

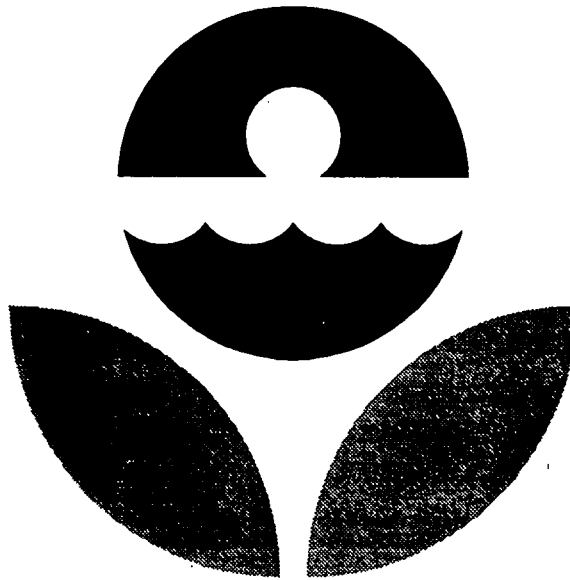


Gross Alpha-Beta in Water Performance Evaluation Study

A Statistical Evaluation of the January 31, 1997 Data



Gross Alpha-Beta in Water
Performance Evaluation Study
January 31, 1997



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 Chemistry Branch (ESD-LV) Performance Evaluation Study for *Gross Alpha-Beta in Water; January 31, 1997*.

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 cursive script that reads "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.

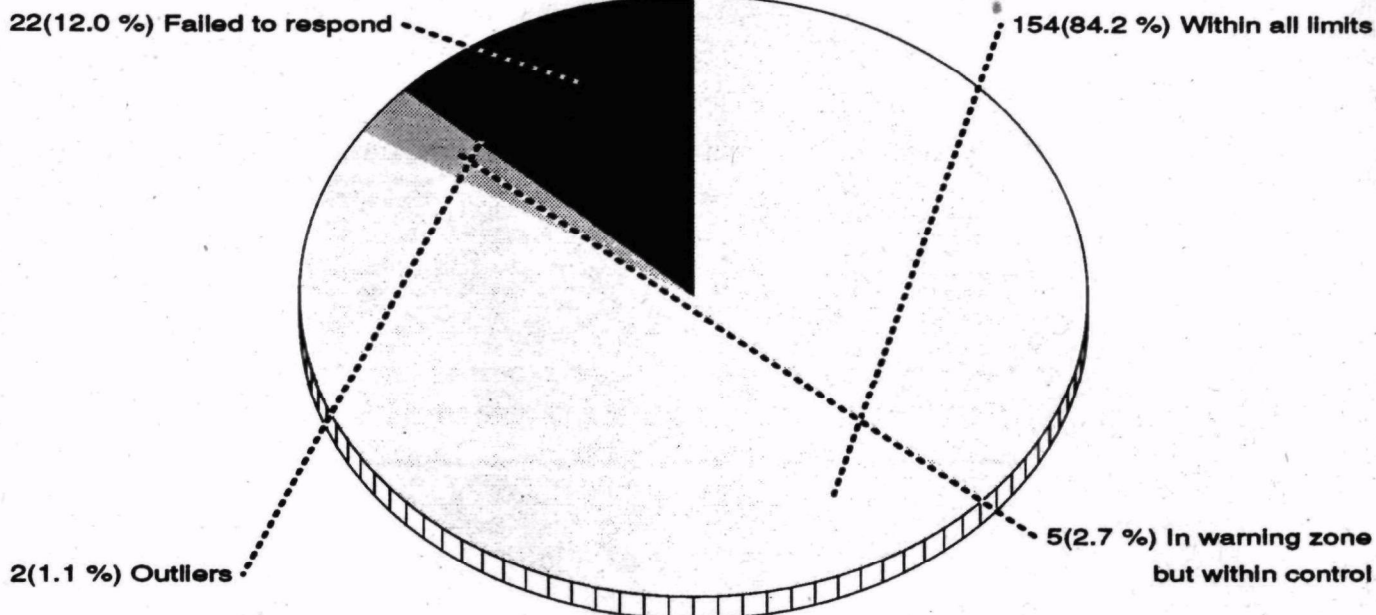
A complete explanation of the statistical calculations involved in the report may be found in the Environmental Radioactivity Performance Evaluation Studies Program information brochure [Draft Revision of EPA-600/4-81-004], available from Patricia Honsa, ESD-LV, 702/798-2141.

Gross Alpha

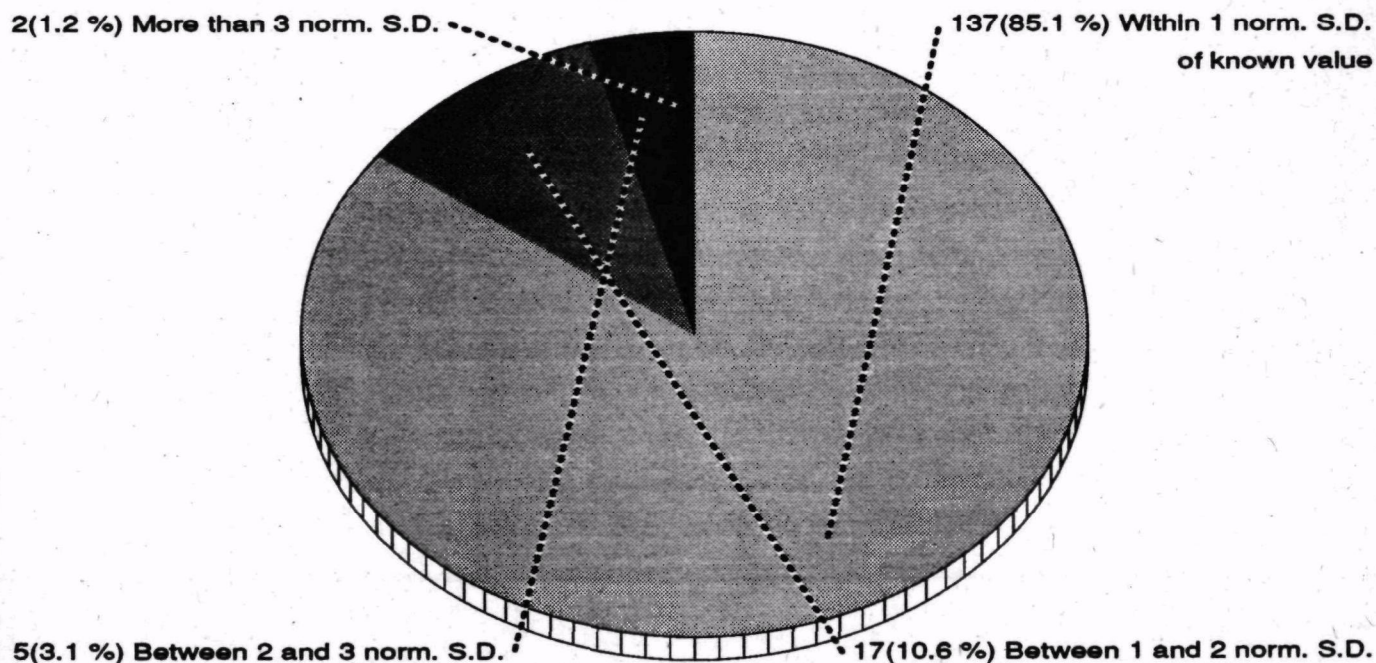
Statistical Summary

183 Participants

The known value of this nuclide is 5.2 pCi/l with an expected precision of 5.0; the control limits are 0.0 to 13.9; the warning regions are 0.0 to 0.0 and 11.0 to 13.9



