2019	K-40	4.22 ± 0.49	3.81 ± 0.41	4.02 ± 0.32	Pass
S-2162,2163	6/12/2019	Tl-208	0.09 ± 0.02	0.10 ± 0.02	0.09 ± 0.01	Pass
S-2162,2163	6/12/2019	Pb-212	0.34 ± 0.03	0.26 ± 0.03	0.30 ± 0.02	Pass
SWT-2355,2356	6/25/2019	Gr. Beta	1.12 ± 0.57	1.24 ± 0.56	1.18 ± 0.40	Pass
AP-2689,2690	6/28/2019	Be-7	0.089 ± 0.020	0.075 ± 0.018	0.082 ± 0.013	Pass
AP-2710,2711	7/1/2019	Be-7	0.091 ± 0.010	0.097 ± 0.010	0.094 ± 0.007	Pass
AP-2731,2732	7/2/2019	Be-7	0.073 ± 0.013	0.072 ± 0.011	0.072 ± 0.009	Pass
DW-10062,10063	7/5/2019	Ra-226	4.10 ± 0.30	4.03 ± 0.30	4.07 ± 0.21	Pass
DW-10062,10063	7/5/2019	Ra-228	1.95 ± 0.60	2.31 ± 0.62	2.13 ± 0.43	Pass
AP-70818,70819	7/8/2019	Gr. Beta	0.021 ± 0.004	0.023 ± 0.004	0.022 ± 0.003	Pass
XW-2459,2460	7/10/2019	H-3	304 ± 92	234 ± 89	269 ± 64	Pass
VE-2516,2517	7/10/2019	Be-7	0.63 ± 0.16	0.52 ± 0.19	0.58 ± 0.12	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
VE-2516,2517	7/10/2019	K-40	6.50 ± 0.47	6.81 ± 0.54	6.66 ± 0.36	Pass
AP-71518A,B	7/15/2019	Gr. Beta	0.022 ± 0.004	0.025 ± 0.004	0.023 ± 0.003	Pass
VE-2668,2669	7/16/2019	K-40	3.84 ± 0.27	3.74 ± 0.26	3.79 ± 0.19	Pass
DW-10076,10077	7/16/2019	Gr. Alpha	3.01 ± 0.92	4.13 ± 0.91	3.57 ± 0.65	Pass
DW-10073,10074	7/16/2019	Ra-226	1.57 ± 0.18	1.51 ± 0.21	1.54 ± 0.14	Pass
DW-10073,10074	7/16/2019	Ra-228	1.29 ± 0.56	1.48 ± 0.57	1.385 ± 0.40	Pass
AP-72218A,B	7/22/2019	Gr. Beta	0.013 ± 0.004	0.016 ± 0.004	0.015 ± 0.003	Pass
G-2752,2753	7/23/2019	K-40	4.53 ± 0.42	4.47 ± 0.46	4.50 ± 0.31	Pass
G-2752,2753	7/23/2019	Be-7	1.98 ± 0.29	1.96 ± 0.29	1.97 ± 0.20	Pass
AP-2800,2801	7/25/2019	Be-7	0.208 ± 0.090	0.321 ± 0.147	0.264 ± 0.086	Pass
AP-72918A,B	7/29/2019	Gr. Beta	0.026 ± 0.005	0.025 ± 0.005	0.025 ± 0.003	Pass
VE-2840,2841	7/31/2019	K-40	3.94 ± 0.38	3.99 ± 0.47	3.96 ± 0.30	Pass
AP-2903,2904	8/1/2019	Be-7	0.198 ± 0.102	0.228 ± 0.102	0.213 ± 0.072	Pass
P-2882,2983	8/1/2019	H-3	265 ± 85	327 ± 88	296 ± 61	Pass
SG-2926,2927	8/5/2019	Pb-214	9.07 ± 0.39	8.82 ± 0.39	8.95 ± 0.28	Pass
SG-2926,2927	8/5/2019	Ac-228	9.00 ± 0.76	8.58 ± 0.72	8.79 ± 0.52	Pass
AV-2993,2994	8/9/2019	Gr. Beta	1.22 ± 0.19	1.28 ± 0.21	1.25 ± 0.14	Pass
