CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Blended Cement Proficiency Samples
Number 79 and Number 80

April 2017

CCRL
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Reference Laboratory

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April 25, 2017

TO: Participants in the CCRL Blended Cement Proficiency Sample Program

SUBJECT: Final Report on Blended Cement Proficiency Samples No. 79 and No. 80

Following is the final report for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2017. Both cements were an ASTM C595 Blended Hydraulic Cement. Sample No 79 was a Type IP (25) and No. 80 was a Type IP (25).

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/.

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 of CCRL EXTRA Samples.

It is presently anticipated that the next Blended Cement Proficiency Samples will be distributed in February 2018.

Sincerely,

Robin K. Haupt

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

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Sponsored by Committees C-1 and C-9 of ASTM International

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. 79 and No. 80

This letter, and the material included with it, constitutes the final report and summary of results for the current pair of Blended Cement Proficiency Samples, which were distributed in February 2017. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of general 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.

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.

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.

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.

Participants subscribing to the primary 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.

[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.*

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 ± 7.5 are satisfactory, labs with flow values outside this range will be flagged as a “Labs Eliminated” or “Labs Off Diagram” 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

Usually, averages, standard deviations, and coefficients of variation are given with all results reported, and then with one or more outlying results omitted. Sometimes, two or more recalculations with laboratories omitted, have been done 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 subscription to the given program.

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 indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Chemical Analysis Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Silicon Dioxide (**percent**)							
	96	29.60	1.25	4.2	28.69	0.91	3.2
	*88	29.47	0.58	2.0	28.60	0.48	1.7
* Labs Eliminated - 1, 42, 284, 413, 504, 2352, 2491, 3431							
Aluminum Oxide (**percent**)							
	94	7.93	0.67	8.4	9.17	0.66	7.2
	*89	7.96	0.25	3.2	9.20	0.28	3.1
* Labs Eliminated - 47, 690, 2360, 2491, 3431							
Ferric Oxide (**percent**)							
	95	5.26	0.44	8.3	3.91	0.27	6.9
	*91	5.26	0.27	5.2	3.89	0.21	5.4
* Labs Eliminated - 42, 1956, 2360, 3431							
Calcium Oxide (**percent**)							
	95	48.00	0.96	2.00	48.86	0.89	1.82
	*91	47.97	0.64	1.34	48.81	0.67	1.38
* Labs Eliminated - 354, 413, 504, 690							
Magnesium Oxide (**percent**)							
	97	2.06	0.30	14.6	1.57	0.21	13.4
	*86	2.03	0.08	4.0	1.57	0.09	5.5
* Labs Eliminated - 14, 23, 36, 42, 125, 158, 413, 440, 2360, 2491, 3504							
Sulfur Trioxide (**percent**)							
	98	3.03	0.14	4.7	3.37	0.16	4.8
	*94	3.04	0.11	3.6	3.38	0.12	3.6
* Labs Eliminated - 246, 694, 2352, 3930							

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Chemical Analysis Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Loss on Ignition (**percent**)							
	98	2.28	1.81	79.2	2.31	1.59	68.9
	*92	2.10	0.08	3.8	2.15	0.09	4.0
* Labs Eliminated - 42, 43, 124, 209, 3504, 3930							
Sodium Oxide (**percent**)							
	90	0.414	0.079	19	0.525	0.089	17
	*83	0.417	0.044	11	0.527	0.049	9
* Labs Eliminated - 47, 284, 504, 2352, 2360, 2463, 2491							
Potassium Oxide (**percent**)							
	93	1.14	0.15	13.1	0.81	0.07	9.0
	*86	1.16	0.07	5.9	0.82	0.04	5.3
* Labs Eliminated - 1, 169, 354, 2360, 2491, 3409, 3504							
Titanium Dioxide (**percent**)							
	76	0.41	0.062	15.3	0.36	0.076	21.0
	*70	0.41	0.031	7.6	0.36	0.029	8.0
* Labs Eliminated - 125, 2292, 2491, 3409, 3503, 3930							
Phosphorus Pentoxide (**percent**)							
	78	0.185	0.074	40.3	0.388	0.191	49.2
	*65	0.175	0.009	5.0	0.381	0.019	4.9
* Labs Eliminated - 9, 24, 40, 47, 125, 1956, 2360, 2463, 2491, 3059, 3504, 3930, 4131							
Zinc Oxide (**percent**)							
	43	0.026	0.006	22.5	0.046	0.008	18.0
	*39	0.026	0.002	8.5	0.047	0.003	6.9
* Labs Eliminated - 101, 413, 2360, 4051							

CCRL PROFICIENCY SAMPLE PROGRAM

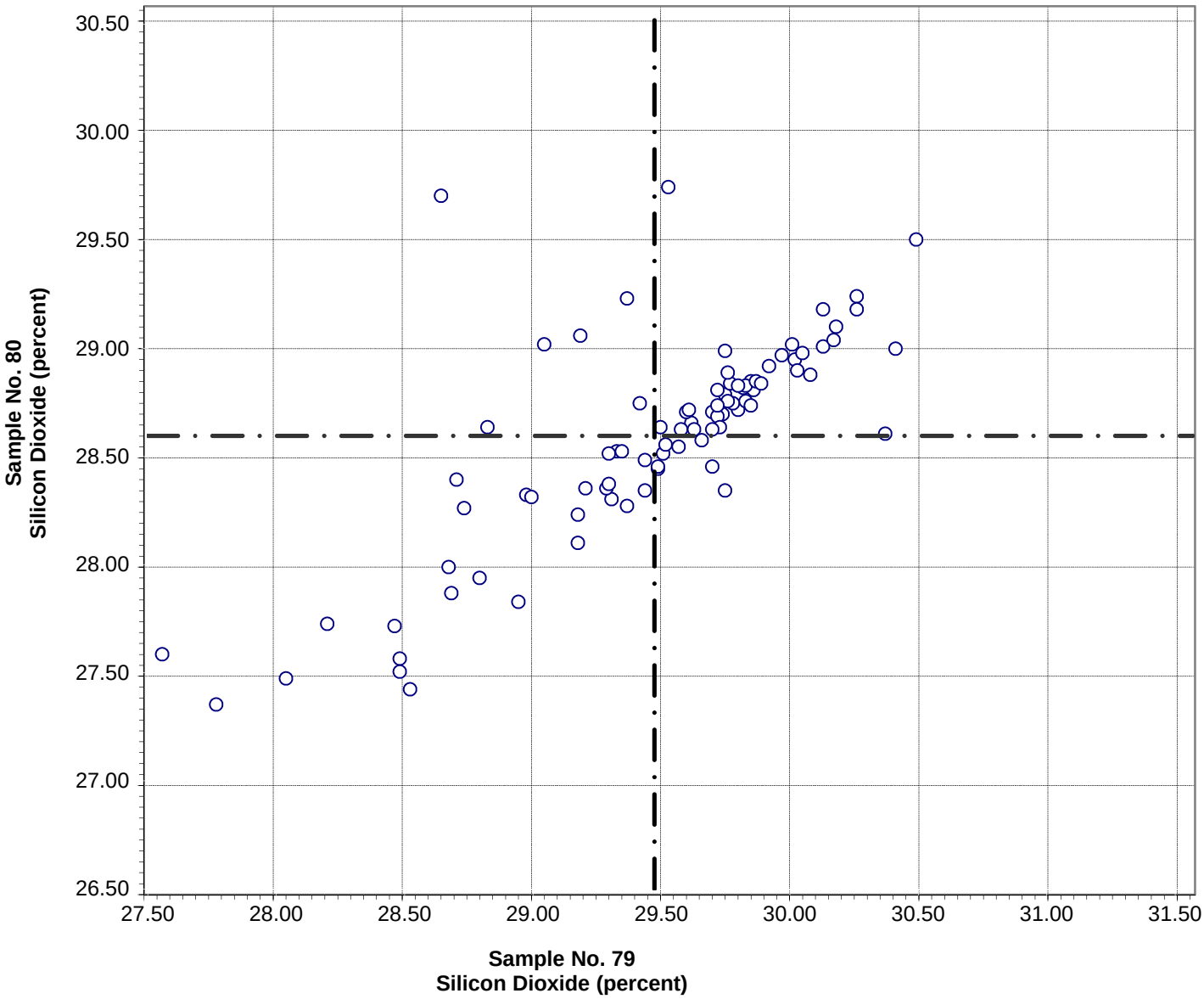
Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Chemical Analysis Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Manganic Oxide (**percent**)							
	61	0.061	0.020	33.4	0.185	0.049	26.6
	*53	0.063	0.006	10.0	0.196	0.012	6.3
* Labs Eliminated - 47, 413, 2360, 2491, 3409, 3504, 4051, 4131							
Chloride (**percent**)							
	43	0.020	0.011	52	0.013	0.007	51
No Labs Eliminated for This Test							
Insoluble Residue (**percent**)							
	84	20.38	3.99	20	15.30	3.13	20
	*78	21.28	1.67	8	15.81	1.61	10
* Labs Eliminated - 35, 504, 691, 698, 2360, 3059							
Chromium Oxide (**percent**)							
	40	0.020	0.004	22	0.023	0.047	204
	*37	0.020	0.004	19	0.012	0.003	23
* Labs Eliminated - 47, 1956, 4051							

CCRL Proficiency Sample Program
Silicon Dioxide
BLENDED CEMENT Samples No. 79 and No. 80

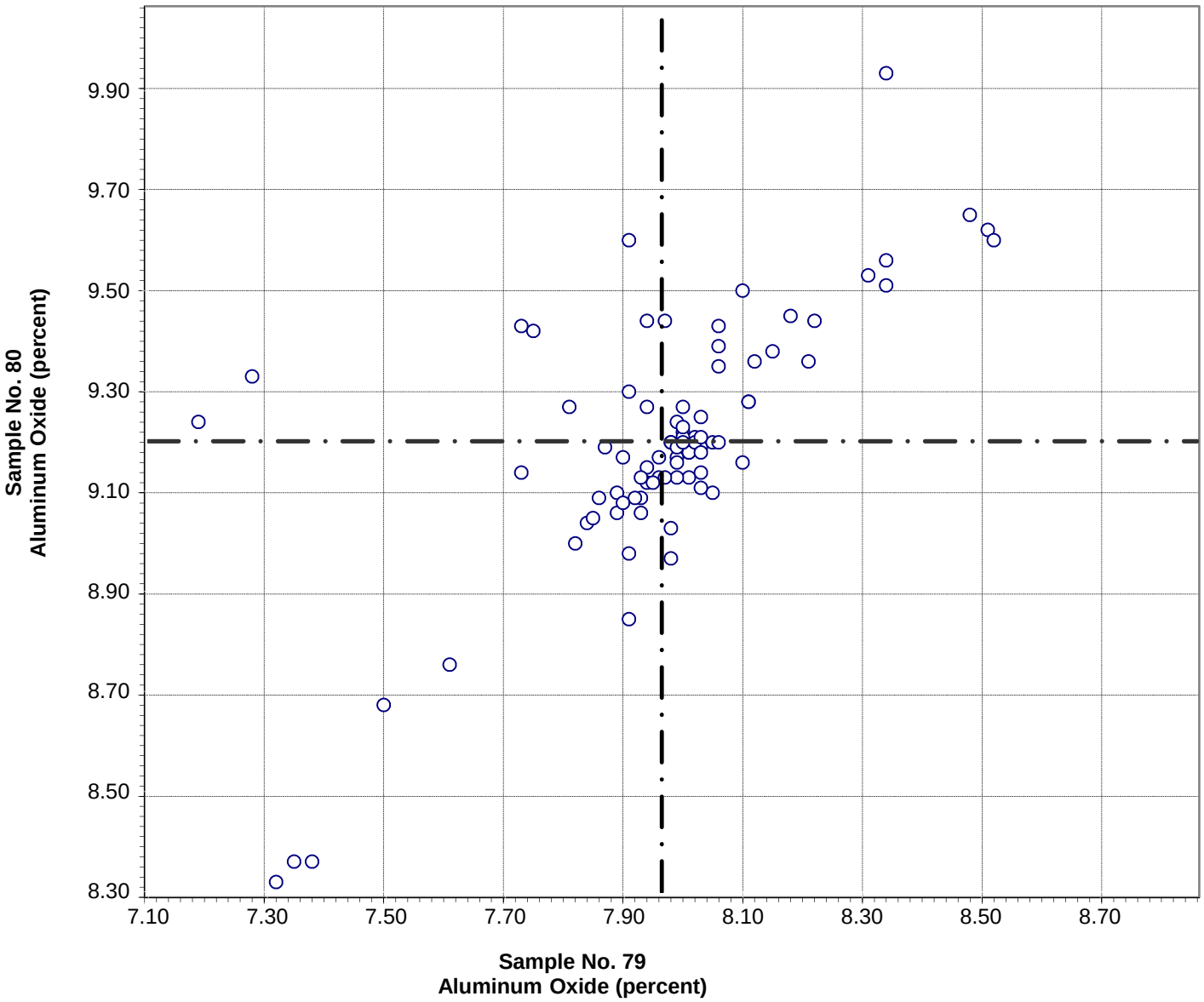


Test No. 10 Silicon Dioxide 88 Points

Sample No. 79	Ave	29.47	S.D.	0.58	C.V. 2.0
Sample No. 80	Ave	28.60	S.D.	0.48	C.V. 1.7

Labs Eliminated: 1, 42, 284, 413, 504, 2352, 2491, 3431

CCRL Proficiency Sample Program
Aluminum Oxide
BLENDED CEMENT Samples No. 79 and No. 80



