♦EPA
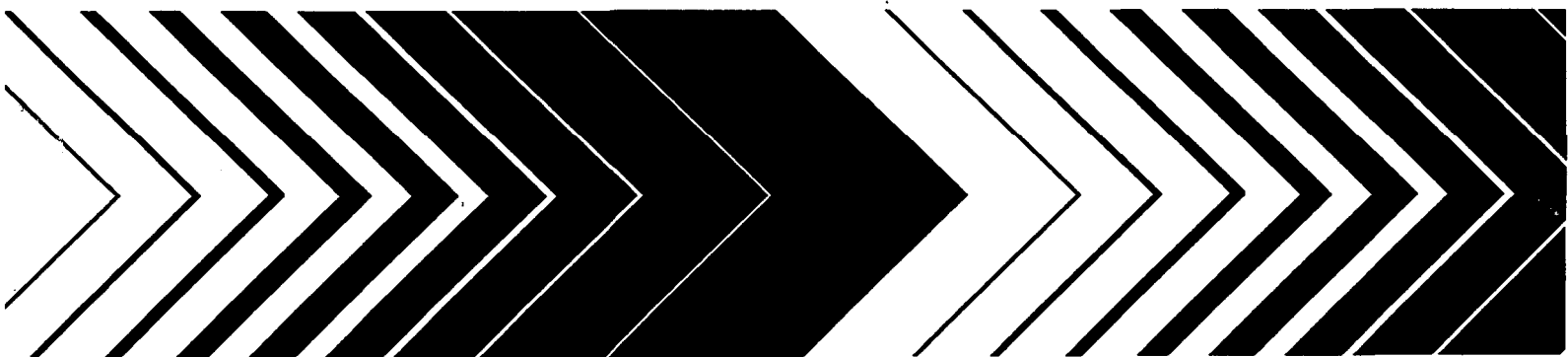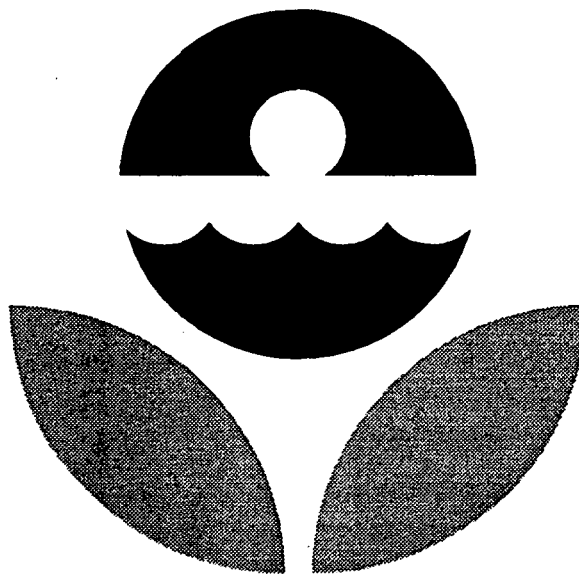
Iodine in Water Intercomparison Study

A Statistical Evaluation of the February 7, 1992 Data

Iodine in Water

Intercomparison Study

February 7, 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 - FTS 545-2100)

Dear Participant,

Enclosed are the results of the Nuclear Radiation Assessment Division (EMSL-LV) Intercomparison Study for *Iodine in Water; February 7, 1992.*

This report introduces a new format that we hope is easier to read and interpret. Although we have tested the software that produces this report carefully, and compared the results with the previous format, there is a possibility of error. We encourage you to examine the data and inform us of any apparent discrepancies.

We especially 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, it becomes unrealistic for us to receive results by mail or FAX.

If you have any questions or comments, please send a message via the data-entry system or contact Frank Novielli at 702/798-2159 (FTS 545-2159) or Patricia Honsa at 702/798-2141 (FTS 545-2141).

