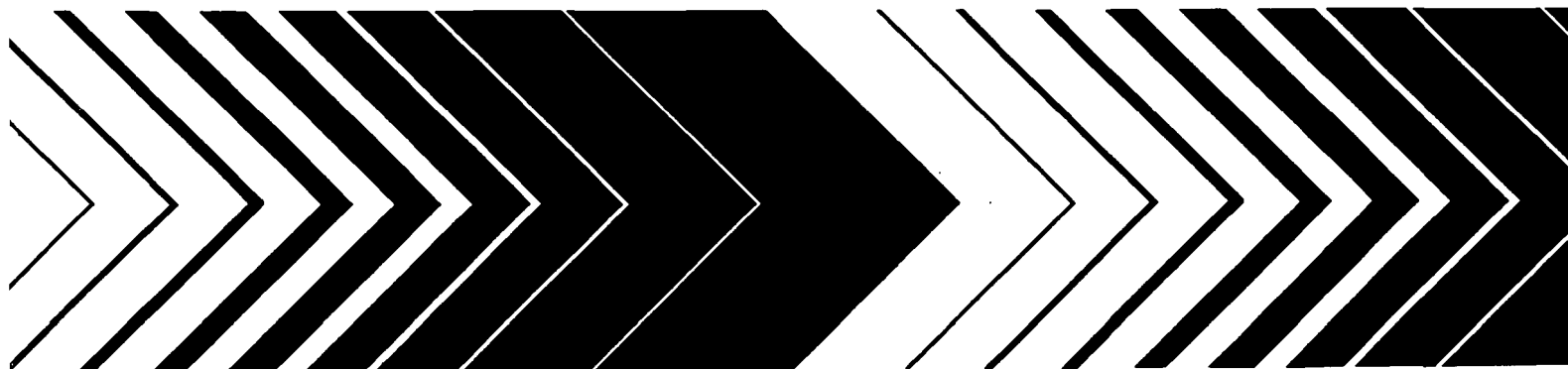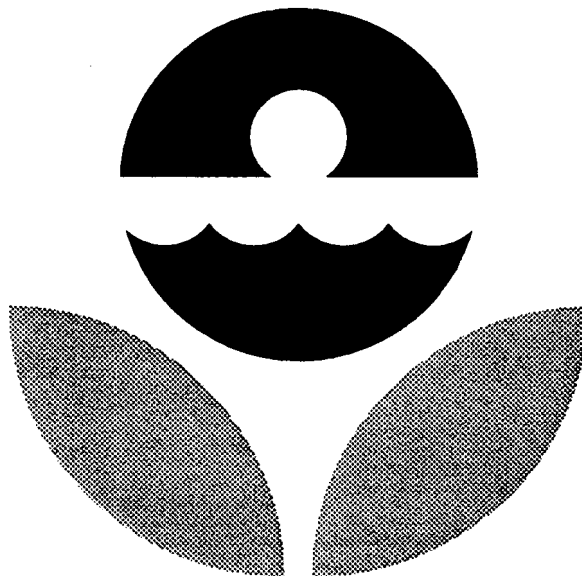**&EPA**

Gross Alpha-Beta in Water Intercomparison Study

A Statistical Evaluation of the September 18, 1992 Data

Gross Alpha-Beta in Water

Intercomparison Study

September 18, 1992

Environmental Protection Agency

Environmental Monitoring Systems Laboratory

Las Vegas, Nevada

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

Dear Participant,

Enclosed are the results of the Nuclear Radiation Assessment Division (EMSL-LV) Intercomparison Study for *Gross Alpha-Beta in Water; September 18, 1992.*

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 Frank Novielli at 702/798-2159 or Patricia Honsa at 702/798-2141.

Sincerely,

Frank Novielli
Senior Chemist
Radioanalysis Branch

Enclosure

Note: This gross alpha-beta in water sample was prepared differently from previous studies, and participants were instructed not to dilute the sample. Results which are suspected to be from the analysis of diluted samples were not included in the statistical calculations of this report. The third result of the suspect data was dropped, and the data is tagged with the symbol Ø, which denotes insufficient data.

NOTICE

This material has been funded wholly by
the U.S. Environmental Protection Agency.
It has been subject to the Agency's review,
and it 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. 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. The eighth and ninth columns are the differences from the mean of all non-outliers and from the known value, respectively. 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.

Gross Alpha   Statistical Summary   219 Participants

The known value of this nuclide is **45.0 pCi/l** with an expected precision of **11.0**; the control limits are 25.9 to 64.1; the warning regions are 25.9 to 32.3 and 57.7 to 64.1

