

**CEMENT AND CONCRETE REFERENCE LABORATORY**  
**PROFICIENCY SAMPLE PROGRAM**

**Final Report**  
**Blended Cement Proficiency Samples**  
**Number 57 and Number 58**

May 2006

# CEMENT AND CONCRETE REFERENCE LABORATORY

AT THE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
GAITHERSBURG, MARYLAND 20899  
(301) 975-6704

SPONSORED BY  
COMMITTEE C-1 ON CEMENT  
COMMITTEE C-9 ON CONCRETE AND  
CONCRETE AGGREGATES  
AMERICAN SOCIETY FOR TESTING AND MATERIALS

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May 8, 2005

**To: Participants in the CCRL Blended Cement Proficiency Sample Program**

**SUBJECT: Final Report on Blended Cement Proficiency Samples No. 57 and No. 58**

Following is the final report for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2006. Both cements were an ASTM C595 Blended Hydraulic Cement. Sample No 57 and No. 58 were a Type IPM with silica fume.

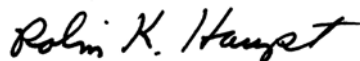
This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for participating laboratories can be downloaded at our website located at: <http://ccrl.us/>. Laboratory ratings were not assigned for the eight chemical components that were added to this pair of samples. This will be noted in the individualized laboratory ratings.

The CCRL Proficiency Sample Programs are intended for internal use by the laboratory as a tool to identify potential problems in laboratory procedures or test equipment and to initiate remedial actions. These programs are designed to complement the CCRL Laboratory Inspection Program as part of a total quality system. Care should be taken when using this program for any other purpose.

**Additional samples of these two cements and other CCRL samples are available for purchase.** These samples may be useful for equipment verification, technician training, and research. Contact CCRL for availability and price.

It is presently anticipated that the next Blended Cement Proficiency Samples will be distributed in February 2007.

Sincerely,



Robin K. Haupt  
Supervisor, Proficiency Sample Programs  
Cement and Concrete Reference Laboratory

Enclosure

**TO: Participants in the CCRL Blended Cement Proficiency Sample Program**

**FROM: Robin K. Haupt, Supervisor, PSP**

**SUBJECT: Explanation of Final Report on Results of Tests for Blended Cement Proficiency Samples No. 57 and No. 58**

This letter, and the material included with it, constitute a portion of the final report for the current pair of Blended Cement Proficiency Samples distributed in February 2006. This material includes a statistical Summary of Results, and a set of general Scatter Diagrams. If your laboratory was a participant in this program a Table of Laboratory Results (lab ratings) for your laboratory data can be viewed and printed on the CCRL website

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine [View document](#), and "Statistical Aspects of the Cement Testing Program" by W.J. Youden [View document](#), which can be found in Volume 59, Proceedings of the 62<sup>nd</sup> Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

### **Table of Laboratory Results**

Each laboratory receives an individualized Table of Laboratory Results. Your unique laboratory number is displayed at the top of the Table of Laboratory Results. This table shows the, test title, and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples.

Laboratory ratings, shown in the Table of Results for the individual laboratory, were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

<b>Ratings</b>	<b>Range (Number of Standard Deviations)</b>	<b>Number (Per 100) of Laboratories achieving the rating <sup>1</sup></b>
5	Less than 1	69
4	1 to 1.5	18
3	1.5 to 2	9
2	2 to 2.5	3
1	Greater than 2.5	1

The sign of the rating merely shows whether the result reported was greater or less than the average obtained.

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<sup>1</sup>Youden, W.J., "Statistical Aspects of the Cement Testing Program", Volume 59, *Proceedings of the 62<sup>nd</sup> Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.*

Participants subscribing to the chemical analysis portion of this report should note that the statistics were calculated using data obtained by wet methods, and rapid methods of chemical analysis.

Please note that individual laboratory ratings were not given for the flow of air content mortar (test no. 190) and compressive strength mortar (test no. 230). Air content flows in the range of  $87.5 \pm 7.5$  are satisfactory. Similarly, the compressive strength flows in the range of  $110 \pm 5$  are satisfactory. Labs with flow values outside these ranges will be flagged as a "Labs Eliminated" on the scatter diagram. Averages, standard deviations, and a scatter diagram are provided for your information. This information may be a helpful indicator of a problem with flow table apparatus or mortar mixing procedures. Flow values of 151 were assigned to laboratories reporting a mortar flow off the flow table top.

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other laboratories' results, are recalculated using the data remaining after the elimination. Since the laboratory ratings given are the results from this one series of tests, you need not attach too much significance to a single low rating, or pair of ratings, from this one series. A continuing tendency to get low ratings on several pairs of samples should lead a laboratory to consider the types of error, systematic and random, contribute to ratings that are low. Systematic error, which is indicated by low ratings with the same signs on each pair of samples, means a consistent error is occurring in equipment and/or test procedures. One indication of random error is low ratings on both samples with different signs. Since systematic error occurs with more regularity, its cause is generally easier to find than the cause of random error.

### **Summary of Results - General**

The Summary of Results provide the statistical summary for each test. Each line lists the test, the number of participants represented, the averages, standard deviations and coefficients of variations. When necessary the data from the test is represented in two lines, one line with all results reported, and then a second line with outlying results omitted. Sometimes two or more recalculations are required to eliminate all outliers from the test. In these cases, all of the laboratories omitted in previous recalculations are also omitted in subsequent ones. Results omitted are values that are more than three standard deviations from the mean of one or both samples. Often, elimination of these outlying results has little effect on the average, but may have a more pronounced effect on the standard deviation and coefficient of variation.

### **Scatter Diagrams**

General scatter diagrams are supplied with this report. Crandall and Blaine describe the manner of preparing scatter diagrams, and their interpretation, in the paper published in the 1959 ASTM Proceedings.

Using the results received from each laboratory, a scatter diagram is generated for each test method by plotting the value for the odd numbered samples on the X, or horizontal axis, against the value for the even numbered samples on the Y, or vertical axis. Vertical and horizontal dashed lines, which divide the diagrams into four sections or quadrants, place the average values for the odd and even numbered samples, respectively. The first line of print under the diagram includes the test number, as given on the data sheet, the test title, and the number of data points on the diagrams. The number of plotted points may not agree with the total number of data pairs included in the analysis because a few points may be off the diagram, and some points may represent several data pairs, which are identical. Laboratories whose points are off the diagram will have a rating of  $\pm 1$  for that particular test.

As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 57 and No. 58  
Final Report - Chemical Results  
May 5, 2006

SUMMARY OF RESULTS

Test		#Labs	Sample No. 57			Sample No. 58		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Silicon Dioxide	prent	68	26.04	1.0	4.04	26.28	1.2	4.69
Silicon Dioxide	prent *	64	25.86	0.79	3.06	26.07	0.93	3.58
Aluminum Oxide	prent	65	4.53	0.41	9.05	5.28	0.46	8.74
Aluminum Oxide	prent *	61	4.48	0.26	5.89	5.25	0.34	6.43
Ferric Oxide	prent	68	3.04	0.14	4.48	2.57	0.17	6.74
Ferric Oxide	prent *	60	3.04	0.072	2.37	2.55	0.085	3.35
Calcium Oxide	prent	67	58.50	0.91	1.56	56.29	1.11	1.98
Calcium Oxide	prent *	63	58.60	0.66	1.12	56.38	0.90	1.60
Magnesium Oxide	prent	67	1.94	0.19	9.57	2.32	0.22	9.72
Magnesium Oxide	prent *	62	1.94	0.11	5.75	2.32	0.16	6.86
Sulfur Trioxide	prent	66	3.16	0.18	5.62	4.22	0.25	6.00
Loss on Ignition	prent	70	1.96	0.12	5.91	1.70	0.15	8.90
Loss on Ignition	prent *	66	1.96	0.094	4.77	1.69	0.092	5.42
Sodium Oxide	prent	58	0.248	0.093	37.4	0.321	0.099	30.7
Sodium Oxide	prent *	54	0.229	0.051	22.2	0.304	0.064	21.1
Potassium Oxide	prent	60	0.43	0.16	36.5	0.94	0.12	13.3
Potassium Oxide	prent *	54	0.42	0.026	6.16	0.96	0.038	3.94

CONTINUED ON NEXT PAGE

\* ELIMINATED LABS: Data over three S.D. from the mean

Silicon Dioxide	20 413 38 691
Aluminum Oxide	40 126 1715 2116
Ferric Oxide	42 51 52 126 20 413 975 2463
Calcium Oxide	413 2116 870 2463
Magnesium Oxide	870 1799 39 126 3059
Loss on Ignition	695 1799 354 2116
Sodium Oxide	1251 1799 1196 3059
Potassium Oxide	52 1799 2463 3 1251 3009

CCRL PROFICIENCY SAMPLE PROGRAM  
 Blended Cement Proficiency Samples No. 57 and No. 58  
 Final Report - Chemical Results  
 May 5, 2006

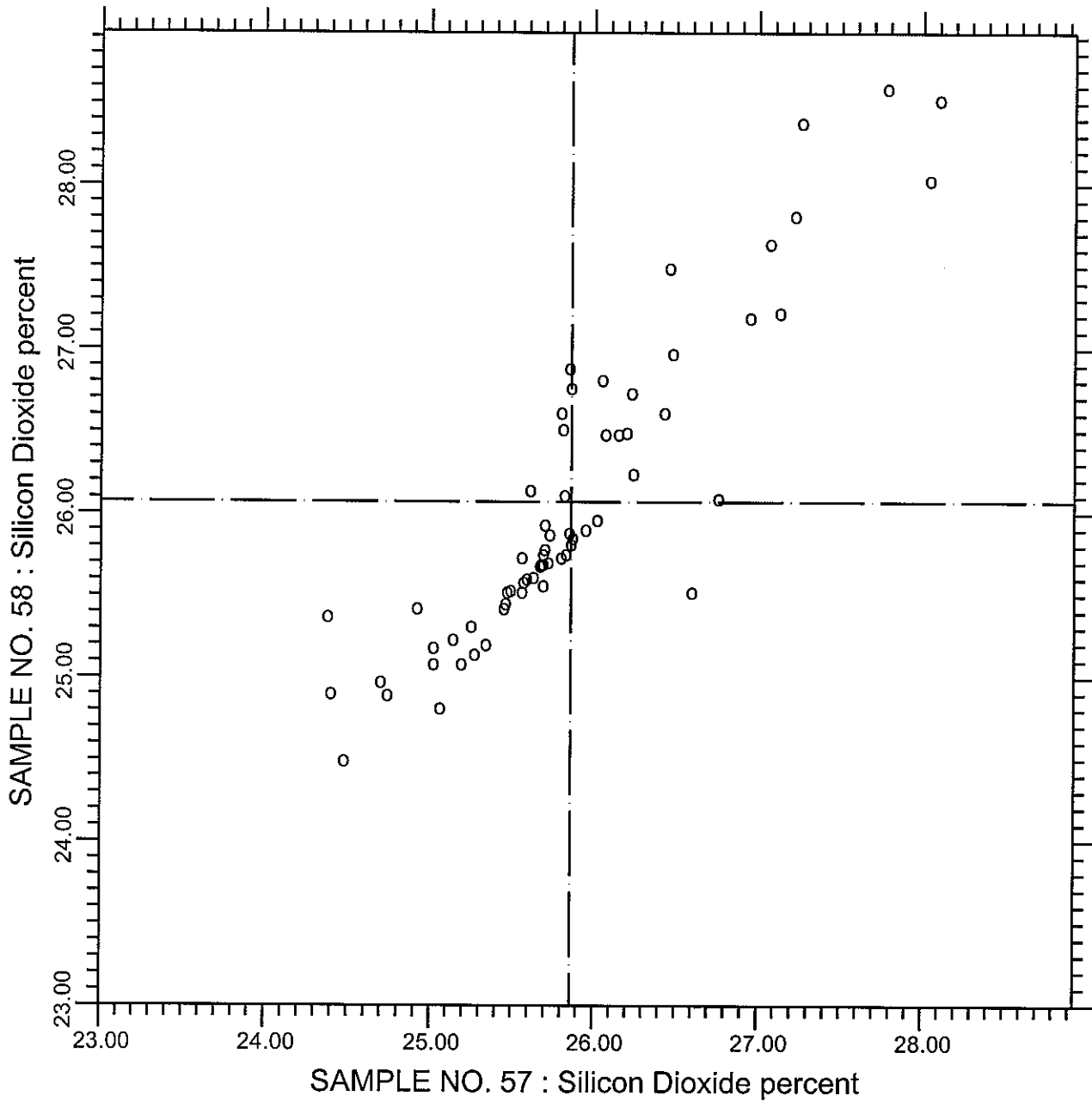
SUMMARY OF RESULTS

Test		#Labs	Sample No. 57			Sample No. 58		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Titanium Dioxide	prcnt	50	0.32	0.015	4.72	0.23	0.036	15.40
Titanium Dioxide	prcnt	* 47	0.32	0.0117	3.64	0.23	0.0100	4.25
Phosphorus Pent	prcnt	50	0.136	0.061	45.0	0.240	0.045	18.7
Phosphorus Pent	prcnt	* 44	0.123	0.011	8.64	0.232	0.016	7.08
Zinc Oxide	prcnt	21	0.020	0.0056	27.7	0.050	0.0154	30.5
Zinc Oxide	prcnt	* 17	0.021	0.0013	6.39	0.053	0.0022	4.08
Manganic Oxide	prcnt	38	0.091	0.017	18.4	0.100	0.016	16.3
Manganic Oxide	prcnt	* 31	0.094	0.0035	3.71	0.102	0.0042	4.16
Sulfide Sulfur	prcnt	9	0.643	1.1	172	0.837	1.4	169
Chloride	prcnt	31	0.012	0.0108	90.2	0.010	0.0088	91.0
Chloride	prcnt	* 26	0.009	0.0044	48.6	0.006	0.0041	64.2
Insoluble Residue	prcnt	45	2.96	1.7	57.4	3.52	2.2	61.5
Chromium Oxide	prcnt	21	0.019	0.033	179	0.016	0.033	212
Chromium Oxide	prcnt	* 19	0.010	0.0044	42.9	0.008	0.0041	51.1

\* ELIMINATED LABS: Data over three S.D. from the mean

Titanium Dioxide	126 413 2463
Phosphorus Pentoxide	126 2463 413 1799 1940 3059
Zinc Oxide	40 413 542 1196
Manganic Oxide	40 207 413 1251 2462 181 3059
Chloride	23 158 246 870 1799
Chromium Oxide	36 40

CCRL PROFICIENCY SAMPLE PROGRAM  
 Silicon Dioxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.10

Silicon Dioxide

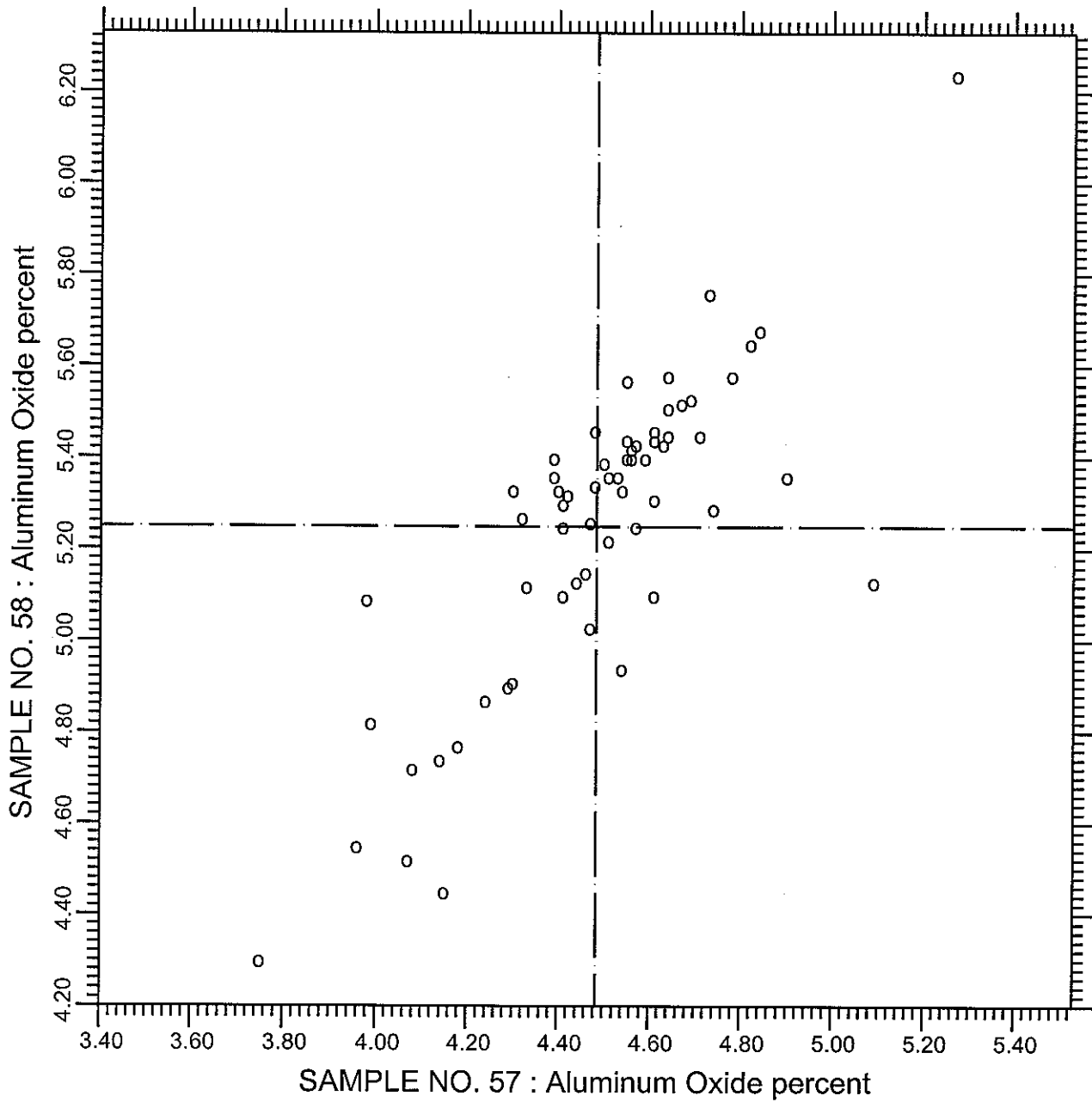
64 POINTS

SAMPLE NO. 57 AVE 25.861 S.D. 0.79 C.V. 3.06

SAMPLE NO. 58 AVE 26.070 S.D. 0.93 C.V. 3.58

LABS ELIMINATED 20 413 38 691

CCRL PROFICIENCY SAMPLE PROGRAM  
 Aluminum Oxide - wo/minor oxides  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.21

Aluminum Oxide

61 POINTS

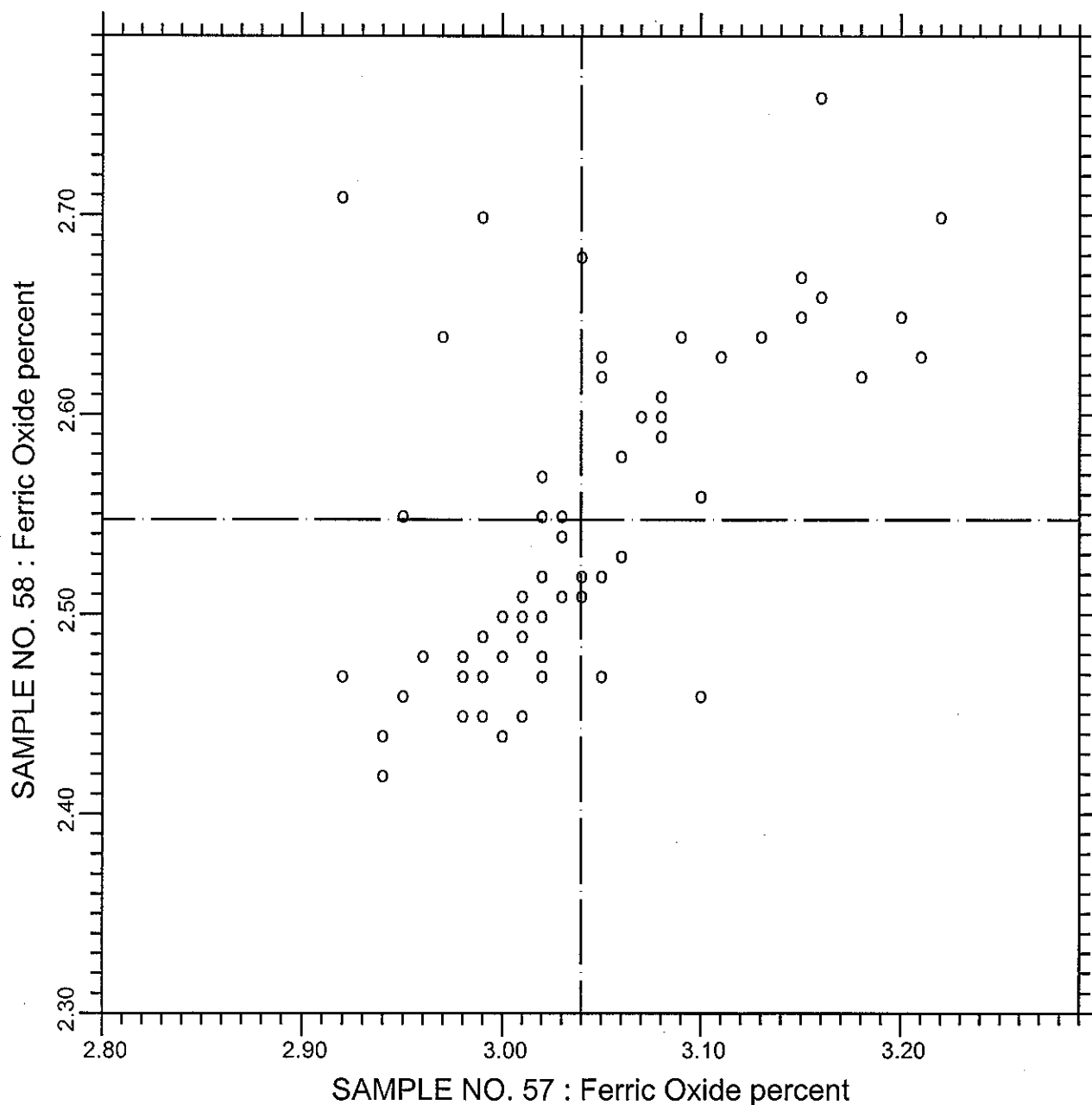
SAMPLE NO. 57 AVE 4.485 S.D. 0.26 C.V. 5.89