Sincerely,

Frank Novielli
Senior Chemist
Radioanalysis Branch

Enclosure

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 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.
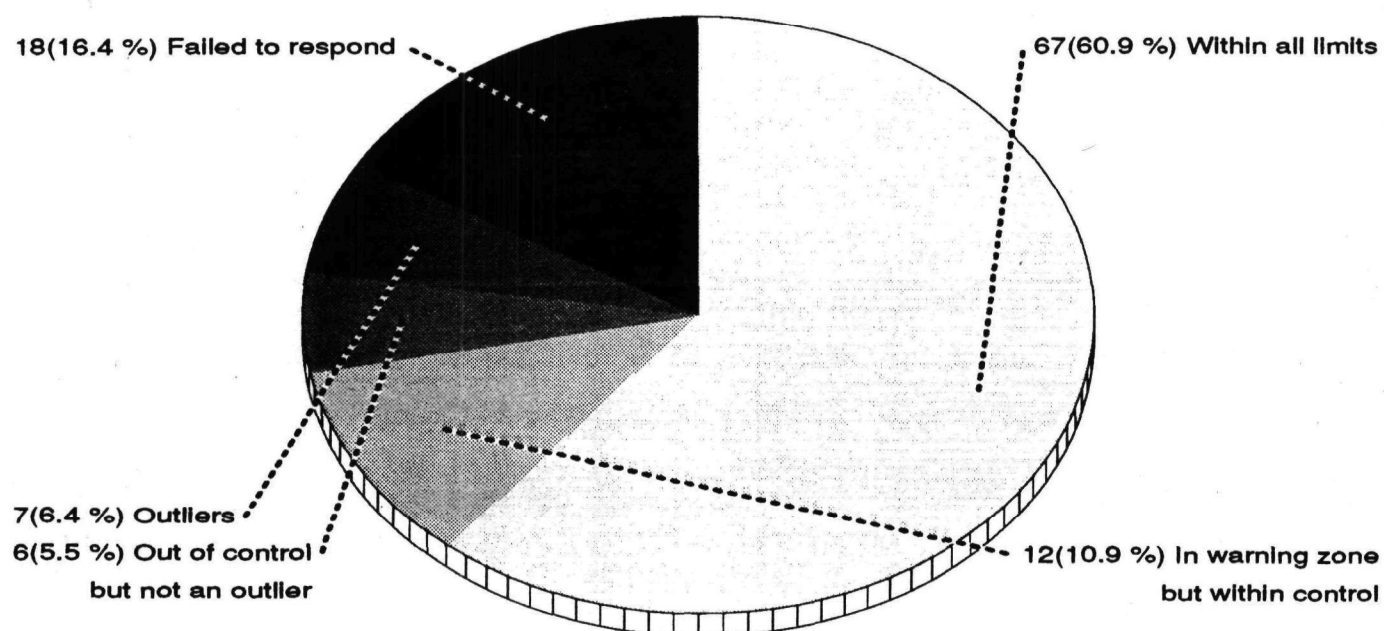
The second part is an alphabetical listing, in lab-code order, of submitted data and several calculated quantities. An entry that is shaded has been rejected because of one of the reasons listed above or failure of the outlier test. The fifth and sixth columns are a measure of laboratory precision. The 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.

Iodine-131   Statistical Summary   110 Participants

The known value of this nuclide is **59.0 pCi/l** with an expected precision of **6.0**; the control limits are 48.6 to 69.4, and the warning levels are 52.1 to 65.9