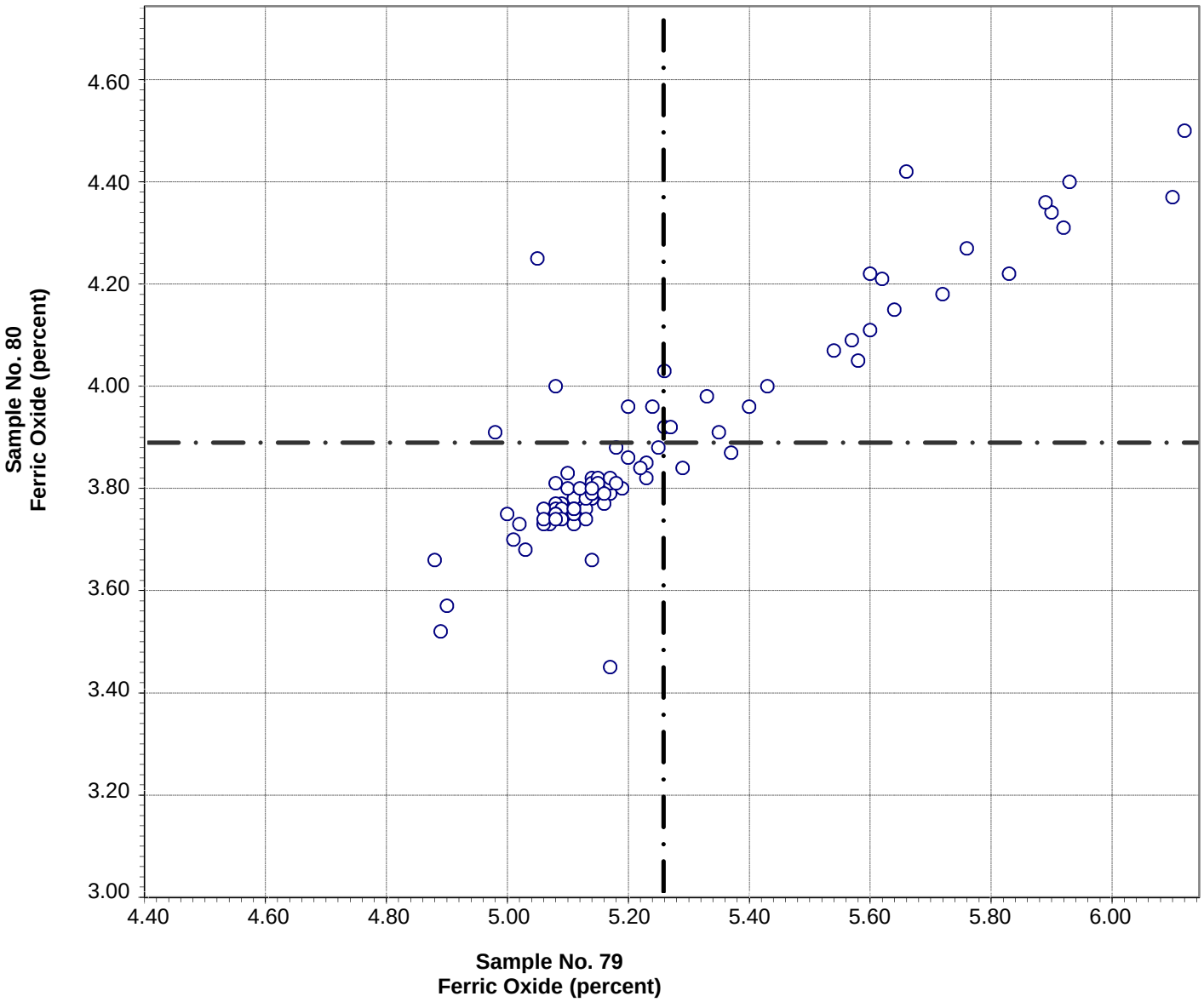
Test No. 21 Aluminum Oxide 87 Points

Sample No. 79	Ave	7.96	S.D.	0.25	C.V. 3.2
Sample No. 80	Ave	9.20	S.D.	0.28	C.V. 3.1

Labs Eliminated: 47, 690, 2360, 2491, 3431

Labs off Diagram: 110, 3504

CCRL Proficiency Sample Program
Ferric Oxide
BLENDED CEMENT Samples No. 79 and No. 80

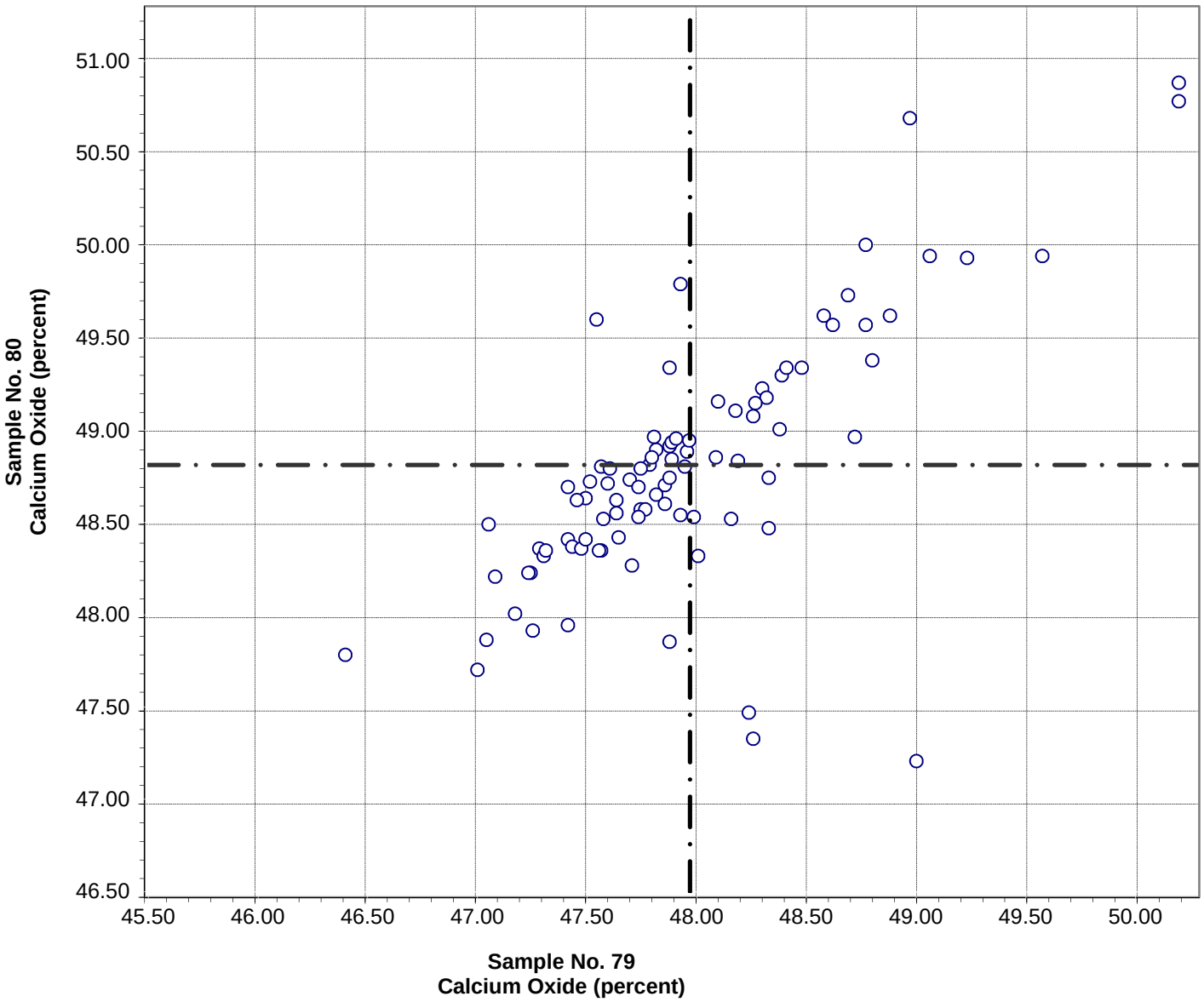


Test No. 30 Ferric Oxide 91 Points

Sample No. 79	Ave	5.26	S.D.	0.27	C.V. 5.2
Sample No. 80	Ave	3.89	S.D.	0.21	C.V. 5.4

Labs Eliminated: 42, 1956, 2360, 3431

CCRL Proficiency Sample Program
Calcium Oxide
BLENDED CEMENT Samples No. 79 and No. 80

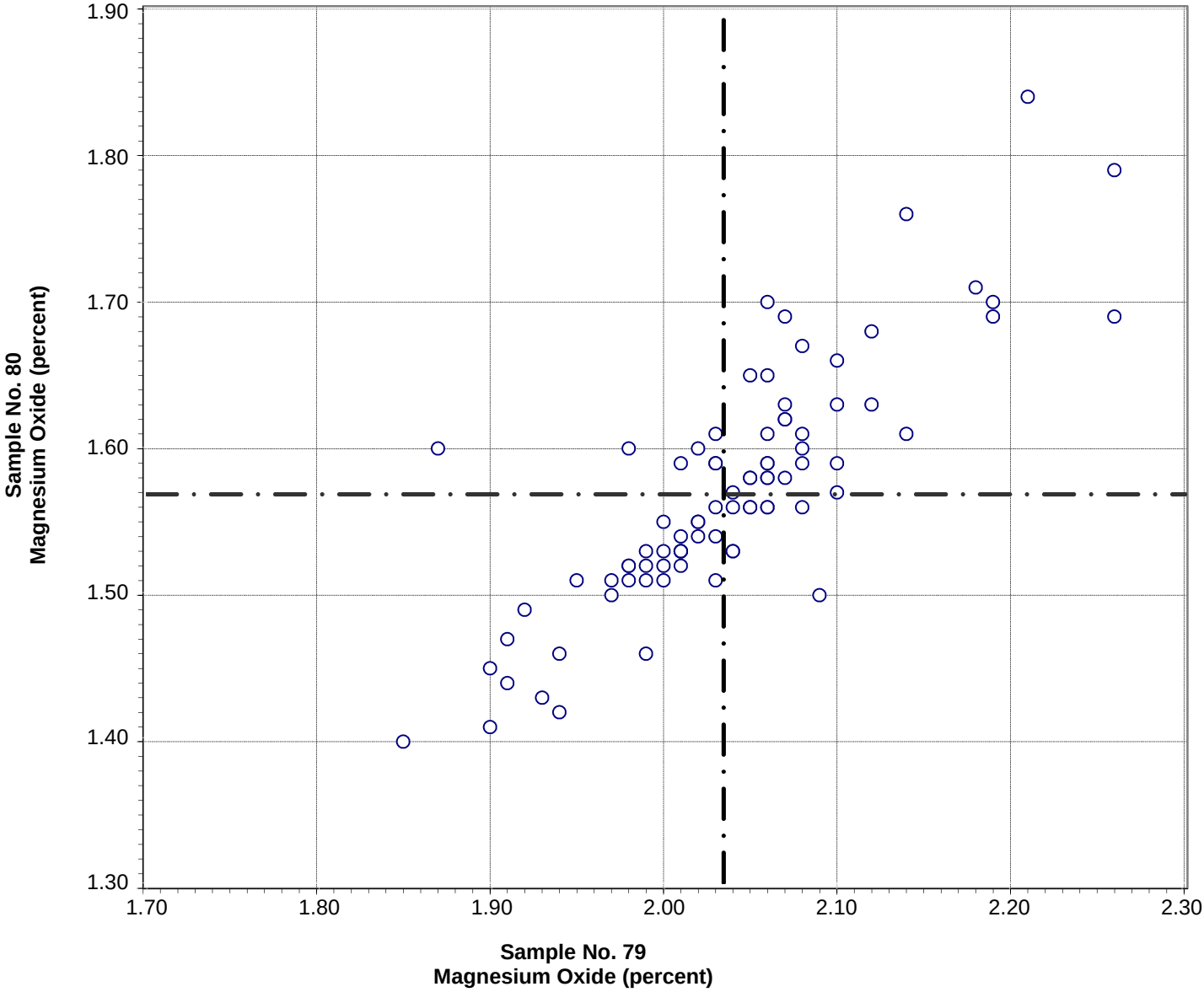


Test No. 40 Calcium Oxide 91 Points

Sample No. 79	Ave	47.97	S.D.	0.64	C.V. 1.34
Sample No. 80	Ave	48.81	S.D.	0.67	C.V. 1.38

Labs Eliminated: 354, 413, 504, 690

CCRL Proficiency Sample Program
Magnesium Oxide
BLENDED CEMENT Samples No. 79 and No. 80



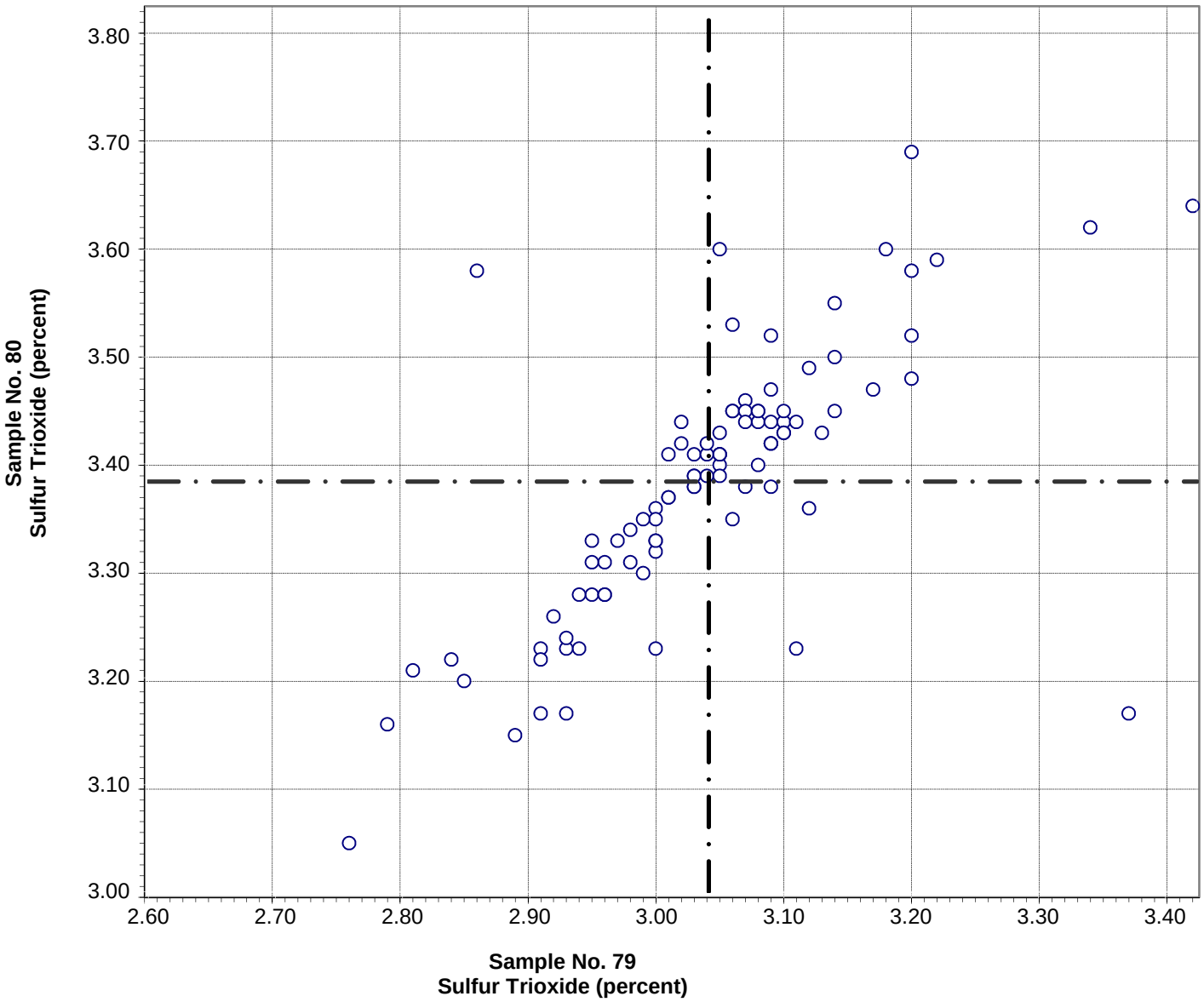
Test No. 50 Magnesium Oxide 85 Points

Sample No. 79	Ave	2.03	S.D.	0.08	C.V. 4.0
Sample No. 80	Ave	1.57	S.D.	0.09	C.V. 5.5