80(36.5 %) Failed to respond

72(32.9 %) Within all limits

2(0.9 %) Outliers

29(13.2 %) Out of control but not an outlier

36(16.4 %) In warning zone but within control
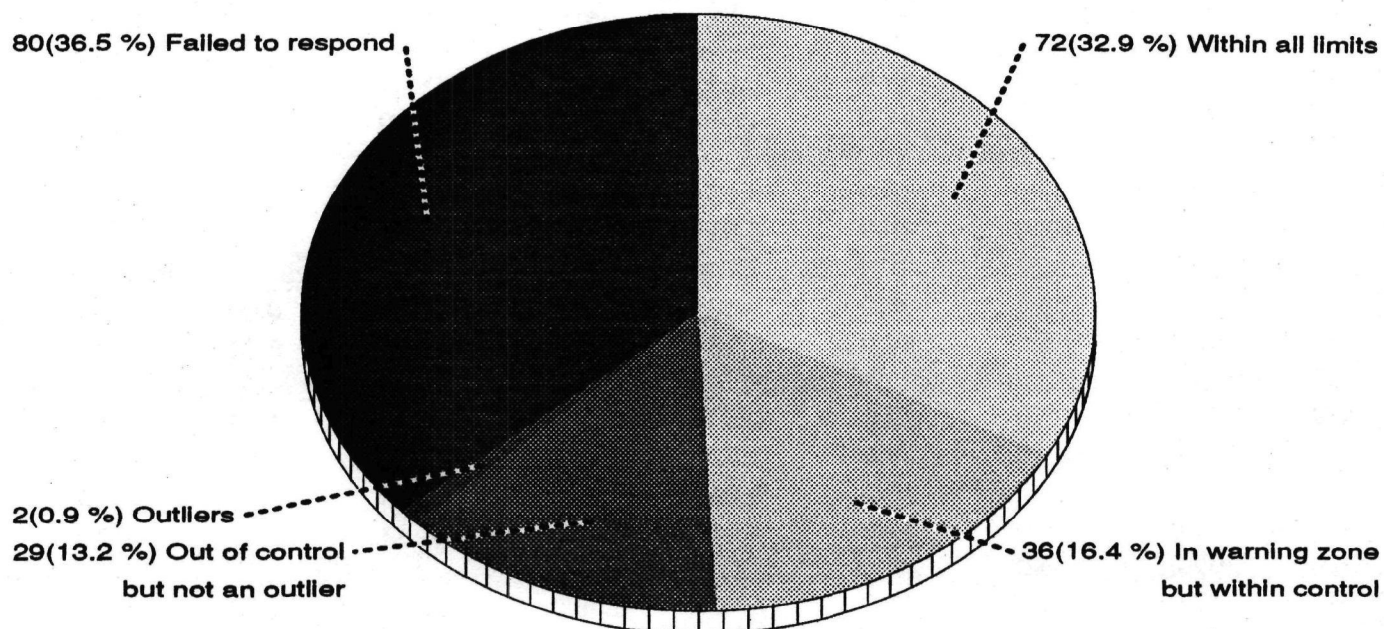
Statistic	Respondents	Non-outliers
Mean	37.75	Grand Avg 36.46
Std. Dev.	15.78	11.52
Variance	248.99	132.73
% Coef. of Var.	41.80	31.59
% deviation of mean from known value	-16.12	-18.97
Norm. dev. of mean from known value	-0.46	-0.74
Median	35.00	34.67
% deviation of median from known value	-22.22	-22.96
Norm. dev. of median from known value	-0.63	-0.90
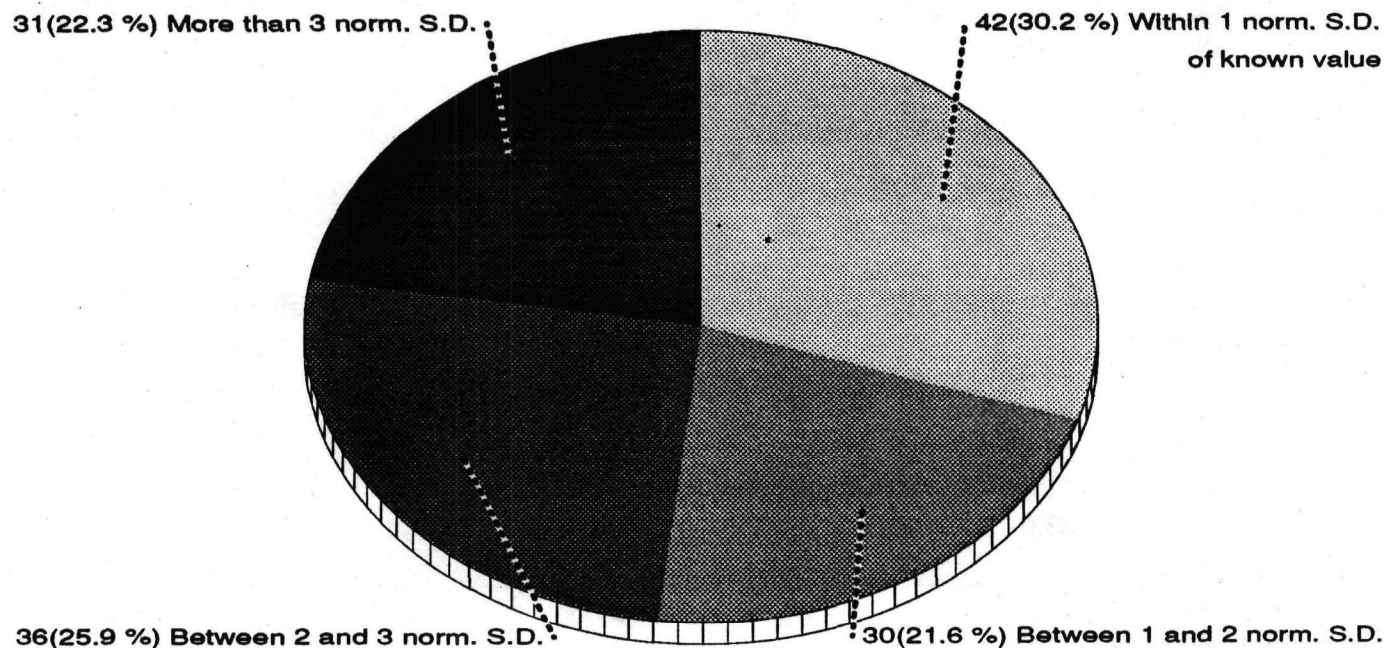
31(22.3 %) More than 3 norm. S.D.

42(30.2 %) Within 1 norm. S.D. of known value

36(25.9 %) Between 2 and 3 norm. S.D.

30(21.6 %) Between 1 and 2 norm. S.D.

Gross Alpha

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg)	(known)	Tag
A	31.0	31.0	32.0	0.58	0.054	31.33	-0.81	-2.15	
AE	31.0	29.0	27.0	2.00	0.215	29.00	-1.18	-2.52	
AF	43.0	44.0	45.0	1.00	0.107	44.00	1.19	-0.16	
AI	48.0	37.0	43.0	5.51	0.591	42.67	0.98	-0.37	
AJ	39.0	40.0	41.0	1.00	0.107	40.00	0.56	-0.79	
AK	5.0	6.0							Ø
AL	32.0	29.0	33.0	2.08	0.215	31.33	-0.81	-2.15	
AN	62.0	68.0	75.0	6.51	0.698	68.33	5.02	3.67	⇑
AO									•
AP	39.0	35.0	36.0	2.08	0.215	36.67	0.03	-1.31	
AR	62.0	65.0	55.0	5.13	0.537	60.67	3.81	2.47	
AU									•
AW	29.0	28.0	29.0	0.58	0.054	28.67	-1.23	-2.57	
AY	30.0	30.0	33.0	1.73	0.161	31.00	-0.86	-2.20	
AZ	30.0	37.0	35.0	3.61	0.376	34.00	-0.39	-1.73	
BA	42.0	42.0	49.0	4.04	0.376	44.33	1.24	-0.10	
BB	7.0	6.0							Ø
BC	48.0	52.0	41.0	5.57	0.591	47.00	1.66	0.31	
BG	10.0	12.0							Ø
BH	22.0	22.0	21.0	0.58	0.054	21.67	-2.33	-3.67	⇓
BK	4.0	5.0							Ø
BL	29.0	23.0	26.0	3.00	0.322	26.00	-1.65	-2.99	
BM	24.0	25.0	28.0	2.08	0.215	25.67	-1.70	-3.04	⇓
BN									•
BO	19.0	20.0	19.0	0.58	0.054	19.33	-2.70	-4.04	⇓
BS									•
BW	57.0	61.0	60.0	2.08	0.215	59.33	3.60	2.26	
C	40.0	41.0	43.0	1.53	0.161	41.33	0.77	-0.58	
CA	50.0	37.0	42.0	6.56	0.698	43.00	1.03	-0.31	
CE	4.0	4.0							Ø
CG	42.0	40.0	49.0	4.73	0.483	43.67	1.13	-0.21	
CJ	47.0	45.0	43.0	2.00	0.215	45.00	1.34	0.00	
CK	6.0	6.0							Ø
CO	41.0	36.0	32.0	4.51	0.483	36.33	-0.02	-1.36	
CP									•
CQ	6.0	5.0							Ø
CS	36.0	40.0	47.0	5.57	0.591	41.00	0.71	-0.63	
CX	117.0	151.0	162.0	23.46	3.698	143.33	16.83	15.48	×
D	57.0	57.0	56.0	0.58	0.054	56.67	3.18	1.84	
DB	45.0	46.0	54.0	4.93	0.483	48.33	1.87	0.52	
DD	30.0	35.0	31.0	2.65	0.268	32.00	-0.70	-2.05	
DE	26.0	26.0	26.0	0.00	0.000	26.00	-1.65	-2.99	
DG	26.0	21.0	20.0	3.21	0.322	22.33	-2.23	-3.57	⇓
DH	28.0	23.0	23.0	2.89	0.268	24.67	-1.86	-3.20	⇓
DJ									•