18(16.4 %) Failed to respond

67(60.9 %) Within all limits

7(6.4 %) Outliers

6(5.5 %) Out of control
but not an outlier

12(10.9 %) In warning zone
but within control

Statistic	Respondents	Non-outliers
Mean	63.57	**Grand Avg 60.16**
Std. Dev.	27.19	5.54
Variance	739.53	30.74
% Coef. of Var.	42.78	9.22
% deviation of mean from known value	7.75	1.96
Norm. dev. of mean from known value	0.17	0.21
Median	60.33	60.33
% deviation of median from known value	2.26	2.26
Norm. dev. of median from known value	0.05	0.24
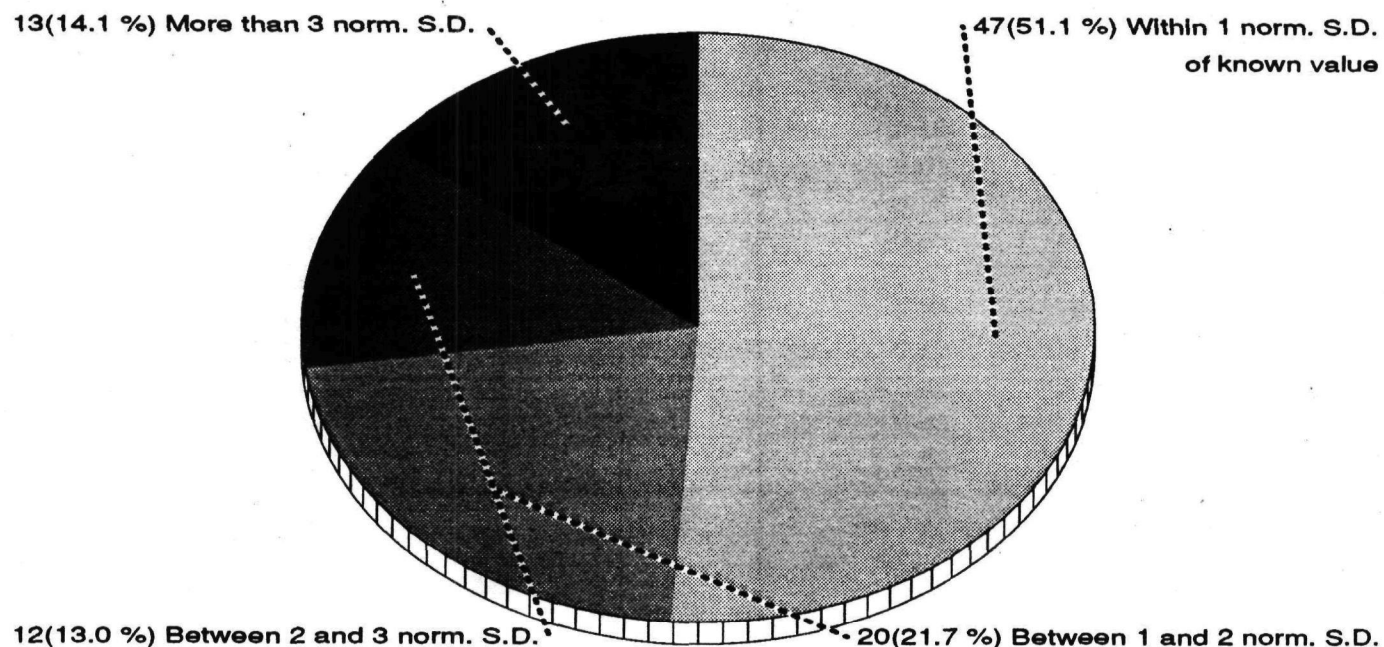
13(14.1 %) More than 3 norm. S.D.

47(51.1 %) Within 1 norm. S.D.
of known value

12(13.0 %) Between 2 and 3 norm. S.D.

20(21.7 %) Between 1 and 2 norm. S.D.