AV-2993,2994	8/9/2019	K-40	3.12 ± 0.36	3.14 ± 0.35	3.13 ± 0.25	Pass
DW-10088,10089	8/9/2019	Ra-228	0.60 ± 0.50	1.20 ± 0.50	0.90 ± 0.35	Pass
DW-10088,10089	8/9/2019	Ra-226	1.40 ± 0.20	0.94 ± 0.20	1.17 ± 0.14	Pass
VE-3016,3017	8/12/2019	Be-7	0.39 ± 0.12	0.47 0.28	0.43 0.15	Pass
VE-3016,3017	8/12/2019	K-40	6.13 ± 0.41	6.24 0.64	6.18 0.38	Pass
G-3600,3601	8/12/2019	Be-7	4.42 ± 0.33	4.35 0.27	4.39 0.21	Pass
WW-3100,3101	8/14/2019	H-3	480 ± 96	401 ± 92	441 ± 66	Pass
MI-3211,3212	8/27/2019	K-40	1862 ± 131	1923 ± 136	1893 ± 94	Pass
MI-3211,3212	8/27/2019	Sr-90	0.90 ± 0.33	0.56 ± 0.29	0.73 ± 0.22	Pass
LW-3512,3513	8/30/2019	Gr. Beta	0.79 ± 0.50	1.39 ± 0.58	1.09 ± 0.38	Pass
F-3379,3380	9/3/2019	K-40	2.98 ± 0.40	3.04 ± 0.37	3.01 ± 0.27	Pass
P-3278,3279	9/3/2019	H-3	1110 ± 123	1076 ± 121	1093 ± 86	Pass
VE-3309,3310	9/4/2019	K-40	2.23 ± 0.26	1.72 ± 0.25	1.98 ± 0.18	Pass
DW-10100,10101	9/5/2019	Ra-226	0.50 ± 0.11	0.57 0.12	0.54 ± 0.08	Pass
DW-10100,10101	9/5/2019	Ra-228	3.38 ± 0.82	2.54 1.03	2.96 ± 0.66	Pass
VE-3400,3401	9/10/2019	Be-7	1.68 ± 0.22	1.45 ± 0.41	1.57 ± 0.24	Pass
VE-3400,3401	9/12/2019	K-40	4.63 ± 0.42	5.09 ± 0.41	4.86 ± 0.30	Pass
VE-3488,3489	9/17/2019	K-40	22.9 ± 0.8	24.1 ± 1.4	23.5 ± 0.8	Pass
VE-3488,3489	9/17/2019	Be-7	4.33 ± 0.35	4.09 ± 0.50	4.21 ± 0.31	Pass
WW-3467,3468	9/18/2019	H-3	211 ± 85	209 ± 85	210 ± 60	Pass
WW-3730,3731	9/18/2019	H-3	229 ± 83	256 ± 85	242 ± 59	Pass
AP-3533,3534	9/19/2019	Be-7	0.217 ± 0.093	0.261 ± 0.112	0.239 ± 0.073	Pass
WW-3554,3555	9/23/2019	Gr. Beta	1.62 ± 1.10	1.93 ± 1.07	1.77 ± 0.77	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
DW-10111,10112	9/23/2019	Gr. Alpha	1.72 ± 0.73	1.41 ± 0.68	1.57 ± 0.50	Pass
DW-10115,10116	9/25/2019	Ra-228	3.65 ± 0.80	2.76 ± 0.68	3.21 ± 0.52	Pass
DW-10115,10116	9/25/2019	Ra-226	2.99 ± 0.23	2.74 ± 0.25	2.87 ± 0.17	Pass
G-3600,3601	9/26/2019	K-40	5.19 ± 0.46	5.48 ± 0.41	5.33 ± 0.31	Pass
AP-3921,3922	10/1/2019	Be-7	0.074 ± 0.011	0.070 ± 0.012	0.072 ± 0.008	Pass
AP-3986,3987	10/2/2019	Be-7	0.060 ± 0.009	0.066 ± 0.011	0.063 ± 0.007	Pass
WW-3793,3794	10/8/2019	Gr. Beta	3.75 ± 1.18	4.34 1.20	4.05 ± 0.84	Pass