• ≡ 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
DM									•
DO	32.0	21.0	30.0	5.86	0.591	27.67	-1.39	-2.73	
DP	30.0	31.0	33.0	1.53	0.161	31.33	-0.81	-2.15	
DR									•
DT	53.0	49.0	41.0	6.11	0.644	47.67	1.76	0.42	
DX	31.0	30.0	29.0	1.00	0.107	30.00	-1.02	-2.36	
DZ	25.0	28.0	30.0	2.52	0.268	27.67	-1.39	-2.73	
E	44.0	41.0	41.0	1.73	0.161	42.00	0.87	-0.47	
EA	44.0	56.0	47.0	6.24	0.644	49.00	1.97	0.63	
EB	5.0	5.0							Ø
EH	4.0	4.0							Ø
EL									•
EN	29.0	36.0	45.0	8.02	0.859	36.67	0.03	-1.31	
EO	39.0	41.0	41.0	1.15	0.107	40.33	0.61	-0.73	
ER	58.0	52.0	57.0	3.21	0.322	55.67	3.02	1.68	
ES									•
EV	25.0	34.0	26.0	4.93	0.483	28.33	-1.28	-2.62	
EW									•
FE	34.0	39.0	37.0	2.52	0.268	36.67	0.03	-1.31	
FF									•
FJ	15.0	19.0	13.0	3.06	0.322	15.67	-3.27	-4.62	⇓
FL									•
FN	2.0	2.0							Ø
FP									•
FU	22.0	25.0	34.0	6.24	0.644	27.00	-1.49	-2.83	
FW	10.0	5.0							Ø
FZ									•
GE									•
GJ	5.0	8.0							Ø
GT	34.0	36.0	46.0	6.43	0.644	38.67	0.35	-1.00	
GZ	38.0	46.0	47.0	4.93	0.483	43.67	1.13	-0.21	
HE	44.0	44.0	41.0	1.73	0.161	43.00	1.03	-0.31	
HH	3.0	4.0							Ø
HI	21.0	14.0	16.0	3.61	0.376	17.00	-3.06	-4.41	⇓
HK	51.0	53.0	49.0	2.00	0.215	51.00	2.29	0.94	
HL	36.0	36.0	36.0	0.00	0.000	36.00	-0.07	-1.42	
HN	35.0	30.0	27.0	4.04	0.430	30.67	-0.91	-2.26	
HP	26.0	31.0	34.0	4.04	0.430	30.33	-0.97	-2.31	
HU	32.0	32.0	34.0	1.15	0.107	32.67	-0.60	-1.94	
HY	45.0	50.0	44.0	3.21	0.322	46.33	1.55	0.21	
I	21.0	27.0	29.0	4.16	0.430	25.67	-1.70	-3.04	⇓
IC	43.0	46.0	38.0	4.04	0.430	42.33	0.92	-0.42	
ID									•
IE	30.0	32.0	33.0	1.53	0.161	31.67	-0.76	-2.10	
IU									•

	TAG SYMBOLS	
• ≡ No data submitted		⇑ ≡ 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
J	35.0	34.0	32.0	1.53	0.161	33.67	-0.44	-1.78	
JH									•
JN	2.0	2.0							Ø
JP									•
JQ	53.0	62.0	42.0	10.02	1.141	52.33	2.50	1.15	
JS	50.0	48.0	41.0	4.73	0.483	46.33	1.55	0.21	
K	21.0	19.0	20.0	1.00	0.107	20.00	-2.59	-3.94	⇓
KC	8.0	8.0							Ø
KE	24.0	17.0	27.0	5.13	0.537	22.67	-2.17	-3.52	⇓
KH	24.0	25.0	25.0	0.58	0.054	24.67	-1.86	-3.20	⇓
KT	53.0	52.0	53.0	0.58	0.054	52.67	2.55	1.21	
KX	34.0	39.0	36.0	2.52	0.268	36.33	-0.02	-1.36	
KZ	23.0	23.0	23.0	0.00	0.000	23.00	-2.12	-3.46	⇓
L	29.0	24.0	25.0	2.65	0.268	26.00	-1.65	-2.99	
LA	4.0	4.0							Ø
LE	24.0	22.0	23.0	1.00	0.107	23.00	-2.12	-3.46	⇓
LF	55.0	45.0	43.0	6.43	0.644	47.67	1.76	0.42	
LG									•
LL	42.0	42.0	46.0	2.31	0.215	43.33	1.08	-0.26	
LM									•
LR	18.0	17.0	16.0	1.00	0.107	17.00	-3.06	-4.41	⇓
LS									•
LT	45.0	45.0	45.0	0.00	0.000	45.00	1.34	0.00	
LX									•
M	9.0	8.0							Ø
MA									•
ME	7.0	7.0							Ø
MQ	30.0	30.0	26.0	2.31	0.215	28.67	-1.23	-2.57	
MS	56.0	56.0	59.0	1.73	0.161	57.00	3.23	1.89	
MV	38.0	53.0	32.0	10.82	1.243	41.00	0.71	-0.63	
MY									•
N									•
NA	36.0	38.0	40.0	2.00	0.215	38.00	0.24	-1.10	
NB	28.0	30.0	26.0	2.00	0.215	28.00	-1.33	-2.68	
NE	55.0	59.0	55.0	2.31	0.215	56.33	3.13	1.78	
NF	1.0	2.0							Ø
NH	38.0	30.0	35.0	4.04	0.430	34.33	-0.34	-1.68	
NI	25.0	40.0	34.0	7.55	0.805	33.00	-0.55	-1.89	
NJ	27.0	20.0	27.0	4.04	0.376	24.67	-1.86	-3.20	⇓
NK	25.0	32.0	30.0	3.61	0.376	29.00	-1.18	-2.52	
NO	21.0	19.0	24.0	2.52	0.268	21.33	-2.38	-3.73	⇓
NP									•
NT	57.0	54.0	53.0	2.08	0.215	54.67	2.87	1.52	
NZ									•
O	27.0	24.0	27.0	1.73	0.161	26.00	-1.65	-2.99	

