

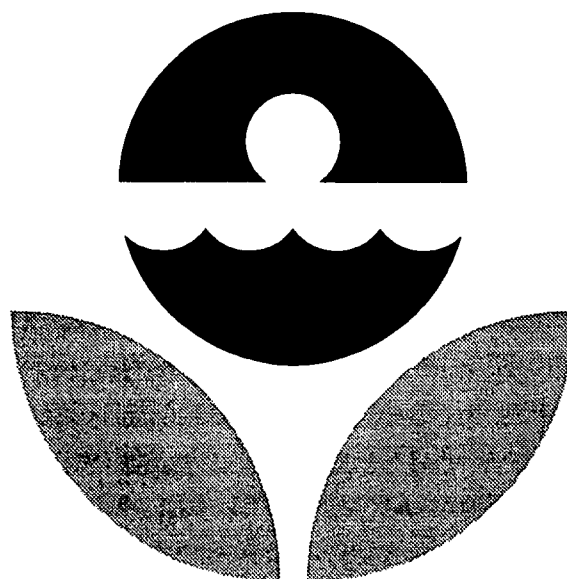


Gross Alpha-Beta in Water Performance Evaluation Study

A Statistical Evaluation of the July 19, 1996 Data



Gross Alpha-Beta in Water
Performance Evaluation Study
July 19, 1996



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



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

Dear Participant,

Enclosed are the results of the Analytical Sciences Branch (CRD-LV) Performance Evaluation Study for *Gross Alpha-Beta in Water; July 19, 1996*.

The known value for each analysis was determined by gravimetric methods, checked by chemical analyses performed by CRD-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.

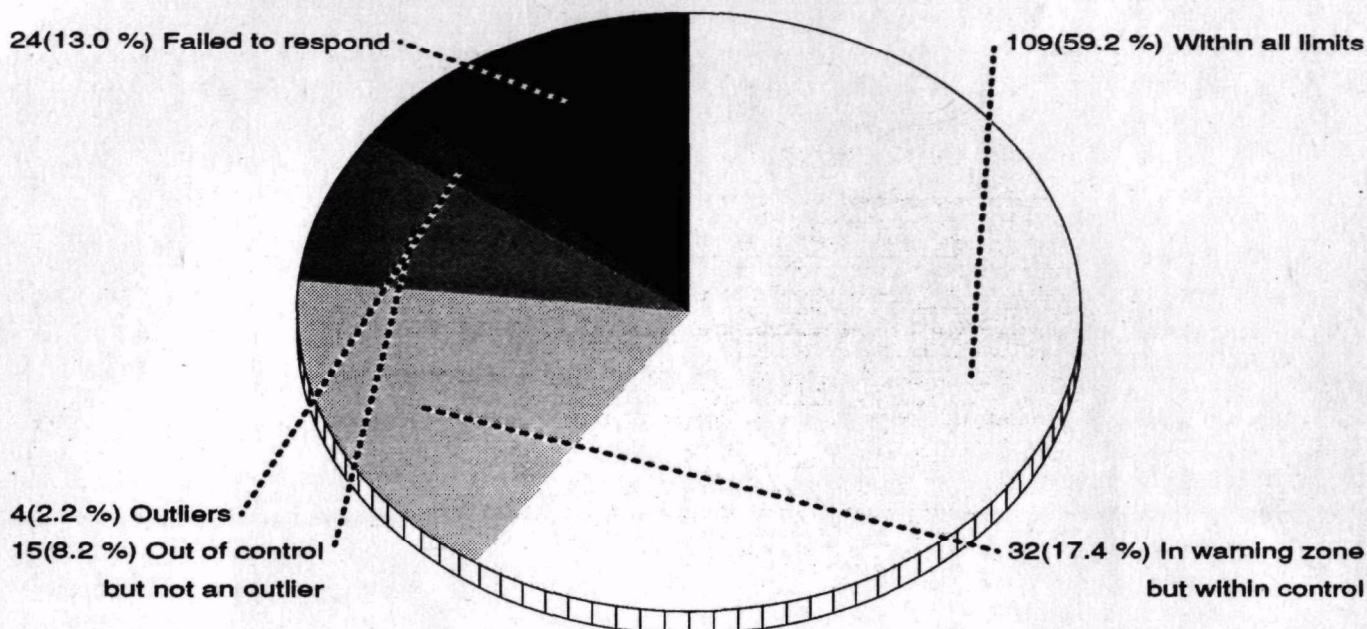
The normalized deviation of the mean from the known value is calculated from the deviation of the mean from the known value and the standard error of the mean values. The deviation of the mean from the known value is calculated by subtracting the known value from the average of the laboratory's three 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, CRD-LV, 702/798-2141.

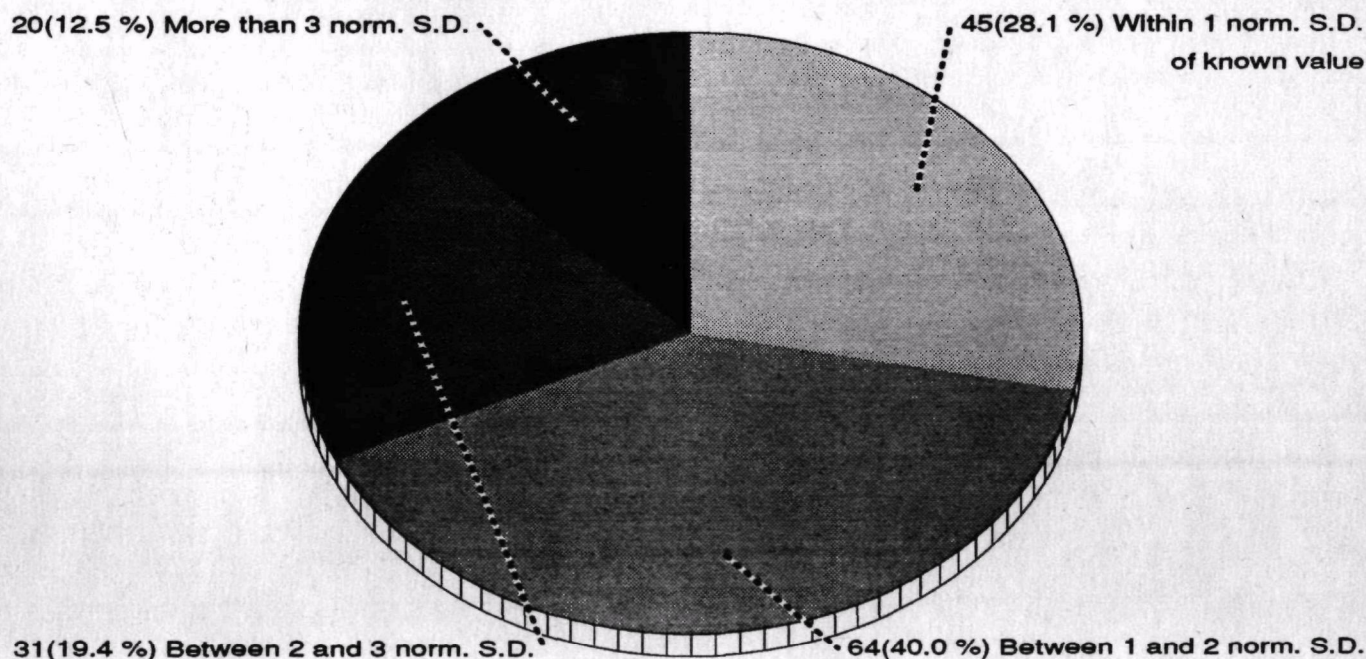
Gross Alpha**Statistical Summary**

184 Participants

The known value of this nuclide is **24.4 pCi/l** with an expected precision of **6.1**; the control limits are 13.8 to 35.0; the warning regions are 13.8 to 17.3 and 31.5 to 35.0



