CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Pozzolan Proficiency Samples
Number 39 and Number 40

January 2007

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CEMENT AND CONCRETE REFERENCE LABORATORY
AT THE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
GAITHERSBURG, MARYLAND 20899
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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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January 4, 2007

TO: Participants in the CCRL Pozzolan Proficiency Sample Program

SUBJECT: Pozzolan Proficiency Samples No. 39 and No. 40

Following is the final report for the pair of CCRL **Pozzolan** Proficiency Samples which were distributed in August 2006. Both samples were a Class F fly ash.

This report consists of two parts and each part must be downloaded from our website located at: http://www.ccrl.us/. One part contains general information that consists of a statistical Summary of Results, a set of Scatter Diagrams, and other associated information. The second part is laboratory specific information that consists of the Table of Results containing test results and ratings for your laboratory

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 samples 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 Pozzolan Proficiency Samples will be distributed in August 2007.

Sincerely,

Robin K. Haupt

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

Attachment

To: Participants in the CCRL Pozzolan Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests on Pozzolan Proficiency Samples No. 39 and No. 40

This memo and the material included with it constitute the final report and summary of results for the current pair of Pozzolan Proficiency Samples, which were distributed in August 2006. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of Scatter Diagrams. Your unique laboratory number is displayed at the top of the individual Table of Results.

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 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Table of Results - Laboratory Ratings

Each laboratory receives an individualized Table of Results. The Table of Results 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.

The ratings for the individual laboratory were determined in the manner described by Crandall and Blaine using a rating scale 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.

Ratings	Range (Number of Standard Deviations)	Number (Per 100) of Laboratories achieving the rating [1]
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.

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

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, which 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

Usually, averages, standard deviations, and coefficients of variation are given with all test results reported, and then with one or more outlying test results omitted. Sometimes, two or more recalculations with laboratories omitted, have been performed for the same 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. Each laboratory will receive a complete set of diagrams according to their participation in chemical and/or physical tests.

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. To find your point, just plot as you would when plotting any scatter diagram. 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 ±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 may indicate strong evidence of bias in many cases.

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficiency Samples No. 39 and No. 40
Final Report - Chemical Results
January 4, 2007

SUMMARY OF RESULTS

Test			#Labs	Sample No. 39 Average	S.D.	C.V.	Sample No. 40 Average	S.D.	C.V.
Moisture Content	prcnt		63	0.09	0.061	71.4	0.31	0.133	43.4
Silicon Dioxide	prcnt		55	60.30	5.0	8.29	44.55	4.7	10.61
Silicon Dioxide	prcnt	*	51	60.56	2.9	4.83	44.15	2.2	5.05
Al_2O_3 w/minor[1]	prcnt		25	19.30	1.1	5.52	23.60	1.7	7.06
[1] (P_2O_3 & TiO_2 included)									
Al_2O_3 wo/minor[2]	prcnt		49	17.82	1.7	9.75	22.02	2.9	13.22
Al_2O_3 wo/minor[2]	prcnt	*	48	18.03	0.94	5.23	22.41	1.08	4.84
[2] (P_2O_3 & TiO_2 not included)									
Ferric Oxide	prcnt		55	6.18	1.0	16.7	16.32	2.4	14.9
Ferric Oxide	prcnt	*	49	6.04	0.37	6.15	16.56	1.10	6.64
Calcium Oxide	prcnt		57	7.67	1.0	13.6	4.53	1.6	34.9
Calcium Oxide	prcnt	*	51	7.59	0.46	6.11	4.09	0.34	8.42
Magnesium Oxide	prcnt		57	2.63	0.48	18.1	0.83	0.39	47.2
Magnesium Oxide	prcnt	*	50	2.61	0.20	7.72	0.80	0.12	15.54

CONTINUED ON NEXT PAGE

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

Silicon Dioxide	29 20 125 176
Al_2O_3 wo/minor	25
Ferric Oxide	25 125 158 1 58 1479
Calcium Oxide	41 1 50 125 52 2150
Magnesium Oxide	20 176 205 1 25 1379 2150

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficiency Samples No. 39 and No. 40
Final Report - Chemical Results
January 4, 2007

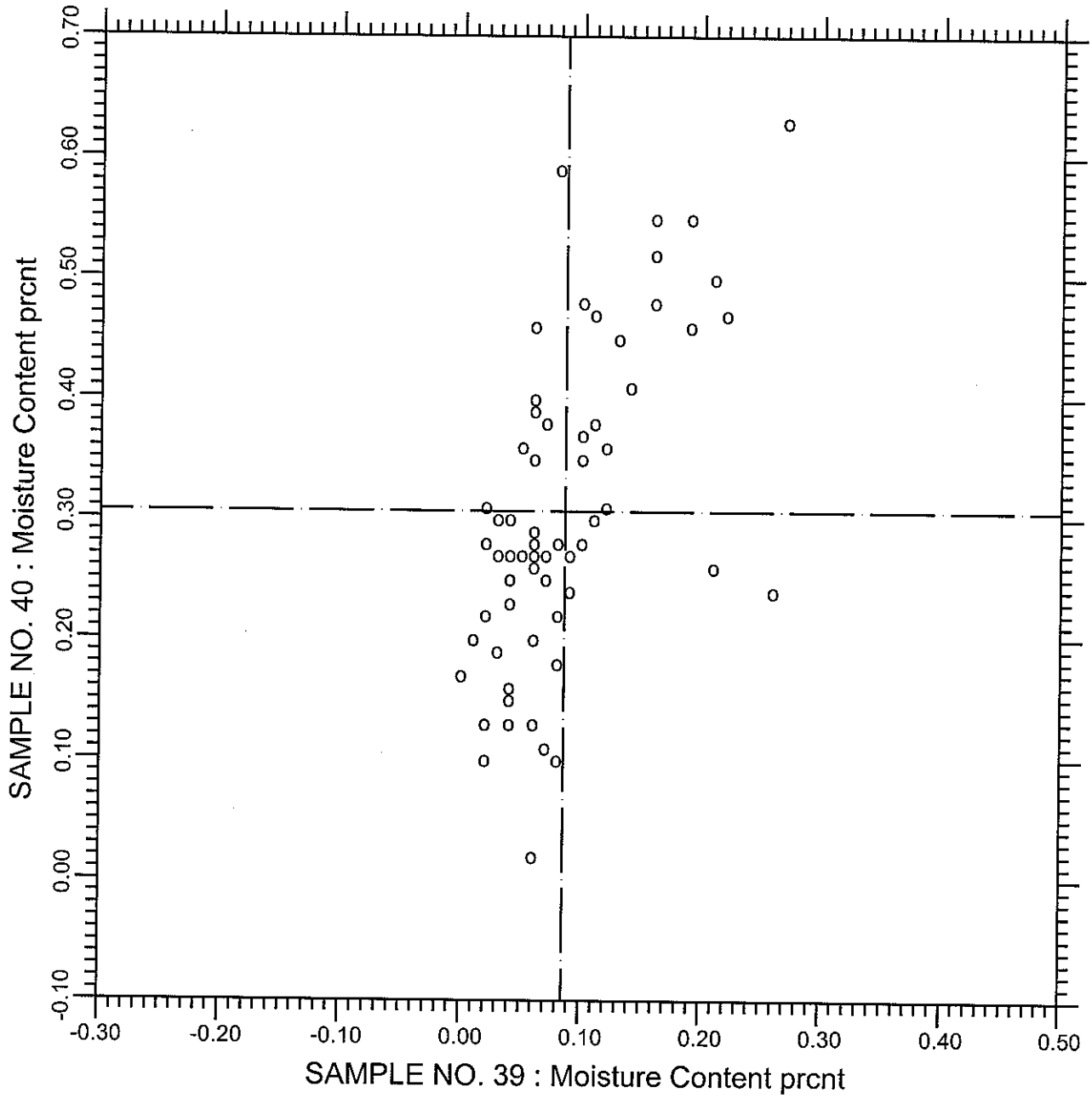
SUMMARY OF RESULTS

			Sample No. 39			Sample No. 40		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Sulfur Trioxide	prcnt	61	0.40	0.12	30.4	1.07	0.42	39.3
Loss on Ignition	prcnt	68	0.20	0.18	88.9	8.47	1.58	18.6
Loss on Ignition	prcnt	* 62	0.18	0.091	50.72	8.72	0.207	2.37
Sodium Oxide	prcnt	52	0.55	0.45	81.6	0.74	0.44	59.0
Sodium Oxide	prcnt	* 49	0.48	0.11	22.4	0.70	0.15	21.7
Potassium Oxide	prcnt	52	1.12	0.16	14.2	1.39	0.20	14.7
Potassium Oxide	prcnt	* 50	1.14	0.074	6.49	1.42	0.088	6.23
Available Na_2O	prcnt	24	0.58	1.8	303	0.91	2.8	308
Available Na_2O	prcnt	* 21	0.20	0.074	36.2	0.30	0.066	22.1
Available K_2O	prcnt	24	0.83	2.3	281	1.51	4.7	310
Available K_2O	prcnt	* 21	0.29	0.059	20.1	0.49	0.113	23.2
Available Alkali	prcnt	23	1.12	3.4	302	1.90	6.0	317
Available Alkali	prcnt	* 21	0.39	0.094	23.8	0.61	0.139	22.7

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

Loss on Ignition	9 33 29 52 284 1479
Sodium Oxide	52 205 1251
Potassium Oxide	25 205
Available Na_2O	3 19 24
Available K_2O	3 19 24
Available Alkali	19 24

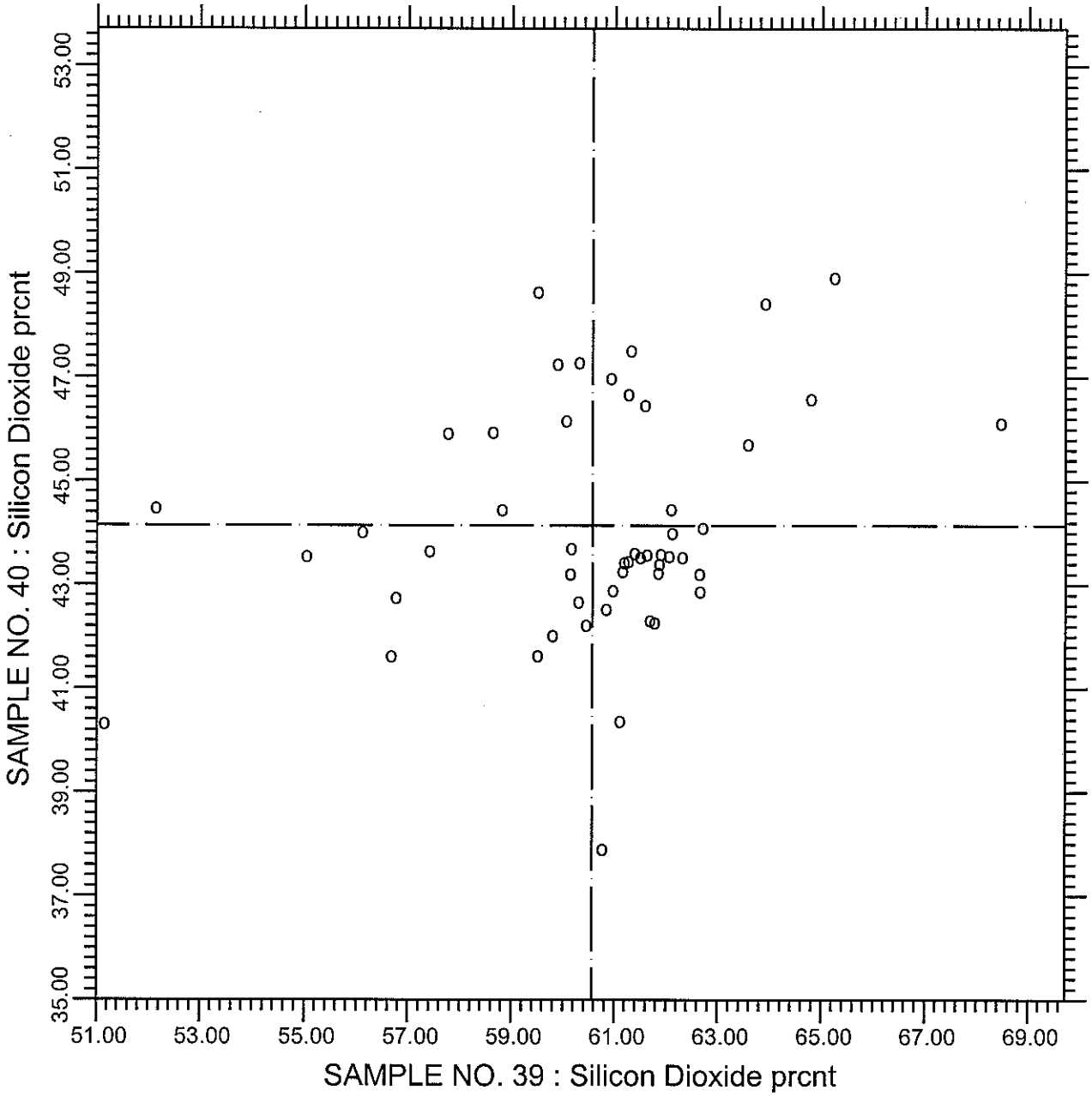
CCRL PROFICIENCY SAMPLE PROGRAM
Moisture Content
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.5 Moisture Content 63 POINTS