SAMPLE NO. 58 AVE 5.249 S.D. 0.34 C.V. 6.43

LABS ELIMINATED 40 126 1715 2116



CCRL PROFICIENCY SAMPLE PROGRAM  
 Ferric Oxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.30

Ferric Oxide

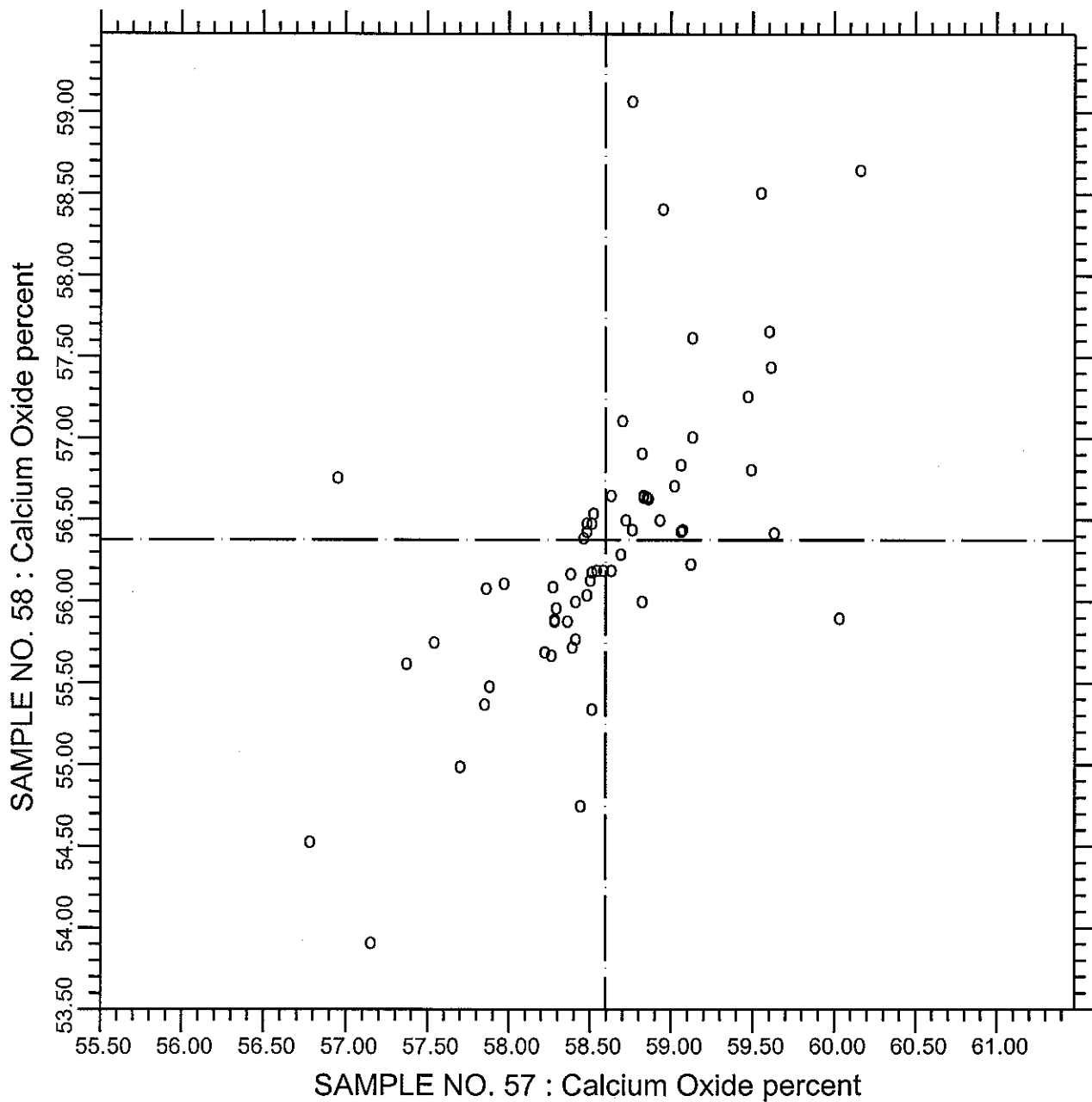
60 POINTS

SAMPLE NO. 57 AVE 3.0397 S.D. 0.072 C.V. 2.37

SAMPLE NO. 58 AVE 2.5473 S.D. 0.085 C.V. 3.35

LABS ELIMINATED 42 51 52 126 20 413 975 2463

CCRL PROFICIENCY SAMPLE PROGRAM  
 Calcium Oxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.40

Calcium Oxide

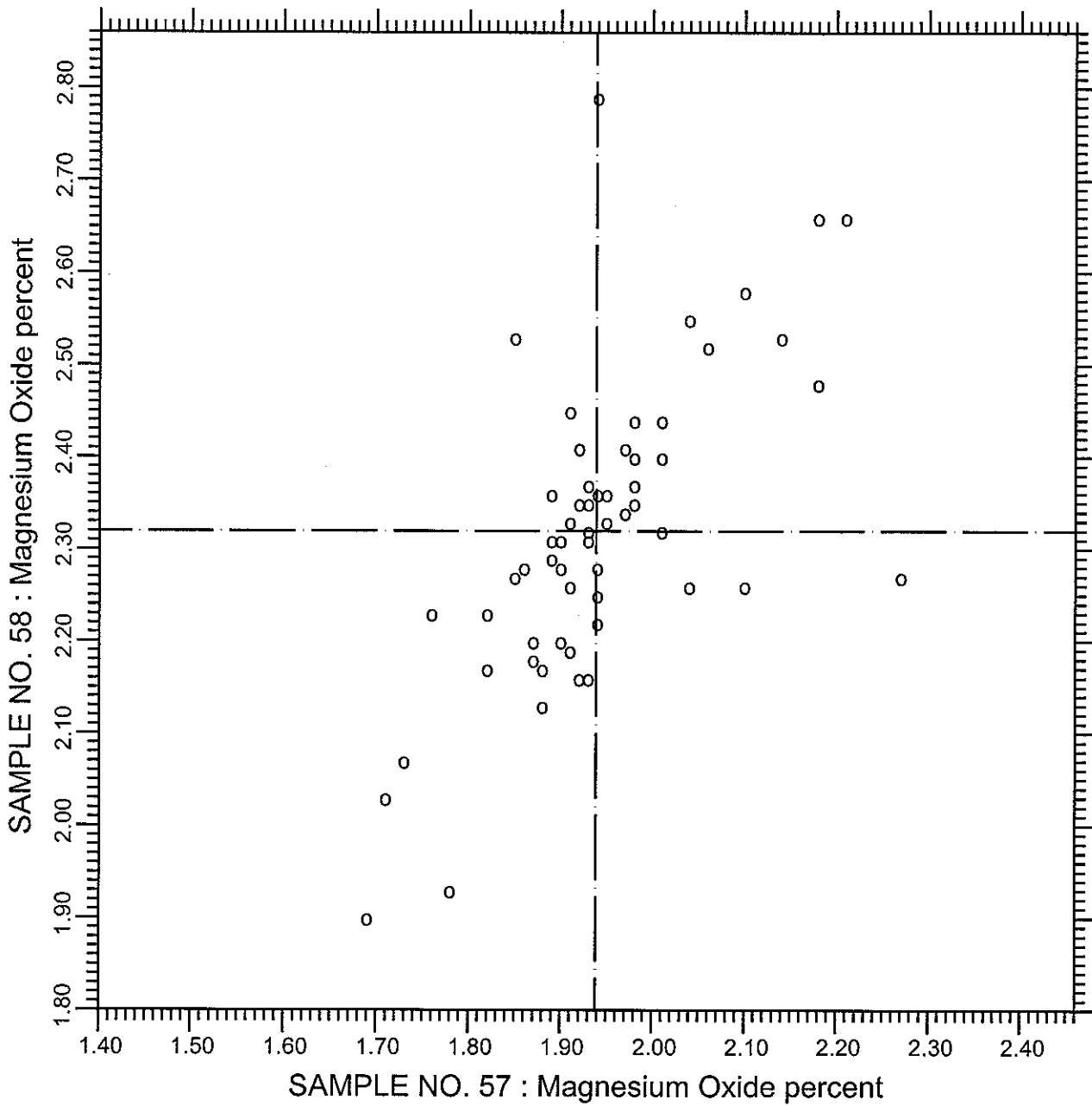
63 POINTS

SAMPLE NO. 57 AVE 58.596 S.D. 0.66 C.V. 1.12

SAMPLE NO. 58 AVE 56.375 S.D. 0.90 C.V. 1.60

LABS ELIMINATED 413 2116 870 2463

CCRL PROFICIENCY SAMPLE PROGRAM  
Magnesium Oxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.50

Magnesium Oxide

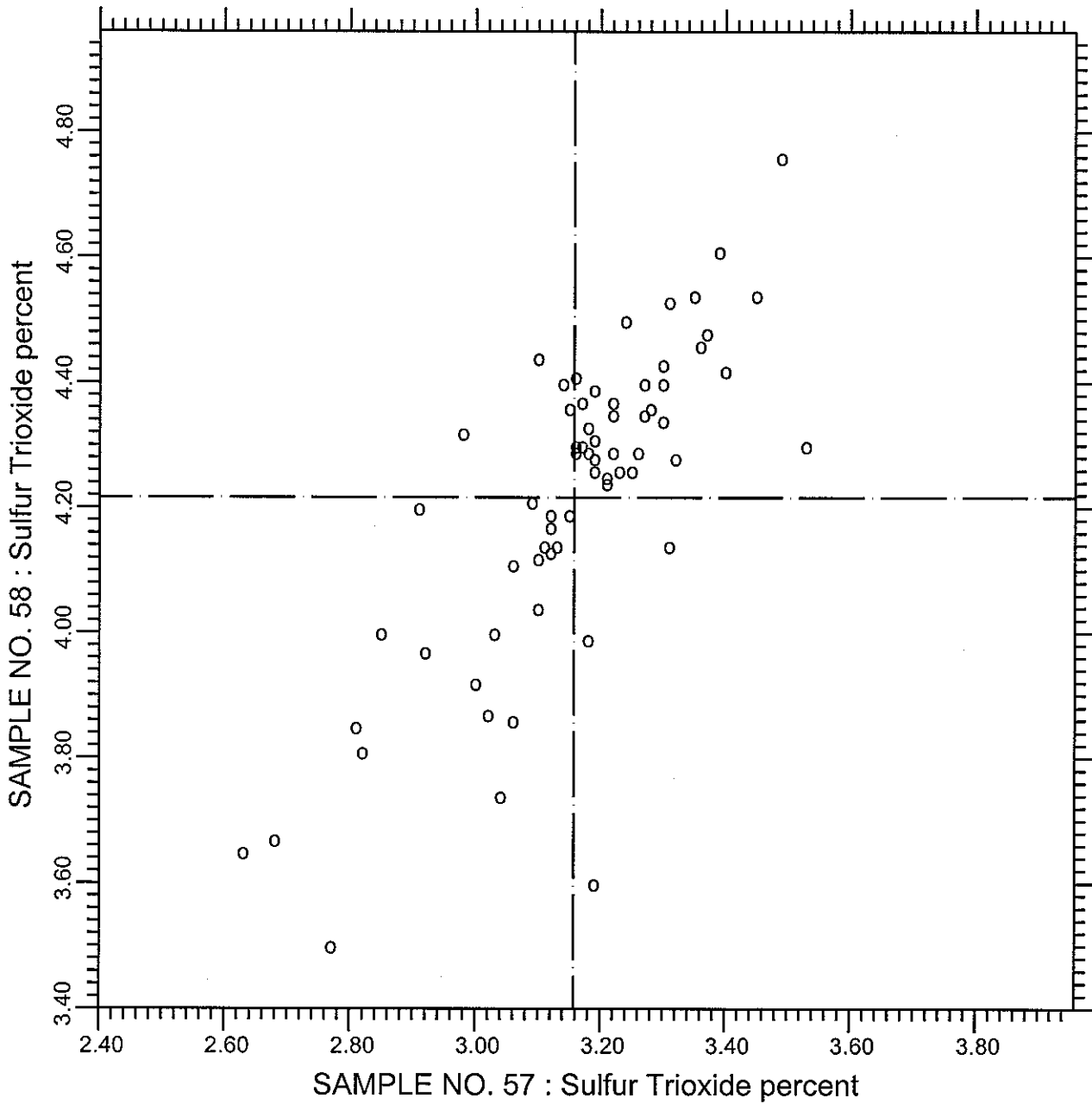
62 POINTS

SAMPLE NO. 57 AVE 1.938 S.D. 0.11 C.V. 5.75

SAMPLE NO. 58 AVE 2.320 S.D. 0.16 C.V. 6.86

LABS ELIMINATED 870 1799 39 126 3059

CCRL PROFICIENCY SAMPLE PROGRAM  
Sulfur Trioxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



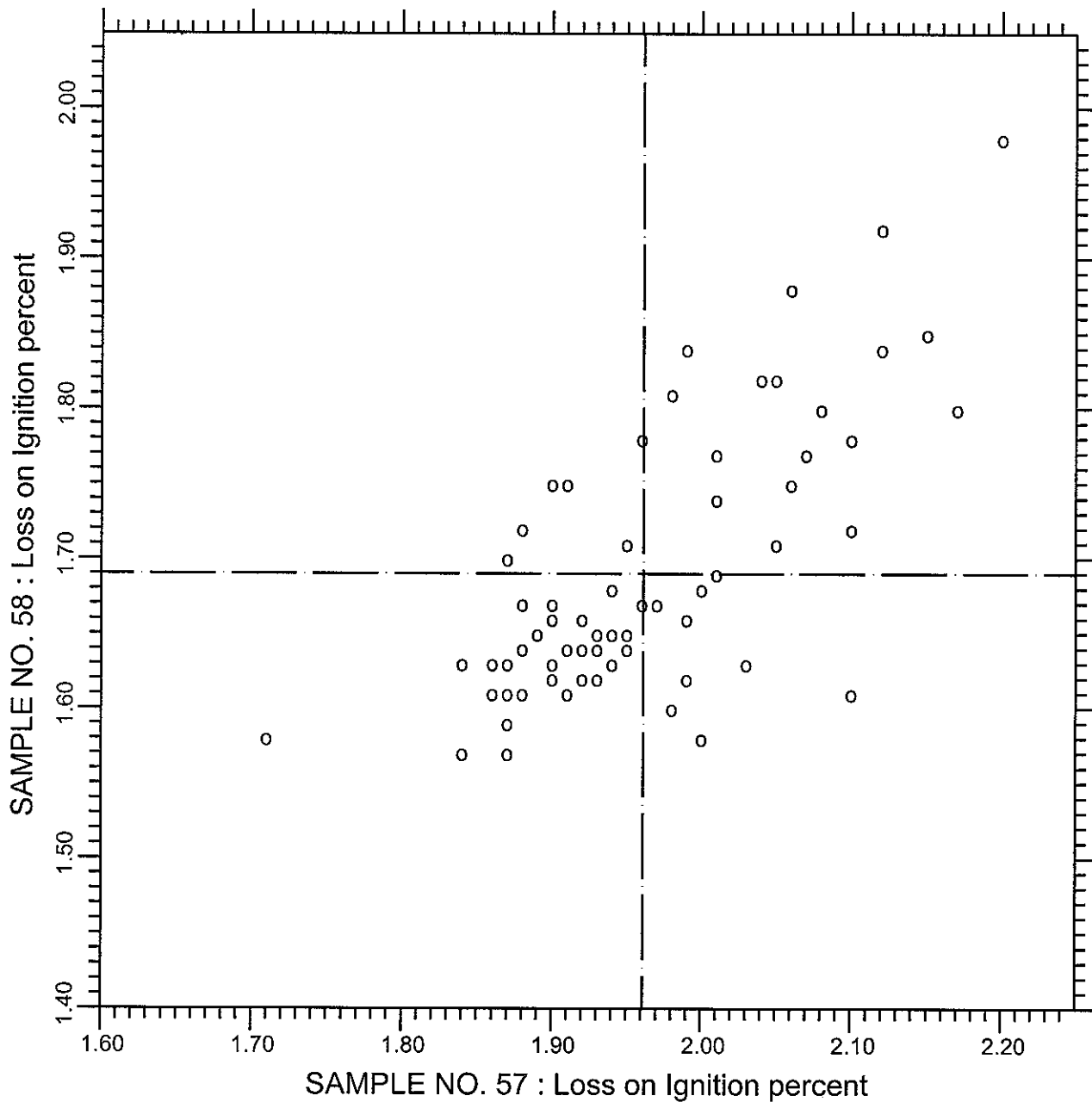
TEST NO.60

Sulfur Trioxide

66 POINTS

SAMPLE NO. 57	AVE	3.157	S.D.	0.18	C.V.	5.62
SAMPLE NO. 58	AVE	4.216	S.D.	0.25	C.V.	6.00

CCRL PROFICIENCY SAMPLE PROGRAM  
 Loss on Ignition  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.70

Loss on Ignition

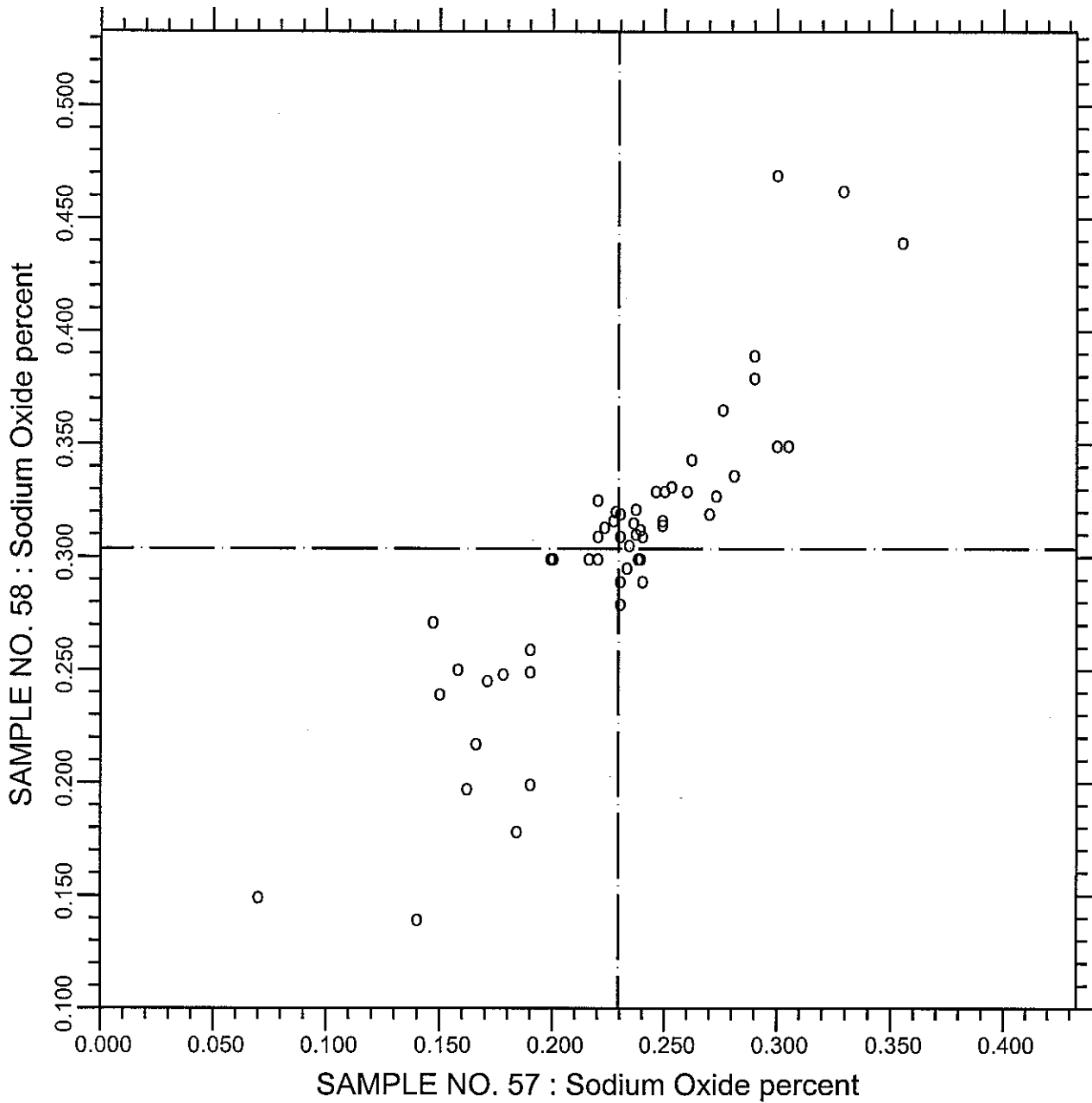
66 POINTS

SAMPLE NO. 57 AVE 1.961 S.D. 0.094 C.V. 4.77

SAMPLE NO. 58 AVE 1.690 S.D. 0.092 C.V. 5.42

LABS ELIMINATED 695 1799 354 2116

CCRL PROFICIENCY SAMPLE PROGRAM  
Sodium Oxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.90

