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PuW40 Participating Laboratories

Lab Code	Lab Name	Matrix Code
ARGO01	Idaho National Laboratory	PuW
ERCL01	Washington State Public Health Laboratories	PuW
FSCL01	Forensic Science Center Lawrence Livermore 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

Lab Code	Lab Name	Matrix Code
ERAD01	Lawrence Livermore National Laboratory ERAD	PuW
HCAL01	Lawrence Livermore National Laboratory	PuW
SRPD01	Sandia National Laboratories, Radiation Protection Sample Diagnostics	PuW

Study Reference Values

MAPEP-19-PuW40

Radiological Reference Date: 02/01/2019

Analyte	Ref Value	Ref Unc
Mass (%)	Units: (%)	
Wt% Pu-239	62.0	0.8

Analyte	Ref Value	Ref Unc
Mass (Pu)	Units: (pg/g)	
Plutonium-239	37.4	0.4
Plutonium-240	22.9	0.2

Sample Statistical Summary

MAPEP-19-PuW40

Radiological Reference Date: 02/01/2019

Analyte	T(1)	A(2)	Grand(3) Mean	Std Dev	Ref Value	Ref Unc	Acceptance Range
Mass (%)							Units: (%)
Wt% Pu-239	5	5			62.0	0.8	43.4 - 80.6

Analyte	T(1)	A(2)	Grand(3) Mean	Std Dev	Ref Value	Ref Unc	Acceptance Range
Mass (Pu)							Units: (pg/g)
Plutonium-239	6	5			37.4	0.4	26.2 - 48.6
Plutonium-240	5	4			22.9	0.2	16.0 - 29.8

- 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

MAPEP-19-PuW40

Mass (%)

Analyte	A	W	RW	N
Wt% Pu-239	5			

Mass (Pu)

Analyte	A	W	RW	N
Plutonium-240	2	2		1
Plutonium-239	4	1		1



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

Laboratory Results For MAPEP-19-PuW40

(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	43.4	37.4	A		16.0	26.2 - 48.6	3.98	
Plutonium-240	NR	22.9				16.0 - 29.8		

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	NR	62.0				43.4 - 80.6		

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-PuW40
 (ERCL01) Washington State Public Health Laboratories
 1610 N.E. 150th Street
 Shoreline, WA 98155-9701

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	48.8	37.4	N		30.5	26.2 - 48.6	6.9	
Plutonium-240	18.4	22.9	A		-19.7	16.0 - 29.8	2.6	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	72.6	62.0	A		17.1	43.4 - 80.6	13.0	

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-PuW40

(FSCL01) Forensic Science Center Lawrence Livermore Laboratory

7000 East Ave.

Livermore, CA 94550

Mass (Pu)							Units: (pg/g)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Plutonium-239	37.71	37.4	A		0.8	26.2 - 48.6	0.21	
Plutonium-240	22.80	22.9	A		-0.4	16.0 - 29.8	0.11	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	62.3	62.0	A		0.5	43.4 - 80.6	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



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Laboratory Results For MAPEP-19-PuW40

(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	31.21	37.4	A		-16.6	26.2 - 48.6	3.43	
Plutonium-240	16.38	22.9	W		-28.5	16.0 - 29.8	1.80	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	65.6	62.0	A		5.8	43.4 - 80.6	9.0	

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-PuW40
 (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	34.4	37.4	A		-8.0	26.2 - 48.6	5.3	
Plutonium-240	15.7	22.9	N		-31.4	16.0 - 29.8	4.9	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	68.7	62.0	A		10.7	43.4 - 80.6	14.5	

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-PuW40
 (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	48.52	37.4	W		29.7	26.2 - 48.6	0.14	
Plutonium-240	29.32	22.9	W		28.0	16.0 - 29.8	0.08	

Mass (%)							Units: (%)	
Analyte	Result	Ref Value	Flag	Notes	Bias (%)	Acceptance Range	Unc Value	Unc Flag
Wt% Pu-239	62.3	62.0	A		0.5	43.4 - 80.6	0.2	

Result Flags:

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

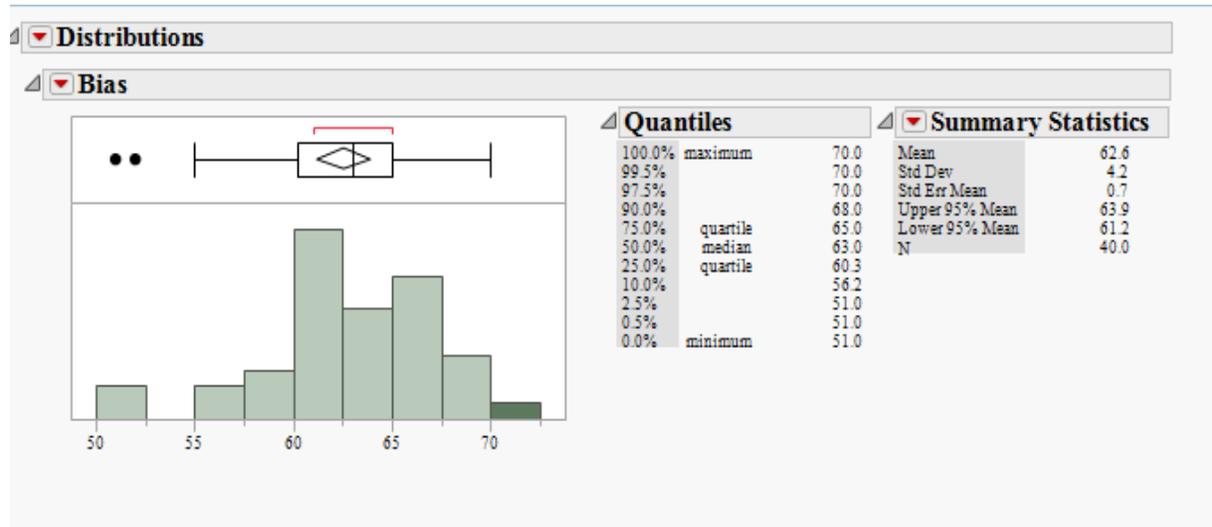
W = Result acceptable with warning $20\% < \text{Bias} < 30\%$

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

RW = Report Warning

NR = Not Reported

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.

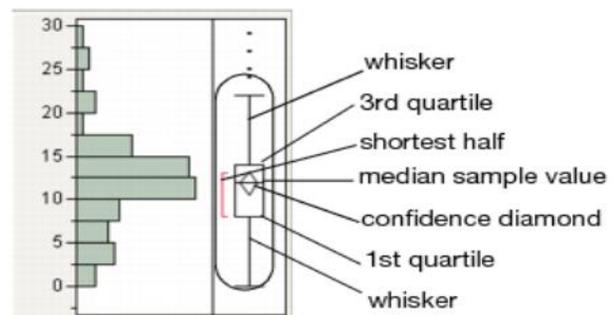


Outlier Box Plot

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 1st and 3rd quartile. The difference between the 1st and 3rd 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)

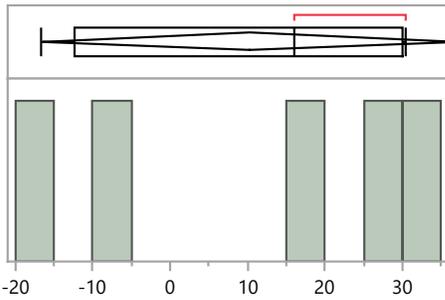


If the data points do not reach the computed ranges, then the whiskers are determined by the upper and lower data point values (not including outliers). The bracket outside of the box identifies the *shortest half*, which is the most dense 50% of the observations (Rousseuw and Leroy 1987).

PuW Distribution by Detection Method

Distributions Analyte_Detection=Plutonium-239 Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

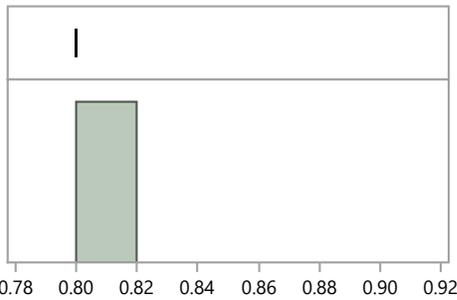
100.0%	maximum	30.5
99.5%		30.5
97.5%		30.5
90.0%		30.5
75.0%	quartile	30.1
50.0%	median	16.0
25.0%	quartile	-12.3
10.0%		-16.6
2.5%		-16.6
0.5%		-16.6
0.0%	minimum	-16.6

Summary Statistics

Mean	10.3
Std Dev	21.7
Std Err Mean	9.7
Upper 95% Mean	37.2
Lower 95% Mean	-16.6
N	5.0

Distributions Analyte_Detection=Plutonium-239 Multicollector Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