• ≡ 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
OA	34.0	38.0	32.0	3.06	0.322	34.67	-0.28	-1.63	
OB	45.0	29.0	31.0	8.72	0.859	35.00	-0.23	-1.57	
OE	28.0	30.0	31.0	1.53	0.161	29.67	-1.07	-2.41	
OF	34.0	47.0	42.0	6.56	0.698	41.00	0.71	-0.63	
OL									•
OM									•
OS	6.0	6.0							Ø
OT									•
OY	61.0	59.0	62.0	1.53	0.161	60.67	3.81	2.47	
OZ									•
P	26.0	27.0	24.0	1.53	0.161	25.67	-1.70	-3.04	⇓
PA									•
PB	35.0	35.0	34.0	0.58	0.054	34.67	-0.28	-1.63	
PC									•
PE									•
PG	31.0	33.0	31.0	1.15	0.107	31.67	-0.76	-2.10	
PM	22.0	20.0	17.0	2.52	0.268	19.67	-2.65	-3.99	⇓
PP									•
PQ	33.0	38.0	36.0	2.52	0.268	35.67	-0.13	-1.47	
PR	39.0	41.0	44.0	2.52	0.268	41.33	0.77	-0.58	
PT	29.0	26.0	23.0	3.00	0.322	26.00	-1.65	-2.99	
PV	12.0	12.0							Ø
PW	51.0	52.0	51.0	0.58	0.054	51.33	2.34	1.00	
Q	13.0	15.0	18.0	2.52	0.268	15.33	-3.33	-4.67	⇓
QA									•
QC	38.0	43.0	39.0	2.65	0.268	40.00	0.56	-0.79	
QP									•
QQ	22.0	23.0	23.0	0.58	0.054	22.67	-2.17	-3.52	⇓
QT	26.0	23.0	21.0	2.52	0.268	23.33	-2.07	-3.41	⇓
QU	35.0	37.0	38.0	1.53	0.161	36.67	0.03	-1.31	
QW									•
QX	27.0	27.0	29.0	1.15	0.107	27.67	-1.39	-2.73	
QZ	46.0	50.0	52.0	3.06	0.322	49.33	2.03	0.68	
R	51.0	52.0	53.0	1.00	0.107	52.00	2.45	1.10	
RB	43.0	43.0	39.0	2.31	0.215	41.67	0.82	-0.52	
RC	70.0	31.0	44.0	19.86	3.084	48.33	1.87	0.52	
RD	58.0	44.0	65.0	10.69	1.243	55.67	3.02	1.68	
RE	47.0	42.0	45.0	2.52	0.268	44.67	1.29	-0.05	
RG									•
RJ	22.0	25.0	26.0	2.08	0.215	24.33	-1.91	-3.25	⇓
RK									•
RM	27.0	28.0	29.0	1.00	0.107	28.00	-1.33	-2.68	
RN	30.0	31.0	30.0	0.58	0.054	30.33	-0.97	-2.31	
RQ	12.0	13.0							Ø
RR	29.0	30.0	30.0	0.58	0.054	29.67	-1.07	-2.41	

• ≡ 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
RS									•
RT	5.0	5.0							Ø
RU									•
RV	34.0	30.0	37.0	3.51	0.376	33.67	-0.44	-1.78	
RW	38.0	37.0	29.0	4.93	0.483	34.67	-0.28	-1.63	
RZ	6.0	5.0							Ø
S	4.0	4.0							Ø
SA									•
SC	47.0	54.0	53.0	3.79	0.376	51.33	2.34	1.00	
SD	53.0	56.0	43.0	6.81	0.698	50.67	2.24	0.89	
SG									•
SI	48.0	48.0	59.0	6.35	0.591	51.67	2.39	1.05	
SL	5.0	5.0							Ø
SO	42.0	42.0	48.0	3.46	0.322	44.00	1.19	-0.16	
SS	4.0	4.0							Ø
ST	24.0	26.0	21.0	2.52	0.268	23.67	-2.02	-3.36	⇓
SU	27.0	20.0	21.0	3.79	0.376	22.67	-2.17	-3.52	⇓
SX	32.0	30.0	28.0	2.00	0.215	30.00	-1.02	-2.36	
SZ	30.0	31.0	31.0	0.58	0.054	30.67	-0.91	-2.26	
T	4.0	6.0							Ø
TA									•
TC									•
TE	32.0	32.0	29.0	1.73	0.161	31.00	-0.86	-2.20	
TG	22.0	24.0	20.0	2.00	0.215	22.00	-2.28	-3.62	⇓
TH	52.0	45.0	45.0	4.04	0.376	47.33	1.71	0.37	
TI	7.0	7.0							Ø
TK	9.0	3.0							Ø
TL	46.0	47.0	39.0	4.36	0.430	44.00	1.19	-0.16	
TM	108.0	108.0	108.0	0.00	0.000	108.00	11.26	9.92	×
TN	22.0	23.0	24.0	1.00	0.107	23.00	-2.12	-3.46	⇓
TO	21.0	21.0	15.0	3.46	0.322	19.00	-2.75	-4.09	⇓
TP									•
TR									•
TY	67.0	65.0	61.0	3.06	0.322	64.33	4.39	3.04	⇑
U	44.0	51.0	41.0	5.13	0.537	45.33	1.40	0.05	
W	45.0	44.0	45.0	0.58	0.054 ·	44.67	1.29	-0.05	
X	40.0	35.0	40.0	2.89	0.268	38.33	0.29	-1.05	
Y	47.0	55.0	34.0	10.60	1.243	45.33	1.40	0.05	
Z	29.0	32.0	29.0	1.73	0.161	30.00	-1.02	-2.36	

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
15.33	⇓	Q	17.00	⇓	HI	19.67	⇓	PM
15.67	⇓	FJ	19.00	⇓	TO	20.00	⇓	K
17.00	⇓	LR	19.33	⇓	BO	21.33	⇓	NO

TAG SYMBOLS

• ≡ No data submitted		⇑ ≡ Above control limit
Ø ≡ 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
21.67	⇓	BH	31.00		TE	43.33		LL
22.00	⇓	TG	31.00		AY	43.67		GZ
22.33	⇓	DG	31.33		DP	43.67		CG
22.67	⇓	SU	31.33		AL	44.00		TL
22.67	⇓	QQ	31.33		A	44.00		SO
22.67	⇓	KE	31.67		PG	44.00		AF
23.00	⇓	TN	31.67		IE	44.33		BA
23.00	⇓	LE	32.00		DD	44.67		W
23.00	⇓	KZ	32.67		HU	44.67		RE
23.33	⇓	QT	33.00		NI	45.00		LT
23.67	⇓	ST	33.67		RV	45.00		CJ
24.33	⇓	RJ	33.67		J	45.33		Y
24.67	⇓	NJ	34.00		AZ	45.33		U
24.67	⇓	KH	34.33		NH	46.33		JS
24.67	⇓	DH	34.67		RW	46.33		HY
25.67	⇓	P	34.67		PB	47.00		BC
25.67	⇓	I	34.67		OA	47.33		TH
25.67	⇓	BM	35.00		OB	47.67		LF
26.00		PT	35.67		PQ	47.67		DT
26.00		O	36.00		HL	48.33		RC
26.00		L	36.33		KX	48.33		DB
26.00		DE	36.33		CO	49.00		EA
26.00		BL	36.67		QU	49.33		QZ
27.00		FU	36.67		FE	50.67		SD
27.67		QX	36.67		EN	51.00		HK
27.67		DZ	36.67		AP	51.33		SC
27.67		DO	38.00		NA	51.33		PW
28.00		RM	38.33		X	51.67		SI
28.00		NB	38.67		GT	52.00		R
28.33		EV	40.00		QC	52.33		JQ
28.67		MQ	40.00		AJ	52.67		KT
28.67		AW	40.33		EO	54.67		NT
29.00		NK	41.00		OF	55.67		RD
29.00		AE	41.00		MV	55.67		ER
29.67		RR	41.00		CS	56.33		NE
29.67		OE	41.33		PR	56.67		D
30.00		Z	41.33		C	57.00		MS
30.00		SX	41.67		RB	59.33		BW
30.00		DX	42.00		E	60.67		OY
30.33		RN	42.33		IC	60.67		AR
30.33		HP	42.67		AI	64.33	⇑	TY
30.67		SZ	43.00		HE	68.33	⇑	AN
30.67		HN	43.00		CA	108.00	×	TM
						143.33	×	CX