SAMPLE NO. 39	AVE	0.0859	S.D.	0.061	C.V.	71.4
SAMPLE NO. 40	AVE	0.3060	S.D.	0.133	C.V.	43.4

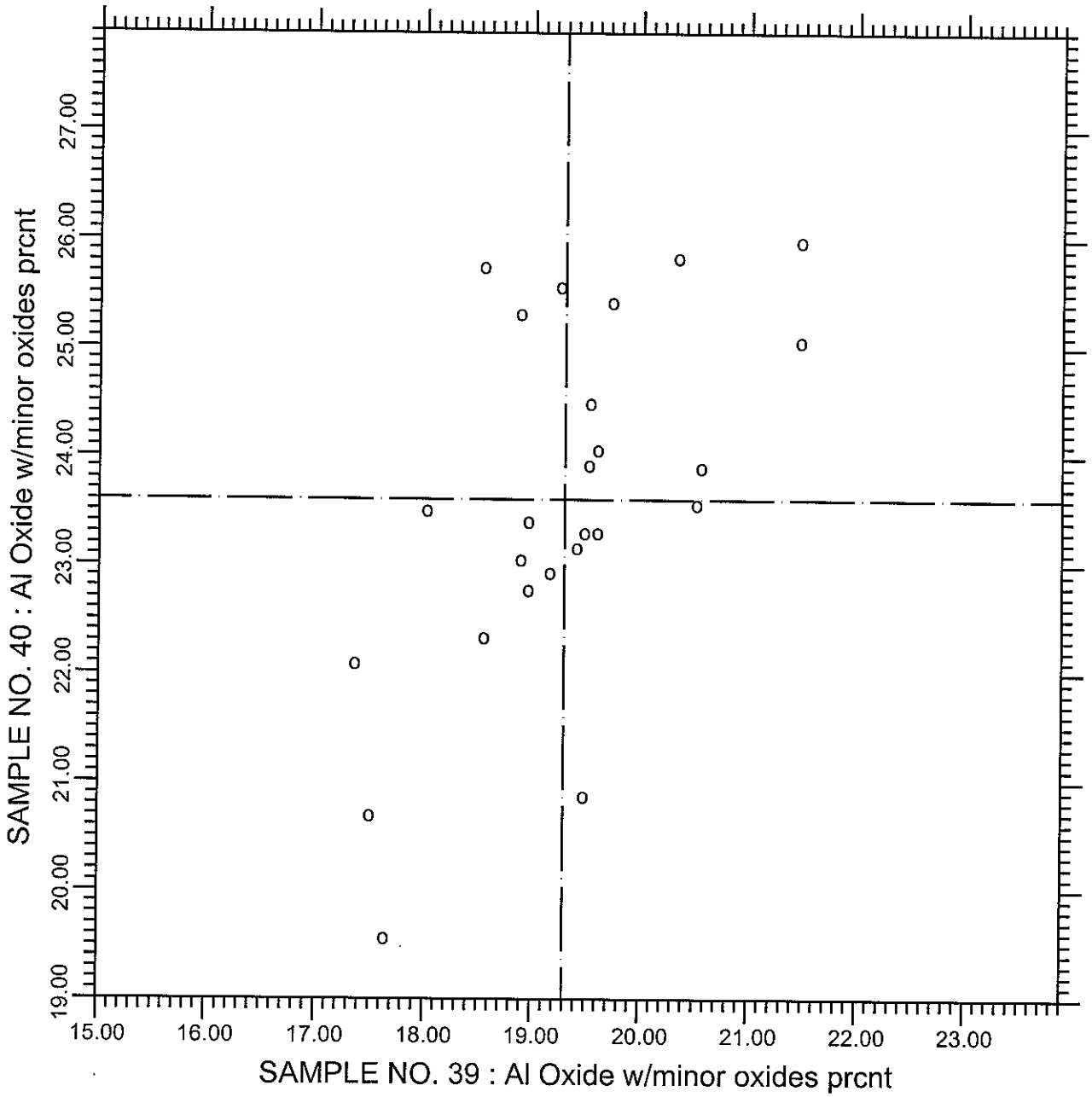
CCRL PROFICIENCY SAMPLE PROGRAM
Silicon Dioxide
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.10 Silicon Dioxide 51 POINTS

SAMPLE NO. 39 AVE 60.56 S.D. 2.9 C.V. 4.83
SAMPLE NO. 40 AVE 44.15 S.D. 2.2 C.V. 5.05
LABS ELIMINATED 29 20 125 176

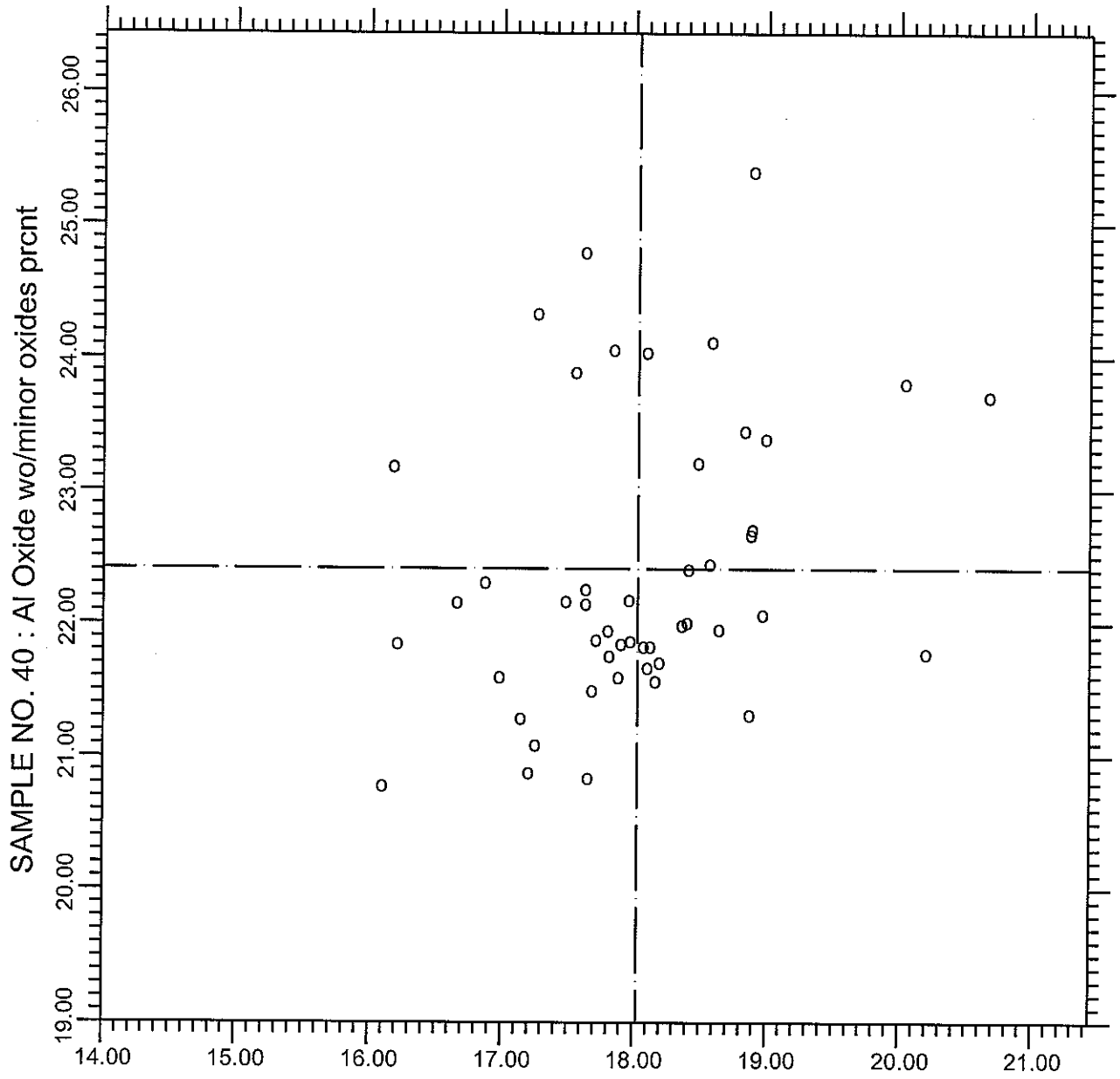
CCRL PROFICIENCY SAMPLE PROGRAM
Aluminum Oxide (minor oxides included)
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.20 Al Oxide w/minor oxides 25 POINTS

SAMPLE NO. 39	AVE	19.30	S.D.	1.1	C.V.	5.52
SAMPLE NO. 40	AVE	23.60	S.D.	1.7	C.V.	7.06

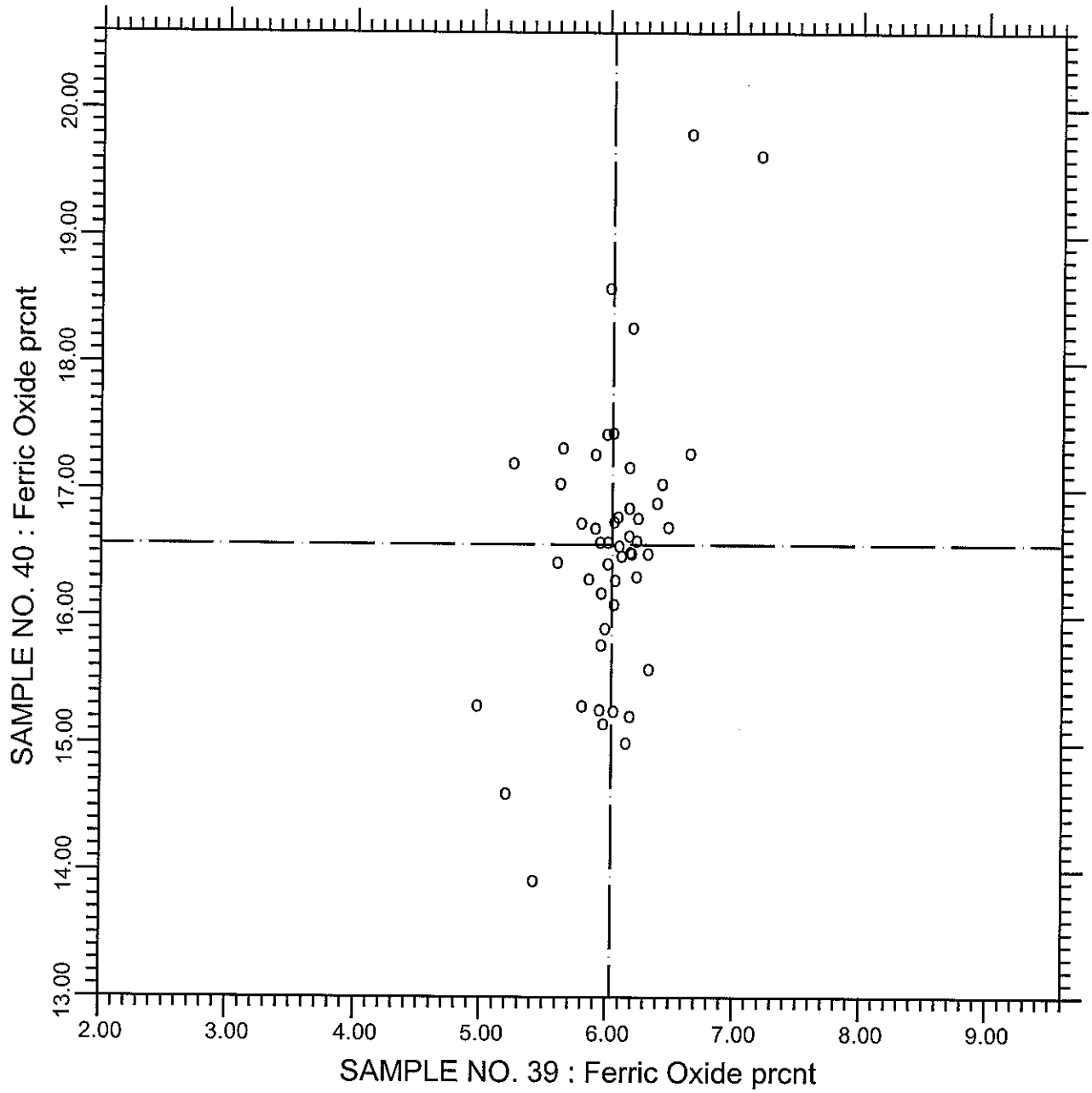
CCRL PROFICIENCY SAMPLE PROGRAM
Aluminum Oxide (minor oxides excluded)
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.21 Al Oxide wo/minor oxides 48 POINTS

SAMPLE NO. 39 AVE 18.03 S.D. 0.94 C.V. 5.23
SAMPLE NO. 40 AVE 22.41 S.D. 1.08 C.V. 4.84
LABS ELIMINATED 25

CCRL PROFICIENCY SAMPLE PROGRAM
Ferric Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40