Statistic	Respondents	Non-outliers
Mean	6.14	Grand Avg 6.02
Std. Dev.	2.20	1.92
Variance	4.85	3.68
% Coef. of Var.	35.84	31.86
% deviation of mean from known value	18.12	15.79
Norm. dev. of mean from known value	0.43	0.43
Median	5.67	5.67
% deviation of median from known value	8.97	8.97
Norm. dev. of median from known value	0.21	0.24



Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
A	5.0	4.7	4.4	0.30	0.071	4.70	-0.46	-0.17
AE	8.2	8.8	8.0	0.42	0.095	8.33	0.80	1.09
AF	5.5	4.4	3.0	1.25	0.295	4.30	-0.60	-0.31
AH	4.4	3.5	3.4	0.55	0.118	3.77	-0.78	-0.50
AJ	3.9	2.7	2.3	0.83	0.189	2.97	-1.06	-0.77
AK	6.7	6.2	5.6	0.55	0.130	6.17	0.05	0.33
AL	7.6	7.1	7.7	0.32	0.071	7.47	0.50	0.79
AP	6.8	6.0	6.0	0.46	0.095	6.27	0.09	0.37
AR	7.2	6.1	5.9	0.70	0.154	6.40	0.13	0.42
AU	2.7	2.7	2.9	0.12	0.024	2.77	-1.13	-0.84
AW	5.5	5.3	4.8	0.36	0.083	5.20	-0.28	0.00
AZ	7.5	7.8	7.2	0.30	0.071	7.50	0.51	0.80
BA	4.3	4.9	4.9	0.35	0.071	4.70	-0.46	-0.17
BB	4.3	4.1	4.2	0.10	0.024	4.20	-0.63	-0.35
BC	11.6	11.6	13.0	0.81	0.165	12.07	2.09	2.38
BG	5.0	3.0	6.0	1.53	0.354	4.67	-0.47	-0.18
BH	5.4	4.8	5.2	0.31	0.071	5.13	-0.31	-0.02
BK	5.9	5.5	5.6	0.21	0.047	5.67	-0.12	0.16
BL	18.4	13.6	15.8	1.04	0.224	14.10	2.80	3.08 ×
BM	4.8	5.3	4.5	0.40	0.095	4.87	-0.40	-0.12
BN	3.0	4.0	3.0	0.58	0.118	3.33	-0.93	-0.65
BO	4.8	6.0	4.0	1.01	0.236	4.93	-0.38	-0.09
BS	5.2	7.5	7.1	1.23	0.272	6.60	0.20	0.48
C	6.6	7.2	7.0	0.31	0.071	6.93	0.32	0.60
CA	11.4	8.7	9.8	1.36	0.319	9.97	1.37	1.65
CC	4.5	5.0	4.7	0.25	0.059	4.73	-0.45	-0.16
CE	5.7	3.1	4.5	1.30	0.307	4.43	-0.55	-0.27
CG	5.0	5.8	4.8	0.53	0.118	5.20	-0.28	0.00
CJ	7.1	8.8	8.4	0.89	0.201	8.10	0.72	1.00
CO	5.3	5.4	5.8	0.26	0.059	5.50	-0.18	0.10
CP	3.2	4.5	5.4	1.11	0.260	4.37	-0.57	-0.29
CS	4.2	5.0	7.3	1.61	0.366	5.50	-0.18	0.10
CX	3.6	3.5	4.6	0.61	0.130	3.90	-0.73	-0.45
D	6.0	6.2	5.4	0.42	0.095	5.87	-0.05	0.23
DB	7.3	7.1	6.8	0.25	0.059	7.07	0.36	0.65
DD	6.3	8.3	6.3	1.15	0.236	6.97	0.33	0.61
DE	6.3	6.4	6.5	0.10	0.024	6.40	0.13	0.42
DH	5.0	4.5	5.3	0.40	0.095	4.93	-0.38	-0.09
DO	7.8	7.8	7.1	0.40	0.083	7.57	0.54	0.82
DR		1.6	1.4					∅
DS								•
DT	6.8	7.9	6.5	0.74	0.165	7.07	0.36	0.65
DZ	6.7	5.9	7.2	0.66	0.154	6.60	0.20	0.48
E	5.0	5.8	5.7	0.44	0.095	5.50	-0.18	0.10
EB	7.8	7.1	6.8	0.51	0.118	7.23	0.42	0.70