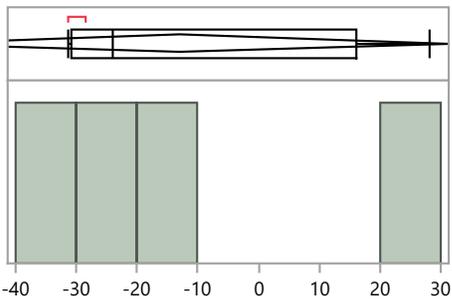
100.0%	maximum	0.8
99.5%		0.8
97.5%		0.8
90.0%		0.8
75.0%	quartile	0.8
50.0%	median	0.8
25.0%	quartile	0.8
10.0%		0.8
2.5%		0.8
0.5%		0.8
0.0%	minimum	0.8

Summary Statistics

Mean	0.8
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

Distributions Analyte_Detection=Plutonium-240 Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

100.0%	maximum	28.0
99.5%		28.0
97.5%		28.0
90.0%		28.0
75.0%	quartile	16.1
50.0%	median	-24.1
25.0%	quartile	-30.7
10.0%		-31.4
2.5%		-31.4
0.5%		-31.4
0.0%	minimum	-31.4

Summary Statistics

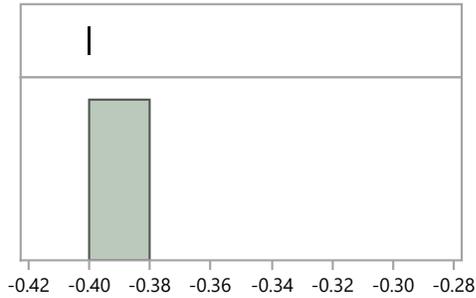
Mean	-12.9
Std Dev	27.7
Std Err Mean	13.9
Upper 95% Mean	31.2
Lower 95% Mean	-57.0
N	4.0

PuW40 Distribution by Detection Method

PuW Distribution by Detection Method

Distributions Analyte_Detection=Plutonium-240 Multicollector Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

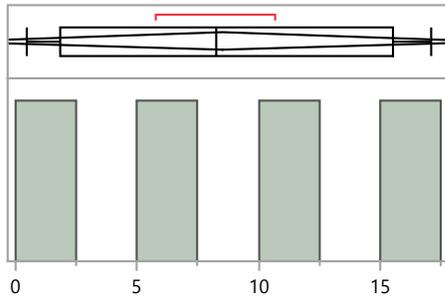
100.0%	maximum	-0.4
99.5%		-0.4
97.5%		-0.4
90.0%		-0.4
75.0%	quartile	-0.4
50.0%	median	-0.4
25.0%	quartile	-0.4
10.0%		-0.4
2.5%		-0.4
0.5%		-0.4
0.0%	minimum	-0.4

Summary Statistics

Mean	-0.4
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

Distributions Analyte_Detection=Wt% Pu-239 Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

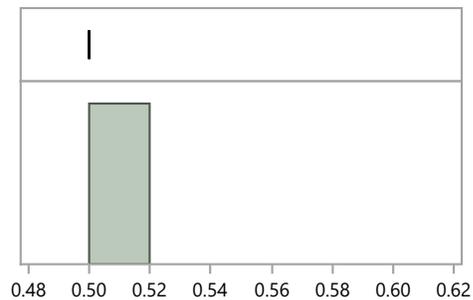
100.0%	maximum	17.1
99.5%		17.1
97.5%		17.1
90.0%		17.1
75.0%	quartile	15.5
50.0%	median	8.3
25.0%	quartile	1.8
10.0%		0.5
2.5%		0.5
0.5%		0.5
0.0%	minimum	0.5

Summary Statistics

Mean	8.5
Std Dev	7.1
Std Err Mean	3.5
Upper 95% Mean	19.8
Lower 95% Mean	-2.7
N	4.0

Distributions Analyte_Detection=Wt% Pu-239 Multicollector Inductively Coupled Plasma Mass Spectrometry

Bias



Quantiles

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

Summary Statistics

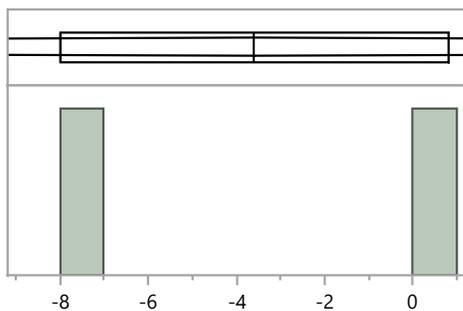
Mean	0.5
Std Dev	.
Std Err Mean	.
Upper 95% Mean	.
Lower 95% Mean	.
N	1.0