Labs Eliminated: 14, 23, 36, 42, 125, 158, 413, 440, 2360, 2491, 3504

Labs off Diagram: 1715

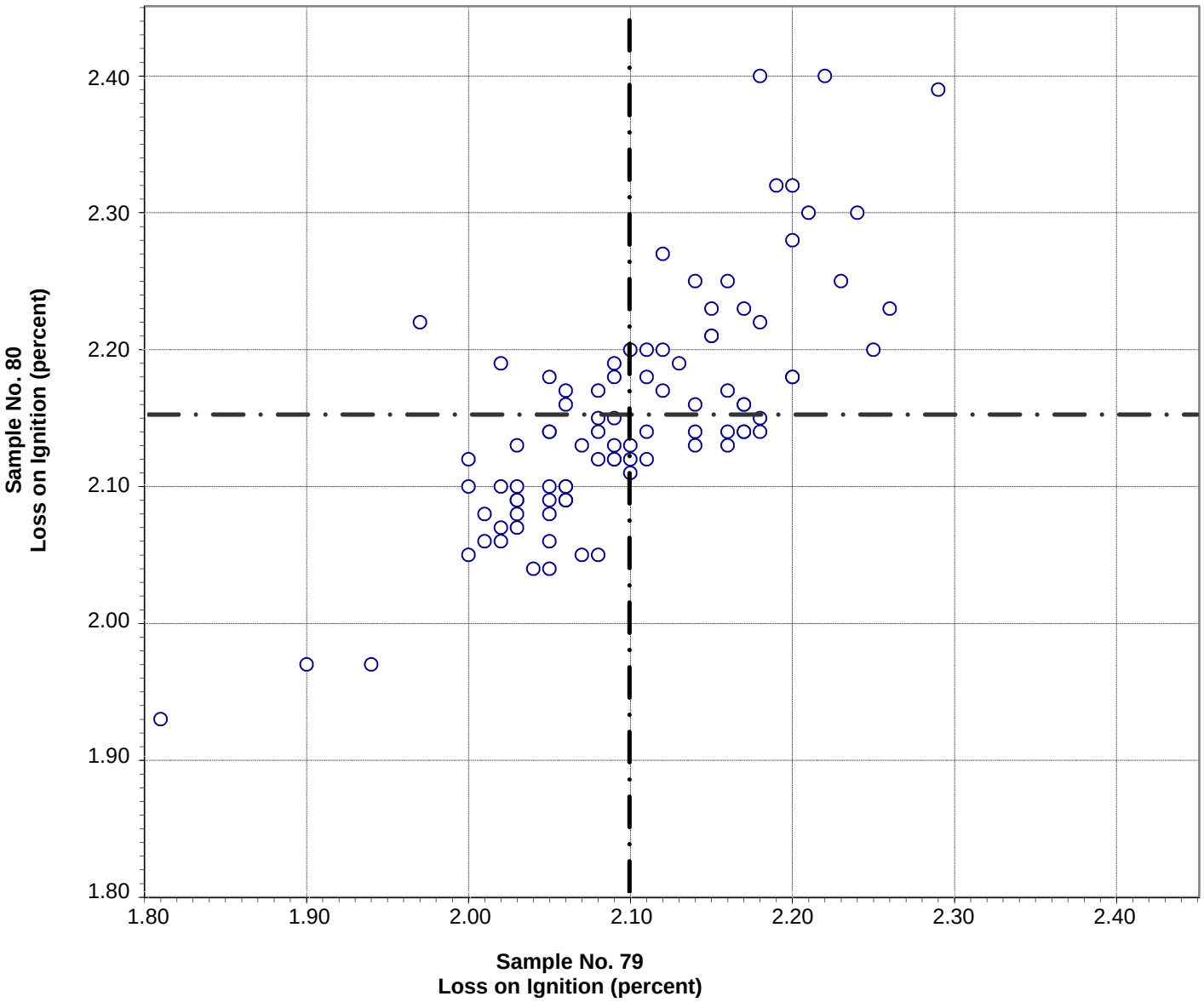
CCRL Proficiency Sample Program
Sulfur Trioxide
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 60 Sulfur Trioxide 94 Points

Sample No. 79	Ave	3.04	S.D.	0.11	C.V.	3.6
Sample No. 80	Ave	3.38	S.D.	0.12	C.V.	3.6

CCRL Proficiency Sample Program
Loss on Ignition
BLENDED CEMENT Samples No. 79 and No. 80

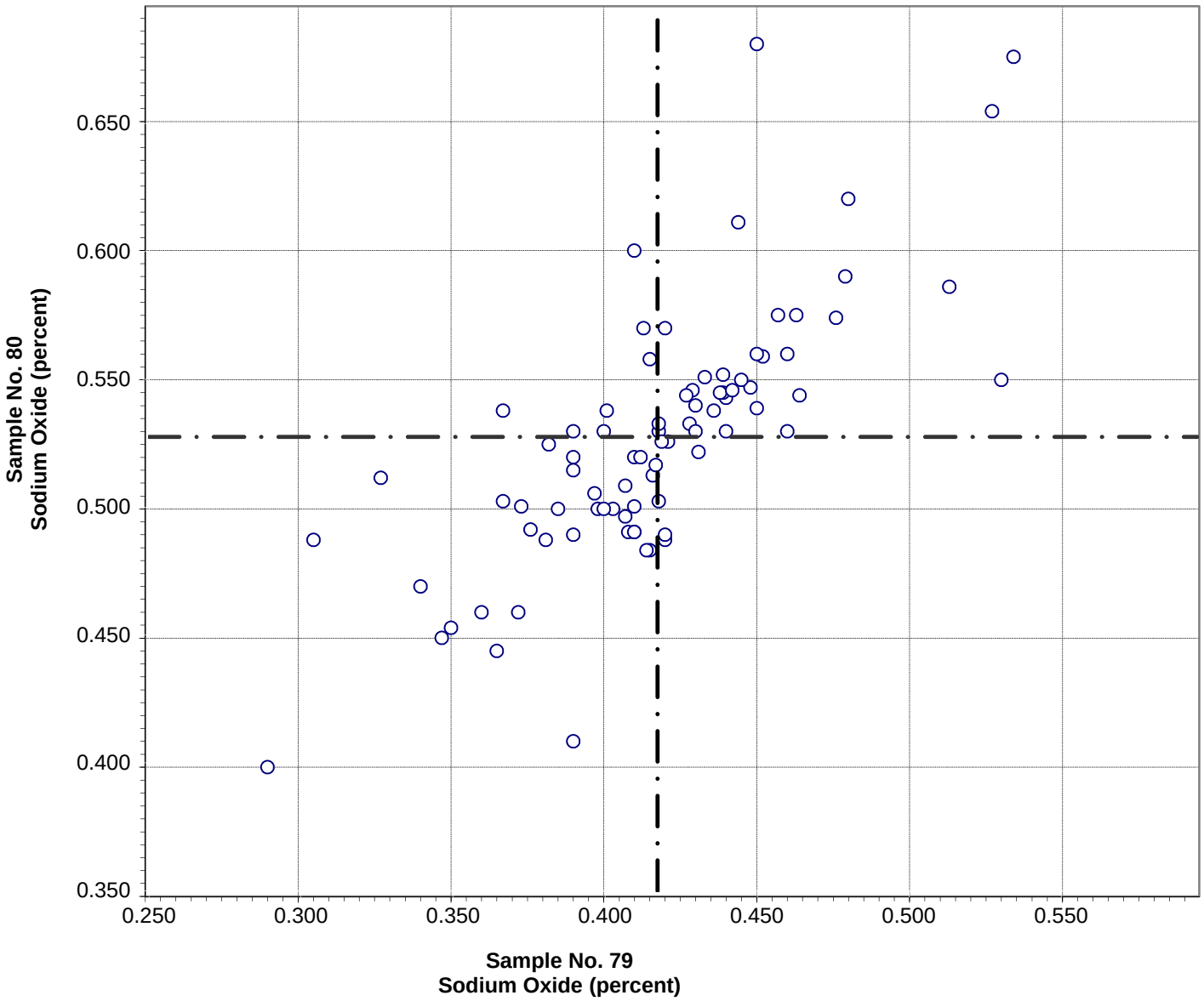


Test No. 70 Loss on Ignition 92 Points

Sample No. 79	Ave	2.10	S.D.	0.08	C.V. 4
Sample No. 80	Ave	2.15	S.D.	0.09	C.V. 4

Labs Eliminated: 42, 43, 124, 209, 3504, 3930

CCRL Proficiency Sample Program
Sodium Oxide
BLENDED CEMENT Samples No. 79 and No. 80

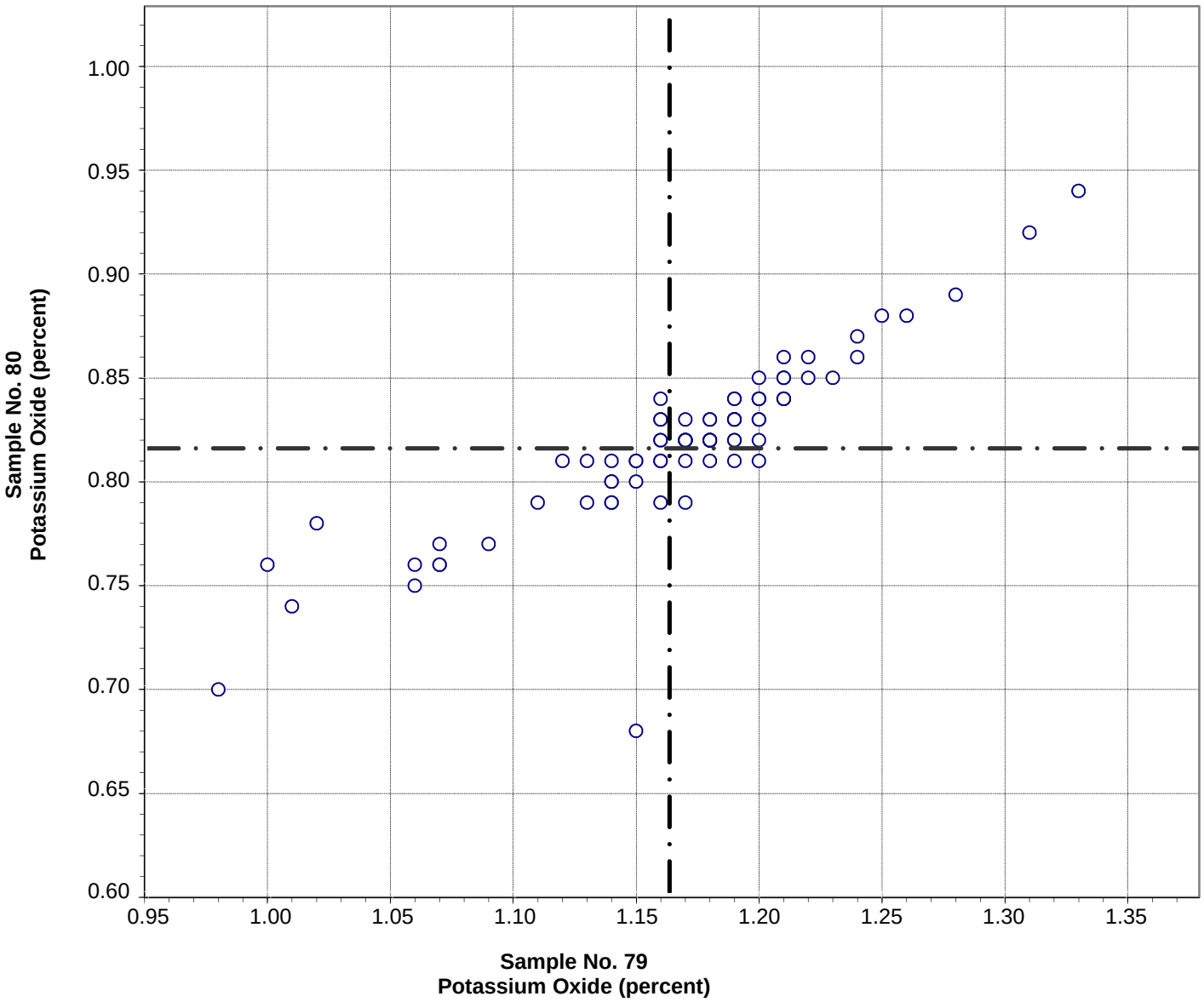


Test No. 90 Sodium Oxide 83 Points

Sample No. 79	Ave	0.417	S.D.	0.044	C.V. 11
Sample No. 80	Ave	0.527	S.D.	0.049	C.V. 9

Labs Eliminated: 47, 284, 504, 2352, 2360, 2463, 2491

CCRL Proficiency Sample Program
Potassium Oxide
BLENDED CEMENT Samples No. 79 and No. 80