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

Gross Alpha								
Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
EL	4.9	3.9	3.9	0.58	0.118	4.23	-0.62	-0.33
EO	7.0	6.0	5.0	1.00	0.236	6.00	-0.01	0.28
ER	4.7	4.4	4.7	0.17	0.035	4.60	-0.49	-0.21
EV	4.6	4.8	6.8	1.22	0.260	5.40	-0.22	0.07
EW								
EX	5.5	5.2	5.3	0.15	0.035	5.33	-0.24	0.05
FE	4.9	5.1	5.2	0.15	0.035	5.07	-0.33	-0.05
FF	6.1	5.4	5.8	0.35	0.083	5.77	-0.09	0.20
FJ								
FL	7.2	6.9	6.7	0.25	0.059	6.93	0.32	0.60
FN	4.0	3.0	3.0	0.58	0.118	3.33	-0.93	-0.65
GQ	6.3	6.0	6.1	0.15	0.035	6.13	0.04	0.32
GT	6.9	6.5	4.8	1.12	0.248	6.07	0.02	0.30
GZ								
HI	6.3	6.3	4.4	1.10	0.224	5.67	-0.12	0.16
HK	8.6	7.7	9.1	0.71	0.165	8.47	0.85	1.13
HL	6.4	5.2	5.0	0.76	0.165	5.53	-0.17	0.12
HP	4.2	4.4	4.1	0.15	0.035	4.23	-0.62	-0.33
I	7.1	7.6	8.5	0.71	0.165	7.73	0.59	0.88
ID	8.8	6.8	10.6	1.90	0.449	8.73	0.94	1.22
IU								
J								
JG	4.4	4.5	5.6	0.67	0.142	4.83	-0.41	-0.13
JM	4.7	5.0	4.1	0.46	0.106	4.60	-0.49	-0.21
JN	4.8	4.8	4.8	0.00	0.000	4.80	-0.42	-0.14
JP	4.9	4.0	5.1	0.59	0.130	4.67	-0.47	-0.18
JQ	5.7	6.6	6.5	0.49	0.106	6.27	0.09	0.37
JS	5.2	5.6	6.3	0.56	0.130	5.70	-0.11	0.17
JY	5.7	6.9	6.3	0.60	0.142	6.30	0.10	0.38
K	6.6	7.4	7.2	0.42	0.095	7.07	0.36	0.65
KE	6.7	6.7	6.5	0.12	0.024	6.63	0.21	0.50
KH	5.0	4.8	5.3	0.25	0.059	5.03	-0.34	-0.06
KT	9.0	8.7	8.3	0.35	0.083	8.67	0.92	1.20
KX	8.0	8.0	8.0	0.00	0.000	8.00	0.69	0.97
L	7.9	9.3	8.6	0.70	0.165	8.60	0.89	1.18
LE	5.5	6.8	4.5	1.15	0.272	5.60	-0.15	0.14
LF	4.1	5.4	7.2	1.56	0.366	5.57	-0.16	0.13
LL	14.3	19.3	7.6	5.87	1.728	13.73	2.67	2.96
LR	3.9	3.1	4.4	0.66	0.154	3.80	-0.77	-0.48
LT	2.9	4.3	3.6	0.70	0.165	3.60	-0.84	-0.55
M	9.2	9.3	8.1	0.67	0.142	8.87	0.99	1.27
MF	4.4	4.5	4.5	0.06	0.012	4.47	-0.54	-0.25
MV	4.4	6.0	8.3	1.96	0.461	6.23	0.07	0.36
MX								
N	7.0	6.6	6.8	0.20	0.047	6.80	0.27	0.55

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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	
NA	10.0	10.0	10.0	0.00	0.000	10.00	1.38	1.66
NB	17.3	15.0	20.1	2.55	0.602	17.47	3.98	4.25 ×
NJ	4.3	4.0	3.6	0.35	0.083	3.97	-0.71	-0.43
NK	5.5	6.2	4.5	0.85	0.201	5.40	-0.22	0.07
NO	8.0	9.0	10.0	1.00	0.236	9.00	1.03	1.32
NP	6.0	4.6	5.3	0.70	0.165	5.30	-0.25	0.03
NT	6.6	6.5	7.0	0.26	0.059	6.70	0.24	0.52
O	8.8	7.8	8.5	0.51	0.118	8.37	0.81	1.10
OA	3.5	2.8	6.6	2.02	0.449	4.30	-0.60	-0.31
OB	4.3	5.1	6.9	1.33	0.307	5.43	-0.20	0.08
OF	5.4	6.2	7.6	1.11	0.260	6.40	0.13	0.42
OS	8.0	6.0	7.0	1.00	0.236	7.00	0.34	0.62
OT								•
OX								•
OY								•
P	9.5	10.4	15.1	3.01	0.662	11.67	1.96	2.24
PA	1.7	2.8	2.6	0.59	0.130	2.37	-1.27	-0.98
PB	5.5	5.7	5.9	0.20	0.047	5.70	-0.11	0.17
PG	8.3	6.1	5.6	1.44	0.319	6.67	0.22	0.51
PM	6.2	5.6	5.1	0.55	0.130	5.63	-0.13	0.15
PQ								•
PR	12.1	10.9	12.1	0.69	0.142	11.70	1.97	2.25
PV	4.5	4.6	4.8	0.15	0.035	4.63	-0.48	-0.20
Q	4.9	5.4	6.8	0.98	0.224	5.70	-0.11	0.17
QM	5.2	4.0	4.2	0.64	0.142	4.47	-0.54	-0.25
QP	5.3	6.4	5.2	0.67	0.142	5.63	-0.13	0.15
QQ	6.4	5.1	5.8	0.65	0.154	5.77	-0.09	0.20
QT	6.5	4.8	5.0	0.93	0.201	5.43	-0.20	0.08
QU	7.8	7.4	7.3	0.26	0.059	7.50	0.51	0.80
QW	6.2	6.1	6.1	0.06	0.012	6.13	0.04	0.32
QX	6.1	6.2	5.9	0.15	0.035	6.07	0.02	0.30
QZ	4.0	5.0	4.8	0.53	0.118	4.60	-0.49	-0.21
R	7.1	5.6	6.7	0.78	0.177	6.47	0.15	0.44
RB	7.7	5.1	6.8	1.32	0.307	6.53	0.18	0.46
RD	5.4	5.4	5.6	0.12	0.024	5.47	-0.19	0.09
RF	4.1	4.5	4.8	0.35	0.083	4.47	-0.54	-0.25
RG	5.1	6.0	6.0	0.52	0.106	5.70	-0.11	0.17
RI	4.1	5.8	5.3	0.87	0.201	5.07	-0.33	-0.05
RK	4.4	4.2	4.0	0.20	0.047	4.20	-0.63	-0.35
RR	6.6	6.4	6.3	0.15	0.035	6.43	0.14	0.43
RZ								•
S	8.3	9.8	8.3	0.87	0.177	8.80	0.96	1.25
SC	3.5	7.4	4.2	2.08	0.461	5.03	-0.34	-0.06
SD	6.0	6.0	6.0	0.00	0.000	6.00	-0.01	0.28
SF	13.0	13.0	13.0	0.00	0.000	13.00	2.42	2.70