Iodine-131

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg)	(known)	Tag
A	85.0	82.0	87.0	2.52	0.492	84.67	7.08	7.41	×
AB	66.0	67.0	65.0	1.00	0.197	66.00	1.69	2.02	
AF	59.0	59.0	62.0	1.73	0.295	60.00	-0.05	0.29	
AI	54.0	71.0	62.0	8.50	2.283	62.33	0.63	0.96	
AJ	49.0	51.0	48.0	1.53	0.295	49.33	-3.12	-2.79	
AK	60.0	60.0	60.0	0.00	0.000	60.00	-0.05	0.29	
AL	56.0	64.0	59.0	4.04	0.788	59.67	-0.14	0.19	
AN	64.0	66.0	60.0	3.06	0.591	63.33	0.92	1.25	
AP	61.0	62.0	64.0	1.53	0.295	62.33	0.63	0.96	
AU	57.0	56.0	59.0	1.53	0.295	57.33	-0.82	-0.48	
AW	123.0	111.0	121.0	6.43	1.345	118.33	16.79	17.13	×
AY	54.0	48.0	46.0	4.16	0.788	49.33	-3.12	-2.79	
AZ	56.0	60.0	62.0	3.06	0.591	59.33	-0.24	0.10	
BA	58.0	57.0	57.0	0.58	0.098	57.33	-0.82	-0.48	
BC	73.0	86.0	88.0	8.14	1.908	82.33	6.40	6.74	×
BH	57.0	57.0	60.0	1.73	0.295	58.00	-0.62	-0.29	
BL	57.0	57.0	50.0	4.04	0.689	54.67	-1.58	-1.25	
BM	60.0	57.0	58.0	1.53	0.295	58.33	-0.53	-0.19	
BO	57.0	64.0	61.0	3.51	0.689	60.67	0.15	0.48	
BW	70.0	68.0	70.0	1.15	0.197	69.33	2.65	2.98	
C	66.0	65.0	67.0	1.00	0.197	66.00	1.69	2.02	
CA	62.0	61.0	58.0	2.08	0.394	60.33	0.05	0.38	
CE	67.0	63.0	63.0	2.31	0.394	64.33	1.21	1.54	
CJ	62.0	62.0	59.0	1.73	0.295	61.00	0.24	0.58	
CP	53.0	52.0	54.0	1.00	0.197	53.00	-2.07	-1.73	
CQ	65.0	70.0	72.0	3.61	0.689	69.00	2.55	2.89	
D	61.0	61.0	59.0	1.15	0.197	60.33	0.05	0.38	
DD	59.0	64.0	60.0	2.65	0.492	61.00	0.24	0.58	
DE	59.0	59.0	60.0	0.58	0.098	59.33	-0.24	0.10	
DG	35.0	29.0	29.0	3.46	0.591	31.00	-8.42	-8.08	×
DL	58.0	52.0	54.0	3.06	0.591	54.67	-1.58	-1.25	
DM	59.0	61.0	61.0	1.15	0.197	60.33	0.05	0.38	
DR	52.0	55.0	62.0	5.13	0.984	56.33	-1.10	-0.77	
DT	53.0	58.0	50.0	4.04	0.788	53.67	-1.87	-1.54	
DY	61.0	61.0	63.0	1.15	0.197	61.67	0.44	0.77	
E	63.0	63.0	64.0	0.58	0.098	63.33	0.92	1.25	
EB	60.0	62.0	64.0	2.00	0.394	62.00	0.53	0.87	
EH	56.0	59.0	53.0	3.00	0.591	56.00	-1.20	-0.87	
EL	65.0	67.0	61.0	3.06	0.591	64.33	1.21	1.54	
EX	59.0	59.0	61.0	1.15	0.197	59.67	-0.14	0.19	
EZ	44.0	34.0	59.0	12.58	3.783	45.67	-4.18	-3.85	⇓
FE	56.0	52.0	52.0	2.31	0.394	53.33	-1.97	-1.64	
FL	62.0	60.0	59.0	1.53	0.295	60.33	0.05	0.38	
FU									•
GD									•

