

## **RESL CUSTOMER EXPORT CONTROL AGREEMENT**

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4. The obligations and requirements described herein shall survive the expiration or termination of any agreement or contract between RESL and Customer.

## PuW41 Participating Laboratories

<b>Lab Code</b>	<b>Lab Name</b>	<b>Matrix Code</b>
ARGO01	Idaho National Laboratory	PuW
LOCK03	Advanced Test Reactor (ATR) Complex Radioanalytical Laboratory	PuW
SOUT01	Southwest Research Institute	PuW
WSHL01	Wisconsin State Laboratory of Hygiene	PuW

## Laboratories Not Reporting

<b>Lab Code</b>	<b>Lab Name</b>	<b>Matrix Code</b>
CHMH01	222-S Laboratory	PuW
ERCL01	Washington State Public Health Laboratories	PuW
FSCL01	Forensic Science Center Lawrence Livermore Laboratory	PuW
SRPD01	Sandia National Laboratories, Radiation Protection Sample Diagnostics	PuW

## Study Reference Values

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MAPEP-19-PuW41

*Radiological Reference Date: 08/01/2019*

Analyte	Ref Value	Ref Unc
Mass (%)	Units: (%)	
Wt% Pu-239	33.0	0.9

Analyte	Ref Value	Ref Unc
Mass (Np)	Units: (pg/g)	
Neptunium-237	58.1	1.3

Analyte	Ref Value	Ref Unc
Mass (Pu)	Units: (pg/g)	
Plutonium-239	21.7	0.5
Plutonium-240	44.0	0.9

## Sample Statistical Summary

MAPEP-19-PuW41

Radiological Reference Date: 08/01/2019

Analyte	T(1)	A(2)	Grand(3) Mean	Std Dev	Ref Value	Ref Unc	Acceptance Range
Mass (%)							Units: (%)
Wt% Pu-239	3	3			33.0	0.9	23.1 - 42.9

Analyte	T(1)	A(2)	Grand(3) Mean	Std Dev	Ref Value	Ref Unc	Acceptance Range
Mass (Np)							Units: (pg/g)
Neptunium-237	3	3			58.1	1.3	40.7 - 75.5

Analyte	T(1)	A(2)	Grand(3) Mean	Std Dev	Ref Value	Ref Unc	Acceptance Range
Mass (Pu)							Units: (pg/g)
Plutonium-239	4	3			21.7	0.5	15.2 - 28.2
Plutonium-240	3	3			44.0	0.9	30.8 - 57.2

- Note:**
- (1) T = Total number of laboratories reporting analyte.
  - (2) A = Number of laboratories with 'Acceptable' performance.
  - (3) Mean excludes values outside of a bias range of +/- 30%.

### Result Flags:

- A = Result acceptable Bias <=20%
- W = Result acceptable with warning 20% < Bias < 30%
- N = Result not acceptable Bias > 30%
- RW = Report Warning
- NR = Not Reported

## Flag Summary Report

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MAPEP-19-PuW41

Mass (%)				
Analyte	A	W	RW	N
Wt% Pu-239	3			

Mass (Np)				
Analyte	A	W	RW	N
Neptunium-237	3			

Mass (Pu)				
Analyte	A	W	RW	N
Plutonium-240	2	1		
Plutonium-239	3			1



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Laboratory Results For MAPEP-19-PuW41  
 (ARGO01) Idaho National Laboratory  
 INL, Materials and Fuels Complex  
 Idaho Falls, ID 83415

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	24.2	21.7	A		11.5	15.2 - 28.2	0.7	
Plutonium-240	49.9	44.0	A		13.4	30.8 - 57.2	1.5	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	32.7	33.0	A		-1.0	23.1 - 42.9	1.2	

**Result Flags:**

A = Result acceptable Bias  $\leq 20\%$

W = Result acceptable with warning  $20\% < \text{Bias} < 30\%$

N = Result not acceptable Bias  $> 30\%$

RW = Report Warning

NR = Not Reported



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*Laboratory Results For MAPEP-19-PuW41*