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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
SG	5.6	14.0	6.2	4.69	0.992	8.60	0.89	1.18
SI	5.8	5.5	5.1	0.35	0.083	5.47	-0.19	0.09
SL	6.2	6.3	7.0	0.44	0.095	6.50	0.17	0.45
SM	5.5	4.3	4.7	0.61	0.142	4.83	-0.41	-0.13
SN	2.8	3.2	3.3	0.26	0.059	3.10	-1.01	-0.73
SO	6.4	6.1	4.8	0.85	0.189	5.77	-0.09	0.20
SR	9.7	7.1	7.0	1.53	0.319	7.93	0.66	0.95
SS	4.3	3.3	3.9	0.50	0.118	3.83	-0.76	-0.47
SU	5.3	3.9	2.1	1.60	0.378	3.77	-0.78	-0.50
SV	11.3	11.2	9.8	0.84	0.177	10.77	1.64	1.93
SX	5.4	6.2	4.3	0.95	0.224	5.30	-0.25	0.03
SZ	4.3	5.3	4.5	0.53	0.118	4.70	-0.46	-0.17
T	4.1	3.3	5.6	1.17	0.272	4.33	-0.58	-0.30
TD	3.6	3.5	4.4	0.49	0.106	3.83	-0.76	-0.47
TG								•
TH								•
TL								•
TN	3.1	5.0	4.7	1.02	0.224	4.27	-0.61	-0.32
TQ	3.5	5.3	4.8	0.93	0.213	4.53	-0.52	-0.23
TW	8.4	4.5	7.3	2.01	0.461	6.73	0.25	0.53
TY	4.6	4.4	4.3	0.15	0.035	4.43	-0.55	-0.27
U	8.2	8.1	8.9	0.44	0.095	8.40	0.82	1.11
UA	7.0	9.4	8.0	1.21	0.284	8.13	0.73	1.02
UE	5.2	6.3	5.3	0.61	0.130	5.60	-0.15	0.14
UP	5.1	6.1	6.4	0.68	0.154	5.87	-0.05	0.23
UQ	7.1	6.4	7.1	0.40	0.083	6.87	0.29	0.58
VA	5.5	5.0	4.0	0.76	0.177	4.83	-0.41	-0.13
VC								•
VH	7.8	6.5	6.1	0.89	0.201	6.80	0.27	0.55
VI	4.2	4.8	4.7	0.32	0.071	4.57	-0.50	-0.22
VJ	4.4	4.9	3.8	0.55	0.130	4.37	-0.57	-0.29
VO	6.7	4.9	3.1	1.80	0.425	4.90	-0.39	-0.10
VT								•
W	4.9	5.2	6.3	0.74	0.165	5.47	-0.19	0.09
WE	6.5	7.0	6.9	0.26	0.059	6.80	0.27	0.55
WH	5.8	7.4	8.2	1.22	0.284	7.13	0.39	0.67
WJ	6.2	5.6	4.8	0.70	0.165	5.53	-0.17	0.12
WN	6.5	6.8	6.4	0.21	0.047	6.57	0.19	0.47
WO	8.7	7.5	8.9	0.76	0.165	8.37	0.81	1.10
WP	4.1	4.0	3.9	0.10	0.024	4.00	-0.70	-0.42
WR								•
WS								•
WU								•
WW	4.8	4.9	5.0	0.10	0.024	4.90	-0.39	-0.10
WX	4.0	4.5	3.7	0.40	0.095	4.07	-0.68	-0.39

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

Ø = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known) Tag	
X	6.3	5.4	6.5	0.59	0.130	6.07	0.02	0.30
XB								•
XC	6.0	6.3	5.2	0.57	0.130	5.83	-0.07	0.22

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
2.37		PA	4.70		SZ	5.63		PM
2.77		AU	4.70		BA	5.67		HI
2.97		AJ	4.70		A	5.67		BK
3.10		SN	4.73		CC	5.70		RG
3.33		FN	4.80		JN	5.70		Q
3.33		BN	4.83		VA	5.70		PB
3.60		LT	4.83		SM	5.70		JS
3.77		SU	4.83		JG	5.77		SO
3.77		AH	4.87		BM	5.77		QQ
3.80		LR	4.90		WW	5.77		FF
3.83		TD	4.90		VO	5.83		XC
3.83		SS	4.93		DH	5.87		UP
3.90		CX	4.93		BO	5.87		D
3.97		NJ	5.03		SC	6.00		SD
4.00		WP	5.03		KH	6.00		EO
4.07		WX	5.07		FE	6.07		X
4.20		RK	5.07		RI	6.07		QX
4.20		BB	5.13		BH	6.07		GT
4.23		HP	5.20		CG	6.13		QW
4.23		EL	5.20		AW	6.13		GQ
4.27		TN	5.30		SX	6.17		AK
4.30		OA	5.30		NP	6.23		MV
4.30		AF	5.33		EX	6.27		JQ
4.33		T	5.40		NK	6.27		AP
4.37		VJ	5.40		EV	6.30		JY
4.37		CP	5.43		QT	6.40		OF
4.43		TY	5.43		OB	6.40		DE
4.43		CE	5.47		W	6.40		AR
4.47		RF	5.47		SI	6.43		RR
4.47		QM	5.47		RD	6.47		R
4.47		MF	5.50		E	6.50		SL
4.53		TQ	5.50		CS	6.53		RB
4.57		VI	5.50		CO	6.57		WN
4.60		QZ	5.53		WJ	6.60		DZ
4.60		JM	5.53		HL	6.60		BS
4.60		ER	5.57		LF	6.63		KE
4.63		PV	5.60		UE	6.67		PG
4.67		JP	5.60		LE	6.70		NT
4.67		BG	5.63		QP	6.73		TW

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

∅ = Insufficient data

× = Determined to be an outlier

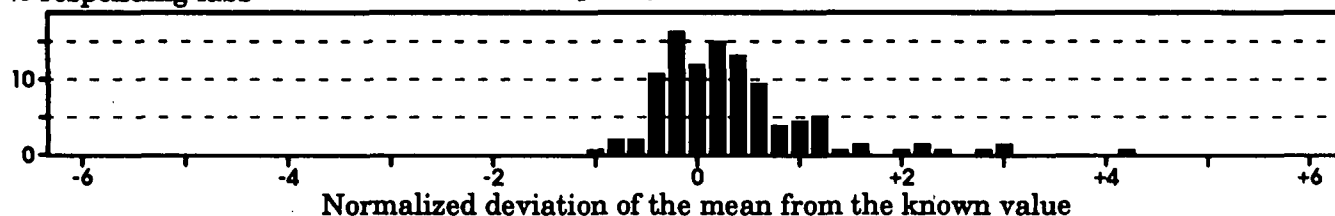
↓ = Below control limit

Gross Alpha**Data sorted by Laboratory Average**

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
6.80		WE	7.50		QU	8.67		KT
6.80		VH	7.50		AZ	8.73		ID
6.80		N	7.57		DO	8.80		S
6.87		UQ	7.73		I	8.87		M
6.93		FL	7.93		SR	9.00		NO
6.93		C	8.00		KX	9.97		CA
6.97		DD	8.10		CJ	10.00		NA
7.00		OS	8.13		UA	10.77		SV
7.07		K	8.33		AE	11.67		P
7.07		DT	8.37		WO	11.70		PR
7.07		DB	8.37		O	12.07		BC
7.13		WH	8.40		U	13.00		SF
7.23		EB	8.47		HK	13.73		LL
7.47		AL	8.60		SG	14.10	×	BL
			8.60		L	17.47	×	NB