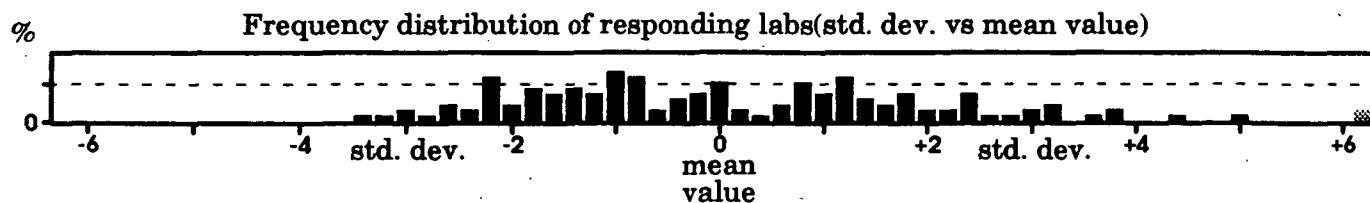|		
• ≡ No data submitted	**TAG SYMBOLS**	⇑ ≡ Above control limit
∅ ≡ Insufficient data	× ≡ Determined to be an outlier	⇓ ≡ Below control limit

Gross Alpha

%   Frequency distribution of responding labs(expected prec. vs known value)

−6   −4   exp. prec.   −2   0   +2   exp. prec.   +4   +6
                                              known
                                              value

%   Frequency distribution of responding labs(std. dev. vs mean value)

−6   −4   std. dev.   −2   0   +2   std. dev.   +4   +6
                                              mean
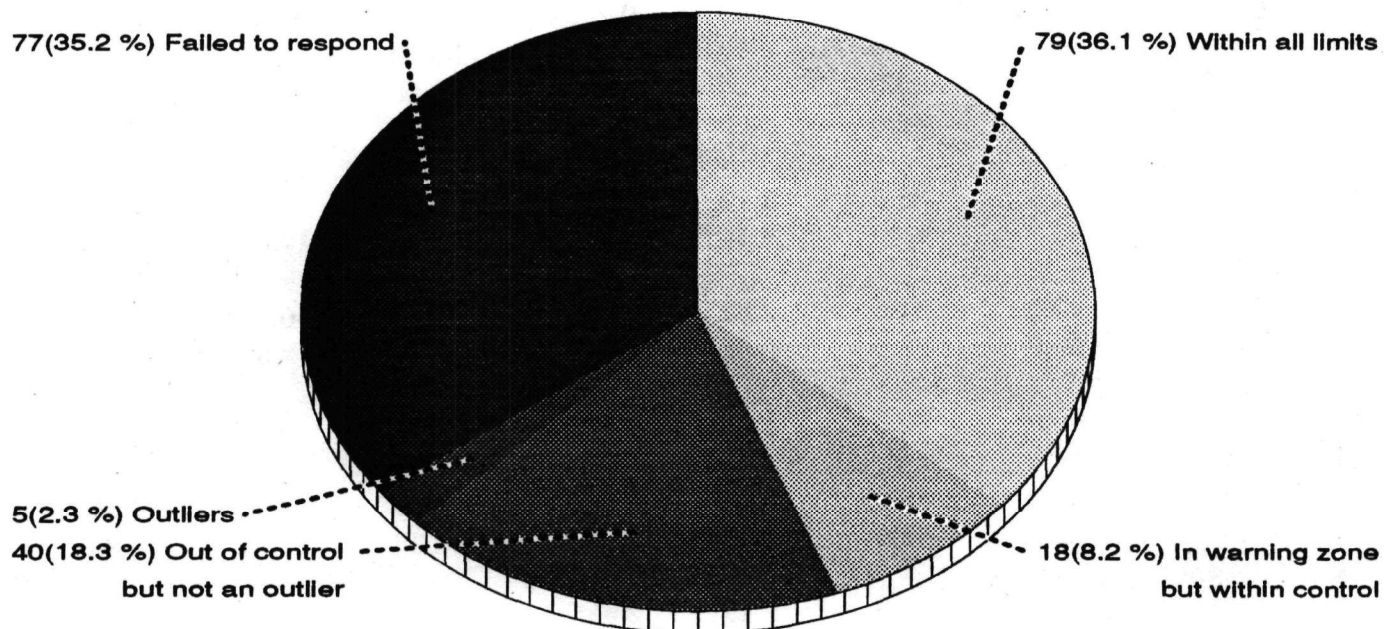   value
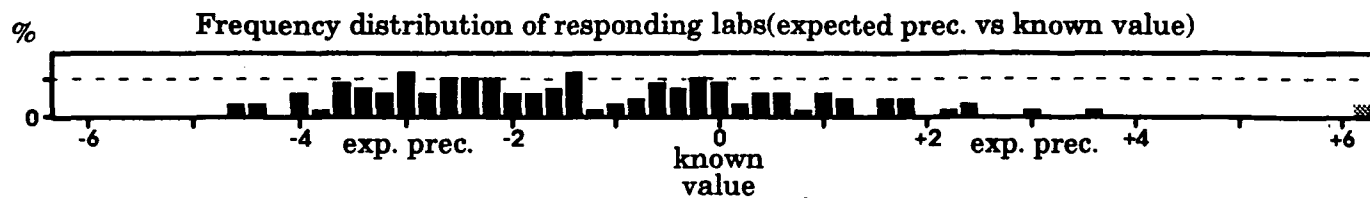
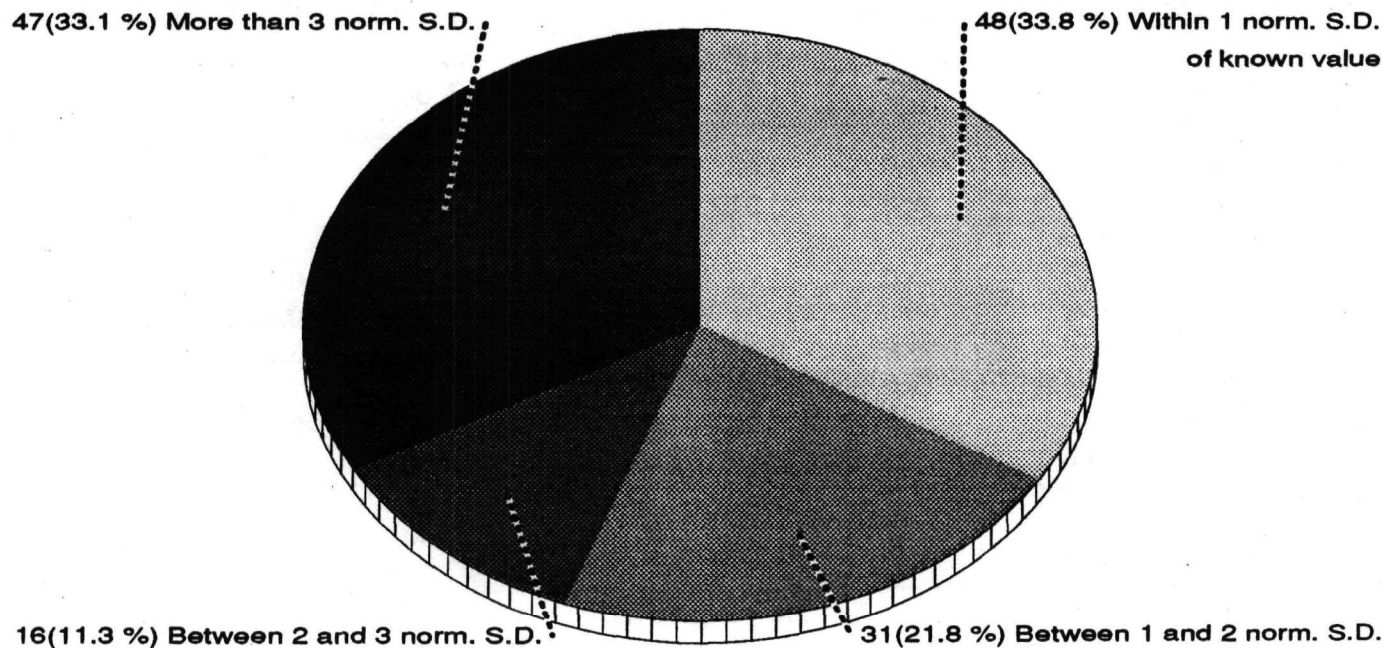**Gross Beta**   Statistical Summary   219 Participants