Sodium Oxide

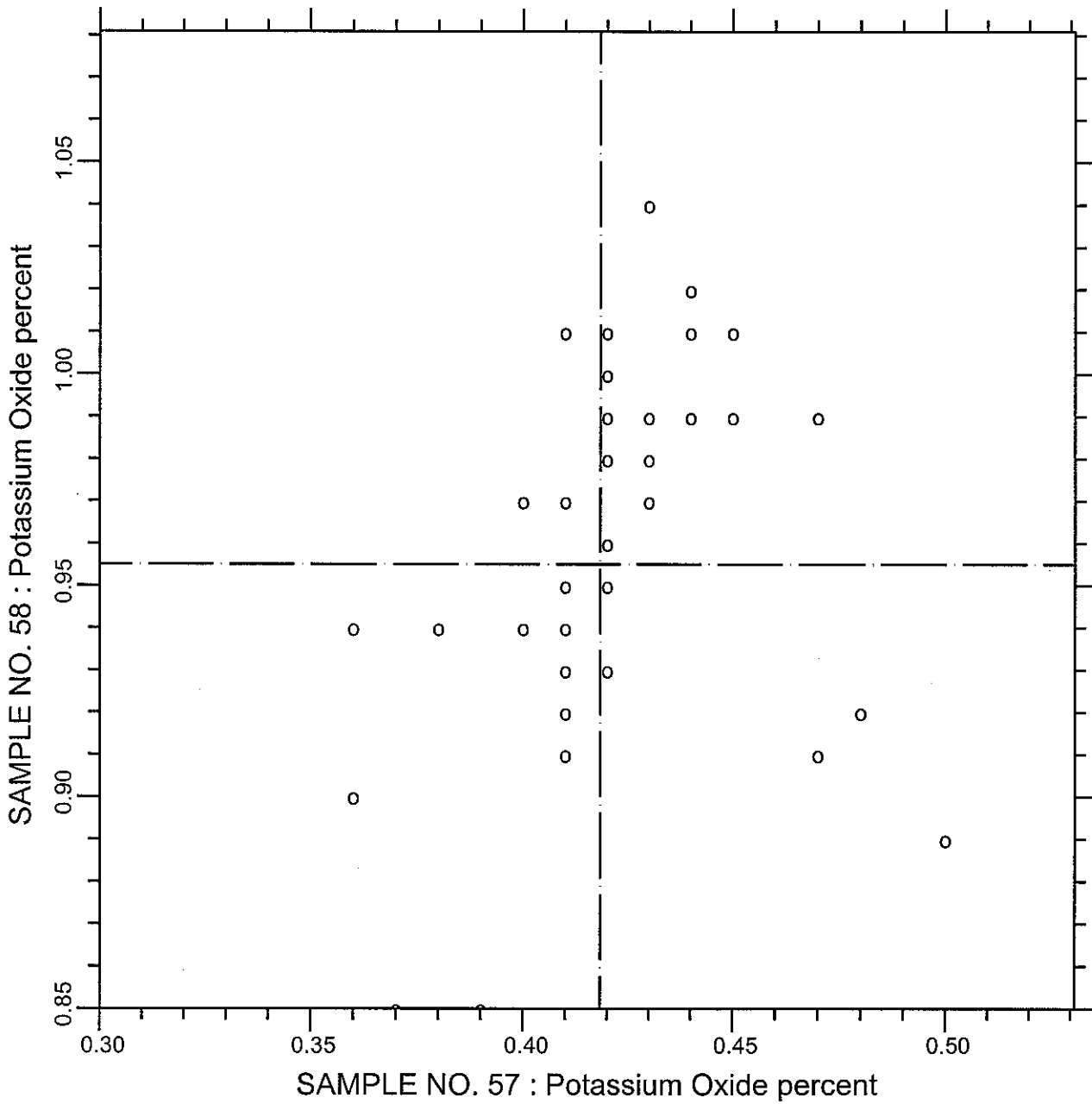
54 POINTS

SAMPLE NO. 57 AVE 0.2292 S.D. 0.051 C.V. 22.2

SAMPLE NO. 58 AVE 0.3036 S.D. 0.064 C.V. 21.1

LABS ELIMINATED 1251 1799 1196 3059

CCRL PROFICIENCY SAMPLE PROGRAM  
 Potassium Oxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.100

Potassium Oxide

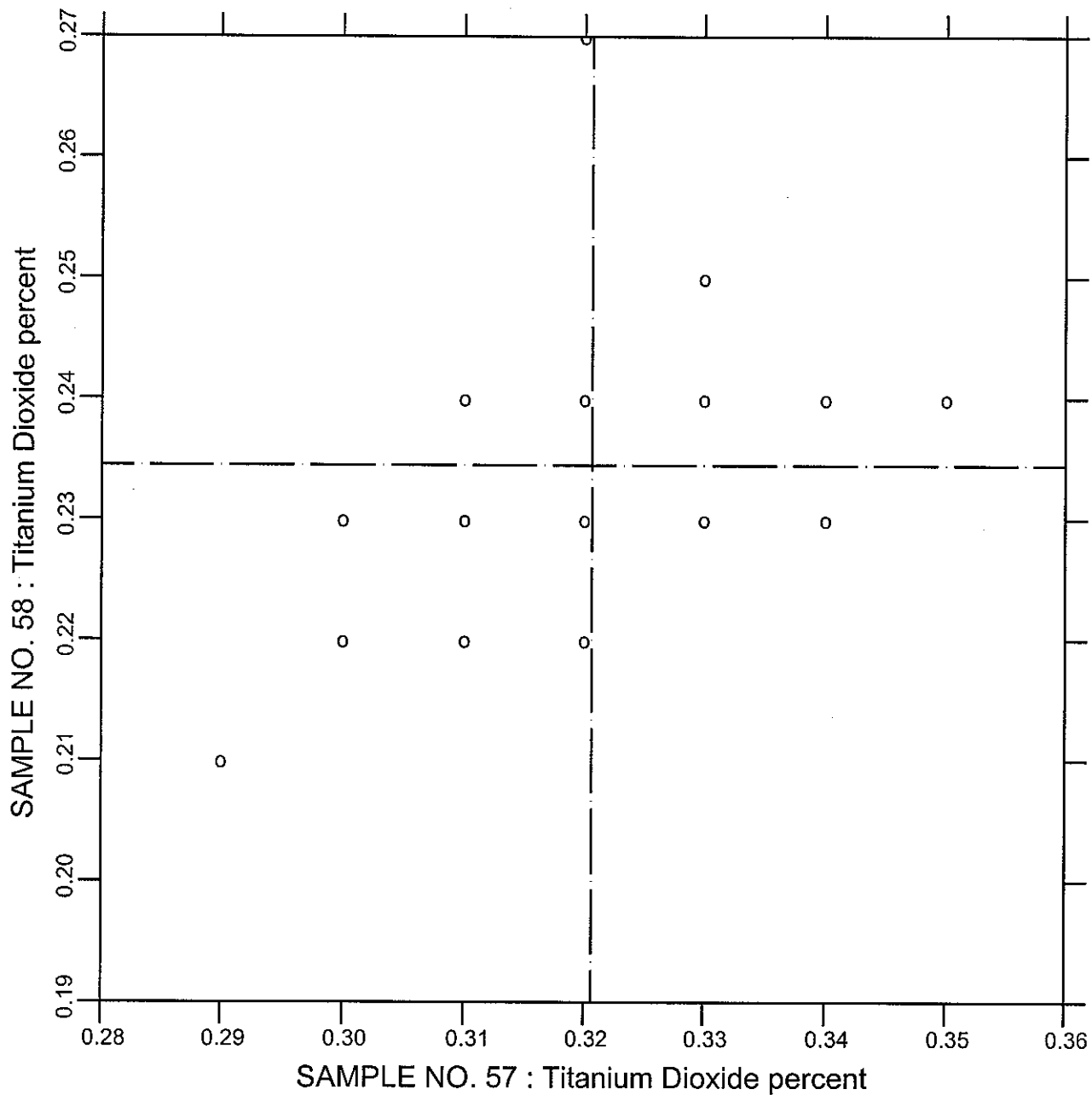
54 POINTS

SAMPLE NO. 57 AVE 0.4183 S.D. 0.026 C.V. 6.16

SAMPLE NO. 58 AVE 0.9550 S.D. 0.038 C.V. 3.94

LABS ELIMINATED 52 1799 2463 3 1251 3009

CCRL PROFICIENCY SAMPLE PROGRAM  
Titanium Dioxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.103

Titanium Dioxide

47 POINTS

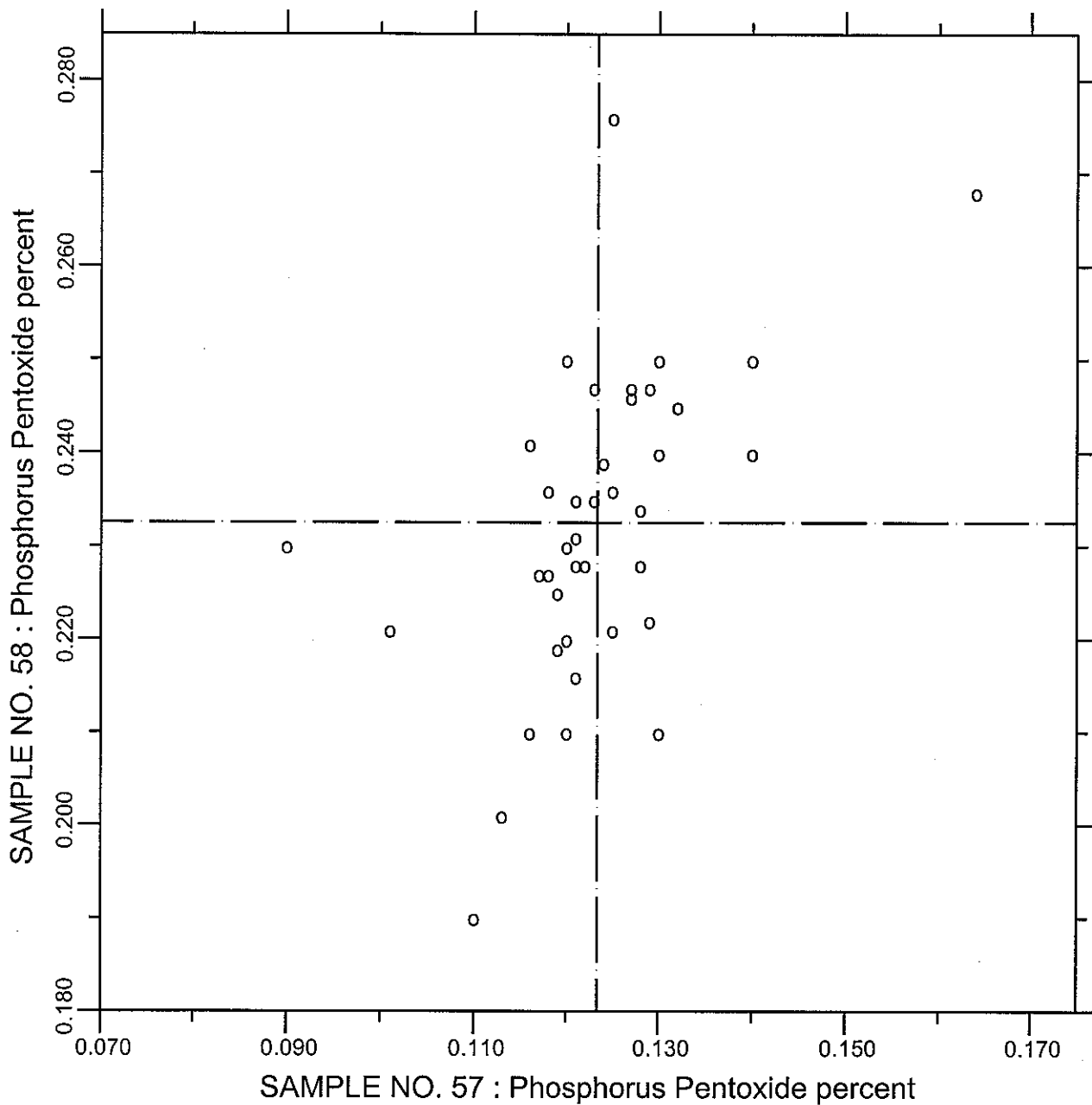
SAMPLE NO. 57 AVE 0.3206 S.D. 0.0117 C.V. 3.64

SAMPLE NO. 58 AVE 0.2345 S.D. 0.0100 C.V. 4.25

LABS ELIMINATED 126 413 2463



CCRL PROFICIENCY SAMPLE PROGRAM  
 Phosphorus Pentoxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



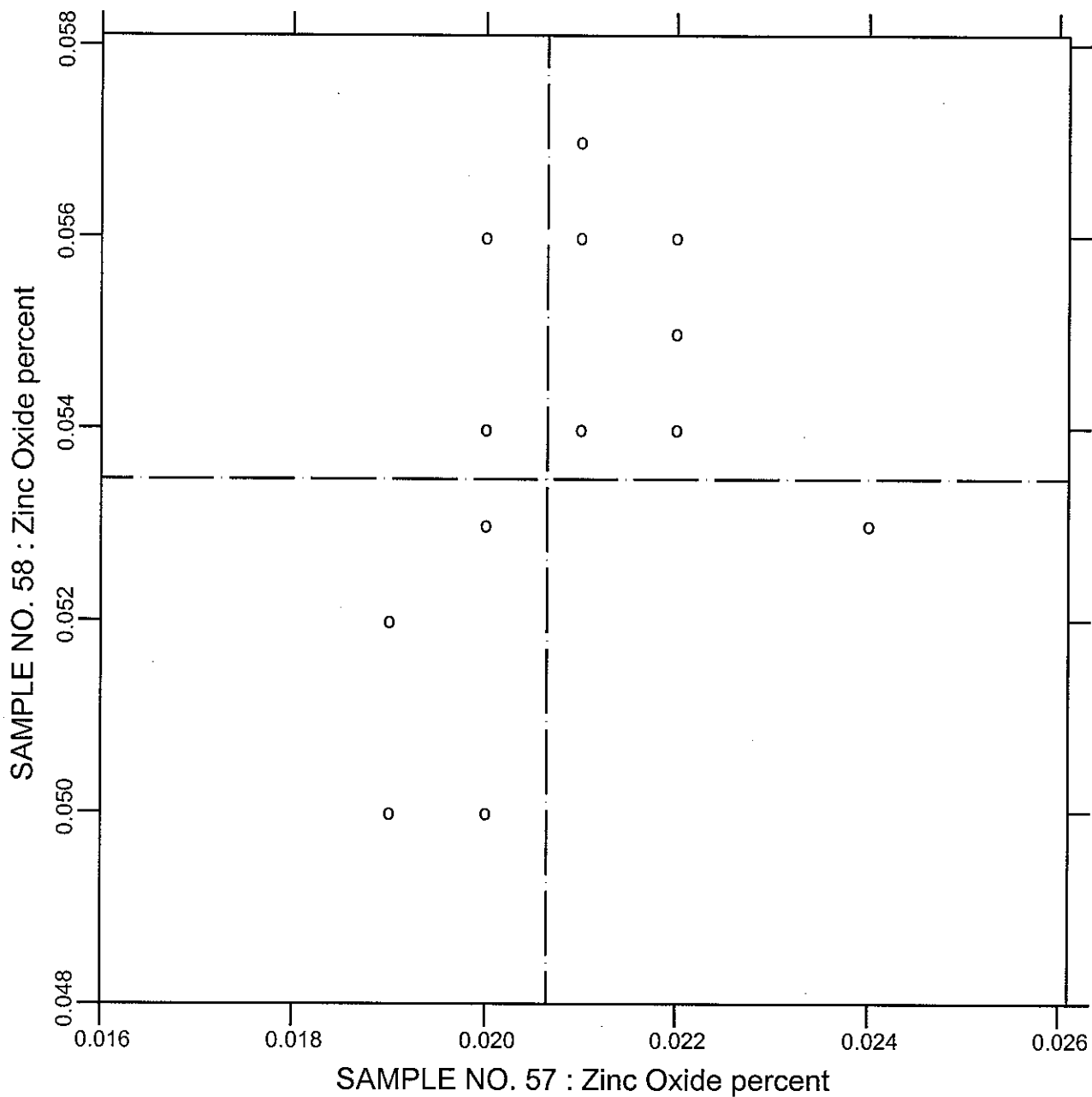
TEST NO.102                      Phosphorus Pentoxide                      44 POINTS

SAMPLE NO. 57    AVE 0.1234    S.D. 0.011    C.V. 8.64

SAMPLE NO. 58    AVE 0.2325    S.D. 0.016    C.V. 7.08

LABS ELIMINATED 126 2463 413 1799 1940 3059

CCRL PROFICIENCY SAMPLE PROGRAM  
Zinc Oxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.99

Zinc Oxide

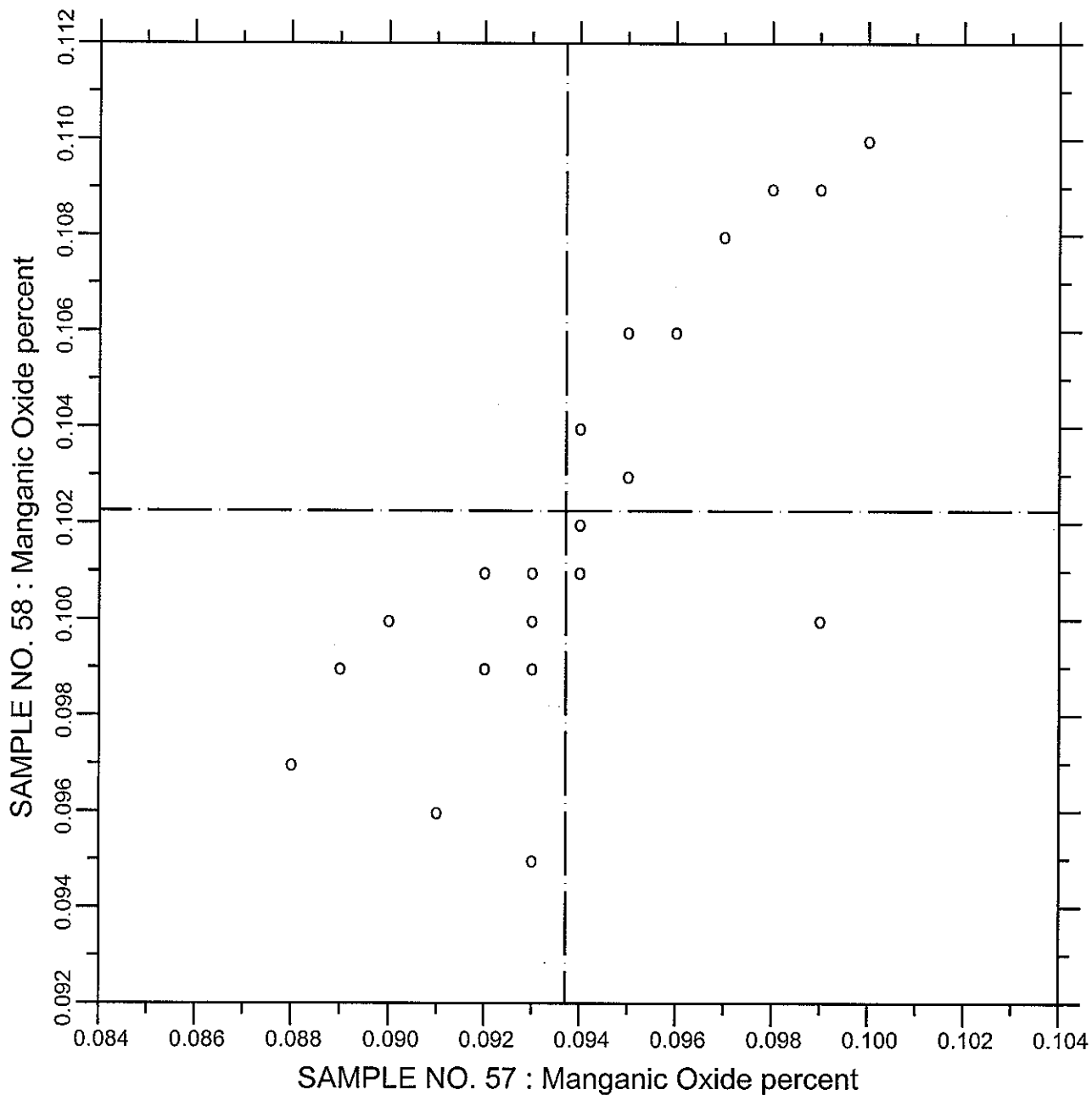
17 POINTS

SAMPLE NO. 57 AVE 0.02065 S.D. 0.0013 C.V. 6.39

SAMPLE NO. 58 AVE 0.05347 S.D. 0.0022 C.V. 4.08

LABS ELIMINATED 40 413 542 1196

CCRL PROFICIENCY SAMPLE PROGRAM  
Manganic Oxide  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.101