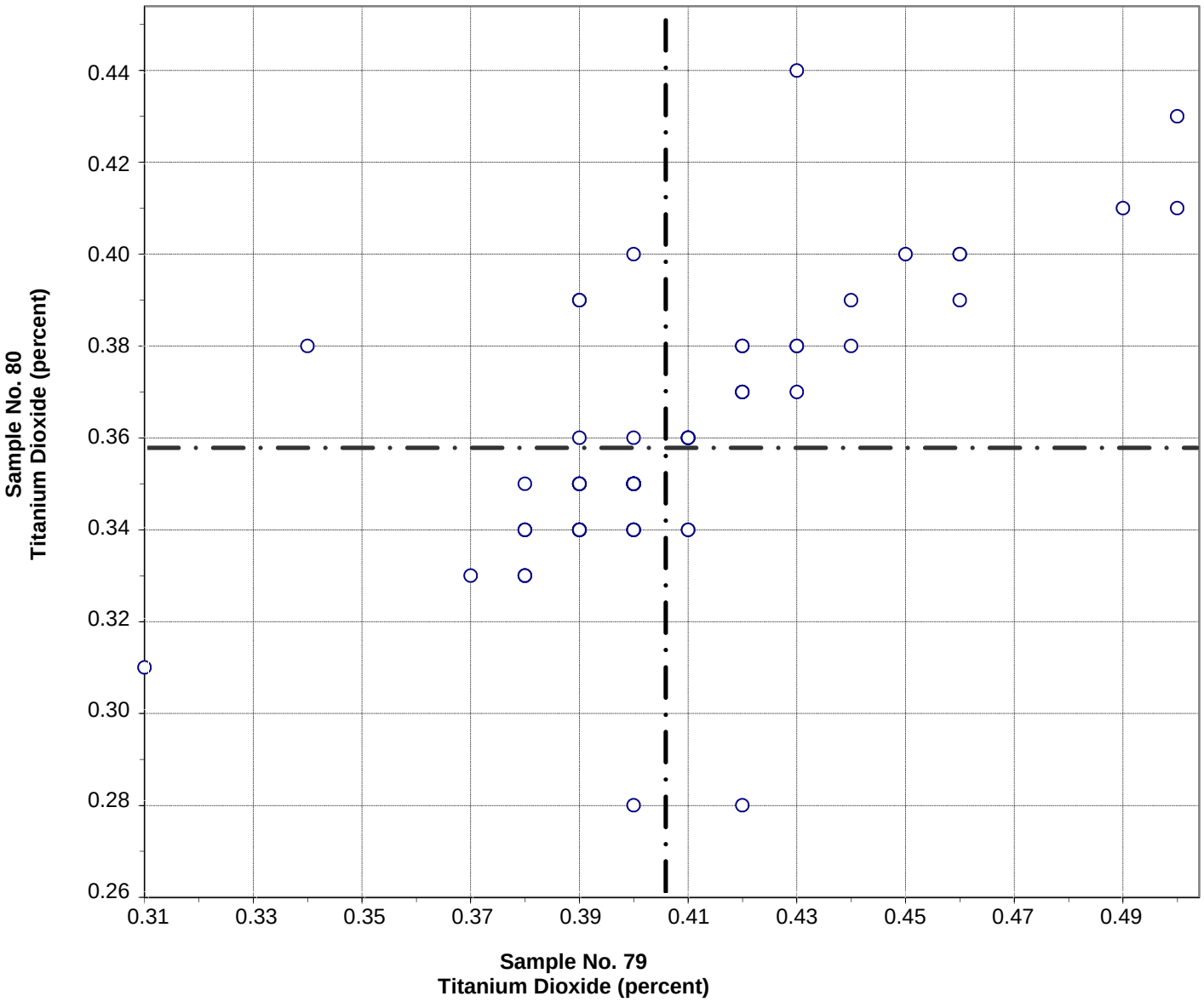
Test No. 100 Potassium Oxide 84 Points

Sample No. 79	Ave	1.16	S.D.	0.07	C.V. 5.9
Sample No. 80	Ave	0.82	S.D.	0.04	C.V. 5.3

Labs Eliminated: 1, 169, 354, 2360, 2491, 3409, 3504

Labs off Diagram: 694, 3503

CCRL Proficiency Sample Program
Titanium Dioxide
BLENDED CEMENT Samples No. 79 and No. 80

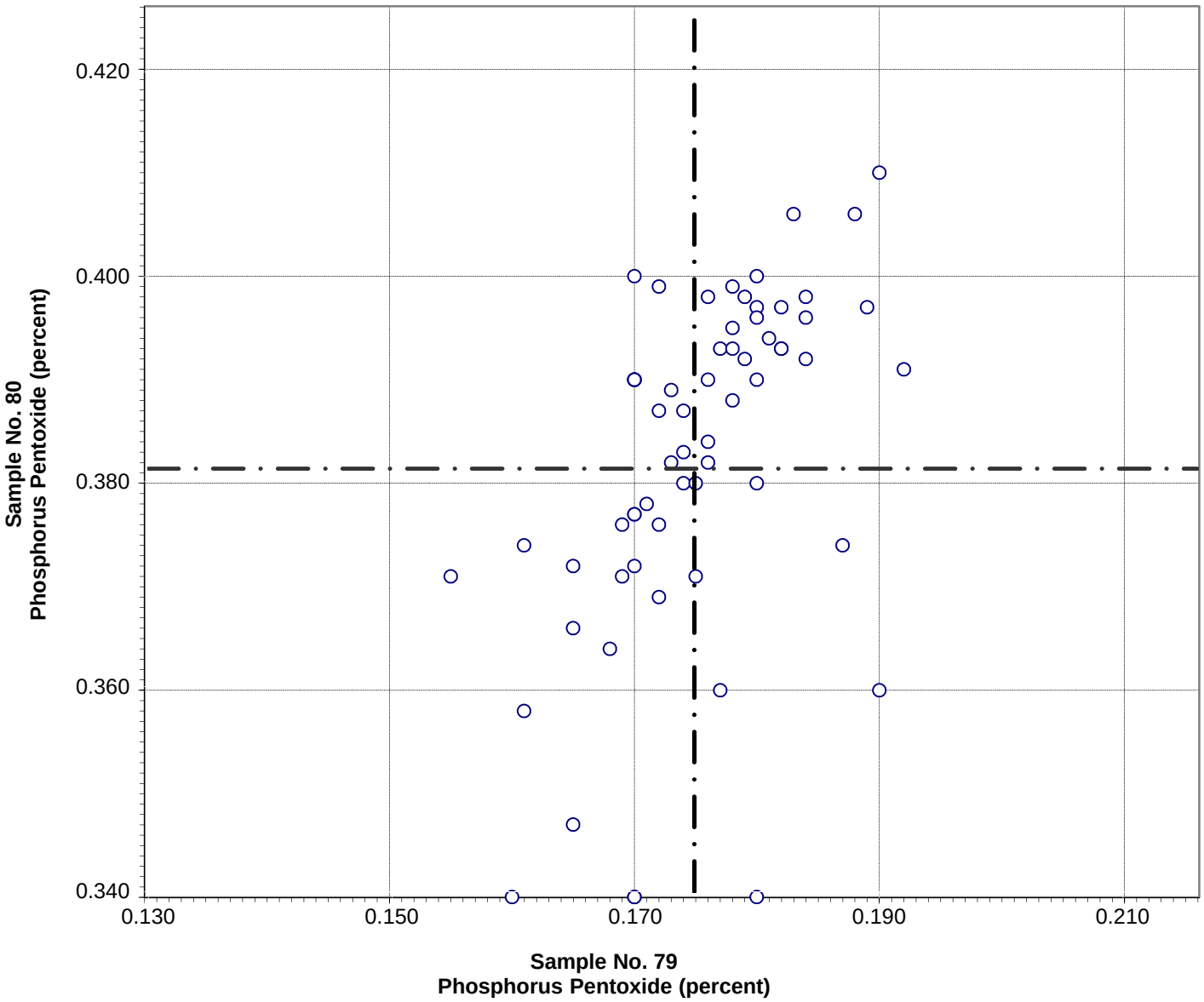


Test No. 103 Titanium Dioxide 70 Points

Sample No. 79	Ave	0.41	S.D.	0.031	C.V. 7.6
Sample No. 80	Ave	0.36	S.D.	0.029	C.V. 8.0

Labs Eliminated: 125, 2292, 2491, 3409, 3503, 3930

CCRL Proficiency Sample Program
Phosphorus Pentoxide
BLENDED CEMENT Samples No. 79 and No. 80



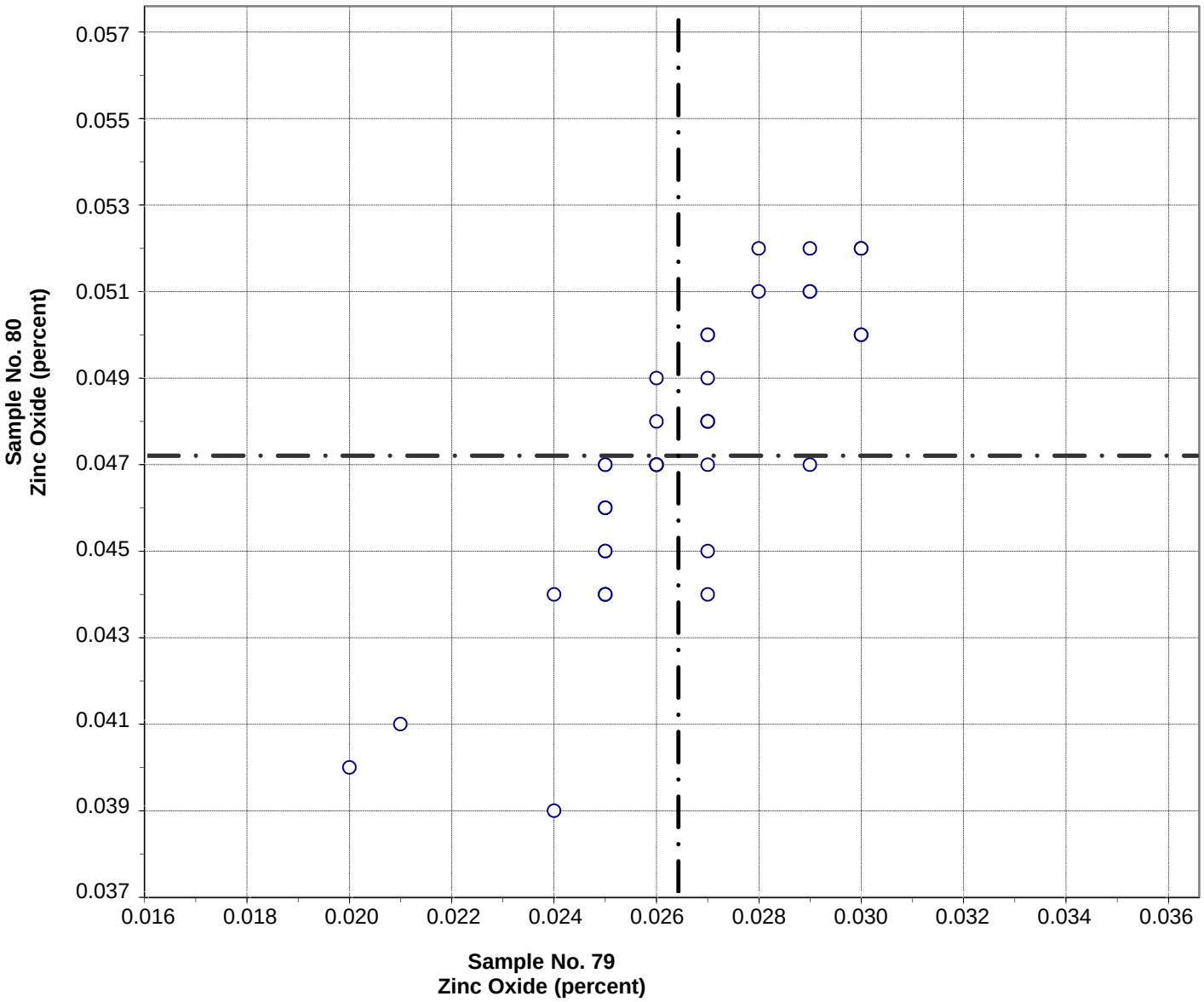
Test No. 102 Phosphorus Pentoxide 64 Points

Sample No. 79	Ave	0.175	S.D.	0.009	C.V. 5.0
Sample No. 80	Ave	0.381	S.D.	0.019	C.V. 4.9

Labs Eliminated: 9, 24, 40, 47, 125, 1956, 2360, 2463, 2491, 3059, 3504, 3930, 4131

Labs off Diagram: 10

CCRL Proficiency Sample Program
Zinc Oxide
BLENDED CEMENT Samples No. 79 and No. 80

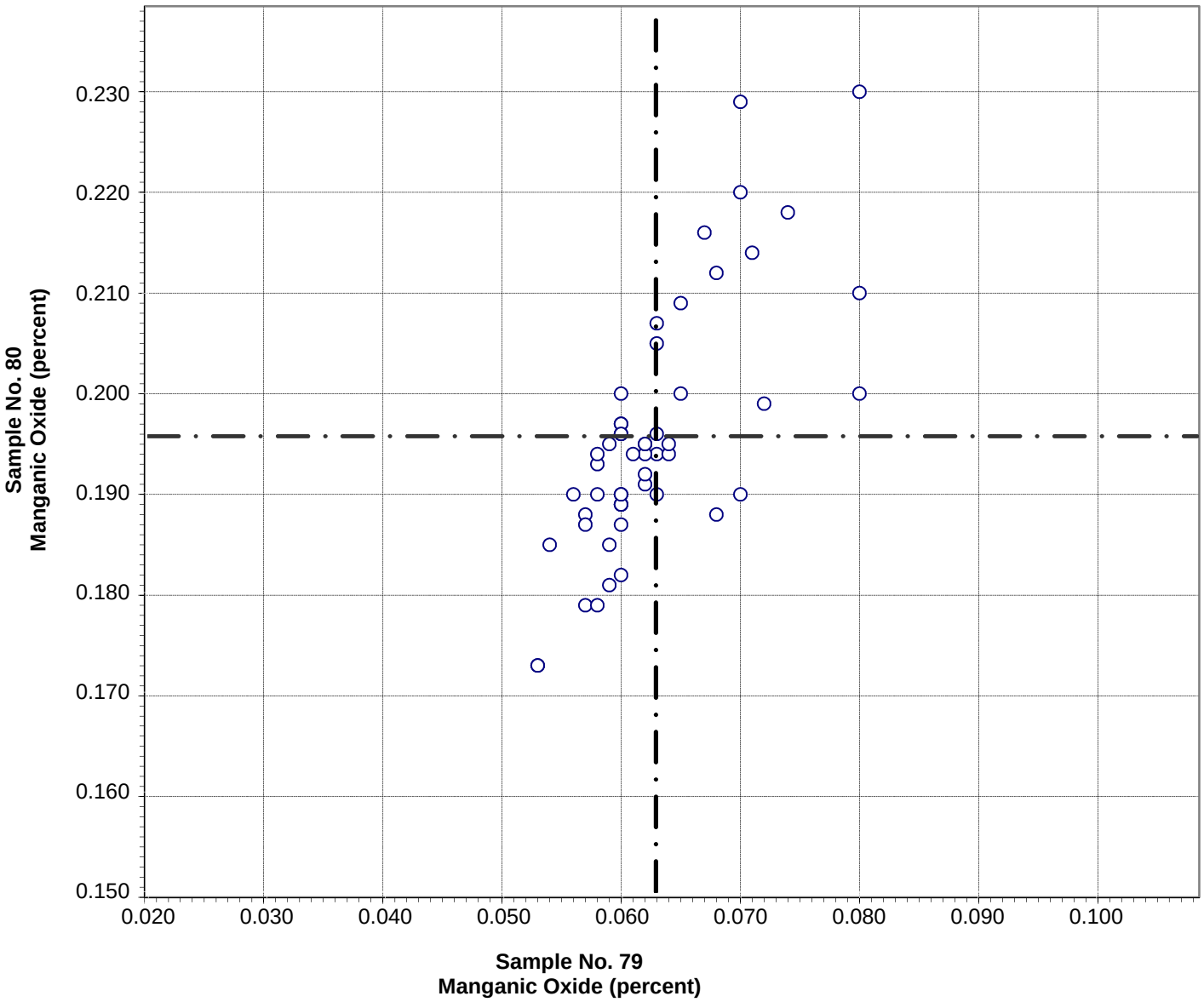


Test No. 99 Zinc Oxide 39 Points

Sample No. 79	Ave	0.026	S.D.	0.002	C.V. 8.5
Sample No. 80	Ave	0.047	S.D.	0.003	C.V. 6.9