Statistic	Respondents	Non-outliers
Mean	20.16	Grand Avg 19.67
Std. Dev.	5.56	4.68
Variance	30.87	21.93
% Coef. of Var.	27.56	23.81
% deviation of mean from known value	-17.39	-19.40
Norm. dev. of mean from known value	-0.76	-1.01
Median	19.40	19.15
% deviation of median from known value	-20.49	-21.52
Norm. dev. of median from known value	-0.90	-1.12



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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	22.8	25.6	24.4	1.40	0.271	24.27	1.31	-0.04	
AE	20.1	20.0	18.6	0.84	0.145	19.57	-0.03	-1.37	
AF	17.8	17.9	20.3	1.42	0.242	18.67	-0.28	-1.63	
AH	16.6	12.6	14.5	2.00	0.387	14.57	-1.45	-2.79	
AJ	44.5	31.6	44.0	7.31	1.475	40.03	5.78	4.44	×
AK	24.4	23.7	24.6	0.47	0.087	24.23	1.30	-0.05	
AL	21.2	23.1	23.3	1.16	0.203	22.53	0.81	-0.53	
AP	22.2	21.9	19.2	1.65	0.290	21.10	0.41	-0.94	
AR	11.9	11.3	11.1	0.42	0.077	11.43	-2.34	-3.68	↓
AU	14.4	11.4	14.7	1.82	0.320	13.50	-1.75	-3.09	↓
AW	21.7	24.2	24.1	1.42	0.242	23.33	1.04	-0.30	
AZ									•
BA	18.1	20.8	22.8	2.36	0.455	20.57	0.26	-1.09	
BB	18.0	15.0	18.2	1.79	0.310	17.07	-0.74	-2.08	
BC	20.1	19.0	21.2	1.10	0.213	20.10	0.12	-1.22	
BG	12.5	16.7	12.6	2.40	0.407	13.93	-1.63	-2.97	
BH	18.6	23.8	19.1	2.87	0.504	20.50	0.24	-1.11	
BK	24.8	26.5	25.4	0.86	0.165	25.57	1.68	0.33	
BL	46.5	38.5	40.5	4.16	0.775	41.83	6.29	4.95	×
BM	20.6	20.5	20.4	0.10	0.019	20.50	0.24	-1.11	
BN	21.0	20.7	19.0	1.08	0.194	20.23	0.16	-1.18	
BO	17.5	13.2	12.4	2.74	0.494	14.37	-1.50	-2.85	
BS	23.0	26.0	25.0	1.53	0.290	24.67	1.42	0.08	
C	22.7	21.6	20.8	0.95	0.184	21.70	0.58	-0.77	
CA	21.2	17.8	21.2	1.96	0.329	20.07	0.11	-1.23	
CE	22.7	21.9	19.5	1.67	0.310	21.37	0.48	-0.86	
CG	19.4	16.5	21.1	2.33	0.445	19.00	-0.19	-1.53	
CJ	23.0	22.0	23.0	0.58	0.097	22.67	0.85	-0.49	
CO	17.8	19.1	16.9	1.11	0.213	17.93	-0.49	-1.84	
CS	16.7	21.9	16.1	3.19	0.562	18.23	-0.41	-1.75	
CX	18.6	17.7	18.4	0.47	0.087	18.23	-0.41	-1.75	
D	24.3	25.7	22.1	1.81	0.349	24.03	1.24	-0.10	
DB	19.0	18.8	20.8	1.10	0.194	19.53	-0.04	-1.38	
DD	16.9	20.4	19.1	1.77	0.339	18.80	-0.25	-1.59	
DE	25.8	25.8	25.9	0.06	0.010	25.83	1.75	0.41	
DH	20.8	18.9	17.8	1.52	0.290	19.17	-0.14	-1.49	
DO	24.7	27.0	22.8	2.10	0.407	24.83	1.47	0.12	
DR	15.0	14.0	11.0	2.08	0.387	13.33	-1.80	-3.14	↓
DS	18.3	20.6	12.2	4.34	0.813	17.03	-0.75	-2.09	
DT	26.4	24.8	25.0	0.87	0.155	25.40	1.63	0.28	
DZ	28.7	30.9	28.5	1.33	0.232	29.37	2.75	1.41	
E	21.9	22.0	22.8	0.49	0.087	22.23	0.73	-0.62	
EB	21.1	18.4	19.0	1.42	0.261	19.50	-0.05	-1.39	
EL	10.9	10.0	11.5	0.75	0.145	10.80	-2.52	-3.86	↓
EO	20.0	21.0	16.0	2.65	0.484	19.00	-0.19	-1.53	

