

IAEA/AL/034

INTERCOMPARISON STUDY IAEA-155
on the DETERMINATION of
INORGANIC CONSTITUENTS IN WHEY POWDER

by

E. Zeiller, V. Strachnov, R. Dekner

International Atomic Energy Agency
Agency's Laboratories
Analytical Quality Control Services

Vienna, November 1990

CONTENTS

	<u>Page</u>
INTRODUCTION	1
SCOPE OF THE STUDY	1
DESCRIPTION OF THE MATERIAL	1
HOMOGENEITY TESTING	2
MOISTURE DETERMINATION	2
EVALUATION OF RESULTS	2
EXPLANATION OF TABLES	3
SUMMARY OF RESULTS TABLES	4
DESCRIPTION OF FIGURES	5
CRITERIA FOR RECOMMENDED VALUE AND CONFIDENCE INTERVALS	5
RESULTS AND CONCLUSION	7
EVALUATION OF IAEA*	8
ACKNOWLEDGEMENTS	8
CODES FOR LABORATORY METHODS (Table A)	9
IAEA-155 - CLASSIFICATION (Table B)	10
IAEA-153 - STATISTICAL CLASSIFICATION (Table C)	12
Ca IN IAEA-155 (Table D)	13
DATA TABLES AND FIGURES	14
LIST OF PARTICIPATING LABORATORIES	61

Introduction

Analytical results need to be reliable, and analysts are well serviced to test their complete analytical systems, methods, instruments, personnel, data reduction, etc., on a frequent basis. Besides the use of standard reference materials, the intercomparison runs provide an excellent opportunity for the determination of accuracy. By comparing their results with results obtained by different methods of preparation and measurement, the participating laboratories have the opportunity to check their analytical performances. At the same time the IAEA'S AQCS can establish the concentration of some elements for certification purposes.

The great number of participants (69 laboratories) and the large number of results (45 elements, 580 laboratory averages) demonstrate again the increasing awareness of the need for quality control and quality assurance in analytical chemistry.

Scope of the study

The participants were requested to determine as many elements as possible with emphasis on "essential" and "toxic" elements related to human health and environmental pollution in the "intercomparison sample" IAEA-155 as well as in the control sample IAEA*. It was expected that the results for IAEA* would improve the evaluation of the intercomparison results of IAEA-155 as the concentrations of some inorganic constituents were well established in the IAEA* sample. In total 69 laboratories from 24 different countries participated in this exercise. As a basis for the evaluation, 580 laboratory means were reported comprising 2699 individual results for 45 elements. For 3 additional elements information was supplied that the value was below the detection limits of the methods.

Description of material

A bulk sample of approximately 500 kg (20 sacks of about 25 kg each) of white powder was collected from a processing plant in Europe. These twenty sacks were all from the same batch process. Thus, they were assumed to be as

homogeneous as possible. Nevertheless, preliminary homogeneity testing of every two sacks for Mg and Zn using atomic absorption spectrometry (AAS) was performed prior to bottling in approximate portions of 50 grams. In order to assure long-term stability of the material, all bottles were sealed and sterilized by gamma-ray irradiation of about 2.5×10^4 Gy using a ^{60}Co source.

Homogeneity testing

The homogeneity of the materials (after bottling) was checked by determining the concentrations of some elements. Determinations of Cu, Fe, Mg, Mn, Zn, Ca and P by inductivity coupled plasma atomic emission spectrometry (ICP-ES), Cu, Fe, Mg and K by atomic absorption spectrometry (AAS) and Br, Na, and Cs by neutron activation analysis (NAA) were performed on six samples taken from one bottle and the results were compared with those obtained on sub-samples taken from five bottles chosen at random.

By applying the F-test it was found that the results did not differ significantly and that this material could be considered homogeneous for a sample size of greater or equal to 300 mg at a confidence level of 0.05. Only Cu showed a higher variation than usual which could be caused by the generally larger measurement variation near the detection limit. Fe was homogeneous for ICP measurement but AAS results showed a few outliers.

Moisture determination

The participants were asked to report results on a dry weight basis. It was recommended that they determine the moisture content by drying a separate sub-sample of 2-5 grams (spread in a layer less than 0.5 cm thick) for 2 hours at 105°C.

Evaluation of the results

The original data that were received from the participating laboratories were edited (converted to the same units and format) and then stored as a data file. This data file was processed by a computer program especially written

for evaluating intercomparison results. Outliers (i.e. observations which deviated significantly from the population of the other results) were detected and rejected in the data evaluation if they failed either one of the following statistical tests at the significance level of $\alpha=0.05$.

- 1) Dixon's
- 2) Grubb's
- 3) coefficient of Skewness, and
- 4) coefficient of Kurtosis

Additional information regarding these statistical tests can be found in Analyst 103 (1978) 733; R. Dybczynski, A. Tugsavul and O. Suschny.

Explanation of Tables

The laboratory mean values for specific elements for which at least one laboratory mean was submitted are presented in Tables 1 to 45.

Lab. Code No.: Each laboratory was assigned a code number, which is the same throughout the report. To ensure anonymity, the numbering sequence does not correspond to the sequence of the laboratories in the list of participants. If a laboratory presented results using different analytical techniques for the determination of a specific element, it was differentiated by (*) after its code number.

Method Code: The analytical techniques employed by the participating laboratories are presented in the form of codes (a letter and number). The key to the different analytical techniques is given in Table A.

No. of Determinations: The number of individual results for a given element supplied by the participating laboratory. Results reported as "less than" have not been included in the evaluation.

Lab. Mean: The arithmetic mean computed from all the individual results supplied by the participating laboratories. An asterisk (*) after the lab. mean denotes that it was rejected as an outlier. Outliers were not included in the calculation of the overall mean for an element.

Lab. Standard Deviation: The absolute and relative standard deviations were calculated if at least three results were reported by the participating laboratory.

Acceptance Code: If the laboratory mean is within the confidence interval the acceptance code states 'ok'. When the laboratory mean is above or below the boundary of the confidence interval its acceptance code is calculated $\pm\delta/SD$, while $\pm\delta$ express the distance of the laboratory mean to the confidence interval boundary and SD is the calculated standard deviation of the laboratory individual results or the laboratory's own estimation of its overall error. If no SD information is available or if it is $>30\%$ or δ/SD is ≥ 100 'HI' or 'LO' (meaning high or low) are printed to show the big positiv or negativ distance from the confidence interval.

Lab. Lod.: The limit of detection (i.e. results below level of quantification) which were reported by the laboratories for some elements are given at the end of the respective tables.

Summary of results tables

Most of the terms used in these tables have been already defined. The standard error (SE) is defined as the standard deviation of the reported mean values divided by the square root of the number of accepted laboratory means. Elements for which at least two laboratory means have been reported are included.

Confidence Interval: Confidence intervals for the mean of the population of all laboratory means were calculated from the expressions

$$X - t_{0.05} \times (S.E.) \leq \mu \leq X + t_{0.05} \times (S.E.)$$

where $t_{0.05}$ = student's factor for significance level 0.05

SE = Standard error

X = overall mean (non-weighted mean of all accepted laboratory averages).

Description of figures

A figure has been plotted for each element for which at least six laboratory means were reported. The laboratory means have been plotted in ascending concentration values on the y-axis against their corresponding laboratory code number on the x-axis.

The respective error bars (standard deviation of the mean) have also been plotted on the same graph. The code above the error bar is the laboratory method code, while the value below the error bar is the number of individual determinations. If a "less than" value was reported, this has been represented by an arrow downwards rather than the numerical value. The 95 % confidence interval is also shown on the graph as dotted lines when appropriate.

The points represented by an X within a circle have been rejected as outliers and have not been used for the calculation of the overall laboratory mean.

In order to achieve a better arrangement, some graphs do not contain all of the laboratory results for a particular element. Sometimes high outlying values and high values reporting "below detection limits" were excluded.

Criteria* for recommended values and confidence intervals

In this report, recommended values are reported under two classes (A and B), each with its own set of criteria that are listed below. In addition some information values are listed. The criteria for class A qualification are more stringent than for class B so a class A recommended value has a higher level of confidence. A mean value (excluding outliers) is reported as class A if it meets the following criteria:

- 1) there are ten or more accepted laboratory means,

* Note that these criteria apply only to this report and may not apply to data in other IAEA reports.

- 2) the accepted laboratory means include at least two different analytical techniques which do not differ significantly,
- 3) the percentage of outliers is less than 20%,
- 4) the overall standard deviation is less than 2.5 times the average standard deviation of the accepted laboratory means,
- 5) the range of the confidence interval is not more than $\pm 5\%$ of the accepted laboratory mean.

If a mean value fails to meet class A criteria, it may still be reported as a class B recommended value providing it meets the following criteria:

- 1) there are five to nine accepted laboratory means,
- 2) the accepted laboratory means include only one analytical technique,
- 3) the percentage of outliers is less than 30%,
- 4) the overall standard deviation is less than 3.5 times the average standard deviation of the accepted laboratory means or less than 5 times the average standard deviation if the result is smaller than 50 ng/g,
- 5) the range of the confidence interval is determined by criteria 4, no limitation is considered.

Note: Laboratory means with zero standard deviation were not considered.

Information values (class I) fail one of the criteria for class B but might still be of interest for the users.

Results and conclusions

Even though information and data on 48 elements were reported for IAEA 155 only 4 elements are assigned Class A and 13 elements Class B recommended values [Table B]. But contrary to some former intercomparison exercises, this time sufficient results could be obtained to set "Class B" recommended values for some "difficult to determine" elements like Cd, Co, Cr, Hg, Ni, Pb, Se.

Also, the decreasing percentage of outlying laboratories demonstrate the generally increasing expertise.

The elements Mg, Mn, Na and P were assigned "Class A". Rb which met 4 out of 5 Class A criteria had a confidence interval range $\pm 7.2\%$ that was too large.

The confidence interval for Class B values is generally smaller than $\pm 20\%$ from the recommended mean value, except for the low concentrated elements like Cd $16,0 \pm 3,5$ ng/g (22,0%), Co $42,7 \pm 13,4$ ng/g (31,4%), Hg $2,6 \pm 1,2$ ng/g (43,5%), Pb 140 ± 32 ng/g (31,6%) and Se 64 ± 13 ng/g (20,16%).

The confidence interval of Pb seems to be too narrow. The fact that six values are below the detection limits (<160 ng/g and even <50 ng/g) can be taken as an indication that the "true value" of Pb should be lower than mathematically calculated. This also agrees with experience from former intercomparison runs where the Pb values always decreased during recertification procedures where only experienced laboratories took part.

For Hg the reported values for less than 'limit of detection' (6 values are <5 ppb) fit well in the calculated confidence interval.

Results of 7 elements are included for information only [Table B]. They failed to be "Class B" mainly because the overall standard deviation was more than 3.5 times the average standard deviation of the accepted laboratory means. Surprisingly, Cu, Fe, Ca and K also fall into this group and could not be certified.

While Cu and Fe, which have standard deviations of approximately 50%, might have homogeneity problems (see homogeneity testing page 2), Ca and K results show problems in the statistical evaluation.

Only between 28% (for K) and 46% (for Ca) of the accepted results fall within the confidence intervals of the elements. No outliers were detected and the apparently wrong results were not rejected by the 4 outlier tests normally used. The extent to which deviating results can influence the mean is shown for Ca in Table D, where evaluations are compared using selected results.

Evaluation of IAEA*

IAEA* correspond to IAEA-153 Milk Powder reference material which is certified for some elements [Table C].

It was planned to use the results of this sample to draw conclusions on the reliability of the laboratories in the analysis of certain elements. But, since not all laboratories sent results (some were even not requested to analyse it), and since the concentrations in both materials were not very comparable, this idea was abandoned. The results received will only be used for a future re-evaluation of the IAEA-153 material.

Aknowledgements

The authors of this report wish to thank Ms. Katalin Lewis-Göttler of the IAEA Computer Section for computation of the results and Mr. E. Cooper for his comments and editorial corrections.

We also thank the Oesterreichische Forschungszentrum for their cost-free cobalt-60 irradiation of these intercomparison samples.

Finally, we would also like to acknowledge all the participating laboratories that are listed at the end of this report for their active participation. We are especially grateful to Mr. Wegscheider and the Members of the "Oesterreichische Gesellschaft für Mikrochemie and Analytische Chemie" for their assistance in certifying some "difficult to determine" elements.

Table A

Laboratory Method Code used in the IAEA-155 Intercomparison

Method Code	Method
A1	Atomic absorption spectrometry (flame)
A2	Atomic absorption spectrometry (electrothermal)
A3	Atomic absorption spectrometry (electrothermal + zeman background correction)
A4	Atomic absorption spectrometry (cold vapor)
A5	Atomic absorption spectrometry (hydride generation)
C1	Colorimetry (spectrophotometry)
E1	Emission spectrometry (flame)
E2	Emission spectrometry (flame photometry)
E5	Emission spectrometry (inductively coupled plasma, simultaneous)
E6	Emission spectrometry (inductively coupled plasma, sequential)
N1	Neutron activation analysis (thermal, radiochemical)
N2	Neutron activation analysis (thermal, instrumental)
N3	Neutron activation analysis (epithermal, instrumental)
N5	Neutron activation analysis (fast instrumental)
P2	Photon activation analysis (instrumental)
X1	X-ray fluorescence analysis
X3	X-ray fluorescence analysis (particle induced) PIXE
V1	Voltametry/Polarography
Z	Other or unspecified methods.

TABLE B
IAEA-155 (Whey Powder)

Classification

Class A

Element	Mean	Confidence Interval
Mg	3.19 mg/g	3.06 - 3.31
Mn	9.30 µg/g	8.78 - 9.82
Na	15.82 µg/g	15.23 - 16.42
P	16.21 mg/g	15.46 - 16.95

Class B

Element	Mean	Confidence Interval
Br	39.1 µg/g	36.1 - 42.0
Cd	16.0 ng/g	12.5 - 19.6
Cl	69.2 mg/g	65.9 - 72.4
Co	42.7 ng/g	29.3 - 56.1
Cr	0.59µg/g	0.51- 0.66
Cs	86 ng/g	71 - 102
Hg	2.6 ng/g	1.5 - 3.8
Ni	0.54µg/g	0.44- 0.64
Pb	104 ng/g	71 - 136
Rb	39.2 µg/g	36.4 - 42.0
Sc	28 ng/g	21 - 34
Se	64 ng/g	51 - 77
Zn	34.3 µg/g	32.8 - 35.7

Information Values

Class I

Element	Mean	Confidence Interval
Al	53 µg/g	38 - 68
As	49 ng/g	16 - 83
B	5.1 µg/g	4.3 - 6.0
Ca	36.0 mg/g	31.2 - 40.8
Cu	0.57µg/g	0.46- 0.68
Fe	62 µg/g	50 - 74
K	41.7 mg/g	35.4 - 48.1
S	3.0 mg/g	1.6 - 4.4
Sr	10.5 µg/g	6.6 - 14.5

Table C
IAEA-153 (Milk Powder)

Statistical classification

Element	Mean	Confidence Intervals
Class A		
Ca	12.87 mg/g	12.54 - 13.17
Mg	1.06 mg/g	1.00 - 1.15
Zn	39.56 µg/g	37.66 - 41.23

Class B		
Br	12.32 µg/g	11.01 - 13.64
Fe	2.53 µg/g	1.66 - 3.47
K	17.62 mg/g	16.48 - 18.76
Na	4.18 mg/g	3.87 - 4.44
P	10.10 mg/g	9.01 - 11.04
Rb	14.03 µg/g	12.27 - 16.10

TABLE D

Ca in Whey Powder IAEA-155 [mg/g]
Influence of measurement methods

Method	Means of total results	selected results	outliers ?
AAS	32.0 ± 14.6 (n=10)	42.3 ± 2.6 (n=6)	12.2 ± 6.2 (n=3) 30.4 (n=1)
NAA	38.0 ± 10.8 (n= 8)	42.0 ± 5.0 (n=7)	14.5 (n=1)
ICP-ES	43.6 ± 2.5 (n= 4)	43.6 ± 3.5 (n=4)	
XRF	27.0 ± 11.0 (n= 2)		19.2 (n =1) 34.8(n=1)

Mean value total: 36.0 mg/g

95% confidence interval: 31.2 to 40.8

Mean value selected results: 42.1 mg/g

95% confidence interval: 40.4 - 43.9

TABLE NO. 1 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR AG IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	30	E6	3	7.46	0.63	8.4
2	41	N2	1	0.94		

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	37	N1	0.01

TABLE NO. 2 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR AL IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	7	E5	3	32.33	2.52	7.8	-2.2
2	9A	N2	4	52.75	7.14	13.5	OK
3	9B	N2	4	57.75	9.54	16.5	OK
4	11	E5	4	48.52	5.59	11.5	OK
5	13	A2	3	4.57	0.06	1.3	LO
6	30	E6	3	11.10	1.32	11.9	-20.3
7	34	A2	5	1.33	0.08	6.3	LO
8	39	N2	3	72.33	4.51	6.2	1.0
9	42	E6	6	47.28	1.36	2.9	OK
10	44	N2	5	48.42	3.66	7.6	OK
11	45	N5	6	135.87	38.33	28.2	1.8
12	50	E6	6	45.77	1.98	4.3	OK
13	52	E5	6	35.50	0.55	1.5	-4.5
14	55	A1	6	109.00	10.10	9.3	4.1
15	56	E6	6	33.63	1.67	5.0	-2.6
16	57	A1	3	51.67	3.21	6.2	OK
17	58	A1	4	32.02	3.47	10.8	-1.7
18	59	A2	3	67.09	9.72	14.5	OK
19	60	A3	6	66.40	1.76	2.6	OK
20	66	A1	2	57.55	0.86	1.5	OK
21	67	A1	4	100.00	0.00	0.0	HI