Labs Eliminated: 101, 413, 2360, 4051

CCRL Proficiency Sample Program
Manganic Oxide
BLENDED CEMENT Samples No. 79 and No. 80

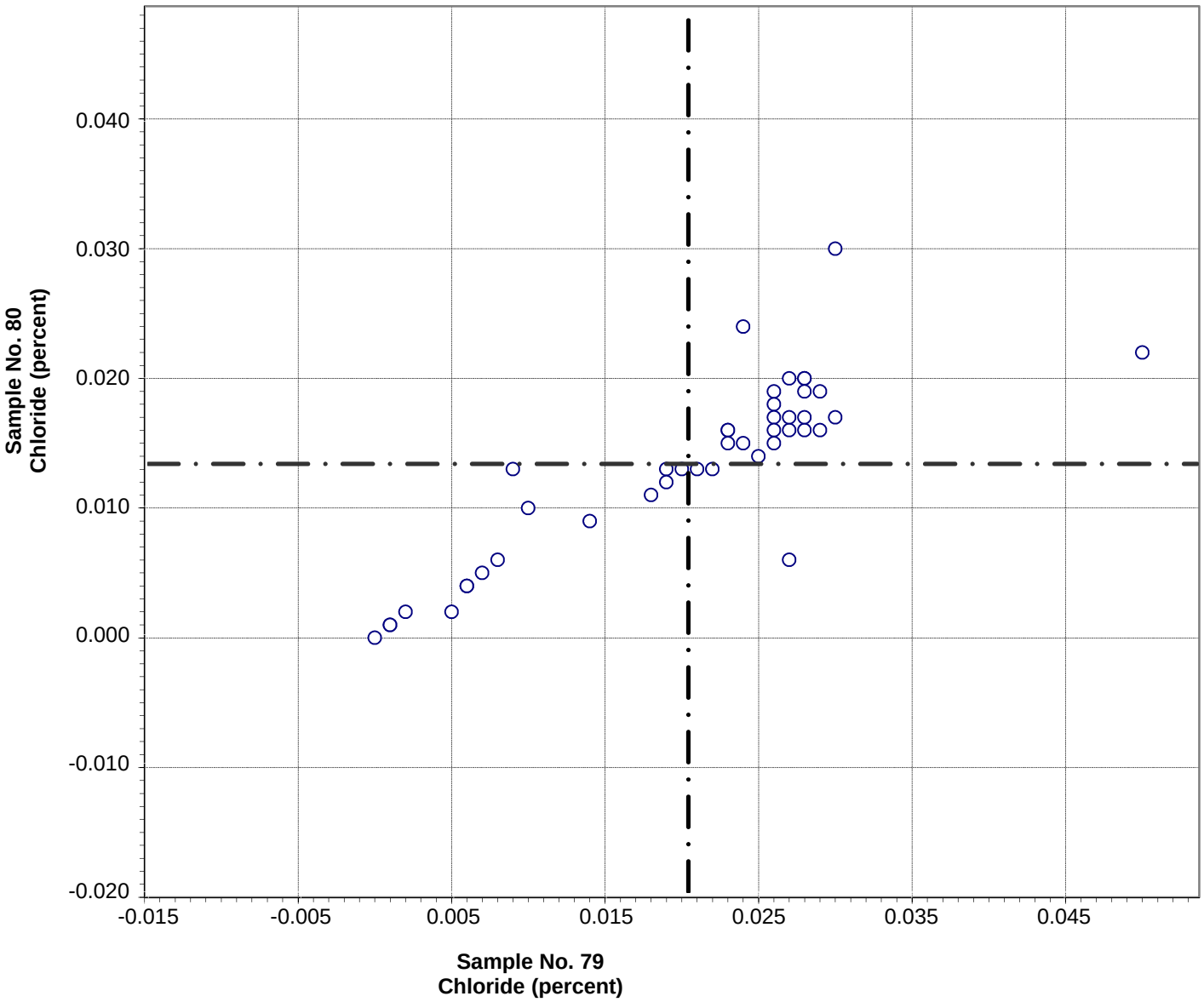


Test No. 101 Manganic Oxide 53 Points

Sample No. 79	Ave	0.063	S.D.	0.006	C.V. 10.0
Sample No. 80	Ave	0.196	S.D.	0.012	C.V. 6.3

Labs Eliminated: 47, 413, 2360, 2491, 3409, 3504, 4051, 4131

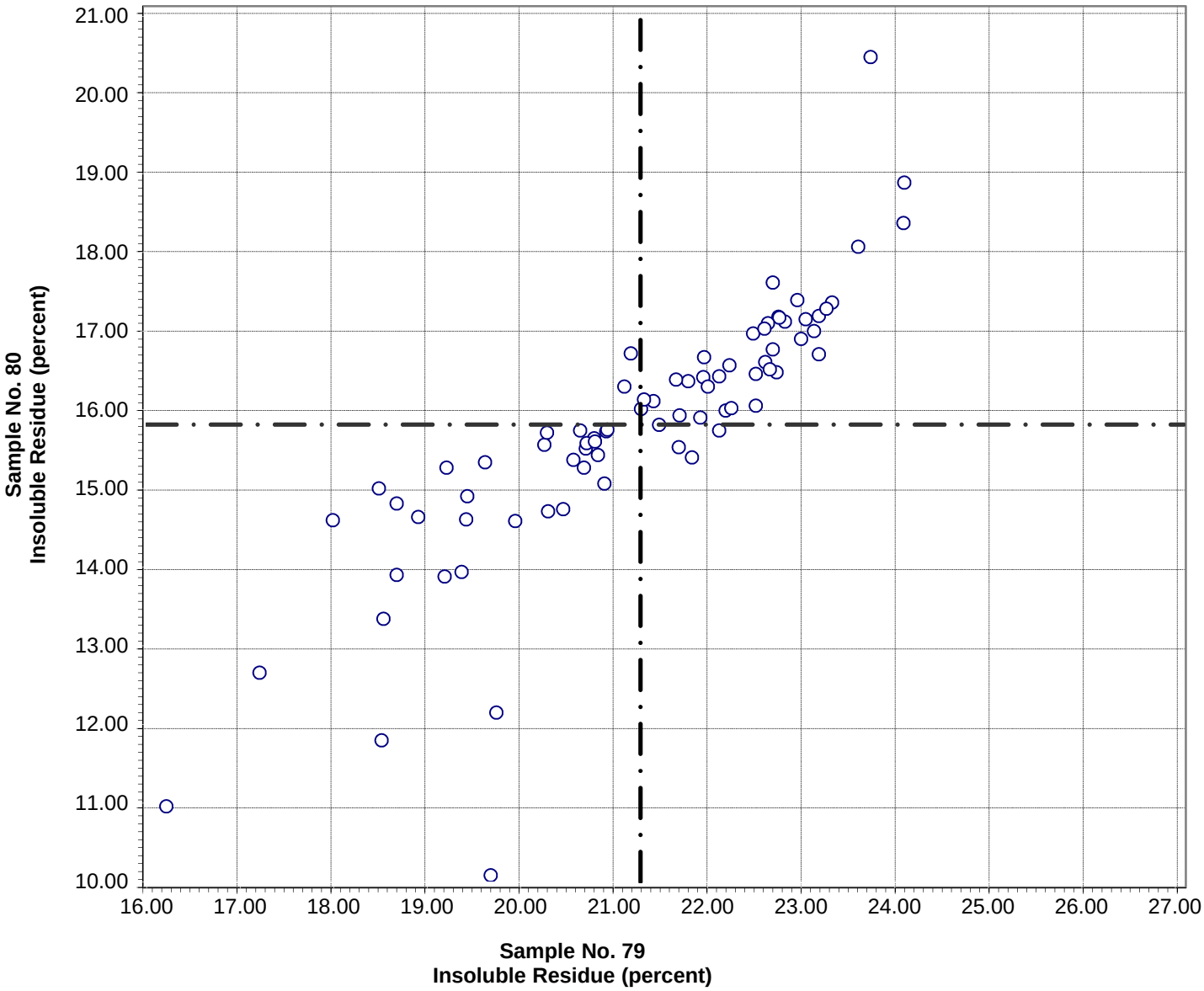
CCRL Proficiency Sample Program
Chloride
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 104 Chloride 43 Points

Sample No. 79	Ave	0.020	S.D.	0.011	C.V.	52
Sample No. 80	Ave	0.013	S.D.	0.007	C.V.	51

CCRL Proficiency Sample Program
Insoluble Residue
BLENDED CEMENT Samples No. 79 and No. 80

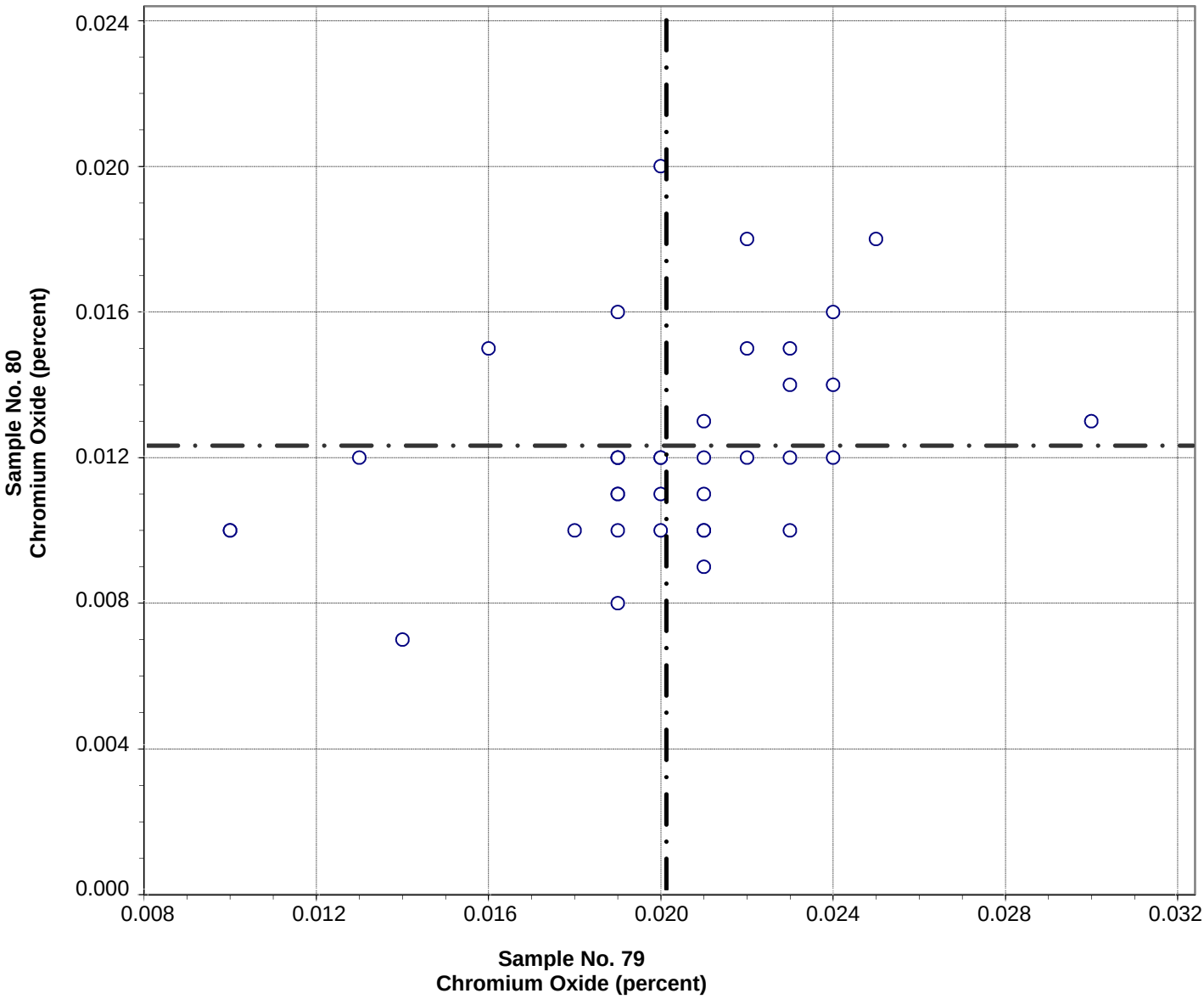


Test No. 80 Insoluble Residue 78 Points

Sample No. 79	Ave	21.28	S.D.	1.67	C.V. 8
Sample No. 80	Ave	15.81	S.D.	1.61	C.V. 10

Labs Eliminated: 35, 504, 691, 698, 2360, 3059

CCRL Proficiency Sample Program
Chromium Oxide
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 105 Chromium Oxide 37 Points

Sample No. 79	Ave	0.020	S.D.	0.004	C.V. 19
Sample No. 80	Ave	0.012	S.D.	0.003	C.V. 23

Labs Eliminated: 47, 1956, 4051

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Physical Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Normal Consistency - % Water (**percent**)							
	106	26.4	2.6	9.9	25.8	2.5	9.8
	*103	26.6	0.5	1.7	26.0	0.4	1.4
* Labs Eliminated - 124, 3504, 3913							
Vicat Time of Set - Initial (**min**)							
	105	143	20	14.2	134	22	16.7
	*98	139	13	9.3	129	11	8.8
* Labs Eliminated - 7, 14, 51, 52, 124, 209, 690							
Vicat Time of Set - Final (**min**)							
	99	257	42	17	250	37	15
	*98	254	37	15	250	37	15
* Labs Eliminated - 3							
Autoclave Expansion (**percent**)							
	95	-0.04	0.03	78	-0.07	0.05	71
	*92	-0.04	0.02	62	-0.06	0.04	60
* Labs Eliminated - 19, 38, 497							
Air Content % (**percent**)							
	91	8.9	1.2	14	7.4	1.0	14
	*90	8.9	1.2	14	7.4	1.0	13
* Labs Eliminated - 2116							
Air Content - % Water (**percent**)							
	89	62.3	9.3	14.9	64.5	9.6	14.9
	*85	63.7	2.6	4.0	66.0	2.3	3.5
* Labs Eliminated - 354, 1251, 4098, 4131							
Air Content - Flow (**percent**)							
	90	90	3.3	3.6	87	3.6	4.1
No Labs Eliminated for This Test							