Manganic Oxide

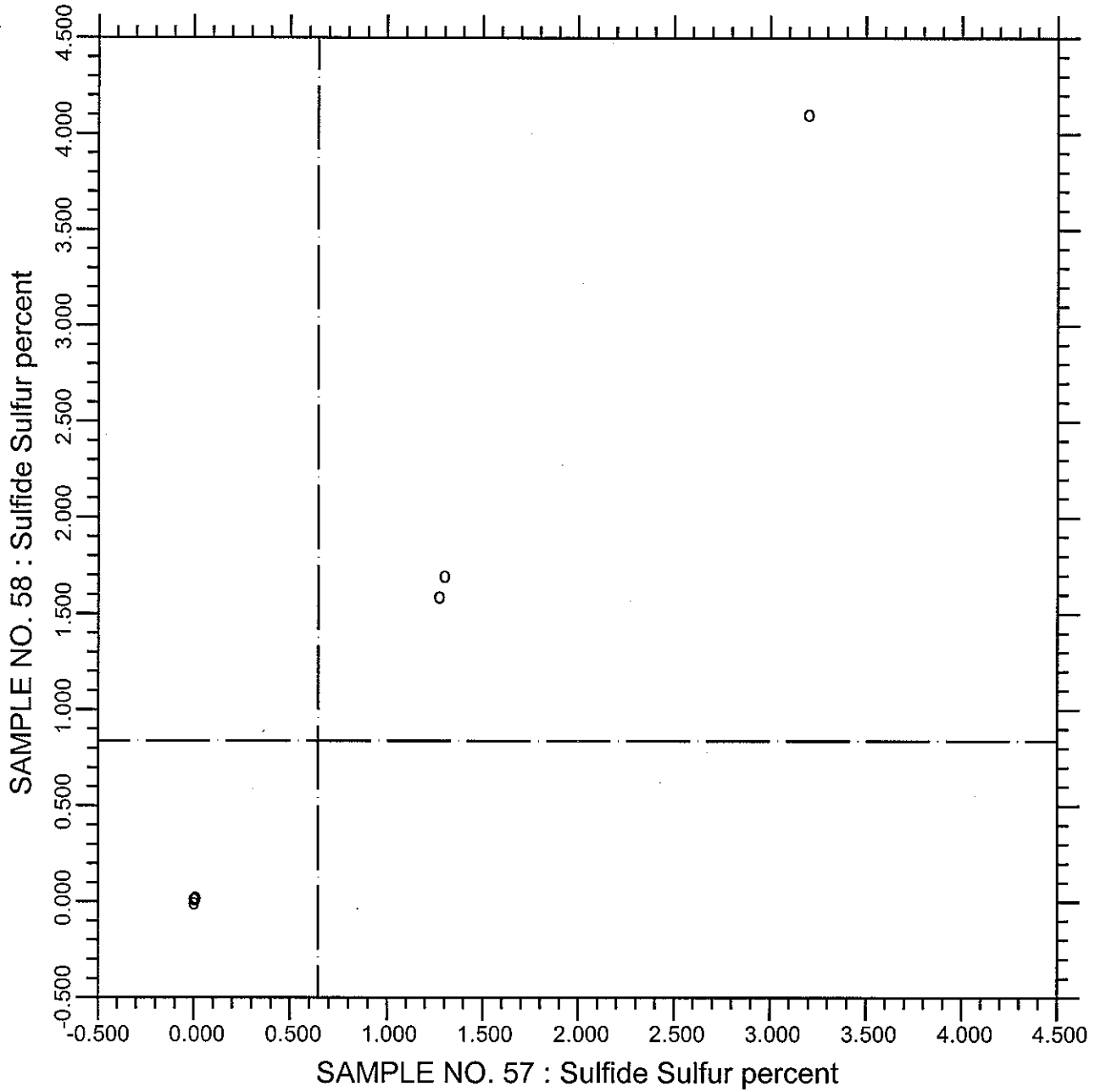
31 POINTS

SAMPLE NO. 57 AVE 0.09371 S.D. 0.0035 C.V. 3.71

SAMPLE NO. 58 AVE 0.10226 S.D. 0.0042 C.V. 4.16

LABS ELIMINATED 40 207 413 1251 2462 181 3059

CCRL PROFICIENCY SAMPLE PROGRAM  
Sulfide Sulfur  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



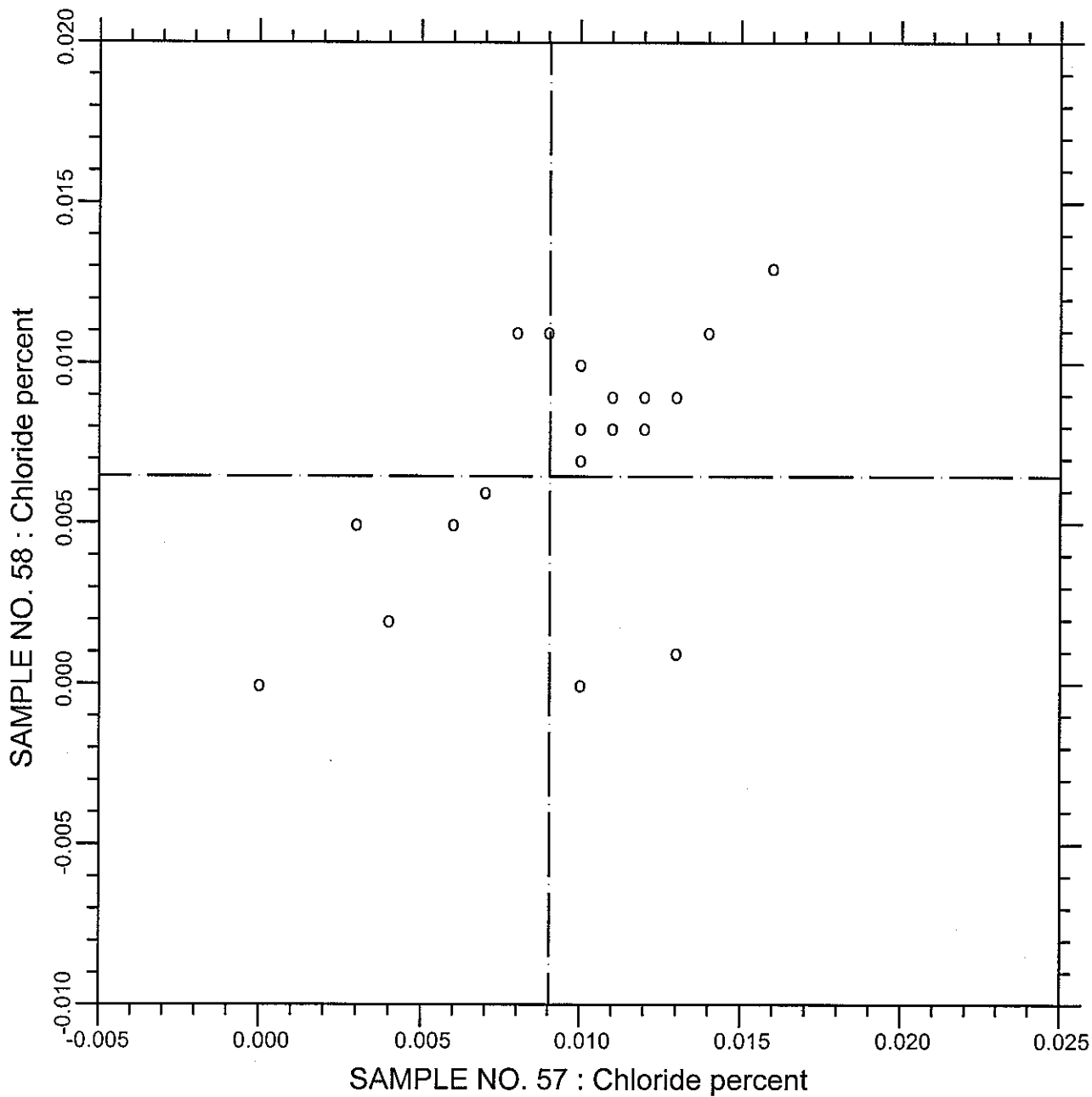
TEST NO.65

Sulfide Sulfur

9 POINTS

SAMPLE NO. 57	AVE	0.64	S.D.	1.1	C.V.	172
SAMPLE NO. 58	AVE	0.84	S.D.	1.4	C.V.	169

CCRL PROFICIENCY SAMPLE PROGRAM  
Chloride  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.104

Chloride

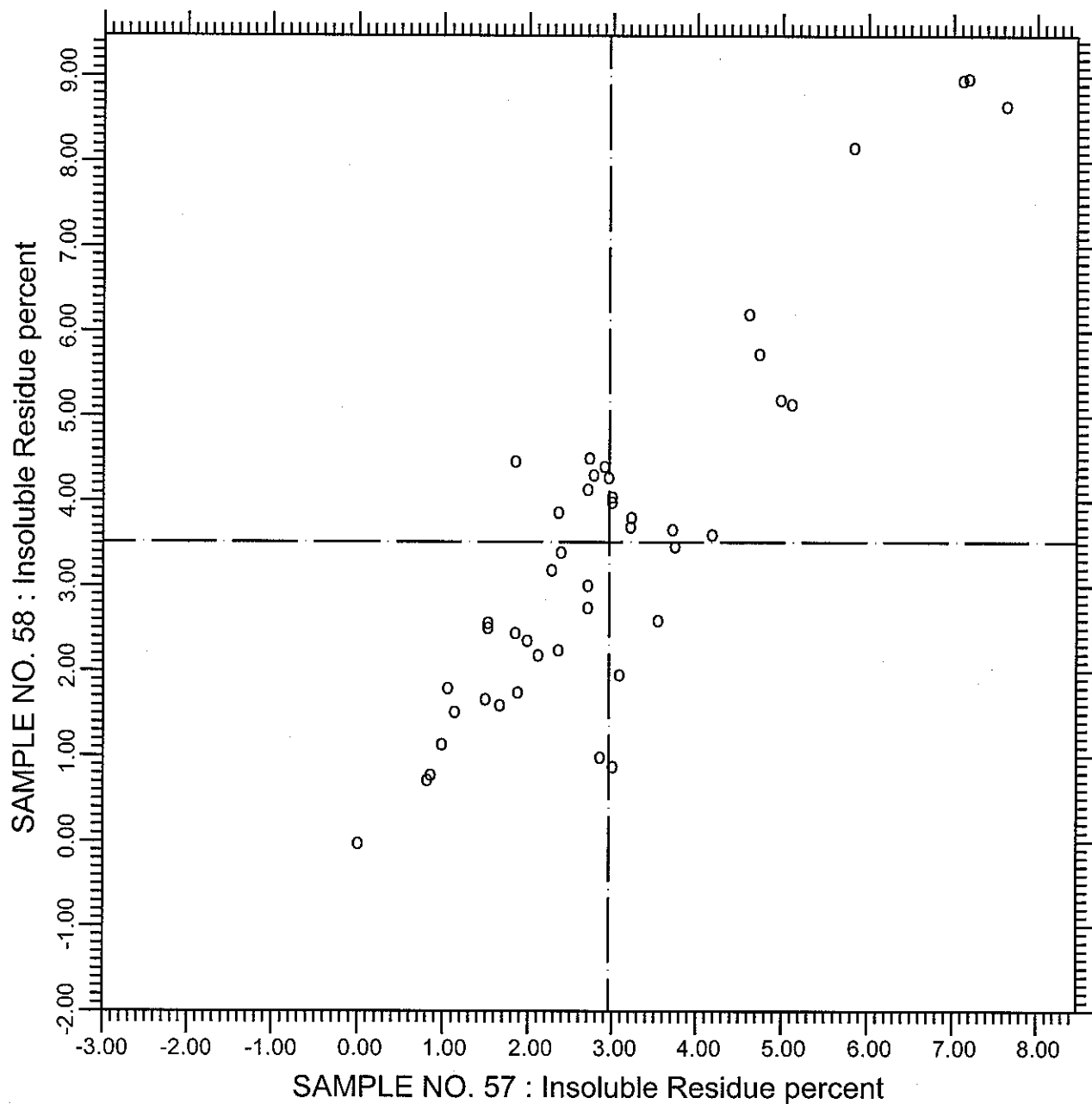
26 POINTS

SAMPLE NO. 57 AVE 0.00904 S.D. 0.0044 C.V. 48.6

SAMPLE NO. 58 AVE 0.00646 S.D. 0.0041 C.V. 64.2

LABS ELIMINATED 23 158 246 870 1799

CCRL PROFICIENCY SAMPLE PROGRAM  
 Insoluble Residue  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



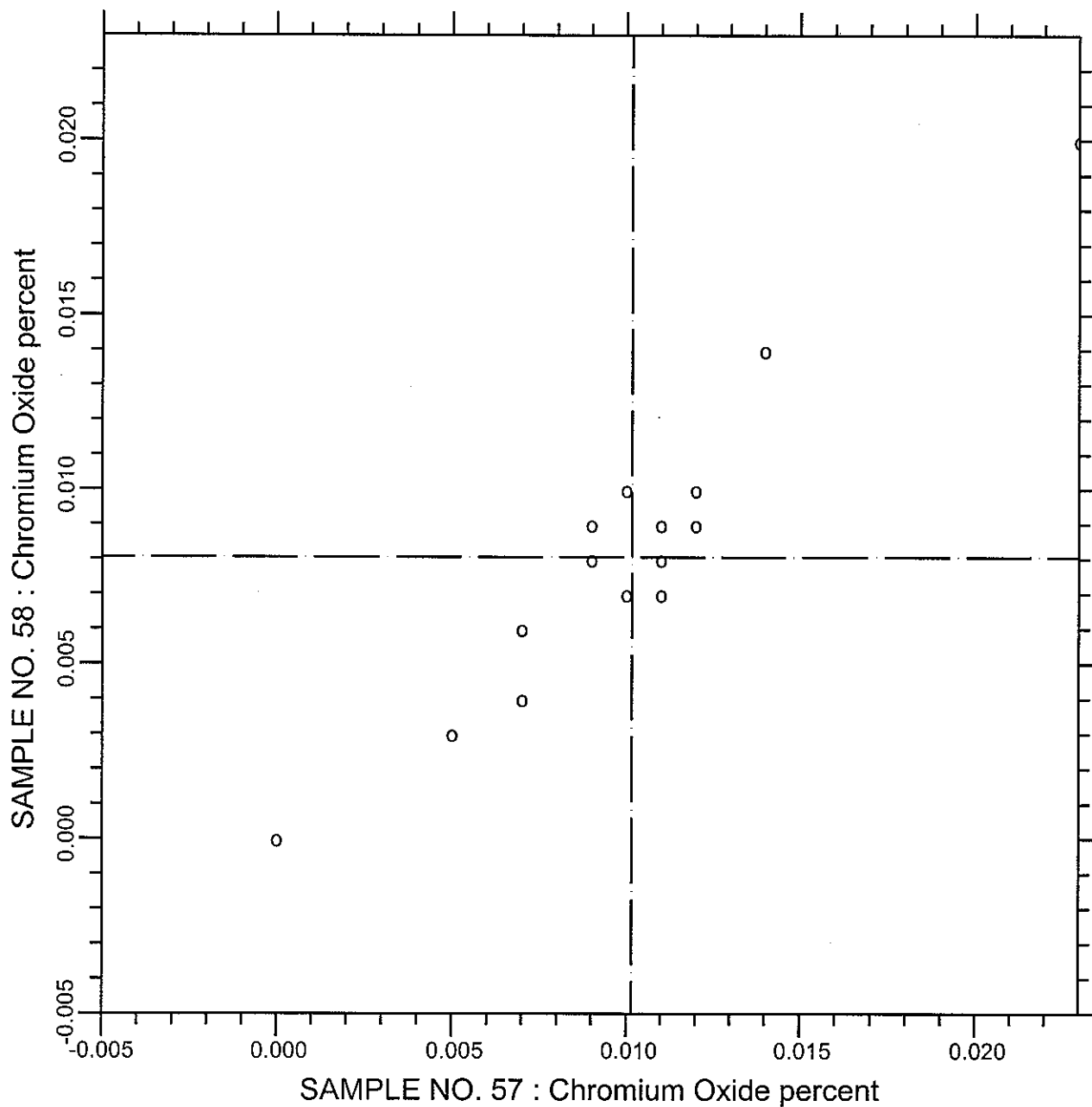
TEST NO.80

Insoluble Residue

45 POINTS

SAMPLE NO. 57	AVE	2.96	S.D.	1.7	C.V.	57.4
SAMPLE NO. 58	AVE	3.52	S.D.	2.2	C.V.	61.5

CCRL PROFICIENCY SAMPLE PROGRAM  
 Chromium Oxide  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.105

Chromium Oxide

19 POINTS

SAMPLE NO. 57 AVE 0.01016 S.D. 0.0044 C.V. 42.9

SAMPLE NO. 58 AVE 0.00805 S.D. 0.0041 C.V. 51.1

LABS ELIMINATED 36 40

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 57 and No. 58  
Final Report - Physical Results  
May 5, 2006

SUMMARY OF RESULTS

Test		#Labs	Sample No. 57			Sample No. 58		
			Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	prcnt	78	27.2	0.72	2.67	26.9	0.66	2.46
N.C. Water	prcnt	* 75	27.14	0.62	2.29	26.8	0.54	2.02
Vicat TS Initial	min	76	115	19.4	16.8	119	22.3	18.8
Vicat TS Initial	min	* 73	114	17.4	15.3	116	14.4	12.5
Vicat TS Final	min	73	228	43.8	19.2	236	45.0	19.0
Vicat TS Final	min	* 69	220	31.2	14.2	230	36.5	15.9
Autoclave Expan	prcnt	72	-0.004	0.058	-1448.7	-0.005	0.044	-887.5
Autoclave Expan	prcnt	* 69	-0.012	0.022	-183.6	-0.007	0.019	-277.5
Air Content	prcnt	67	8.2	1.0	12.3	8.9	1.1	12.0
Air Content	prcnt	* 66	8.2	1.0	12.3	9.0	1.0	11.2
AC Mix Water	prcnt	66	69.3	6.0	8.67	69.4	5.9	8.57
AC Mix Water	prcnt	* 65	70.0	2.0	2.90	70.1	1.9	2.67
AC Flow	prcnt	66	86	3.1	3.59	87	2.9	3.39
Specific Gravity		58	3.04	0.093	3.07	3.00	0.095	3.17
Specific Gravity		* 57	3.05	0.036	1.17	3.01	0.045	1.51

CONTINUED ON NEXT PAGE

\* ELIMINATED LABS: Data over three S.D. from the mean

Normal Consistency,	33 38 51
Vicat TS Initial	33 51 2251
Vicat TS Final	36 38 698 2352
Autoclave Expansion	23 1196 1940
Air Content	1940
Air Content, Mix Water	10
Specific Gravity	36



CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 57 and No. 58  
Final Report - Physical Results  
May 5, 2006

