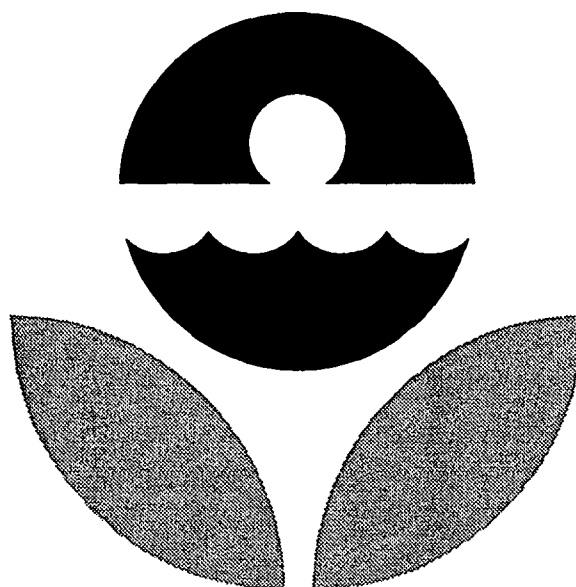




Gross Alpha-Beta in Water Performance Evaluation Study

A Statistical Evaluation of the November 13, 1998 Data

Gross Alpha-Beta in Water
Performance Evaluation Study
November 13, 1998



Environmental Protection Agency
National Exposure Research Laboratory
Environmental Sciences Division
Las Vegas, Nevada



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT
NATIONAL EXPOSURE RESEARCH LABORATORY
ENVIRONMENTAL SCIENCES DIVISION-LAS VEGAS
P.O. BOX 93478
LAS VEGAS, NEVADA 89193-3478
(702/798-2100)

Dear Participant,

Enclosed are the results of the Environmental Sciences Division (ESD-LV) Performance Evaluation Study for *Gross Alpha-Beta in Water; November 13, 1998*.

The known value for each analysis was determined by gravimetric methods, checked by chemical analyses performed by ESD-LV's Radiochemistry Laboratory, and compared to the participating laboratories' grand average.

The expected precision, determined by the known value, was taken from "Table 3. Laboratory Precision: One Standard Deviation Values and Control Limits for Various Analyses", which is based on data accumulated over the years by the Performance Evaluation Program, and can be found in the Environmental Radioactivity Performance Evaluation Studies Program and Radioactive Standards Distribution Program information brochure.

Please take a few minutes to review this report and the analytical data your laboratory submitted to us. If there are any apparent discrepancies, please notify us immediately.

We encourage you to make use of the computer-automated data-entry system that has been in place for some time now. As the number of participants increases, and it becomes unrealistic for us to receive results by mail or FAX, the computer system will be our only avenue for accepting data.

If you have any questions or comments, please send a message via the data-entry system or contact Stephen Pia at 702/798-2102 or Patricia Honsa at 702/798-2141.

Sincerely,

A handwritten signature in black ink, appearing to read "Stephen Pia".

Stephen Pia
Team Leader
RADQA Program

Enclosure

NOTICE

**This material has been funded wholly by
the U.S. Environmental Protection Agency.
It has been subjected to the Agency's review,
and has been approved for publication as
an EPA document.**

The following pages consist of separate sections for each of the nuclides in this study with four parts per section. After the first, each part is separated from the next by a new page or a thick horizontal bar. The first page of each section is a statistical summary for the nuclide and starts with a statement of the known value, the control limits, and the warning limits.

The warning limits are placed at two normalized standard deviations above and below the known value and the control limits are three normalized standard deviations above and below the known value. If you keep control charts, these values will be useful for anticipating problems with the accuracy of your analytical methods.

The coin shaped pie chart at the top of the summary page shows the fate of all the samples sent out in number and percentage terms. The pie chart starts at the top and rotates clockwise. The first sector represents those participants who submitted analytical results within both the warning and control limits. The next sector represents those who are in the warning region but not out of control. The third sector represents those who are out of control, but have passed the outlier test. The fourth sector represents those who have failed the outlier test. The last sector represents those participants who have failed to respond properly. This is the case if no analytical results were returned, or less than three determinations were reported, or if the results were received too late. The reeding on the edge of the coin is spaced at one percent intervals, and the sector shading becomes darker as the data reliability decreases. Sectors with zero width are not shown.

The table in the center shows a number of statistical quantities calculated from the submitted data based on the mean and median values in relation to the known value, both before and after outlier removal. The lower pie chart uses the same construction as the upper chart and shows the distribution of properly submitted data in terms of deviation from the known value divided into sectors representing one, two, three, and greater than three normalized standard deviations.

The second part is an alphabetical listing, in lab-code order, of submitted data and several calculated quantities. An entry that is shaded has been rejected because of one of the reasons listed above or failure of the outlier test. The fifth and sixth columns are a measure of laboratory precision. The Range analysis is a normalized value that you may use to keep precision control charts. The eighth and ninth columns are the differences from the mean of all non-outliers and from the known value, respectively. If this value is between 2.0 and 3.0, your analytical process precision is in the warning zone; if it exceeds 3.0 it is out of control. A tag symbol may appear in the last column. Each page with tags has a symbol definition summary at the bottom. If there is no tag symbol, the data is within the control limits, but it may be in the warning zone.

The third part is a three-column listing of result average, tag symbol, and lab-code in average order excluding those labs not responding properly. In this order, all outliers and out-of-control results appear at the top or bottom of the list.

The last part is two bar chart displays showing frequency distributions of responding participants. The first chart places the known value at the center and a bar at each 0.2 unit of expected precision. The second chart places the mean of the reported measurements at the center and a bar at each 0.2 unit of standard deviation. In both cases, a bar includes those results within 0.1 unit up to the maximum of six. Any results more than six units from the center value are shown cumulatively by a shaded bar one past the sixth unit. If the central tendency of the known value distribution falls away from the center, an error in accuracy is indicated. If the distribution is broad, poor precision is indicated. The mean value distribution is similar but uses the average and standard deviation of reported results as its basis.

The Range Analysis($R + SR$) is calculated from the range, mean range and standard error of the range values. The range is the difference between the maximum and minimum results for the laboratory. The mean range is calculated by multiplying the expected precision by 1.693(for three results). The standard error of the range is calculated by multiplying the mean range by 2.575(for three results), subtracting the mean range from this product, and dividing the result by 3. If the range is greater than the mean range, then the range analysis is calculated by subtracting the mean range from the range, dividing the result by the standard error of the range and adding 1. If the mean range is greater than or equal to the range, then the range analysis is calculated by dividing the range by the mean range.

The normalized deviation of the mean from the grand average is calculated from the deviation of the mean from the grand average and the standard error of the mean values. The deviation of the mean from the grand average is calculated by subtracting the grand average from the average of the laboratory's three results. The standard error of the mean is calculated by dividing the expected precision by the square root of 3(the number of results). The normalized deviation of the mean from the grand average is calculated by dividing the deviation of the mean from the grand average by the standard error of the mean.