• = 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
ER	19.0	19.2	19.0	0.12	0.019	19.07	-0.17	-1.51	
EV	12.5	15.6	16.5	2.10	0.387	14.87	-1.36	-2.71	
EW									•
EX	25.2	25.2	20.0	3.00	0.504	23.47	1.08	-0.27	
FF	37.2	41.3	36.5	2.59	0.465	38.33	5.30	3.96	×
FJ									•
FL	10.0	13.0	10.0	1.73	0.290	11.00	-2.46	-3.80	↓
FN	18.0	19.0	22.0	2.08	0.387	19.67	0.00	-1.34	
FZ	20.2	20.6	19.7	0.45	0.087	20.17	0.14	-1.20	
GQ	20.8	22.1	21.8	0.68	0.126	21.57	0.54	-0.80	
GT	30.9	26.1	27.6	2.46	0.465	28.20	2.42	1.08	
GZ	19.7	18.0	18.2	0.93	0.165	18.63	-0.29	-1.64	
HI	14.7	15.6	12.8	1.43	0.271	14.37	-1.50	-2.85	
HK	21.1	21.3	21.2	0.10	0.019	21.20	0.44	-0.91	
HL	19.4	20.6	20.5	0.67	0.116	20.17	0.14	-1.20	
HP	18.5	18.6	17.8	0.44	0.077	18.30	-0.39	-1.73	
I	35.3	32.8	32.8	1.44	0.242	33.63	3.97	2.62	
ID	12.8	11.1	15.8	2.38	0.455	13.23	-1.83	-3.17	↓
J	24.2	23.7	25.3	0.82	0.155	24.40	1.34	0.00	
JG	24.1	22.7	21.5	1.30	0.252	22.77	0.88	-0.46	
JM	14.5	19.7	17.4	2.61	0.504	17.20	-0.70	-2.04	
JN	15.4	16.4	15.9	0.50	0.097	15.90	-1.07	-2.41	
JP	17.6	16.7	15.8	0.90	0.174	16.70	-0.84	-2.19	
JQ	19.2	20.3	19.7	0.55	0.107	19.73	0.02	-1.33	
JS	13.0	11.9	12.8	0.59	0.107	12.57	-2.02	-3.36	↓
JY	18.7	15.5	18.4	1.77	0.310	17.53	-0.61	-1.95	
K	36.0	31.6	26.4	4.81	0.930	31.33	3.31	1.97	
KE	16.5	14.6	23.3	4.57	0.842	18.13	-0.44	-1.78	
KH	17.8	17.3	17.9	0.32	0.058	17.67	-0.57	-1.91	
KT	22.0	23.0	24.0	1.00	0.194	23.00	0.95	-0.40	
KX									•
L	16.4	19.6	17.8	1.60	0.310	17.93	-0.49	-1.84	
LE									•
LF	24.0	24.0	23.0	0.58	0.097	23.67	1.14	-0.21	
LL	19.7	23.0	26.0	3.15	0.610	22.90	0.92	-0.43	
LR	16.0	15.0	16.0	0.58	0.097	15.67	-1.14	-2.48	
LT	14.6	15.9	14.7	0.72	0.126	15.07	-1.31	-2.65	
M	26.0	26.0	40.0	8.08	1.677	30.67	3.12	1.78	
MF	19.1	18.4	19.9	0.75	0.145	19.13	-0.15	-1.50	
MV	14.3	14.4	14.0	0.21	0.039	14.23	-1.54	-2.89	
MX	14.1	11.6	15.0	1.76	0.329	13.57	-1.73	-3.08	↓
N	24.0	22.3	23.2	0.85	0.165	23.17	0.99	-0.35	
NA	30.0	27.0	28.0	1.53	0.290	28.33	2.46	1.12	
NB	11.0	12.0	14.0	1.53	0.290	12.33	-2.08	-3.43	↓
NJ	17.5	18.8	18.3	0.66	0.126	18.20	-0.42	-1.76	

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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
NK	19.3	16.5	16.0	1.78	0.320	17.27	-0.68	-2.03	
NO	18.0	19.0	20.0	1.00	0.194	19.00	-0.19	-1.53	
NP	15.3	17.2	13.5	1.85	0.358	15.33	-1.23	-2.57	
NT	26.1	25.3	25.1	0.53	0.097	25.50	1.66	0.31	
O	22.8	21.9	21.2	0.80	0.155	21.97	0.65	-0.69	
OA	13.8	11.4	13.8	1.39	0.232	13.00	-1.89	-3.24	↓
OB	16.2	17.0	18.3	1.06	0.203	17.17	-0.71	-2.05	
OF	19.5	18.6	19.1	0.45	0.087	19.07	-0.17	-1.51	
OS	18.0	21.0	22.0	2.08	0.387	20.33	0.19	-1.15	
OT									•
OX									•
OY									•
P	26.6	25.6	22.3	2.25	0.416	24.83	1.47	0.12	
PA	11.4	10.2	17.2	3.74	0.678	12.93	-1.91	-3.26	↓
PB	21.1	22.4	21.4	0.68	0.126	21.63	0.56	-0.79	
PG	23.2	23.4	22.2	0.64	0.116	22.93	0.93	-0.42	
PM	20.7	19.2	19.6	0.78	0.145	19.83	0.05	-1.30	
PQ	14.2	17.4	15.4	1.62	0.310	15.67	-1.14	-2.48	
PR	40.5	35.6	34.2	3.31	0.610	36.77	4.86	3.51	×
PV	18.5	18.6	19.4	0.49	0.087	18.83	-0.24	-1.58	
Q	21.6	22.2	23.4	0.92	0.174	22.40	0.78	-0.57	
QC									•
QM	15.6	20.0	16.9	2.26	0.426	17.50	-0.62	-1.96	
QP	19.6	16.3	18.7	1.71	0.320	18.20	-0.42	-1.76	
QQ	23.2	17.8	17.6	3.18	0.542	19.53	-0.04	-1.38	
QT	18.9	20.1	21.9	1.51	0.290	20.30	0.18	-1.16	
QU	17.2	17.2	17.5	0.17	0.029	17.30	-0.67	-2.02	
QW	14.0	18.7	19.8	3.08	0.562	17.50	-0.62	-1.96	
QX	22.1	21.8	21.8	0.17	0.029	21.90	0.63	-0.71	
QZ	17.2	17.4	18.8	0.87	0.155	17.80	-0.53	-1.87	
R	16.8	18.9	15.8	1.58	0.300	17.17	-0.71	-2.05	
RB	29.6	29.6	27.1	1.44	0.242	28.77	2.58	1.24	
RD	17.6	18.4	19.1	0.75	0.145	18.37	-0.37	-1.71	
RF	17.6	12.2	11.7	3.27	0.571	13.83	-1.66	-3.00	
RG	18.3	17.5	15.2	1.61	0.300	17.00	-0.76	-2.10	
RI	20.8	20.3	20.0	0.40	0.077	20.37	0.20	-1.15	
RK	28.6	27.0	23.0	2.88	0.542	26.20	1.86	0.51	
RR	27.0	26.0	27.0	0.58	0.097	26.67	1.99	0.64	
RZ	19.7	20.1	20.2	0.26	0.048	20.00	0.09	-1.25	
S	22.0	24.5	25.4	1.76	0.329	23.97	1.22	-0.12	
SC									•
SD	23.2	20.5	21.8	1.35	0.261	21.83	0.62	-0.73	
SF	16.0	13.7	15.1	1.16	0.223	14.93	-1.34	-2.69	
SG	10.1	8.1	12.7	2.31	0.445	10.30	-2.66	-4.00	↓
SI	18.5	20.7	18.7	1.22	0.213	19.30	-0.10	-1.45	