(LOCK03) Advanced Test Reactor (ATR) Complex Radioanalytical Laboratory

INL/Battelle Energy Alliance, LLC

Idaho Falls, ID 83415-7111

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	5.556	21.7	N		-74.4	15.2 - 28.2	0.35	
Plutonium-240	NR	44.0				30.8 - 57.2		

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	NR	33.0				23.1 - 42.9		

**Result Flags:**

A = Result acceptable Bias <=20%

W = Result acceptable with warning 20% < Bias < 30%

N = Result not acceptable Bias > 30%

RW = Report Warning

NR = Not Reported





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Laboratory Results For MAPEP-19-PuW41  
 (SOUT01) Southwest Research Institute  
 6220 Culebra Rd.  
 San Antonio, TX 78228-0510

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	19.2	21.7	A		-11.5	15.2 - 28.2	4.20	
Plutonium-240	34.4	44.0	W		-21.8	30.8 - 57.2	4.62	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	35.8	33.0	A		8.5	23.1 - 42.9	8.9	

**Result Flags:**

A = Result acceptable Bias <=20%

W = Result acceptable with warning 20% < Bias < 30%

N = Result not acceptable Bias > 30%

RW = Report Warning

NR = Not Reported



Department of Energy RESL - 1955 Fremont Ave, MS4149 - Idaho Falls, ID 83415

Laboratory Results For MAPEP-19-PuW41  
 (WSHL01) Wisconsin State Laboratory of Hygiene  
 2601 Agriculture Drive  
 Madison, WI 53718

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	21.6	21.7	A		-0.5	15.2 - 28.2	0.2	
Plutonium-240	43.2	44.0	A		-1.8	30.8 - 57.2	0.3	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	33.3	33.0	A		1.0	23.1 - 42.9	0.4	

**Result Flags:**

A = Result acceptable Bias  $\leq 20\%$

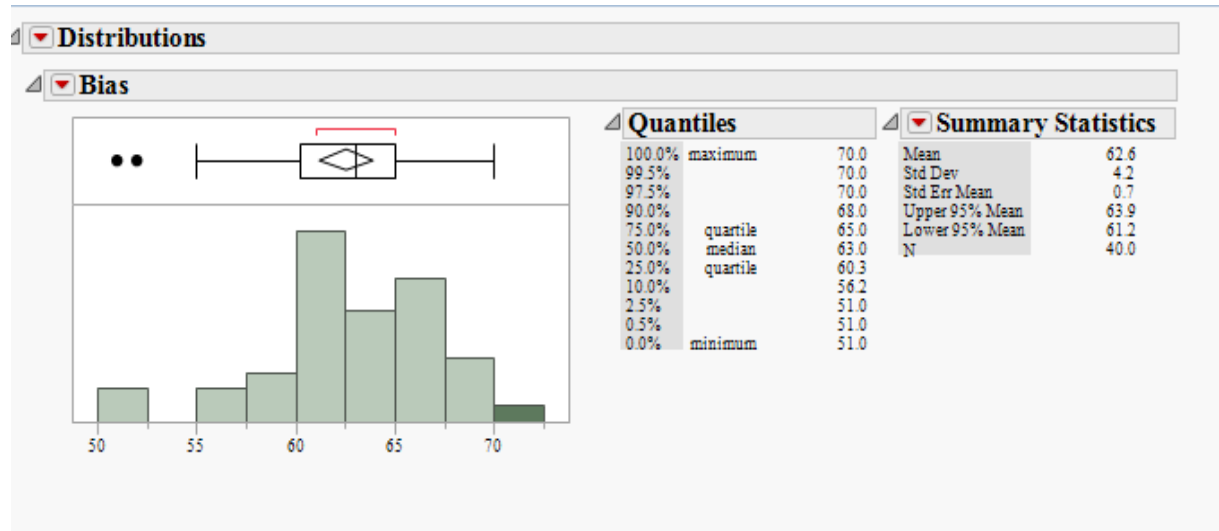
W = Result acceptable with warning  $20\% < \text{Bias} < 30\%$

N = Result not acceptable Bias  $> 30\%$

RW = Report Warning

NR = Not Reported

The intent of the distribution graphs contained within this report is to graphically demonstrate to users how % Bias data within the current MAPEP Series appears when examined by matrix, by analyte, by method of sample preparation or by method of detection. Biases greater than +/- 100% have been screened from the data. The box plot of the bias data points and the mean visually illustrate the breadth of the distribution and where potential outliers in the distribution might lie. The statistics for the distribution plot are provided adjacent to the Bias plot. In some cases, N becomes very small and thus developed statistics may not accurately reflect estimates of the population if N were a significantly larger value.