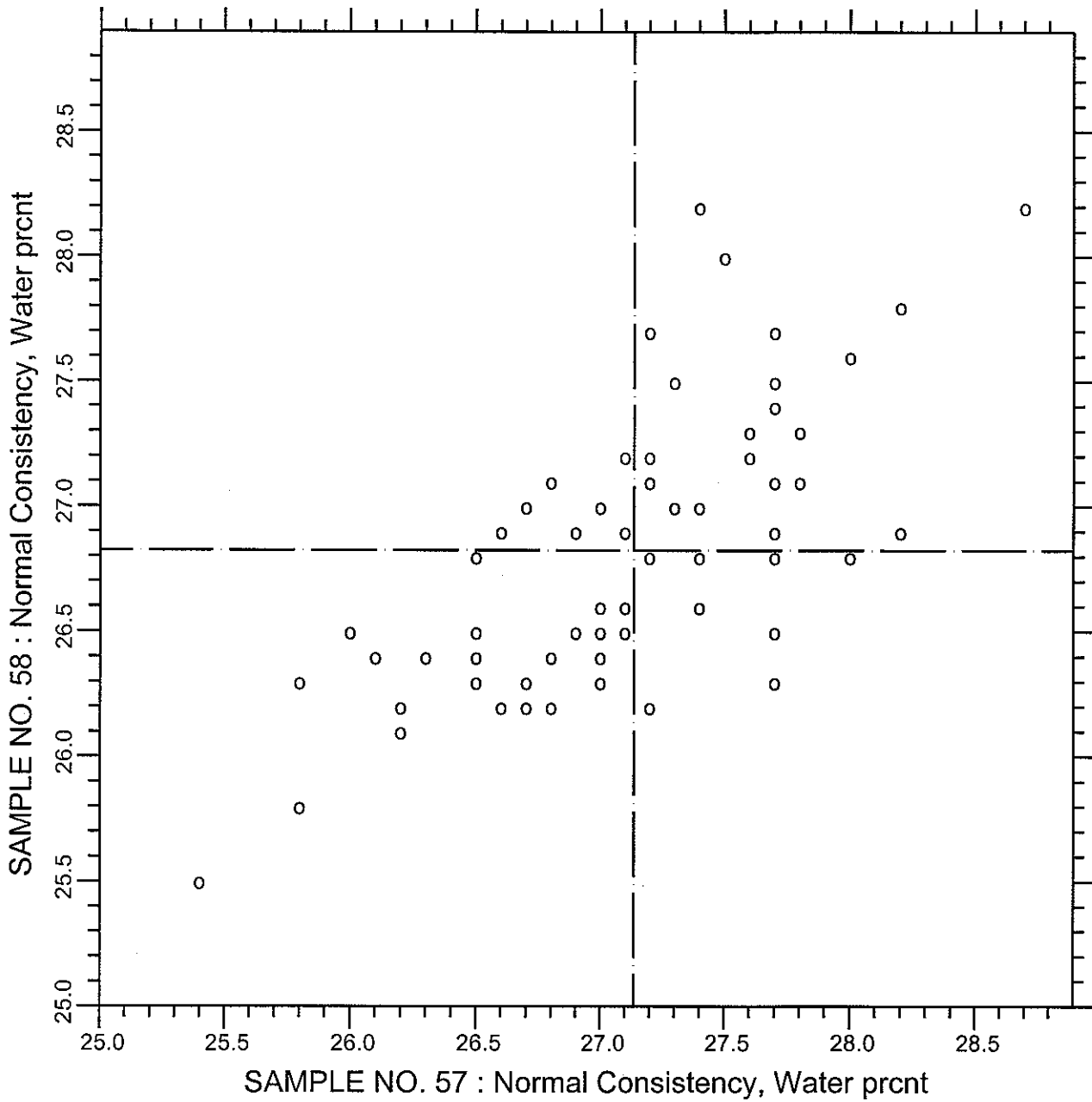
SUMMARY OF RESULTS

Test	#Labs	Sample No. 57			Sample No. 58			
		Average	S.D.	C.V.	Average	S.D.	C.V.	
Comp Str, 3 day	psi	79	3320	345.8	10.4	3995	416.3	10.4
Comp Str, 3 day	psi *	77	3314	321.6	9.70	3998	373.8	9.35
Comp Str, 7 day	psi	78	4497	506.6	11.3	5282	595.7	11.3
Comp Str, 7 day	psi *	75	4465	341.7	7.65	5237	400.7	7.65
Comp Str, 28 day	psi	67	6980	600.8	8.61	7029	653.5	9.30
Comp Str, 28 day	psi *	66	6974	603.8	8.66	6998	607.1	8.67
CS Mix Water	prcnt	72	49.5	3.8	7.70	49.6	3.8	7.75
CS Mix Water	prcnt *	69	50.1	1.4	2.78	50.2	1.4	2.84
Comp Str Flow	prcnt	73	107	4.7	4.36	107	5.2	4.88
Comp Str Flow	prcnt *	66	108	2.1	1.93	109	2.2	2.06
Fineness AP	cm <sup>2</sup> /g	75	5487	390.2	7.11	6136	545.8	8.90
Fineness AP	cm <sup>2</sup> /g *	74	5495	386.6	7.04	6158	513.3	8.34
45µm Sieve	prcnt	75	94.48	3.3	3.54	91.39	3.6	3.99
45µm Sieve	prcnt *	67	95.03	0.41	0.435	91.94	0.88	0.952

\* ELIMINATED LABS: Data over three S.D. from the mean

Comp Strength, 3 day      46 413  
Comp Strength, 7 day      51 413 2335  
Comp Strength, 28 day    2335  
Comp Strength, Water    10 45 354  
Comp Strength, Flow    22 33 19 35 246 2295 3009  
Fineness, Air Permeability    2463  
45µm Sieve              2 34 36 181 28 207 1196 3059

CCRL PROFICIENCY SAMPLE PROGRAM  
 Normal Consistency - % Water  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



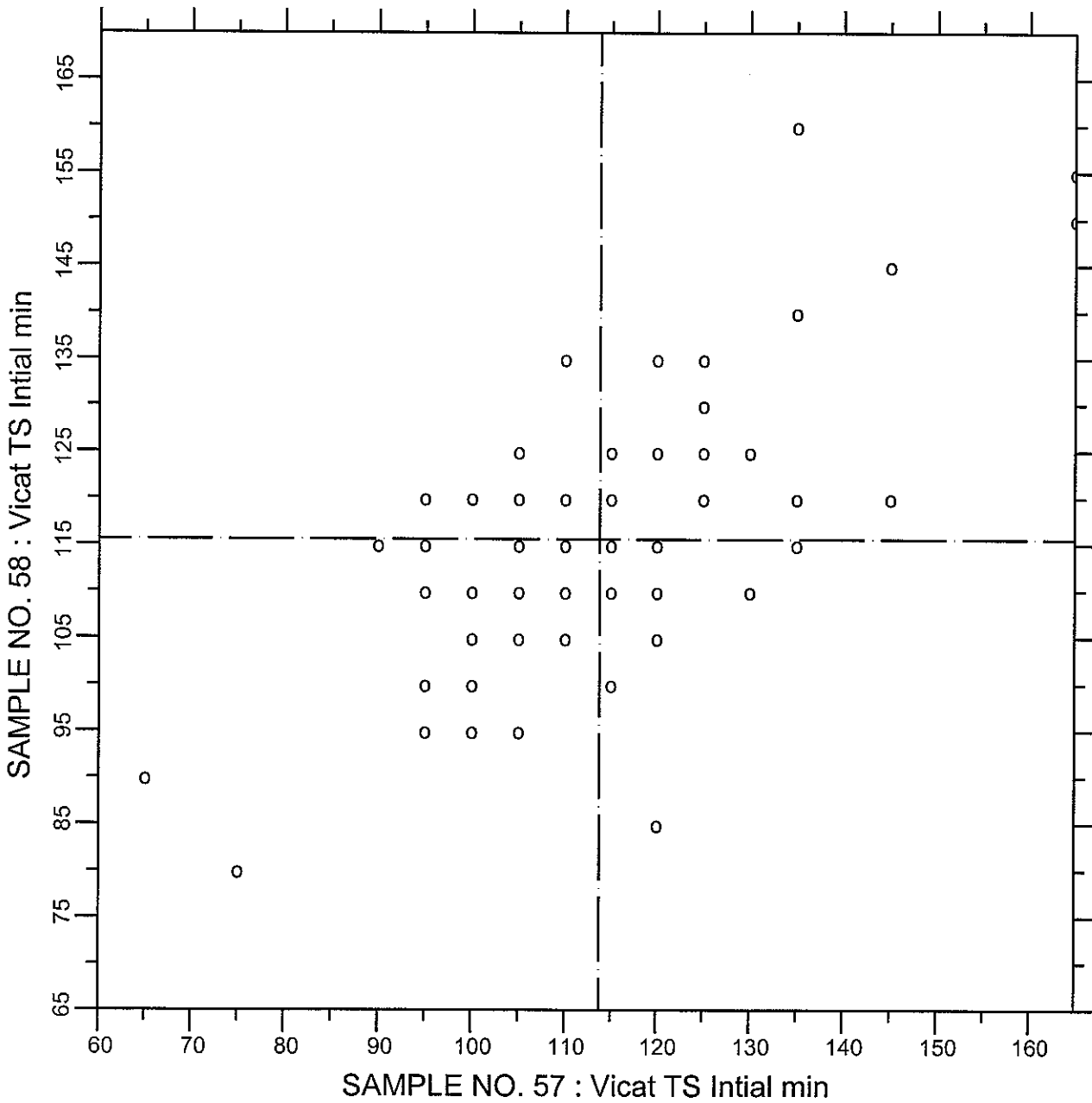
TEST NO.110      Normal Consistency, Water      75 POINTS

SAMPLE NO. 57    AVE 27.137    S.D. 0.62    C.V. 2.29

SAMPLE NO. 58    AVE 26.824    S.D. 0.54    C.V. 2.02

LABS ELIMINATED 33 38 51

CCRL PROFICIENCY SAMPLE PROGRAM  
 Vicat Time of Set - Initial  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.120

Vicat TS Intial

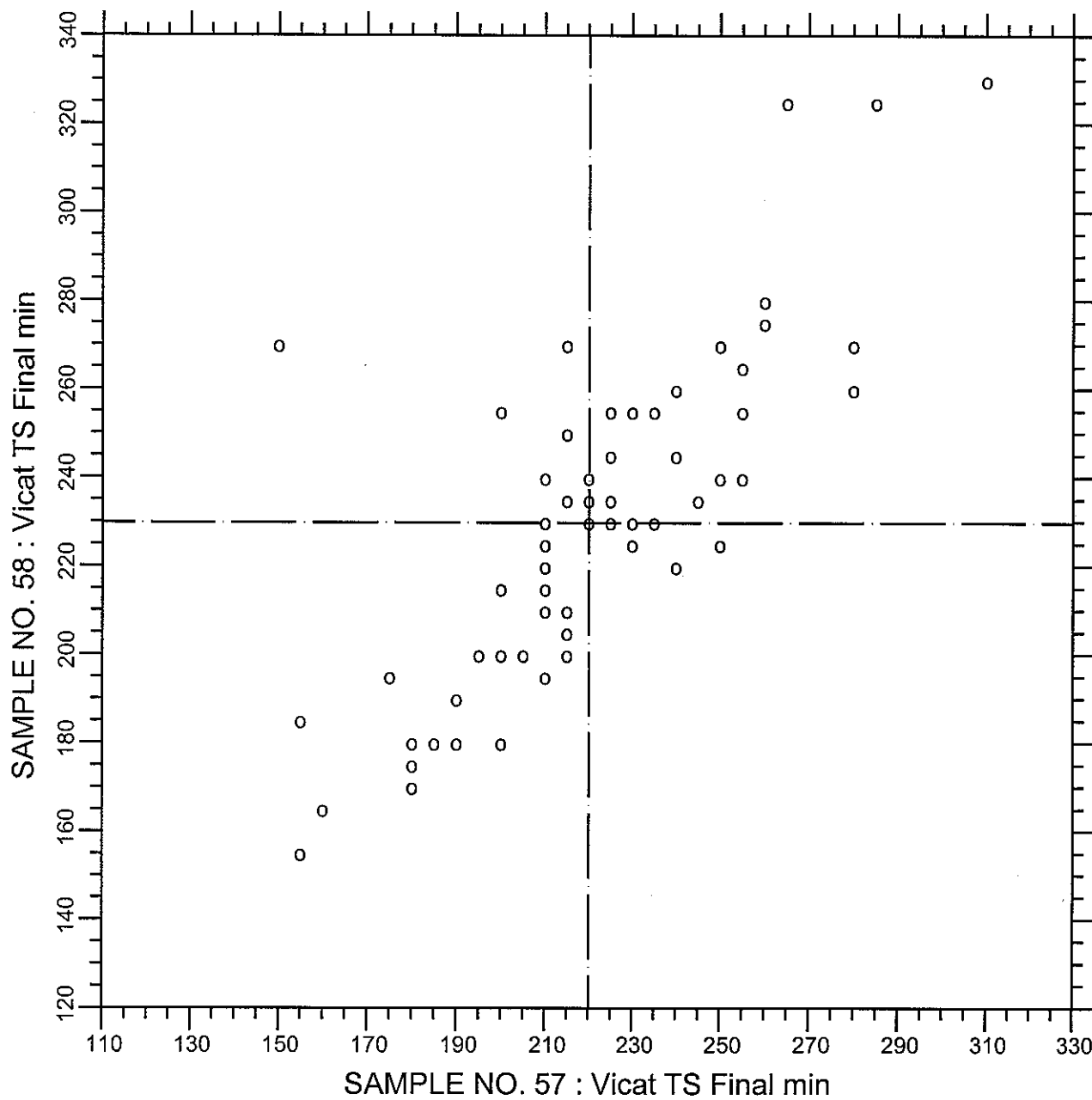
73 POINTS

SAMPLE NO. 57 AVE 113.8 S.D. 17.4 C.V. 15.3

SAMPLE NO. 58 AVE 115.5 S.D. 14.4 C.V. 12.5

LABS ELIMINATED 33 51 2251

CCRL PROFICIENCY SAMPLE PROGRAM  
 Vicat Time of Set - Final  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.121

Vicat TS Final

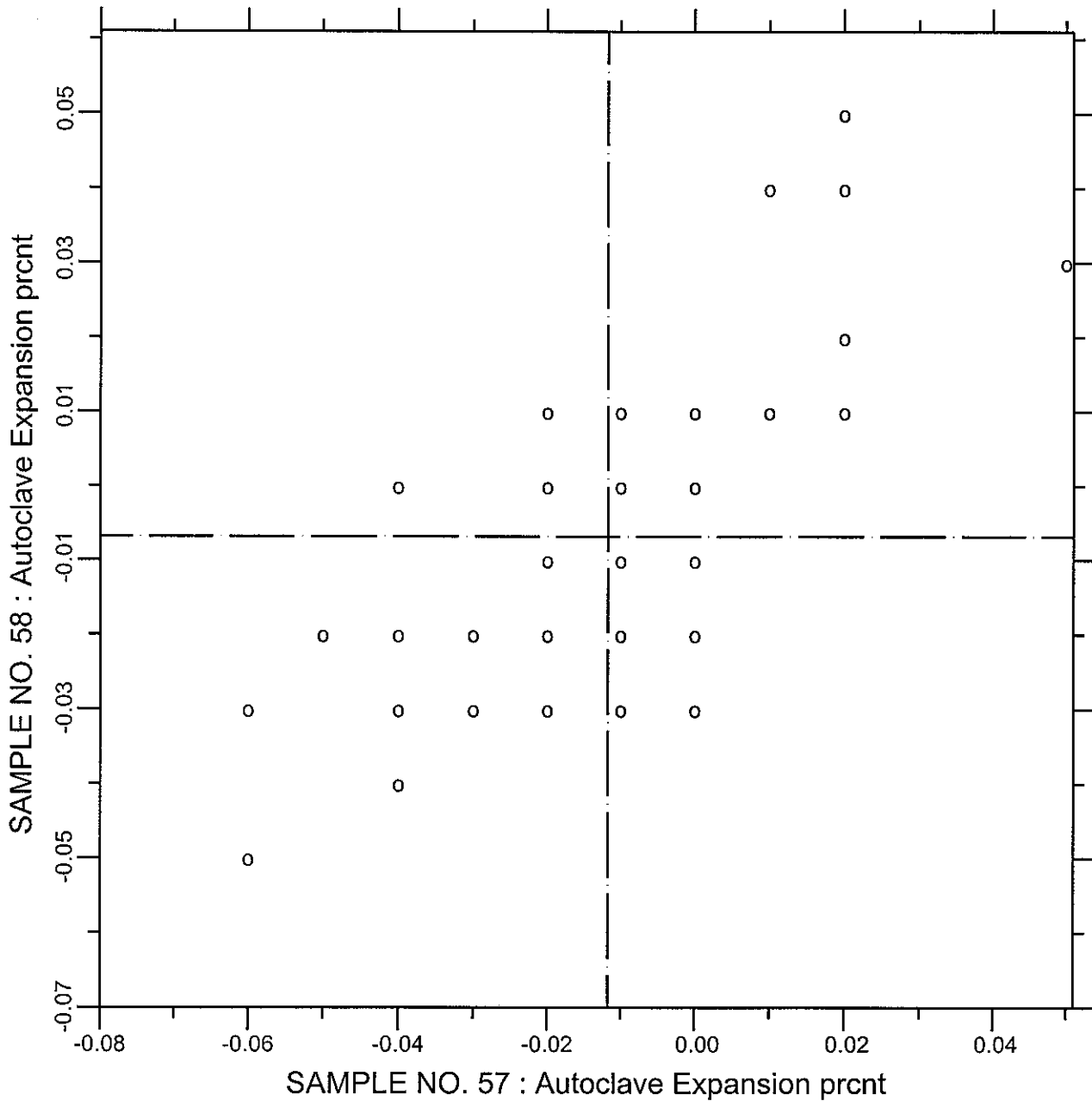
69 POINTS

SAMPLE NO. 57 AVE 220.1 S.D. 31.2 C.V. 14.2

SAMPLE NO. 58 AVE 229.8 S.D. 36.5 C.V. 15.9

LABS ELIMINATED 36 38 698 2352

CCRL PROFICIENCY SAMPLE PROGRAM  
 Autoclave Expansion  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.160                      Autoclave Expansion                      68 POINTS

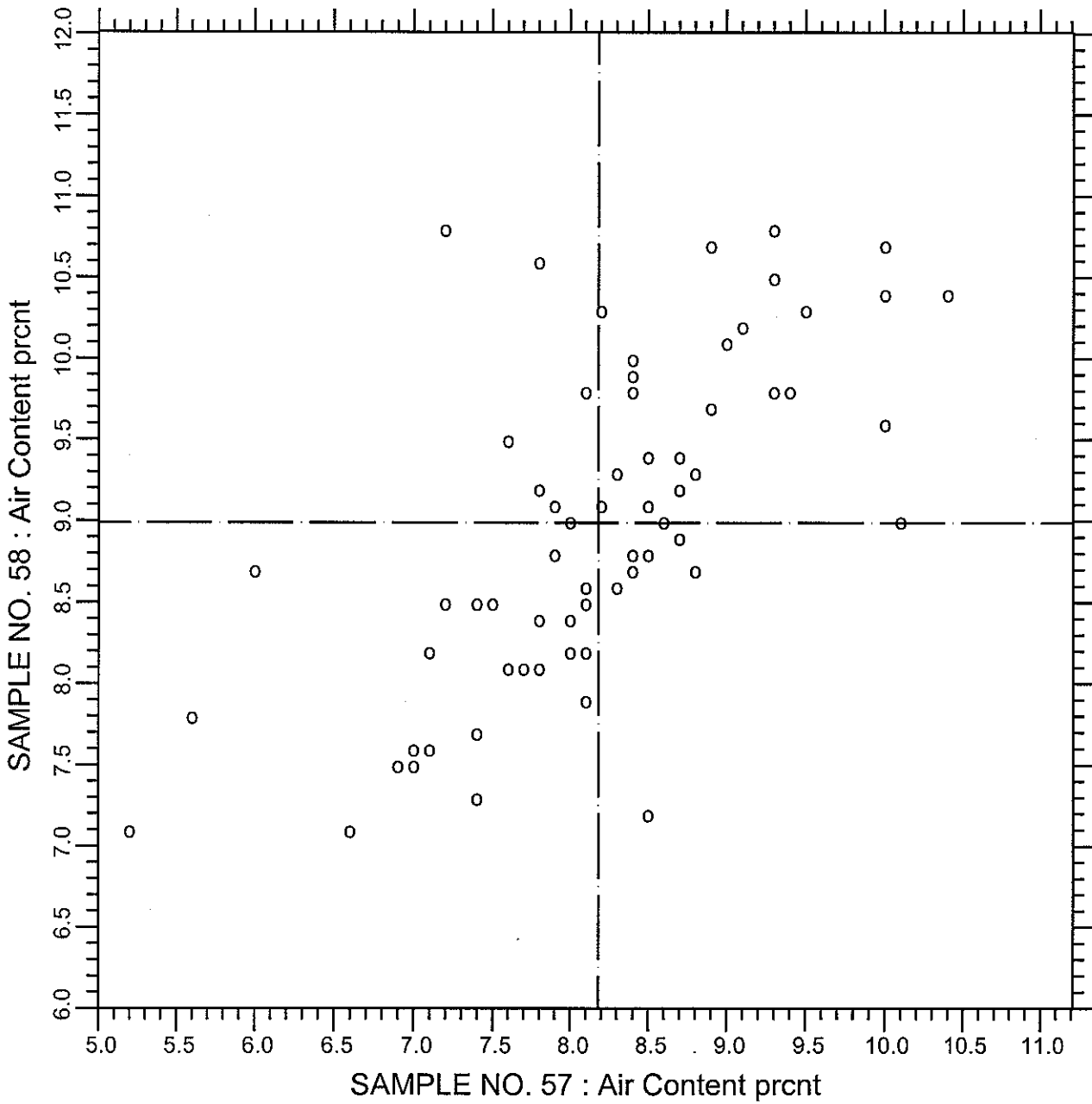
SAMPLE NO. 57    AVE -0.0117    S.D. 0.022    C.V. -183.609

SAMPLE NO. 58    AVE -0.0068    S.D. 0.019    C.V. -277.515

LABS ELIMINATED 23 1196 1940

LABS OFF DIAGRAM 1251

CCRL PROFICIENCY SAMPLE PROGRAM  
Air Content  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.170