Note: Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

<sup>a</sup> Results are reported in units of pCi/L, except for air filters (pCi/Filter or pCi/m<sup>3</sup>), food products, vegetation, soil and sediment (pCi/g).

<sup>b</sup> Laboratory codes: AP (Air Particulate), AV (Aquatic Vegetation), BS (Bottom Sediment), CF (Cattle Feed), CH (Charcoal Canister), DW (Drinking Water), E (Egg), F (Fish), G (Grass), LW (Lake Water), P (Precipitation), PM (Powdered Milk), S, (Solid), SG (Sludge), SO (Soil), SS (Shoreline Sediment), SW (Surface Water), SWT (Surface Water Treated), SWU (Surface Water Untreated), VE (Vegetation), W Water (Water), WW (Well Water).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code <sup>b</sup>	Reference Date	Analysis	Laboratory result	Concentration <sup>a</sup>		Acceptance
				Known Activity	Control Limits <sup>c</sup>	
MASO-3638	8/1/2018	Cs-134	688.7 ± 26.2	781	547 - 1015	Pass
MASO-3638	8/1/2018	Cs-137	605.9 ± 22.7	572	400 - 744	Pass
MASO-3638	8/1/2018	Co-57	976.7 ± 37.6	958	671 - 1245	Pass
MASO-3638	8/1/2018	Co-60	604.5 ± 24.9	608	426 - 790	Pass
MASO-3638	8/1/2018	Mn-54	5.2 ± 5.2	0	NA <sup>c</sup>	Pass
MASO-3638	8/1/2018	K-40	630 ± 31	566	396 - 736	Pass
MASO-3638	8/1/2018	Zn-65	556.4 ± 26.8	500	350 - 650	Pass
MAAP-3636	8/1/2018	Cs-134	0.37 ± 0.04	0.444	0.311 - 0.577	Pass
MAAP-3636	8/1/2018	Cs-137	0.34 ± 0.05	0.345	0.242 - 0.449	Pass
MAAP-3636	8/1/2018	Co-57	0.56 ± 0.04	0.592	0.414 - 0.770	Pass
MAAP-3636	8/1/2018	Co-60	0.28 ± 0.03	0.294	0.206 - 0.382	Pass
MAAP-3636	8/1/2018	Mn-54	0.26 ± 0.05	0.266	0.186 - 0.346	Pass
MAAP-3636	8/1/2018	Zn-65	0.22 ± 0.07	0.201	NA <sup>d</sup>	Pass