The normalized deviation of the mean from the known value is calculated from the deviation of the mean from the known value and the standard error of the mean values. The deviation of the mean from the known value is calculated by subtracting the known value from the average of the laboratory's three results. The standard error of the mean is calculated by dividing the expected precision by the square root of 3(the number of results). The normalized deviation of the mean from the known value is calculated by dividing the deviation of the mean from the known value by the standard error of the mean.

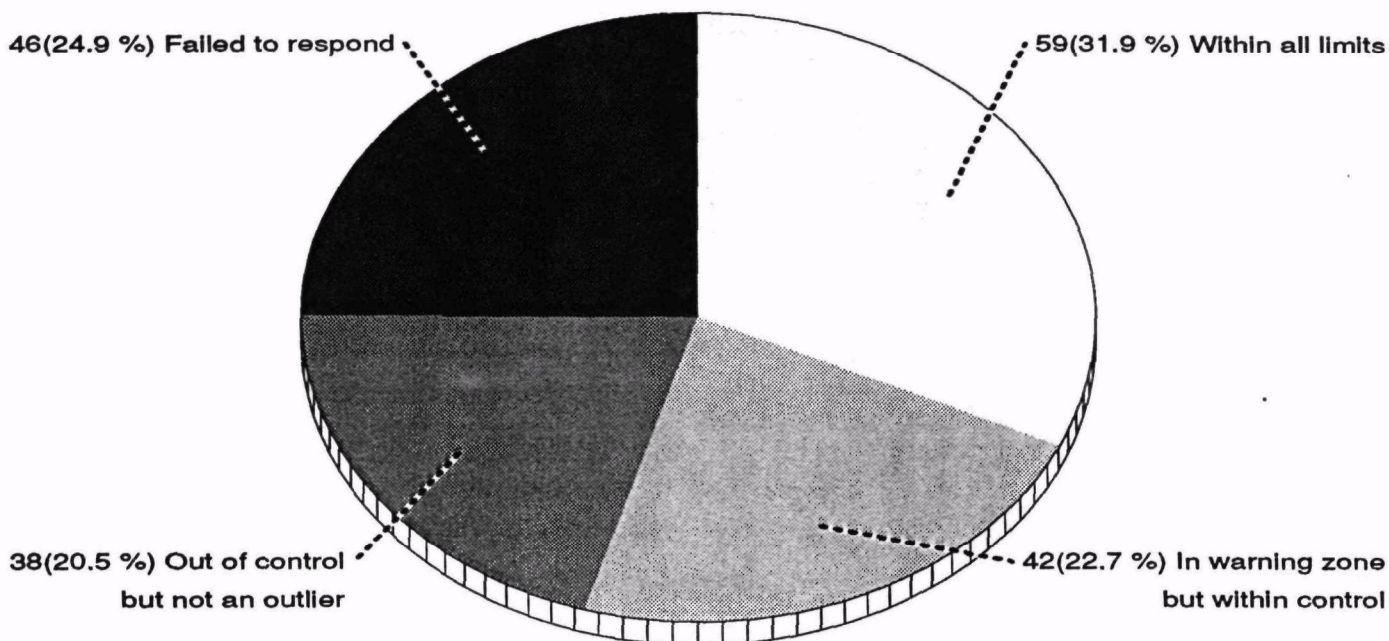
A complete explanation of the statistical calculations involved in the report may be found in the Environmental Radioactivity Performance Evaluation Studies Program information brochure [Draft Revision of EPA-600/4-81-004], available from Patricia Honsa, ESD-LV, 702/798-2141.

Gross Alpha

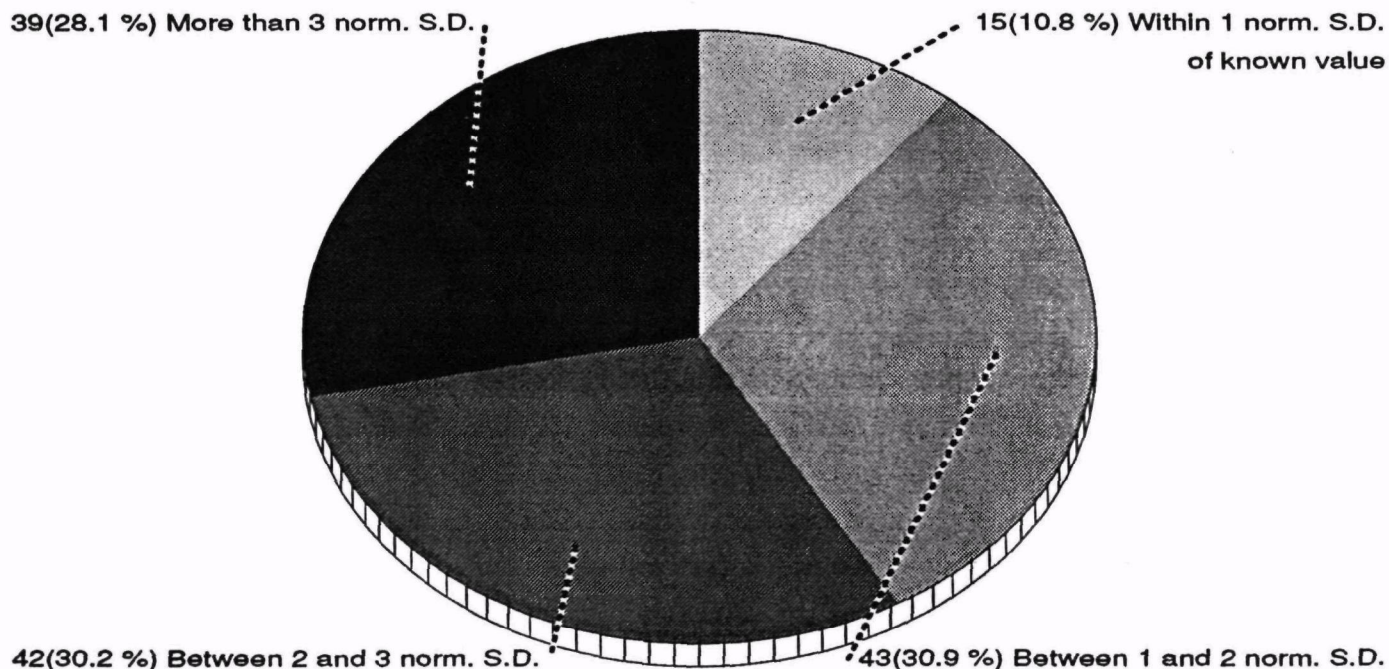
Statistical Summary

185 Participants

The known value of this nuclide is 47.2 pCi/l with an expected precision of 11.8; the control limits are 26.7 to 67.7; the warning regions are 26.7 to 33.5 and 60.9 to 67.7



Statistic	Respondents	Non-outliers
Mean	31.33	Grand Avg 31.33
Std. Dev.	9.10	9.10
Variance	82.75	82.75
% Coef. of Var.	29.04	29.04
% deviation of mean from known value	-33.62	-33.62
Norm. dev. of mean from known value	-1.74	-1.74
Median	31.33	31.33
% deviation of median from known value	-33.62	-33.62
Norm. dev. of median from known value	-1.74	-1.74