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Physical Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Specific Gravity							
	93	2.94	0.10	3.5	2.92	0.10	3.4
	*91	2.95	0.04	1.5	2.92	0.04	1.5
* Labs Eliminated - 38, 474							
Compressive Strength - 3 day (psi)							
	107	3947	330	8.4	3726	290	7.8
	*105	3954	308	7.8	3727	260	7.0
* Labs Eliminated - 33, 3912							
Compressive Strength - 7 day (psi)							
	107	4710	329	7.0	4549	326	7.2
	*106	4721	310	6.6	4564	290	6.4
* Labs Eliminated - 33							
Compressive Strength - 28 day (psi)							
	101	6399	527	8.2	6340	456	7.2
	*100	6416	501	7.8	6360	408	6.4
* Labs Eliminated - 33							
Compressive Strength - % Water (percent)							
	102	43.6	9.0	20.5	44.6	9.1	20.5
	*97	45.5	1.4	3.2	46.5	1.3	2.9
* Labs Eliminated - 124, 354, 958, 2463, 3930							
Compressive Strength - Flow (percent)							
	103	112	4.7	4.2	111	6.1	5.5
	*95	111	2.6	2.4	110	2.8	2.6
* Labs Eliminated - 3, 38, 43, 47, 246, 958, 3413, 3910							
Fineness - Air Permeability (m^2/kg)							
	103	499	51	10.2	478	53	11.1
	*102	503	34	6.8	481	38	7.9
* Labs Eliminated - 110							

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 79 and No. 80

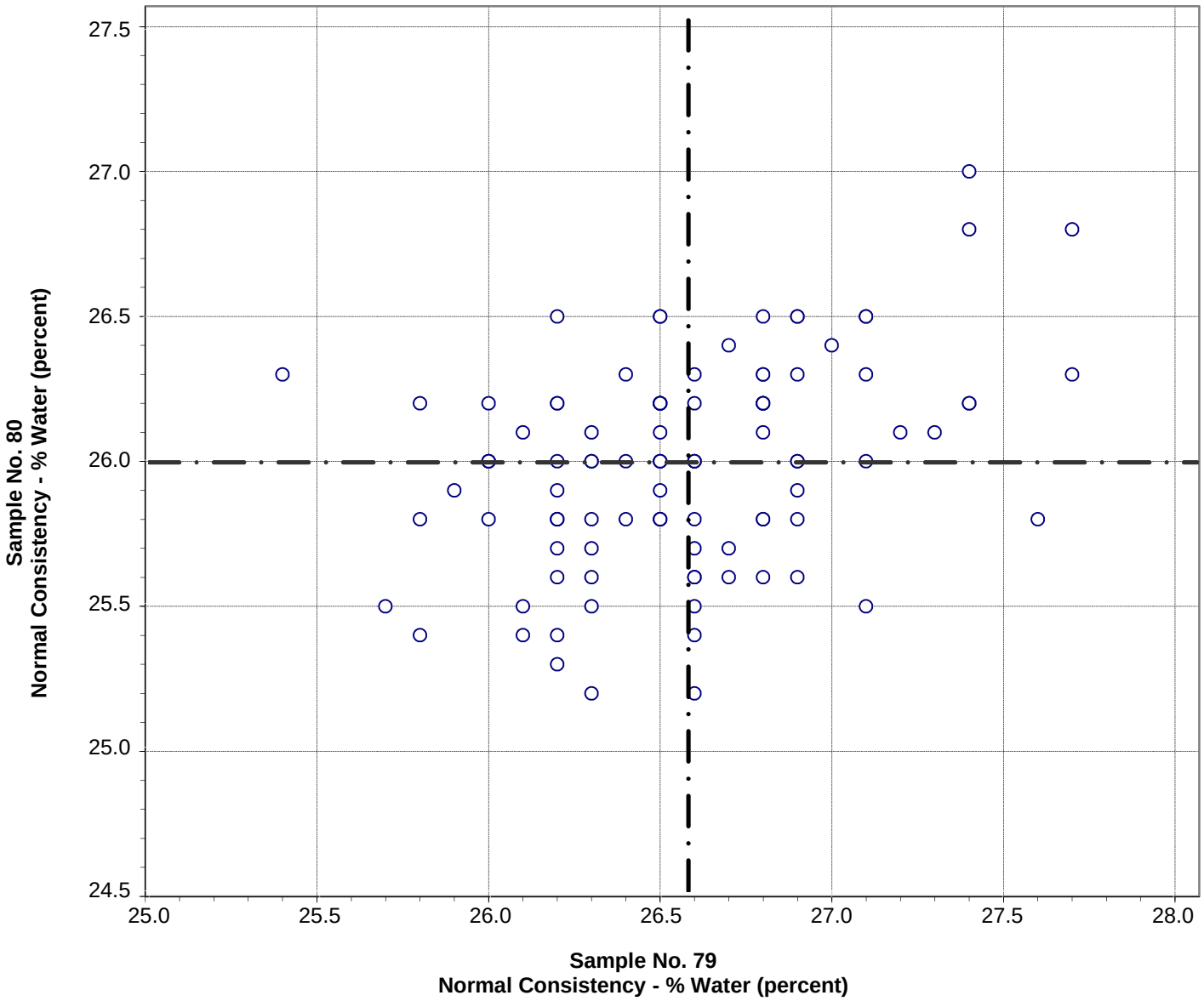
Final Report – Physical Results
April 25, 2017

SUMMARY OF RESULTS

		Sample No.79			Sample No. 80		
Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Fineness - 45µm % Passing (**percent**)							
	104	99.65	0.40	0.40	97.44	0.66	0.67
	*93	99.74	0.15	0.15	97.46	0.42	0.44

* Labs Eliminated - 22, 35, 38, 246, 413, 474, 694, 958, 975, 3930, 4051

CCRL Proficiency Sample Program
Normal Consistency - % Water
BLENDED CEMENT Samples No. 79 and No. 80



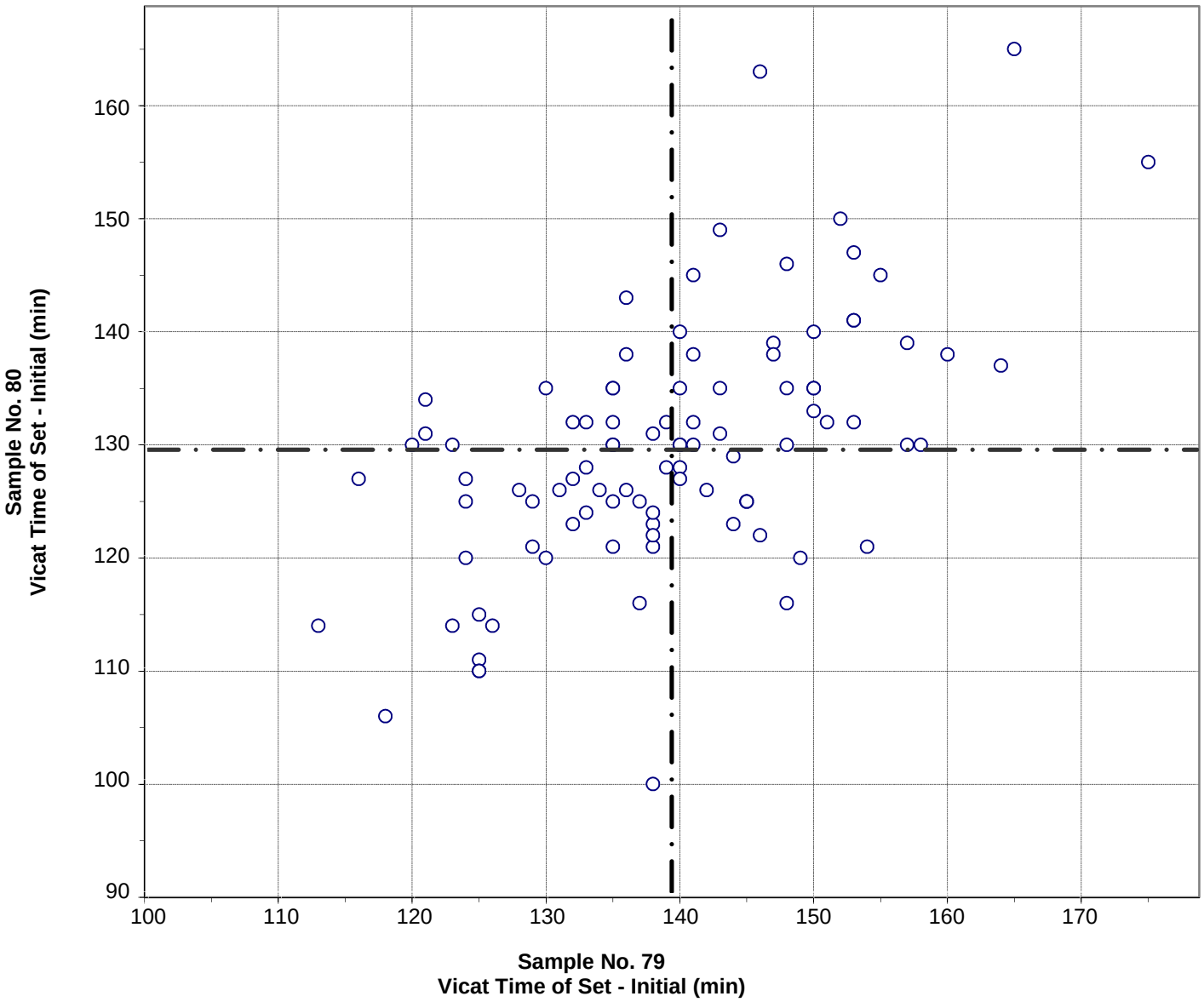
Test No. 110 Normal Consistency - % Water 102 Points

Sample No. 79	Ave	26.6	S.D.	0.5	C.V.	1.7
Sample No. 80	Ave	26.0	S.D.	0.4	C.V.	1.4

Labs Eliminated: 124, 3504, 3913

Labs off Diagram: 19

CCRL Proficiency Sample Program
Vicat Time of Set - Initial
BLENDED CEMENT Samples No. 79 and No. 80



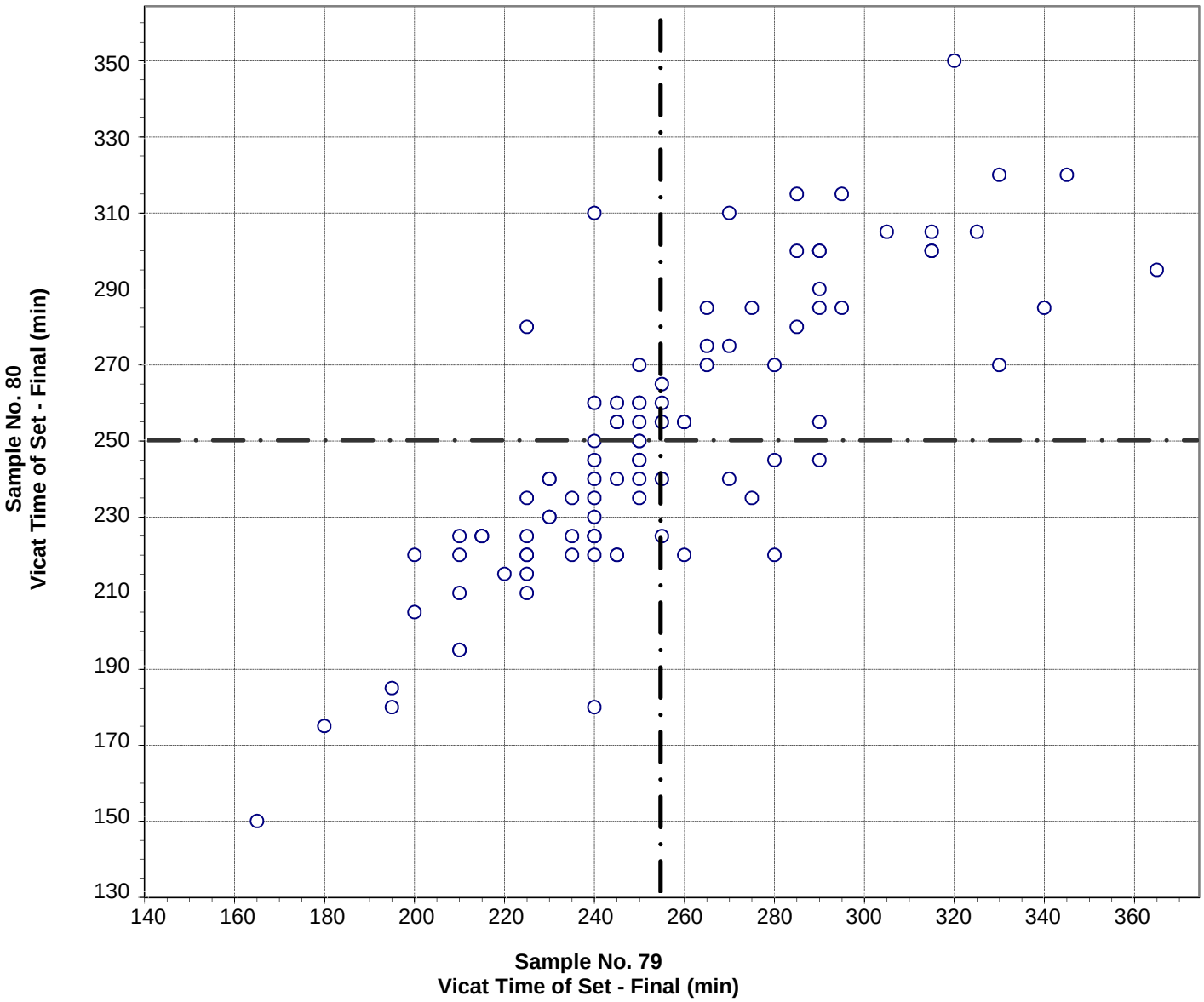
Test No. 120 Vicat Time of Set - Initial 96 Points

Sample No. 79	Ave	139	S.D.	13	C.V. 9.3
Sample No. 80	Ave	129	S.D.	11	C.V. 8.8

Labs Eliminated: 7, 14, 51, 52, 124, 209, 690

Labs off Diagram: 3, 2465

CCRL Proficiency Sample Program
Vicat Time of Set - Final
BLENDED CEMENT Samples No. 79 and No. 80