MAVE-3640	8/1/2018	Cs-134	1.87 ± 0.10	1.94	1.36 - 2.52	Pass
MAVE-3640	8/1/2018	Cs-137	2.69 ± 0.15	2.36	1.65 - 3.07	Pass
MAVE-3640	8/1/2018	Co-57	3.90 ± 0.12	3.31	2.32 - 4.30	Pass
MAVE-3640	8/1/2018	Co-60	1.76 ± 0.09	1.68	1.18 - 2.18	Pass
MAVE-3640	8/1/2018	Mn-54	2.91 ± 0.16	2.53	1.77 - 3.29	Pass
MAVE-3640	8/1/2018	Zn-65	1.53 ± 0.21	1.37	0.96 - 1.78	Pass
MAW-3480	8/1/2018	H-3	336.0 ± 10.7	338	237 - 439	Pass
MAW-3480	8/1/2018	Cs-134	7.86 ± 0.31	8.7	6.1 - 11.3	Pass
MAW-3480	8/1/2018	Cs-137	7.55 ± 0.33	6.9	4.8 - 9.0	Pass
MAW-3480	8/1/2018	Co-57	15.67 ± 0.36	14.9	10.4 - 19.4	Pass
MAW-3480	8/1/2018	Co-60	0.12 ± 0.12	0	NA <sup>c</sup>	Pass
MAW-3480	8/1/2018	Mn-54	13.38 ± 0.44	12.5	8.8 - 16.3	Pass
MAW-3480	8/1/2018	Zn-65	7.80 ± 0.53	7.53	5.27 - 9.79	Pass
MAW-3634	8/1/2018	I-129	1.32 ± 0.08	1.62	1.13 - 2.11	Pass
MAAP-609	2/1/2019	Gross Alpha	0.16 ± 0.03	0.528	0.158 - 0.898	Pass
MAAP-609	2/1/2019	Gross Beta	1.09 ± 0.07	0.948	0.474 - 1.422	Pass
MAW-550	2/1/2019	Gross Alpha	0.73 ± 0.06	0.84	0.25 - 1.43	Pass
MAW-550	2/1/2019	Gross Beta	2.26 ± 0.06	2.33	1.17 - 3.50	Pass
MASO-605	2/1/2019	Am-241	38.89 ± 5.92	49.9	34.9 ± 64.9	Pass
MASO-605	2/1/2019	Cs-134	0.45 ± 2.52	0.0	NA <sup>c</sup>	Pass
MASO-605	2/1/2019	Cs-137	1273.1 ± 13.0	1164	815 - 1513	Pass
MASO-605	2/1/2019	Co-57	0.46 ± 1.1	0.0	NA <sup>c</sup>	Pass
MASO-605	2/1/2019	Co-60	857.96 ± 8.52	855.0	599 - 1112	Pass
MASO-605	2/1/2019	Mn-54	1,138.0 ± 13.5	1027	719 - 1335	Pass
MASO-605	2/1/2019	Zn-65	730.92 ± 16.48	668	468 - 868	Pass
MASO-605	2/1/2019	K-40	676 ± 47	585	410 - 761	Pass
MASO-605	2/1/2019	Sr-90	0.0007 ± 0.0007	0.000	NA <sup>c</sup>	Pass



TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code <sup>b</sup>	Reference Date	Analysis	Laboratory result	Concentration <sup>a</sup>		Acceptance
				Known Activity	Control Limits <sup>c</sup>	
MASO-605	2/1/2019	Pu-238	78.15 ± 6.11	71.0	49.7 - 92.3	Pass
MASO-605	2/1/2019	Pu-239/240	65.00 ± 5.4	59.8	41.9 - 77.7	Pass
MASO-605	2/1/2019	U-234	65 ± 13	56	39 - 73	Pass
MASO-605	2/1/2019	U-238	237 ± 23	205	144 - 267	Pass
MAW-613	2/1/2019	Am-241	0.46 ± 0.03	0.582	0.407 - 0.757	Pass
MAW-613	2/1/2019	Cs-134	5.49 ± 0.18	5.99	4.19 - 7.79	Pass
MAW-613	2/1/2019	Cs-137	0.089 ± 0.080	0	NA <sup>c</sup>	Pass
MAW-613	2/1/2019	Co-57	10.87 ± 0.24	10.00	7.0 - 13.0	Pass
MAW-613	2/1/2019	Co-60	6.78 ± 0.19	6.7	4.7 - 8.7	Pass
MAW-613	2/1/2019	Mn-54	8.98 ± 0.17	8.4	5.9 - 10.9	Pass
MAW-613	2/1/2019	Zn-65	0.096 ± 0.141	0	NA <sup>c</sup>	Pass
MAW-613	2/1/2019	Fe-55	0.004 ± 4.00	0	NA <sup>c</sup>	Pass
MAW-613	2/1/2019	Ni-63	5.54 ± 1.52	5.8	4.1 - 7.5	Pass
MAW-613	2/1/2019	Sr-90	6.02 ± 0.53	6.35	4.45 ± 8.26	Pass
MAW-613	2/1/2019	Pu-238	0.315 ± 0.088	0.451	0.316 - 0.586	Fail <sup>e</sup>
MAW-613	2/1/2019	Pu-239/240	0.07 ± 0.07	0.005	NA <sup>d</sup>	Pass
MAW-613	2/1/2019	U-234	0.96 ± 0.07	0.800	0.56 ± 1.04	Pass
MAW-613	2/1/2019	U-238	0.94 ± 0.07	0.810	0.57 ± 1.05	Pass
MAAP-611	2/1/2019	Cs-134	0.185 ± 0.025	0.216	0.151 - 0.281	Pass
MAAP-611	2/1/2019	Cs-137	0.288 ± 0.045	0.290	0.203 - 0.377	Pass
MAAP-611	2/1/2019	Co-57	0.369 ± 0.033	0.411	0.288 - 0.534	Pass
MAAP-611	2/1/2019	Co-60	0.333 ± 0.045	0.340	0.238 - 0.442	Pass
MAAP-611	2/1/2019	Mn-54	0.546 ± 0.058	0.547	0.383 - 0.711	Pass
MAAP-611	2/1/2019	Zn-65	0.025 ± 0.0348	0	NA <sup>c</sup>	Pass
MAAP-611	2/1/2019	Sr-90	1.34 ± 0.13	0.662	0.463 - 0.861	Fail <sup>f</sup>
MAAP-611	2/1/2019	U-234/233	4.14 ± 0.97	0.106	0.074 - 0.138	Fail <sup>f</sup>
MAAP-611	2/1/2019	U-238	3.89 ± 0.94	0.110	0.077 - 0.143	Fail <sup>f</sup>
MAVE-607	2/1/2019	Cs-134	2.33 ± 0.10	2.44	1.71 - 3.17	Pass
MAVE-607	2/1/2019	Cs-137	2.62 ± 0.13	2.30	1.61 - 2.99	Pass
MAVE-607	2/1/2019	Co-57	2.39 ± 0.11	2.07	1.45 - 2.69	Pass
MAVE-607	2/1/2019	Co-60	0.046 ± 0.04	0	NA <sup>c</sup>	Pass
MAVE-607	2/1/2019	Mn-54	0.031 ± 0.04	0	NA <sup>c</sup>	Pass
MAVE-607	2/1/2019	Sr-90	0.013 ± 0.022	0	NA <sup>c</sup>	Pass
MAW-601	2/1/2019	I-129	0.56 ± 0.08	0.616	0.431 - 0.801	Pass