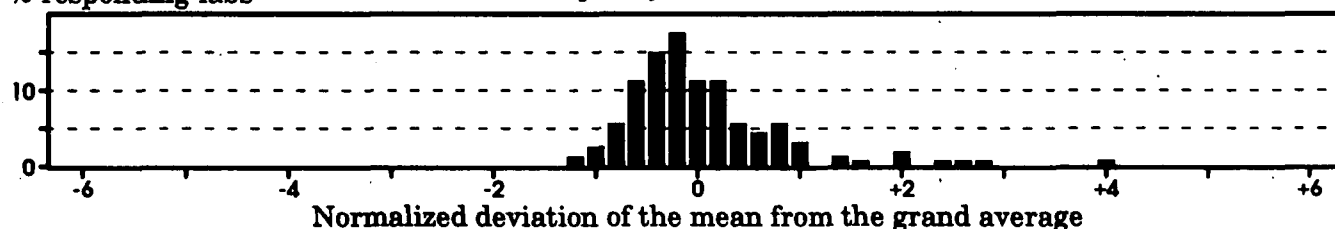
% responding labs

Frequency distribution



% responding labs

Frequency distribution



• ≡ No data submitted

TAG SYMBOLS

↑ ≡ Above control limit

∅ ≡ Insufficient data

× ≡ Determined to be an outlier

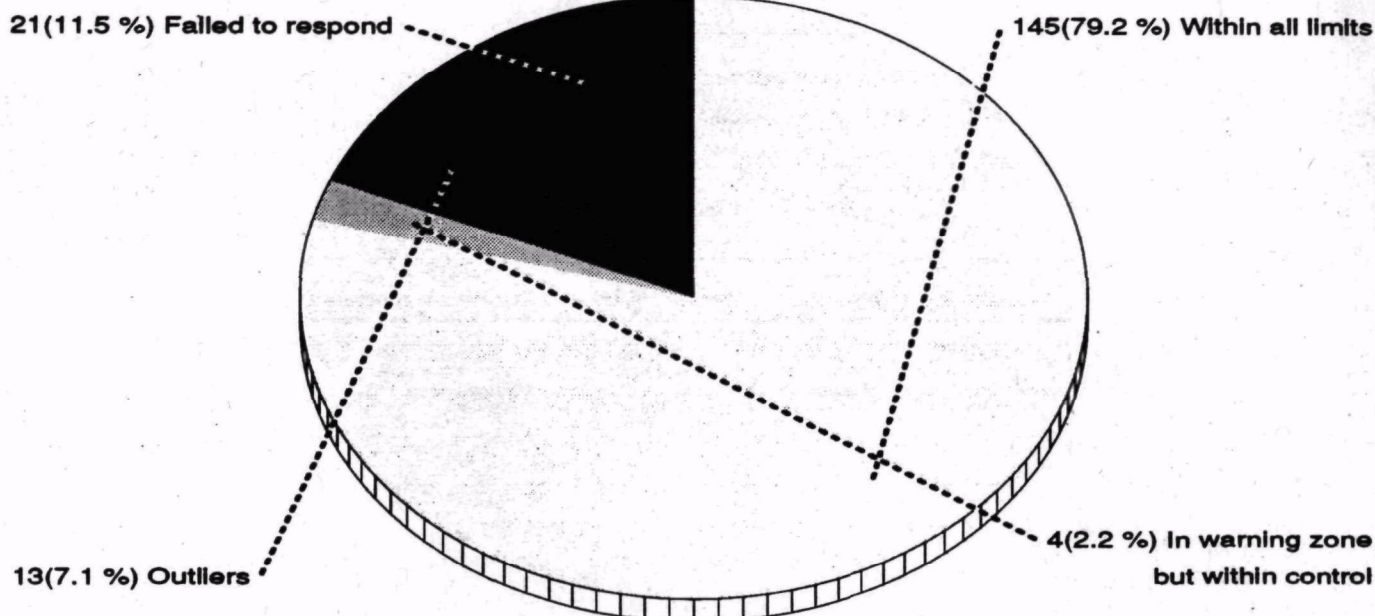
↓ ≡ Below control limit

Gross Beta

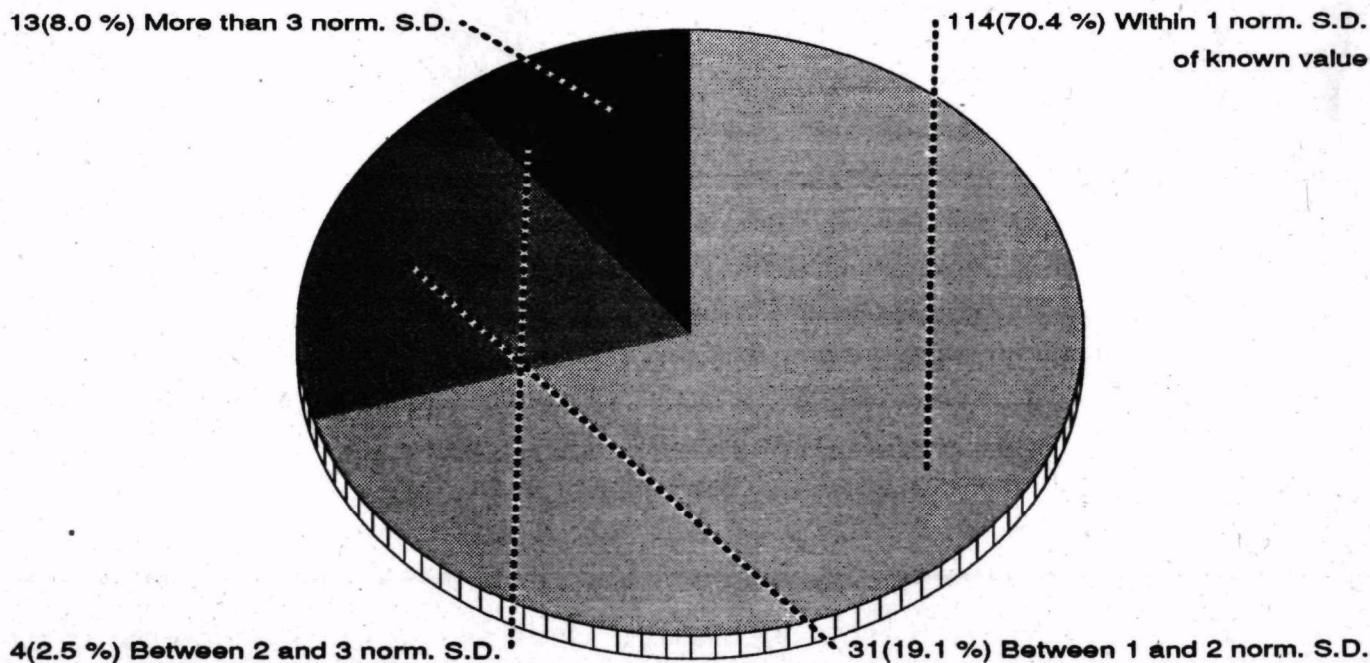
Statistical Summary

183 Participants

The known value of this nuclide is 14.7 pCi/l with an expected precision of 5.0; the control limits are 6.0 to 23.4; the warning regions are 6.0 to 8.9 and 20.5 to 23.4



Statistic	Respondents	Non-outliers
Mean	17.22	Grand Avg 15.66
Std. Dev.	11.42	2.13
Variance	130.32	4.53
% Coef. of Var.	66.30	13.59
% deviation of mean from known value	17.14	6.50
Norm. dev. of mean from known value	0.22	0.45
Median	15.78	15.67
% deviation of median from known value	7.37	6.58
Norm. dev. of median from known value	0.09	0.45