Air Content

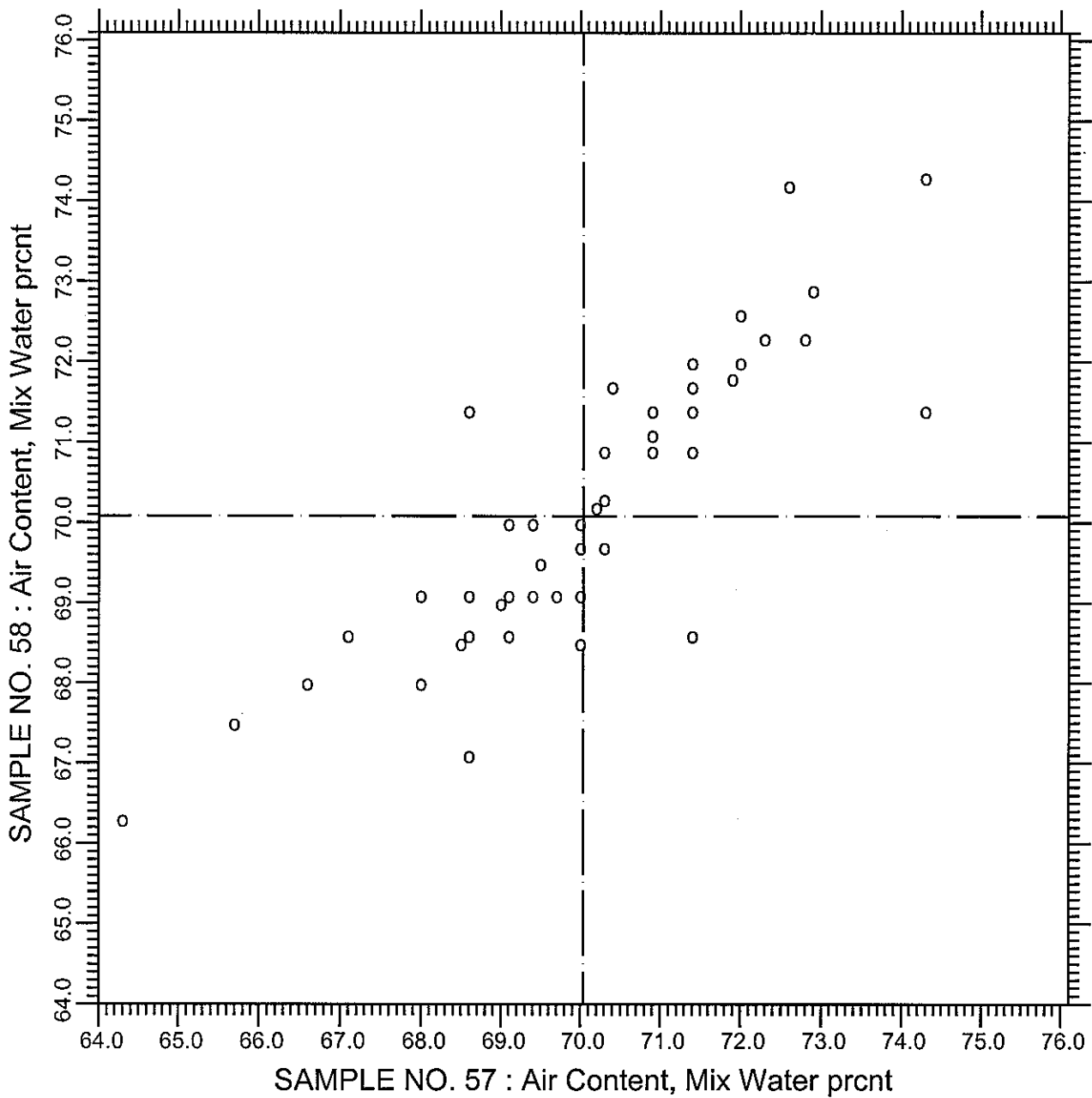
66 POINTS

SAMPLE NO. 57 AVE 8.18 S.D. 1.0 C.V. 12.3

SAMPLE NO. 58 AVE 8.99 S.D. 1.0 C.V. 11.2

LABS ELIMINATED 1940

CCRL PROFICIENCY SAMPLE PROGRAM  
Air Content - % Water  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.180

Air Content, Mix Water

64 POINTS

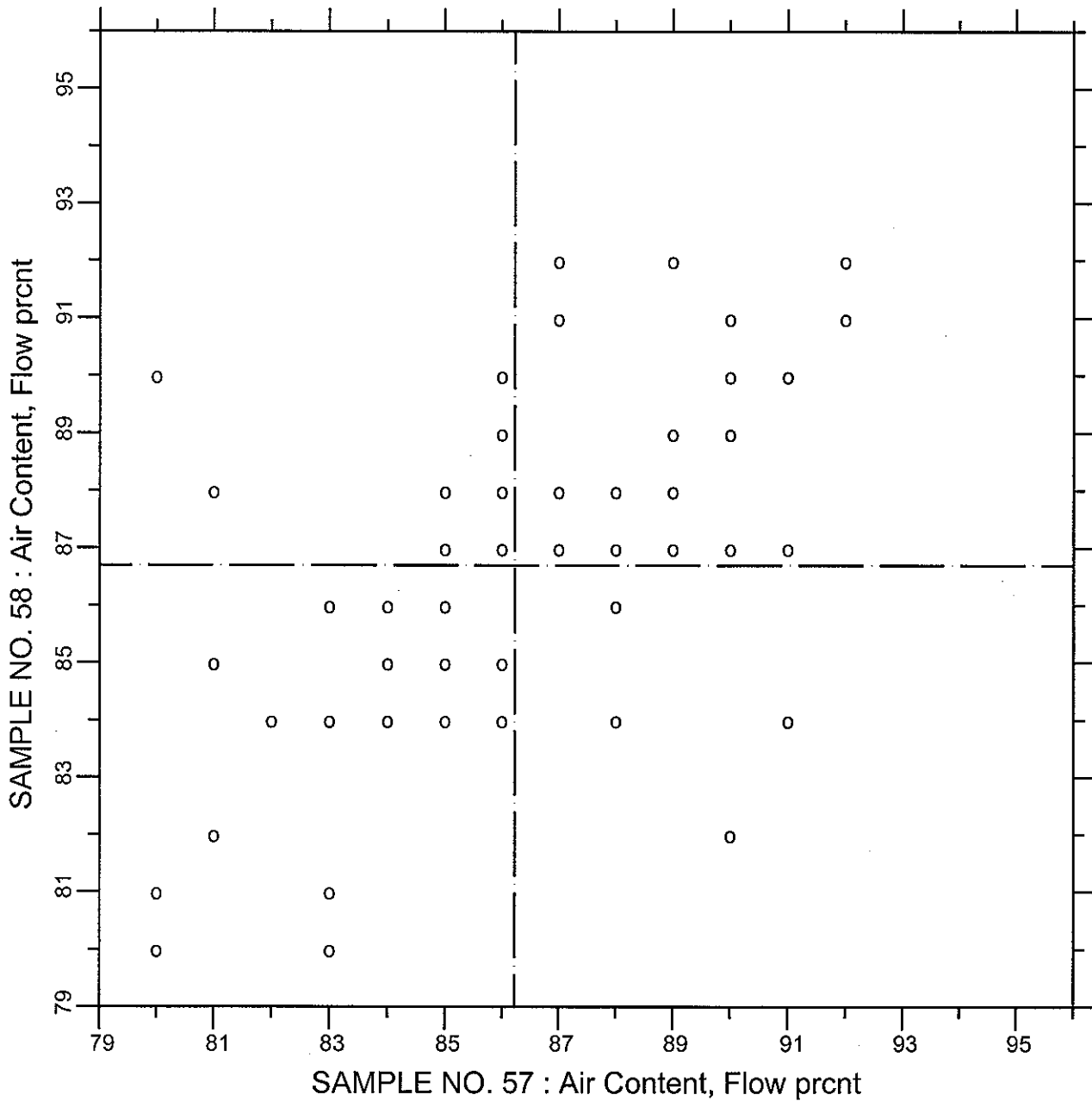
SAMPLE NO. 57 AVE 70.03 S.D. 2.0 C.V. 2.90

SAMPLE NO. 58 AVE 70.08 S.D. 1.9 C.V. 2.67

LABS ELIMINATED 10

LABS OFF DIAGRAM 51

CCRL PROFICIENCY SAMPLE PROGRAM  
Air Content - Flow  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.190

Air Content, Flow

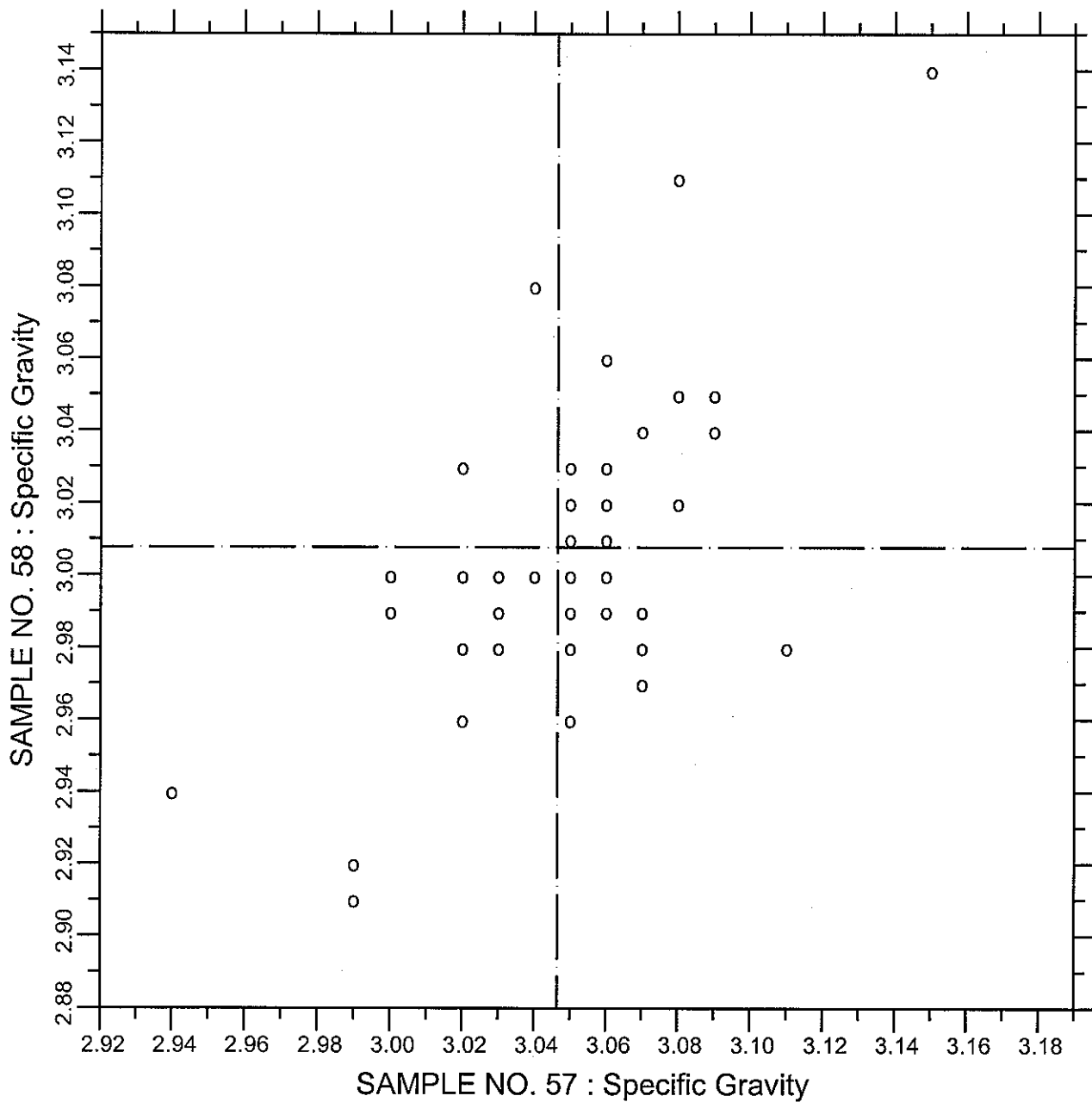
66 POINTS

SAMPLE NO. 57    AVE 86.23    S.D. 3.1    C.V. 3.59

SAMPLE NO. 58    AVE 86.70    S.D. 2.9    C.V. 3.39



CCRL PROFICIENCY SAMPLE PROGRAM  
Specific Gravity  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.310

Specific Gravity

55 POINTS

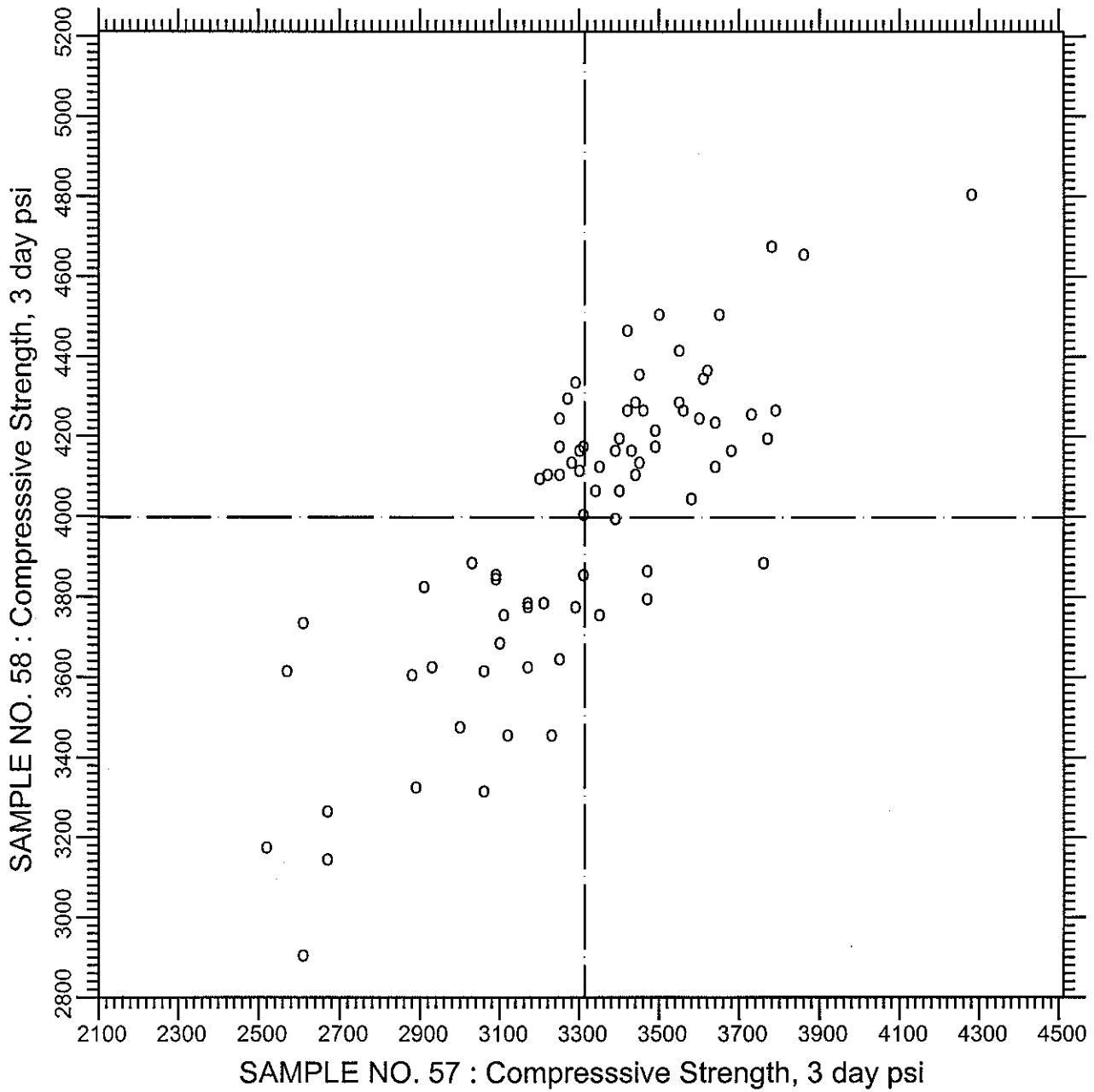
SAMPLE NO. 57 AVE 3.0465 S.D. 0.036 C.V. 1.17

SAMPLE NO. 58 AVE 3.0077 S.D. 0.045 C.V. 1.51

LABS ELIMINATED 36

LABS OFF DIAGRAM 34 354

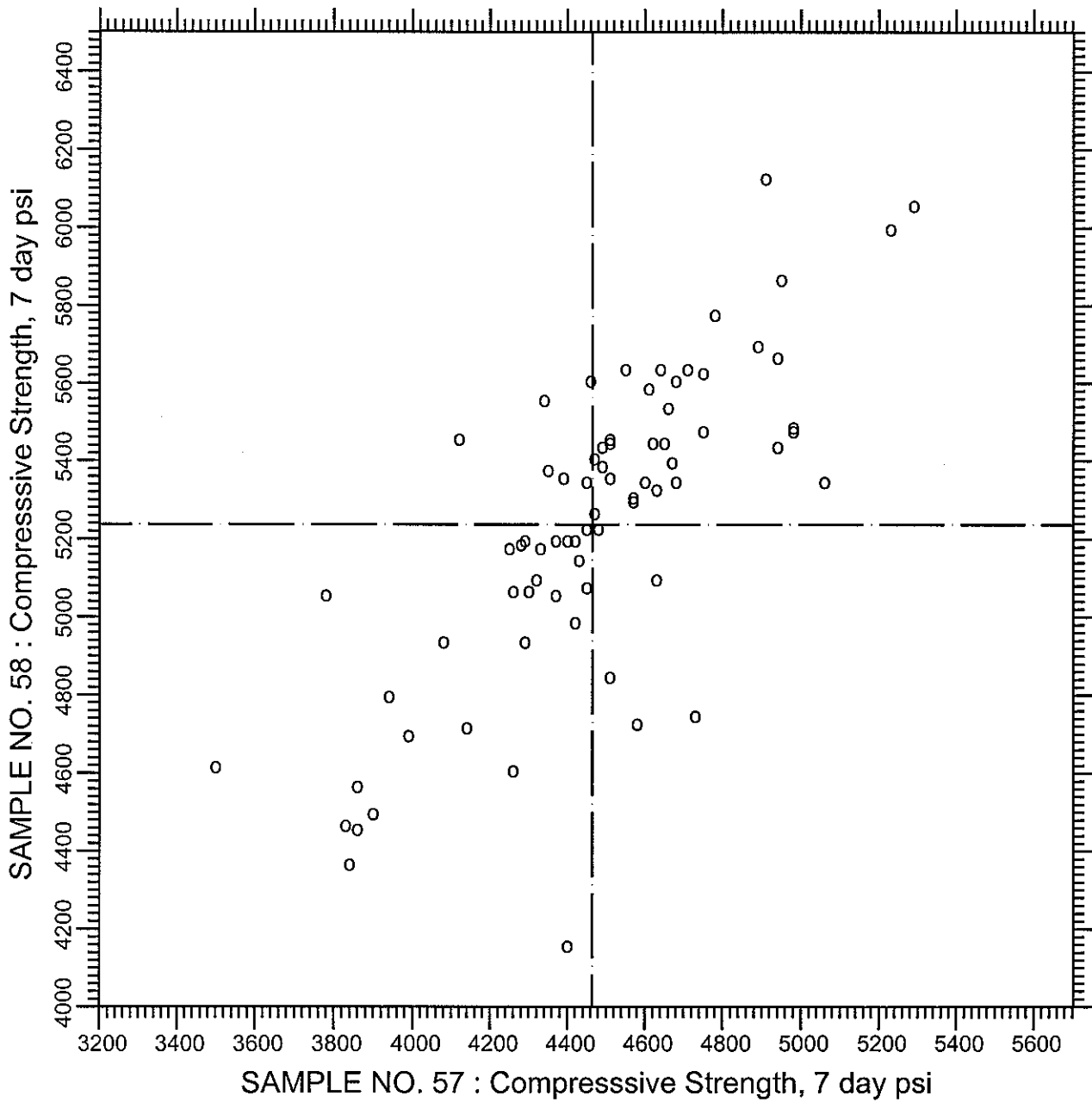
CCRL PROFICIENCY SAMPLE PROGRAM  
Compressive Strength - 3 day  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.200    Compressive Strength, 3 day    77 POINTS

SAMPLE NO. 57	AVE	3313.6	S.D.	321.6	C.V.	9.70
SAMPLE NO. 58	AVE	3997.8	S.D.	373.8	C.V.	9.35
LABS ELIMINATED 46 413						

CCRL PROFICIENCY SAMPLE PROGRAM  
Compressive Strength - 7 day  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