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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	
SL	20.0	21.0	24.0	2.08	0.387	21.67	0.57	-0.78
SM	20.6	19.2	21.4	1.11	0.213	20.40	0.21	-1.14
SN	12.2	13.4	17.0	2.50	0.465	14.20	-1.55	-2.90
SO								•
SR	23.3	23.1	24.6	0.81	0.145	23.67	1.14	-0.21
SS	18.6	18.5	18.4	0.10	0.019	18.50	-0.33	-1.68
SU	15.2	13.9	17.1	1.61	0.310	15.40	-1.21	-2.56
SV	27.0	28.3	31.3	2.21	0.416	28.87	2.61	1.27
SX	18.2	18.8	15.6	1.70	0.310	17.53	-0.61	-1.95
SZ	10.2	12.5	10.9	1.18	0.223	11.20	-2.40	-3.75 ↓
T	20.3	17.1	16.9	1.91	0.329	18.10	-0.44	-1.79
TD	23.3	23.3	26.7	1.96	0.329	24.43	1.35	0.01
TG	20.3	18.1	17.7	1.40	0.252	18.70	-0.27	-1.62
TH								•
TL								•
TN	18.0	15.7	19.5	1.91	0.368	17.73	-0.55	-1.89
TO								•
TQ	15.7	13.8	15.1	0.97	0.184	14.87	-1.36	-2.71
TW	14.7	15.1	19.1	2.43	0.426	16.30	-0.96	-2.30
TY	16.1	17.0	15.6	0.71	0.136	16.23	-0.97	-2.32
U	24.3	23.7	23.2	0.55	0.107	23.73	1.15	-0.19
UA	26.3	27.4	22.8	2.40	0.445	25.50	1.66	0.31
UE								•
UN								•
UP	15.0	14.5	15.1	0.32	0.058	14.87	-1.36	-2.71
UQ	20.1	20.6	21.6	0.76	0.145	20.77	0.31	-1.03
VA	14.7	12.1	12.8	1.35	0.252	13.20	-1.84	-3.18 ↓
VC								•
VH	25.2	32.4	25.8	4.00	0.697	27.80	2.31	0.97
VI	16.5	15.1	14.3	1.11	0.213	15.30	-1.24	-2.58
VJ	28.2	29.8	18.9	5.89	1.106	25.63	1.69	0.35
VO	19.2	17.0	19.9	1.51	0.281	18.70	-0.27	-1.62
VT								•
W	15.1	18.2	21.8	3.35	0.649	18.37	-0.37	-1.71
WE	23.4	21.1	24.8	1.87	0.358	23.10	0.97	-0.37
WF								•
WH	17.8	18.8	17.0	0.90	0.174	17.87	-0.51	-1.86
WJ	19.1	16.5	20.0	1.82	0.339	18.53	-0.32	-1.67
WN	36.6	31.7	33.8	2.46	0.474	34.03	4.08	2.74
WO	19.9	21.7	20.9	0.90	0.174	20.83	0.33	-1.01
WP								•
WR	19.9	20.6	25.1	2.82	0.504	21.87	0.62	-0.72
WS								•
WU	16.0	14.6	13.4	1.30	0.252	14.67	-1.42	-2.76
WV								•

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

Ø = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

8 / 16 CRD-LV Performance Evaluation: Gross Alpha-Beta in Water, 19-Jul-1996

Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
WW	7.6	8.4	6.3	1.06	0.203	7.43	-3.47	-4.82	↓
WX									•
WY									•
X	23.9	21.4	25.1	1.89	0.358	23.47	1.08	-0.27	

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
7.43	↓	WW	17.03		DS	19.07		ER
10.30	↓	SG	17.07		BB	19.13		MF
10.80	↓	EL	17.17		R	19.17		DH
11.00	↓	FL	17.17		OB	19.30		SI
11.20	↓	SZ	17.20		JM	19.50		EB
11.43	↓	AR	17.27		NK	19.53		DB
12.33	↓	NB	17.30		QU	19.53		QQ
12.57	↓	JS	17.50		QW	19.57		AE
12.93	↓	PA	17.50		QM	19.67		FN
13.00	↓	OA	17.53		SX	19.73		JQ
13.20	↓	VA	17.53		JY	19.83		PM
13.23	↓	ID	17.67		KH	20.00		RZ
13.33	↓	DR	17.73		TN	20.07		CA
13.50	↓	AU	17.80		QZ	20.10		BC
13.57	↓	MX	17.87		WH	20.17		HL
13.83		RF	17.93		L	20.17		FZ
13.93		BG	17.93		CO	20.23		BN
14.20		SN	18.10		T	20.30		QT
14.23		MV	18.13		KE	20.33		OS
14.37		BO	18.20		NJ	20.37		RI
14.37		HI	18.20		QP	20.40		SM
14.57		AH	18.23		CX	20.50		BM
14.67		WU	18.23		CS	20.50		BH
14.87		UP	18.30		HP	20.57		BA
14.87		TQ	18.37		W	20.77		UQ
14.87		EV	18.37		RD	20.83		WO
14.93		SF	18.50		SS	21.10		AP
15.07		LT	18.53		WJ	21.20		HK
15.30		VI	18.63		GZ	21.37		CE
15.33		NP	18.67		AF	21.57		GQ
15.40		SU	18.70		VO	21.63		PB
15.67		PQ	18.70		TG	21.67		SL
15.67		LR	18.80		DD	21.70		C
15.90		JN	18.83		PV	21.83		SD
16.23		TY	19.00		NO	21.87		WR
16.30		TW	19.00		EO	21.90		QX
16.70		JP	19.00		CG	21.97		O
17.00		RG	19.07		OF	22.23		E

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

∅ = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

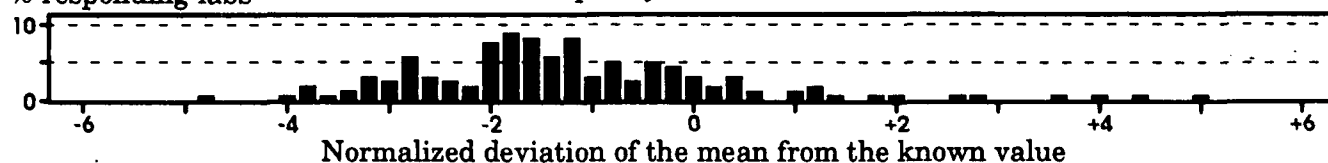
Gross Alpha

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
22.40		Q	23.97		S	26.20		RK
22.53		AL	24.03		D	26.67		RR
22.67		CJ	24.23		AK	27.80		VH
22.77		JG	24.27		A	28.20		GT
22.90		LL	24.40		J	28.33		NA
22.93		PG	24.43		TD	28.77		RB
23.00		KT	24.67		BS	28.87		SV
23.10		WE	24.83		P	29.37		DZ
23.17		N	24.83		DO	30.67		M
23.33		AW	25.40		DT	31.33		K
23.47		X	25.50		UA	33.63		I
23.47		EX	25.50		NT	34.03		WN
23.67		SR	25.57		BK	36.77	×	PR
23.67		LF	25.63		VJ	38.33	×	FF
23.73		U	25.83		DE	40.03	×	AJ
						41.83	×	BL