PuW40 Distribution by Preparation Method

PuW Distribution by Prep Method

Distributions Analyte_Method=Plutonium-239 EPA Method 200.8 Trace Metals in Waters & Wastes

Bias



Quantiles

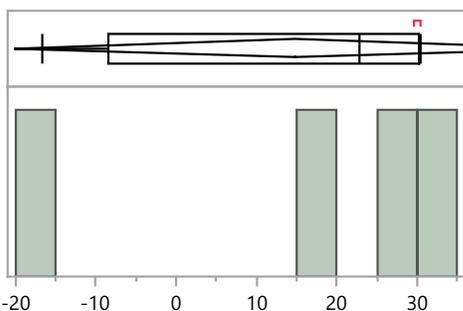
100.0%	maximum	0.8
99.5%		0.8
97.5%		0.8
90.0%		0.8
75.0%	quartile	0.8
50.0%	median	-3.6
25.0%	quartile	-8.0
10.0%		-8.0
2.5%		-8.0
0.5%		-8.0
0.0%	minimum	-8.0

Summary Statistics

Mean	-3.6
Std Dev	6.2
Std Err Mean	4.4
Upper 95% Mean	52.3
Lower 95% Mean	-59.5
N	2.0

Distributions Analyte_Method=Plutonium-239 No preparation - analyzed as received

Bias



Quantiles

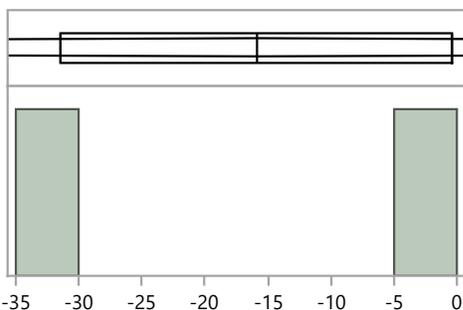
100.0%	maximum	30.5
99.5%		30.5
97.5%		30.5
90.0%		30.5
75.0%	quartile	30.3
50.0%	median	22.9
25.0%	quartile	-8.5
10.0%		-16.6
2.5%		-16.6
0.5%		-16.6
0.0%	minimum	-16.6

Summary Statistics

Mean	14.9
Std Dev	22.0
Std Err Mean	11.0
Upper 95% Mean	50.0
Lower 95% Mean	-20.2
N	4.0

Distributions Analyte_Method=Plutonium-240 EPA Method 200.8 Trace Metals in Waters & Wastes

Bias



Quantiles

100.0%	maximum	-0.4
99.5%		-0.4
97.5%		-0.4
90.0%		-0.4
75.0%	quartile	-0.4
50.0%	median	-15.9
25.0%	quartile	-31.4
10.0%		-31.4
2.5%		-31.4
0.5%		-31.4
0.0%	minimum	-31.4

Summary Statistics

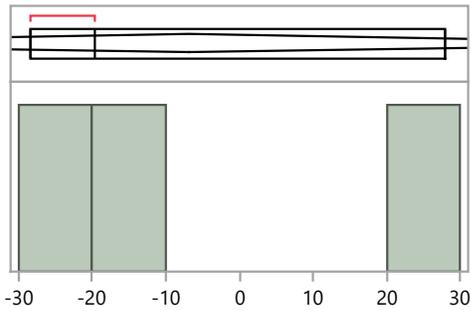
Mean	-15.9
Std Dev	21.9
Std Err Mean	15.5
Upper 95% Mean	181.0
Lower 95% Mean	-212.8
N	2.0

PuW40 Distribution by Preparation Method

PuW Distribution by Prep Method

Distributions Analyte_Method=Plutonium-240 No preparation - analyzed as received

Bias



Quantiles

100.0%	maximum	28.0
99.5%		28.0
97.5%		28.0
90.0%		28.0
75.0%	quartile	28.0
50.0%	median	-19.7
25.0%	quartile	-28.5
10.0%		-28.5
2.5%		-28.5
0.5%		-28.5
0.0%	minimum	-28.5

Summary Statistics

Mean	-6.7
Std Dev	30.4
Std Err Mean	17.6
Upper 95% Mean	68.8
Lower 95% Mean	-82.3
N	3.0