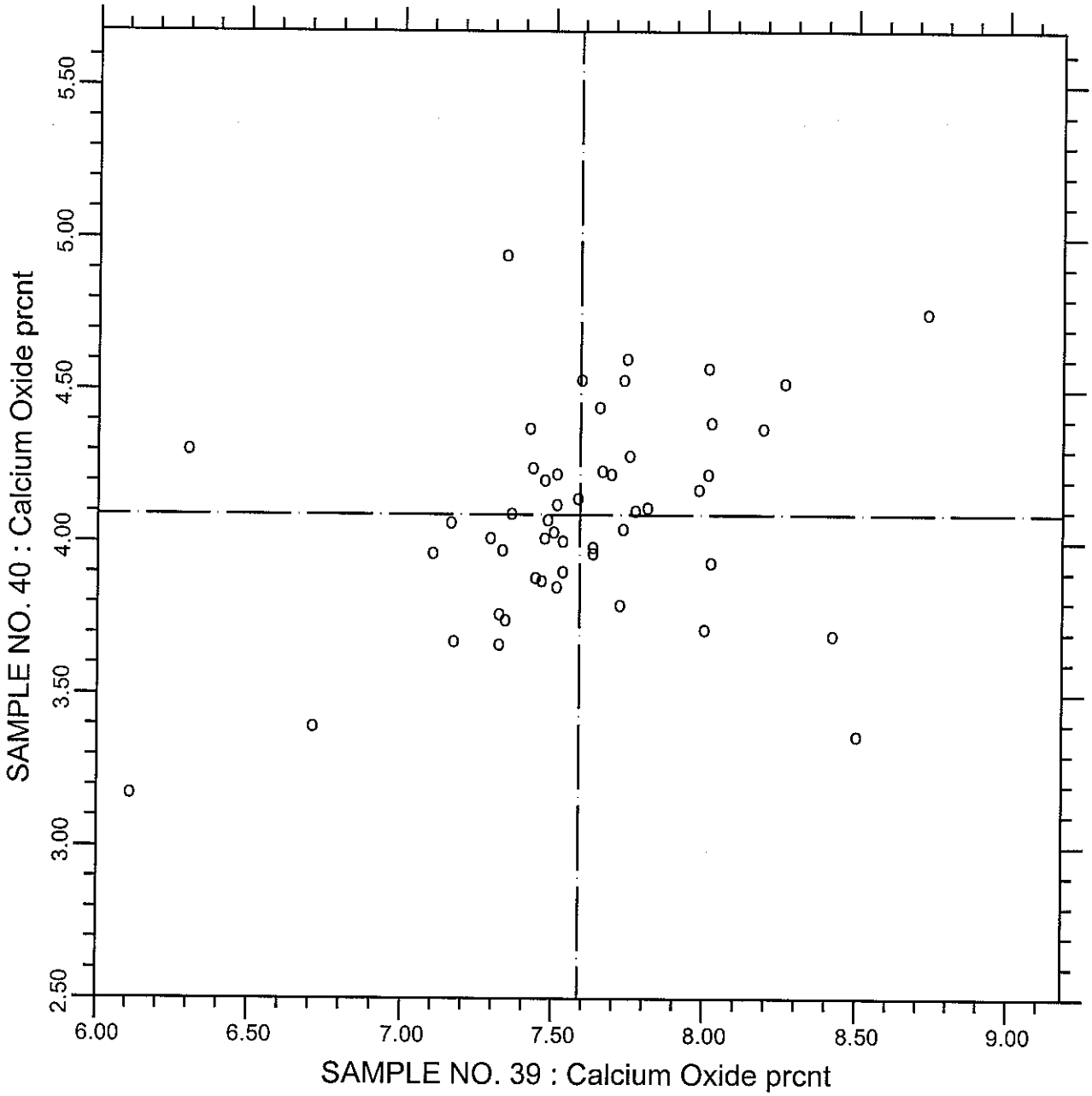
TEST NO.30 Ferric Oxide 49 POINTS

SAMPLE NO. 39 AVE 6.036 S.D. 0.37 C.V. 6.15

SAMPLE NO. 40 AVE 16.565 S.D. 1.10 C.V. 6.64

LABS ELIMINATED 25 125 158 1 58 1479

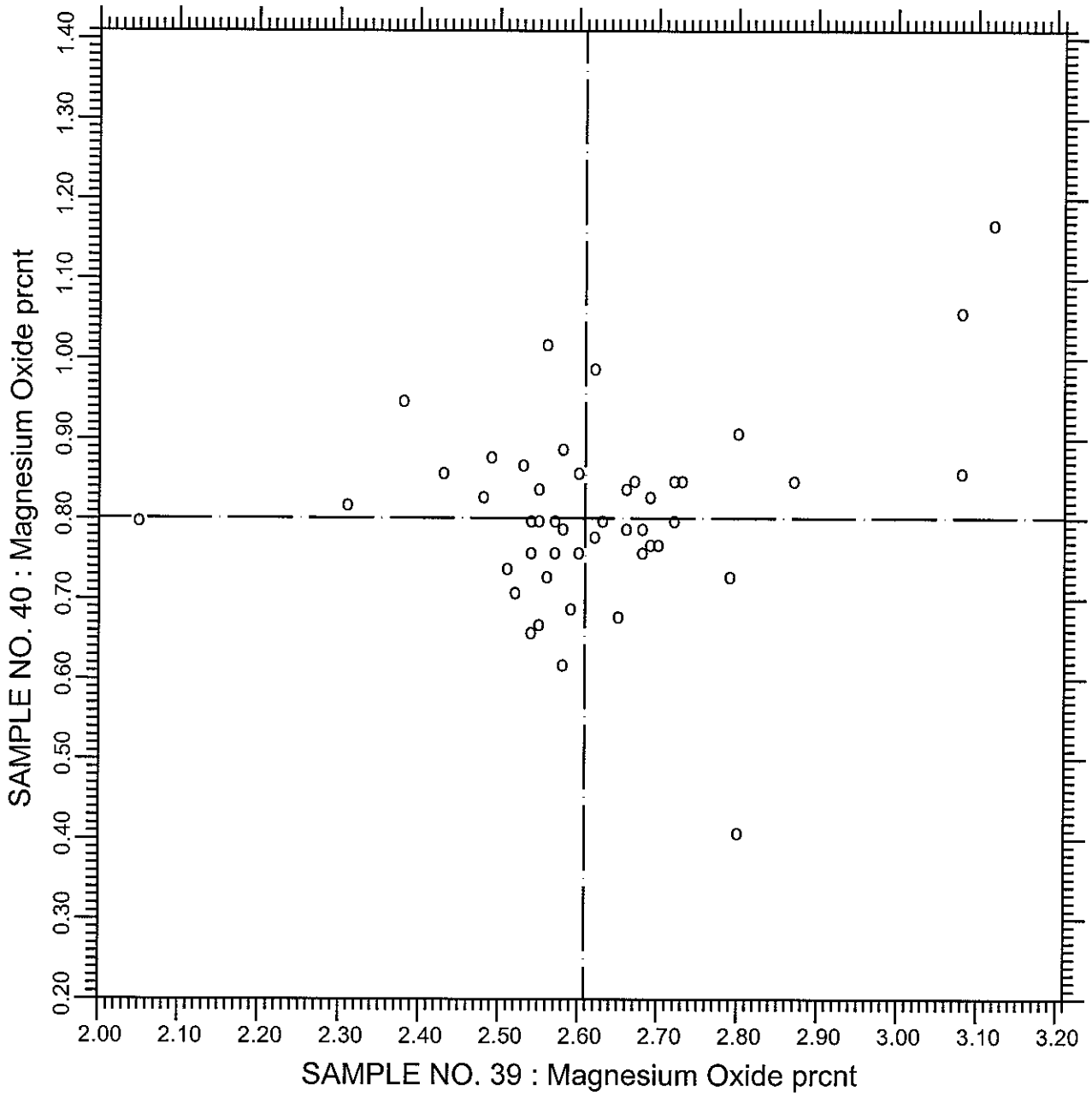
CCRL PROFICIENCY SAMPLE PROGRAM
Calcium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.40 Calcium Oxide 51 POINTS

SAMPLE NO. 39 AVE 7.587 S.D. 0.46 C.V. 6.11
SAMPLE NO. 40 AVE 4.090 S.D. 0.34 C.V. 8.42
LABS ELIMINATED 41 1 50 125 52 2150

CCRL PROFICIENCY SAMPLE PROGRAM
Magnesium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.50 Magnesium Oxide 49 POINTS

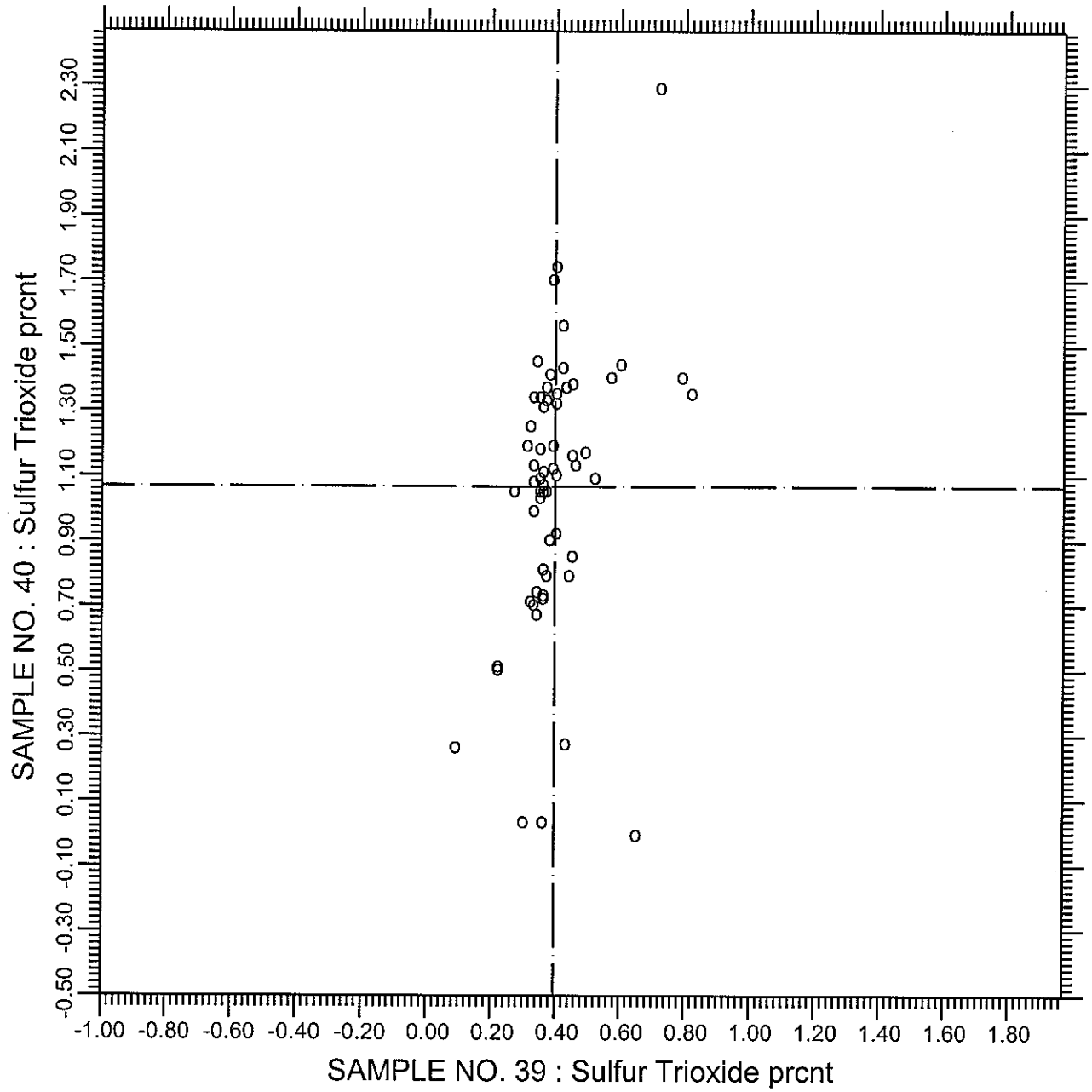
SAMPLE NO. 39 AVE 2.608 S.D. 0.20 C.V. 7.72

SAMPLE NO. 40 AVE 0.801 S.D. 0.12 C.V. 15.54

LABS ELIMINATED 20 176 205 1 25 1379 2150

LABS OFF DIAGRAM 1251

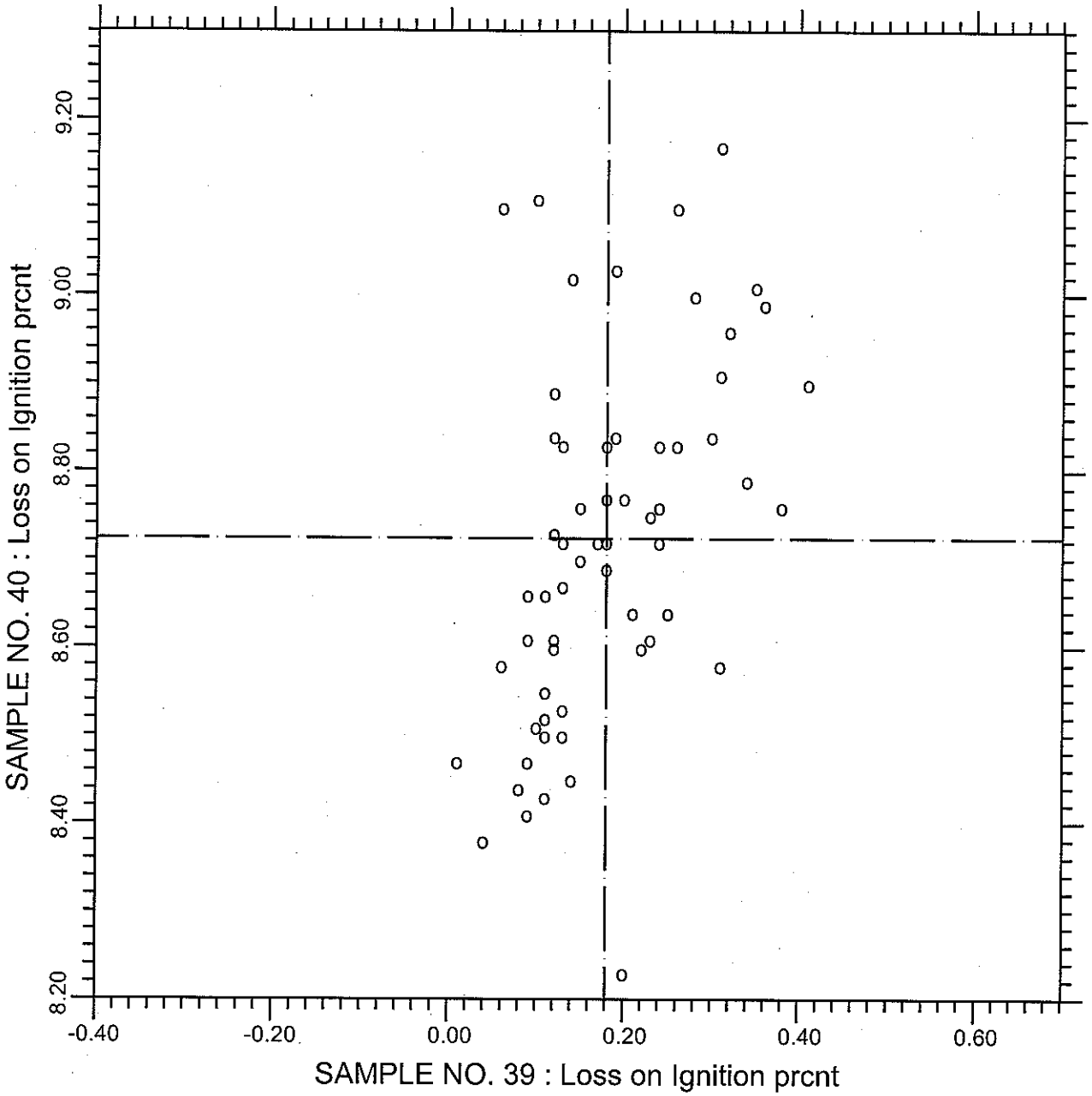
CCRL PROFICIENCY SAMPLE PROGRAM
Sulfur Trioxide
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.60 Sulfur Trioxide 61 POINTS