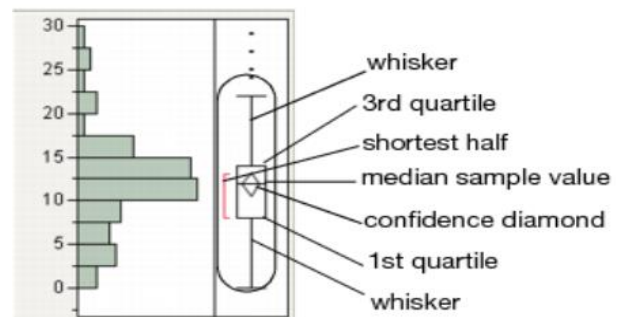


### Outlier Box Plot

The BLACK small vertical line inside the small rectangle at the top of the data distribution graph is the median of the population of the bias shown for that analyte in the matrix. The confidence diamond contains the mean and the upper and lower 95% of the mean. If you drew a line through the middle of the diamond, you would have the mean. The top and bottom points of the diamond represent the upper and lower 95% of the mean. The ends of the box represent the 25th and 75th quantiles, also expressed as 1<sup>st</sup> and 3<sup>rd</sup> quartile. The difference between the 1<sup>st</sup> and 3<sup>rd</sup> quartiles is called the interquartile range. Each box has lines that extend from each end, sometimes called whiskers. The whiskers extend from the ends of the box to the outermost data point that falls within the distances computed as follows:

3rd quartile + 1.5\*(interquartile range)

1st quartile - 1.5\*(interquartile range)

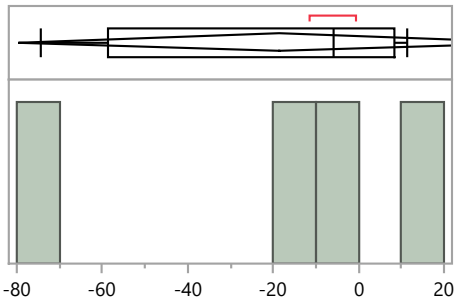


If the data points do not reach the computed ranges, then the whiskers are determined by the upper and lower data point values (not including outliers). The bracket outside of the box identifies the *shortest half*, which is the most dense 50% of the observations (Rousseuw and Leroy 1987).

**PuW Distribution by Detection Method**

**Distributions Analyte\_Detection=Plutonium-239 Inductively Coupled Plasma Mass Spectrometry**

**Bias**



**Quantiles**

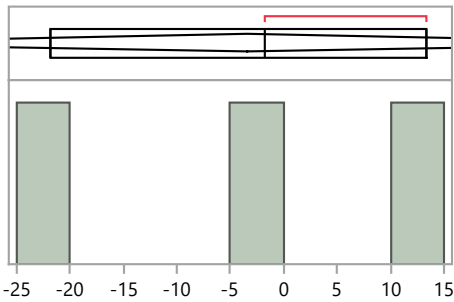
100.0%	maximum	11.5
99.5%		11.5
97.5%		11.5
90.0%		11.5
75.0%	quartile	8.5
50.0%	median	-6.0
25.0%	quartile	-58.7
10.0%		-74.4
2.5%		-74.4
0.5%		-74.4
0.0%	minimum	-74.4

**Summary Statistics**

Mean	-18.7
Std Dev	38.3
Std Err Mean	19.1
Upper 95% Mean	42.2
Lower 95% Mean	-79.6
N	4.0