** FOR CONFIDENCE INTERVAL 37.99 TO 67.81

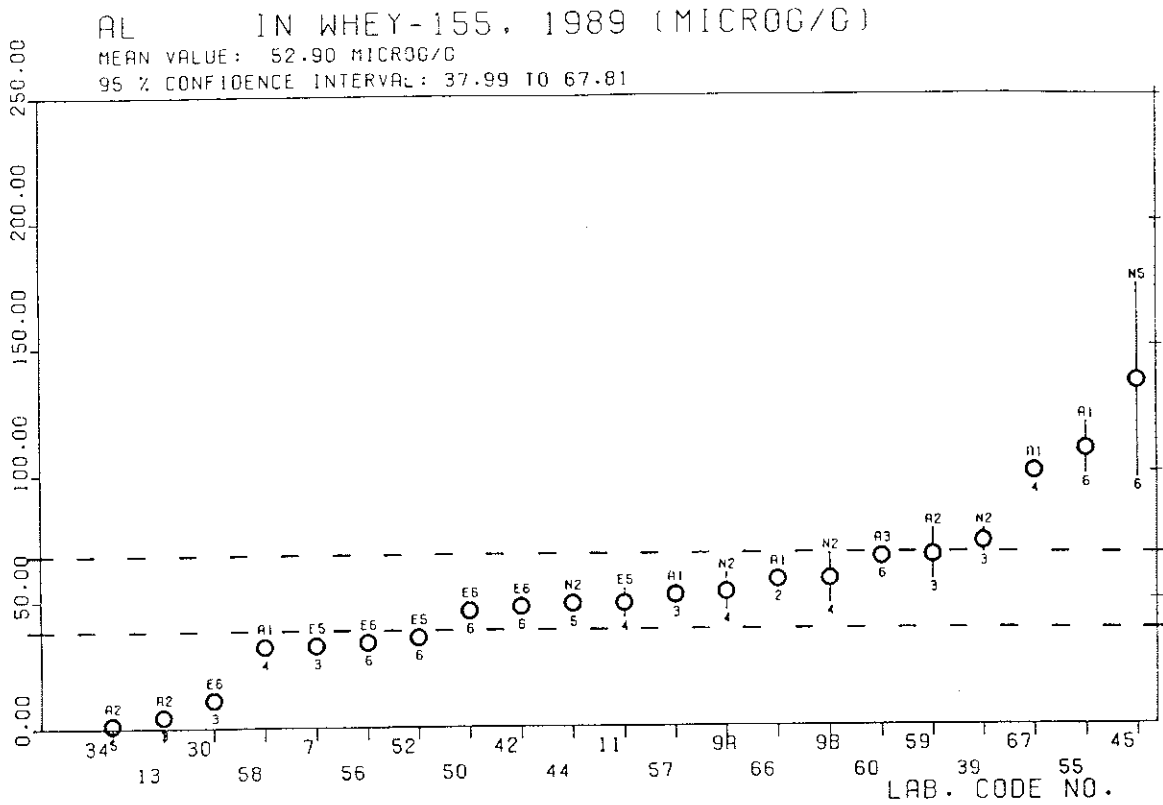


TABLE NO. 3 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR AS IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO. OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	14	A5	4	63.75	0.96	1.5	OK
2	19	N1	5	45.32	0.59	1.3	OK
3	35	N2	3	1.33	0.65	48.8	-22.3
4	37	N2	4	27.25	7.41	27.2	OK
5	47	A5	3	67.33	0.58	0.9	OK
6	50	A5	6	91.67	4.08	4.5	2.1
7	52	E5	6	3893.33*	690.70	17.7	5.5

** FOR CONFIDENCE INTERVAL 15.82 TO 83.07

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	11	E5	10000.00
2	39	N2	700.00
3	55	A2	400.00

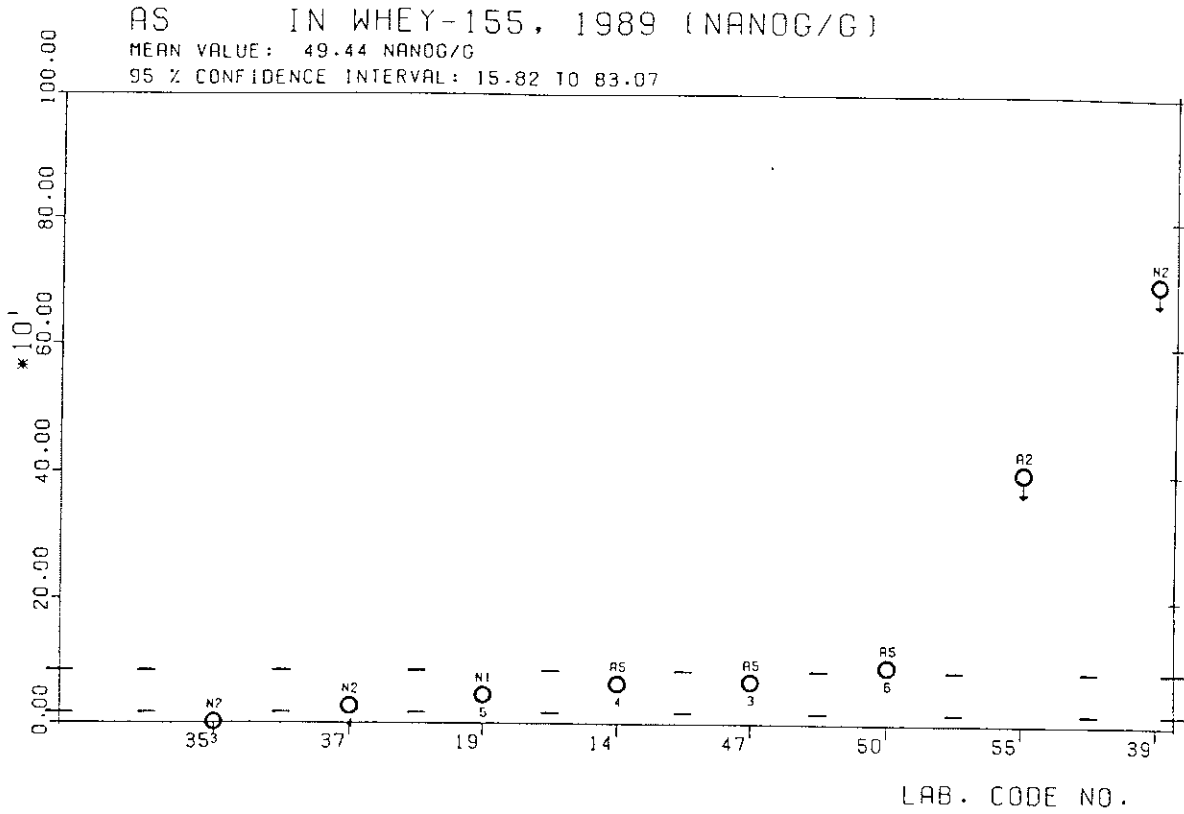


TABLE NO. 4 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR AU IN WHEY-155, 1989

UNIT: NANO/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	39	N2	3	3.00	0.36	12.0
2	41	N2	2	39.50	6.36	16.1

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	37	N1	50.00

TABLE NO. 5 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR B IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	11	E5	4	16.37*	5.69	34.7	1.8
2	47	C1	4	5.65	0.10	1.8	OK
3	50	E6	6	4.60	0.15	3.4	OK
4	51	C1	5	6.54	0.52	7.9	1.0
5	52	E5	6	4.14	0.10	2.3	-1.2
6	56	E6	6	5.07	0.23	4.4	OK
7	57	C1	2	4.85	0.49	10.2	OK

** FOR CONFIDENCE INTERVAL 4.25 TO 6.03

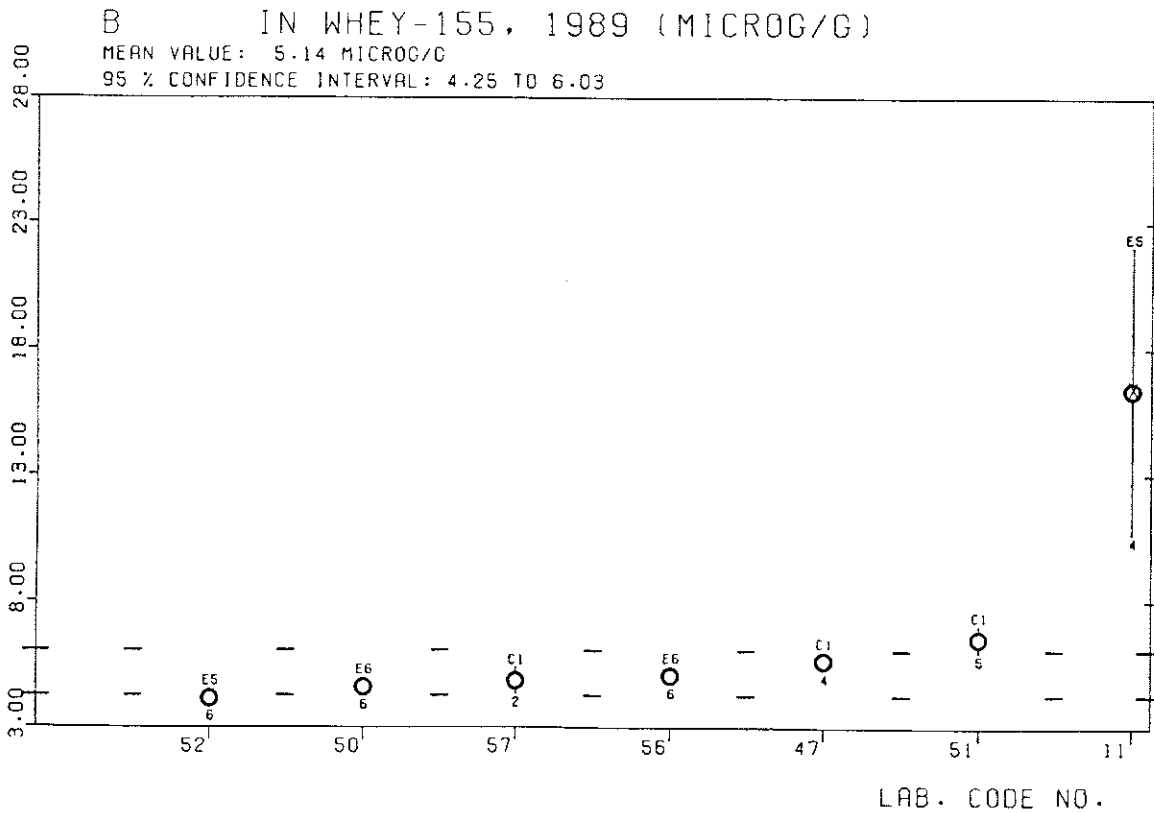


TABLE NO. 6 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR BA IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	7	E5	3	0.47	0.06	12.4
2	16	A1	5	335.60*	26.56	7.9
3	30	E6	3	6.77	0.11	1.6
4	41	X1	1	28.00		

TABLE NO. 7 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR BR IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	5	N2	6	29.72	1.26	4.2	-5.1
2	6	N2	6	35.35	1.03	2.9	-0.7
3	9A	N2	6	35.00	3.63	10.4	-0.3
4	9B	N2	6	35.33	2.50	7.1	-0.3
5	15	N2	6	34.71	1.31	3.8	-1.1
6	18	N2	6	42.75	1.84	4.3	0.4
7	20	N2	6	35.95	3.35	9.3	-0.0
8	23A	N3	5	48.89	6.18	12.6	1.1
9	23B	N3	6	49.07	9.64	19.6	0.7
10	24	N2	6	42.08	4.21	10.0	0.0
11	26	N2	6	33.51	2.01	6.0	-1.3
12	27	N2	6	36.52	1.14	3.1	OK
13	28	N2	6	32.48	2.22	6.8	-1.6
14	35	N2	3	12.80*	1.00	7.8	-23.3
15	37	N2	4	35.75	1.26	3.5	-0.3
16	39	N2	3	46.13	2.57	5.6	1.6
17	41A	X1	3	40.33	5.51	13.7	OK
18	41B	N2	3	47.00	4.36	9.3	1.1
19	44	N2	6	42.55	0.19	0.4	2.9

** FOR CONFIDENCE INTERVAL 36.11 TO 42.01

BR IN WHEY-155, 1989 (MICROG/G)

MEAN VALUE: 39.06 MICROG/G

95 % CONFIDENCE INTERVAL: 36.11 TO 42.01

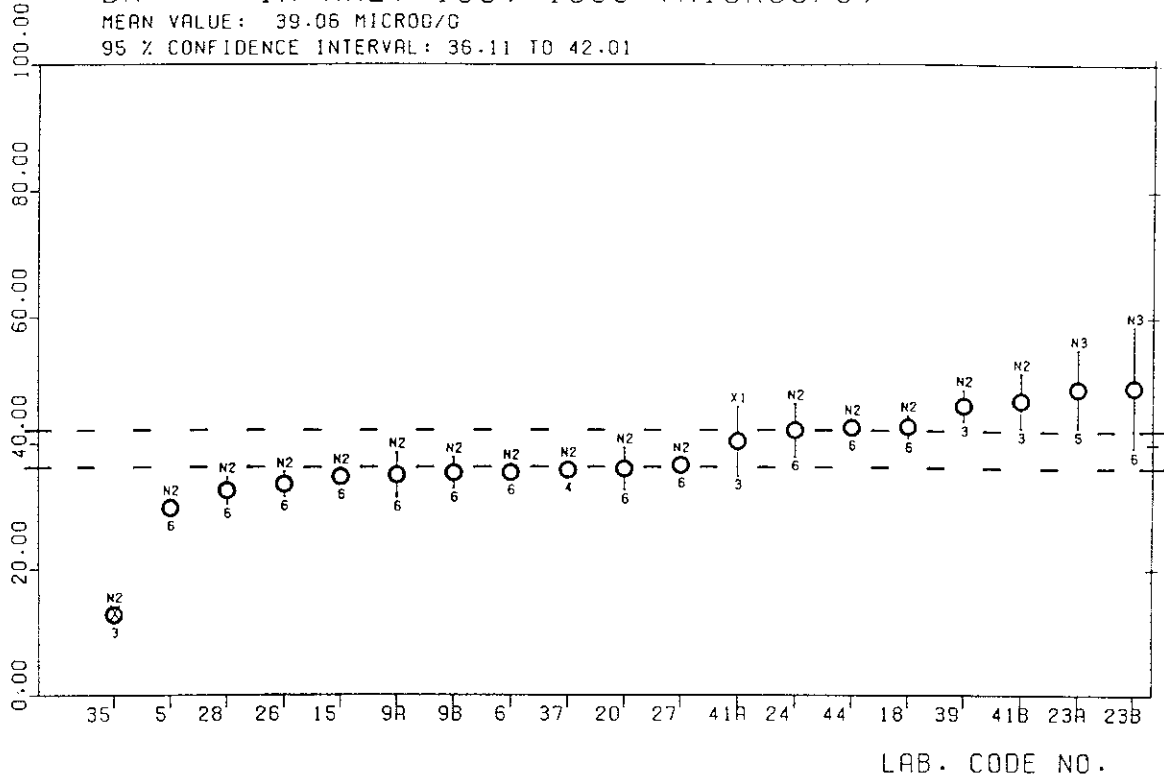


TABLE NO. 8 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CA IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	5	N2	6	33.18	1.77	5.3	OK
2	6	P2	3	41.10	1.10	2.7	0.3
3	7	E5	3	40.74	0.11	0.3	OK
4	8	A1	5	5.21	0.09	1.8	LO
5	10	A1	6	39.22	0.67	1.7	OK
6	11	E5	4	44.45	2.46	5.5	1.5
7	12	A1	6	44.40	0.33	0.8	10.8
8	13	A1	4	40.60	1.54	3.8	OK
9	14	E2	4	46.65	0.65	1.4	9.1
10	15	N2	6	41.16	2.01	4.9	0.2
11	16	A1	5	16.91	0.60	3.5	-24.0
12	18	N2	6	41.42	1.98	4.8	0.3
13	20	N2	6	14.48	2.77	19.1	-6.0
14	22	A1	5	40.86	1.19	2.9	0.1
15	25	A1	5	14.48	0.89	6.1	-18.8
16	26	N2	6	43.08	2.44	5.7	0.9
17	27	N2	6	48.87	1.68	3.4	4.8
18	33	A1	4	46.19	0.56	1.2	9.6
19	34	A1	5	42.44	0.87	2.1	1.9
20	36	X3	6	19.20	4.36	22.7	-2.8
21	39	N2	3	46.67	2.61	5.6	2.3
22	41A	X1	3	34.80	1.35	3.9	OK
23	41B	N2	1	37.00			OK
24	42	E5	6	42.64	0.51	1.2	3.6
25	44	N2	6	39.68	0.42	1.1	OK
26	49	A1	6	30.41	0.32	1.0	-2.5

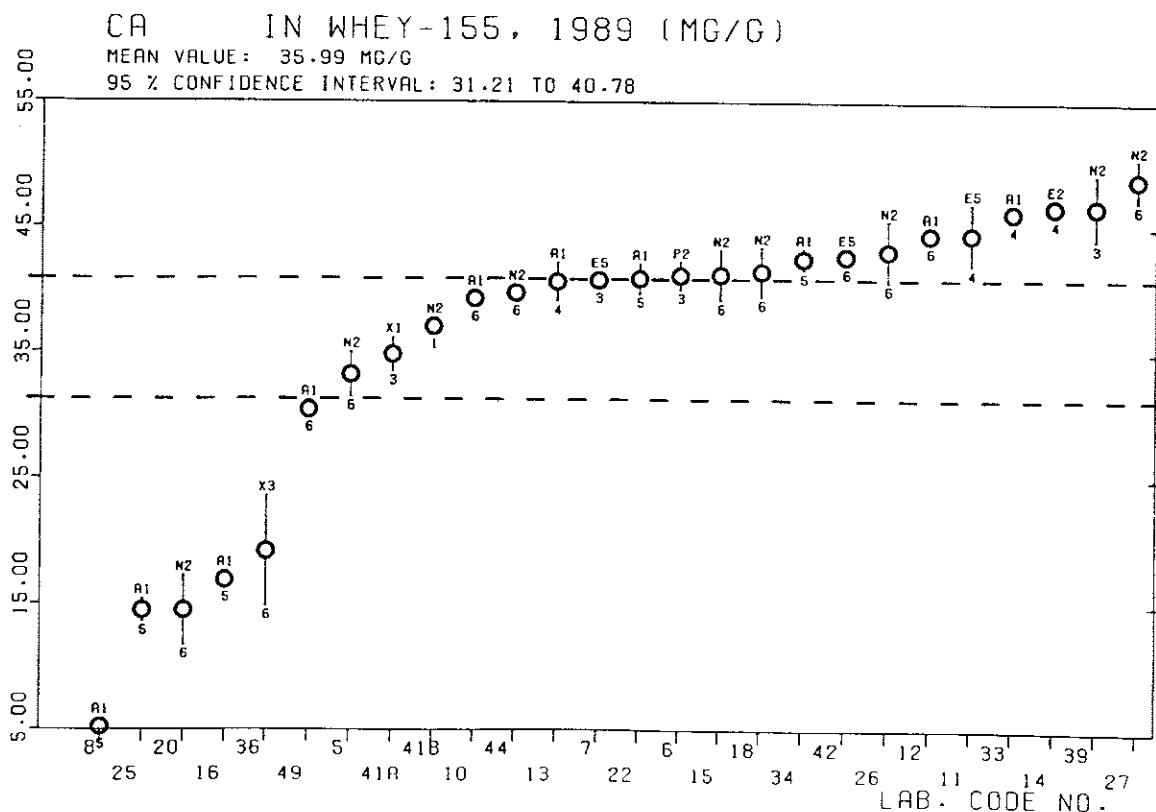


TABLE NO. 9 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CD IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	4	V1	6	12333.33*	1366.26	11.1	9.0
2	8	A1	5	690.00*	82.16	11.9	8.2
3	13	A2	4	19.50	1.91	9.8	OK
4	14	A3	4	14.50	3.00	20.7	OK
5	19	N1	5	247.28*	7.26	2.9	31.4
6	29	A2	3	29.33	6.66	22.7	1.5
7	35	N2	3	0.73	0.06	7.9	LO
8	41	N2	1	38000.00*			HI
9	47	A2	4	18.25	3.20	17.5	OK
10	48	A3	4	14.75	2.87	19.5	OK
11	50	A2	6	15.00	5.48	36.5	OK
12	52	E5	6	66.00*	18.78	28.5	2.5
13	53A	A2	3	48.00*	8.72	18.2	3.3
14	54	A3	6	15.67	1.37	8.7	OK
15	55	A2	6	20.00	0.00	0.0	HI
16	56	A3	6	15.33	1.37	8.9	OK
17	60	A3	6	19.83	0.41	2.1	0.6
18	61	A2	6	14.38	0.52	3.6	OK
19	62	A3	3	30.00	2.00	6.7	5.2
20	63	A2	4	6.20	1.21	19.4	-5.2
21	64	A2	3	5.70	3.20	56.2	-2.1
22	65	A2	4	17.27	0.89	5.1	OK
23	66	A2	3	14.00	0.00	0.0	OK
24	67	A2	4	45.00*	5.77	12.8	4.4
25	69	V1	6	18.00	1.32	7.3	OK