11 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 31-Jan-1997

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
A	13.7	13.8	13.7	0.06	0.012	13.73	-0.67	-0.33	
AE	16.1	15.5	15.8	0.30	0.071	15.80	0.05	0.38	
AF	14.4	14.0	14.8	0.40	0.095	14.40	-0.43	-0.10	
AH	15.5	16.8	16.3	0.66	0.154	16.20	0.19	0.52	
AJ	14.4	14.4	14.7	0.17	0.035	14.50	-0.40	-0.07	
AK	14.6	16.2	16.4	0.99	0.213	15.73	0.03	0.36	
AL	14.8	15.4	16.0	0.60	0.142	15.40	-0.09	0.24	
AP	14.9	14.1	14.0	0.49	0.106	14.33	-0.46	-0.13	
AR	18.0	17.8	18.3	0.25	0.059	18.03	0.82	1.15	
AU	13.3	16.3	14.6	1.50	0.354	14.73	-0.32	0.01	
AW	16.5	17.5	18.3	0.90	0.213	17.43	0.62	0.95	
AZ	12.1	15.6	16.2	2.21	0.484	14.63	-0.35	-0.02	
BA	12.7	14.5	14.8	1.14	0.248	14.00	-0.57	-0.24	
BB	23.3	19.1	21.2	2.10	0.496	21.20	1.92	2.25	
BC	10.9	13.4	14.3	1.76	0.402	12.87	-0.97	-0.64	
BG	15.0	15.0	17.0	1.15	0.236	15.67	0.00	0.33	
BH	14.8	15.9	15.9	0.64	0.130	15.53	-0.04	0.29	
BK	16.7	16.7	17.8	0.64	0.130	17.07	0.49	0.82	
BL	15.3	16.4	17.9	1.31	0.307	16.53	0.30	0.64	
BM	15.1	16.6	14.6	1.04	0.236	15.43	-0.08	0.25	
BN	15.0	13.0	15.0	1.15	0.236	14.33	-0.46	-0.13	
BO	15.5	12.8	15.1	1.46	0.319	14.47	-0.41	-0.08	
BS	14.3	16.6	14.7	1.23	0.272	15.20	-0.16	0.17	
C	17.3	16.6	17.6	0.51	0.118	17.17	0.52	0.85	
CA	16.4	17.4	13.5	2.03	0.461	15.77	0.04	0.37	
CC	31.0	32.4	32.5	0.84	0.177	31.97	5.65	5.98	×
CE	13.5	14.5	13.7	0.53	0.118	13.90	-0.61	-0.28	
CG	15.9	10.9	12.6	2.54	0.591	13.13	-0.87	-0.54	
CJ	15.0	14.0	16.0	1.00	0.236	15.00	-0.23	0.10	
CO	5.8	6.0	4.8	0.64	0.142	5.53	-3.51	-3.18	×
CP	33.7	21.0	20.4	7.51	2.088	25.03	3.25	3.58	×
CS	11.8	12.0	12.9	0.59	0.130	12.23	-1.19	-0.85	
CX	18.2	15.3	21.4	3.05	0.721	18.30	0.92	1.25	
D	15.9	15.6	17.7	1.14	0.248	16.40	0.26	0.59	
DB	15.7	17.6	19.6	1.95	0.461	17.63	0.69	1.02	
DD	9.1	12.5	12.9	2.09	0.449	11.50	-1.44	-1.11	
DE	13.5	13.6	13.7	0.10	0.024	13.60	-0.71	-0.38	
DH	13.9	15.3	15.6	0.91	0.201	14.93	-0.25	0.08	
DO	16.0	16.0	15.0	0.58	0.118	15.67	0.00	0.33	
DR		16.5	16.7						∅
DS									•
DT	16.8	15.4	17.3	0.98	0.224	16.50	0.29	0.62	
DZ	13.1	13.1	13.5	0.23	0.047	13.23	-0.84	-0.51	
E	14.0	16.6	15.9	1.35	0.307	15.50	-0.05	0.28	
EB	15.9	15.4	16.6	0.60	0.142	15.97	0.11	0.44	

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ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 31-Jan-1997 12 / 16

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
EL	14.0	13.9	12.9	0.61	0.130	13.60	-0.71	-0.38	
EO	20.0	19.0	14.0	3.21	0.709	17.67	0.70	1.03	
ER									•
EV	20.5	16.8	15.9	2.44	0.543	17.73	0.72	1.05	
EW	16.1	15.8	13.6	1.37	0.295	15.17	-0.17	0.16	
EX	11.0	12.8	15.4	2.21	0.520	13.07	-0.90	-0.57	
FE	14.3	14.3	14.3	0.00	0.000	14.30	-0.47	-0.14	
FF	15.7	15.7	16.0	0.17	0.035	15.80	0.05	0.38	
FJ									•
FL	145.6	156.8	159.4	7.33	2.200	153.93	47.90	48.23	×
FN	16.0	14.0	15.0	1.00	0.236	15.00	-0.23	0.10	
GQ	17.4	14.4	16.0	1.50	0.354	15.93	0.10	0.43	
GT	20.2	17.6	13.4	3.43	0.803	17.07	0.49	0.82	
GZ									•
HI	28.8	29.5	33.3	2.42	0.532	30.53	5.15	5.48	×
HK	18.6	17.5	17.2	0.74	0.165	17.77	0.73	1.06	
HL	14.0	15.4	15.2	0.76	0.165	14.87	-0.27	0.06	
HP	16.9	14.7	23.4	4.52	1.053	18.33	0.93	1.26	
I	16.5	16.4	15.7	0.44	0.095	16.20	0.19	0.52	
ID	17.2	15.9	15.2	1.01	0.236	16.10	0.15	0.48	
IU	16.0	14.0	15.0	1.00	0.236	15.00	-0.23	0.10	
J									•
JG	15.0	15.4	15.9	0.45	0.106	15.43	-0.08	0.25	
JM	15.7	16.2	14.5	0.87	0.201	15.47	-0.07	0.27	
JN	14.2	14.9	14.3	0.38	0.083	14.47	-0.41	-0.08	
JP	14.6	13.9	15.5	0.80	0.189	14.67	-0.34	-0.01	
JQ	19.9	17.0	13.5	3.20	0.756	16.80	0.40	0.73	
JS	13.4	15.5	16.5	1.58	0.366	15.13	-0.18	0.15	
JY	18.2	18.9	16.6	1.18	0.272	17.90	0.78	1.11	
K	17.9	16.6	16.4	0.81	0.177	16.97	0.45	0.79	
KE	13.8	13.4	12.9	0.45	0.106	13.37	-0.79	-0.46	
KH	15.3	13.9	15.8	0.98	0.224	15.00	-0.23	0.10	
KT	10.1	8.1	9.5	1.03	0.236	9.23	-2.22	-1.89	
KX	16.0	16.0	13.0	1.73	0.354	15.00	-0.23	0.10	
L	12.8	13.9	12.1	0.91	0.213	12.93	-0.94	-0.61	
LE	13.6	20.2	19.7	3.67	0.780	17.83	0.75	1.09	
LF	17.0	22.0	16.0	3.21	0.709	18.33	0.93	1.26	
LL	18.9	22.9	15.0	3.95	0.933	18.93	1.14	1.47	
LR	16.4	18.7	18.8	1.36	0.284	17.97	0.80	1.13	
LT	15.4	15.5	16.3	0.49	0.106	15.73	0.03	0.36	
M	20.0	16.0	17.0	2.08	0.473	17.67	0.70	1.03	
MF	15.5	16.0	16.2	0.36	0.083	15.90	0.08	0.42	
MV	12.1	14.0	15.3	1.61	0.378	13.80	-0.64	-0.31	
MX									•
N	12.9	12.6	12.7	0.15	0.035	12.73	-1.01	-0.68	