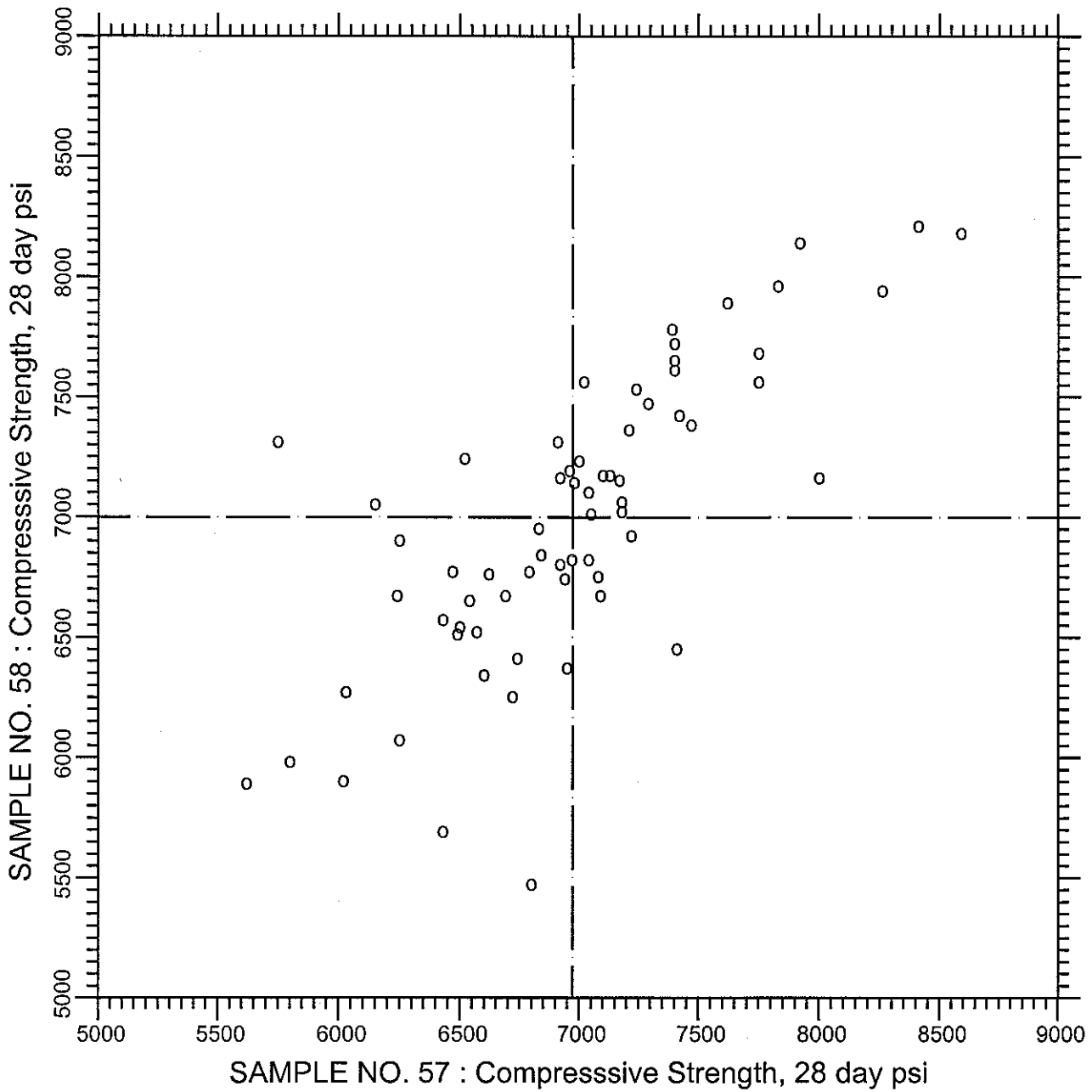
TEST NO.210    Compressive Strength, 7 day    75 POINTS

SAMPLE NO. 57    AVE 4464.9    S.D. 341.7    C.V. 7.65

SAMPLE NO. 58    AVE 5237.3    S.D. 400.7    C.V. 7.65

LABS ELIMINATED 51 413 2335

CCRL PROFICIENCY SAMPLE PROGRAM  
 Compressive Strength - 28 day  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



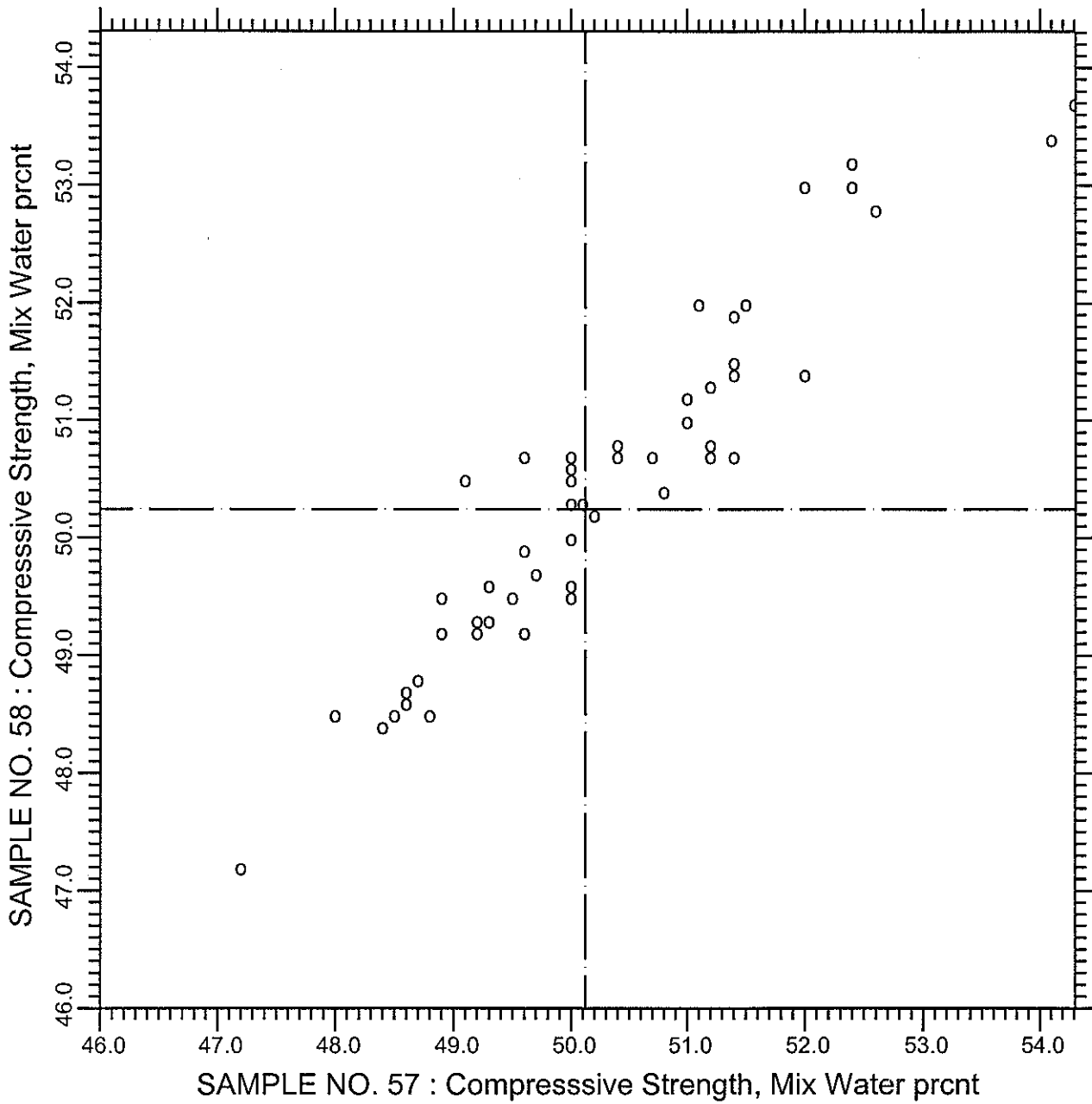
TEST NO.211 Compressive Strength, 28 day 66 POINTS

SAMPLE NO. 57 AVE 6974.2 S.D. 603.8 C.V. 8.66

SAMPLE NO. 58 AVE 6998.5 S.D. 607.1 C.V. 8.67

LABS ELIMINATED 2335

CCRL PROFICIENCY SAMPLE PROGRAM  
 Compressive Strength - % Water  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



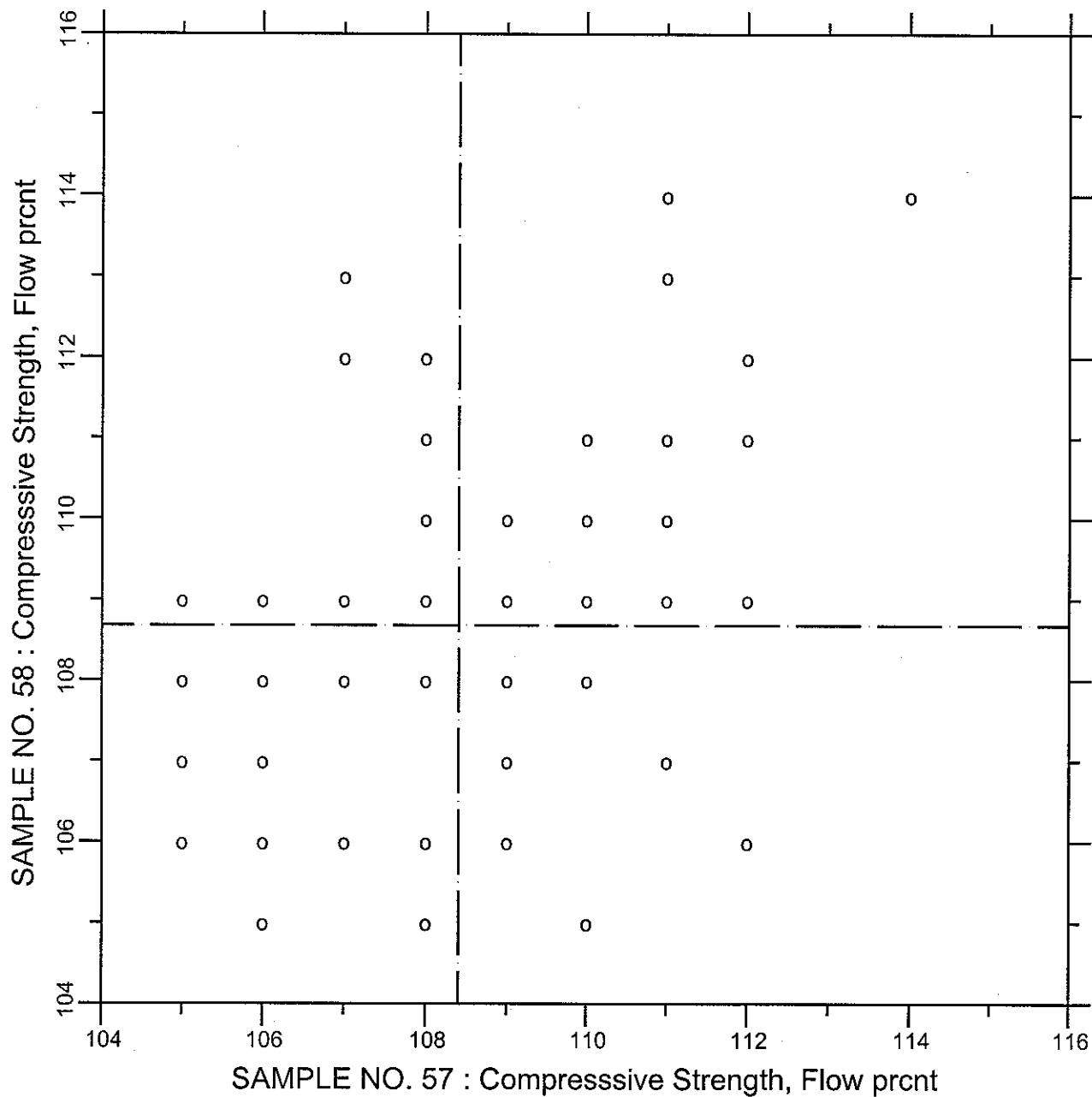
TEST NO.220 Compressive Strength, Mix Water 69 POINTS

SAMPLE NO. 57 AVE 50.12 S.D. 1.4 C.V. 2.78

SAMPLE NO. 58 AVE 50.24 S.D. 1.4 C.V. 2.84

LABS ELIMINATED 10 45 354

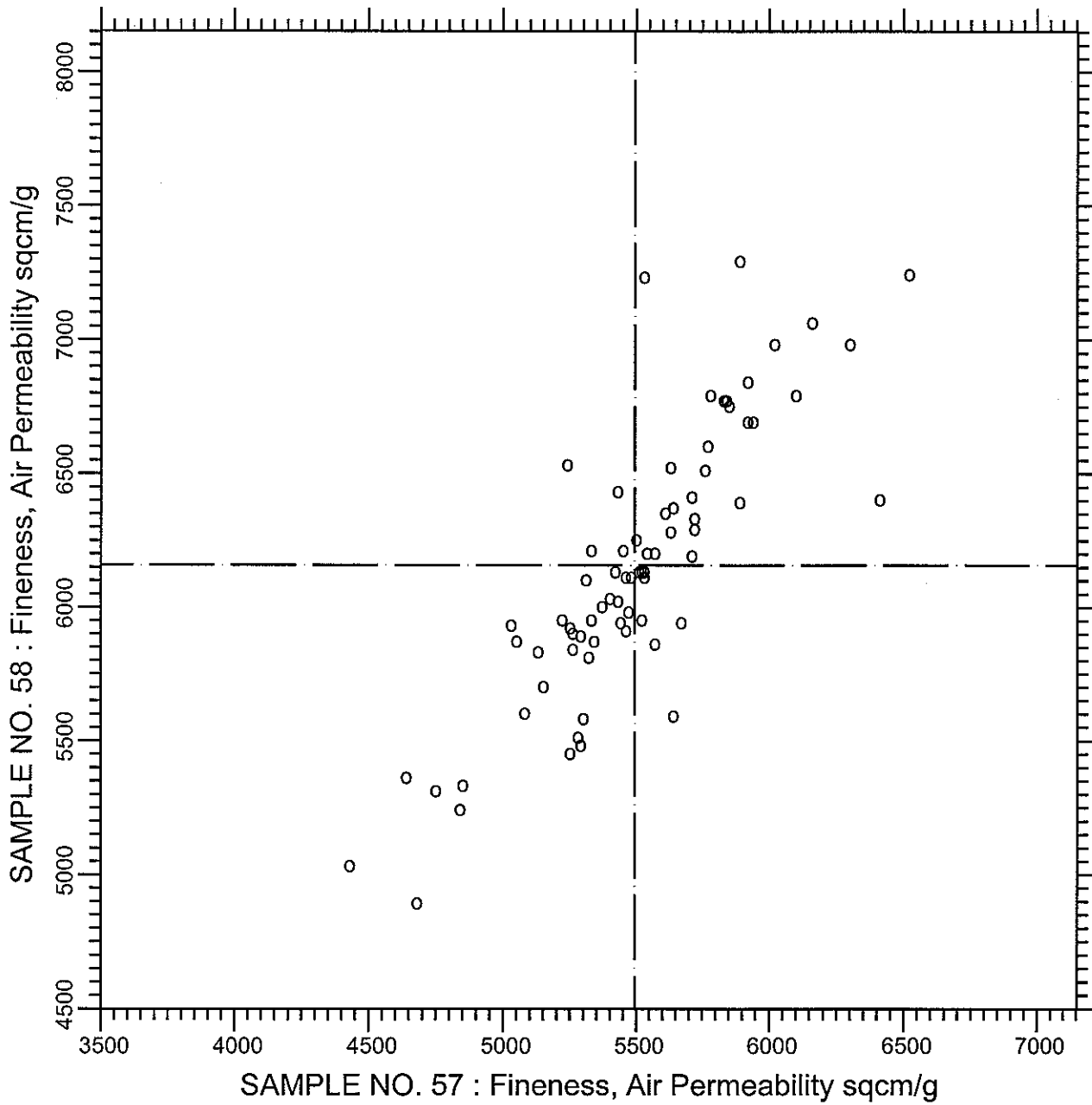
**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Compressive Strength - Flow**  
**BLENDED CEMENT SAMPLES NO. 57 & NO. 58**



**TEST NO.230      Compressive Strength, Flow      66 POINTS**

SAMPLE NO. 57    AVE 108.41    S.D. 2.1    C.V. 1.93  
 SAMPLE NO. 58    AVE 108.68    S.D. 2.2    C.V. 2.06  
 LABS ELIMINATED 22 33 19 35 246 2295 3009

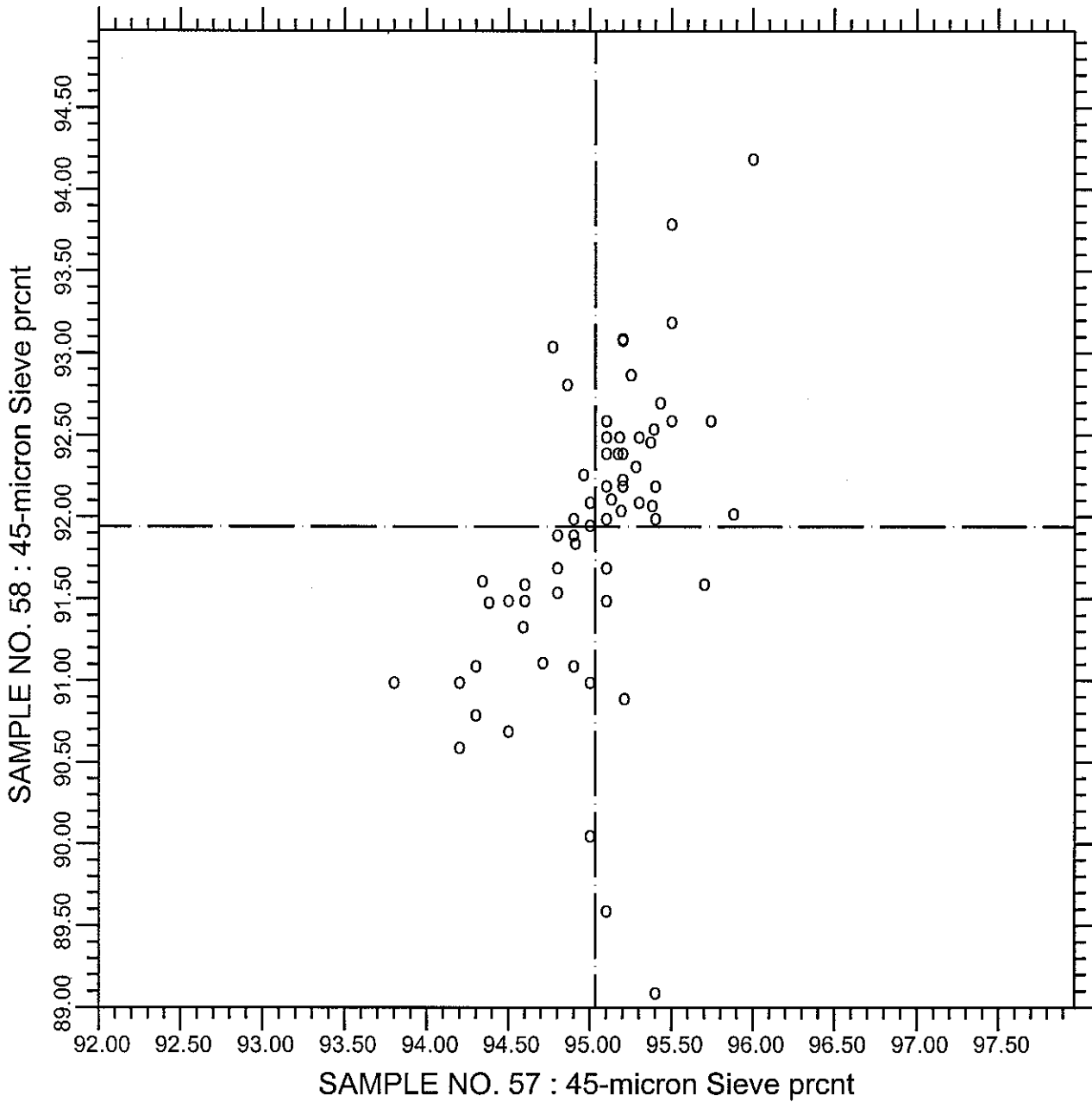
CCRL PROFICIENCY SAMPLE PROGRAM  
 Fineness - Air Permeability  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.270      Fineness, Air Permeability      74 POINTS

SAMPLE NO. 57	AVE	5494.7	S.D.	386.6	C.V.	7.04
SAMPLE NO. 58	AVE	6158.0	S.D.	513.3	C.V.	8.34
LABS ELIMINATED 2463						

CCRL PROFICIENCY SAMPLE PROGRAM  
 45-micron Sieve - % Passing  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.281