** FOR CONFIDENCE INTERVAL 12.46 TO 19.59

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	3	A1	50.00
2	11	E5	1500.00
3	16	A1	250.00
4	46	A3	30.00
5	57	A1	500.00

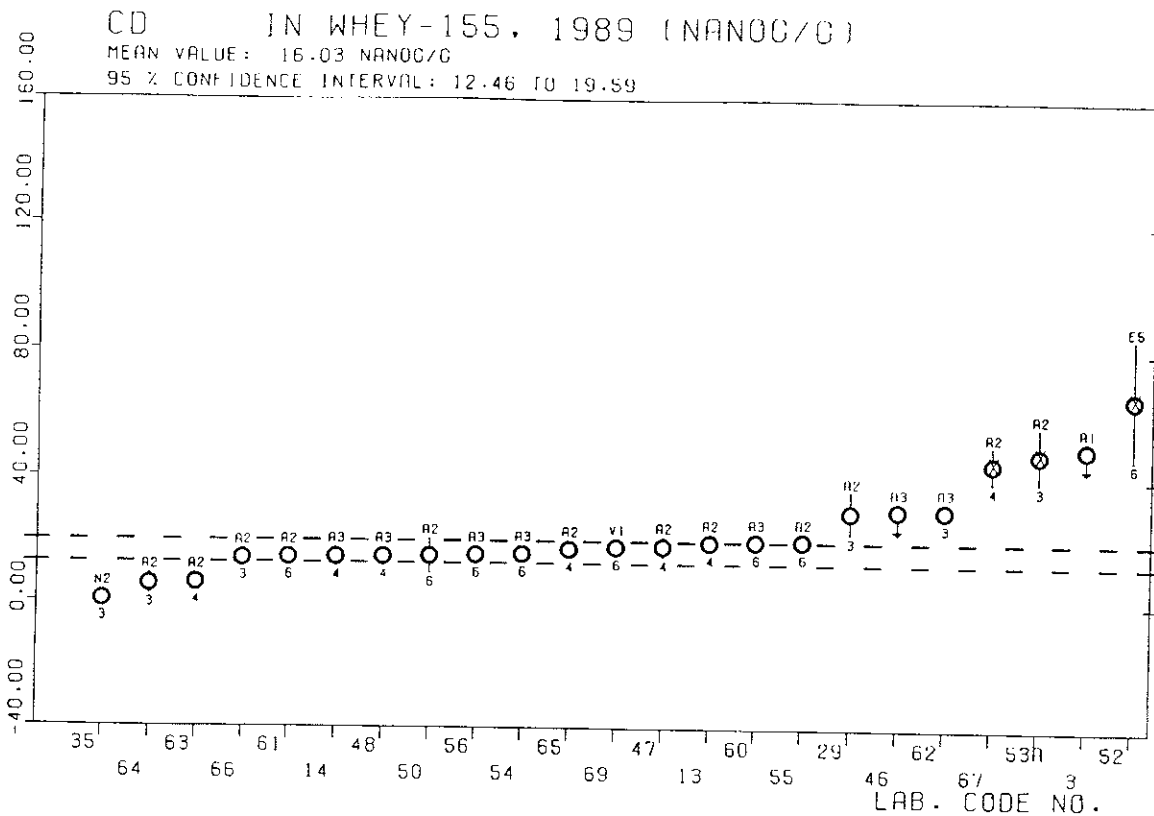


TABLE NO. 10 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CL IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	5	N3	6	66.25	0.92	1.4	OK
2	6	N2	4	63.90	5.28	8.3	-0.4
3	9A	N2	5	73.80	7.26	9.8	0.2
4	9B	N2	5	74.00	6.52	8.8	0.3
5	15	N2	6	51.02*	1.48	2.9	-10.1
6	23	N3	5	64.04	8.83	13.8	-0.2
7	26	N2	6	65.13	2.81	4.3	-0.3
8	27	N2	6	70.69	2.34	3.3	OK
9	28	N2	6	72.17	2.32	3.2	OK
10	35	N2	4	9.55*	0.63	6.6	-89.0
11	39	N2	3	75.27	2.61	3.5	1.1
12	41	X1	3	89.00*	20.30	22.8	0.8
13	44	N2	6	66.22	0.88	1.3	OK
14	45	N5	6	87.41*	5.54	6.3	2.7

** FOR CONFIDENCE INTERVAL 65.94 TO 72.35

CL IN WHEY-155, 1989 (MG/G)

MEAN VALUE: 69.15 MG/G

95 % CONFIDENCE INTERVAL: 65.94 TO 72.35

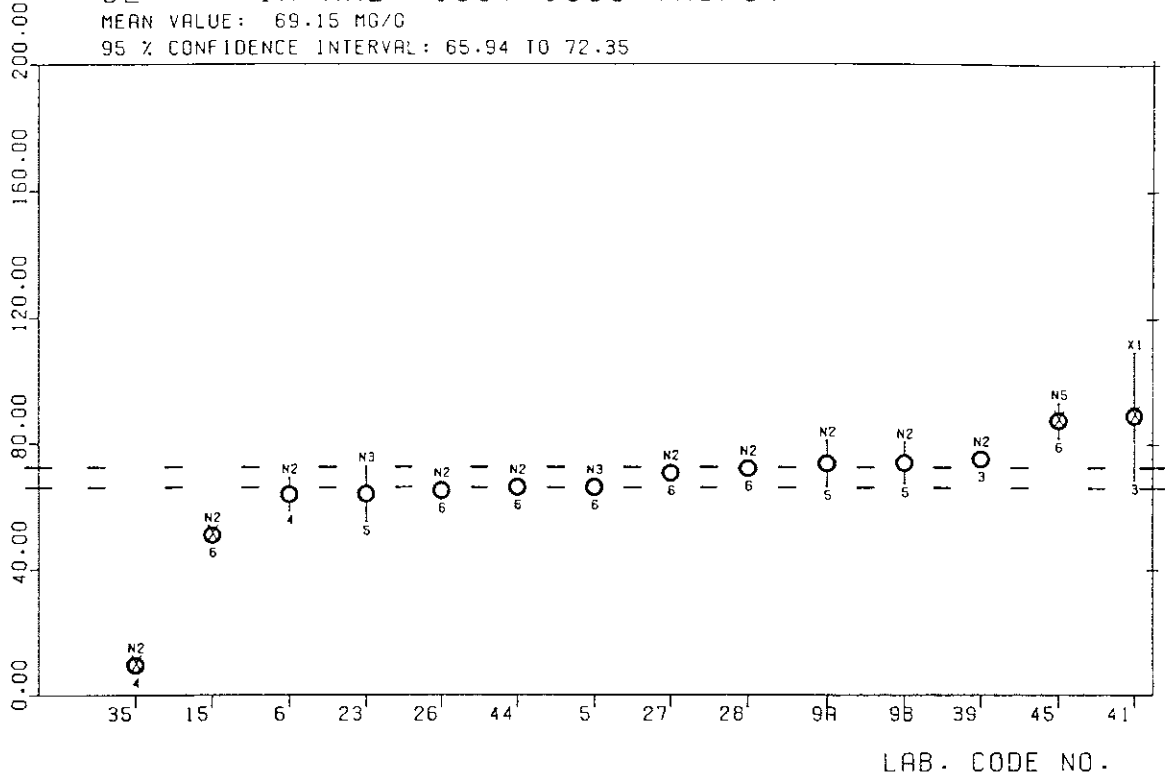


TABLE NO. 11 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CO IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	3	A1	6	350.00*	72.39	20.7	4.1
2	4	V1	5	28.00	5.74	20.5	-0.2
3	5	N2	6	59.33	3.78	6.4	0.9
4	6	N2	6	57.17	5.46	9.5	0.2
5	8	A1	5	2430.00*	290.69	12.0	8.2
6	9A	N2	2	45.00	7.07	15.7	OK
7	9B	N2	2	40.00	0.00	0.0	OK
8	13	A2	4	9.25	4.11	44.5	-4.9
9	15	N2	6	8.89	1.60	18.0	-12.7
10	17	A1	5	4980.00*	89.44	1.8	55.1
11	18	N2	6	57.08	2.52	4.4	0.4
12	23	N3	5	5.37	1.06	19.7	-22.6
13	24	N2	6	138.33*	9.83	7.1	8.4
14	27	N2	6	1003.33*	152.67	15.2	6.2
15	28	N2	6	59.67	5.35	9.0	0.7
16	31	N1	4	52.82	0.85	1.6	OK
17	37	N2	4	49.50	2.08	4.2	OK
18	38	N1	4	3.41	0.37	10.9	-69.7
19	39	N2	3	92.67	13.80	14.9	2.7
20	41	N2	1	200.00*			HI
21	43	N2	3	55.33	1.53	2.8	OK
22	44	N3	6	59.65	0.73	1.2	4.9

** FOR CONFIDENCE INTERVAL 29.29 TO 56.10

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	11	E5	1700.00
2	16	A1	1250.00

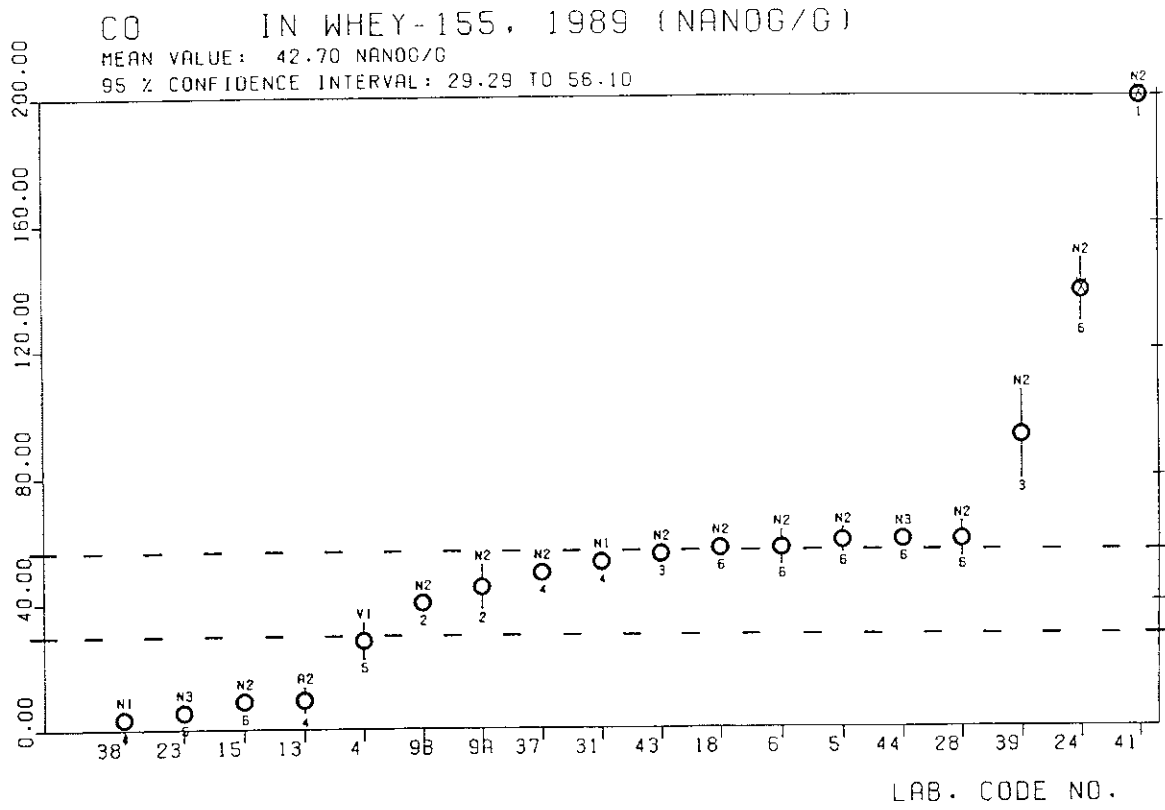


TABLE NO. 12 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CR IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	1	A1	3	1366.67*	20.82	1.5	33.8
2	2	X1	6	8016.66*	3795.48	47.3	1.9
3	3	A1	5	2484.00*	87.64	3.5	20.8
4	5	N2	6	646.67	30.77	4.8	OK
5	6	N2	6	509.67	213.04	41.8	-0.0
6	8	A1	5	2840.00*	518.89	18.3	4.2
7	12	A1	6	1716.67*	75.28	4.4	14.0
8	13	A2	4	512.50	55.00	10.7	OK
9	14	A3	4	517.50	52.52	10.1	OK
10	15	N2	3	187.78	21.46	11.4	-15.1
11	18	N2	6	645.17	74.21	11.5	OK
12	20	N2	6	723.33	141.52	19.6	0.4
13	22	A3	5	567.00	24.75	4.4	OK
14	24	N2	6	2688.33*	646.48	24.0	3.1
15	37	N2	4	617.50	62.38	10.1	OK
16	39	N2	3	423.33	55.08	13.0	-1.6
17	41	N2	2	3750.00*	919.24	24.5	3.4
18	42	E6	6	565.00	20.74	3.7	OK
19	43A	N2	6	595.00	32.71	5.5	OK
20	43B	N1	3	553.33	23.09	4.2	OK
21	44	N2	6	589.50	34.43	5.8	OK
22	46	A3	6	593.33	196.33	33.1	OK
23	47	A2	4	545.00	17.32	3.2	OK
24	50	A2	6	678.33	30.61	4.5	0.5
25	52	E5	6	990.00	20.98	2.1	15.6
26	54	A3	6	820.00	37.95	4.6	4.1
27	55	A2	6	1100.00	63.25	5.7	6.9
28	56	A2	6	756.67	36.15	4.8	2.6
29	58	A2	4	460.00	25.82	5.6	-2.0
30	59	A2	4	338.00	44.99	13.3	-3.9
31	60	A3	6	243.50	11.27	4.6	-23.8
32	61	A2	6	335.00	22.58	6.7	-7.8
33	62	A3	3	640.00	30.00	4.7	OK
34	64	A2	4	555.00	260.06	46.9	OK
35	65	A2	3	740.00	70.00	9.5	1.1
36	67	A1	4	1500.00*	577.35	38.5	1.4

** FOR CONFIDENCE INTERVAL 511.44 TO 663.42

RESULTS BELOW LIMIT OF DETECTION REPORTED FOR CR

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	11	E5	1000.00
2	16	A1	1250.00
3	57	A1	1000.00

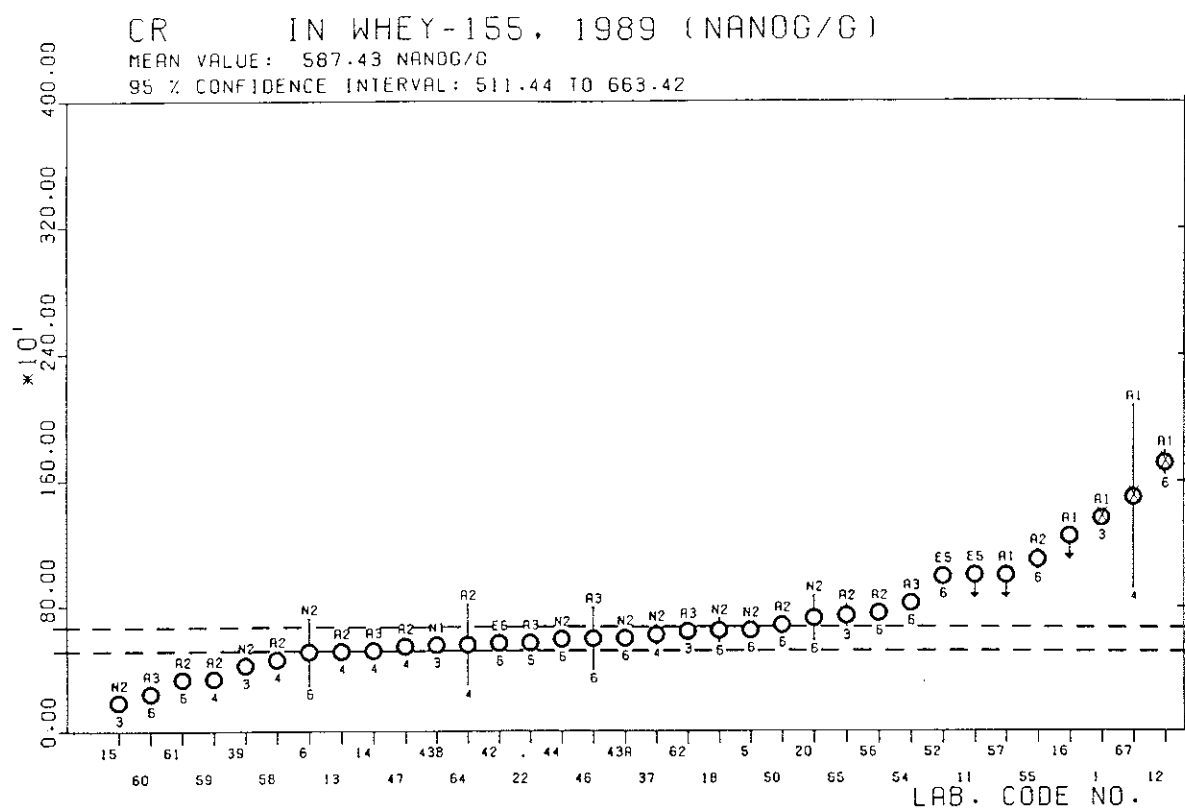


TABLE NO. 13 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CS IN WHEY-155, 1989

UNIT: NANO/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	6	N2	6	88.00	4.34	4.9	OK
2	15	N2	4	65.06	5.49	8.4	-1.0
3	18	N2	6	95.10	16.00	16.8	OK
4	20	N2	6	101.67	24.83	24.4	0.0
5	23	N3	4	152.91*	22.44	14.7	2.3
6	24	N2	6	108.33	24.83	22.9	0.3
7	27	N2	6	20146.66*	2595.87	12.9	7.7
8	28	N2	6	51.33	5.05	9.8	-3.8
9	37	N2	4	69.75	3.86	5.5	-0.2
10	39	N2	3	107.67	3.79	3.5	1.6
11	44	N2	6	88.00	1.46	1.7	OK