SAMPLE NO. 39	AVE	0.397	S.D.	0.12	C.V.	30.4
SAMPLE NO. 40	AVE	1.068	S.D.	0.42	C.V.	39.3

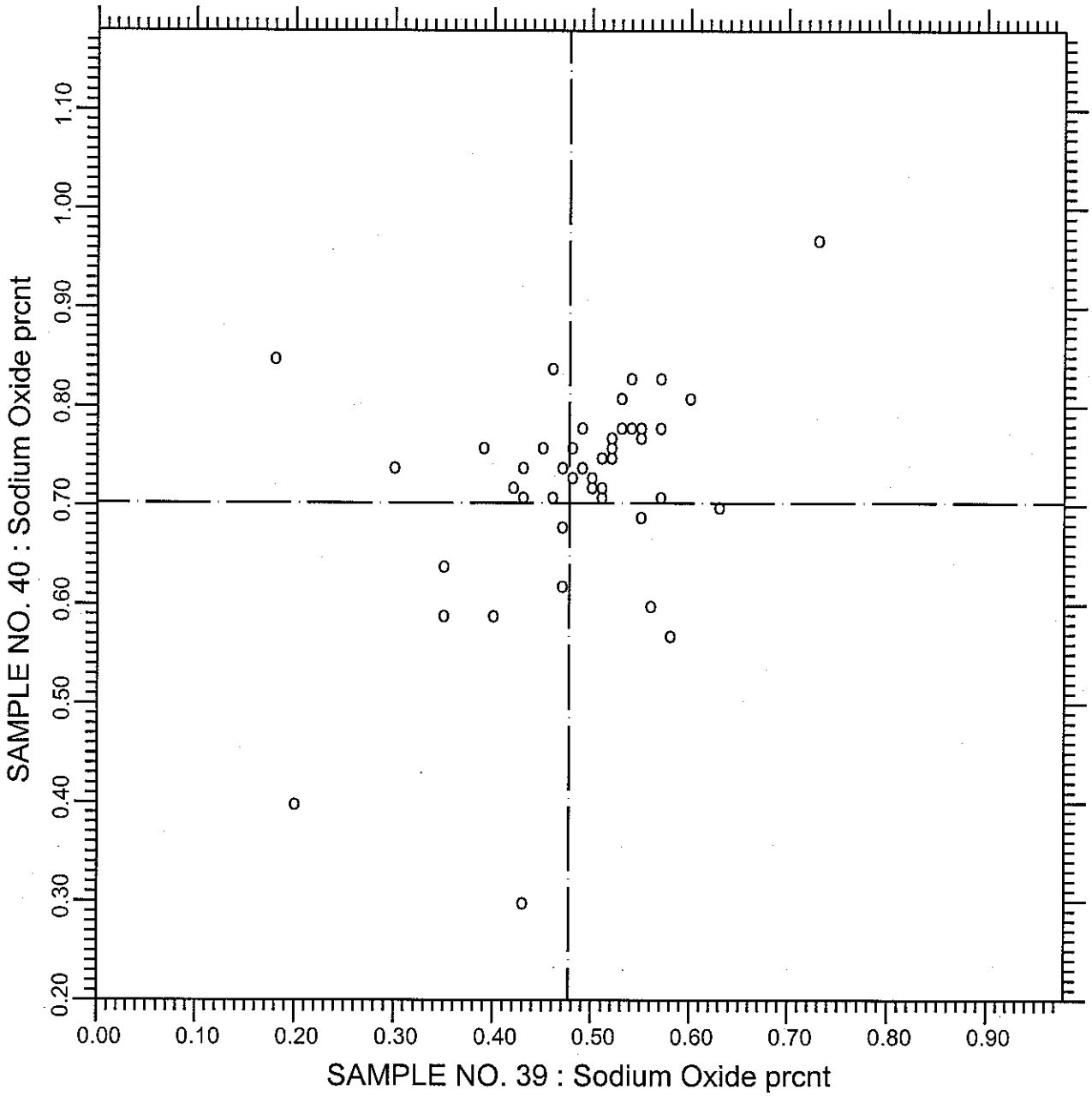
CCRL PROFICIENCY SAMPLE PROGRAM
Loss on Ignition
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.70 Loss on Ignition 62 POINTS

SAMPLE NO. 39 AVE 0.180 S.D. 0.091 C.V. 50.72
SAMPLE NO. 40 AVE 8.724 S.D. 0.207 C.V. 2.37
LABS ELIMINATED 9 33 29 52 284 1479

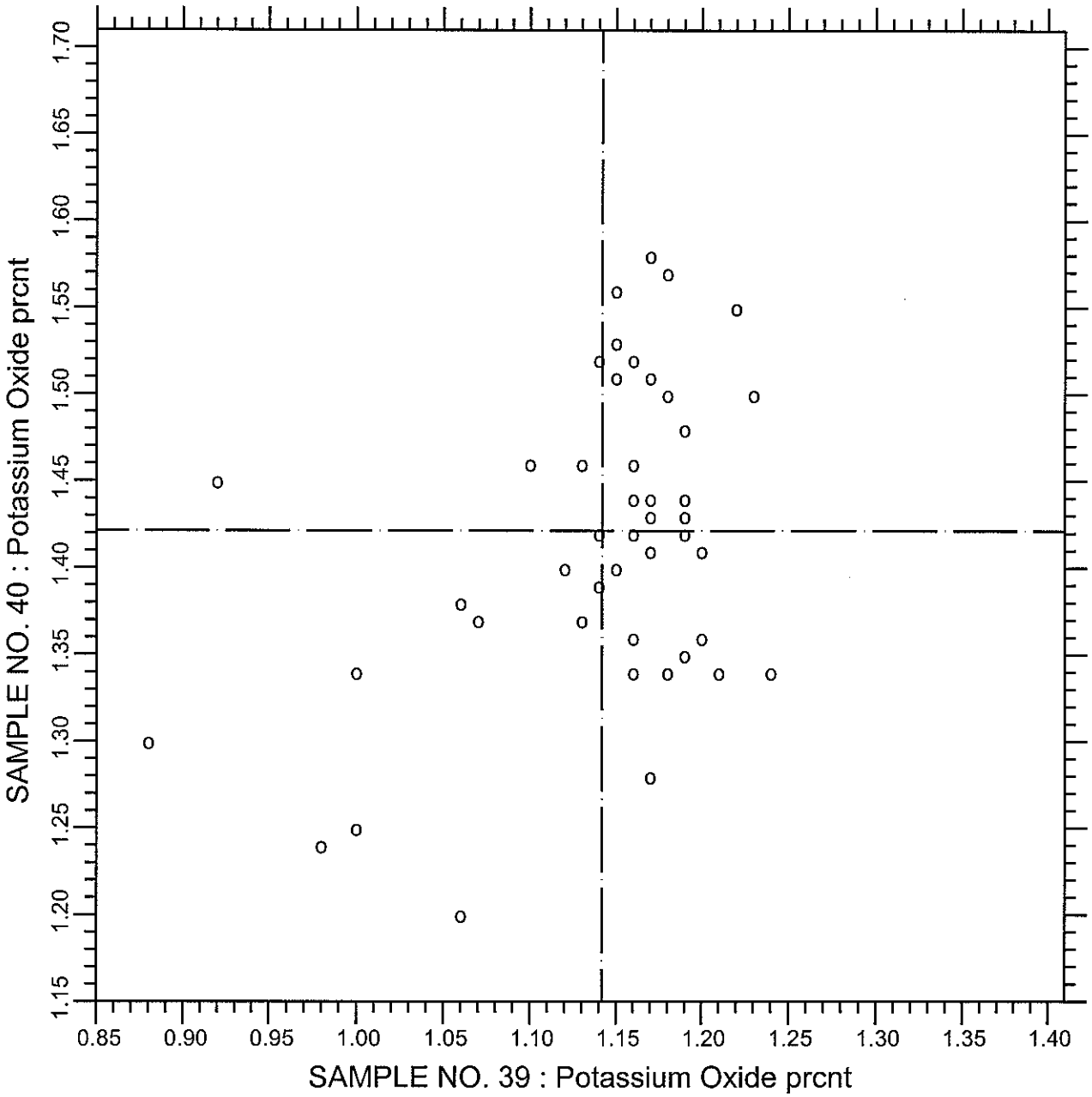
CCRL PROFICIENCY SAMPLE PROGRAM
Sodium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.90 Sodium Oxide 47 POINTS

SAMPLE NO. 39 AVE 0.477 S.D. 0.11 C.V. 22.4
SAMPLE NO. 40 AVE 0.703 S.D. 0.15 C.V. 21.7
LABS ELIMINATED 52 205 1251
LABS OFF DIAGRAM 24 25

CCRL PROFICIENCY SAMPLE PROGRAM
Potassium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40



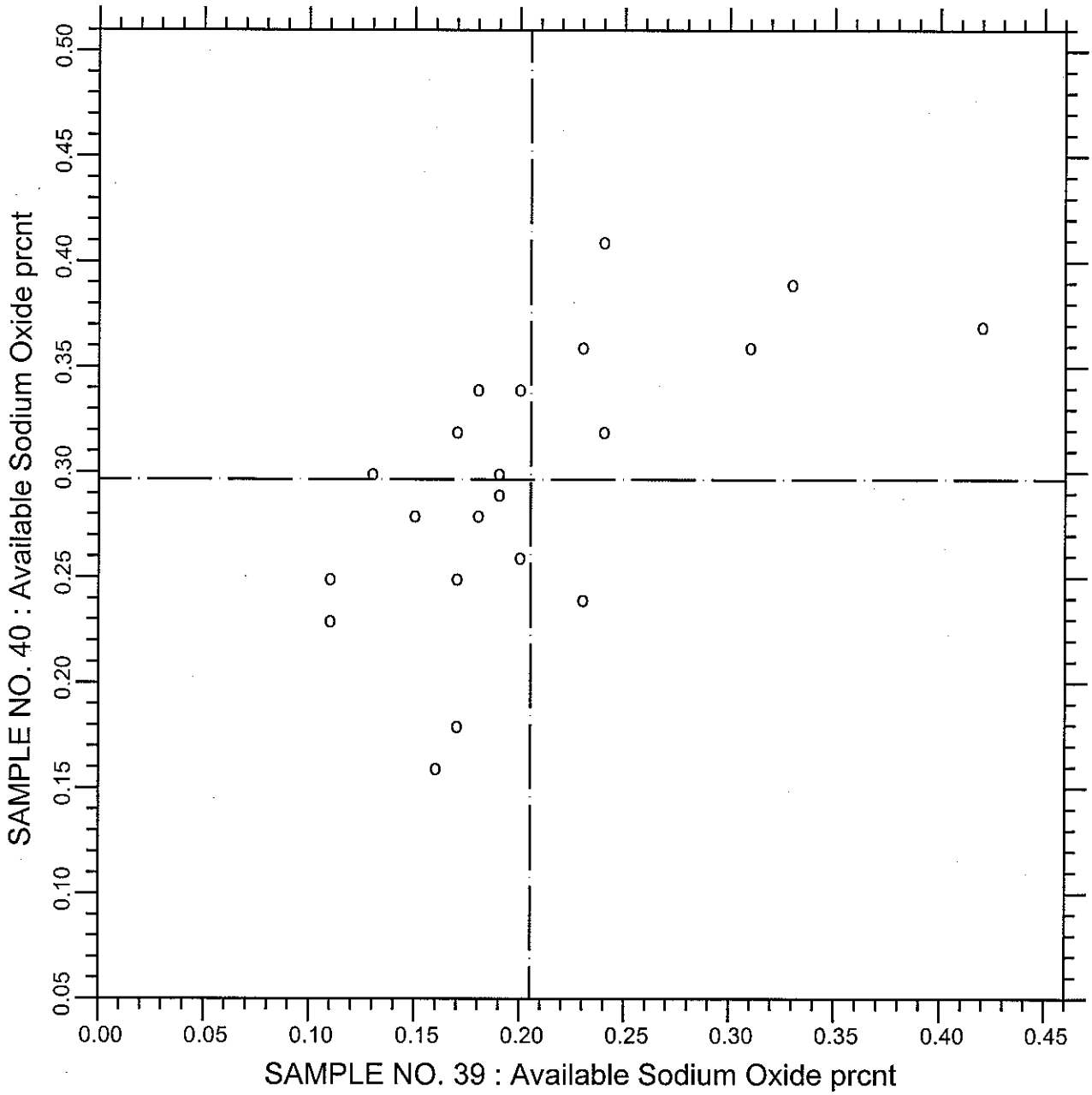
TEST NO.100 Potassium Oxide 50 POINTS

SAMPLE NO. 39 AVE 1.142 S.D. 0.074 C.V. 6.49

SAMPLE NO. 40 AVE 1.421 S.D. 0.088 C.V. 6.23

LABS ELIMINATED 25 205

CCRL PROFICIENCY SAMPLE PROGRAM
Available Sodium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40