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

Iodine-131

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg)	(known)	Tag
GE	54.0	52.0	58.0	3.06	0.591	54.67	-1.58	-1.25	
GI									•
HE	69.0	68.0	65.0	2.08	0.394	67.33	2.07	2.41	
HJ	66.0	65.0	63.0	1.53	0.295	64.67	1.30	1.64	
HK	41.0	45.0	46.0	2.65	0.492	44.00	-4.66	-4.33	⇓
HP	66.0	64.0	68.0	2.00	0.394	66.00	1.69	2.02	
HU									•
I	59.0	59.0	59.0	0.00	0.000	59.00	-0.33	0.00	
IA									•
IC	65.0	61.0	64.0	2.08	0.394	63.33	0.92	1.25	
IU	58.0	56.0	58.0	1.15	0.197	57.33	-0.82	-0.48	
J	61.0	60.0	62.0	1.00	0.197	61.00	0.24	0.58	
JR	61.0	57.0	59.0	2.00	0.394	59.00	-0.33	0.00	
JS	67.0	62.0	62.0	2.89	0.492	63.67	1.01	1.35	
K	63.0	68.0	65.0	2.52	0.492	65.33	1.49	1.83	
KL	55.0	58.0	63.0	4.04	0.788	58.67	-0.43	-0.10	
KX	60.0	59.0	62.0	1.53	0.295	60.33	0.05	0.38	
L	58.0	60.0	60.0	1.15	0.197	59.33	-0.24	0.10	
LF	60.0	57.0	57.0	1.73	0.295	58.00	-0.62	-0.29	
M	54.0	56.0	57.0	1.53	0.295	55.67	-1.30	-0.96	
MA	45.0	44.0	45.0	0.58	0.098	44.67	-4.47	-4.14	⇓
ME	55.0	59.0	61.0	3.06	0.591	58.33	-0.53	-0.19	
MN									•
MP									•
MQ	35.0	34.0	32.0	1.53	0.295	33.67	-7.65	-7.31	×
MS	70.0	68.0	68.0	1.15	0.197	68.67	2.46	2.79	
MV									•
N	60.0	60.0	59.0	0.58	0.098	59.67	-0.14	0.19	
NJ	62.0	57.0	59.0	2.52	0.492	59.33	-0.24	0.10	
NV									•
O	68.0	68.0	68.0	0.00	0.000	68.00	2.26	2.60	
OA	59.0	57.0	58.0	1.00	0.197	58.00	-0.62	-0.29	
OB	74.0	75.0	74.0	0.58	0.098	74.33	4.09	4.43	⇑
OL									•
OM	64.0	62.0	70.0	4.16	0.788	65.33	1.49	1.83	
OT	69.0	68.0	65.0	2.08	0.394	67.33	2.07	2.41	
PB	56.0	58.0	54.0	2.00	0.394	56.00	-1.20	-0.87	
PC									•
PU	82.0	84.0	79.0	2.52	0.492	81.67	6.21	6.54	×
PV	60.0	63.0	60.0	1.73	0.295	61.00	0.24	0.58	
PW									•
Q	53.0	55.0	55.0	1.15	0.197	54.33	-1.68	-1.35	
QK	59.0	56.0	55.0	2.08	0.394	56.67	-1.01	-0.67	
QU									•
QX	72.0	67.0	71.0	2.65	0.492	70.00	2.84	3.18	⇑

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

Iodine-131

Lab	Res. 1	Res. 2	Res. 3	Exper. Sigma	Rng anal (R + SR)	Average	Normalized deviation (grand-avg)	(known)	Tag
QZ	71.0	70.0	70.0	0.58	0.098	70.33	2.94	3.27	⇑
R	60.0	61.0	60.0	0.58	0.098	60.33	0.05	0.38	
RM	51.0	52.0	55.0	2.08	0.394	52.67	-2.16	-1.83	
RN									•
RQ	302.0	300.0	309.0	4.73	0.886	303.67	70.30	70.63	×
RS									•
S	60.0	60.0	60.0	0.00	0.000	60.00	-0.05	0.29	
SC	63.0	62.0	60.0	1.53	0.295	61.67	0.44	0.77	
SD									•
SF	58.0	64.0	68.0	5.03	0.984	63.33	0.92	1.25	
SI									•
SK	64.0	63.0	58.0	3.21	0.591	61.67	0.44	0.77	
SS	61.0	58.0	59.0	1.53	0.295	59.33	-0.24	0.10	
ST									•
SY	67.0	65.0	71.0	3.06	0.591	67.67	2.17	2.50	
U	56.0	60.0	66.0	5.03	0.984	60.67	0.15	0.48	
W	60.0	54.0	54.0	3.46	0.591	56.00	-1.20	-0.87	
X	65.0	62.0	64.0	1.53	0.295	63.67	1.01	1.35	
Y	62.0	63.0	63.0	0.58	0.098	62.67	0.72	1.06	
Z	65.0	61.0	58.0	3.51	0.689	61.33	0.34	0.67	