** FOR CONFIDENCE INTERVAL 70.71 TO 101.50

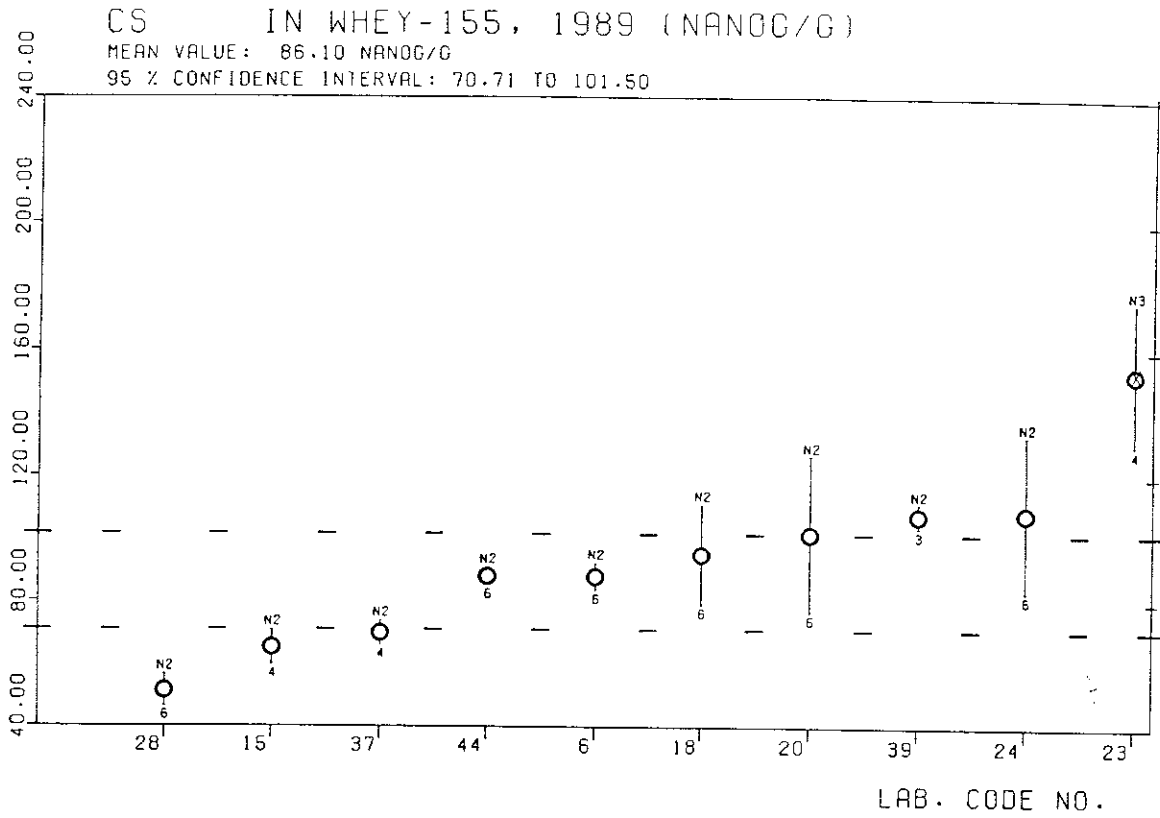


TABLE NO. 14 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR CU IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	1	A1	6	248.33	9.83	4.0	-21.3
2	3	A1	6	426.67	48.44	11.4	-0.6
3	4	A1	6	183.33	44.57	24.3	-6.2
4	7	E5	3	950.00	50.00	5.3	5.5
5	8	A1	5	1030.00	115.11	11.2	3.1
6	10	A2	6	1743.33*	394.85	22.6	2.7
7	12	A1	6	1600.00*	109.54	6.8	8.4
8	13	A1	4	310.00	34.64	11.2	-4.3
9	14	A3	4	462.50	26.30	5.7	OK
10	17	A1	5	2084.00*	98.39	4.7	14.3
11	19	N1	5	1996.26*	15.17	0.8	87.0
12	22	A3	5	965.40	55.92	5.8	5.2
13	25	A1	5	5900.00*	412.31	7.0	12.7
14	29	A2	3	308.67	26.69	8.6	-5.6
15	30	E6	6	4501.66*	1283.31	28.5	3.0
16	32	A1	6	275.00	17.61	6.4	-10.4
17	33	A1	3	3547.23*	106.69	3.0	26.9
18	34	A1	5	3500.00*	533.85	15.3	5.3
19	35	N2	4	777.50	49.24	6.3	2.0
20	37A	N1	6	246.67	66.83	27.1	-3.2
21	37B	N2	6	515.00	50.50	9.8	OK
22	41	X1	3	38333.33*	6110.10	15.9	6.2
23	42	E6	6	411.67	85.42	20.7	-0.5
24	46	A3	6	326.67	60.55	18.5	-2.2
25	47	A2	4	442.50	22.17	5.0	-0.7
26	49	A3	5	384.27	16.98	4.4	-4.3
27	50	E6	6	916.67	98.32	10.7	2.4
28	52	E5	6	790.00	24.49	3.1	4.6
29	53A	A1	3	7069.00*	310.04	4.4	20.6
30	53B	A1	4	1855.00*	306.00	16.5	3.9
31	54	A3	6	588.33	21.37	3.6	OK
32	55	A2	6	1900.00*	219.09	11.5	5.6
33	56	A2	6	393.33	32.66	8.3	-2.0
34	58	A2	4	1200.00	81.65	6.8	6.4
35	59	A2	2	1875.00*	77.78	4.1	15.4
36	60	A3	6	384.00	8.58	2.2	-8.6
37	61	A1	6	645.00	22.58	3.5	OK
38	62	A3	3	616.67	15.28	2.5	OK
39	65	A2	3	630.00	36.06	5.7	OK
40	66	A2	3	1006.67	9.50	0.9	34.7
41	67	A1	4	1500.00*	577.35	38.5	1.4
42	69	V1	6	451.50	34.27	7.6	-0.2

** FOR CONFIDENCE INTERVAL 457.85 TO 676.89

RESULTS BELOW LIMIT OF DETECTION REPORTED FOR CU

NO.	LAB. CODE	METHOD CODE	LAB. LOD
1	11	E5	900.00
2	16	A1	1250.00
3	57	A1	1000.00

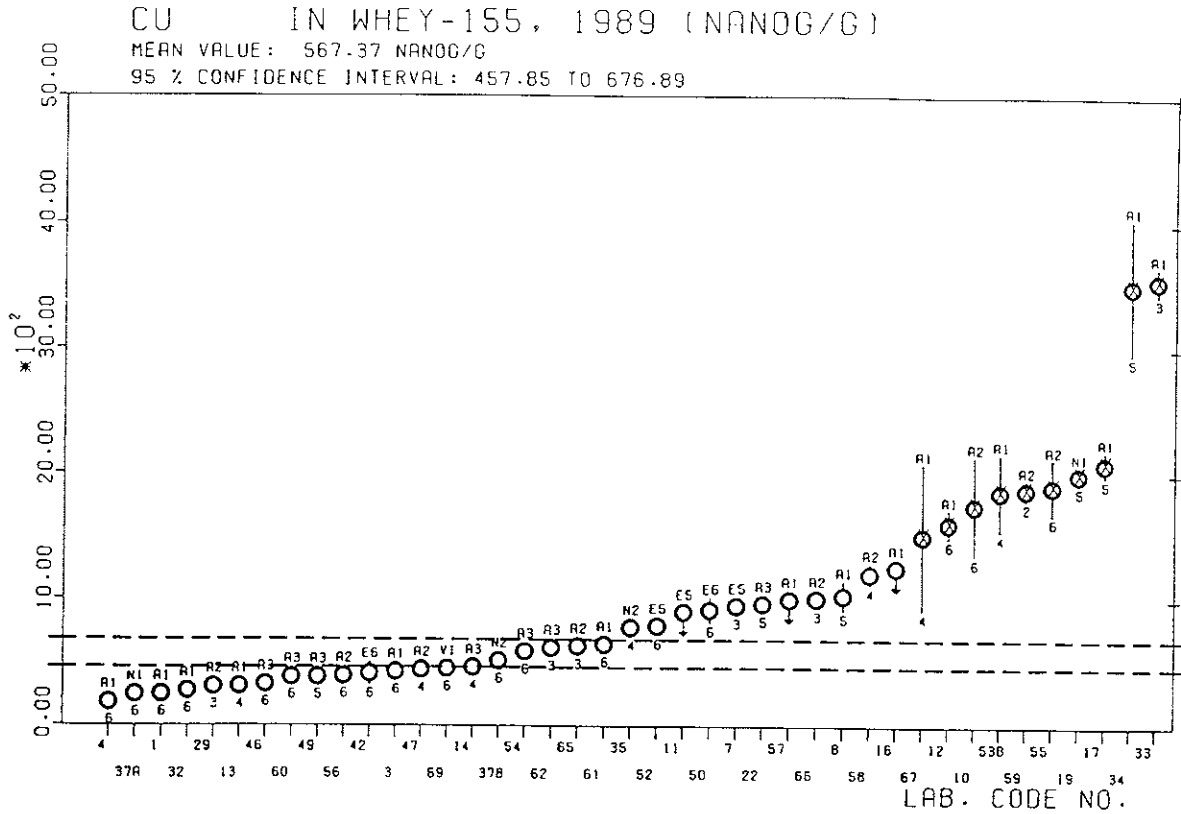


TABLE NO. 15 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR EU IN WHEY-155, 1989

UNIT: NANOGRAM/G

NO.	LAB. CODE	METHOD CODE	NO. OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	39	N2	3	10.67	2.08	19.5
2	41	N2	1	110.00*		
3	44	N3	6	7.38	0.39	5.3

TABLE NO. 16 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR FE IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	1	A1	3	62.13	1.94	3.1	OK
2	2	X1	6	2816.67*	30.75	1.1	89.2
3	3	A1	6	38.30	1.69	4.4	-7.1
4	5	N2	6	9.42	0.67	7.1	-61.1
5	6	N2	6	71.05	9.39	13.2	OK
6	7	E5	3	40.00	1.00	2.5	-10.3
7	8	A1	5	4.45	0.23	5.2	LO
8	9A	N2	4	64.75	9.81	15.2	OK
9	9B	N2	4	66.25	4.92	7.4	OK
10	10	A1	6	64.47	0.87	1.3	OK
11	11	E5	4	67.35	4.59	6.8	OK
12	12	A1	6	66.17	0.75	1.1	OK
13	13	A1	4	74.75	3.20	4.3	0.1
14	14	A1	4	73.75	0.96	1.3	OK
15	15	N2	5	60.37	10.17	16.8	OK
16	16	A1	5	71.80	5.43	7.6	OK
17	17	A1	5	90.48	1.76	1.9	9.1
18	18	N2	6	76.52	2.98	3.9	0.7
19	20	N2	6	36.27	4.06	11.2	-3.5
20	23	N3	5	7.68	2.66	34.7	-16.0
21	24	N2	6	106.30	10.97	10.3	2.9
22	26	N2	6	23.77	1.50	6.3	-17.8
23	27	N2	6	24.61	1.59	6.5	-16.2
24	28	N2	6	68.92	1.51	2.2	OK
25	30	E6	6	120.42	3.35	2.8	13.7
26	33	A1	3	57.83	0.45	0.8	OK
27	36	X3	6	17.18	4.02	23.4	-8.3
28	37	N2	4	67.75	3.69	5.4	OK
29	38	N1	4	2.66	0.34	12.6	LO
30	39	N2	3	69.33	0.58	0.8	OK
31	41A	X1	3	143.67	65.74	45.8	1.1
32	41B	N2	3	154.67	38.28	24.7	2.1
33	42	E5	6	69.90	3.62	5.2	OK
34	43	N2	3	74.33	3.21	4.3	OK
35	44	N2	6	69.53	1.08	1.5	OK
36	49	A1	4	66.88	16.18	24.2	OK

** FOR CONFIDENCE INTERVAL 50.34 TO 74.44

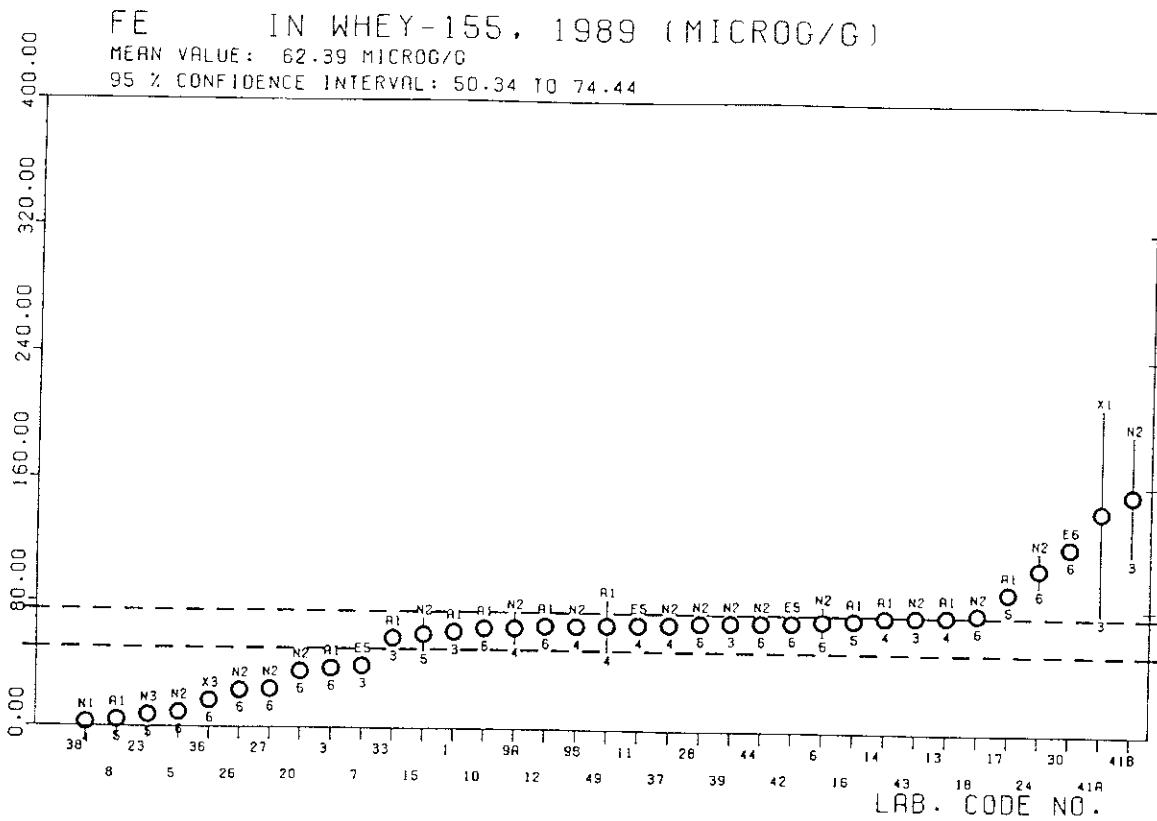


TABLE NO. 17 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR HF IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	N2	1	11.00		

TABLE NO. 18 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR HG IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	4	A4	6	2.03	0.20	9.9	OK
2	14	A4	4	1.92	0.13	6.5	OK
3	21	A4	4	5.55	1.58	28.4	1.1
4	27	N2	6	2841.67*	271.10	9.5	10.5
5	28	N2	6	4.33	0.52	11.9	1.1
6	41	N2	3	54333.33*	9139.83	35.2	2.8
7	47	A4	3	2.70	0.17	6.4	OK
8	52	A4	6	18.17*	2.32	12.8	6.2
9	54	A3	6	0.75	0.05	7.3	-13.3
10	56	A4	6	2.78	0.33	11.9	OK
11	60	A4	6	1.45	0.24	16.8	-0.1
12	63	A4	4	2.07	0.33	15.9	OK

** FOR CONFIDENCE INTERVAL 1.48 TO 3.76

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	1	A1	0.00
2	40	A4	2.00
3	43	N2	4.00
4	46	A5	30.00
5	48	A4	10.00
6	50	A5	5.00
7	55	A4	50.00
8	57	A4	500.00
9	61	A5	2.00
10	62	A3	5.00
11	65	A5	2.00

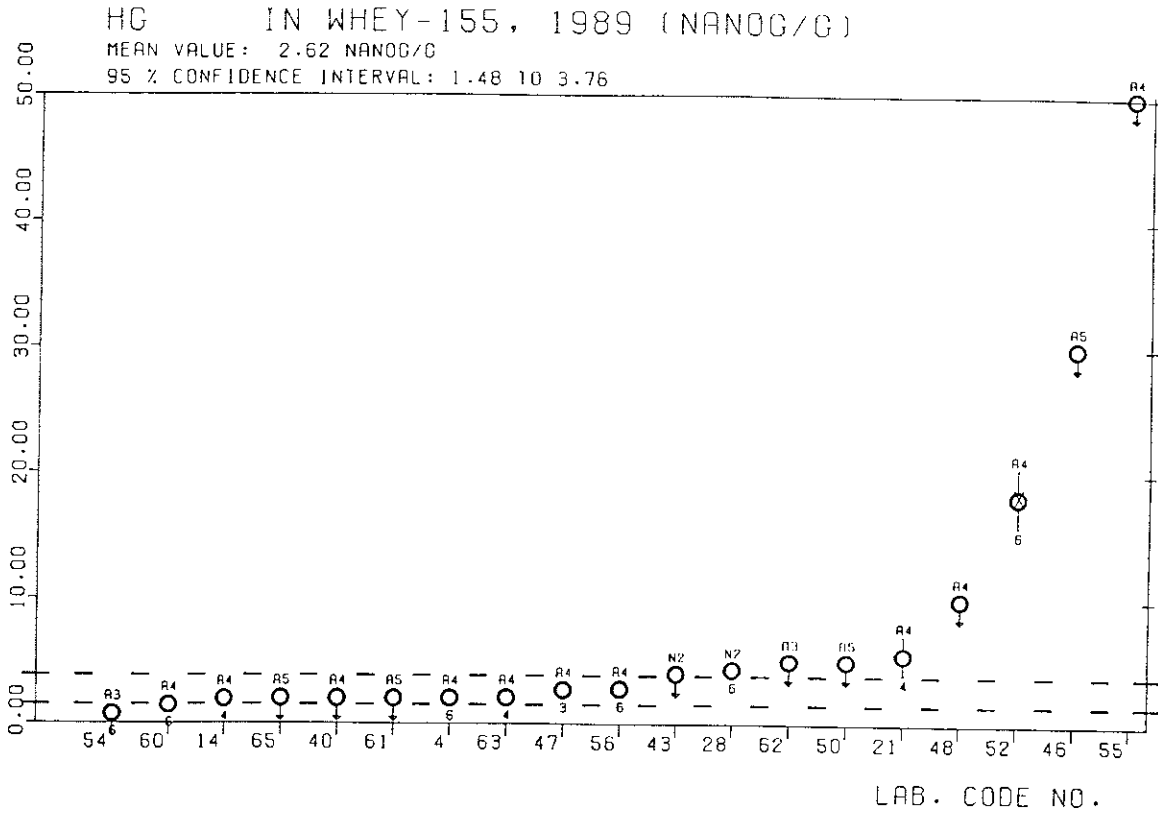


TABLE NO. 19 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR I IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	6	P2	3	1.87	0.06	3.1

TABLE NO. 20 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR K IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE
					ABS	REL %	
1	5	N2	6	44.03	1.84	4.2	OK
2	6	N2	4	49.90	0.65	1.3	2.7
3	7	E5	3	50.10	0.16	0.3	12.5
4	8	A1	5	51.13	1.90	3.7	1.6
5	10	A1	6	43.73	1.49	3.4	OK
6	11	E5	4	51.33	2.68	5.2	1.2
7	12	A1	6	50.80	0.88	1.7	3.1
8	13	A1	4	49.85	0.73	1.5	2.4
9	15	N2	6	39.03	1.16	3.0	OK
10	16	A1	5	14.79	1.77	12.0	-11.6
11	18	N2	6	53.13	2.77	5.2	1.8
12	20	N2	6	38.94	2.11	5.4	OK
13	22	A1	5	45.34	0.69	1.5	OK
14	25	A1	5	9.64	0.62	6.5	-41.3
15	26	N2	6	25.13	1.44	5.7	-7.1
16	27	N2	6	24.27	1.42	5.9	-7.8
17	28	N2	6	52.67	2.80	5.3	1.6
18	34	E2	6	51.40	1.29	2.5	2.6
19	35	N2	6	16.72	0.76	4.6	-24.4
20	36	X3	6	23.18	5.04	21.7	-2.4
21	39	N2	3	28.87	2.02	7.0	-3.2
22	41A	N2	3	69.33	9.02	13.0	2.4
23	41B	X1	3	66.27	7.22	10.9	2.5
24	44	N2	6	47.22	0.50	1.1	OK
25	45	N5	6	46.48	2.42	5.2	OK