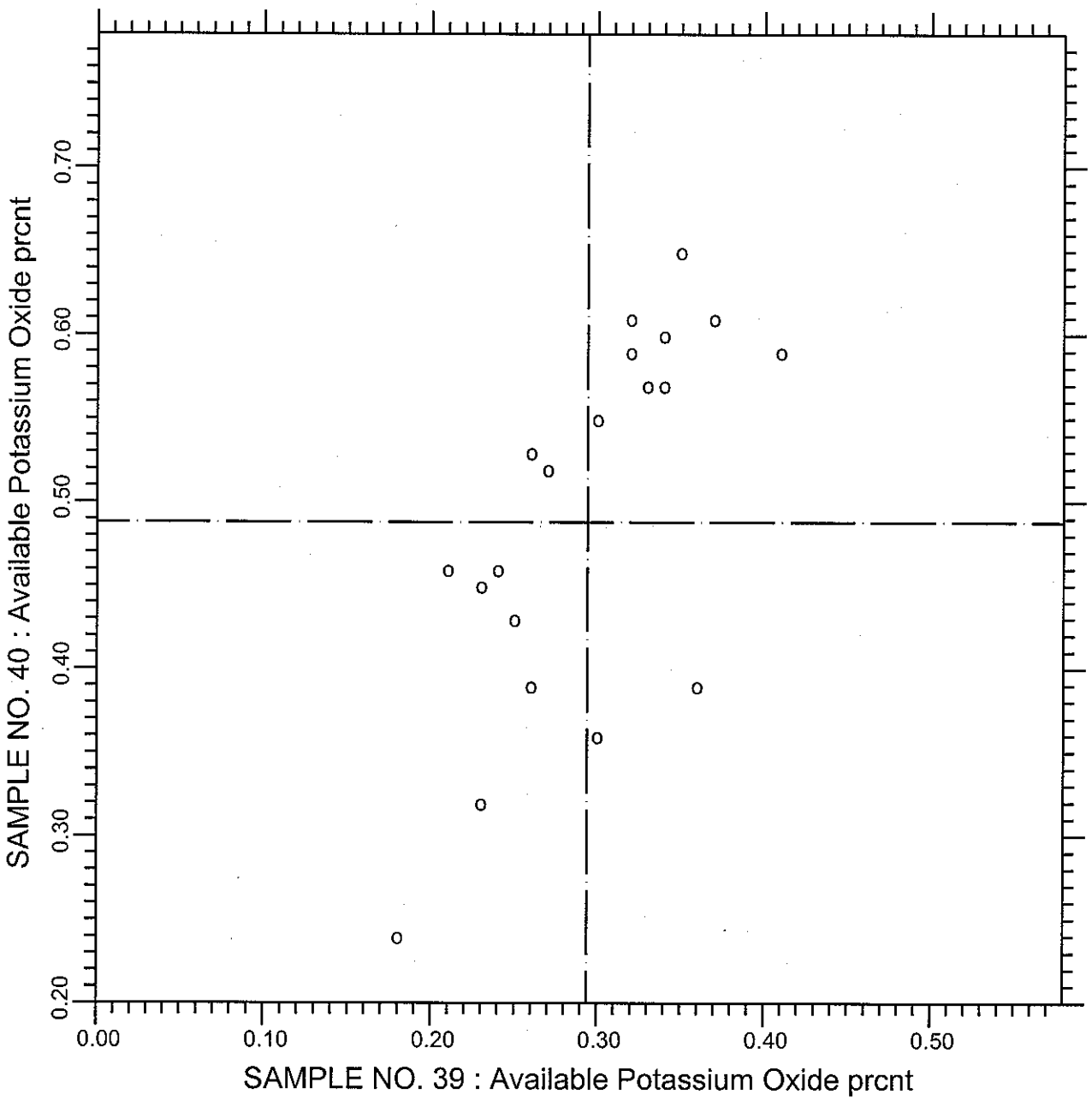


TEST NO.91 Available Sodium Oxide 21 POINTS

SAMPLE NO. 39	AVE 0.205	S.D. 0.074	C.V. 36.2
SAMPLE NO. 40	AVE 0.297	S.D. 0.066	C.V. 22.1

LABS ELIMINATED 3 19 24

CCRL PROFICIENCY SAMPLE PROGRAM
Available Potassium Oxide
POZZOLAN SAMPLES NO. 39 & NO. 40

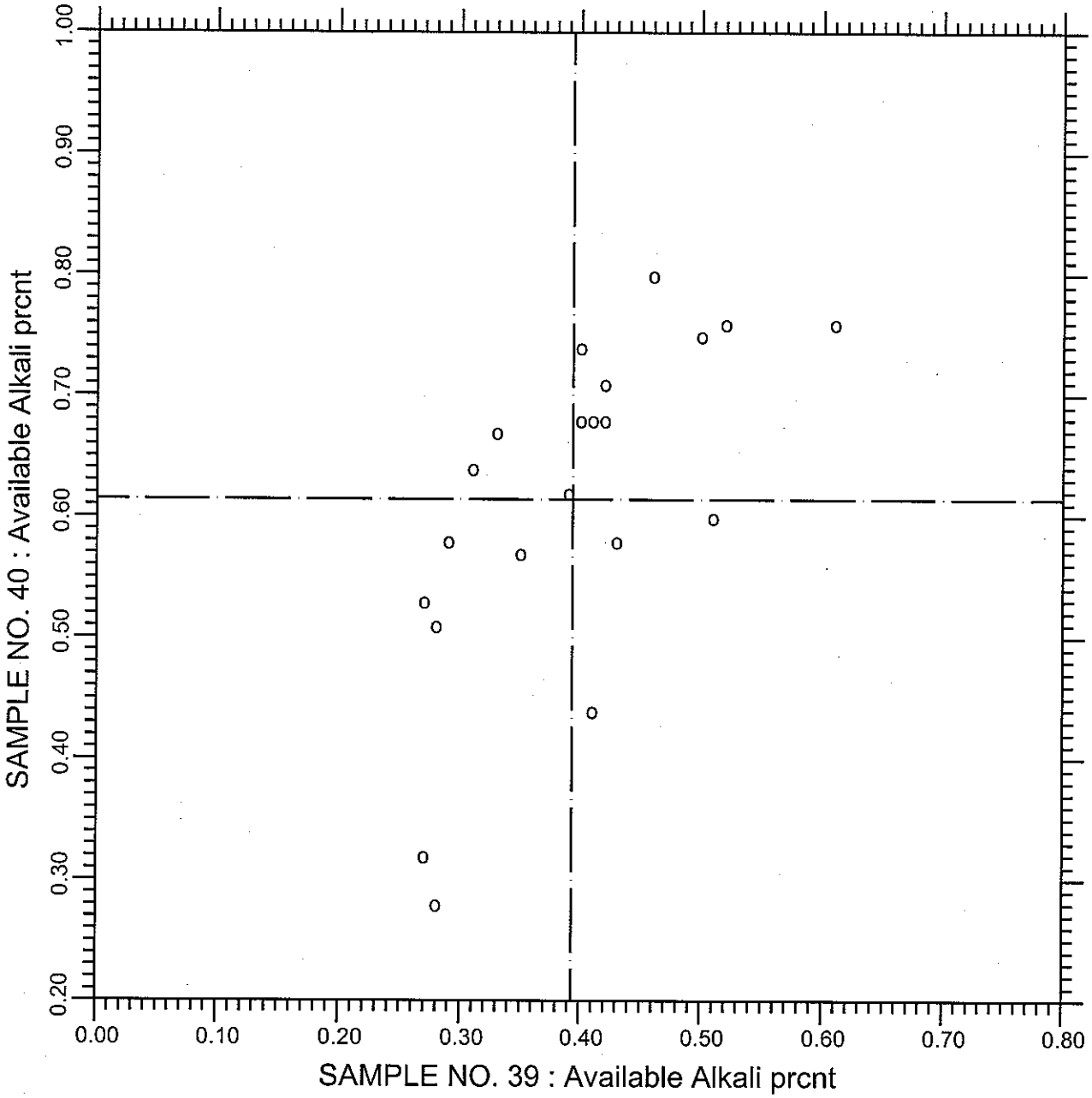


TEST NO.93 Available Potassium Oxide 21 POINTS

SAMPLE NO. 39	AVE	0.294	S.D.	0.059	C.V.	20.1
SAMPLE NO. 40	AVE	0.488	S.D.	0.113	C.V.	23.2

LABS ELIMINATED 3 19 24

CCRL PROFICIENCY SAMPLE PROGRAM
Available Alkali
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.95 Available Alkali 21 POINTS

SAMPLE NO. 39 AVE 0.393 S.D. 0.094 C.V. 23.8
SAMPLE NO. 40 AVE 0.614 S.D. 0.139 C.V. 22.7
LABS ELIMINATED 19 24

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficency Sample No. 39 and No. 40
Final Report - Physical Results
January 4, 2007

SUMMARY OF RESULTS

Test			#Labs	Sample No. 39 Average	S.D.	C.V.	Sample No. 40 Average	S.D.	C.V.
Density	g/cm^3		62	2.46	0.045	1.82	2.41	0.072	3.01
Density	g/cm^3	*	59	2.46	0.033	1.35	2.41	0.042	1.77
45µm Sieve	prcnt		74	37.92	6.2	16.5	17.68	6.0	33.7
45µm Sieve	prcnt	*	65	38.00	2.1	5.63	17.36	1.2	6.64
Drying Shrinkage	prcnt		16	-0.002	0.029	-1286	0.001	0.026	2608
Drying Shrinkage	prcnt	*	15	0.004	0.014	323	0.007	0.012	172
Autoclave Expan	prcnt		54	0.06	0.031	53.2	0.07	0.031	47.4
Autoclave Expan	prcnt	*	49	0.06	0.014	22.1	0.07	0.015	22.2
N.C. Water	prcnt		56	23.3	3.3	14.1	28.4	4.8	17.0
N.C. Water	prcnt	*	51	23.5	0.47	2.00	28.6	0.61	2.12
Air Entrainment	prcnt		9	0.036	0.066	183.2	0.084	0.082	98.5
Strength Activity Index (SAI) with Portland Cement									
SAI 7 day	prcnt		64	80	8.5	10.6	81	8.9	11.1
SAI 7 day	prcnt	*	61	81	4.5	5.58	81	4.8	5.94
SAI 28-day	prcnt		48	87	7.7	8.81	88	8.4	9.48
SAI 28-day	prcnt	*	46	89	4.2	4.70	90	4.6	5.12
SAI Water	prcnt		60	96	9.1	9.46	100	9.9	9.90
SAI Water	prcnt	*	56	98	1.6	1.67	102	1.8	1.75
EFFECTIVENESS OF MINERAL ADMIIXTURES IN CONTROLLING ALKALI-SILICA REACTIONS (ASR)									
Reduction Expan	prcnt		12	50	25.0	50.3	53	25.5	48.5
Reduction Expan	prcnt	*	11	54	20.4	37.7	57	20.3	35.4