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13 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 31-Jan-1997
Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
NA	25.0	25.0	25.0	0.00	0.000	25.00	3.24	3.57	×
NB	26.3	31.0	28.8	2.35	0.555	28.70	4.52	4.85	×
NJ	16.7	14.3	14.7	1.29	0.284	15.23	-0.15	0.18	
NK	15.6	17.2	14.0	1.60	0.378	15.60	-0.02	0.31	
NO	13.0	16.0	19.0	3.00	0.709	16.00	0.12	0.45	
NP	16.6	18.6	16.9	1.08	0.236	17.37	0.59	0.92	
NT	15.5	17.2	15.4	1.01	0.213	16.03	0.13	0.46	
O	16.3	16.9	15.9	0.50	0.118	16.37	0.25	0.58	
OA	20.1	18.4	24.0	2.87	0.662	20.83	1.79	2.12	
OB	16.6	18.6	17.5	1.00	0.236	17.57	0.66	0.99	
OF	14.1	14.1	12.5	0.92	0.189	13.57	-0.72	-0.39	
OS	22.0	25.0	28.0	3.00	0.709	25.00	3.24	3.57	×
OT	17.5	15.9	16.5	0.81	0.189	16.63	0.34	0.67	
OX									•
OY									•
P	18.9	13.6	18.7	3.00	0.626	17.07	0.49	0.82	
PA	13.9	14.5	12.4	1.08	0.248	13.60	-0.71	-0.38	
PB	15.4	15.2	15.6	0.20	0.047	15.40	-0.09	0.24	
PG	18.6	15.5	15.9	1.69	0.366	16.67	0.35	0.68	
PM	14.5	14.0	12.4	1.10	0.248	13.63	-0.70	-0.37	
PQ									•
PR	15.7	14.8	15.2	0.45	0.106	15.23	-0.15	0.18	
PV	13.9	18.2	11.4	3.44	0.803	14.50	-0.40	-0.07	
Q	23.0	24.8	25.0	1.10	0.236	24.27	2.98	3.31	×
QM	13.0	11.9	11.0	1.00	0.236	11.97	-1.28	-0.95	
QP	17.9	17.9	19.4	0.87	0.177	18.40	0.95	1.28	
QQ	18.4	18.2	18.1	0.15	0.035	18.23	0.89	1.22	
QT	17.9	19.4	17.6	0.96	0.213	18.30	0.92	1.25	
QU	14.8	13.1	11.5	1.65	0.390	13.13	-0.87	-0.54	
QW	13.3	15.6	14.2	1.16	0.272	14.37	-0.45	-0.12	
QX	17.8	17.8	17.9	0.06	0.012	17.83	0.75	1.09	
QZ	16.8	17.1	18.3	0.79	0.177	17.40	0.60	0.94	
R	19.4	16.7	17.6	1.37	0.319	17.90	0.78	1.11	
RB	15.0	16.0	15.0	0.58	0.118	15.33	-0.11	0.22	
RD	15.4	15.5	16.1	0.38	0.083	15.67	0.00	0.33	
RF	17.3	16.1	17.5	0.76	0.165	16.97	0.45	0.79	
RG	17.1	16.8	18.2	0.74	0.165	17.37	0.59	0.92	
RI	14.0	14.2	17.8	2.14	0.449	15.33	-0.11	0.22	
RK	19.9	17.4	17.4	1.44	0.295	18.23	0.89	1.22	
RR	13.0	14.0	13.0	0.58	0.118	13.33	-0.80	-0.47	
RZ									•
S	16.0	16.2	15.3	0.47	0.106	15.83	0.06	0.39	
SC	14.9	17.4	17.2	1.39	0.295	16.50	0.29	0.62	
SD	13.1	12.4	13.6	0.60	0.142	13.03	-0.91	-0.58	
SF	19.0	29.0	31.0	6.43	1.795	26.33	3.70	4.03	×

• = No data submitted

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TAG SYMBOLS

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↑ = Above control limit

↓ = Below control limit

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
SG	22.3	31.3	28.4	4.59	1.120	27.33	4.05	4.38	×
SI	14.5	13.6	13.8	0.47	0.106	13.97	-0.59	-0.25	
SL	18.5	18.7	18.2	0.25	0.059	18.47	0.97	1.30	
SM	13.9	13.4	15.4	1.04	0.236	14.23	-0.49	-0.16	
SN	13.0	14.0	15.0	1.00	0.236	14.00	-0.57	-0.24	
SO	17.2	16.9	16.3	0.46	0.106	16.80	0.40	0.73	
SR	23.7	17.4	14.7	4.62	1.120	18.60	1.02	1.35	
SS	14.0	13.7	13.6	0.21	0.047	13.77	-0.65	-0.32	
SU	13.2	14.9	14.9	0.98	0.201	14.33	-0.46	-0.13	
SV	19.2	17.5	18.0	0.87	0.201	18.23	0.89	1.22	
SX	18.6	16.4	17.6	1.10	0.260	17.53	0.65	0.98	
SZ	13.7	14.6	15.0	0.67	0.154	14.43	-0.42	-0.09	
T	18.1	13.4	13.6	2.66	0.555	15.03	-0.22	0.12	
TD	11.1	12.6	15.1	2.02	0.473	12.93	-0.94	-0.61	
TG									•
TH									•
TL									•
TN	13.3	17.2	18.1	2.55	0.567	16.20	0.19	0.52	
TQ	14.2	14.7	15.4	0.60	0.142	14.77	-0.31	0.02	
TW	12.1	15.8	11.9	2.20	0.461	13.27	-0.83	-0.50	
TY	16.7	17.3	17.9	0.60	0.142	17.30	0.57	0.90	
U	16.2	16.1	16.2	0.06	0.012	16.17	0.18	0.51	
UA	8.0	7.8	8.0	0.12	0.024	7.93	-2.68	-2.34	
UE	16.7	17.5	17.4	0.44	0.095	17.20	0.53	0.87	
UP	21.1	17.2	20.8	2.17	0.461	19.70	1.40	1.73	
UQ	17.7	17.0	18.2	0.60	0.142	17.63	0.69	1.02	
VA	15.1	16.3	15.0	0.72	0.154	15.47	-0.07	0.27	
VC									•
VH	15.9	14.6	15.8	0.72	0.154	15.43	-0.08	0.25	
VI	8.7	8.3	8.1	0.31	0.071	8.37	-2.52	-2.19	
VJ	15.4	15.5	15.8	0.21	0.047	15.57	-0.03	0.30	
VO	17.7	17.8	16.9	0.49	0.106	17.47	0.63	0.96	
VT									•
W	15.7	16.1	16.6	0.45	0.106	16.13	0.17	0.50	
WE	14.5	14.9	15.5	0.50	0.118	14.97	-0.24	0.09	
WH	11.3	11.2	10.9	0.21	0.047	11.13	-1.57	-1.24	
WJ	18.5	18.3	18.4	0.10	0.024	18.40	0.95	1.28	
WN									•
WO	22.3	17.0	18.1	2.80	0.626	19.13	1.20	1.54	
WP	25.8	26.6	28.9	1.61	0.366	27.10	3.96	4.30	×
WR									•
WS									•
WU									•
WW	19.5	16.2	17.3	1.68	0.390	17.67	0.70	1.03	
WX	16.8	14.9	15.8	0.95	0.224	15.83	0.06	0.39	