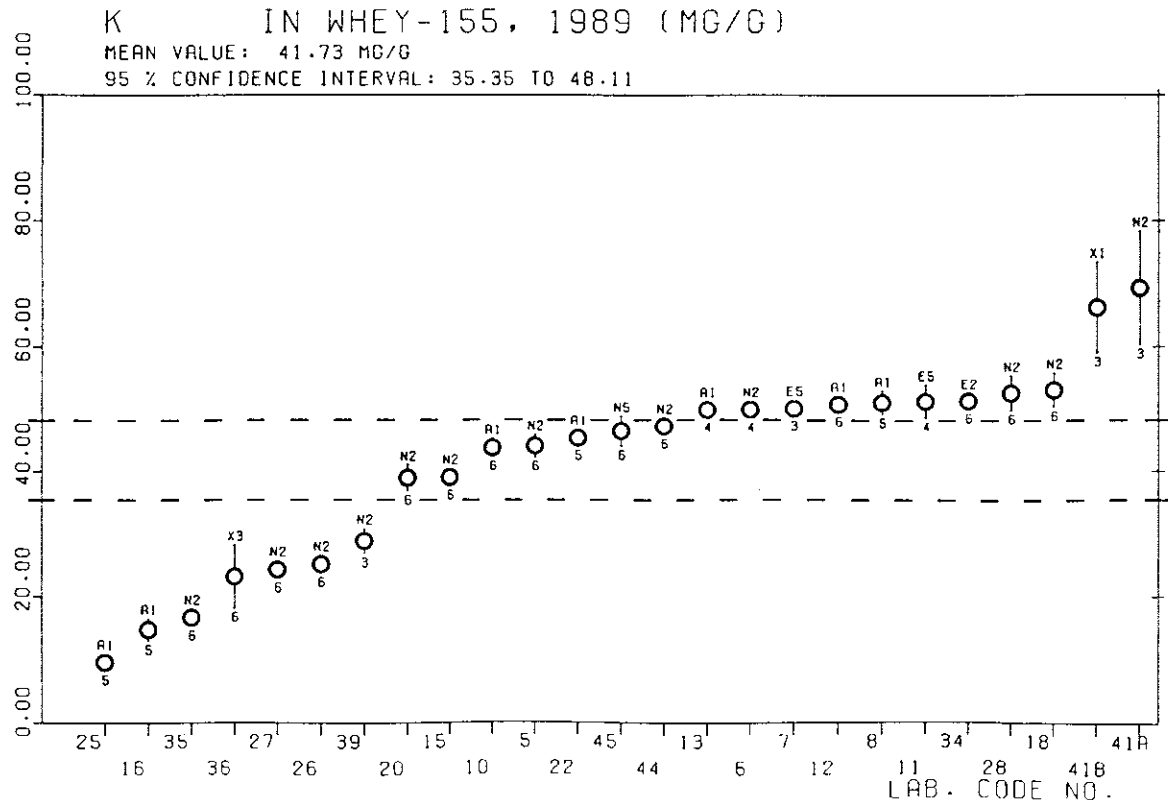


TABLE NO. 21 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR LA IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	37	N1	6	0.13	0.01	5.7
2	39	N2	3	0.24	0.01	4.9
3	44	N2	6	0.25	0.01	3.1

RESULTS BELOW LIMIT OF DETECTION REPORTED FOR LI

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	16	A1	0.25

TABLE NO. 22 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR LU IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	N2	1	0.12		

TABLE NO. 23 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR MG IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE
					ABS	REL %	
1	2	X1	6	1.33*	0.05	4.1	-31.4
2	6	P2	3	3.36	0.07	1.9	0.8
3	7	E5	3	3.02	0.03	1.0	-1.2
4	8	A1	5	1.08*	0.02	1.5	LO
5	10	A1	6	3.59	0.07	2.0	3.9
6	11	E5	4	2.99	0.15	5.0	-0.5
7	12	A1	6	3.26	0.08	2.4	OK
8	13	A1	4	3.16	0.11	3.5	OK
9	14	A1	4	3.19	0.05	1.6	OK
10	15	N2	6	2.08*	0.10	4.9	-9.5
11	16	A1	5	2.75	0.09	3.3	-3.4
12	22	A1	5	3.07	0.05	1.6	OK
13	23	N3	3	3.97*	0.22	5.5	3.0
14	25	A1	5	4.10*	0.45	10.9	1.8
15	30	E6	3	5.37*	0.19	3.5	11.0
16	33	A1	3	3.18	0.01	0.2	OK
17	34	A1	6	3.03	0.12	4.0	-0.2
18	39	N2	3	3.11	0.19	6.2	OK
19	42	E5	6	3.06	0.07	2.4	OK
20	44	N2	6	3.12	0.26	8.4	OK
21	45	N5	6	3.61	0.57	15.9	0.5
22	49	A1	6	3.48	0.30	8.5	0.6

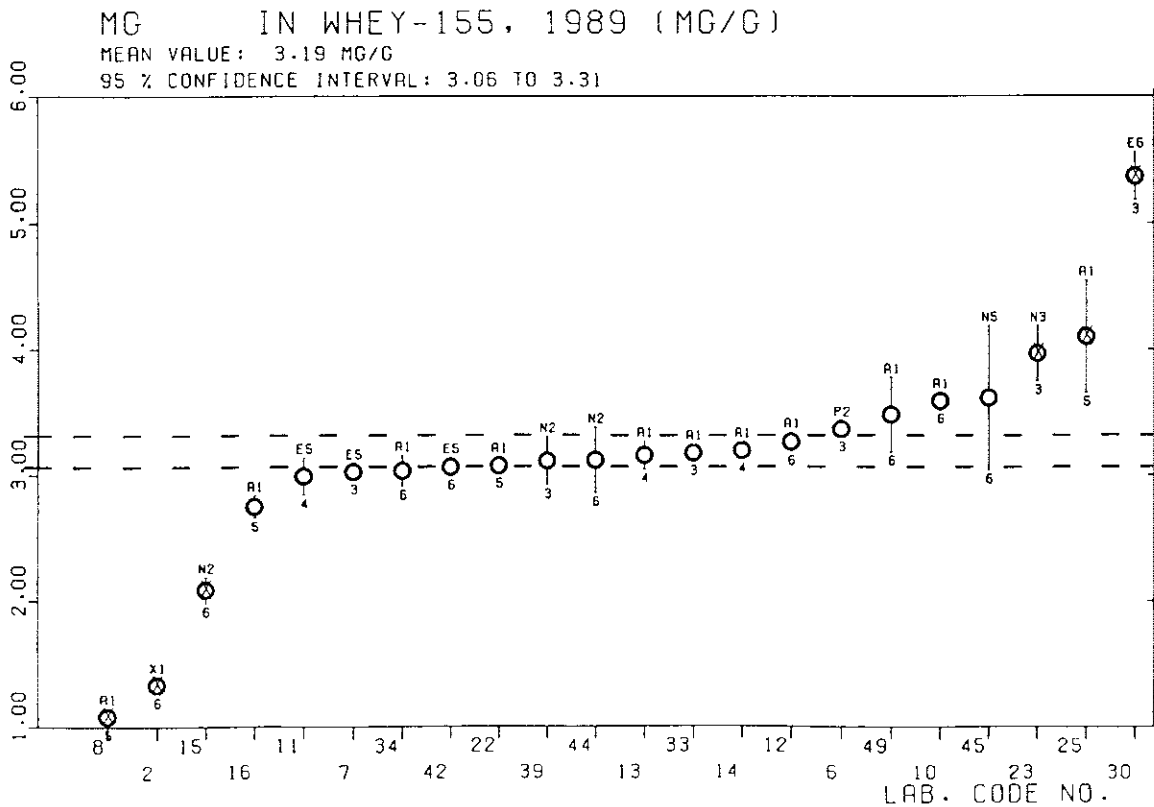
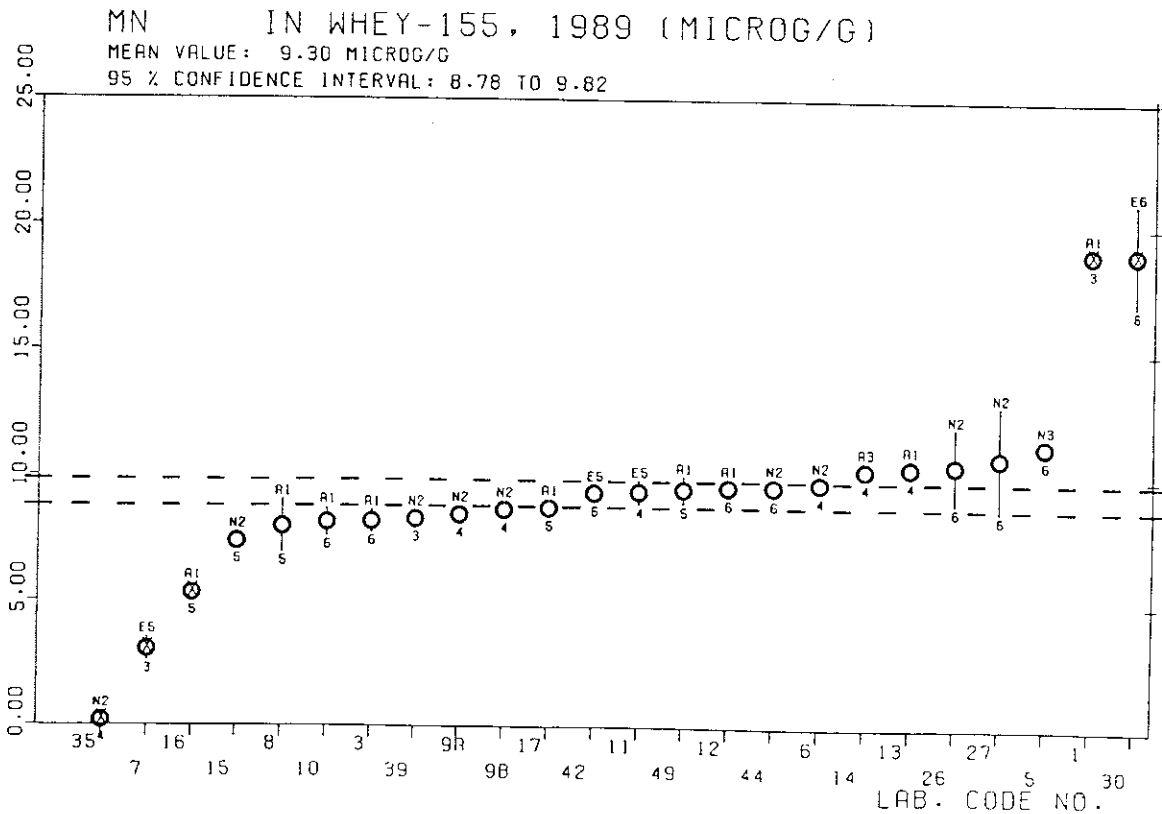


TABLE NO. 24 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR MN IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE
					ABS	REL %	
1	1	A1	3	18.97*	0.23	1.2	39.6
2	3	A1	6	8.20	0.42	5.1	-1.4
3	5	N3	6	11.31	0.34	3.0	4.4
4	6	N2	4	9.77	0.36	3.7	OK
5	7	E5	3	3.07*	0.45	14.7	-12.7
6	8	A1	5	8.00	1.03	12.9	-0.8
7	9A	N2	4	8.47	0.17	2.0	-1.8
8	9B	N2	4	8.67	0.29	3.3	-0.4
9	10	A1	6	8.17	0.55	6.7	-1.1
10	11	E5	4	9.42	0.46	4.9	OK
11	12	A1	6	9.60	0.13	1.3	OK
12	13	A1	4	10.42	0.36	3.4	1.7
13	14	A3	4	10.32	0.05	0.5	10.1
14	15	N2	5	7.40	0.26	3.5	-5.3
15	16	A1	5	5.32*	0.13	2.4	-26.6
16	17	A1	5	8.76	0.09	1.0	-0.2
17	26	N2	6	10.53	1.50	14.2	0.5
18	27	N2	6	10.83	2.08	19.2	0.5
19	30	E6	6	18.98*	1.99	10.5	4.6
20	35	N2	4	0.19*	0.02	10.7	LO
21	39	N2	3	8.30	0.30	3.6	-1.6
22	41	X1	3	136.00*	45.18	33.2	2.8
23	42	E5	6	9.36	0.18	1.9	OK
24	44	N2	6	9.62	0.37	3.8	OK
25	49	A1	5	9.52	0.53	5.5	OK



RESULTS BELOW LIMIT OF DETECTION REPORTED FOR MO

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	11	E5	1000.00

TABLE NO. 25 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR N IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	45	N5	6	36.67	2.26	6.2

TABLE NO. 26 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR NA IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	5	N2	6	16.03	0.64	4.0	OK
2	6	N2	4	16.00	0.45	2.8	OK
3	7	E5	3	14.90	0.05	0.3	-7.2
4	8	A1	5	17.55	1.72	9.8	0.7
5	10	A1	6	14.32	0.31	2.1	-3.0
6	11	E5	4	15.80	0.67	4.3	OK
7	12	A1	6	16.18	0.24	1.5	OK
8	13	A1	4	14.52	0.25	1.7	-2.8
9	15	N2	6	15.68	0.93	5.9	OK
10	16	A1	5	6.03*	0.30	5.1	-30.2
11	17	A1	5	14.58	0.10	0.7	-6.4
12	18	N2	6	17.72	0.76	4.3	1.7
13	20	N2	6	13.46	0.42	3.1	-4.2
14	22	A1	5	15.80	0.89	5.6	OK
15	23	N3	5	14.64	0.95	6.5	-0.6
16	25	A1	5	4.16*	0.72	17.2	-15.5
17	26	N2	6	18.57	2.14	11.6	1.0
18	27	N2	6	15.25	0.95	6.2	OK
19	28	N2	6	17.05	0.30	1.8	2.1
20	34	E2	6	16.67	0.32	1.9	0.8
21	35	N2	6	6.59*	0.45	6.8	-19.2
22	39	N2	3	17.27	0.81	4.7	1.0
23	41	N2	3	14.41	0.79	5.5	-1.0
24	44	N2	6	15.90	0.00	0.0	OK

** FOR CONFIDENCE INTERVAL 15.23 TO 16.42

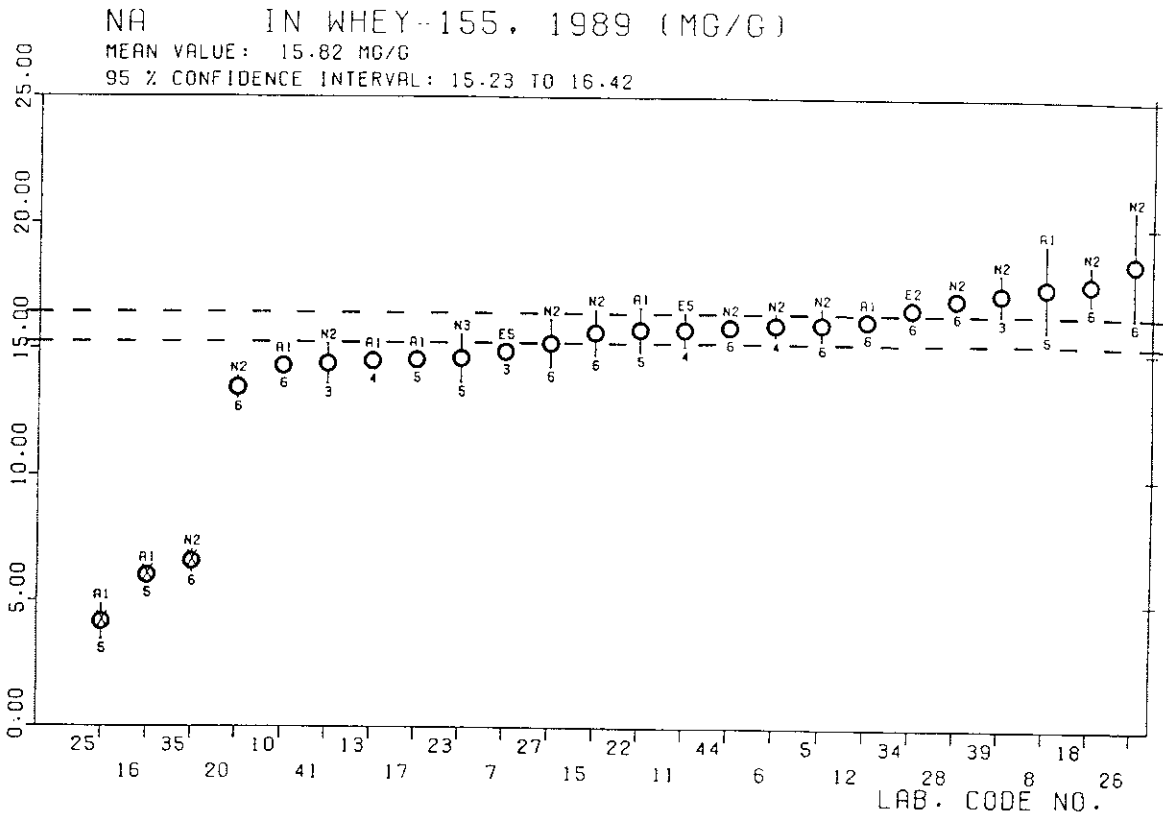


TABLE NO. 27 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR NI IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	2	X1	6	5.12*	2.42	47.3	1.9
2	3	A1	6	0.83	0.07	8.9	2.6
3	4	V1	6	0.42	0.03	8.2	-0.5
4	13	A2	4	0.55	0.02	2.7	OK
5	14	A3	3	0.55	0.06	11.2	OK
6	17	A1	5	3.20*	0.06	2.0	40.9
7	22	A3	5	2.03*	0.19	9.5	7.2
8	42	E6	6	0.57	0.08	14.1	OK
9	46	A3	6	0.49	0.09	17.5	OK
10	47	A2	4	0.72	0.01	1.1	9.8
11	50	A2	6	0.56	0.02	4.4	OK
12	52	E5	6	0.76	0.09	11.7	1.3
13	55	A2	6	0.31	0.04	12.2	-3.5
14	56	A2	6	0.75	0.02	2.5	6.1
15	58	A2	5	0.50	0.04	8.6	OK
16	61	A2	6	0.37	0.02	4.7	-4.2
17	62	A3	3	0.18	0.01	3.1	-46.5
18	65	A2	3	0.55	0.01	1.0	OK
19	66	A2	3	35.42*	0.73	2.0	47.9
20	67	A1	4	3.00*	0.82	27.2	2.9

** FOR CONFIDENCE INTERVAL 0.44 TO 0.64

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	11	E5	1.30
2	16	A1	1.25
3	57	A1	1.00

NI IN WHEY-155, 1989 (MICROG/G)