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Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
A	40.7	38.2	40.3	1.34	0.125	39.73	1.23	-1.10	
AE	39.2	33.7	41.1	3.84	0.370	38.00	0.98	-1.35	
AF	29.8	26.4	29.2	1.81	0.170	28.47	-0.42	-2.75	
AH									•
AJ	17.1	25.4	21.5	4.15	0.415	21.33	-1.47	-3.80	↓
AK	33.4	27.2	29.1	3.18	0.310	29.90	-0.21	-2.54	
AL	43.4	40.6	40.9	1.54	0.140	41.63	1.51	-0.82	
AP									•
AR	36.3	39.8	41.7	2.74	0.270	39.27	1.17	-1.16	
AU	42.2	36.3	40.1	2.99	0.295	39.53	1.20	-1.13	
AW	27.3	28.4	30.6	1.68	0.165	28.77	-0.38	-2.71	
AZ	34.9	32.4	28.9	3.01	0.300	32.07	0.11	-2.22	
BA	32.7	38.4	35.0	2.87	0.285	35.37	0.59	-1.74	
BB	20.5	22.4	25.1	2.31	0.230	22.67	-1.27	-3.60	↓
BC	41.4	40.2	38.0	1.72	0.170	39.87	1.25	-1.08	
BG									•
BH	33.3	39.0	33.9	3.13	0.285	35.40	0.60	-1.73	
BK	36.2	34.3	33.6	1.35	0.130	34.70	0.49	-1.83	
BL	30.3	29.5	33.2	1.95	0.185	31.00	-0.05	-2.38	
BM	38.1	40.9	35.8	2.55	0.255	38.27	1.02	-1.31	
BN	25.2	27.5	24.3	1.65	0.160	25.67	-0.83	-3.16	↓
BO	35.7	49.9	32.1	9.41	0.891	39.23	1.16	-1.17	
BS	37.4	43.6	45.5	4.24	0.405	42.17	1.59	-0.74	
C	39.0	41.9	44.2	2.61	0.260	41.70	1.52	-0.81	
CA	26.6	24.6	25.2	1.03	0.100	25.47	-0.86	-3.19	↓
CC									•
CE	33.2	42.0	39.8	4.58	0.440	38.33	1.03	-1.30	
CJ									•
CO	19.0	24.5	24.8	3.27	0.290	22.77	-1.26	-3.59	↓
CP	27.8	26.4	30.2	1.92	0.190	28.13	-0.47	-2.80	
CS	37.3	41.1	32.9	4.10	0.410	37.10	0.85	-1.48	
CX	23.0	17.0	21.7	3.16	0.300	20.57	-1.58	-3.91	↓
D	34.8	39.6	36.9	2.41	0.240	37.10	0.85	-1.48	
DB	30.3	29.4	31.2	0.90	0.090	30.30	-0.15	-2.48	
DD	23.8	22.6	21.1	1.35	0.135	22.50	-1.30	-3.63	↓
DE	30.7	30.9	31.0	0.15	0.015	30.87	-0.07	-2.40	
DH	35.6	43.0	39.0	3.70	0.370	39.20	1.16	-1.17	
DO	41.0	32.0	35.0	4.58	0.451	36.00	0.69	-1.64	
DR	8.8	8.3	10.0	0.87	0.085	9.03	-3.27	-5.60	↓
DT	45.2	43.7	39.5	2.95	0.285	42.80	1.68	-0.65	
DZ	33.3	32.1	30.8	1.25	0.125	32.07	0.11	-2.22	
E	33.5	33.1	34.0	0.45	0.045	33.53	0.32	-2.01	
EB	33.1	40.3	34.2	3.88	0.360	35.87	0.67	-1.66	
EL									•
EO	29.0	27.0	29.0	1.15	0.100	28.33	-0.44	-2.77	

• = No data submitted

TAG SYMBOLS

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× = Determined to be an outlier

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Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
ER	31.3	33.9	33.3	1.36	0.130	32.83	0.22	-2.11	
EV	19.9	24.3	17.2	3.58	0.355	20.47	-1.59	-3.92	↓
EW									•
EX	19.8	20.1	20.3	0.25	0.025	20.07	-1.65	-3.98	↓
FE	22.0	19.0	21.0	1.53	0.150	20.67	-1.57	-3.89	↓
FF									•
FJ									•
FL	26.9	27.1	31.3	2.48	0.220	28.43	-0.43	-2.75	
FN	47.0	48.0	40.0	4.36	0.400	45.00	2.01	-0.32	
GQ	34.3	34.9	36.0	0.86	0.085	35.07	0.55	-1.78	
GZ	36.3	32.0	44.0	6.08	0.601	37.43	0.90	-1.43	
HE	38.2	42.6	42.2	2.43	0.220	41.00	1.42	-0.91	
HI	27.2	18.8	21.5	4.29	0.420	22.50	-1.30	-3.63	↓
HK	27.4	28.5	27.1	0.74	0.070	27.67	-0.54	-2.87	
HL	40.1	29.5	41.3	6.49	0.591	36.97	0.83	-1.50	
HP	19.4	18.0	18.4	0.72	0.070	18.60	-1.87	-4.20	↓
I	33.5	32.8	32.0	0.75	0.075	32.77	0.21	-2.12	
ID	40.8	32.7	35.7	4.10	0.405	36.40	0.74	-1.59	
IU									•
J									•
JE	32.5	31.0	31.8	0.75	0.075	31.77	0.06	-2.27	
JG	25.0	25.2	24.5	0.36	0.035	24.90	-0.94	-3.27	↓
JM	31.6	30.7	31.1	0.45	0.045	31.13	-0.03	-2.36	
JN	50.9	53.1	49.7	1.72	0.170	51.23	2.92	0.59	
JP	40.0	38.0	36.0	2.00	0.200	38.00	0.98	-1.35	
JQ	36.9	41.2	37.6	2.31	0.215	38.57	1.06	-1.27	
JS	32.6	26.4	26.3	3.61	0.315	28.43	-0.43	-2.75	
JY	38.3	30.4	40.4	5.27	0.501	36.37	0.74	-1.59	
K	37.4	36.0	37.9	0.98	0.095	37.10	0.85	-1.48	
KE	22.7	24.2	23.8	0.78	0.075	23.57	-1.14	-3.47	↓
KH	26.5	28.8	27.1	1.19	0.115	27.47	-0.57	-2.90	
KT	38.0	39.0	41.0	1.53	0.150	39.33	1.17	-1.15	
KX	26.1	21.8	24.6	2.18	0.215	24.17	-1.05	-3.38	↓
L	37.0	32.1	31.6	2.98	0.270	33.57	0.33	-2.00	
LE	28.9	30.6	28.6	1.08	0.100	29.37	-0.29	-2.62	
LF	28.0	27.0	33.0	3.21	0.300	29.33	-0.29	-2.62	
LL	37.4	44.4	32.2	6.12	0.611	38.00	0.98	-1.35	
LR	15.1	15.3	14.7	0.31	0.030	15.03	-2.39	-4.72	↓
M									•
MF	36.3	36.4	36.7	0.21	0.020	36.47	0.75	-1.58	
MT									•
MV	28.7	27.0	32.0	2.54	0.250	29.23	-0.31	-2.64	
MX	16.5	17.1	19.2	1.42	0.135	17.60	-2.02	-4.34	↓
N									•
NA	34.6	38.9	38.6	2.40	0.215	37.37	0.89	-1.44	