The known value of this nuclide is **50.0 pCi/l** with an expected precision of **5.0**; the control limits
are 41.3 to 58.7; the warning regions are 41.3 to 44.2 and 55.8 to 58.7

77(35.2 %) Failed to respond

79(36.1 %) Within all limits

5(2.3 %) Outliers

40(18.3 %) Out of control
but not an outlier

18(8.2 %) In warning zone
but within control

Statistic	Respondents	Non-outliers
Mean	59.38	**Grand Avg 48.61**
Std. Dev.	114.45	9.14
Variance	13098.83	83.51
% Coef. of Var.	192.75	18.80
% deviation of mean from known value	18.76	-2.78
Norm. dev. of mean from known value	0.08	-0.15
Median	49.00	48.67
% deviation of median from known value	-2.00	-2.67
Norm. dev. of median from known value	-0.01	-0.15

47(33.1 %) More than 3 norm. S.D.

48(33.8 %) Within 1 norm. S.D.
of known value

16(11.3 %) Between 2 and 3 norm. S.D.

31(21.8 %) Between 1 and 2 norm. S.D.

Gross Beta

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg)	(known)	Tag
A	47.0	45.0	47.0	1.15	0.236	46.33	-0.79	-1.27	
AE	44.0	42.0	42.0	1.15	0.236	42.67	-2.06	-2.54	
AF	60.0	58.0	51.0	4.73	1.120	56.33	2.68	2.19	
AI	51.0	52.0	50.0	1.00	0.236	51.00	0.83	0.35	
AJ	46.0	45.0	42.0	2.08	0.473	44.33	-1.48	-1.96	
AK	6.0	6.0							∅
AL	38.0	41.0	38.0	1.73	0.354	39.00	-3.33	-3.81	⇓
AN	87.0	85.0	85.0	1.15	0.236	85.67	12.84	12.36	×
AO									•
AP	47.0	47.0	51.0	2.31	0.473	48.33	-0.10	-0.58	
AR	55.0	55.0	56.0	0.58	0.118	55.33	2.33	1.85	
AU									•
AW	48.0	50.0	50.0	1.15	0.236	49.33	0.25	-0.23	
AY	14.0	14.0							∅
AZ	41.0	51.0	46.0	5.00	1.345	46.00	-0.90	-1.39	
BA	60.0	62.0	62.0	1.15	0.236	61.33	4.41	3.93	⇑
BB	4.0	4.0							∅
BC	31.0	47.0	36.0	8.19	2.695	38.00	-3.68	-4.16	⇓
BG	28.0	29.0	28.0	0.58	0.118	28.33	-7.02	-7.51	⇓
BH	49.0	48.0	48.0	0.58	0.118	48.33	-0.10	-0.58	
BK	6.0	6.0							∅
BL	51.0	50.0	48.0	1.53	0.354	49.67	0.37	-0.12	
BM	51.0	51.0	52.0	0.58	0.118	51.33	0.94	0.46	
BN									•
BO	51.0	52.0	48.0	2.08	0.473	50.33	0.60	0.12	
BS									•
BW	34.0	35.0	36.0	1.00	0.236	35.00	-4.71	-5.20	⇓
C	51.0	52.0	51.0	0.58	0.118	51.33	0.94	0.46	
CA	31.0	49.0	44.0	9.29	3.146	41.33	-2.52	-3.00	
CE	7.0	6.0							∅
CG	50.0	51.0	50.0	0.58	0.118	50.33	0.60	0.12	
CJ	46.0	43.0	46.0	1.73	0.354	45.00	-1.25	-1.73	
CK	7.0	7.0							∅
CO	36.0	33.0	49.0	8.50	2.695	39.33	-3.21	-3.70	⇓
CP	47.0	40.0	42.0	3.61	0.827	43.00	-1.94	-2.42	
CQ	7.0	7.0							∅
CS	54.0	53.0	45.0	4.93	1.120	50.67	0.71	0.23	
CX	1120.0	1400.0	1700.0	290.06	129.605	1406.67	470.44	469.96	×
D	59.0	59.0	59.0	0.00	0.000	59.00	3.60	3.12	⇑
DB	71.0	64.0	72.0	4.36	0.945	69.00	7.06	6.58	⇑
DD	42.0	44.0	30.0	7.57	2.245	38.67	-3.44	-3.93	⇓
DE	47.0	48.0	48.0	0.58	0.118	47.67	-0.33	-0.81	
DG	52.0	43.0	35.0	8.50	2.921	43.33	-1.83	-2.31	
DH	49.0	45.0	47.0	2.00	0.473	47.00	-0.56	-1.04	
DJ									•