MEAN VALUE: 0.54 MICROG/G

95 % CONFIDENCE INTERVAL: 0.44 TO 0.64

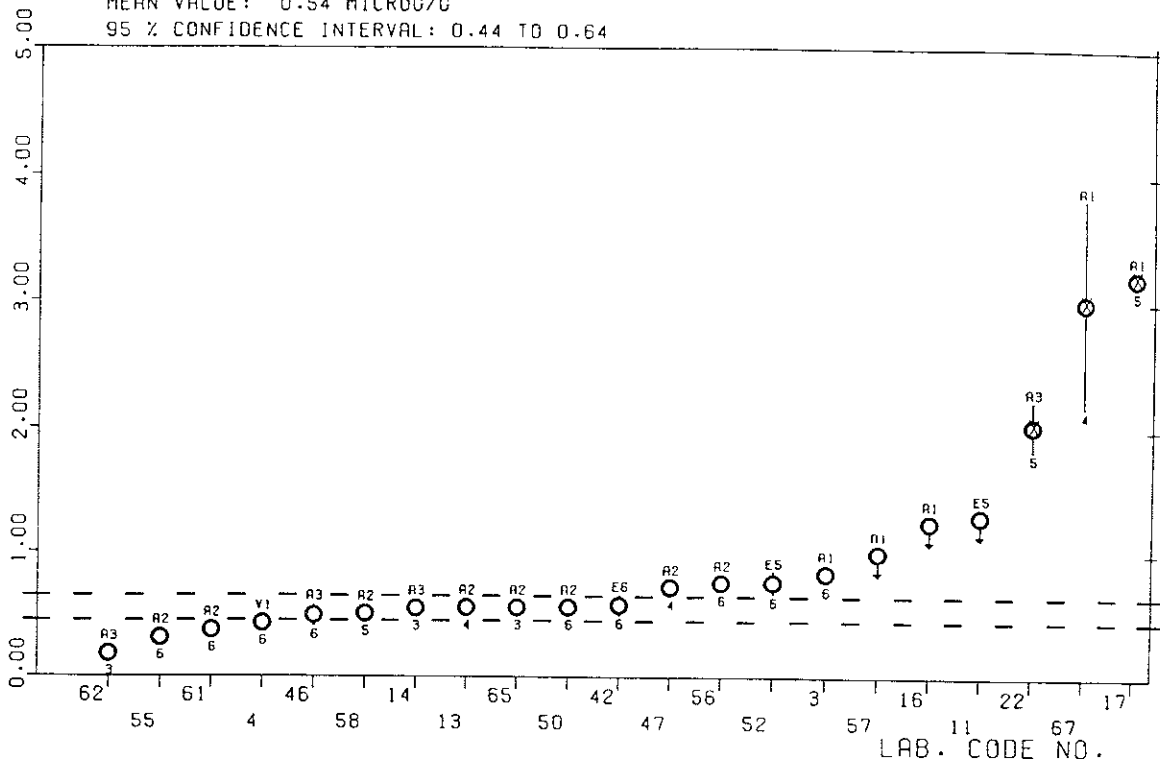


TABLE NO. 28 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR P IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	5	N5	6	15.62	0.45	2.9	OK
2	7	E5	3	17.56	0.56	3.2	1.1
3	11	E5	4	16.98	0.87	5.1	0.0
4	14	C1	4	16.83	1.13	6.7	OK
5	33	Z	2	16.38	0.43	2.6	OK
6	34	C1	5	14.74	0.64	4.3	-1.1
7	35	N2	3	16.07	0.40	2.5	OK
8	42	E5	6	17.25	0.20	1.2	1.5
9	44	N2	6	16.25	0.33	2.1	OK
10	45	N5	6	14.40	0.82	5.7	-1.3

** FOR CONFIDENCE INTERVAL 15.46 TO 16.95

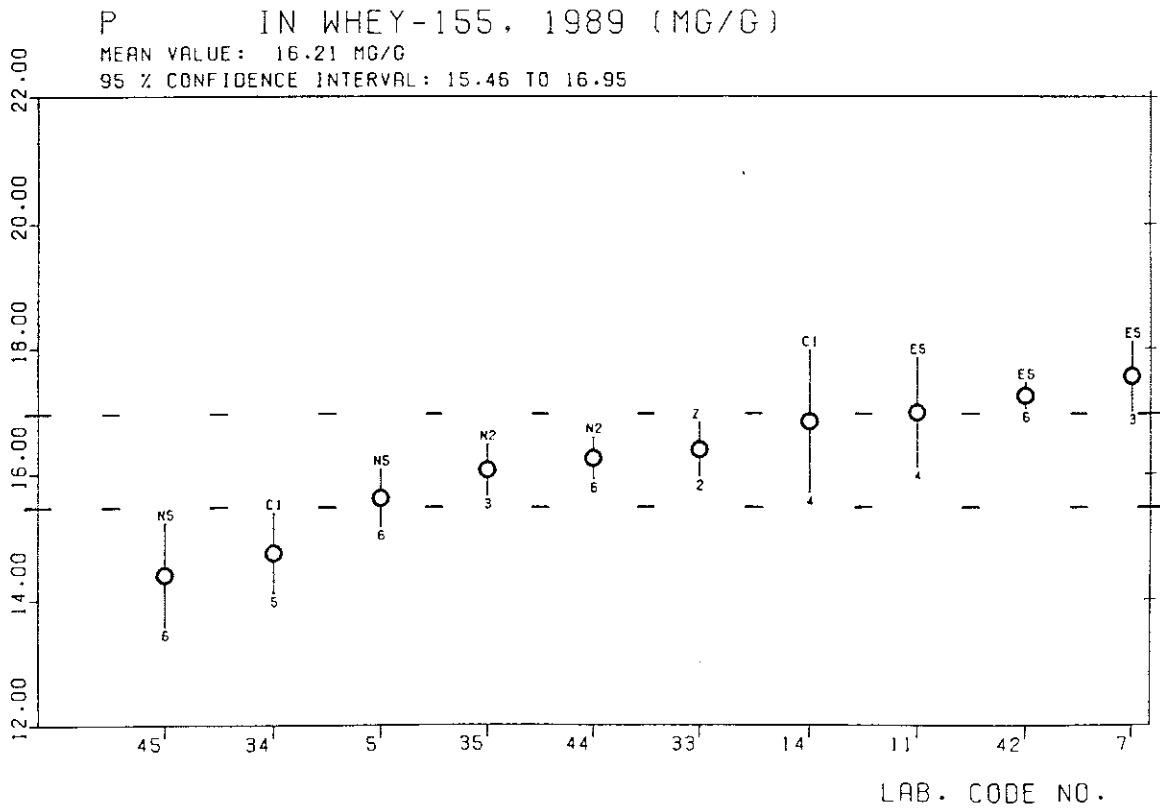


TABLE NO. 29 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR PB IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	3	A1	6	450.00*	175.61	39.0	1.8
2	4	V1	5	36.20	4.44	12.3	-7.8
3	8	A1	5	6530.00*	90.83	1.4	70.4
4	13	A2	4	73.25	8.42	11.5	OK
5	14	A3	4	104.75	6.08	5.8	OK
6	25	A1	5	756.00*	49.30	6.5	12.6
7	37	N2	4	187.50	25.00	13.3	2.0
8	40	A4	6	325.00*	114.15	35.1	1.7
9	47	A2	4	137.50	18.93	13.8	0.1
10	52	E5	6	500.00*	361.28	72.3	1.0
11	53A	A2	6	56.02	17.75	31.7	-0.8
12	54	A3	6	63.50	1.38	2.2	-5.4
13	55	A2	6	100.00	0.00	0.0	OK
14	56	A3	6	230.00	6.32	2.7	14.8
15	60	A3	6	125.33	4.68	3.7	OK
16	63	A2	4	24.50	4.80	19.6	-9.7
17	64	A2	4	135.00	79.37	58.8	OK
18	65	A2	1	30.00			LO
19	66	A2	3	425.67*	23.18	5.4	12.5
20	67	A2	4	150.00	57.74	38.5	0.2
21	69	V1	6	100.50	13.47	13.4	OK

** FOR CONFIDENCE INTERVAL 70.90 TO 136.31

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	1	A1	160.00
2	16	A1	5000.00
3	46	A3	50.00
4	50	A2	100.00
5	53B	A2	1.00
6	57	A1	2000.00
7	61	A2	40.00
8	62	A3	20.00

PB IN WHEY-155, 1989 (NANO/G)

MEAN VALUE: 103.60 NANO/G
 95 % CONFIDENCE INTERVAL: 70.90 TO 136.31

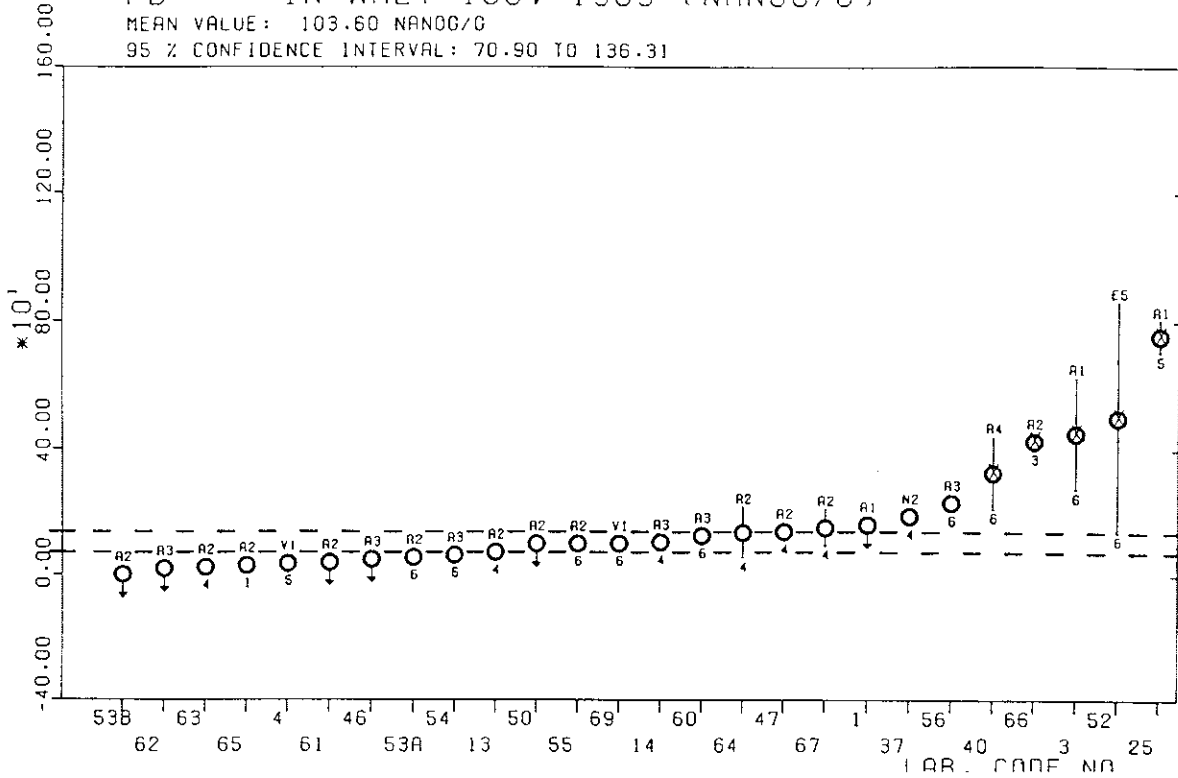


TABLE NO. 30 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR PB IN WHEY-155, 1989

UNIT: MICRO/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	2	X1	6	79.82*	6.05	7.6	6.2
2	5	N2	6	29.65	1.01	3.4	-6.7
3	6	N2	6	48.40	2.35	4.9	2.7
4	7	E5	3	30.33	0.58	1.9	-10.6
5	9A	N2	4	37.47	4.48	12.0	OK
6	9B	N2	4	40.40	0.85	2.1	OK
7	10	A1	6	40.53	2.20	5.4	OK
8	15	N2	5	40.51	2.56	6.3	OK
9	18	N2	6	39.45	1.81	4.6	OK
10	20	N2	6	38.73	1.45	3.7	OK
11	23	N3	6	73.75*	10.59	14.4	3.0
12	24	N2	6	48.82	5.58	11.4	1.2
13	26	N2	6	32.65	1.60	4.9	-2.4
14	27	N2	6	34.37	1.39	4.0	-1.5
15	37	N2	4	42.25	1.50	3.6	0.1
16	39	N2	3	42.83	3.02	7.0	0.3
17	41A	N2	3	34.33	2.89	8.4	-0.7
18	41B	X1	3	36.00	3.00	8.3	-0.1
19	43	N2	3	43.67	0.58	1.3	2.8
20	44	N2	6	45.77	0.58	1.3	6.4

** FOR CONFIDENCE INTERVAL 36.43 TO 42.04

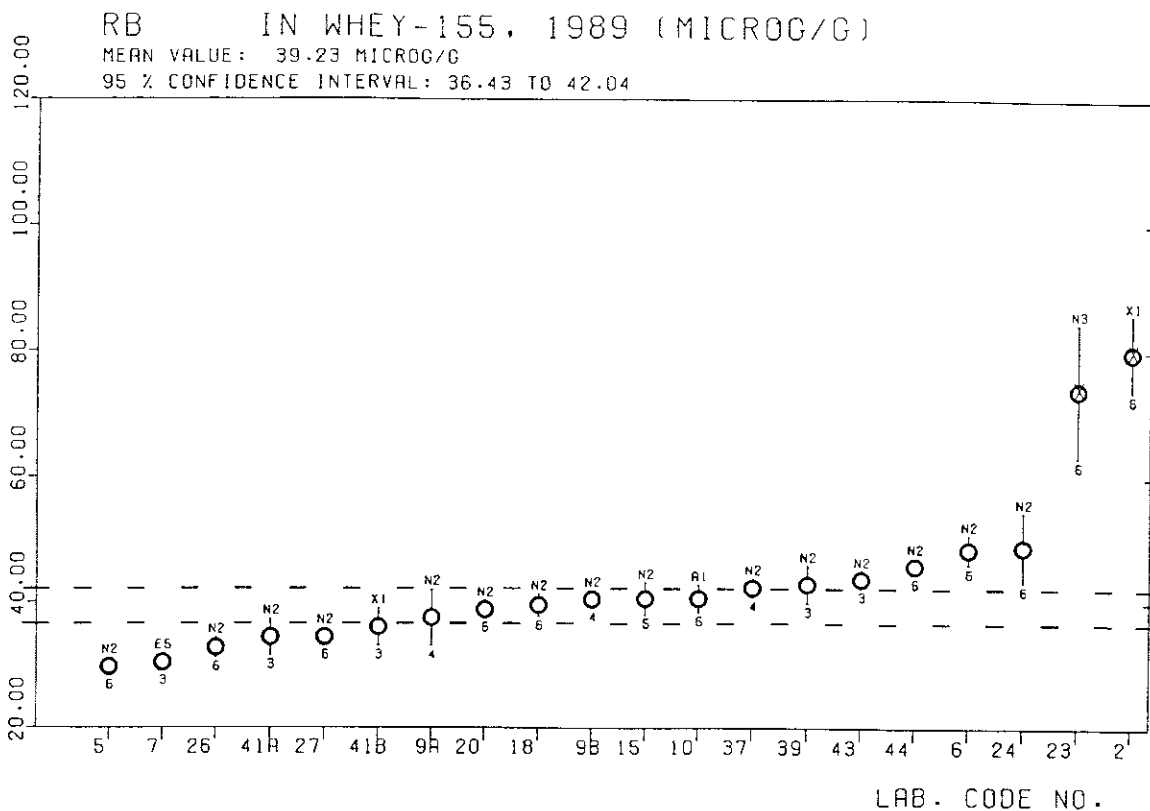


TABLE NO. 31 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR S IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	47	Z	5	3224.00	161.34	5.0	OK
2	50	E6	6	4633.33	121.11	2.6	2.0
3	57	Z	2	1395.00	21.21	1.5	-9.4
4	66	Z	3	2433.33	152.75	6.3	OK
5	67	Z	1	4400.00			HI
6	68	C1	3	1866.33	29.87	1.6	OK

** FOR CONFIDENCE INTERVAL 1594.8 TO 4389.2

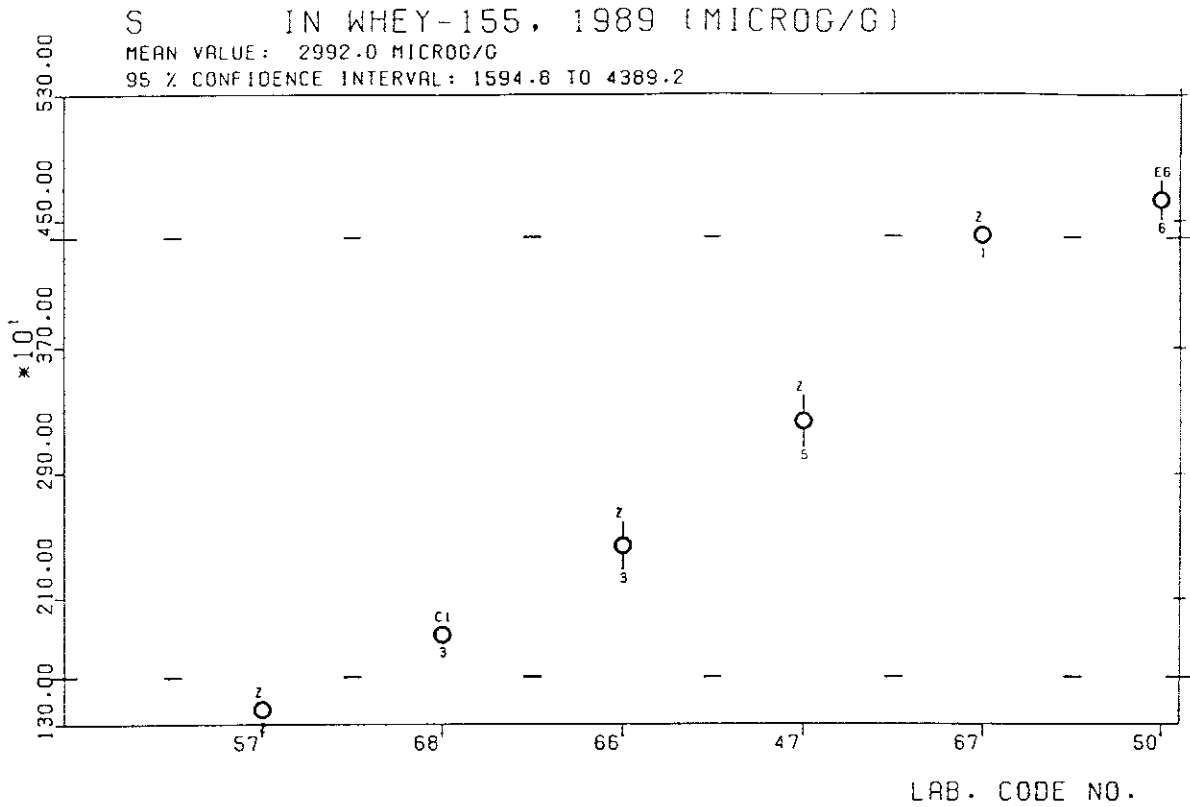


TABLE NO. 32 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SB IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	35	N2	3	0.20	0.10	50.0
2	37	N2	4	5.95	0.72	12.1
3	38	N1	3	2.25	0.60	26.8
4	39	N2	3	61.67*	15.18	24.6
5	44	N2	6	6.00	0.14	2.4