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

⊘ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

15 / 16 ESD-LV Performance Evaluation: Gross Alpha-Beta in Water, 31-Jan-1997
Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
X	21.6	17.6	19.8	2.00	0.473	19.67	1.39	1.72	
XB									•
XC	29.8	24.9	29.5	3.31	0.744	26.07	3.61	3.94	x

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
5.53	x	CO	14.43		SZ	15.73		LT
7.93		UA	14.47		JN	15.73		AK
8.37		VI	14.47		BO	15.77		CA
9.23		KT	14.50		PV	15.80		FF
11.13		WH	14.50		AJ	15.80		AE
11.50		DD	14.63		AZ	15.83		WX
11.97		QM	14.67		JP	15.83		S
12.23		CS	14.73		AU	15.90		MF
12.73		N	14.77		TQ	15.93		GQ
12.87		BC	14.87		HL	15.97		EB
12.93		L	14.93		DH	16.00		NO
12.93		TD	14.97		WE	16.03		NT
13.03		SD	15.00		KX	16.10		ID
13.07		EX	15.00		KH	16.13		W
13.13		QU	15.00		IU	16.17		U
13.13		CG	15.00		FN	16.20		I
13.23		DZ	15.00		CJ	16.20		AH
13.27		TW	15.03		T	16.20		TN
13.33		RR	15.13		JS	16.37		O
13.37		KE	15.17		EW	16.40		D
13.57		OF	15.20		BS	16.50		SC
13.60		PA	15.23		PR	16.50		DT
13.60		EL	15.23		NJ	16.53		BL
13.60		DE	15.33		RI	16.63		OT
13.63		PM	15.33		RB	16.67		PG
13.73		A	15.40		PB	16.80		SO
13.77		SS	15.40		AL	16.80		JQ
13.80		MV	15.43		VH	16.97		RF
13.90		CE	15.43		JG	16.97		K
13.97		SI	15.43		BM	17.07		P
14.00		SN	15.47		VA	17.07		GT
14.00		BA	15.47		JM	17.07		BK
14.23		SM	15.50		E	17.17		C
14.30		FE	15.53		BH	17.20		UE
14.33		SU	15.57		VJ	17.30		TY
14.33		BN	15.60		NK	17.37		RG
14.33		AP	15.67		RD	17.37		NP
14.37		QW	15.67		DO	17.40		QZ
14.40		AF	15.67		BG	17.43		AW

• = No data submitted

TAG SYMBOLS

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Ø = Insufficient data

x = Determined to be an outlier

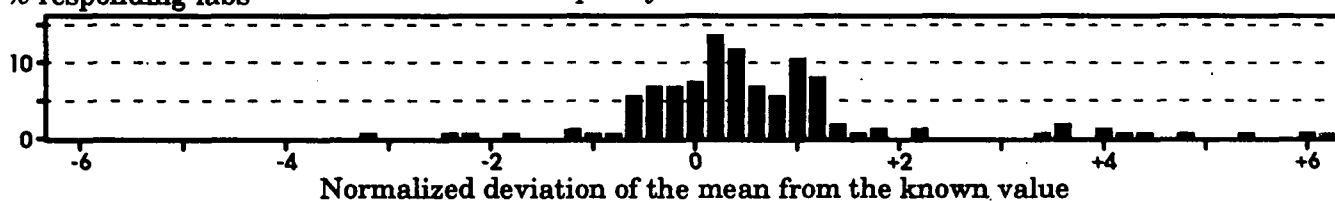
↓ = Below control limit

Gross Beta**Data sorted by Laboratory Average**

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
17.47		VO	18.03		AR	19.70		UP
17.53		SX	18.23		SV	20.83		OA
17.57		OB	18.23		RK	21.20		BB
17.63		UQ	18.23		QQ	24.27	×	Q
17.63		DB	18.30		QT	25.00	×	OS
17.67		WW	18.30		CX	25.00	×	NA
17.67		M	18.33		LF	25.03	×	CP
17.67		EO	18.33		HP	26.07	×	XC
17.73		EV	18.40		WJ	26.33	×	SF
17.77		HK	18.40		QP	27.10	×	WP
17.83		QX	18.47		SL	27.33	×	SG
17.83		LE	18.60		SR	28.70	×	NB
17.90		R	18.93		LL	30.53	×	HI
17.90		JY	19.13		WO	31.97	×	CC
17.97		LR	19.67		X	153.93	×	FL

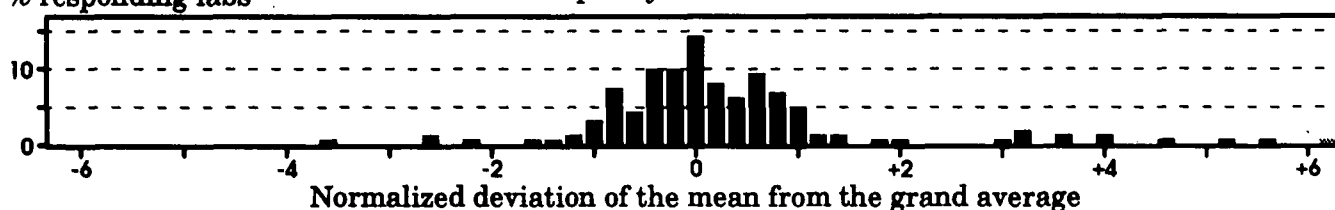
% responding labs

Frequency distribution



% responding labs

Frequency distribution



• ≡ No data submitted

TAG SYMBOLS

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