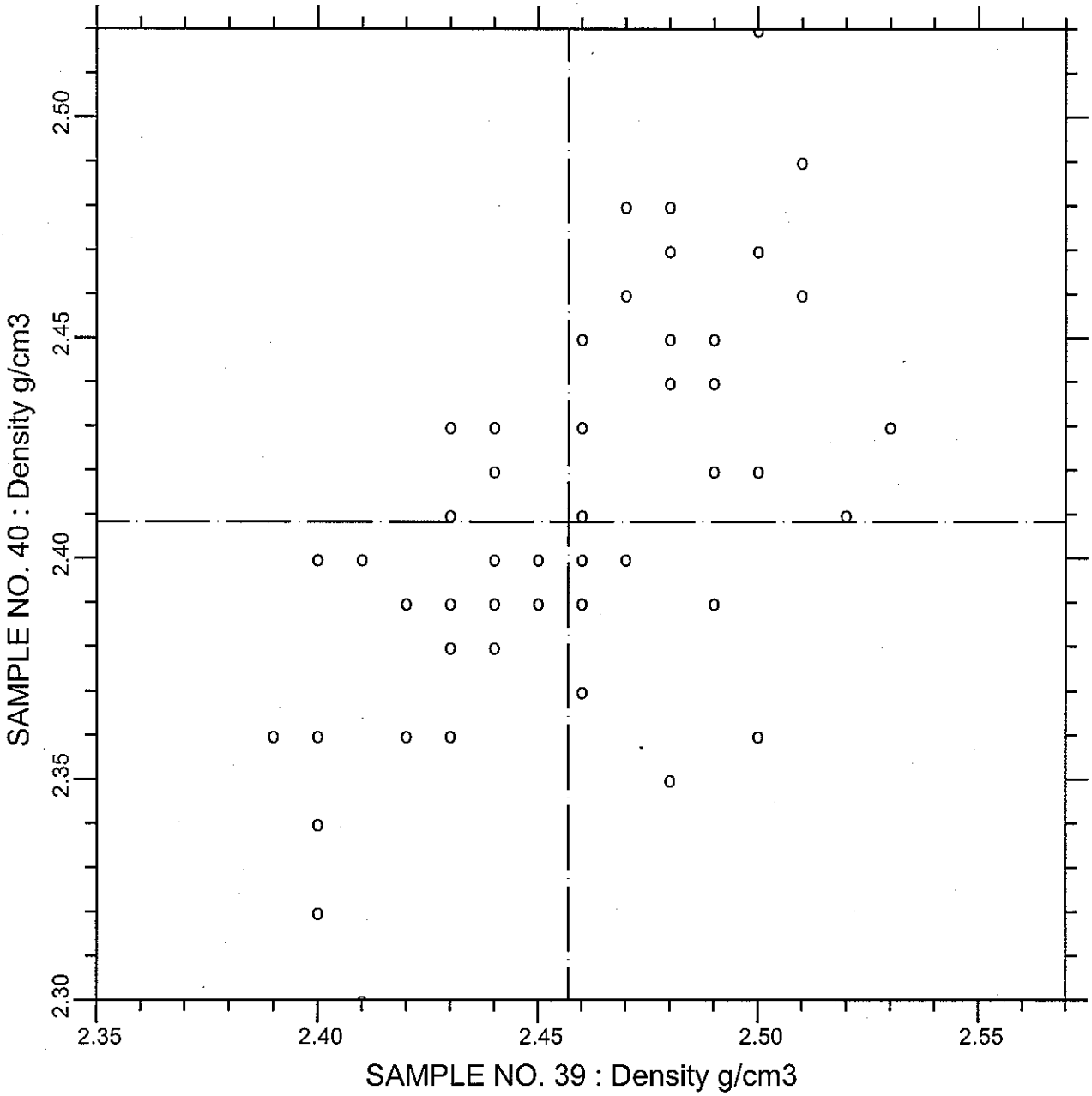
* ELIMINATED LABS: Data over three S.D. from the mean

Density	265 1379 1435
45µm Sieve	1379 1940 125 265 21 25 196 2295 3059
Drying Shrinkage	207
Autoclave Expansion	36 47 70 265 1859
N.C. Water	33 47 196 1251 1479
SAI 7 day	29 33 823
SAI 28 day	29 33
SAI Water Requirement	1379 29 158 3135
ASR Reduction of Expan	125

CCRL PROFICIENCY SAMPLE PROGRAM

Density

POZZOLAN SAMPLES NO. 39 & NO. 40



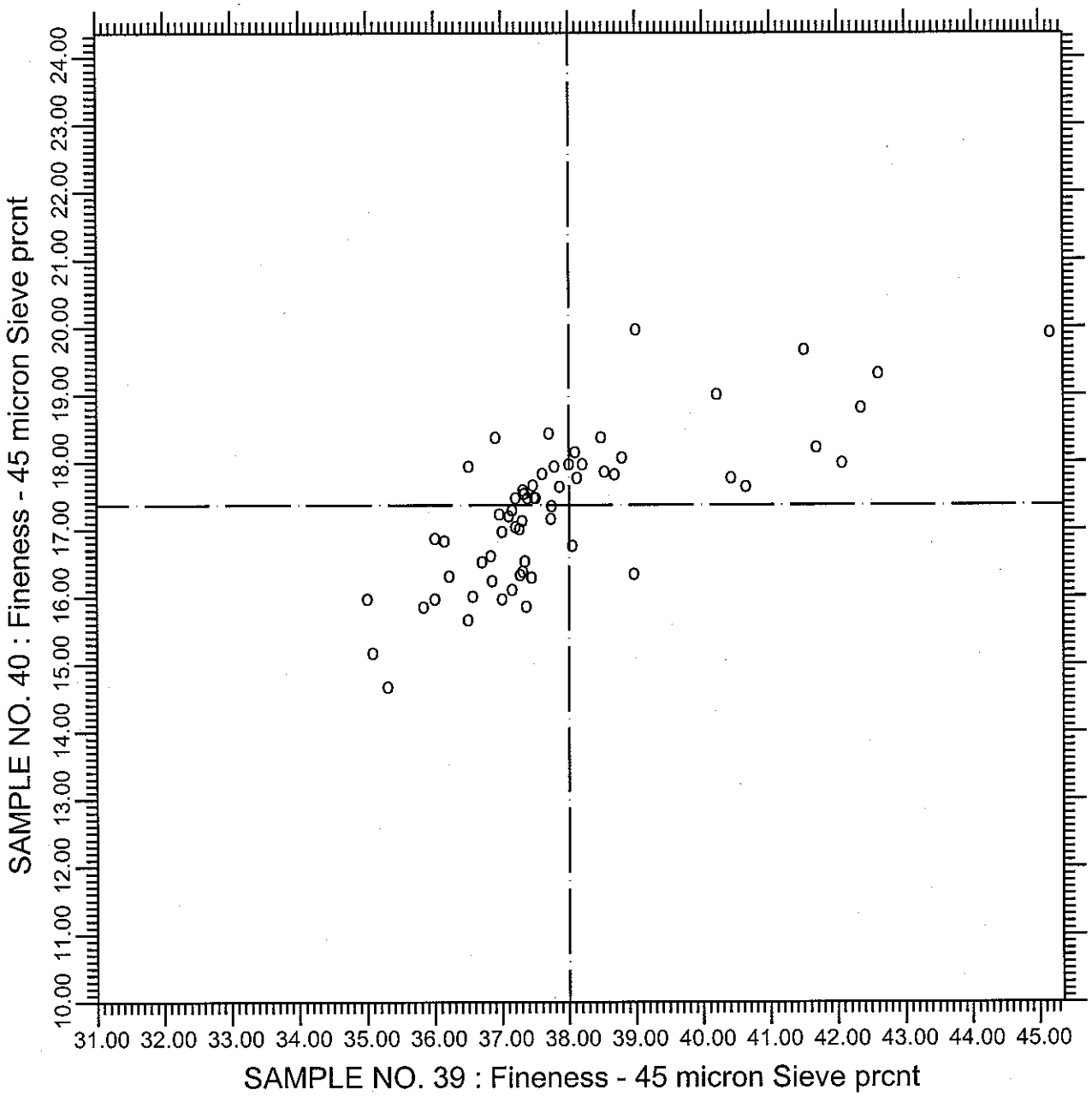
TEST NO.310 Density 59 POINTS

SAMPLE NO. 39 AVE 2.4569 S.D. 0.033 C.V. 1.35

SAMPLE NO. 40 AVE 2.4083 S.D. 0.042 C.V. 1.77

LABS ELIMINATED 265 1379 1435

CCRL PROFICIENCY SAMPLE PROGRAM
Fineness - 45 micron Sieve Retained
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.281 Fineness - 45 micron Sieve 64 POINTS

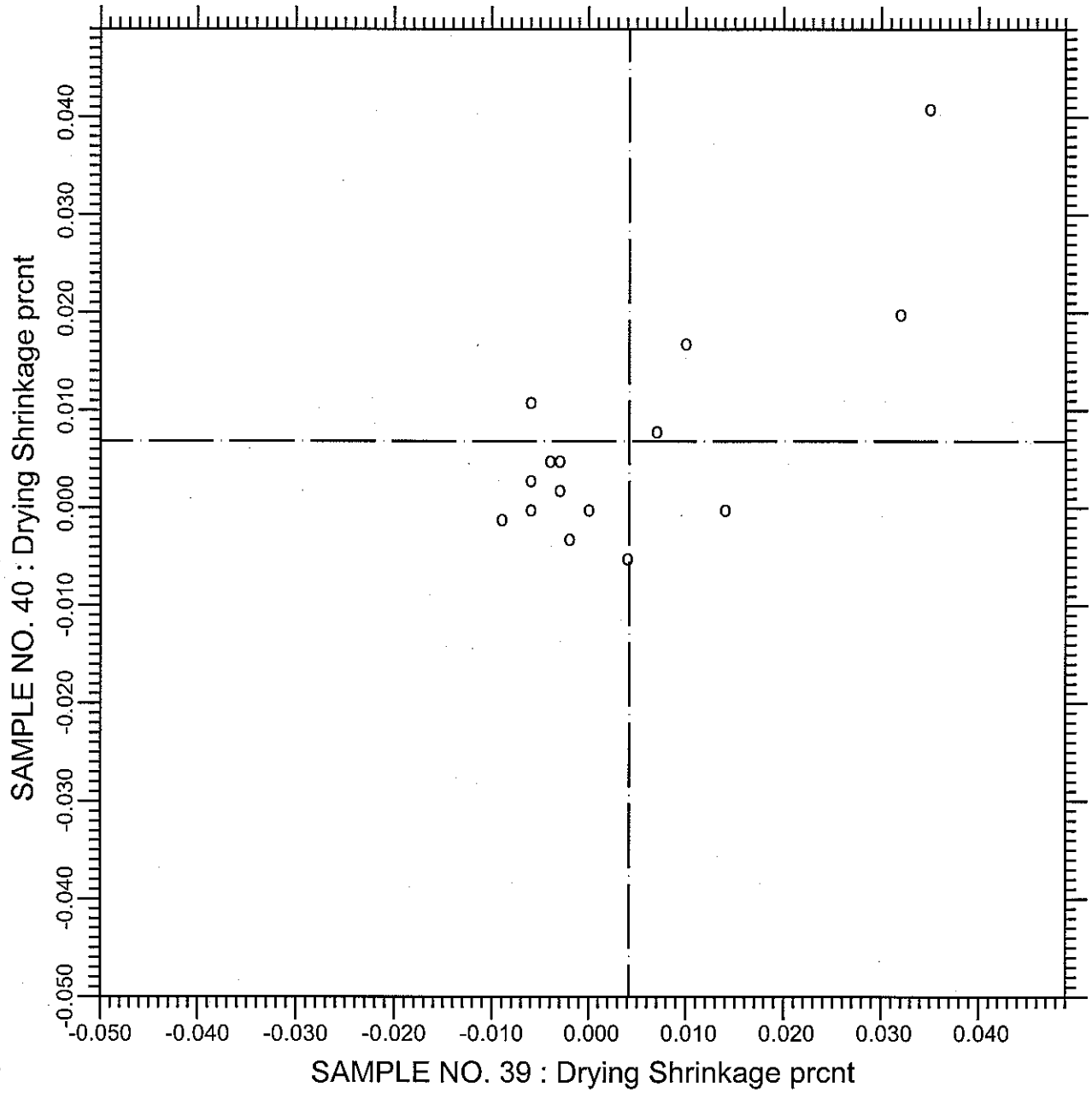
SAMPLE NO. 39 AVE 38.00 S.D. 2.1 C.V. 5.63

SAMPLE NO. 40 AVE 17.36 S.D. 1.2 C.V. 6.64

LABS ELIMINATED 1379 1940 125 265 21 25 196 2295 3059

LABS OFF DIAGRAM 9

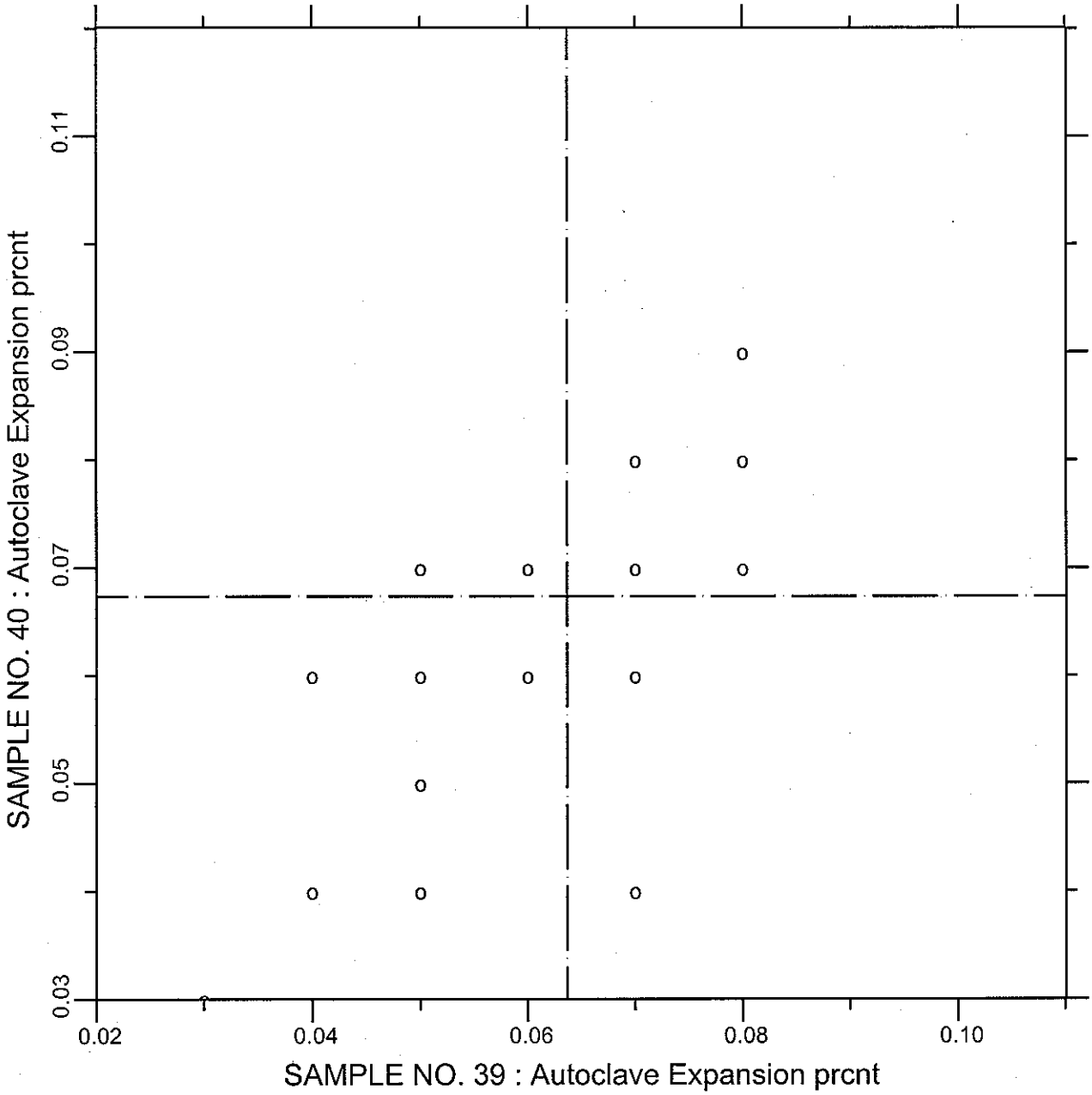
CCRL PROFICIENCY SAMPLE PROGRAM
Drying Shrinkage
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.340 Drying Shrinkage 15 POINTS