<sup>a</sup> Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

<sup>b</sup> Laboratory codes as follows: MAW (water), MAAP (air filter), MASO (soil) and MAVE (vegetation).

<sup>c</sup> MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

<sup>d</sup> Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

<sup>e</sup> An investigation is in progress to determine the reason for the failure of the Pu-239 study.

<sup>f</sup> An erroneous volume conversion caused some incorrect values to be submitted. If the conversion had been performed properly the results in Bq/sample would have been (Sr-90: 0.671 ± 0.066 ) and (U-234: 0.153 ± 0.036) and (U-238: 0.144 ± 0.035). This result had been included in the Uranium investigation. See footnote "C" on Table A-1.

TABLE A-7. Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (ERA)<sup>a</sup>.

MRAD-30 Study						
Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Control Limits <sup>d</sup>	Acceptance
			Laboratory Result	ERA Value <sup>c</sup>		
ERAP-846	3/18/2019	Am-241	19.1	18.7	13.3 - 24.9	Pass
ERAP-846	3/18/2019	Cs-134	612	721	468 - 884	Pass
ERAP-846	3/18/2019	Cs-137	679	634	521 - 832	Pass
ERAP-846	3/18/2019	Co-60	93.7	93.8	79.7 - 119	Pass
ERAP-846	3/18/2019	Fe-55	612	718	262 - 1150	Pass
ERAP-846	3/18/2019	Mn-54	< 0.5	< 50.0	0.00 - 50.0	Pass
ERAP-846	3/18/2019	Zn-65	1500	1380	1130 - 2110	Pass
ERAP-846	3/18/2019	Pu-238	34.0	33.8	25.5 - 41.5	Pass
ERAP-846	3/18/2019	Pu-239	64.9	67.0	50.1 - 80.8	Pass
ERAP-846	3/18/2019	Sr-90	199	181	114 - 246	Pass
ERAP-846	3/18/2019	U-234 <sup>e</sup>	29.0	18.2	13.5 - 21.3	Fail
ERAP-846	3/18/2019	U-238 <sup>e</sup>	28.6	18.1	13.7 - 21.6	Fail
ERAP-848	3/18/2019	Gross Alpha	48.4	50.3	26.3 - 82.9	Pass
ERAP-848	3/18/2019	Gross Beta	95.5	78.6	47.7 - 119	Pass

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory (EIML) as a participant in the crosscheck program for proficiency testing administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

<sup>b</sup> Laboratory code ERAP (air filter). Results are reported in units of (pCi/Filter).

<sup>c</sup> The ERA Assigned values for the air filter standards are equal to 100% of the parameter present in the standard as determined by the gravimetric and/or volumetric measurements made during standard preparation as applicable. The acceptance limits are established per the guidelines contained in the Department of Energy (DOE)

<sup>d</sup> The acceptance limits are established per the guidelines contained in the Department of Energy (DOE) report EML-56 Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes or ERA's SOP for the generation of Performance Acceptance Limits.

<sup>e</sup> Failure due to an over-estimated U-232 tracer value. Tracer has been re-standardized. (See footnote "c" on Table A-1.

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## APPENDIX B

### DATA REPORTING CONVENTIONS

## Data Reporting Conventions

- 1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

### 2.0. Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where:  $x$  = value of the measurement;

$s$  =  $2\sigma$  counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection  $L$ , it is reported as:  $< L$ , where  $L$  = the lower limit of detection based on  $4.66\sigma$  uncertainty for a background sample.

### 3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows.:

- 3.1 Individual results: For two analysis results;  $x_1 \pm s_1$  and  $x_2 \pm s_2$

Reported result:  $x \pm s$ ; where  $x = (1/2)(x_1 + x_2)$  and  $s = (1/2)\sqrt{s_1^2 + s_2^2}$

- 3.2. Individual results:  $< L_1, < L_2$

Reported result:  $< L$ , where  $L$  = lower of  $L_1$  and  $L_2$

- 3.3. Individual results:  $x \pm s, < L$

Reported result:  $x \pm s$  if  $x \geq L$ ;  $< L$  otherwise.

### 4.0. Computation of Averages and Standard Deviations

- 4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average  $\bar{x}$  and standard deviation "s" of a set of  $n$  numbers  $x_1, x_2, \dots, x_n$  are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4 If all but one of the values are less than the highest LLD, the single value  $x$  and associated two sigma error is reported.
- 4.5 In rounding off, the following rules are followed:
- 4.5.1. If the number following those to be retained is less than 5, the number is dropped, and the retained numbers are kept unchanged. As an example, 11.443 is rounded off to 11.44.
- 4.5.2. If the number following those to be retained is equal to or greater than 5, the number is dropped and the last retained number is raised by 1. As an example, 11.445 is rounded off to 11.45.