TABLE NO. 33 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SC IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	6	N2	6	28.50	1.52	5.3	OK
2	9A	N2	4	40.50	2.52	6.2	2.5
3	9B	N2	4	44.25	2.87	6.5	3.5
4	15	N2	6	12.58	1.09	8.7	-7.9
5	20	N2	6	22.00	2.37	10.8	OK
6	24	N2	6	24.17	4.17	17.2	OK
7	27	N2	6	951.67*	89.76	9.4	10.2
8	30	E6	3	2436.67*	275.38	11.3	8.7
9	37	N2	4	29.50	0.58	2.0	OK
10	39	N2	3	22.57	0.25	1.1	OK
11	41	N2	3	27.00	8.00	29.6	OK
12	44	N2	6	26.10	0.17	0.6	OK

** FOR CONFIDENCE INTERVAL 21.21 TO 34.22

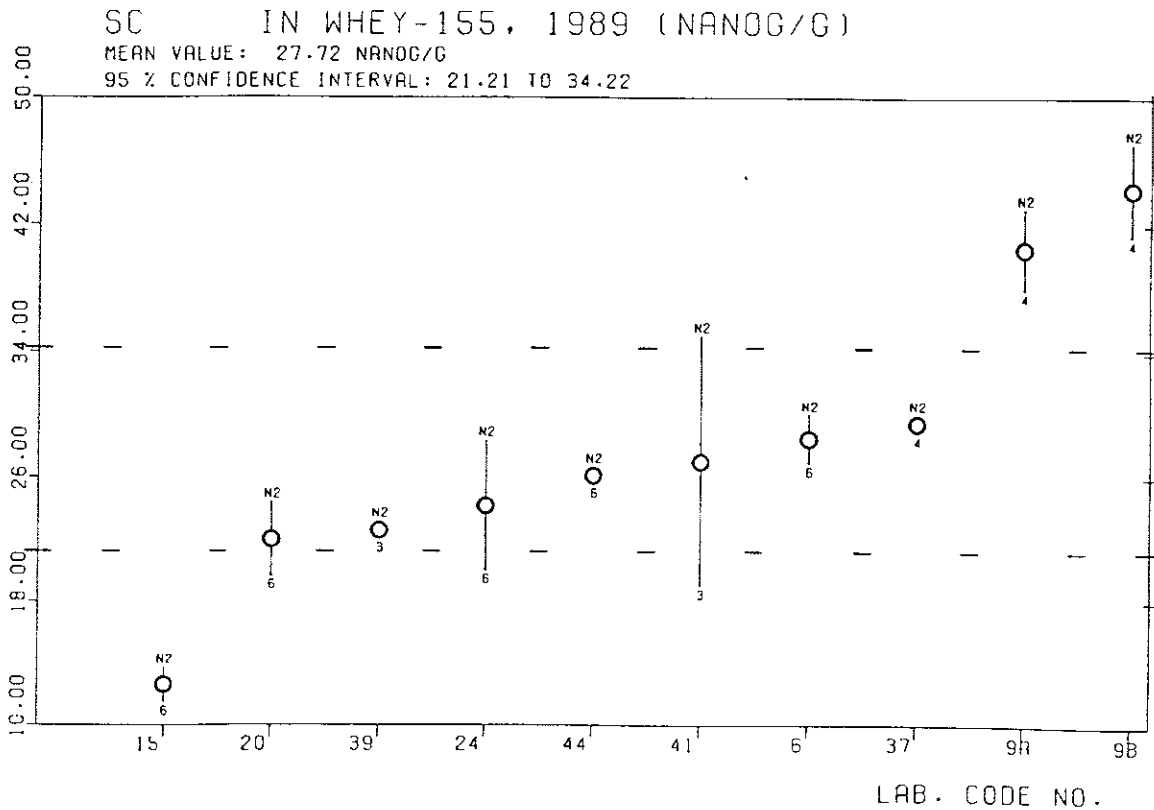


TABLE NO. 34 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SE IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	6	N2	6	0.07*	0.01	17.9	LO
2	19	N1	6	55.18	5.42	9.8	OK
3	28	N2	6	54.67	5.47	10.0	OK
4	37	N2	4	50.00	2.94	5.9	-0.5
5	38	N1	4	94.75	14.86	15.7	1.2
6	43	N2	3	53.33	5.77	10.8	OK
7	44	N2	6	61.85	8.62	13.9	OK
8	47	A5	4	60.75	2.63	4.3	OK
9	50	A5	6	56.33	6.50	11.5	OK
10	55	A5	6	391.67*	48.75	12.4	6.4
11	64	A5	1	92.00			HI

** FOR CONFIDENCE INTERVAL 51.35 TO 77.29

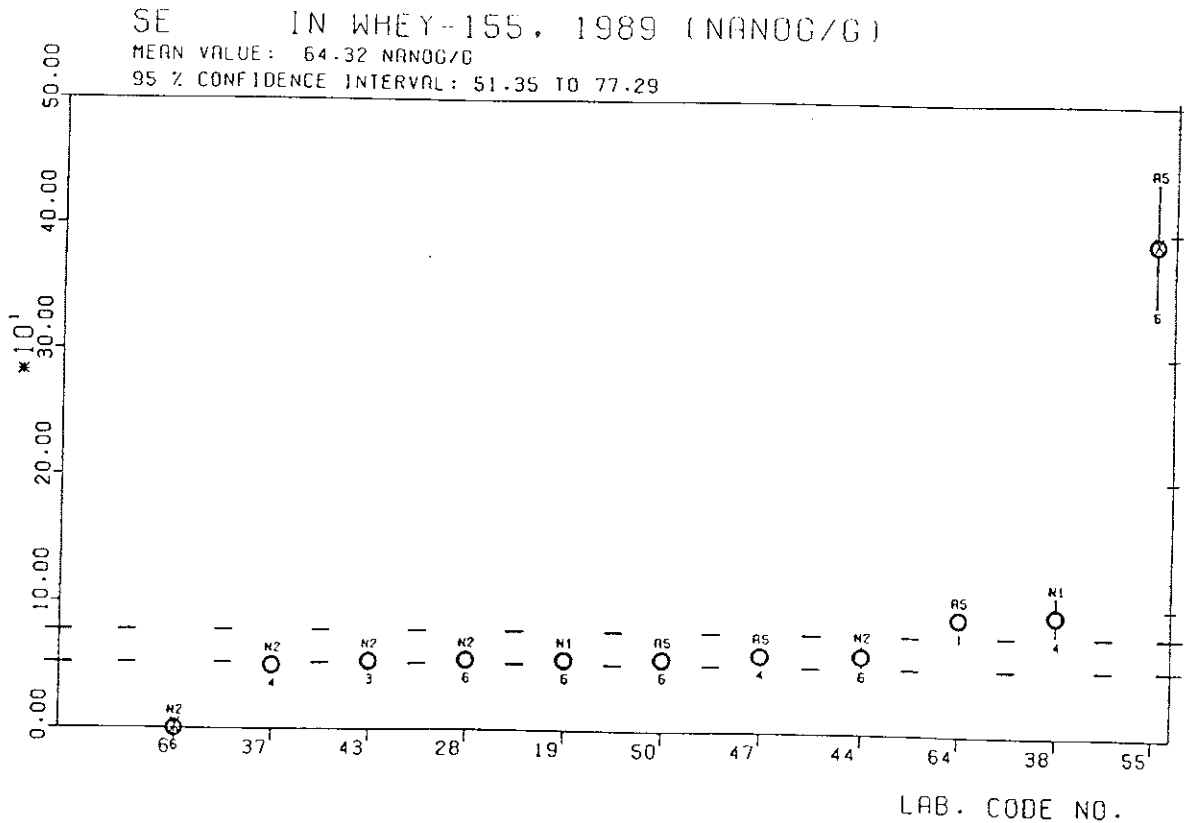


TABLE NO. 35 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SI IN WHEY-155, 1989

UNIT: MG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	45	N5	5	4.96	0.72	14.6

TABLE NO. 36 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SM IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	N2	1	0.29		
2	44	N2	4	0.03	0.00	3.9

TABLE NO. 37 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR SR IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	7	E5	3	5.03	0.15	3.0	-10.1
2	10	A1	6	7.92	0.68	8.6	OK
3	16	A1	5	14.30	1.85	12.9	OK
4	30	E6	6	14.22	0.77	5.4	OK
5	41	X1	3	9.07	4.58	50.5	OK
6	44	N3	4	12.72	0.21	1.6	OK

** FOR CONFIDENCE INTERVAL 6.57 TO 14.52

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	2	X1	20.00

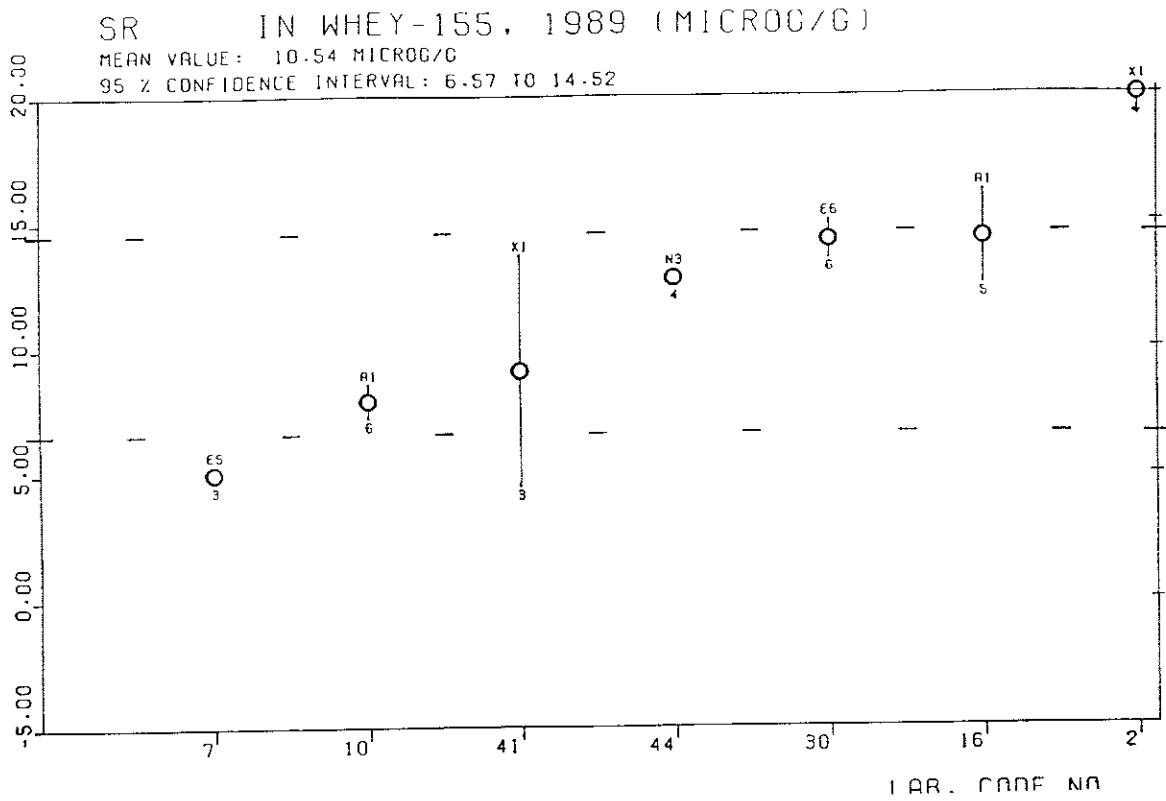


TABLE NO. 38 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR TA IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	N2	1	0.05		
2	44	N2	6	0.00	0.00	7.1

TABLE NO. 39 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR TB IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	44	N2	6	6.43	0.35	5.5

TABLE NO. 40 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR TH IN WHEY-155, 1989

UNIT: NANOG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	44	N2	3	3.58	0.12	3.3

TABLE NO. 41 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR TI IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	2	X1	6	173.33	70.00	40.4
2	30	E6	3	6.55	0.38	5.8
3	41	X1	3	650.00	101.49	15.6

RESULTS BELOW LIMIT OF DETECTION REPORTED FOR TL

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	55	A2	0.05
2	57	A1	1.00

TABLE NO. 42 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR V IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	2	X1	6	7.88	0.98	12.5
2	50	A2	6	0.13	0.01	6.9
3	52	E5	6	0.59	0.06	9.3

RESULTS BELOW LIMIT OF DETECTION REPORTED

NO.	LAB. CODE NO.	METHOD CODE	LAB. LOD
1	55	A2	0.25
2	57	A1	2.00

TABLE NO. 43 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR Y IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	X1	3	4.57	1.75	38.3

TABLE NO. 44 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR ZN IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE **
					ABS	REL %	
1	1	A1	3	36.13	0.31	0.8	1.4
2	2	X1	6	73.63*	5.27	7.2	7.2
3	3	A1	6	20.70	2.31	11.2	-5.3
4	4	A1	6	36.83	2.40	6.5	0.5
5	5	N2	6	24.62	1.41	5.7	-5.8
6	6	N2	6	33.62	1.46	4.4	OK
7	7	E5	3	38.00	1.00	2.6	2.3
8	9A	N2	4	35.00	3.89	11.1	OK
9	9B	N2	4	37.90	0.22	0.6	10.1
10	10	A1	6	38.67	0.82	2.1	3.6
11	12	A1	6	38.83	0.41	1.1	7.6
12	13	A1	4	31.87	0.05	0.2	-18.9
13	14	A1	4	35.82	0.35	1.0	0.3
14	15	N2	6	30.52	1.43	4.7	-1.6
15	16	A1	5	35.08	2.14	6.1	OK
16	17	A1	5	61.31*	0.96	1.6	26.7
17	18	N2	6	36.05	2.64	7.3	0.1
18	19	N1	5	36.13	0.09	0.3	4.3
19	20	N2	6	30.18	1.69	5.6	-1.6
20	22	A1	5	35.86	0.44	1.2	0.3
21	23	N3	3	116.59*	19.59	16.8	4.1
22	24	N2	6	39.68	4.58	11.5	0.9
23	25	A1	5	36.44	4.31	11.8	0.2
24	27	N2	6	39.31	3.29	8.4	1.1
25	28	N2	6	29.52	2.42	8.2	-1.4
26	29	A1	3	32.37	2.18	6.7	-0.2
27	30	E6	6	53.00*	5.51	10.4	3.1
28	32	A1	6	20.83	0.41	2.0	-29.4
29	33	A1	3	35.97	0.89	2.5	0.3
30	34	A1	5	35.24	1.34	3.8	OK
31	35	N2	3	46.43	2.66	5.7	4.0
32	36	X3	6	15.15*	1.58	10.4	-11.2
33	37A	N1	6	27.17	1.83	6.8	-3.1
34	37B	N1	3	26.33	2.08	7.9	-3.1
35	38	N1	4	45.80	3.57	7.8	2.8
36	39	N2	3	34.87	4.07	11.7	OK
37	41	X1	3	46.33	7.09	15.3	1.5
38	42	E5	6	33.53	0.50	1.5	OK
39	43	N2	3	33.67	0.58	1.7	OK
40	44	N2	6	35.40	0.24	0.7	OK
41	47	A1	3	34.97	0.60	1.7	OK
42	48	A1	4	33.00	1.41	4.3	OK
43	49	A1	6	29.79	1.15	3.9	-2.6
44	50	E6	6	33.00	1.77	5.4	OK
45	52	E5	6	26.75	0.23	0.9	-25.9
46	53A	A1	5	43.50	2.22	5.1	3.5
47	53B	A1	5	36.49	1.02	2.8	0.8
48	54	A3	6	36.48	0.28	0.8	2.7
49	55	A1	6	33.00	0.63	1.9	OK
50	56	E6	6	30.45	1.28	4.2	-1.9

TABLE NO. 44 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR ZN IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.		ACCEPTANCE CODE
					ABS	REL %	
51	57	A1	3	34.00	0.00	0.0	OK
52	58	A1	5	36.22	0.35	1.0	1.4
53	59	A2	4	35.53	3.59	10.1	OK
54	60	A1	4	34.97	0.95	2.7	OK
55	61	A1	6	37.17	0.75	2.0	1.9
56	64	A1	4	26.40	3.33	12.6	-1.9
57	65	A1	3	32.20	0.90	2.8	-0.7
58	67	A1	4	34.00	0.82	2.4	OK
59	69	V1	6	31.88	0.50	1.6	-1.9

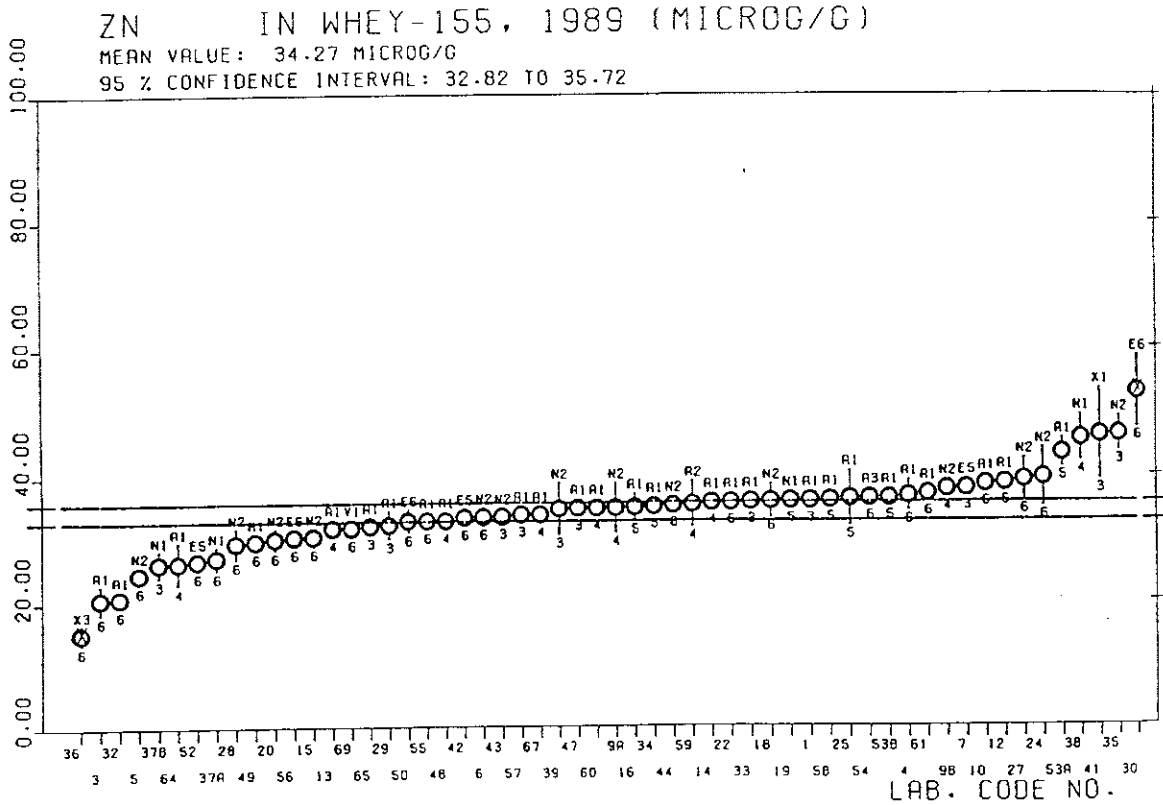


TABLE NO. 45 SIGNIFICANCE LEVEL 0.05

RESULTS OF INTERCOMPARISON FOR ZR IN WHEY-155, 1989

UNIT: MICROG/G

NO.	LAB. CODE NO.	METHOD CODE	NO.OF DETERM.	MEAN	STANDARD DEV.	
					ABS	REL %
1	41	X1	1	0.50		

SUMMARY OF RESULTS OF THE INTERCOMPARISON WHEY-155, 1989

ELEMENTS DETERMINED	AG	AL	AS	AU	B	BA	BR	CA
UNIT	MICROG/G	MICROG/G	NANO/G	NANO/G	MICROG/G	MICROG/G	MICROG/G	MG/G
NUMBER OF REPORTED RESULTS	2	21	7	2	7	4	19	26
INDIVIDUAL DETERMINATIONS	4	92	31	5	33	12	99	126
NUMBER OF ACCEPTED RESULTS	2	21	6	2	6	3	18	26
INDIVIDUAL DETERMINATIONS	4	92	25	5	29	7	96	126
TOTAL RANGE OF LABORATORY AVERAGES	0.94 - 7.46	1.33 - 135.87	1.33 - 3893.33	3.00 - 39.50	4.14 - 16.37	0.47 - 335.60	12.80 - 49.07	5.21 - 48.87
RANGE OF ACCEPTED LABORATORY AVERAGES	0.94 - 7.46	1.33 - 135.87	1.33 - 91.67	3.00 - 39.50	4.14 - 6.54	0.47 - 28.00	29.72 - 49.07	5.21 - 48.87
PERCENTAGE OF OUTLYING LABORATORIES	0	0	14	0	14	25	5	0
OVERALL MEAN OF ACCEPTED LABORATORY AVERAGES	4.20	52.90	49.44	21.25	5.14	11.74	39.06	35.99
STANDARD DEVIATION (S.D.)	4.61	32.75	32.04	25.81	0.85	14.43	5.93	11.85
REL%	109.8	61.9	64.8	121.5	16.5	122.8	15.2	32.9
STANDARD ERROR (S.E.)	3.26	7.15	13.08	18.25	0.35	8.33	1.40	2.32
REL%	77.6	13.5	26.5	85.9	6.7	70.9	3.6	6.5
CONFIDENCE INTERVALS FOR THE MEAN OF POPULATION FOR SIGNIFICANCE LEVEL .05	-37.20 - 45.60	37.99 - 67.81	15.82 - 83.07	-210.63 - 253.13	4.25 - 6.03	-24.09 - 47.58	36.11 - 42.01	31.21 - 40.78