**Distributions Analyte\_Detection=Plutonium-240 Inductively Coupled Plasma Mass Spectrometry**

**Bias**



**Quantiles**

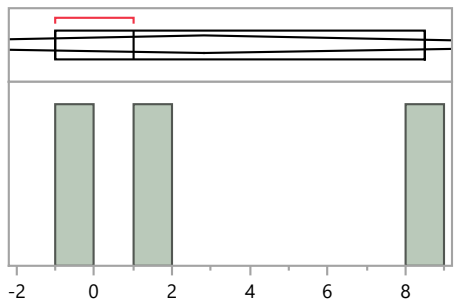
100.0%	maximum	13.4
99.5%		13.4
97.5%		13.4
90.0%		13.4
75.0%	quartile	13.4
50.0%	median	-1.8
25.0%	quartile	-21.8
10.0%		-21.8
2.5%		-21.8
0.5%		-21.8
0.0%	minimum	-21.8

**Summary Statistics**

Mean	-3.4
Std Dev	17.7
Std Err Mean	10.2
Upper 95% Mean	40.5
Lower 95% Mean	-47.3
N	3.0

**Distributions Analyte\_Detection=Wt% Pu-239 Inductively Coupled Plasma Mass Spectrometry**

**Bias**



**Quantiles**

100.0%	maximum	8.5
99.5%		8.5
97.5%		8.5
90.0%		8.5
75.0%	quartile	8.5
50.0%	median	1.0
25.0%	quartile	-1.0
10.0%		-1.0
2.5%		-1.0
0.5%		-1.0
0.0%	minimum	-1.0

**Summary Statistics**

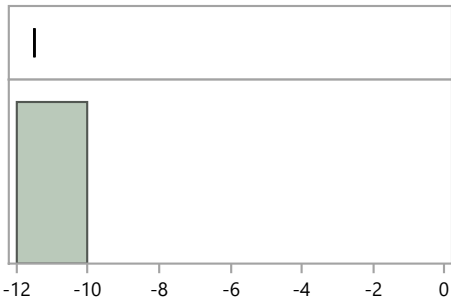
Mean	2.8
Std Dev	5.0
Std Err Mean	2.9
Upper 95% Mean	15.3
Lower 95% Mean	-9.6
N	3.0

PuW41 Distribution by Prep Method

**PuW Distribution by Prep Method**

**Distributions Analyte\_Method=Plutonium-239 EPA Method 200.8 Trace Metals in Waters & Wastes**

**Bias**



**Quantiles**

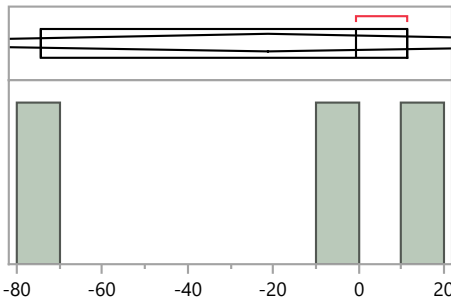
100.0%	maximum	-11.5
99.5%		-11.5
97.5%		-11.5
90.0%		-11.5
75.0%	quartile	-11.5
50.0%	median	-11.5
25.0%	quartile	-11.5
10.0%		-11.5
2.5%		-11.5
0.5%		-11.5
0.0%	minimum	-11.5

**Summary Statistics**

Mean	-11.5
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

**Distributions Analyte\_Method=Plutonium-239 No preparation - analyzed as received**

**Bias**



**Quantiles**

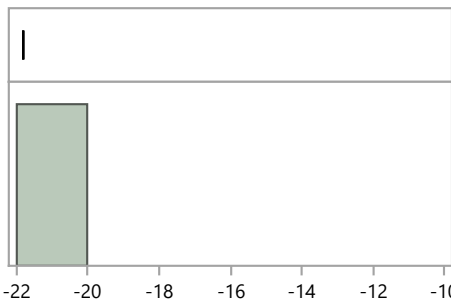
100.0%	maximum	11.5
99.5%		11.5
97.5%		11.5
90.0%		11.5
75.0%	quartile	11.5
50.0%	median	-0.5
25.0%	quartile	-74.4
10.0%		-74.4
2.5%		-74.4
0.5%		-74.4
0.0%	minimum	-74.4