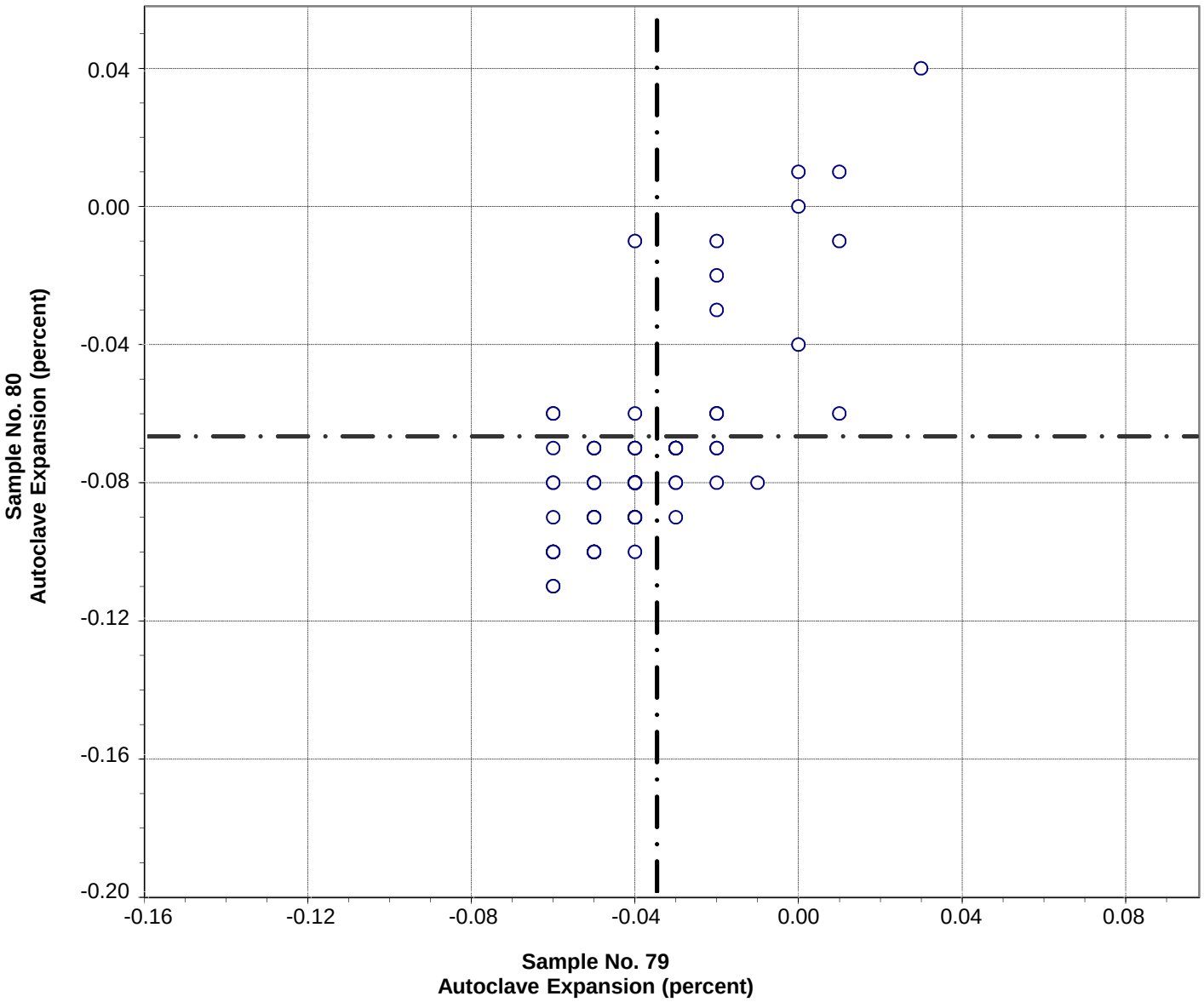


Test No. 121 Vicat Time of Set - Final 98 Points

Sample No. 79	Ave	254	S.D.	37	C.V.	15
Sample No. 80	Ave	250	S.D.	37	C.V.	15

Labs Eliminated: 3

CCRL Proficiency Sample Program
Autoclave Expansion
BLENDED CEMENT Samples No. 79 and No. 80



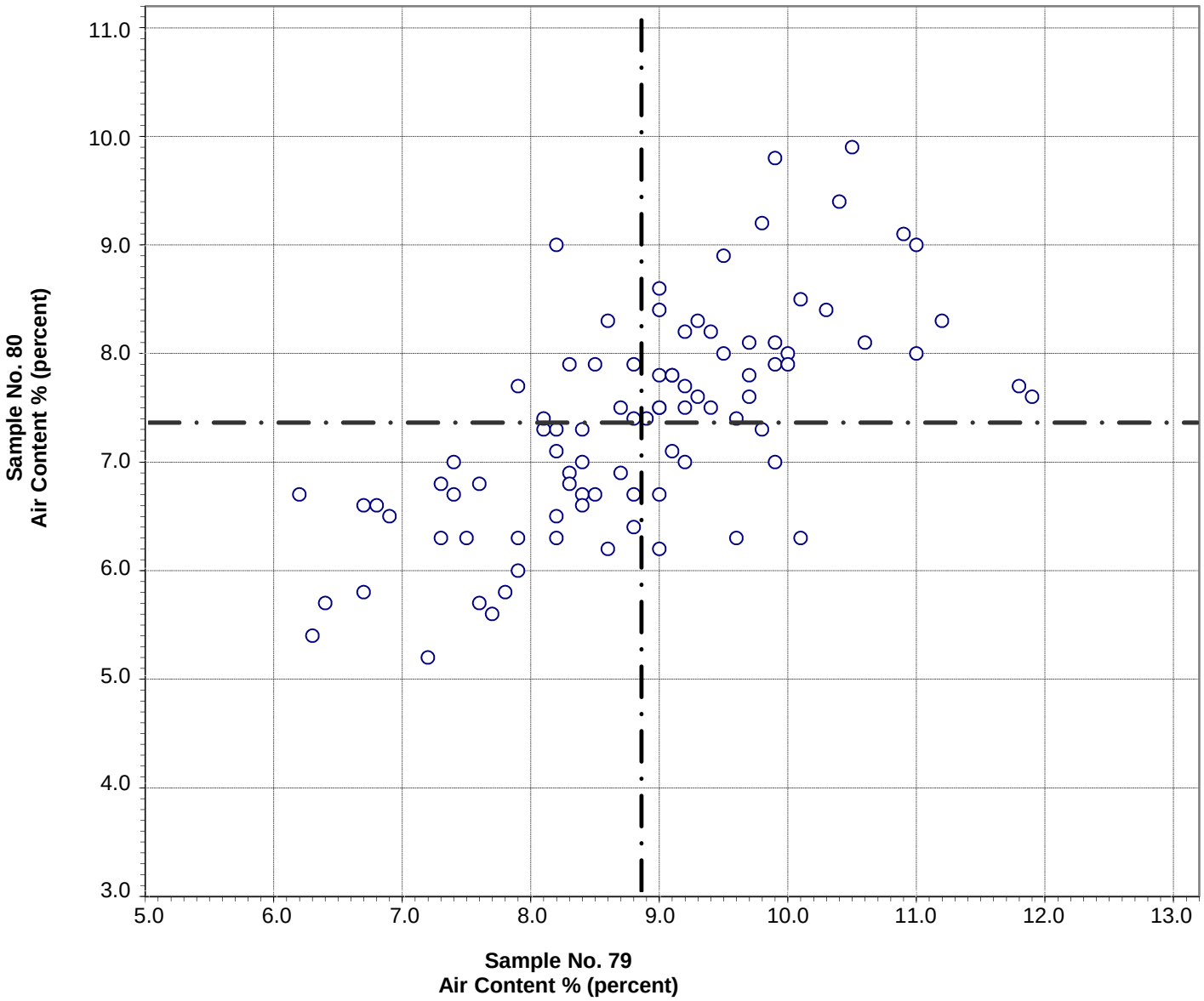
Test No. 160 Autoclave Expansion 88 Points

Sample No. 79	Ave -0.04	S.D. 0.02	C.V. 62
Sample No. 80	Ave -0.06	S.D. 0.04	C.V. 60

Labs Eliminated: 19, 38, 497

Labs off Diagram: 34, 39, 246, 1251

CCRL Proficiency Sample Program
Air Content %
BLENDED CEMENT Samples No. 79 and No. 80

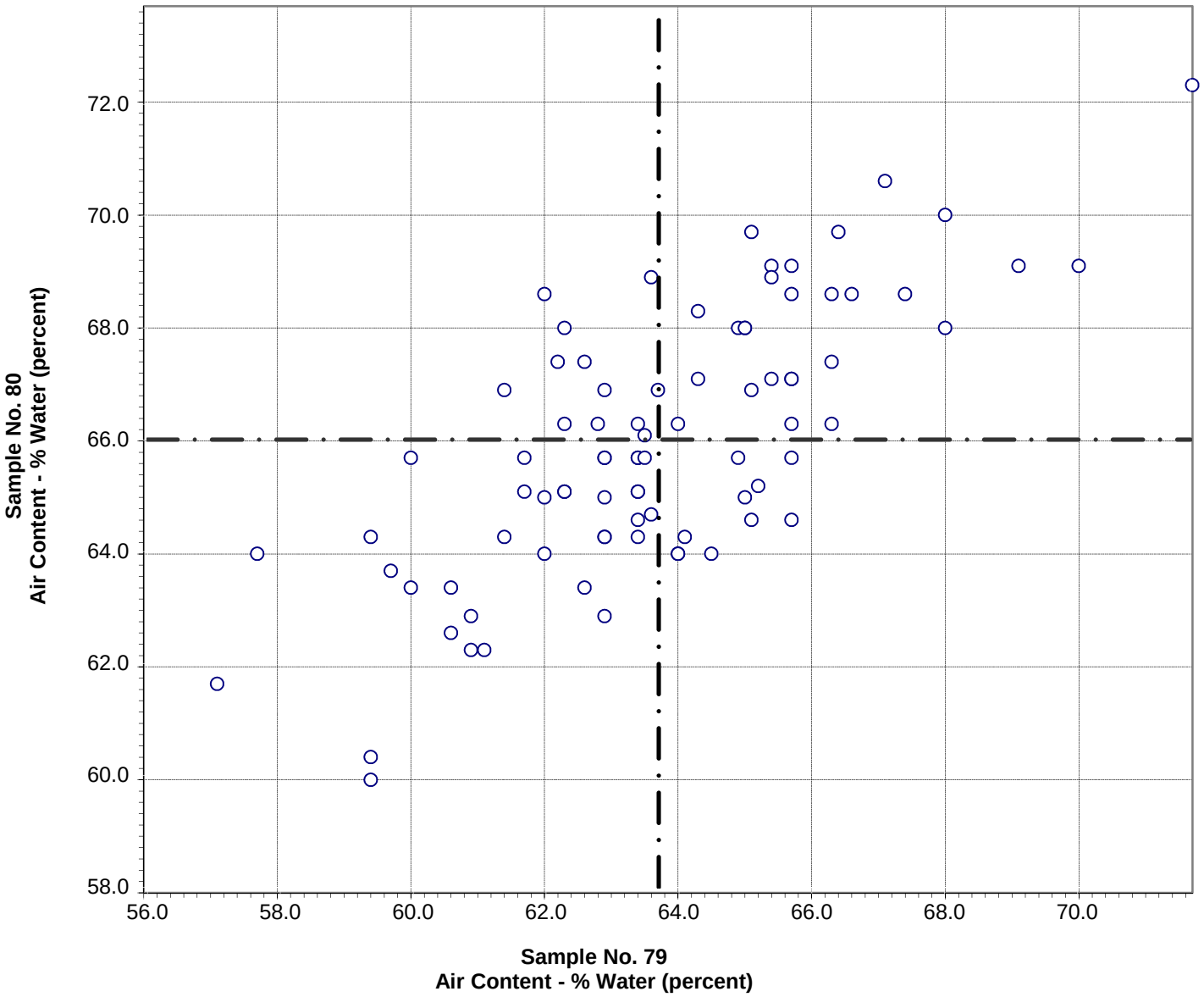


Test No. 170 Air Content % 90 Points

Sample No. 79	Ave	8.9	S.D.	1.2	C.V. 14
Sample No. 80	Ave	7.4	S.D.	1.0	C.V. 13

Labs Eliminated: 2116

CCRL Proficiency Sample Program
Air Content - % Water
BLENDED CEMENT Samples No. 79 and No. 80