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Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
NB									•
NH	24.0	27.0	26.0	1.53	0.150	25.67	-0.83	-3.16	↓
NJ	20.5	26.4	29.3	4.48	0.440	25.40	-0.87	-3.20	↓
NK									•
NO	22.3	26.5	30.7	4.20	0.420	26.50	-0.71	-3.04	↓
NP	26.4	26.3	25.4	0.55	0.050	26.03	-0.78	-3.11	↓
O	38.8	38.0	34.8	2.12	0.200	37.20	0.86	-1.47	
OA									•
OB	36.1	32.6	33.0	1.92	0.175	33.90	0.38	-1.95	
OF	28.0	28.6	28.8	0.42	0.040	28.47	-0.42	-2.75	
OS									•
OT									•
OY									•
P	19.5	21.7	26.5	3.58	0.350	22.57	-1.29	-3.62	↓
PB	32.2	33.8	32.3	0.90	0.080	32.77	0.21	-2.12	
PD									•
PG	30.3	28.1	34.3	3.14	0.310	30.90	-0.06	-2.39	
PM	40.7	36.0	36.2	2.66	0.235	37.63	0.93	-1.40	
Q	21.3	21.8	21.6	0.25	0.025	21.57	-1.43	-3.76	↓
QM	20.3	17.1	15.7	2.36	0.230	17.70	-2.00	-4.33	↓
QP	32.7	35.3	34.6	1.35	0.130	34.20	0.42	-1.91	
QQ	36.9	37.5	36.1	0.70	0.070	36.83	0.81	-1.52	
QT	36.0	34.5	40.9	3.35	0.320	37.13	0.85	-1.48	
QU	26.5	33.5	30.1	3.50	0.350	30.03	-0.19	-2.52	
QW	32.8	29.2	30.3	1.84	0.180	30.77	-0.08	-2.41	
QX	8.4	9.7	8.3	0.78	0.070	8.80	-3.31	-5.64	↓
QZ	31.7	32.4	34.5	1.46	0.140	32.87	0.23	-2.10	
R	16.7	17.0	16.0	0.51	0.050	16.57	-2.17	-4.50	↓
RB	41.8	36.7	38.3	2.61	0.255	38.93	1.12	-1.21	
RD	39.2	46.0	47.1	4.28	0.395	44.10	1.87	-0.46	
RG									•
RI	37.9	28.3	27.8	5.69	0.506	31.33	0.00	-2.33	
RK									•
RR									•
RZ	39.6	36.5	36.6	1.76	0.155	37.57	0.92	-1.41	
S	41.3	40.5	41.6	0.57	0.055	41.13	1.44	-0.89	
SD	52.0	48.5	50.3	1.75	0.175	50.27	2.78	0.45	
SF	25.5	26.0	25.5	0.29	0.025	25.67	-0.83	-3.16	↓
SG	37.3	35.5	34.9	1.25	0.120	35.90	0.67	-1.66	
SI	24.7	26.2	25.6	0.76	0.075	25.50	-0.86	-3.19	↓
SL	25.2	24.5	24.4	0.44	0.040	24.70	-0.97	-3.30	↓
SM	29.1	28.7	25.1	2.20	0.200	27.63	-0.54	-2.87	
SN	28.7	26.3	29.8	1.79	0.175	28.27	-0.45	-2.78	
SO	28.1	26.1	26.0	1.18	0.105	26.73	-0.67	-3.00	
SR	34.3	35.3	33.7	0.81	0.080	34.43	0.46	-1.87	

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Gross Alpha									
Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
SS	33.1	32.5	34.0	0.75	0.075	33.20	0.27	-2.05	
SU	7.1	5.9	9.8	2.00	0.195	7.60	-3.48	-5.81	↓
SV									•
SX	22.3	20.3	21.0	1.01	0.100	21.20	-1.49	-3.82	↓
T									•
TD	24.1	25.0	24.1	0.52	0.045	24.40	-1.02	-3.35	↓
TL									•
TN	44.1	40.2	44.8	2.48	0.230	43.03	1.72	-0.61	
TO									•
TQ	28.9	28.2	30.6	1.23	0.120	29.23	-0.31	-2.64	
TW	25.7	21.4	26.2	2.64	0.240	24.43	-1.01	-3.34	↓
TX									•
TY	29.3	26.5	26.4	1.65	0.145	27.40	-0.58	-2.91	
U	30.8	30.9	28.6	1.30	0.115	30.10	-0.18	-2.51	
UA									•
UM									•
UP	38.8	31.8	33.0	3.74	0.350	34.53	0.47	-1.86	
UQ									•
UY									•
VA									•
VC									•
VH	30.8	28.2	24.6	3.11	0.310	27.87	-0.51	-2.84	
VI	28.8	35.4	29.5	3.63	0.330	31.23	-0.01	-2.34	
VJ	27.9	26.8	32.2	2.85	0.270	28.97	-0.35	-2.68	
VO	31.5	33.0	37.6	3.18	0.305	34.03	0.40	-1.93	
VT	57.9	51.1	58.6	4.14	0.375	55.87	3.60	1.27	
W	28.5	26.3	25.9	1.40	0.130	26.90	-0.65	-2.98	
WE	4.3	5.1	3.4	0.85	0.085	4.27	-3.97	-6.30	↓
WH	38.5	35.5	39.2	1.97	0.185	37.73	0.94	-1.39	
WJ									•
WN	48.8	47.6	45.2	1.83	0.180	47.20	2.33	0.00	
WO	21.4	14.0	25.8	5.96	0.591	20.40	-1.60	-3.93	↓
WP									•
WR	53.1	54.4	57.0	1.99	0.195	54.83	3.45	1.12	
WS									•
WW	38.1	32.5	29.8	4.23	0.415	33.47	0.31	-2.02	
WX									•
X	36.8	45.9	47.9	5.92	0.556	43.53	1.79	-0.54	
XB									•
XC									•
XD									•
XF	37.8	43.8	46.7	4.54	0.446	42.77	1.68	-0.65	
XI	32.0	20.0	24.0	6.11	0.601	25.33	-0.88	-3.21	↓
XJ									•
XK									•

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

8 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998

Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)	Tag
XL	40.2	41.8	42.1	1.02	0.095	41.37	1.47	-0.86
XM	26.1	28.9	27.5	1.40	0.140	27.50	-0.56	-2.89
XN								•
XQ	1.8	2.2	2.6	0.40	0.040	2.20	-4.28	-6.61 ↓
XT								•