SAMPLE NO. 39 AVE 0.0042 S.D. 0.014 C.V. 323
SAMPLE NO. 40 AVE 0.0069 S.D. 0.012 C.V. 172
LABS ELIMINATED 207

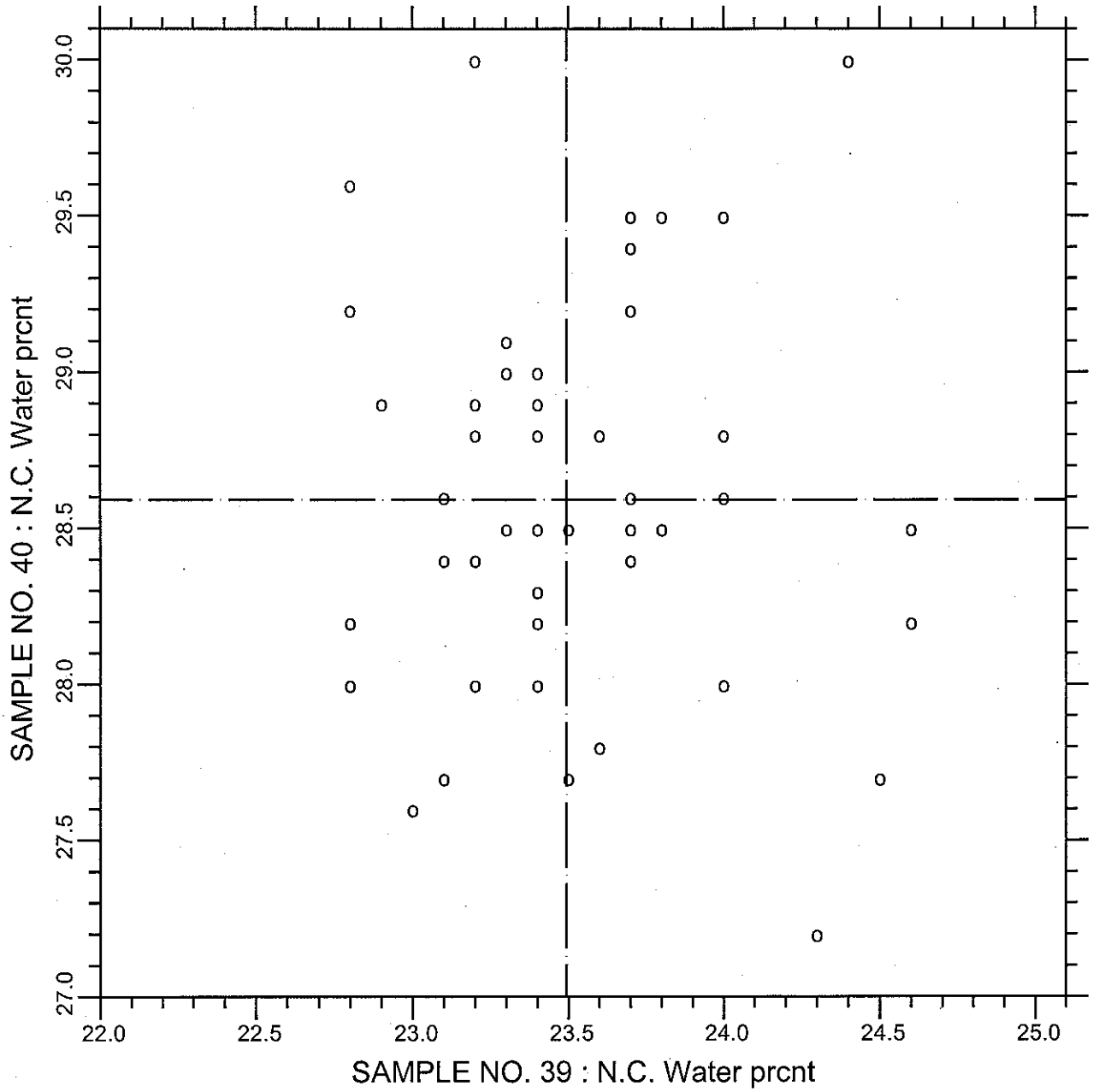
CCRL PROFICIENCY SAMPLE PROGRAM
Autoclave Expansion
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.160 Autoclave Expansion 49 POINTS

SAMPLE NO. 39 AVE 0.0637 S.D. 0.014 C.V. 22.1
SAMPLE NO. 40 AVE 0.0673 S.D. 0.015 C.V. 22.2
LABS ELIMINATED 36 47 70 265 1859

CCRL PROFICIENCY SAMPLE PROGRAM
Normal Consistency Water
POZZOLAN SAMPLES NO. 39 & NO. 40



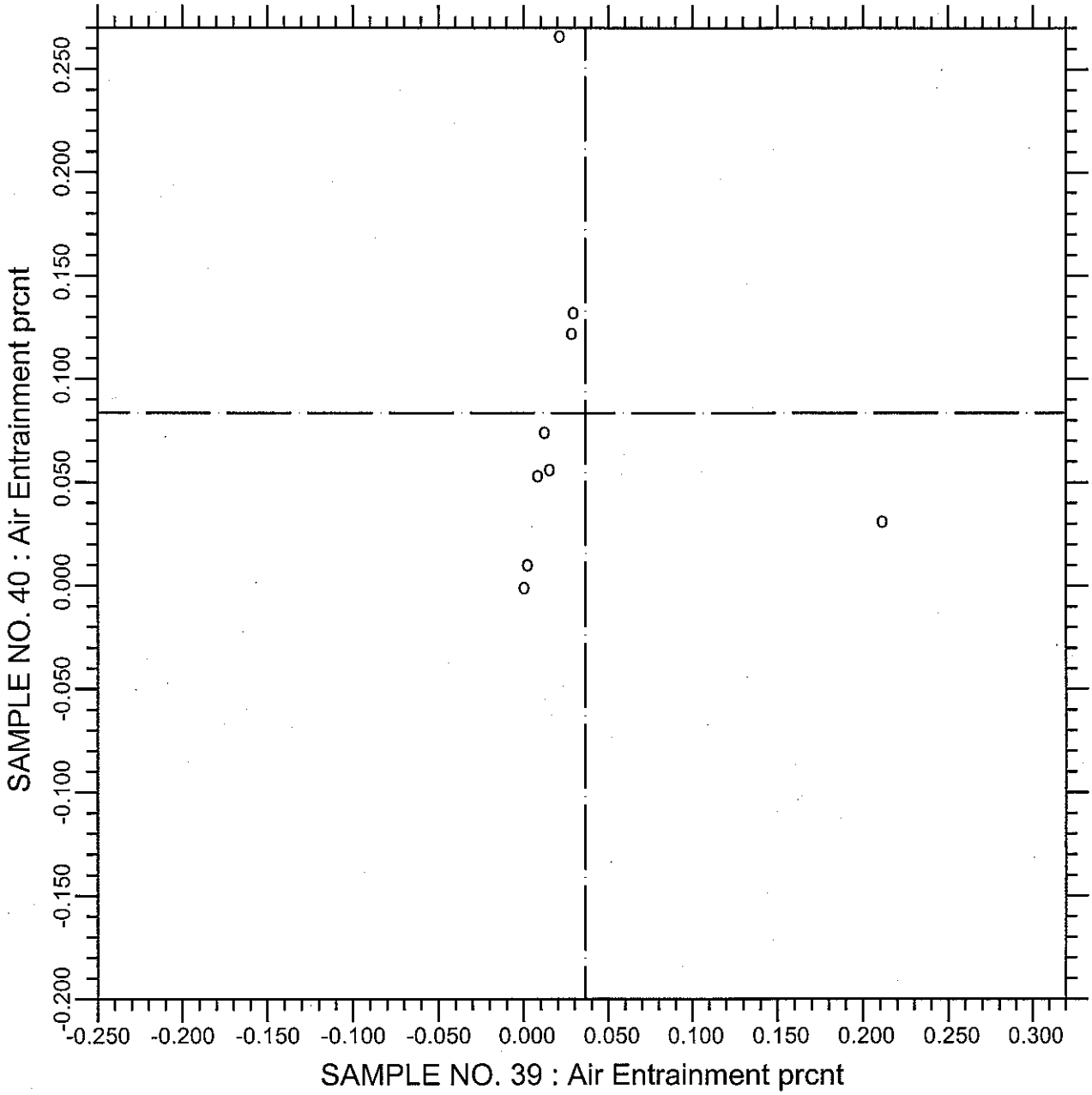
TEST NO.110 N.C. Water 51 POINTS

SAMPLE NO. 39 AVE 23.494 S.D. 0.47 C.V. 2.00

SAMPLE NO. 40 AVE 28.590 S.D. 0.61 C.V. 2.12

LABS ELIMINATED 33 47 196 1251 1479

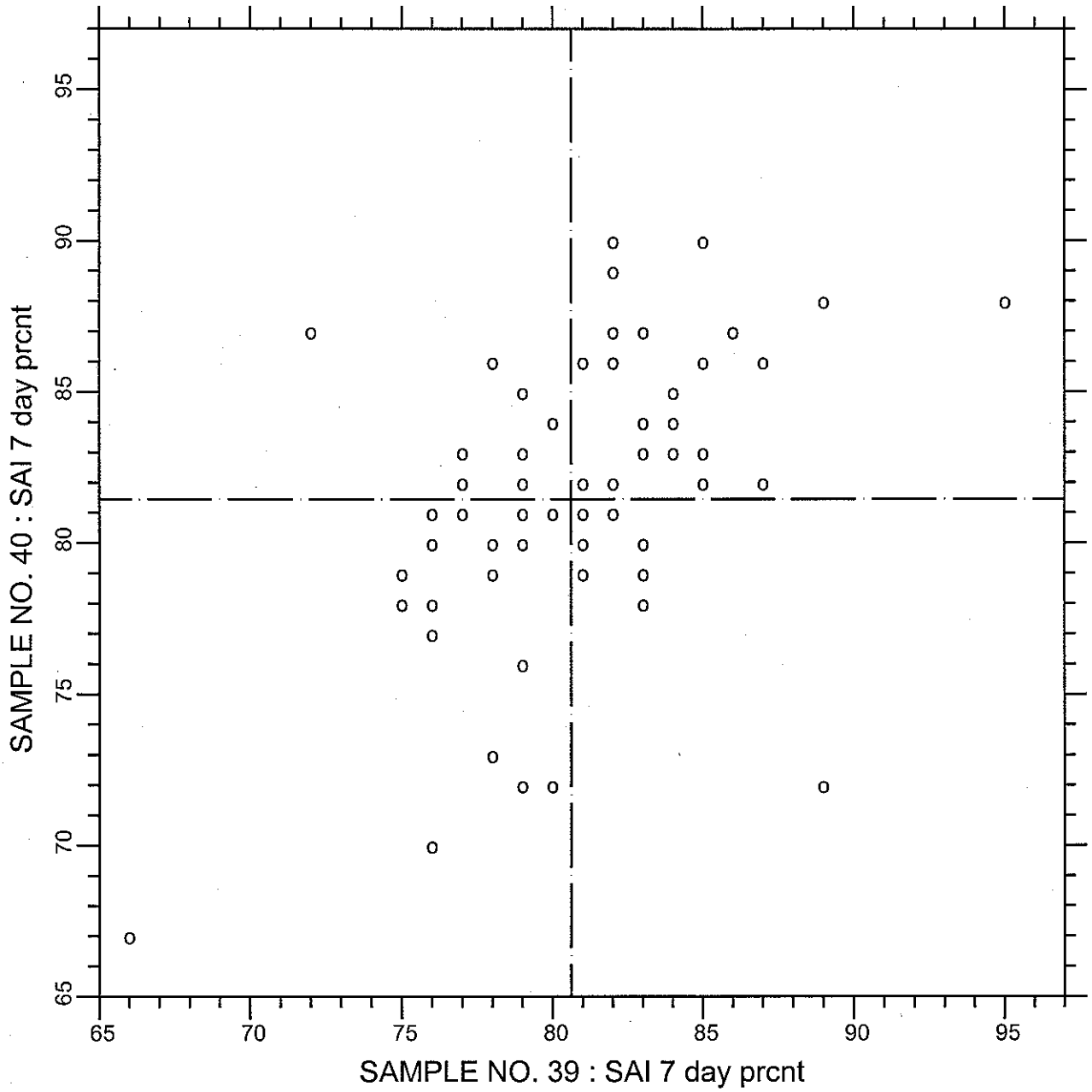
CCRL PROFICIENCY SAMPLE PROGRAM
Air Entrainment
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.350 Air Entrainment 9 POINTS