SUMMARY OF RESULTS OF THE INTERCOMPARISON WHEY-155, 1989

ELEMENTS DETERMINED	CD	CL	CO	CR	CS	CU	EU	FE
UNIT	NANO/G	MG/G	NANO/G	NANO/G	NANO/G	NANO/G	NANO/G	MICROG/G
NUMBER OF LABORATORY REPORTED RESULTS	25	14	22	36	11	42	3	36
INDIVIDUAL DETERMINATIONS	111	71	101	175	57	203	10	174
NUMBER OF LABORATORY ACCEPTED RESULTS	18	10	16	28	9	28	2	35
INDIVIDUAL DETERMINATIONS	81	52	72	138	47	140	9	168
TOTAL RANGE OF LABORATORY AVERAGES	0.73 - 38000.00	9.55 - 89.00	3.41 - 4980.00	187.78 - 8016.66	51.33 - 20146.66	183.33 - 38333.33	7.38 - 110.00	2.66 - 2816.67
RANGE OF ACCEPTED LABORATORY AVERAGES	0.73 - 30.00	63.90 - 75.27	3.41 - 92.67	187.78 - 1100.00	51.33 - 108.33	183.33 - 1200.00	7.38 - 10.67	2.66 - 154.67
PERCENTAGE OF OUTLYING LABORATORIES	28	29	27	22	18	33	33	3
OVERALL MEAN OF ACCEPTED LABORATORY AVERAGES	16.03	69.15	42.70	587.43	86.10	567.37	9.02	62.39
STANDARD DEVIATION (S.D.)	7.17	4.48	25.17	195.95	20.03	282.42	2.32	35.05
REL%	44.8	6.5	58.9	33.4	23.3	49.8	25.8	56.2
STANDARD ERROR (S.E.)	1.69	1.42	6.29	37.03	6.68	53.37	1.64	5.93
CONFIDENCE INTERVALS FOR THE MEAN OF POPULATION FOR SIGNIFICANCE LEVEL .05	12.46 - 19.59	65.94 - 72.35	29.29 - 56.10	511.44 - 663.42	70.71 - 101.50	457.85 - 676.89	-11.86 - 29.90	50.34 - 74.44

SUMMARY OF RESULTS OF THE INTERCOMPARISON WHEY-155, 1989

ELEMENTS DETERMINED	HG	K	LA	MG	MN	NA	NI	P
UNIT	NANO/G	MG/G	MICROG/G	MG/G	MICROG/G	MG/G	MICROG/G	MG/G
NUMBER OF LABORATORY REPORTED AVERAGES	12	25	3	22	25	24	20	10
INDIVIDUAL DETERMINATIONS	60	128	15	104	119	123	99	45
NUMBER OF LABORATORY ACCEPTED AVERAGES	9	25	3	16	19	21	15	10
INDIVIDUAL DETERMINATIONS	45	128	15	76	95	107	76	45
TOTAL RANGE OF LABORATORY AVERAGES	0.75 - 54333.33	9.64 - 69.33	0.13 - 0.25	1.08 - 5.37	0.19 - 136.00	4.16 - 18.57	0.18 - 35.42	14.40 - 17.56
RANGE OF ACCEPTED LABORATORY AVERAGES	0.75 - 5.55	9.64 - 69.33	0.13 - 0.25	2.75 - 3.61	7.40 - 11.31	13.46 - 18.57	0.18 - 0.83	14.40 - 17.56
PERCENTAGE OF OUTLYING LABORATORIES	25	0	0	27	24	13	25	0
OVERALL MEAN OF ACCEPTED LABORATORY AVERAGES	2.62	41.73	0.20	3.19	9.30	15.82	0.54	16.21
STANDARD DEVIATION (S.D.)	1.48	15.46	0.06	0.23	1.08	1.31	0.18	1.04
REL%	56.5	37.0	31.0	7.2	11.6	8.3	32.9	6.4
STANDARD ERROR (S.E.)	0.49	3.09	0.04	0.06	0.25	0.29	0.05	0.33
CONFIDENCE INTERVALS FOR THE MEAN OF POPULATION FOR SIGNIFICANCE LEVEL .05	1.48 - 3.76	35.35 - 48.11	0.05 - 0.36	3.06 - 3.31	8.78 - 9.82	15.23 - 16.42	0.44 - 0.64	15.46 - 16.95

SUMMARY OF RESULTS OF THE INTERCOMPARISON WHEY-155, 1989

ELEMENTS DETERMINED	PB	RB	S	SB	SC	SE	SM	SR
UNIT	NANO/G	MICRO/G	MICRO/G	NANO/G	NANO/G	NANO/G	MICRO/G	MICRO/G
NUMBER OF LABORATORY REPORTED RESULTS	21	20	6	5	12	11	2	6
INDIVIDUAL DETERMINATIONS	101	98	20	19	57	52	5	27
NUMBER OF LABORATORY ACCEPTED RESULTS	15	18	6	4	10	9	2	6
INDIVIDUAL DETERMINATIONS	70	86	20	16	48	40	5	27
TOTAL RANGE OF LABORATORY AVERAGES	24.50 - 6530.00	29.65 - 79.82	1395.00 - 4633.33	0.20 - 61.67	12.58 - 2436.67	0.07 - 391.67	0.03 - 0.29	5.03 - 14.30
RANGE OF ACCEPTED LABORATORY AVERAGES	24.50 - 230.00	29.65 - 48.82	1395.00 - 4633.33	0.20 - 6.00	12.58 - 44.25	50.00 - 94.75	0.03 - 0.29	5.03 - 14.30
PERCENTAGE OF OUTLYING LABORATORIES	29	10	0	20	17	18	0	0
OVERALL MEAN OF ACCEPTED LABORATORY AVERAGES	103.60	39.23	2992.00	3.60	27.72	64.32	0.16	10.54
STANDARD DEVIATION (S.D.)	59.05	5.64	1331.16	2.87	9.10	16.87	0.18	3.79
REL%	57.0	14.4	44.5	79.6	32.8	26.2	114.6	35.9
STANDARD ERROR (S.E.)	15.25	1.33	543.44	1.43	2.88	5.62	0.13	1.55
CONFIDENCE INTERVALS FOR THE MEAN OF POPULATION FOR SIGNIFICANCE LEVEL .05	70.90 - 136.31	36.43 - 42.04	1594.81 - 4389.19	-0.96 - 8.16	21.21 - 34.22	51.35 - 77.29	-1.49 - 1.81	6.57 - 14.52

SUMMARY OF RESULTS OF THE INTERCOMPARISON WHEY-155, 1989

ELEMENTS DETERMINED	TA	TI	V	ZN
	MICROG/G	MICROG/G	MICROG/G	MICROG/G
NUMBER OF LABORATORY REPORTED RESULTS	2	3	3	59
INDIVIDUAL DETERMINATIONS	7	12	18	286
NUMBER OF LABORATORY ACCEPTED RESULTS	2	3	3	54
INDIVIDUAL DETERMINATIONS	7	12	18	260
TOTAL RANGE OF LABORATORY AVERAGES	0.00 - 0.05	6.55 - 650.00	0.13 - 7.88	15.15 - 116.59
RANGE OF ACCEPTED LABORATORY AVERAGES	0.00 - 0.05	6.55 - 650.00	0.13 - 7.88	20.70 - 46.43
PERCENTAGE OF OUTLYING LABORATORIES	0	0	0	8
OVERALL MEAN OF ACCEPTED LABORATORY AVERAGES	0.03	276.63	2.87	34.27
STANDARD DEVIATION (S.D.)	0.03	333.93	4.35	5.31
REL%	131.1	120.7	151.6	15.5
STANDARD ERROR (S.E.)	0.02	192.79	2.51	0.72
CONFIDENCE INTERVALS FOR THE MEAN OF POPULATION FOR SIGNIFICANCE LEVEL .05	-0.28 - 0.33	-552.97 - 1106.22	-7.94 - 13.67	32.82 - 35.72

List of participating Laboratories

Algeria

Laboratoire des Techniques Nucléaires
C.D.T.N.
2, Bd. Frantz Fanon, B.P. N 1017
Alger-Gare, Algérie
A. Azbouche, M. Benammar, S. Tobbeche

DAAN/CDTN
Haut Commissariat à la Recherche
2, Bd. Frantz Fanon
Alger-Gare, Algérie
M. Seghir, Z. Idiri, L. Omari, C. Lakhdar Chaouch

Austria

Bundesanstalt für Agrarbiologie
Wieningerstr. 8
A-4025 Linz
G. Sorger

SBL Institut für Wasseraufbereitung,
Reinigung und Forschung
Hümerstr. 3-5
A-4020 Linz
F. Hochegger

Labor für Zellstoff und Papier
Lenzing AG
A-4860 Lenzing
Hr. Hüpfl

Institut für Analytische Chemie
Mikro- u. Radiochemie der T.U. Graz
Tecknikerstr. 4
A-8010 Graz
G. Knapp

Chemserv Ind. Serv. GesmbH
SCA/ Bau 5
St Peterstr. 25
A-4020 Linz
M. Kores

Institut für Analytische Chemie
Karl-Franzens-Universität
Universitätsplatz 1
A-8010 Graz
W. Kosmus

Institut für Medizinische Chemie
Vete. Medizinische Universität
Linke Bahngasse 11
A-1030 Wien
P. Kruzik

Landwirtschaftlich-chemische Bundesanstalt
Trunnerstr. 1-3
A- 1020 Wien
R.Oeschlmüller

Institut für Botanik
Universität Salzburg
Hellbrunnerstr. 34
A-5020 Salzburg
T. Peer

Geotechnisches Institut
Arsenal Objekt 214
A-1030 Wien
M. Sager

LUA Graz
Beethovenstr. 8
A-8010 Graz
E. Schindler

Institut für Forstökologie der
Universität für Bodenkultur
Peter-Jordanstr. 82
A-1190 Wien
M. Sieghardt

Bundesanstalt für Lebensmitteluntersuchung
Liebeneggerstr. 8
A-6020 Innsbruck
E. Stephi

Landwirtschaftlich-chemisch
Landesversuchs- und -Untersuchungsanstalt
Burggasse 2
A-8010 Graz
A. Stüger-Hopfgartner

IAEA Laboratories
Chemistry Unit
A-2444 Seibersdorf
E. Zeiller, R. Ogris, M. Makarewicz

Versuchsstation für das Gärungsgewerbe
Michaelastr. 25
A-1182 Wien
R. Leubolt

Oesterr. Forschungszentrum Seibersdorf
A-2444 Seibersdorf
E. Benetka, R. Rebler

Oeko-Datenservice GmbH
Budinskygasse 18
A-1190 Wien
Martinetz

Gewässerschutz
Abt. der Oberösterr. Landesregierung
Goethestr. 86
A-4020 Linz
H. Miesbauer

Immissionsschutz
Goethestr. 86
A- 4020 Linz
G. Minnisberger

Zentrallabor der österr.
Draukraftwerke AG
A- 8570 Voitsberg
K. Much, Hr. Maier

Forstl. Bundesversuchsanstalt
Institut für Standortkunde
Schönbrunn
A- 1131 Wien
F. Mutsch

Verein für Konsumenteninformation
Linke Wienzeile 18
A-1060 Wien
K. Brunnhofer

OeMV-AG
Gerasdorferstr. 151
A-1210 Wien
C. Fleischmann

M. Hämmerle
Montfortstr. 4
A-6901 Bregenz

Brazil

IPEN-CNEN/SP
Radiochemistry Division
Caixa Postal 11049 - Pinheiros
05499 - São Paulo, Brazil
D. I.T. Favaro, M. B.A. Vasconcellos

China

Nuclear Analytical Laboratory
Institute of Atomic Energy
P.O. Box 275-50
Beijing, China
Peng Li-Xin

Czechoslovakia

State Veterinary Institute
2. října 61-63
41155 Terezín, CSFR
M. Mynarz

Institute for Research, Production
and Application of Radioisotopes
Radiova 1
10227 Prague 10, CSFR
V. Jiranek

Germany

Bezirkshygiene-Inspektion
Hygiene-Institut Dessau
Am Tivoli 1
D- 4500 Dessau, Germany
G. Ruick

Staatliches Amt für Atomsicherheit und
Strahlenschutz
Waldowallee 117
D-1157 Berlin, Germany
H. Gegusch

Bezirks-Hygieneinspektion und- Institut
Wallonerberg 2/3
P.O. 317
D-3010 Magdeburg, Germany
P. Neske, B. Storch

Bezirks-Hygieneinspektion und -Institut Dresden
Insp. Lebensmittel-und Ernährungshygiene
Reichenbachstr. 71/73
D-8020 Dresden, Germany
D. Hübner

Arbeitshygienische Zentrum der
Chemische Industrie der DDR
PSF 31
D-422 Lenna, Germany
M. Roschig

Karl-Marx-University
Department of Chemistry
Talstr. 35
D-7010 Leipzig, Germany
R. Wennrich

India

Chemistry Department
Nagpua University Campus
Amravati Road
440010 Nagpur, India
A.N. Garg

Indonesia

Toxicology Dept. Research Institute
for Veterinary Science
Jl. R.E. Maratdinata 32
P.O. Box 52
Bogor, Indonesia
Darmono

Iraq

Activation Analysis Group
Nuclear Research Centre
IAEC, P.O. 765
Baghdad, Iraq
S.M. Al-Jobori

Japan

Tokyo Metropolitan Institute
for Neurosciences
2-6 Musashidai, Fuchu-City
Tokyo, Japan
T. Sato

Kuwait

Central Analytical Laboratory
Kuwait Institute for Scientific Research
PO 24885
13109 Safat, Kuwait
F. Abu-Dagga

Mexico

Janya, CFE-PNLV
Apdo Postal 5-756
Col. Cuauhtemoc,
06500 Mexico D.F., Mexico
M.A. Valdovinos, H.A. Silva J.

New Zealand

Analytical Unit
Biotechnology Div.
D.S.I.R.
Private Bag
Palmerston North M-2, New Zealand
P.A. Chin, J. Lee

Chemistry Division
Department of Scientific and Industrial Research
P.O. Box 2224
Auckland, New Zealand
J.W. Mitchell

Nigeria

Department of Chemistry
Abubakar Tafawa-Balewa University
PMB 0248
Bauchi, Nigeria
S.E. Kakulu

Pakistan

Basic Soil Investigations
Soil Survey of Pakistan
P.O. Shahnour Multan Road
Lahore 18, Pakistan
S. Khan

Nuclear Chemistry Division
PINSTECH
P.O. Nilore
Islamabad, Pakistan
A. Mannan, S. Waheed, I. H. Qureshi

Philippines

Analytical Services Laboratory
Environmental Services Division
Environmental Management Department
National Power Corporation
Bagac, Bataan, Philippines
B.D. Osorio

Poland

Institute of Oceanology
Polish Academy of Sciences
P.O. Box 68
Sopot, Poland
J. Pempkowiak

Department of Analytical Chemistry
Institute of Nuclear Chemistry and Technology
Dorobna 16
03-195 Warsaw, Poland
L. Wawrzonek, R. Dybczynski, B. Danko

Romania

Institute for Physics and Nuclear Engineering
P.O. Box MG-6
Section I.
R-76900 Magurele, Bucarest, Romania
S. Spiridon, R. Dumitrescu, M. Salagean, A. Pantelica

South Africa (Republic of)

Atomic Energy Corporation of S.A.
Building P-1600
P.O. 582
Pretoria, South Africa
M.J. Raven, M.C.B. Smit

Sweden

National Food Administration
Box 622
S-75126 Uppsala, Sweden
L. Jorhem

Thailand

Office of Atomic Energy for Peace
Waste Disposal Division
Thanon Vibhavadee - Rangsit
Bangkhen, Bangkok 10900, Thailand
N. Leelhaphunt

Food Chemistry and Human Nutrition Section
Institute of Nutrition
Mahidol University at Salaya
PO Box 31, Talingchan
Bangkok 10170, Thailand
P.P. Sirichakwal

United Kingdom

Environmental Science
Department of Geography
Queen Mary and Westfield College
University of London
Mile End Road
London E1 4NS, UK
P. Jakson

Department of Chemical Pathology
Charing Cross Hospital
Fulham Palace Road
London W6 8RF, UK
B. Sampson

USSR

Laboratory of Radioanalytical and
Electrochemical Methods
Institute of Geochemistry and Analytical Chemistry
USSR Academy of Sciences
ul. Kosygin, 19
117975 Moscow, USSR
V. Kolotov

Neutron Activation Analysis Laboratory
Institute of Physics
Latvian SSR Academy of Sciences
Riga, Salaspils
229021, USSR
M. Vircavs

Polytechnic Institute
Geological Faculty
Nuclear Geochemical Laboratory
30 Lenin Prospect
634004 Tomsk, USSR
E.G. Vertman

Department of Activation Analysis
Laboratory of Neutron Physics
Joint Institute for Nuclear Research
Dubna, USSR
V.M. Nazarov, B. Sterlinski

Atmospheric Physics Department
Institute of Physics
Leningrad University
Leningrad, Petrodvorets 198 904, USSR
V.I. Koudrjashov