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
2.20	↓	XQ	26.50	↓	NO	32.77		I
4.27	↓	WE	26.73		SO	32.83		ER
7.60	↓	SU	26.90		W	32.87		QZ
8.80	↓	QX	27.40		TY	33.20		SS
9.03	↓	DR	27.47		KH	33.47		WW
15.03	↓	LR	27.50		XM	33.53		E
16.57	↓	R	27.63		SM	33.57		L
17.60	↓	MX	27.67		HK	33.90		OB
17.70	↓	QM	27.87		VH	34.03		VO
18.60	↓	HP	28.13		CP	34.20		QP
20.07	↓	EX	28.27		SN	34.43		SR
20.40	↓	WO	28.33		EO	34.53		UP
20.47	↓	EV	28.43		JS	34.70		BK
20.57	↓	CX	28.43		FL	35.07		GQ
20.67	↓	FE	28.47		OF	35.37		BA
21.20	↓	SX	28.47		AF	35.40		BH
21.33	↓	AJ	28.77		AW	35.87		EB
21.57	↓	Q	28.97		VJ	35.90		SG
22.50	↓	HI	29.23		TQ	36.00		DO
22.50	↓	DD	29.23		MV	36.37		JY
22.57	↓	P	29.33		LF	36.40		ID
22.67	↓	BB	29.37		LE	36.47		MF
22.77	↓	CO	29.90		AK	36.83		QQ
23.57	↓	KE	30.03		QU	36.97		HL
24.17	↓	KX	30.10		U	37.10		K
24.40	↓	TD	30.30		DB	37.10		D
24.43	↓	TW	30.77		QW	37.10		CS
24.70	↓	SL	30.87		DE	37.13		QT
24.90	↓	JG	30.90		PG	37.20		O
25.33	↓	XI	31.00		BL	37.37		NA
25.40	↓	NJ	31.13		JM	37.43		GZ
25.47	↓	CA	31.23		VI	37.57		RZ
25.50	↓	SI	31.33		RI	37.63		PM
25.67	↓	SF	31.77		JE	37.73		WH
25.67	↓	NH	32.07		DZ	38.00		JP
25.67	↓	BN	32.07		AZ	38.00		AE
26.03	↓	NP	32.77		PB	38.00		LL

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

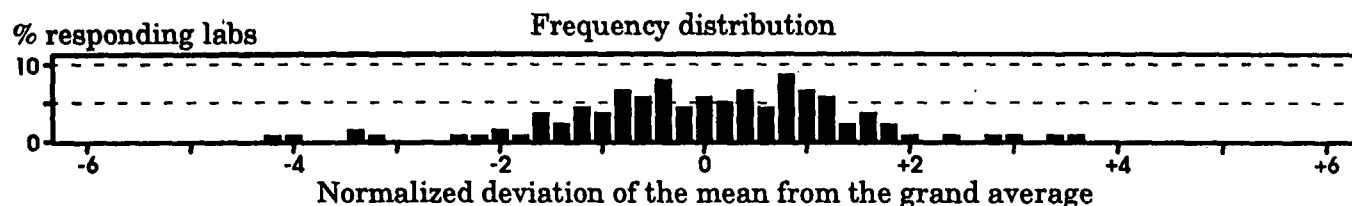
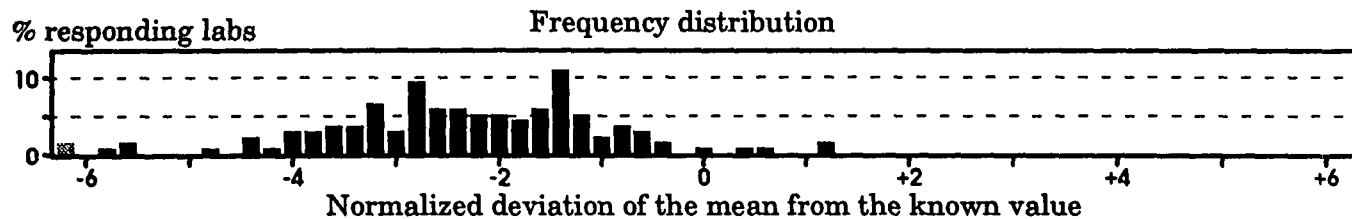
∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

Gross Alpha**Data sorted by Laboratory Average**

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
38.27		BM	39.73		A	42.80		DT
38.33		CE	39.87		BC	43.03		TN
38.57		JQ	41.00		HE	43.53		X
38.93		RB	41.13		S	44.10		RD
39.20		DH	41.37		XL	45.00		FN
39.23		BO	41.63		AL	47.20		WN
39.27		AR	41.70		C	50.27		SD
39.33		KT	42.17		BS	51.23		JN
39.53		AU	42.77		XF	54.83		WR
						55.87		VT