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
31.00	×	DG	57.33		BA	60.33		KX
33.67	×	MQ	57.33		AU	60.33		FL
44.00	⇓	HK	58.00		OA	60.33		DM
44.67	⇓	MA	58.00		LF	60.33		D
45.67	⇓	EZ	58.00		BH	60.33		CA
49.33		AY	58.33		ME	60.67		U
49.33		AJ	58.33		BM	60.67		BO
52.67		RM	58.67		KL	61.00		PV
53.00		CP	59.00		JR	61.00		J
53.33		FE	59.00		I	61.00		DD
53.67		DT	59.33		SS	61.00		CJ
54.33		Q	59.33		NJ	61.33		Z
54.67		GE	59.33		L	61.67		SK
54.67		DL	59.33		DE	61.67		SC
54.67		BL	59.33		AZ	61.67		DY
55.67		M	59.67		N	62.00		EB
56.00		W	59.67		EX	62.33		AP
56.00		PB	59.67		AL	62.33		AI
56.00		EH	60.00		S	62.67		Y
56.33		DR	60.00		AK	63.33		SF
56.67		QK	60.00		AF	63.33		IC
57.33		IU	60.33		R	63.33		E

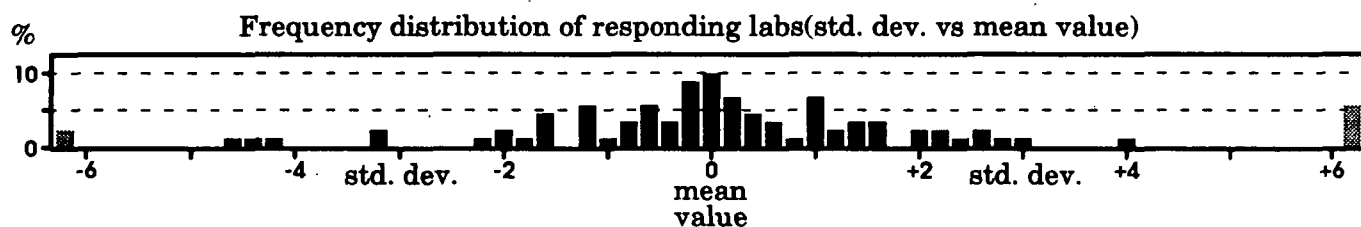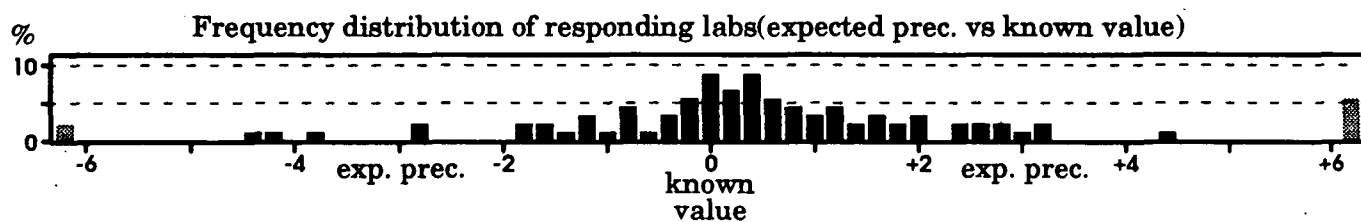|		
• ≡ No data submitted	**TAG SYMBOLS**	⇑ ≡ Above control limit
Ø ≡ Insufficient data	× ≡ Determined to be an outlier	⇓ ≡ Below control limit

Iodine-131

Data sorted by Laboratory Average

Average	Tag	Lab	Average	Tag	Lab	Average	Tag	Lab
63.33		AN	66.00		HP	69.33		BW
63.67		X	66.00		C	70.00	⇑	QX
63.67		JS	66.00		AB	70.33	⇑	QZ
64.33		EL	67.33		OT	74.33	⇑	OB
64.33		CE	67.33		HE	81.67	×	PU
64.67		HJ	67.67		SY	82.33	×	BC
65.33		OM	68.00		O	84.67	×	A
65.33		K	68.67		MS	118.33	×	AW
			69.00		CQ	303.67	×	RQ

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

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

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