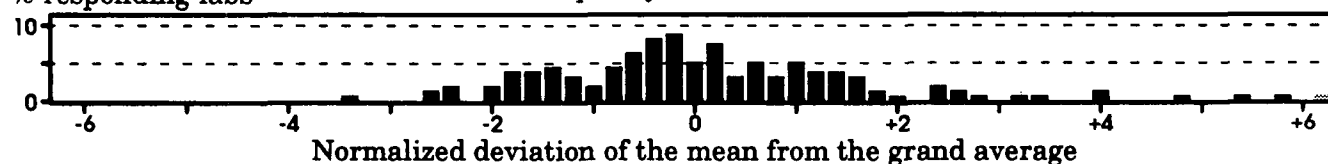
% responding labs

Frequency distribution



% responding labs

Frequency distribution



• ≡ No data submitted

TAG SYMBOLS

↑ ≡ Above control limit

∅ ≡ Insufficient data

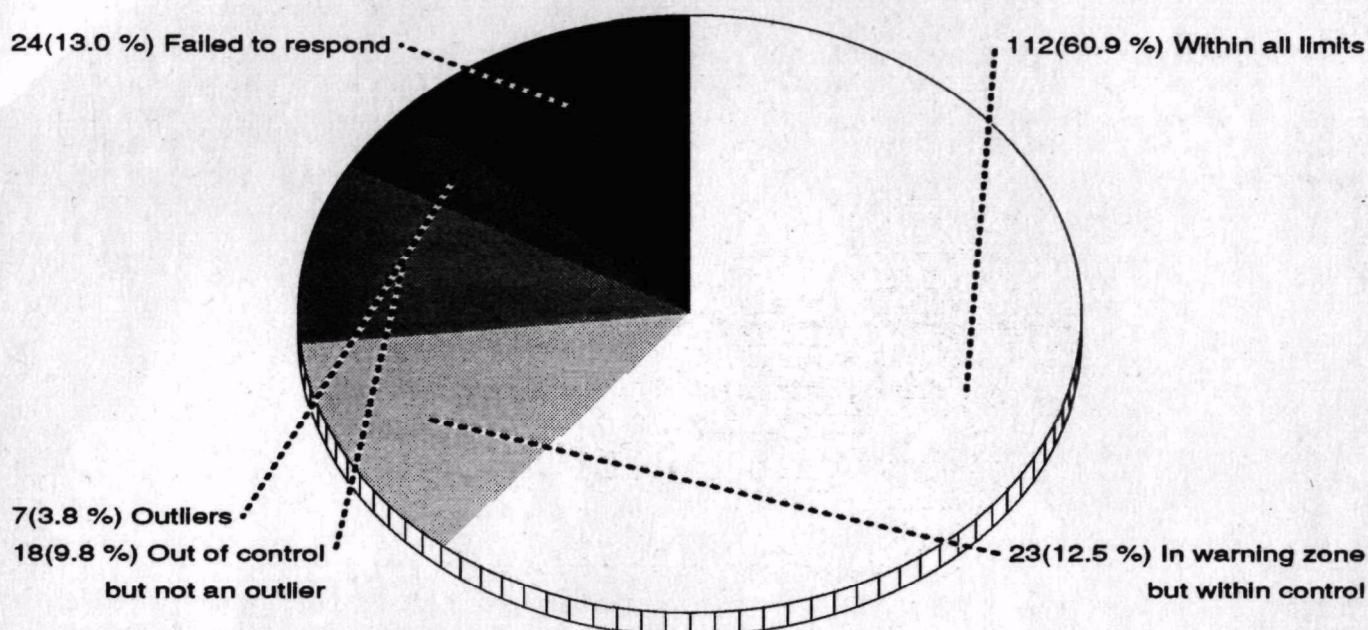
× ≡ Determined to be an outlier

↓ ≡ Below control limit

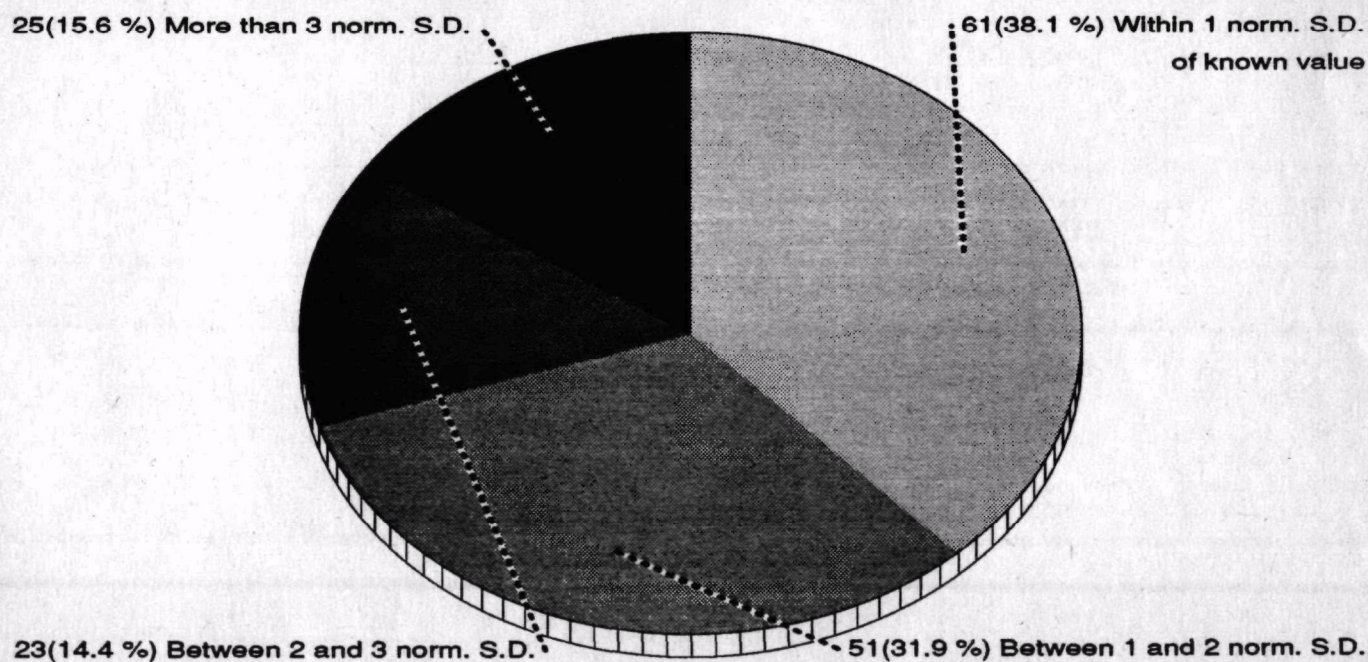
Gross Beta**Statistical Summary**

184 Participants

The known value of this nuclide is **44.8 pCi/l** with an expected precision of **5.0**; the control limits are 36.1 to 53.5; the warning regions are 36.1 to 39.0 and 50.6 to 53.5



Statistic	Respondents	Non-outliers
Mean	44.48	Grand Avg 44.38
Std. Dev.	9.50	5.65
Variance	90.22	31.93
% Coef. of Var.	21.36	12.73
% deviation of mean from known value	-0.72	-0.94
Norm. dev. of mean from known value	-0.03	-0.07
Median	44.82	44.87
% deviation of median from known value	0.04	0.15
Norm. dev. of median from known value	0.00	0.01