• ≡ No data submitted

TAG SYMBOLS

↑ ≡ Above control limit

∅ ≡ Insufficient data

× ≡ Determined to be an outlier

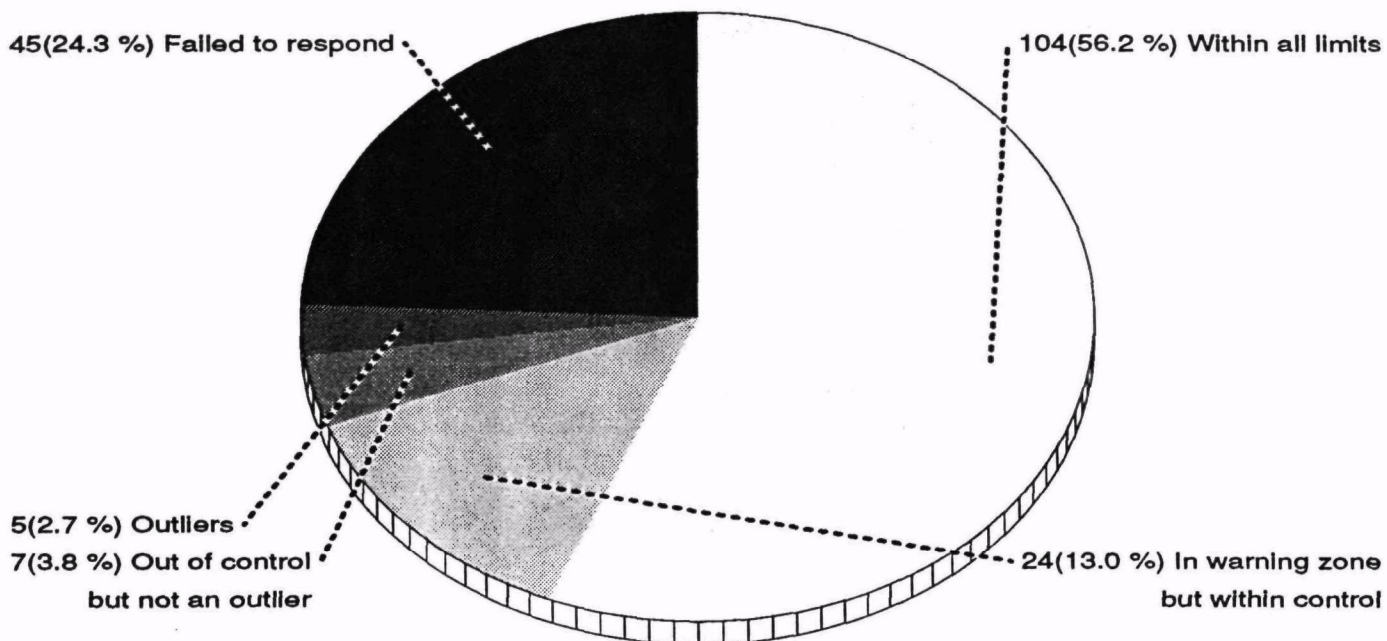
↓ ≡ Below control limit

Gross Beta

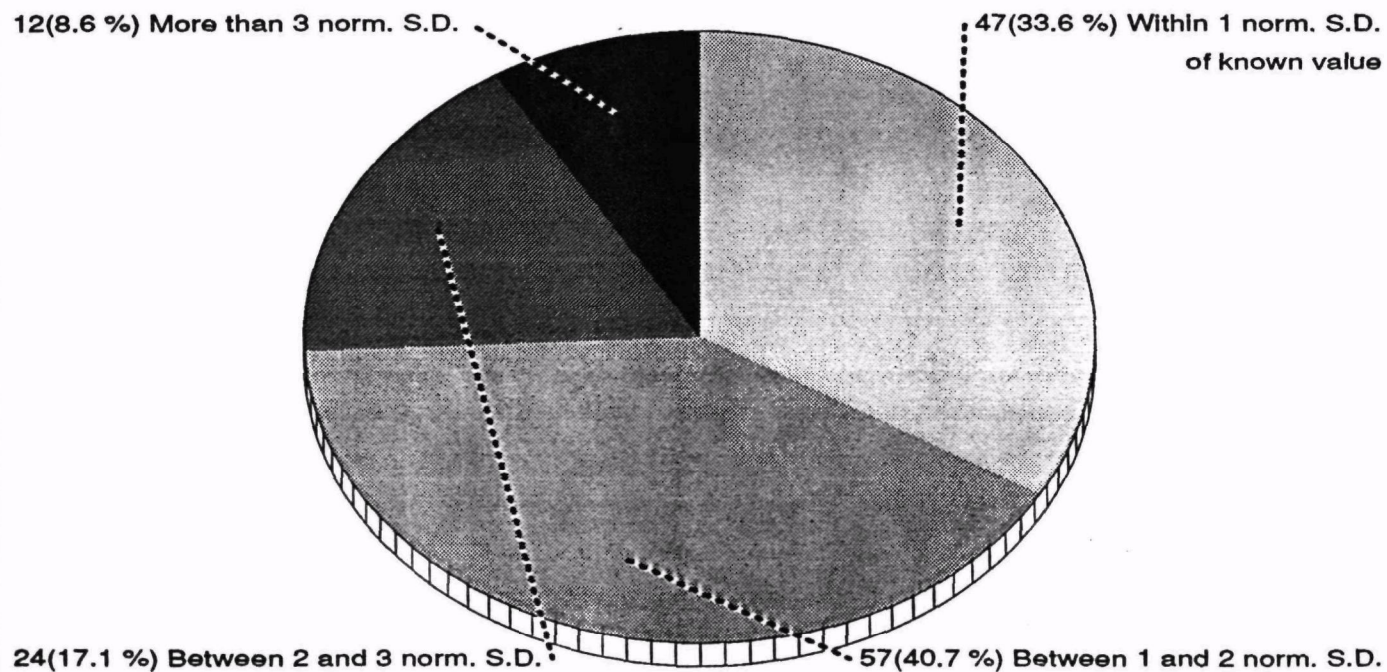
Statistical Summary

185 Participants

The known value of this nuclide is 3.5 pCi/l with an expected precision of 5.0; the control limits are 0.0 to 12.2; the warning regions are 0.0 to 0.0 and 9.3 to 12.2



Statistic	Respondents	Non-outliers
Mean	9.26	Grand Avg 7.56
Std. Dev.	11.02	2.92
Variance	121.44	8.54
% Coef. of Var.	118.96	38.66
% deviation of mean from known value	164.67	115.97
Norm. dev. of mean from known value	0.52	1.39
Median	7.67	7.43
% deviation of median from known value	119.05	112.38
Norm. dev. of median from known value	0.38	1.35



11 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
A	5.4	5.1	4.7	0.35	0.083	5.07	-0.86	0.54
AE	7.6	6.8	7.2	0.40	0.095	7.20	-0.12	1.28
AF	8.6	9.0	8.7	0.21	0.047	8.77	0.42	1.82
AH								•
AJ	8.5	5.4	4.2	2.22	0.508	6.03	-0.53	0.88
AK	7.6	6.2	7.1	0.71	0.165	6.97	-0.21	1.20
AL	7.2	6.8	7.3	0.26	0.059	7.10	-0.16	1.25
AP								•
AR	12.7	9.8	9.5	1.77	0.378	10.67	1.08	2.48
AU	2.6	6.4	6.2	2.14	0.449	5.07	-0.86	0.54
AW	7.4	8.6	9.5	1.05	0.248	8.50	0.33	1.73
AZ	5.8	3.9	3.9	1.10	0.224	4.53	-1.05	0.36
BA	3.9	3.5	2.6	0.67	0.154	3.33	-1.46	-0.06
BB	10.6	10.4	8.4	1.22	0.260	9.80	0.78	2.18
BC	7.9	6.4	8.7	1.17	0.272	7.67	0.04	1.44
BG								•
BH	7.6	8.4	8.4	0.46	0.095	8.13	0.20	1.61
BK	6.8	6.5	6.9	0.21	0.047	6.73	-0.29	1.12
BL	7.7	6.5	6.8	0.62	0.142	7.00	-0.19	1.21
BM	5.6	6.8	6.2	0.60	0.142	6.20	-0.47	0.94
BN	4.4	3.9	2.6	0.93	0.213	3.63	-1.36	0.05
BO	7.5	2.9	3.9	2.42	0.543	4.77	-0.97	0.44
BS	8.4	8.6	8.0	0.31	0.071	8.33	0.27	1.67
C	5.9	6.0	6.0	0.06	0.012	5.97	-0.55	0.85
CA	95.7	88.9	94.9	3.72	0.803	93.17	29.66	31.06 ×
CC								•
CE	4.5	3.8	4.7	0.47	0.106	4.33	-1.12	0.29
CJ								•
CO	2.4	4.7	4.9	1.39	0.295	4.00	-1.23	0.17
CP	4.1	3.8	3.7	0.21	0.047	3.87	-1.28	0.13
CS	4.7	3.4	1.1	1.82	0.425	3.07	-1.56	-0.15
CX	8.8	6.5	7.2	1.18	0.272	7.50	-0.02	1.39
D	9.8	11.3	11.1	0.81	0.177	10.73	1.10	2.51
DB	15.9	15.0	16.1	0.59	0.130	15.67	2.81	4.21 ↑
DD	4.6	5.7	5.0	0.56	0.130	5.10	-0.85	0.55
DE	8.0	8.0	8.0	0.00	0.000	8.00	0.15	1.56
DH	7.2	10.6	7.5	1.88	0.402	8.43	0.30	1.71
DO	8.5	8.7	7.9	0.42	0.095	8.37	0.28	1.69
DR	7.5	7.0	7.2	0.25	0.059	7.23	-0.11	1.29
DT	9.0	9.2	9.0	0.12	0.024	9.07	0.52	1.93
DZ	10.1	8.8	11.4	1.30	0.307	10.10	0.88	2.29
E	8.2	9.2	8.2	0.58	0.118	8.53	0.34	1.74
EB	4.9	4.5	3.8	0.56	0.130	4.40	-1.09	0.31
EL								•
EO	8.0	8.0	7.0	0.58	0.118	7.67	0.04	1.44