**Summary Statistics**

Mean	-21.1
Std Dev	46.5
Std Err Mean	26.9
Upper 95% Mean	94.4
Lower 95% Mean	-136.7
N	3.0

**Distributions Analyte\_Method=Plutonium-240 EPA Method 200.8 Trace Metals in Waters & Wastes**

**Bias**



**Quantiles**

100.0%	maximum	-21.8
99.5%		-21.8
97.5%		-21.8
90.0%		-21.8
75.0%	quartile	-21.8
50.0%	median	-21.8
25.0%	quartile	-21.8
10.0%		-21.8
2.5%		-21.8
0.5%		-21.8
0.0%	minimum	-21.8

**Summary Statistics**

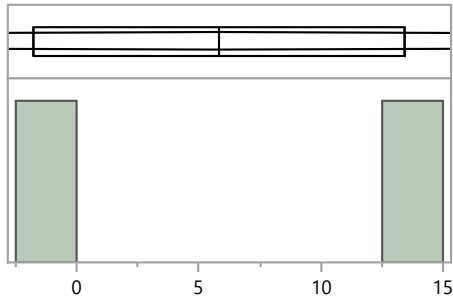
Mean	-21.8
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

PuW41 Distribution by Prep Method

**PuW Distribution by Prep Method**

**Distributions Analyte\_Method=Plutonium-240 No preparation - analyzed as received**

**Bias**



**Quantiles**

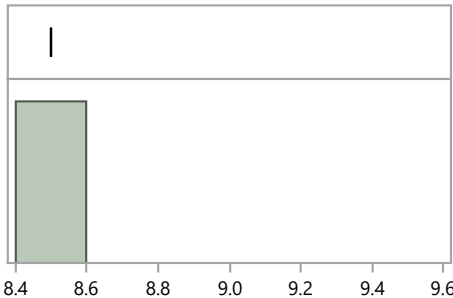
100.0%	maximum	13.4
99.5%		13.4
97.5%		13.4
90.0%		13.4
75.0%	quartile	13.4
50.0%	median	5.8
25.0%	quartile	-1.8
10.0%		-1.8
2.5%		-1.8
0.5%		-1.8
0.0%	minimum	-1.8

**Summary Statistics**

Mean	5.8
Std Dev	10.7
Std Err Mean	7.6
Upper 95% Mean	102.4
Lower 95% Mean	-90.8
N	2.0

**Distributions Analyte\_Method=Wt% Pu-239 EPA Method 200.8 Trace Metals in Waters & Wastes**

**Bias**



**Quantiles**

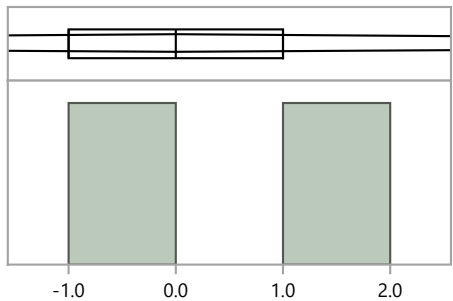
100.0%	maximum	8.5
99.5%		8.5
97.5%		8.5
90.0%		8.5
75.0%	quartile	8.5
50.0%	median	8.5
25.0%	quartile	8.5
10.0%		8.5
2.5%		8.5
0.5%		8.5
0.0%	minimum	8.5

**Summary Statistics**

Mean	8.5
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

**Distributions Analyte\_Method=Wt% Pu-239 No preparation - analyzed as received**

**Bias**



**Quantiles**

100.0%	maximum	1.0
99.5%		1.0
97.5%		1.0
90.0%		1.0
75.0%	quartile	1.0
50.0%	median	0.0
25.0%	quartile	-1.0
10.0%		-1.0
2.5%		-1.0
0.5%		-1.0
0.0%	minimum	-1.0

**Summary Statistics**

Mean	0.0
Std Dev	1.4
Std Err Mean	1.0
Upper 95% Mean	12.7
Lower 95% Mean	-12.7
N	2.0