11 / 16 CRD-LV Performance Evaluation: Gross Alpha-Beta in Water, 19-Jul-1996

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
A	41.0	43.5	42.8	1.29	0.295	42.43	-0.67	-0.82	
AE	30.9	40.0	37.4	4.69	1.143	36.10	-2.87	-3.01	↓
AF	44.6	44.9	39.4	3.09	0.650	42.97	-0.49	-0.64	
AH	50.5	44.9	49.0	2.90	0.662	48.13	1.30	1.15	
AJ	50.9	49.2	40.8	5.41	1.368	46.97	0.90	0.75	
AK	44.0	44.4	45.0	0.50	0.118	44.47	0.03	-0.12	
AL	43.3	42.0	42.0	0.75	0.154	42.43	-0.67	-0.82	
AP	46.0	44.8	45.7	0.62	0.142	45.50	0.39	0.24	
AR	37.9	37.8	36.8	0.61	0.130	37.50	-2.38	-2.53	
AU	37.4	45.3	45.2	4.53	0.933	42.63	-0.60	-0.75	
AW	55.2	50.6	51.1	2.52	0.543	52.30	2.74	2.60	
AZ									•
BA	50.1	44.9	52.8	4.02	0.933	49.27	1.69	1.55	
BB	59.7	40.5	53.2	9.77	3.416	51.13	2.34	2.19	
BC	36.1	38.0	33.8	2.10	0.496	35.97	-2.91	-3.06	↓
BG	49.6	52.1	51.5	1.31	0.295	51.07	2.32	2.17	
BH	41.3	45.3	40.9	2.43	0.520	42.50	-0.65	-0.80	
BK	54.3	50.1	53.5	2.23	0.496	52.63	2.86	2.71	
BL	45.1	50.9	51.6	3.57	0.768	49.20	1.67	1.52	
BM	44.5	44.5	46.1	0.92	0.189	45.03	0.23	0.08	
BN	36.0	39.4	41.1	2.60	0.602	38.83	-1.92	-2.07	
BO	43.8	43.9	42.6	0.72	0.154	43.43	-0.33	-0.47	
BS	48.0	51.0	50.0	1.53	0.354	49.67	1.83	1.69	
C	41.9	41.9	42.0	0.06	0.012	41.93	-0.85	-0.99	
CA	43.5	40.5	37.1	3.20	0.756	40.37	-1.39	-1.54	
CE	42.8	44.6	44.7	1.07	0.224	44.03	-0.12	-0.27	
CG	46.9	44.1	42.5	2.23	0.520	44.50	0.04	-0.10	
CJ	47.0	43.0	46.0	2.08	0.473	45.33	0.33	0.18	
CO	32.9	39.8	32.9	3.98	0.815	35.20	-3.18	-3.33	↓
CS	38.8	43.6	40.8	2.41	0.567	41.07	-1.15	-1.29	
CX	39.2	39.4	38.6	0.42	0.095	39.07	-1.84	-1.99	
D	50.7	52.0	51.8	0.70	0.154	51.50	2.47	2.32	
DB	46.6	47.7	52.0	2.85	0.638	48.77	1.52	1.37	
DD	46.2	46.6	41.0	3.12	0.662	44.60	0.08	-0.07	
DE	44.2	44.2	44.6	0.23	0.047	44.33	-0.02	-0.16	
DH	48.1	45.8	45.2	1.53	0.343	46.37	0.69	0.54	
DO	46.0	45.0	48.0	1.53	0.354	46.33	0.68	0.53	
DR	46.5	50.7	48.7	2.10	0.496	48.63	1.47	1.33	
DS	42.5	37.5	38.1	2.73	0.591	39.37	-1.74	-1.88	
DT	46.5	44.5	44.3	1.22	0.260	45.10	0.25	0.10	
DZ	46.5	43.7	43.7	1.62	0.331	44.63	0.09	-0.06	
E	48.3	48.3	50.3	1.15	0.236	48.97	1.59	1.44	
EB	46.0	44.4	43.2	1.40	0.331	44.53	0.05	-0.09	
EL	40.4	39.7	41.5	0.91	0.213	40.53	-1.33	-1.48	
EO	51.0	46.0	50.0	2.65	0.591	49.00	1.60	1.45	

• = No data submitted

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Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
ER									•
EV	41.3	49.8	46.5	4.29	1.008	45.87	0.52	0.37	
EW	43.1	45.2	46.0	1.50	0.343	44.77	0.13	-0.01	
EX	41.9	39.7	39.5	1.33	0.284	40.37	-1.39	-1.54	
FF	93.1	91.1	96.2	2.57	0.602	93.47	17.00	16.86	×
FJ									•
FL	38.0	39.0	30.0	4.93	1.120	35.67	-3.02	-3.16	↓
FN	46.0	47.0	49.0	1.53	0.354	47.33	1.02	0.88	
FZ	35.9	30.1	28.0	4.09	0.933	31.33	-4.52	-4.66	↓
GQ	49.4	49.5	44.3	2.97	0.614	47.73	1.16	1.02	
GT	48.8	53.0	50.5	2.11	0.496	50.77	2.21	2.07	
GZ	43.3	36.6	38.6	3.44	0.791	39.50	-1.69	-1.84	
HI	58.0	40.2	48.3	8.91	3.101	48.83	1.54	1.40	
HK	51.5	50.8	51.2	0.35	0.083	51.17	2.35	2.21	
HL	45.5	46.3	46.3	0.46	0.095	46.03	0.57	0.43	
HP	47.5	49.9	53.1	2.81	0.662	50.17	2.00	1.86	
I	40.1	41.3	40.2	0.67	0.142	40.53	-1.33	-1.48	
ID	41.2	40.2	42.1	0.95	0.224	41.17	-1.11	-1.26	
J	45.5	41.9	45.8	2.17	0.461	44.40	0.01	-0.14	
JG	52.5	47.2	46.0	3.46	0.768	48.57	1.45	1.30	
JM	40.4	37.2	38.6	1.60	0.378	38.73	-1.96	-2.10	
JN	37.1	39.7	38.9	1.33	0.307	38.57	-2.01	-2.16	
JP	48.8	45.7	48.5	1.71	0.366	47.67	1.14	0.99	
JQ	11.0	9.9	9.2	0.91	0.213	10.03	-11.90	-12.04	×
JS	39.9	38.1	39.2	0.91	0.213	39.07	-1.84	-1.99	
JY	41.4	40.9	43.9	1.61	0.354	42.07	-0.80	-0.95	
K	38.2	39.2	38.3	0.55	0.118	38.57	-2.01	-2.16	
KE	33.4	31.3	41.2	5.22	1.323	35.30	-3.15	-3.29	↓
KH	41.4	39.8	43.5	1.86	0.437	41.57	-0.97	-1.12	
KT	46.0	48.0	52.0	3.06	0.709	48.67	1.49	1.34	
KX									•
L	48.2	50.7	47.8	1.57	0.343	48.90	1.57	1.42	
LE									•
LF	45.0	48.0	51.0	3.00	0.709	48.00	1.25	1.11	
LL	32.1	32.0	36.4	2.51	0.520	33.50	-3.77	-3.91	↓
LR	60.0	58.0	59.0	1.00	0.236	59.00	5.06	4.92	↑
LT	48.2	48.6	47.6	0.50	0.118	48.13	1.30	1.15	
M	43.0	39.0	40.0	2.08	0.473	40.67	-1.29	-1.43	
MF	51.7	52.9	49.7	1.62	0.378	51.43	2.44	2.30	
MV	41.3	41.8	42.7	0.71	0.165	41.93	-0.85	-0.99	
MX	42.3	37.3	34.7	3.86	0.898	38.10	-2.18	-2.32	
N	45.5	48.8	47.2	1.65	0.390	47.17	0.97	0.82	
NA	95.0	95.0	97.0	1.15	0.236	95.67	17.77	17.62	×
NB	15.0	17.0	20.0	2.52	0.591	17.33	-9.37	-9.51	×
NJ	42.7	43.0	42.7	0.17	0.035	42.80	-0.55	-0.69	