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ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998 12 / 16

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
ER									•
EV	9.5	9.0	8.0	0.76	0.177	8.83	0.44	1.85	
EW	7.3	10.3	7.3	1.73	0.354	8.30	0.26	1.66	
EX	9.0	8.3	3.2	3.17	0.685	6.83	-0.25	1.15	
FE	3.9	4.2	4.2	0.17	0.035	4.10	-1.20	0.21	
FF									•
FJ									•
FL	12.4	9.3	9.1	1.85	0.390	10.27	0.94	2.34	
FN	24.0	24.0	18.0	3.46	0.709	22.00	5.00	6.41	×
GQ	5.7	5.7	4.3	0.81	0.165	5.23	-0.81	0.60	
GZ	10.8	14.5	17.3	3.26	0.768	14.20	2.30	3.71	↑
HE	8.4	9.0	8.4	0.35	0.071	8.60	0.36	1.77	
HI	9.7	9.0	7.9	0.91	0.213	8.87	0.45	1.86	
HK	8.9	8.0	8.9	0.52	0.106	8.60	0.36	1.77	
HL	8.3	8.5	8.4	0.10	0.024	8.40	0.29	1.70	
HP	7.5	7.2	6.9	0.30	0.071	7.20	-0.12	1.28	
I	5.8	4.9	6.3	0.71	0.165	5.67	-0.66	0.75	
ID	12.3	7.3	10.6	2.54	0.591	10.07	0.87	2.27	
IU									•
J									•
JE	9.2	10.4	9.8	0.60	0.142	9.80	0.78	2.18	
JG	9.0	8.5	8.5	0.29	0.059	8.67	0.38	1.79	
JM	9.2	9.4	11.3	1.16	0.248	9.97	0.83	2.24	
JN	12.3	12.5	15.2	1.62	0.343	13.33	2.00	3.41	↑
JP	2.2	2.5	1.5	0.51	0.118	2.07	-1.90	-0.50	
JQ	1.3	2.9	0.1	1.40	0.331	1.43	-2.12	-0.72	
JS	4.5	5.2	3.8	0.70	0.165	4.50	-1.06	0.35	
JY	10.7	8.1	8.2	1.47	0.307	9.00	0.50	1.91	
K	7.6	9.2	8.7	0.82	0.189	8.50	0.33	1.73	
KE	10.7	10.9	11.9	0.64	0.142	11.17	1.25	2.66	
KH	8.6	8.6	8.1	0.29	0.059	8.43	0.30	1.71	
KT	10.0	11.0	12.0	1.00	0.236	11.00	1.19	2.60	
KX	8.4	5.5	6.1	1.53	0.343	6.67	-0.31	1.10	
L	11.1	10.5	10.2	0.46	0.106	10.60	1.05	2.46	
LE	7.2	9.5	7.8	1.19	0.272	8.17	0.21	1.62	
LF	6.5	10.0	8.6	1.76	0.413	8.37	0.28	1.69	
LL	7.1	6.8	5.0	1.14	0.248	6.30	-0.44	0.97	
LR	4.9	7.5	7.8	1.59	0.343	6.73	-0.29	1.12	
M									•
MF	8.6	8.7	8.4	0.15	0.035	8.57	0.35	1.76	
MT									•
MV	10.5	6.1	4.5	3.11	0.709	7.03	-0.18	1.22	
MX	7.8	7.9	8.0	0.10	0.024	7.90	0.12	1.52	
N									•
NA	7.8	7.4	6.9	0.45	0.106	7.37	-0.07	1.34	

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13 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998
Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
NB								•
NH	9.0	9.0	8.0	0.58	0.118	8.67	0.38	1.79
NJ	7.4	10.7	9.2	1.65	0.390	9.10	0.53	1.94
NK								•
NO	8.4	10.7	13.0	2.30	0.543	10.70	1.09	2.49
NP	2.2	5.1	3.0	1.50	0.343	3.43	-1.43	-0.02
O	6.6	6.6	6.3	0.17	0.035	6.50	-0.37	1.04
OA								•
OB	15.0	8.1	12.4	3.48	0.815	11.83	1.48	2.89
OF	6.5	6.6	6.9	0.21	0.047	6.67	-0.31	1.10
OS								•
OT								•
OY								•
P	4.2	4.1	6.0	1.07	0.224	4.77	-0.97	0.44
PB	9.7	10.2	9.1	0.55	0.130	9.67	0.73	2.14
PD	17.3	16.5	16.9	0.40	0.095	16.90	3.24	4.64 ↑
PG	7.0	7.1	7.9	0.49	0.106	7.33	-0.08	1.33
PM	6.1	8.8	5.3	1.83	0.413	6.73	-0.29	1.12
Q	7.0	7.3	8.0	0.51	0.118	7.43	-0.04	1.36
QM	5.0	5.7	5.4	0.35	0.083	5.37	-0.76	0.65
QP	2.3	2.5	2.4	0.10	0.024	2.40	-1.79	-0.38
QQ	6.2	6.5	6.7	0.25	0.059	6.47	-0.38	1.03
QT	5.9	3.6	4.8	1.15	0.272	4.77	-0.97	0.44
QU	8.1	9.0	7.8	0.62	0.142	8.30	0.26	1.66
QW	8.0	8.4	8.3	0.21	0.047	8.23	0.23	1.64
QX	3.7	3.8	3.7	0.06	0.012	3.73	-1.33	0.08
QZ	7.4	5.1	5.3	1.27	0.272	5.93	-0.56	0.84
R	12.2	9.5	9.4	1.59	0.331	10.37	0.97	2.38
RB	4.4	3.3	4.2	0.59	0.130	3.97	-1.24	0.16
RD	27.1	20.4	12.5	7.31	2.380	20.00	4.31	5.72 ×
RG								•
RI	7.0	5.8	5.3	0.87	0.201	6.03	-0.53	0.88
RK								•
RR								•
RZ	8.9	9.2	9.2	0.17	0.035	9.10	0.53	1.94
S	10.0	11.2	10.4	0.61	0.142	10.53	1.03	2.44
SD	15.3	14.3	16.3	1.00	0.236	15.30	2.68	4.09 ↑
SF	4.9	5.0	4.9	0.06	0.012	4.93	-0.91	0.50
SG	8.8	9.3	7.1	1.15	0.260	8.40	0.29	1.70
SI	6.7	8.2	6.3	1.00	0.224	7.07	-0.17	1.24
SL	6.2	4.5	4.4	1.01	0.213	5.03	-0.87	0.53
SM	6.8	6.5	4.0	1.54	0.331	5.77	-0.62	0.79
SN	5.8	5.9	6.1	0.15	0.035	5.93	-0.56	0.84
SO	4.8	4.8	5.0	0.12	0.024	4.87	-0.93	0.47
SR	8.0	12.2	7.5	2.58	0.555	9.23	0.58	1.99

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ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998 14 / 16