• ≡ No data submitted	**TAG SYMBOLS**		⇑ ≡ Above control limit
∅ ≡ Insufficient data	× ≡ Determined to be an outlier		⇓ ≡ 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
DM	50.0	51.0	46.0	2.65	0.591	49.00	0.13	-0.35	
DO	54.0	57.0	58.0	2.08	0.473	56.33	2.68	2.19	
DP	53.0	49.0	55.0	3.06	0.709	52.33	1.29	0.81	
DR	7.0	7.0							Ø
DT	52.0	49.0	49.0	1.73	0.354	50.00	0.48	0.00	
DX	50.0	51.0	49.0	1.00	0.236	50.00	0.48	0.00	
DZ	49.0	50.0	51.0	1.00	0.236	50.00	0.48	0.00	
E	49.0	51.0	47.0	2.00	0.473	49.00	0.13	-0.35	
EA	45.0	46.0	45.0	0.58	0.118	45.33	-1.14	-1.62	
EB	5.0	6.0							Ø
EH	6.0	6.0							Ø
EL	47.0	47.0	47.0	0.00	0.000	47.00	-0.56	-1.04	
EN	51.0	62.0	85.0	17.35	6.746	66.00	6.02	5.54	⇑
EO	51.0	51.0	52.0	0.58	0.118	51.33	0.94	0.46	
ER									•
ES									•
EV	50.0	59.0	48.0	5.86	1.570	52.33	1.29	0.81	
EW									•
FE	41.0	44.0	42.0	1.53	0.354	42.33	-2.17	-2.66	
FF									•
FJ	53.0	46.0	48.0	3.61	0.827	49.00	0.13	-0.35	
FL									•
FN	6.0	6.0							Ø
FP									•
FU	44.0	47.0	47.0	1.73	0.354	46.00	-0.90	-1.39	
FW									•
FZ									•
GE	47.0	48.0	49.0	1.00	0.236	48.00	-0.21	-0.69	
GJ	13.0	30.0							Ø
GT	72.0	156.0	97.0	43.13	17.997	108.33	20.69	20.21	×
GZ	61.0	66.0	57.0	4.51	1.120	61.33	4.41	3.93	⇑
HE	51.0	48.0	49.0	1.53	0.354	49.33	0.25	-0.23	
HH	9.0	7.0							Ø
HI	37.0	42.0	43.0	3.21	0.709	40.67	-2.75	-3.23	⇓
HK	61.0	51.0	54.0	5.13	1.345	55.33	2.33	1.85	
HL	76.0	76.0	76.0	0.00	0.000	76.00	9.49	9.01	⇑
HN									•
HP	51.0	52.0	51.0	0.58	0.118	51.33	0.94	0.46	
HU	63.0	63.0	64.0	0.58	0.118	63.33	5.10	4.62	⇑
HY									•
I	48.0	46.0	50.0	2.00	0.473	48.00	-0.21	-0.69	
IC	55.0	54.0	54.0	0.58	0.118	54.33	1.98	1.50	
ID									•
IE	44.0	50.0	44.0	3.46	0.709	46.00	-0.90	-1.39	
IU	33.0	31.0	29.0	2.00	0.473	31.00	-6.10	-6.58	⇓

	TAG SYMBOLS	
• ≡ No data submitted		⇑ ≡ Above control limit
Ø ≡ Insufficient data	× ≡ Determined to be an outlier	⇓ ≡ 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
J	52.0	50.0	50.0	1.15	0.236	50.67	0.71	0.23	
JH									•
JN	3.0	3.0							Ø
JP									•
JQ									•
JS	61.0	65.0	66.0	2.65	0.591	64.00	5.33	4.85	⇑
K	45.0	42.0	41.0	2.08	0.473	42.67	-2.06	-2.54	
KC	15.0	14.0							Ø
KE	54.0	47.0	54.0	4.04	0.827	51.67	1.06	0.58	
KH	47.0	47.0	48.0	0.58	0.118	47.33	-0.44	-0.92	
KT									•
KX	40.0	42.0	44.0	2.00	0.473	42.00	-2.29	-2.77	
KZ	55.0	56.0	55.0	0.58	0.118	55.33	2.33	1.85	
L	53.0	57.0	54.0	2.08	0.473	54.67	2.10	1.62	
LA	6.0	6.0							Ø
LE	42.0	49.0	43.0	3.79	0.827	44.67	-1.37	-1.85	
LF	49.0	50.0	43.0	3.79	0.827	47.33	-0.44	-0.92	
LG									•
LL	49.0	50.0	56.0	3.79	0.827	51.67	1.06	0.58	
LM									•
LR	46.0	56.0	65.0	9.50	3.371	55.67	2.44	1.96	
LS									•
LT	50.0	50.0	50.0	0.00	0.000	50.00	0.48	0.00	
LX									•
M	15.0	16.0							Ø
MA	69.0	75.0	76.0	3.79	0.827	73.33	8.56	8.08	⇑
ME	6.0	7.0							Ø
MQ	35.0	36.0	32.0	2.08	0.473	34.33	-4.95	-5.43	⇓
MS	50.0	51.0	51.0	0.58	0.118	50.67	0.71	0.23	
MV	41.0	38.0	35.0	3.00	0.709	38.00	-3.68	-4.16	⇓
MY									•
N									•
NA	45.0	50.0	50.0	2.89	0.591	48.33	-0.10	-0.58	
NB	53.0	49.0	49.0	2.31	0.473	50.33	0.60	0.12	
NE	37.0	40.0	33.0	3.51	0.827	36.67	-4.14	-4.62	⇓
NF	10.0	10.0							Ø
NH	52.0	55.0	52.0	1.73	0.354	53.00	1.52	1.04	
NI	39.0	42.0	40.0	1.53	0.354	40.33	-2.87	-3.35	⇓
NJ	43.0	39.0	43.0	2.31	0.473	41.67	-2.41	-2.89	
NK	32.0	29.0	32.0	1.73	0.354	31.00	-6.10	-6.58	⇓
NO	47.0	54.0	61.0	7.00	2.245	54.00	1.87	1.39	
NP									•
NT	48.0	49.0	49.0	0.58	0.118	48.67	0.02	-0.46	
NZ									•
O	54.0	51.0	52.0	1.53	0.354	52.33	1.29	0.81	

	TAG SYMBOLS	
• ≡ No data submitted		⇑ ≡ Above control limit
Ø ≡ Insufficient data	× ≡ Determined to be an outlier	⇓ ≡ 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
OA	62.0	60.0	59.0	1.53	0.354	60.33	4.06	3.58	⇑
OB	70.0	52.0	44.0	13.32	4.946	55.33	2.33	1.85	
OE	55.0	53.0	51.0	2.00	0.473	53.00	1.52	1.04	
OF	32.0	47.0	46.0	8.39	2.470	41.67	-2.41	-2.89	
OL									•
OM									•
OS	6.0	7.0							Ø
OT	53.0	51.0	46.0	3.61	0.827	50.00	0.48	0.00	
OY	50.0	50.0	48.0	1.15	0.236	49.33	0.25	-0.23	
OZ									•
P	57.0	60.0	66.0	4.58	1.120	61.00	4.29	3.81	⇑
PA									•
PB	48.0	45.0	45.0	1.73	0.354	46.00	-0.90	-1.39	
PC									•
PE									•
PG	51.0	52.0	49.0	1.53	0.354	50.67	0.71	0.23	
PM	46.0	48.0	47.0	1.00	0.236	47.00	-0.56	-1.04	
PP									•
PQ	48.0	49.0	47.0	1.00	0.236	48.00	-0.21	-0.69	
PR	55.0	56.0	57.0	1.00	0.236	56.00	2.56	2.08	
PT	36.0	38.0	35.0	1.53	0.354	36.33	-4.25	-4.73	⇓
PV	29.0	23.0							Ø
PW	53.0	49.0	44.0	4.51	1.120	48.67	0.02	-0.46	
Q	39.0	43.0	46.0	3.51	0.827	42.67	-2.06	-2.54	
QA									•
QC	28.0	34.0	33.0	3.21	0.709	31.67	-5.87	-6.35	⇓
QP									•
QQ	39.0	38.0	38.0	0.58	0.118	38.33	-3.56	-4.04	⇓
QT	86.0	73.0	85.0	7.23	2.020	81.33	11.34	10.85	×
QU	47.0	48.0	49.0	1.00	0.236	48.00	-0.21	-0.69	
QW									•
QX	45.0	47.0	48.0	1.53	0.354	46.67	-0.67	-1.15	
QZ	57.0	57.0	60.0	1.73	0.354	58.00	3.25	2.77	
R	44.0	50.0	47.0	3.00	0.709	47.00	-0.56	-1.04	
RB	34.0	43.0	40.0	4.58	1.120	39.00	-3.33	-3.81	⇓
RC	26.0	30.0	34.0	4.00	0.945	30.00	-6.45	-6.93	⇓
RD	71.0	63.0	63.0	4.62	0.945	65.67	5.91	5.43	⇑
RE	49.0	47.0	49.0	1.15	0.236	48.33	-0.10	-0.58	
RG									•
RJ	53.0	61.0	61.0	4.62	0.945	58.33	3.37	2.89	
RK									•
RM	56.0	58.0	58.0	1.15	0.236	57.33	3.02	2.54	
RN	46.0	46.0	45.0	0.58	0.118	45.67	-1.02	-1.50	
RQ	6.0	6.0							Ø
RR	49.0	47.0	50.0	1.53	0.354	48.67	0.02	-0.46	