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13 / 16 CRD-LV Performance Evaluation: Gross Alpha-Beta in Water, 19-Jul-1996

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
NK	40.4	37.2	38.0	1.67	0.378	38.53	-2.03	-2.17	
NO	51.0	52.0	53.0	1.00	0.236	52.00	2.64	2.49	
NP	75.1	74.7	78.3	1.97	0.425	76.03	10.97	10.82	×
NT	40.6	42.1	43.5	1.45	0.343	42.07	-0.80	-0.95	
O	45.0	49.0	46.6	2.01	0.473	46.87	0.86	0.72	
OA	61.0	52.0	63.0	5.86	1.570	58.67	4.95	4.80	↑
OB	50.0	48.0	46.0	2.00	0.473	48.00	1.25	1.11	
OF	41.0	39.0	38.9	1.18	0.248	39.63	-1.64	-1.79	
OS	52.0	46.0	50.0	3.06	0.709	49.33	1.72	1.57	
OT	43.3	45.7	49.8	3.29	0.768	46.27	0.65	0.51	
OX									•
OY									•
P	46.8	44.0	47.5	1.85	0.413	46.10	0.60	0.45	
PA	54.3	53.9	55.6	0.89	0.201	54.60	3.54	3.39	↑
PB	41.9	42.3	42.4	0.26	0.059	42.20	-0.75	-0.90	
PG	47.5	47.1	48.5	0.72	0.165	47.70	1.15	1.00	
PM	47.4	50.6	46.4	2.19	0.496	48.13	1.30	1.15	
PQ	41.7	40.2	43.8	1.81	0.425	41.90	-0.86	-1.00	
PR	43.7	46.0	40.1	2.97	0.697	43.27	-0.39	-0.53	
PV	43.3	49.0	46.8	2.87	0.673	46.37	0.69	0.54	
Q	48.6	49.5	50.4	0.90	0.213	49.50	1.77	1.63	
QC									•
QM	49.0	52.9	48.4	2.44	0.532	50.10	1.98	1.84	
QP	33.8	43.8	42.9	5.53	1.345	40.17	-1.46	-1.61	
QQ	41.8	39.5	46.2	3.40	0.791	42.50	-0.65	-0.80	
QT	46.3	45.5	43.4	1.50	0.343	45.07	0.24	0.09	
QU	42.5	42.0	41.5	0.50	0.118	42.00	-0.82	-0.97	
QW	43.8	44.0	42.7	0.70	0.154	43.50	-0.30	-0.45	
QX	53.8	53.3	52.6	0.60	0.142	53.23	3.07	2.92	
QZ	40.2	40.0	39.3	0.47	0.106	39.83	-1.57	-1.72	
R	36.3	47.7	42.4	5.70	1.660	42.13	-0.78	-0.92	
RB	44.0	44.0	43.0	0.58	0.118	43.67	-0.25	-0.39	
RD	50.9	50.5	48.0	1.57	0.343	49.80	1.88	1.73	
RF	50.5	46.9	44.7	2.93	0.685	47.37	1.03	0.89	
RG	47.5	48.8	49.4	0.97	0.224	48.57	1.45	1.30	
RI	49.9	53.3	50.1	1.91	0.402	51.10	2.33	2.18	
RK	50.7	50.0	50.4	0.35	0.083	50.37	2.07	1.93	
RR	56.0	53.0	52.0	2.08	0.473	53.67	3.22	3.07	↑
RZ	39.2	38.3	41.3	1.54	0.354	39.60	-1.66	-1.80	
S	48.4	51.4	51.6	1.79	0.378	50.47	2.11	1.96	
SC									•
SD	41.9	32.2	42.6	5.81	1.435	38.90	-1.90	-2.04	
SF	42.8	36.6	39.1	3.12	0.732	39.50	-1.69	-1.84	
SG	35.4	35.2	38.3	1.73	0.366	36.30	-2.80	-2.94	
SI	41.5	42.0	43.4	0.98	0.224	42.30	-0.72	-0.87	

• ≡ No data submitted

TAG SYMBOLS

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CRD-LV Performance Evaluation: Gross Alpha-Beta in Water, 19-Jul-1996 14 / 16