SAMPLE NO. 39	AVE	0.036	S.D.	0.066	C.V.	183.2
SAMPLE NO. 40	AVE	0.084	S.D.	0.082	C.V.	98.5

CCRL PROFICIENCY SAMPLE PROGRAM
Strength Activity Index - 7 day
POZZOLAN SAMPLES NO. 39 & NO. 40



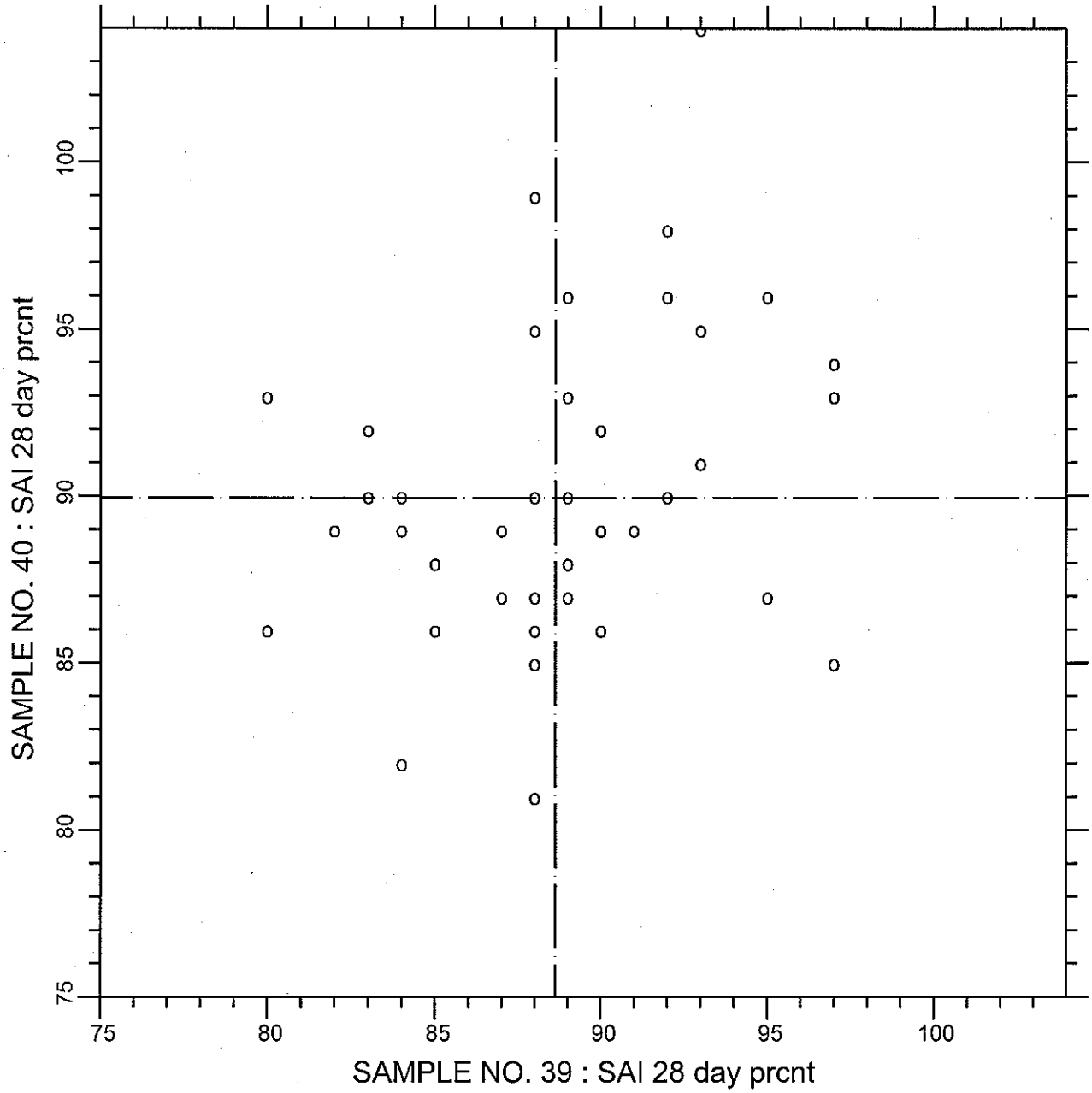
TEST NO.359 SAI 7 day 61 POINTS

SAMPLE NO. 39 AVE 80.62 S.D. 4.5 C.V. 5.58

SAMPLE NO. 40 AVE 81.44 S.D. 4.8 C.V. 5.94

LABS ELIMINATED 29 33 823

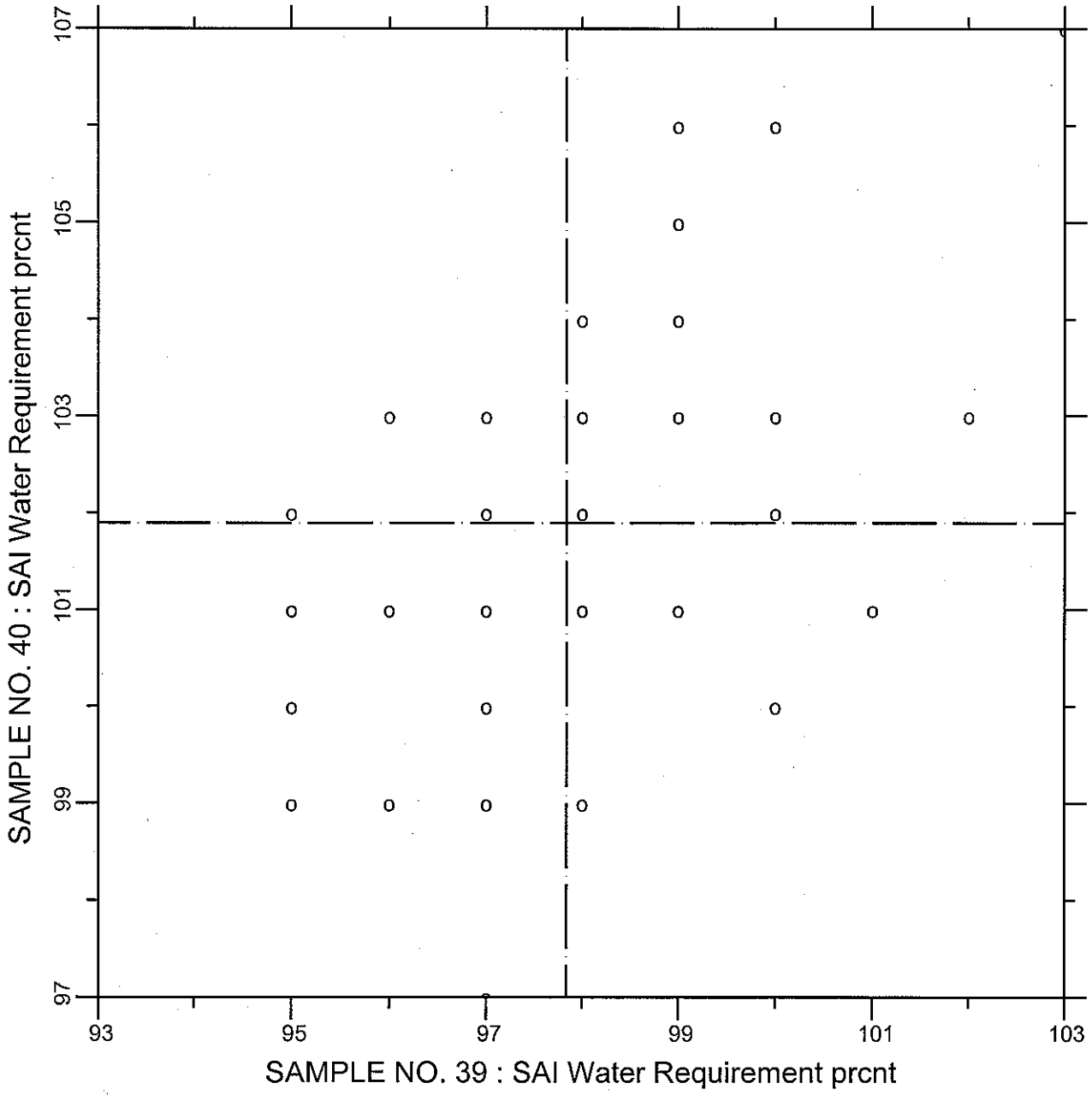
CCRL PROFICIENCY SAMPLE PROGRAM
Strength Activity Index - 28 day
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.360 SAI 28 day 46 POINTS

SAMPLE NO. 39 AVE 88.63 S.D. 4.2 C.V. 4.70
SAMPLE NO. 40 AVE 89.93 S.D. 4.6 C.V. 5.12
LABS ELIMINATED 29 33

CCRL PROFICIENCY SAMPLE PROGRAM
SAI Water Requirement
POZZOLAN SAMPLES NO. 39 & NO. 40



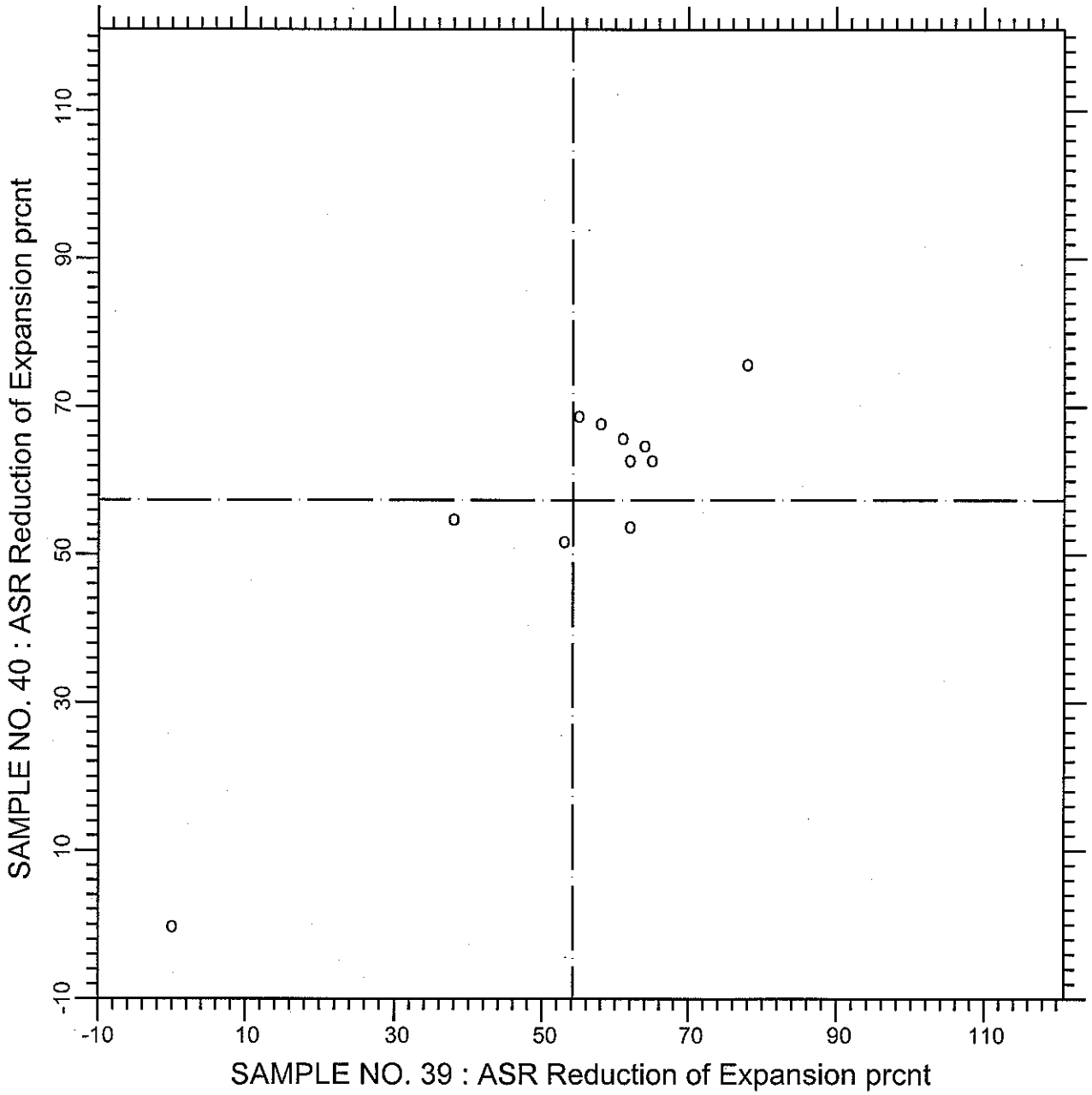
TEST NO.370 SAI Water Requirement 56 POINTS

SAMPLE NO. 39 AVE 97.84 S.D. 1.6 C.V. 1.67

SAMPLE NO. 40 AVE 101.89 S.D. 1.8 C.V. 1.75

LABS ELIMINATED 1379 29 158 3135

CCRL PROFICIENCY SAMPLE PROGRAM
Alkali-Silica Reaction - Reduction of Expansion
POZZOLAN SAMPLES NO. 39 & NO. 40



TEST NO.390 ASR Reduction of Expansion 11 POINTS

SAMPLE NO. 39	AVE	54.2	S.D.	20.4	C.V.	37.7
SAMPLE NO. 40	AVE	57.4	S.D.	20.3	C.V.	35.4

LABS ELIMINATED 125