• ≡ No data submitted   **TAG SYMBOLS**   ⇑ ≡ Above control limit

Ø ≡ Insufficient data   × ≡ Determined to be an outlier   ⇓ ≡ 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
RS									•
RT	4.0	4.0							Ø
RU									•
RV	45.0	43.0	52.0	4.73	1.120	46.67	-0.67	-1.15	
RW	60.0	53.0	53.0	4.04	0.827	55.33	2.33	1.85	
RZ	4.0	4.0							Ø
S	7.0	7.0							Ø
SA									•
SC	58.0	59.0	56.0	1.53	0.354	57.67	3.14	2.66	
SD	37.0	39.0	38.0	1.00	0.236	38.00	-3.68	-4.16	⇓
SG									•
SI	50.0	56.0	58.0	4.16	0.945	54.67	2.10	1.62	
SL	5.0	5.0							Ø
SO	51.0	52.0	52.0	0.58	0.118	51.67	1.06	0.58	
SS	6.0	6.0							Ø
ST	55.0	50.0	48.0	3.61	0.827	51.00	0.83	0.35	
SU	40.0	31.0	36.0	4.51	1.120	35.67	-4.48	-4.97	⇓
SX	37.0	29.0	33.0	4.00	0.945	33.00	-5.41	-5.89	⇓
SZ	41.0	41.0	42.0	0.58	0.118	41.33	-2.52	-3.00	
T	5.0	7.0							Ø
TA									•
TC									•
TE	53.0	50.0	52.0	1.53	0.354	51.67	1.06	0.58	
TG	31.0	34.0	34.0	1.73	0.354	33.00	-5.41	-5.89	⇓
TH	31.0	35.0	31.0	2.31	0.473	32.33	-5.64	-6.12	⇓
TI	20.0	17.0							Ø
TK	77.0	69.0	58.0	9.54	3.371	68.00	6.72	6.24	⇑
TL	87.0	86.0	97.0	6.08	1.570	90.00	14.34	13.86	×
TM	53.0	53.0	53.0	0.00	0.000	53.00	1.52	1.04	
TN	48.0	51.0	52.0	2.08	0.473	50.33	0.60	0.12	
TO	61.0	72.0	75.0	7.37	2.245	69.33	7.18	6.70	⇑
TP									•
TR									•
TY	47.0	45.0	43.0	2.00	0.473	45.00	-1.25	-1.73	
U	48.0	45.0	50.0	2.52	0.591	47.67	-0.33	-0.81	
W	43.0	46.0	47.0	2.08	0.473	45.33	-1.14	-1.62	
X	25.0	23.0	25.0	1.15	0.236	24.33	-8.41	-8.89	⇓
Y	39.0	41.0	40.0	1.00	0.236	40.00	-2.98	-3.46	⇓
Z	60.0	82.0	63.0	11.93	4.046	68.33	6.83	6.35	⇑

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
24.33	⇓	X	31.00	⇓	NK	32.33	⇓	TH
28.33	⇓	BG	31.00	⇓	IU	33.00	⇓	TG
30.00	⇓	RC	31.67	⇓	QC	33.00	⇓	SX

• ≡ No data submitted	**TAG SYMBOLS**	⇑ ≡ Above control limit
Ø ≡ 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
34.33	⇓	MQ	47.00		DH	51.67		LL
35.00	⇓	BW	47.33		LF	51.67		KE
35.67	⇓	SU	47.33		KH	52.33		O
36.33	⇓	PT	47.67		U	52.33		EV
36.67	⇓	NE	47.67		DE	52.33		DP
38.00	⇓	SD	48.00		QU	53.00		TM
38.00	⇓	MV	48.00		PQ	53.00		OE
38.00	⇓	BC	48.00		I	53.00		NH
38.33	⇓	QQ	48.00		GE	54.00		NO
38.67	⇓	DD	48.33		RE	54.33		IC
39.00	⇓	RB	48.33		NA	54.67		SI
39.00	⇓	AL	48.33		BH	54.67		L
39.33	⇓	CO	48.33		AP	55.33		RW
40.00	⇓	Y	48.67		RR	55.33		OB
40.33	⇓	NI	48.67		PW	55.33		KZ
40.67	⇓	HI	48.67		NT	55.33		HK
41.33		SZ	49.00		FJ	55.33		AR
41.33		CA	49.00		E	55.67		LR
41.67		OF	49.00		DM	56.00		PR
41.67		NJ	49.33		OY	56.33		DO
42.00		KX	49.33		HE	56.33		AF
42.33		FE	49.33		AW	57.33		RM
42.67		Q	49.67		BL	57.67		SC
42.67		K	50.00		OT	58.00		QZ
42.67		AE	50.00		LT	58.33		RJ
43.00		CP	50.00		DZ	59.00	⇑	D
43.33		DG	50.00		DX	60.33	⇑	OA
44.33		AJ	50.00		DT	61.00	⇑	P
44.67		LE	50.33		TN	61.33	⇑	GZ
45.00		TY	50.33		NB	61.33	⇑	BA
45.00		CJ	50.33		CG	63.33	⇑	HU
45.33		W	50.33		BO	64.00	⇑	JS
45.33		EA	50.67		PG	65.67	⇑	RD
45.67		RN	50.67		MS	66.00	⇑	EN
46.00		PB	50.67		J	68.00	⇑	TK
46.00		IE	50.67		CS	68.33	⇑	Z
46.00		FU	51.00		ST	69.00	⇑	DB
46.00		AZ	51.00		AI	69.33	⇑	TO
46.33		A	51.33		HP	73.33	⇑	MA
46.67		RV	51.33		EO	76.00	⇑	HL
46.67		QX	51.33		C	81.33	×	QT
47.00		R	51.33		BM	85.67	×	AN
47.00		PM	51.67		TE	90.00	×	TL
47.00		EL	51.67		SO	108.33	×	GT

• ≡ 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
						1406.67	×	**CX**

Frequency distribution of responding labs(expected prec. vs known value)

%
10
0
-6   -4   exp. prec.   -2   0 known value   +2   exp. prec.   +4   +6

Frequency distribution of responding labs(std. dev. vs mean value)

%
10
0
-6   -4   std. dev.   -2   0 mean value   +2   std. dev.   +4   +6