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
SL	40.0	41.0	45.0	2.65	0.591	42.00	-0.82	-0.97	
SM	42.3	41.5	47.4	3.20	0.697	43.73	-0.22	-0.37	
SN	48.5	39.0	52.0	6.73	2.020	46.50	0.73	0.59	
SO									•
SR	50.5	51.6	47.6	2.07	0.473	49.90	1.91	1.77	
SS	45.9	45.3	48.2	1.53	0.343	46.47	0.72	0.58	
SU	33.2	31.5	34.2	1.37	0.319	32.97	-3.95	-4.10	↓
SV	46.2	50.2	48.9	2.04	0.473	48.43	1.40	1.26	
SX	48.0	53.5	45.1	4.27	0.992	48.87	1.55	1.41	
SZ	39.5	39.0	46.0	3.91	0.827	41.50	-1.00	-1.14	
T	42.5	43.1	37.3	3.19	0.685	40.97	-1.18	-1.33	
TD	22.7	19.3	23.3	2.16	0.473	21.77	-7.83	-7.98	×
TG	47.7	46.6	43.0	2.46	0.555	45.77	0.48	0.33	
TH									•
TL									•
TN	48.7	52.1	47.9	2.23	0.496	49.57	1.80	1.65	
TO									•
TQ	40.0	36.0	36.8	2.12	0.473	37.60	-2.35	-2.49	
TW	25.3	32.0	30.2	3.47	0.791	29.17	-5.27	-5.42	↓
TY	46.6	46.3	48.6	1.25	0.272	47.17	0.97	0.82	
U	45.3	46.1	47.1	0.90	0.213	46.17	0.62	0.47	
UA	39.2	37.6	33.6	2.88	0.662	36.80	-2.63	-2.77	
UE									•
UN									•
UP	43.4	46.2	45.0	1.40	0.331	44.87	0.17	0.02	
UQ	46.1	44.4	48.3	1.96	0.461	46.27	0.65	0.51	
VA	29.8	29.3	29.4	0.26	0.059	29.50	-5.15	-5.30	↓
VC									•
VH	56.1	57.7	53.2	2.28	0.532	55.67	3.91	3.76	↑
VI	33.7	33.8	30.9	1.65	0.343	32.80	-4.01	-4.16	↓
VJ	45.3	46.3	43.8	1.26	0.295	45.13	0.26	0.12	
VO	44.4	39.7	40.8	2.46	0.555	41.63	-0.95	-1.10	
VT									•
W	46.4	45.0	46.1	0.74	0.165	45.83	0.50	0.36	
WE	45.2	47.2	50.0	2.41	0.567	47.47	1.07	0.92	
WF									•
WH	30.9	31.0	31.0	0.06	0.012	30.97	-4.65	-4.79	↓
WJ	46.3	50.0	44.1	2.98	0.697	46.80	0.84	0.69	
WN									•
WO	24.4	31.5	28.5	3.56	0.839	28.13	-5.63	-5.77	↓
WP									•
WR	48.0	45.0	47.6	1.63	0.354	46.87	0.86	0.72	
WS									•
WU	9.6	12.8	14.5	2.49	0.579	12.30	-11.11	-11.26	×
WV									•

• = No data submitted

TAG SYMBOLS

↑ = Above control limit

Ø = Insufficient data

× = Determined to be an outlier

↓ = Below control limit

15 / 16 CRD-LV Performance Evaluation: Gross Alpha-Beta in Water, 19-Jul-1996

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg) (known)		Tag
WW	50.8	51.9	49.9	1.00	0.236	50.87	2.25	2.10	
WX									•
WY									•
X	44.4	42.7	44.9	1.15	0.260	44.00	-0.13	-0.28	

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
10.03	×	JQ	40.37		EX	44.53		EB
12.30	×	WU	40.53		I	44.60		DD
17.33	×	NB	40.53		EL	44.63		DZ
21.77	×	TD	40.67		M	44.77		EW
28.13	↓	WO	40.97		T	44.87		UP
29.17	↓	TW	41.07		CS	45.03		BM
29.50	↓	VA	41.17		ID	45.07		QT
30.97	↓	WH	41.50		SZ	45.10		DT
31.33	↓	FZ	41.57		KH	45.13		VJ
32.80	↓	VI	41.63		VO	45.33		CJ
32.97	↓	SU	41.90		PQ	45.50		AP
33.50	↓	LL	41.93		MV	45.77		TG
35.20	↓	CO	41.93		C	45.83		W
35.30	↓	KE	42.00		SL	45.87		EV
35.67	↓	FL	42.00		QU	46.03		HL
35.97	↓	BC	42.07		NT	46.10		P
36.10	↓	AE	42.07		JY	46.17		U
36.30		SG	42.13		R	46.27		UQ
36.80		UA	42.20		PB	46.27		OT
37.50		AR	42.30		SI	46.33		DO
37.60		TQ	42.43		AL	46.37		PV
38.10		MX	42.43		A	46.37		DH
38.53		NK	42.50		QQ	46.47		SS
38.57		K	42.50		BH	46.50		SN
38.57		JN	42.63		AU	46.80		WJ
38.73		JM	42.80		NJ	46.87		WR
38.83		BN	42.97		AF	46.87		O
38.90		SD	43.27		PR	46.97		AJ
39.07		JS	43.43		BO	47.17		TY
39.07		CX	43.50		QW	47.17		N
39.37		DS	43.67		RB	47.33		FN
39.50		SF	43.73		SM	47.37		RF
39.50		GZ	44.00		X	47.47		WE
39.60		RZ	44.03		CE	47.67		JP
39.63		OF	44.33		DE	47.70		PG
39.83		QZ	44.40		J	47.73		GQ
40.17		QP	44.47		AK	48.00		OB
40.37		CA	44.50		CG	48.00		LF

• ≡ No data submitted

TAG SYMBOLS

↑ ≡ Above control limit

∅ ≡ Insufficient data

× ≡ Determined to be an outlier

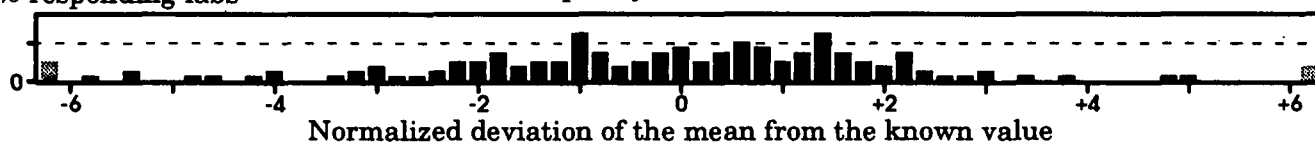
↓ ≡ Below control limit

Gross Beta**Data sorted by Laboratory Average**

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
48.13		LT	49.27		BA	51.13		BB
48.13		PM	49.33		OS	51.17		HK
48.13		AH	49.50		Q	51.43		MF
48.43		SV	49.57		TN	51.50		D
48.57		RG	49.67		BS	52.00		NO
48.57		JG	49.80		RD	52.30		AW
48.63		DR	49.90		SR	52.63		BK
48.67		KT	50.10		QM	53.23		QX
48.77		DB	50.17		HP	53.67	↑↑	RR
48.83		HI	50.37		RK	54.60	↑↑	PA
48.87		SX	50.47		S	55.67	↑↑	VH
48.90		L	50.77		GT	58.67	↑↑	OA
48.97		E	50.87		WW	59.00	↑↑	LR
49.00		EO	51.07		BG	76.03	×	NP
49.20		BL	51.10		RI	93.47	×	FF
						95.67	×	NA

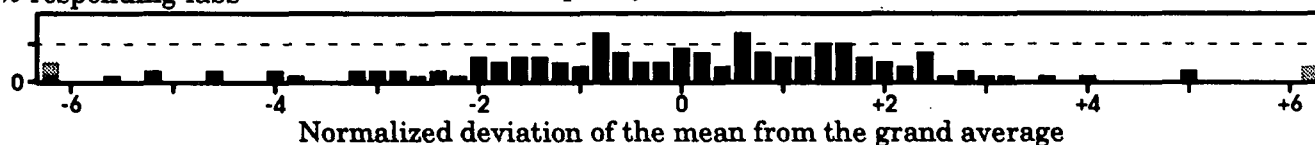
% responding labs

Frequency distribution



% responding labs

Frequency distribution



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