45-micron Sieve

67 POINTS

SAMPLE NO. 57 AVE 95.033 S.D. 0.41 C.V. 0.435

SAMPLE NO. 58 AVE 91.940 S.D. 0.88 C.V. 0.952

LABS ELIMINATED 2 34 36 181 28 207 1196 3059

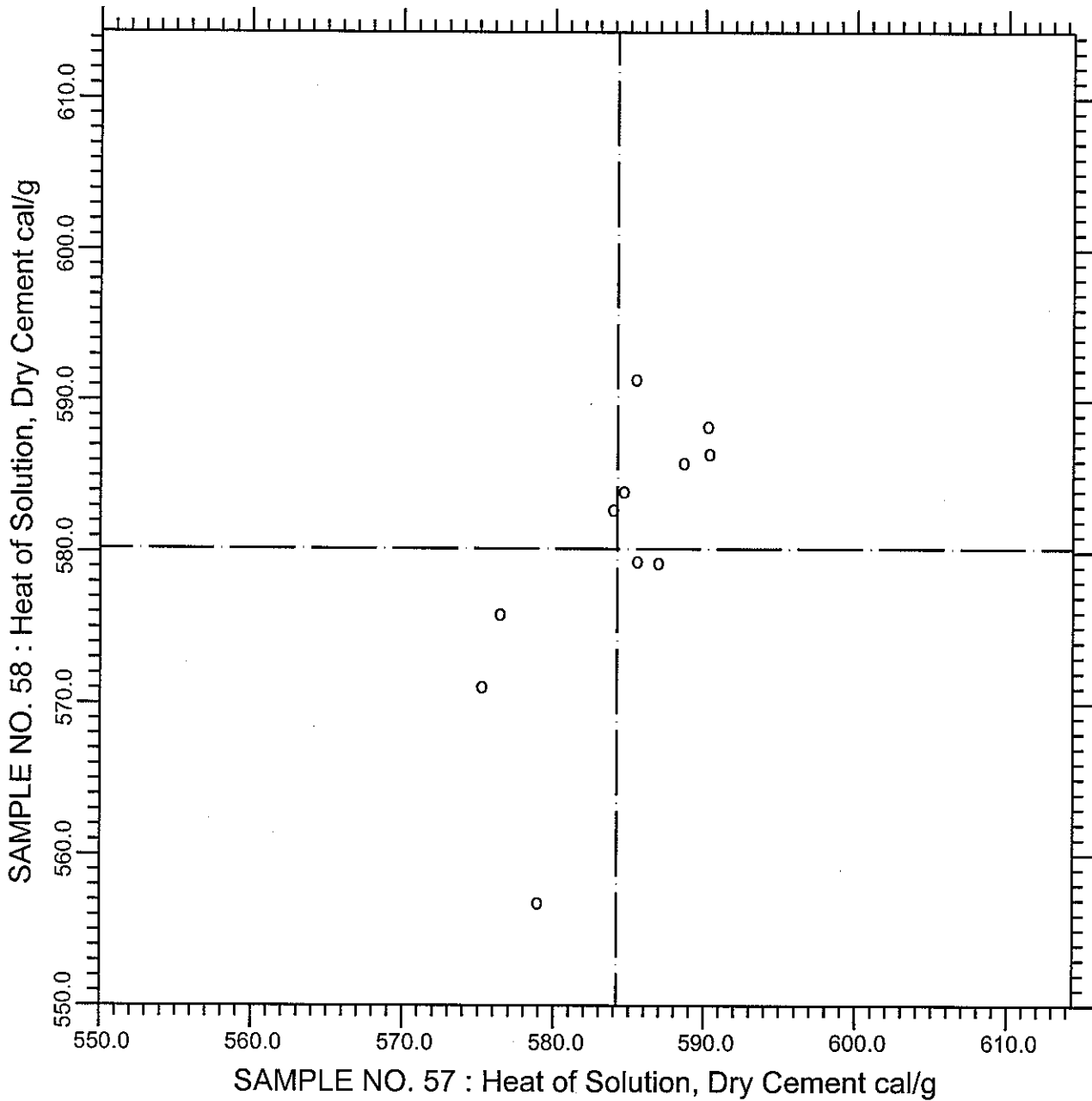


**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Blended Cement Proficiency Samples No. 57 and No. 58**  
**Final Report - Heat of Hydration Results**  
**May 5, 2006**

**SUMMARY OF RESULTS**

Test	#Labs	Sample No. 57			Sample No. 58		
		Average	S.D.	C.V.	Average	S.D.	C.V.
Heat Solution Dry cal/g	11	584.2	5.2	0.895	580.2	9.7	1.666
Heat Sol, 7 day cal/g	11	512.8	23.0	4.49	499.3	5.3	1.06
Heat Sol, 28 day cal/g	7	493.8	5.4	1.087	491.0	3.2	0.658
Heat Hyd, 7 day cal/g	11	78.1	4.9	6.34	81.0	9.4	11.63
Heat Hyd, 28 day cal/g	7	91.2	7.8	8.52	90.4	13.2	14.57

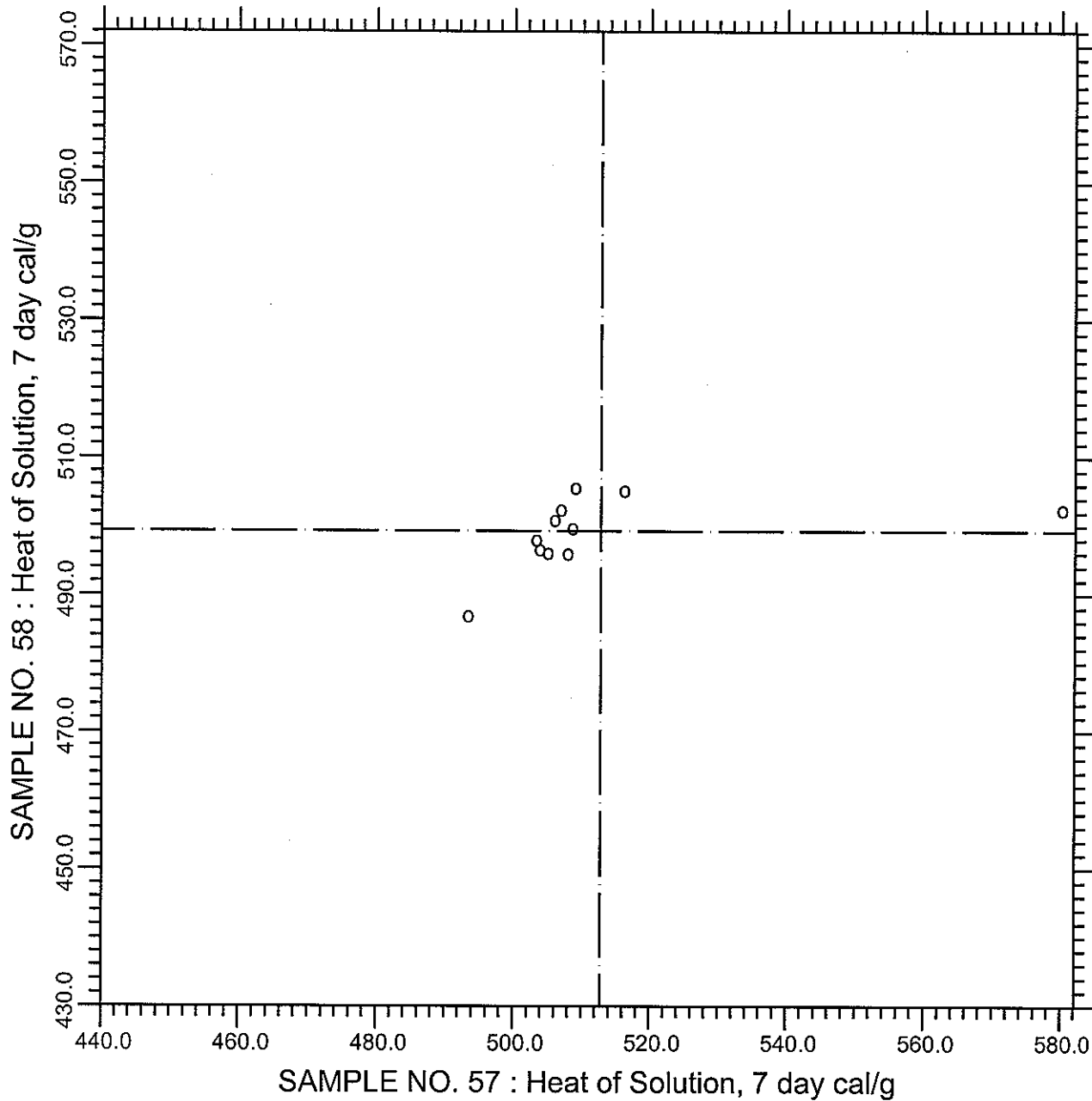
CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Solution - Dry Cement  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.291    Heat of Solution, Dry Cement    11 POINTS

SAMPLE NO. 57	AVE	584.2	S.D.	5.2	C.V.	0.895
SAMPLE NO. 58	AVE	580.2	S.D.	9.7	C.V.	1.666

CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Solution - 7-day  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.292

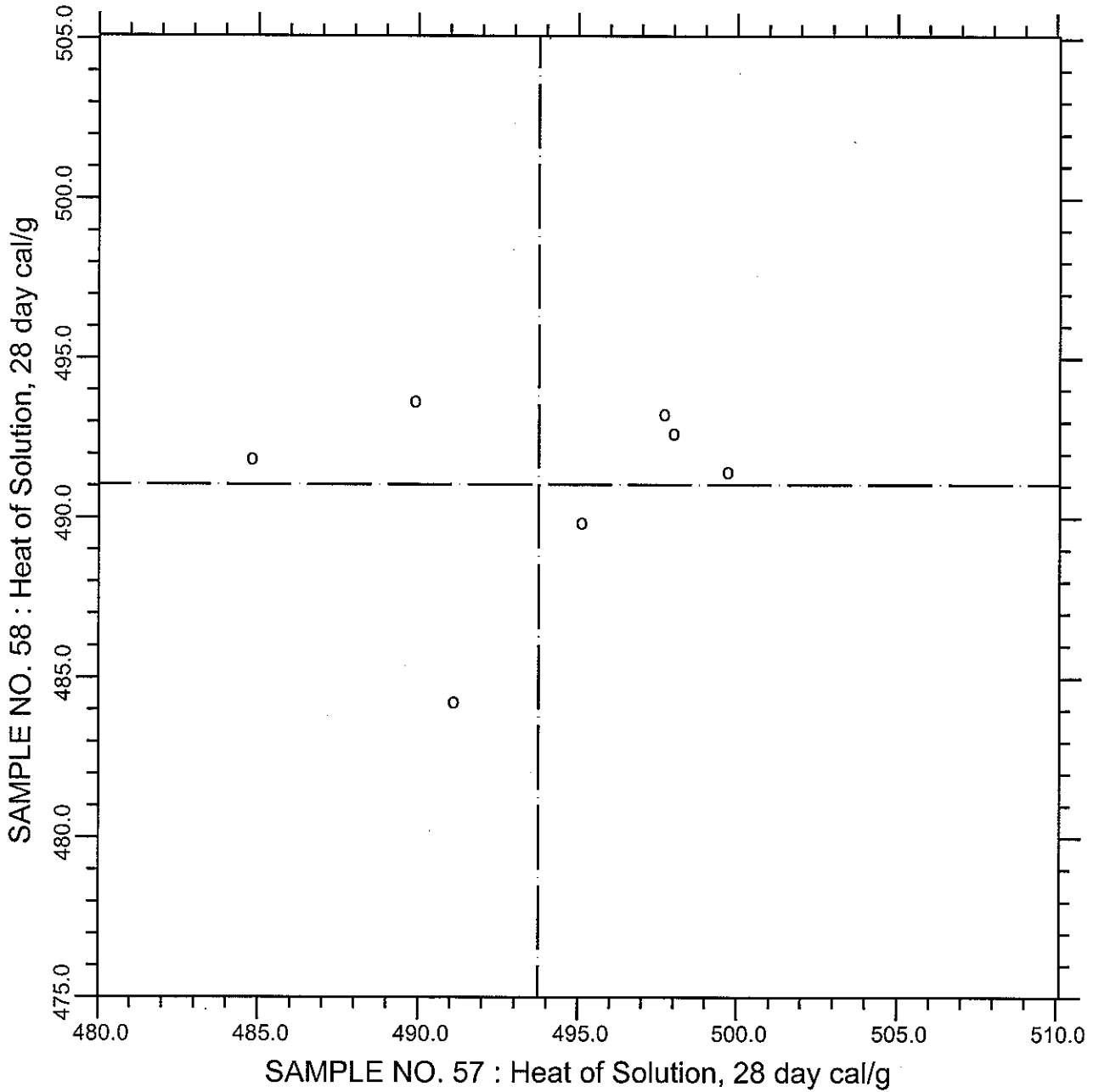
Heat of Solution, 7 day

11 POINTS

SAMPLE NO. 57 AVE 512.8 S.D. 23.0 C.V. 4.49

SAMPLE NO. 58 AVE 499.3 S.D. 5.3 C.V. 1.06

CCRL PROFICIENCY SAMPLE PROGRAM  
 Heat of Solution - 28-day  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.301

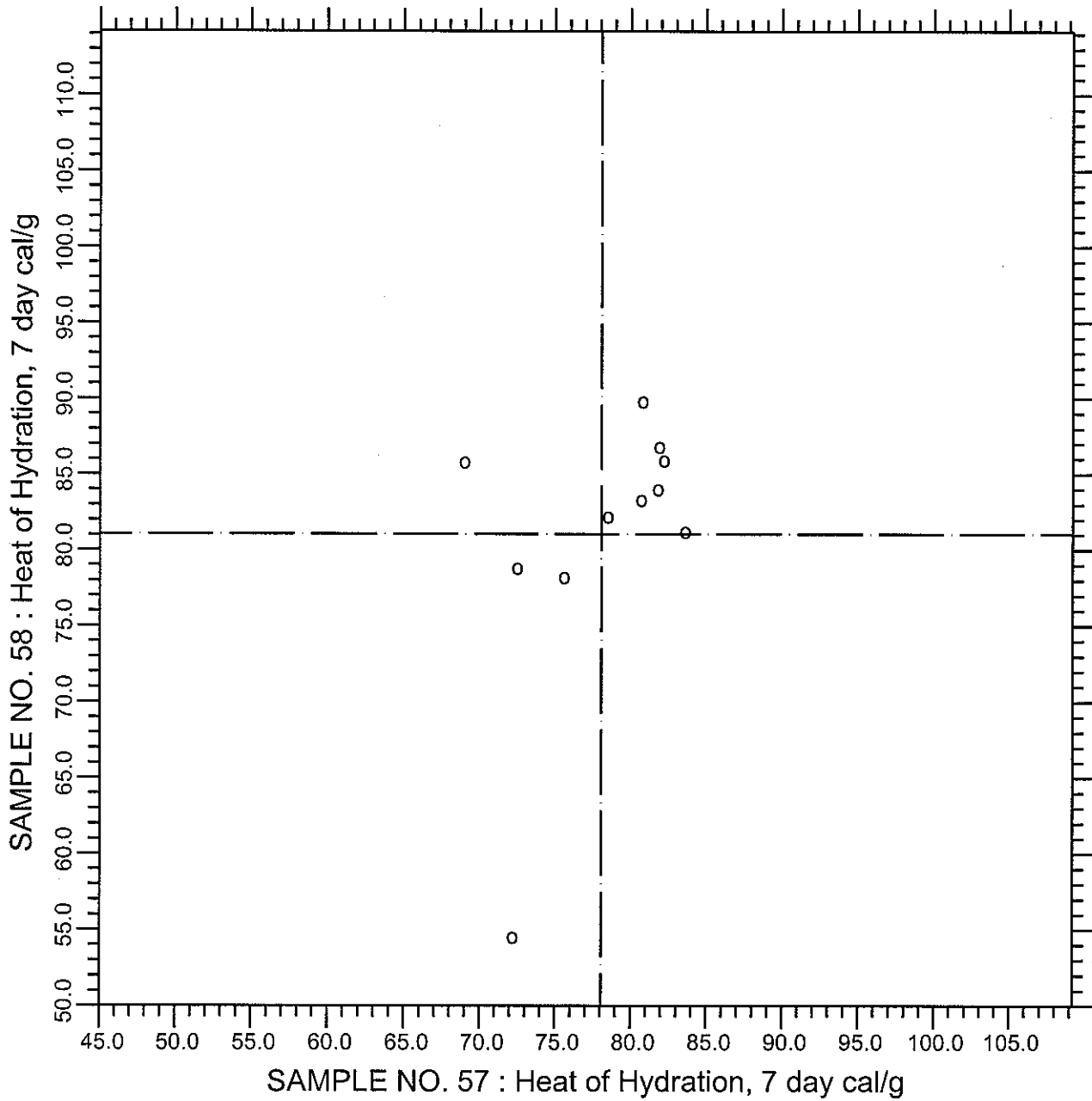
Heat of Solution, 28 day

7 POINTS

SAMPLE NO. 57 AVE 493.8 S.D. 5.4 C.V. 1.087

SAMPLE NO. 58 AVE 491.0 S.D. 3.2 C.V. 0.658

CCRL PROFICIENCY SAMPLE PROGRAM  
 Heat of Hydration - 7-day  
 BLENDED CEMENT SAMPLES NO. 57 & NO. 58

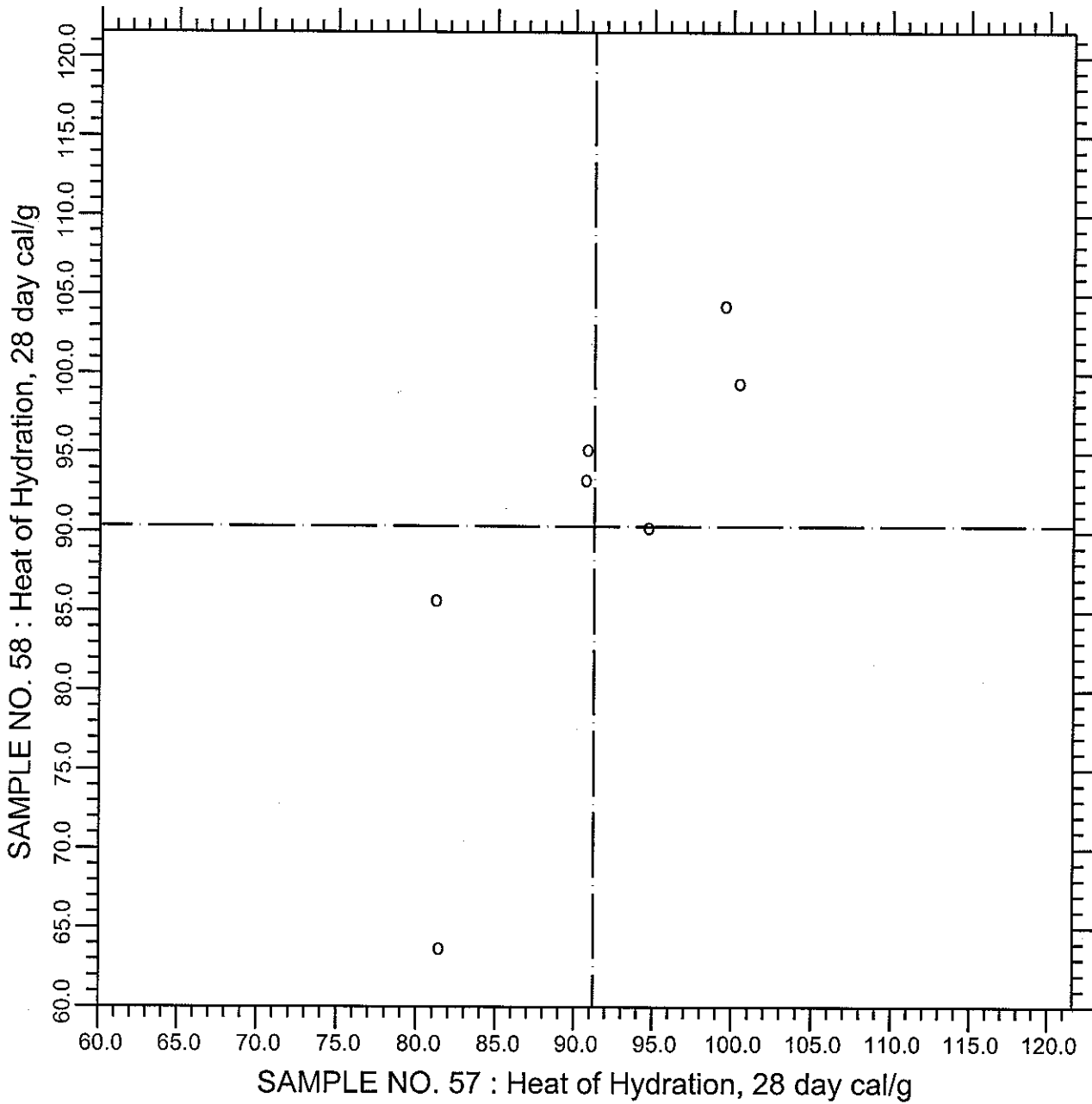


TEST NO.290      Heat of Hydration, 7 day      11 POINTS

SAMPLE NO. 57    AVE 78.1    S.D. 4.9    C.V. 6.34

SAMPLE NO. 58    AVE 81.0    S.D. 9.4    C.V. 11.63

CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Hydration - 28-day  
BLENDED CEMENT SAMPLES NO. 57 & NO. 58



TEST NO.300      Heat of Hydration, 28 day      7 POINTS

SAMPLE NO. 57    AVE 91.2    S.D. 7.8    C.V. 8.52

SAMPLE NO. 58    AVE 90.4    S.D. 13.2    C.V. 14.57