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
SS	5.9	5.6	5.7	0.15	0.035	5.73	-0.63	0.77	
SU	9.5	10.3	12.8	1.72	0.390	10.87	1.15	2.55	
SV									•
SX	9.5	10.2	11.1	0.80	0.189	10.27	0.94	2.34	
T									•
TD	1.4	2.4	4.5	1.58	0.366	2.77	-1.66	-0.25	
TL									•
TN	8.4	8.3	12.1	2.17	0.449	9.60	0.71	2.11	
TO									•
TQ	5.4	3.8	5.8	1.06	0.236	5.00	-0.89	0.52	
TW	6.6	5.6	6.1	0.50	0.118	6.10	-0.51	0.90	
TX									•
TY	3.1	4.4	3.0	0.78	0.165	3.50	-1.41	0.00	
U	10.4	8.8	12.0	1.60	0.378	10.40	0.98	2.39	
UA									•
UM									•
UP	9.2	8.8	8.9	0.21	0.047	8.97	0.49	1.89	
UQ									•
UY	10.9	10.8	11.8	0.55	0.118	11.17	1.25	2.66	
VA									•
VC									•
VH	16.6	12.1	11.1	2.93	0.650	13.27	1.98	3.38	↑
VI	7.5	9.1	6.9	1.14	0.260	7.83	0.10	1.50	
VJ	9.6	7.1	10.3	1.68	0.378	9.00	0.50	1.91	
VO	10.3	10.5	11.0	0.36	0.083	10.60	1.05	2.46	
VT	51.4	55.8	57.3	3.07	0.697	54.83	16.98	17.78	×
W	6.9	6.0	7.1	0.59	0.130	6.67	-0.31	1.10	
WE	1.4	1.7	1.3	0.21	0.047	1.47	-2.11	-0.70	
WH	8.5	6.3	7.0	1.12	0.260	7.27	-0.10	1.30	
WJ									•
WN									•
WO	4.6	4.6	5.6	0.58	0.118	4.93	-0.91	0.50	
WP									•
WR	13.3	16.5	17.4	2.15	0.484	15.73	2.83	4.24	↑
WS									•
WW	5.4	8.1	4.6	1.83	0.413	6.03	-0.53	0.88	
WX									•
X	3.6	3.2	4.1	0.45	0.106	3.63	-1.36	0.05	
XB									•
XC									•
XD									•
XF	6.8	3.4	2.9	2.12	0.461	4.37	-1.11	0.30	
XI	9.1	13.0	12.0	2.03	0.461	11.37	1.32	2.73	
XJ									•
XK	77.7	94.8	86.7	8.55	2.943	86.40	27.31	28.72	×

• = No data submitted

TAG SYMBOLS

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∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

15 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 13-Nov-1998
Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
XL	10.3	9.9	9.0	0.67	0.154	9.73	0.75	2.16
XM	4.1	3.6	5.7	1.10	0.248	4.47	-1.07	0.33
XN								•
XQ								•
XT								•

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
1.43		JQ	5.77		SM	8.13		BH
1.47		WE	5.93		SN	8.17		LE
2.07		JP	5.93		QZ	8.23		QW
2.40		QP	5.97		C	8.30		QU
2.77		TD	6.03		WW	8.30		EW
3.07		CS	6.03		RI	8.33		BS
3.33		BA	6.03		AJ	8.37		LF
3.43		NP	6.10		TW	8.37		DO
3.50		TY	6.20		BM	8.40		SG
3.63		X	6.30		LL	8.40		HL
3.63		BN	6.47		QQ	8.43		KH
3.73		QX	6.50		O	8.43		DH
3.87		CP	6.67		W	8.50		K
3.97		RB	6.67		OF	8.50		AW
4.00		CO	6.67		KX	8.53		E
4.10		FE	6.73		PM	8.57		MF
4.33		CE	6.73		LR	8.60		HK
4.37		XF	6.73		BK	8.60		HE
4.40		EB	6.83		EX	8.67		NH
4.47		XM	6.97		AK	8.67		JG
4.50		JS	7.00		BL	8.77		AF
4.53		AZ	7.03		MV	8.83		EV
4.77		QT	7.07		SI	8.87		HI
4.77		P	7.10		AL	8.97		UP
4.77		BO	7.20		HP	9.00		VJ
4.87		SO	7.20		AE	9.00		JY
4.93		WO	7.23		DR	9.07		DT
4.93		SF	7.27		WH	9.10		RZ
5.00		TQ	7.33		PG	9.10		NJ
5.03		SL	7.37		NA	9.23		SR
5.07		AU	7.43		Q	9.60		TN
5.07		A	7.50		CX	9.67		PB
5.10		DD	7.67		EO	9.73		XL
5.23		GQ	7.67		BC	9.80		JE
5.37		QM	7.83		VI	9.80		BB
5.67		I	7.90		MX	9.97		JM
5.73		SS	8.00		DE	10.07		ID

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

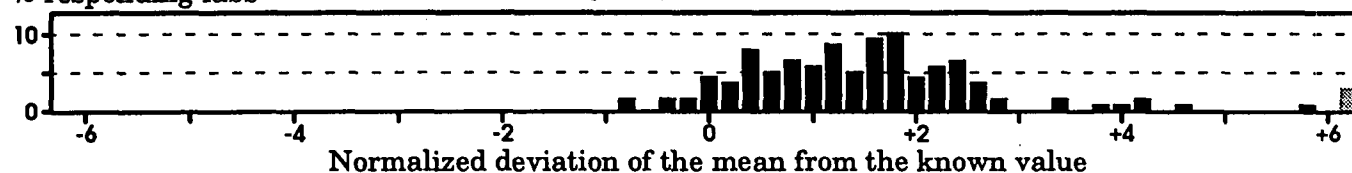
Gross Beta

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
10.10		DZ	10.70		NO	14.20	↑	GZ
10.27		SX	10.73		D	15.30	↑	SD
10.27		FL	10.87		SU	15.67	↑	DB
10.37		R	11.00		KT	15.73	↑	WR
10.40		U	11.17		UY	16.90	↑	PD
10.53		S	11.17		KE	20.00	×	RD
10.60		VO	11.37		XI	22.00	×	FN
10.60		L	11.83		OB	54.83	×	VT
10.67		AR	13.27	↑	VH	86.40	×	XK
			13.33	↑	JN	93.17	×	CA

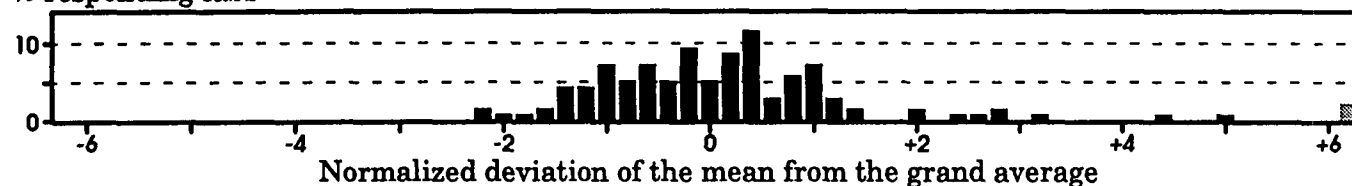
% responding labs

Frequency distribution



% responding labs

Frequency distribution



• ≡ No data submitted

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