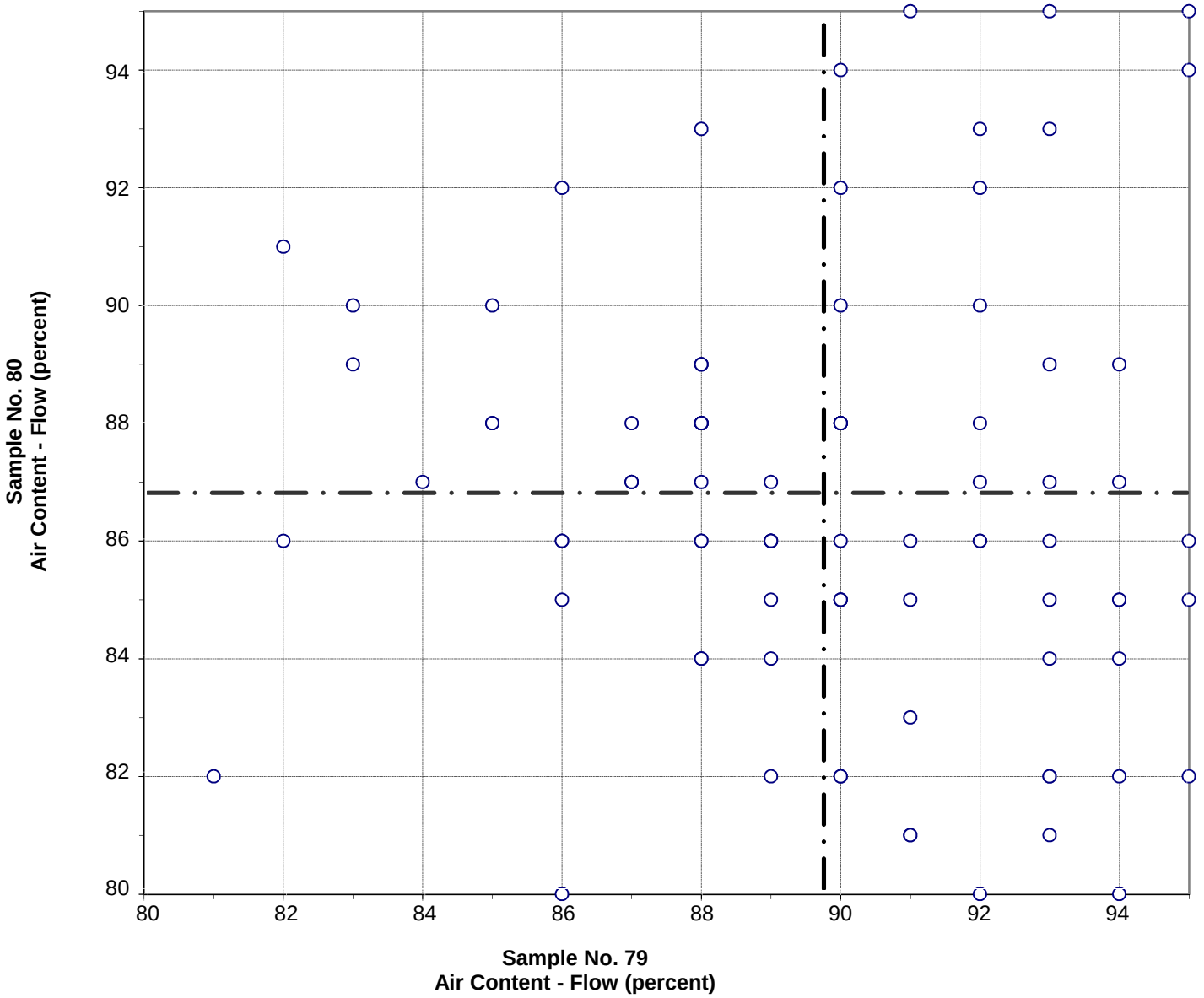


Test No. 180 Air Content - % Water 85 Points

Sample No. 79	Ave	63.7	S.D.	2.6	C.V. 4.0
Sample No. 80	Ave	66.0	S.D.	2.3	C.V. 3.5

Labs Eliminated: 354, 1251, 4098, 4131

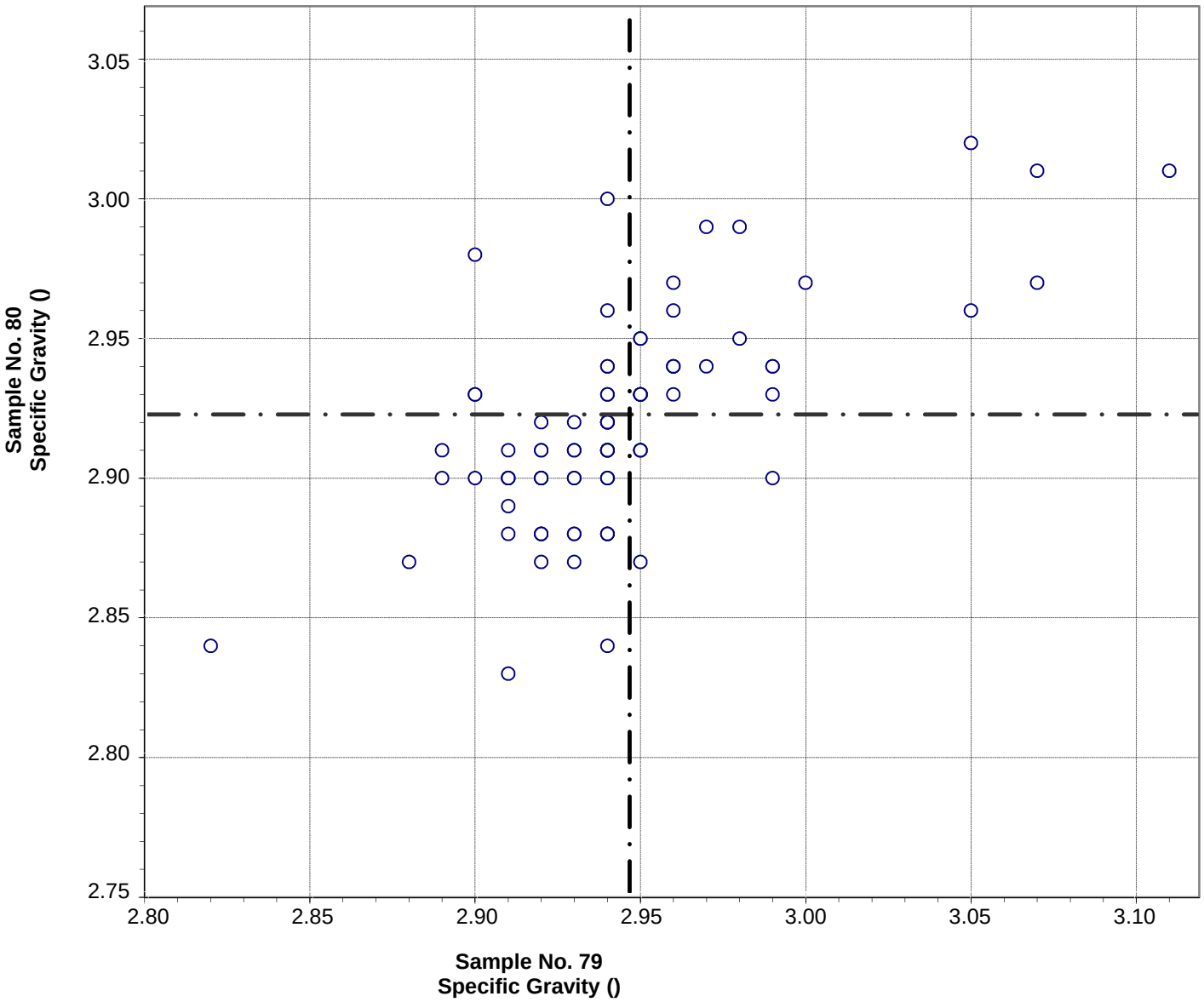
CCRL Proficiency Sample Program
Air Content - Flow
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 190 Air Content - Flow 90 Points

Sample No. 79	Ave	90	S.D.	3.3	C.V.	3.6
Sample No. 80	Ave	87	S.D.	3.6	C.V.	4.1

CCRL Proficiency Sample Program
Specific Gravity
BLENDED CEMENT Samples No. 79 and No. 80



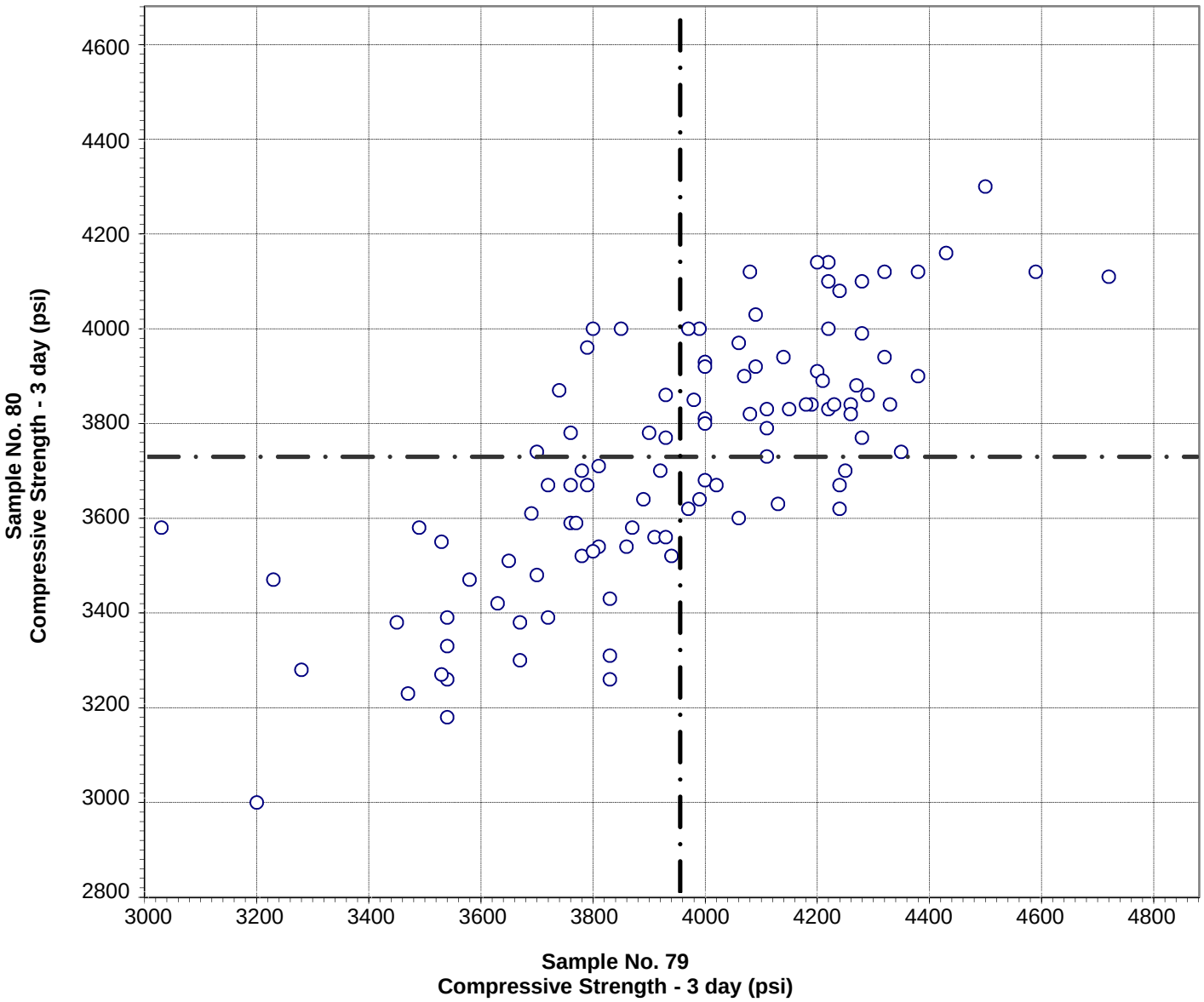
Test No. 310 Specific Gravity 89 Points

Sample No. 79	Ave	2.95	S.D.	0.04	C.V. 1.5
Sample No. 80	Ave	2.92	S.D.	0.04	C.V. 1.5

Labs Eliminated: 38, 474

Labs off Diagram: 51, 1251

CCRL Proficiency Sample Program
Compressive Strength - 3 day
BLENDED CEMENT Samples No. 79 and No. 80

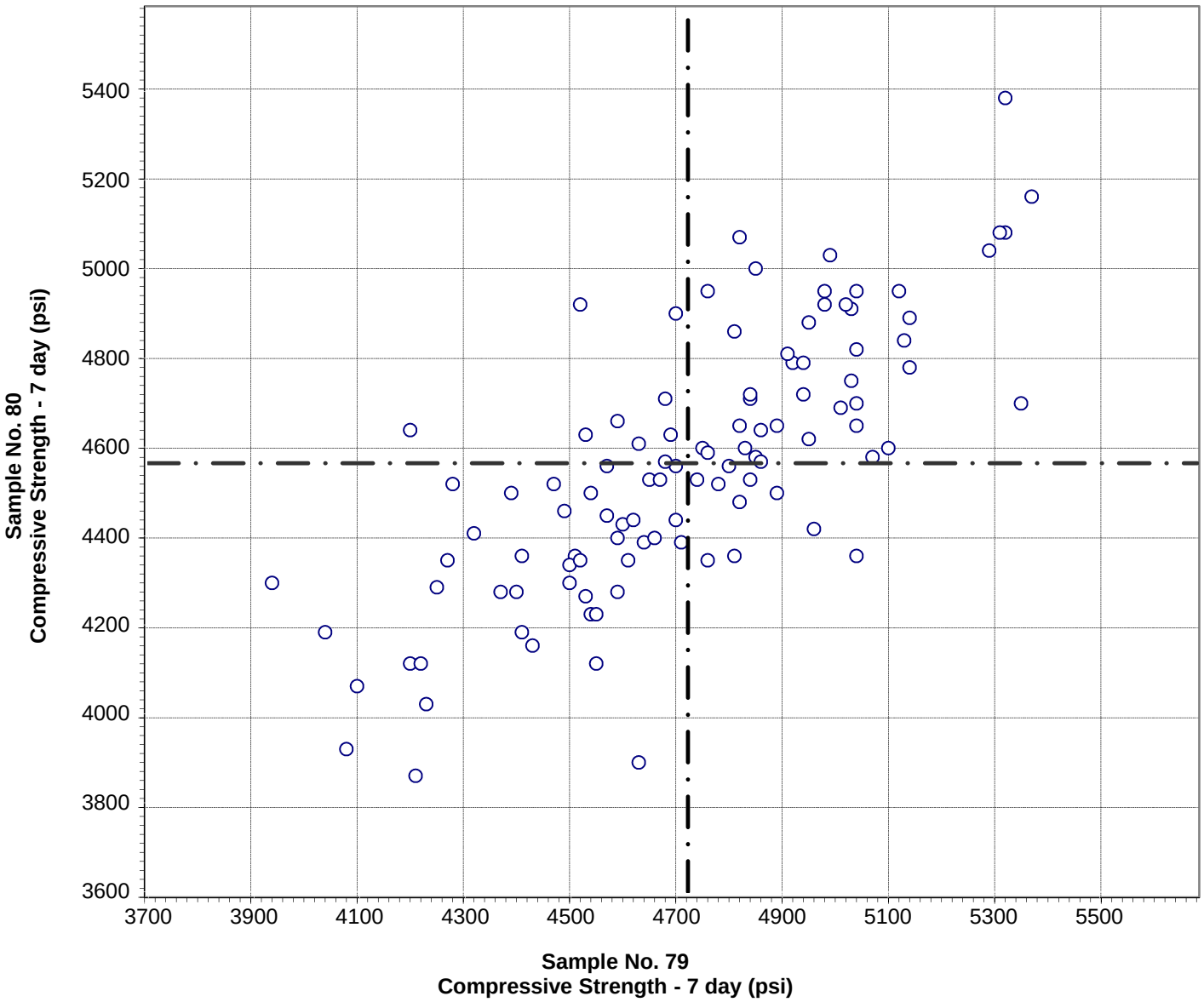


Test No. 200 Compressive Strength - 3 day 105 Points

Sample No. 79	Ave	3954	S.D.	308	C.V. 7.8
Sample No. 80	Ave	3727	S.D.	260	C.V. 7.0

Labs Eliminated: 33, 3912

CCRL Proficiency Sample Program
Compressive Strength - 7 day
BLENDED CEMENT Samples No. 79 and No. 80

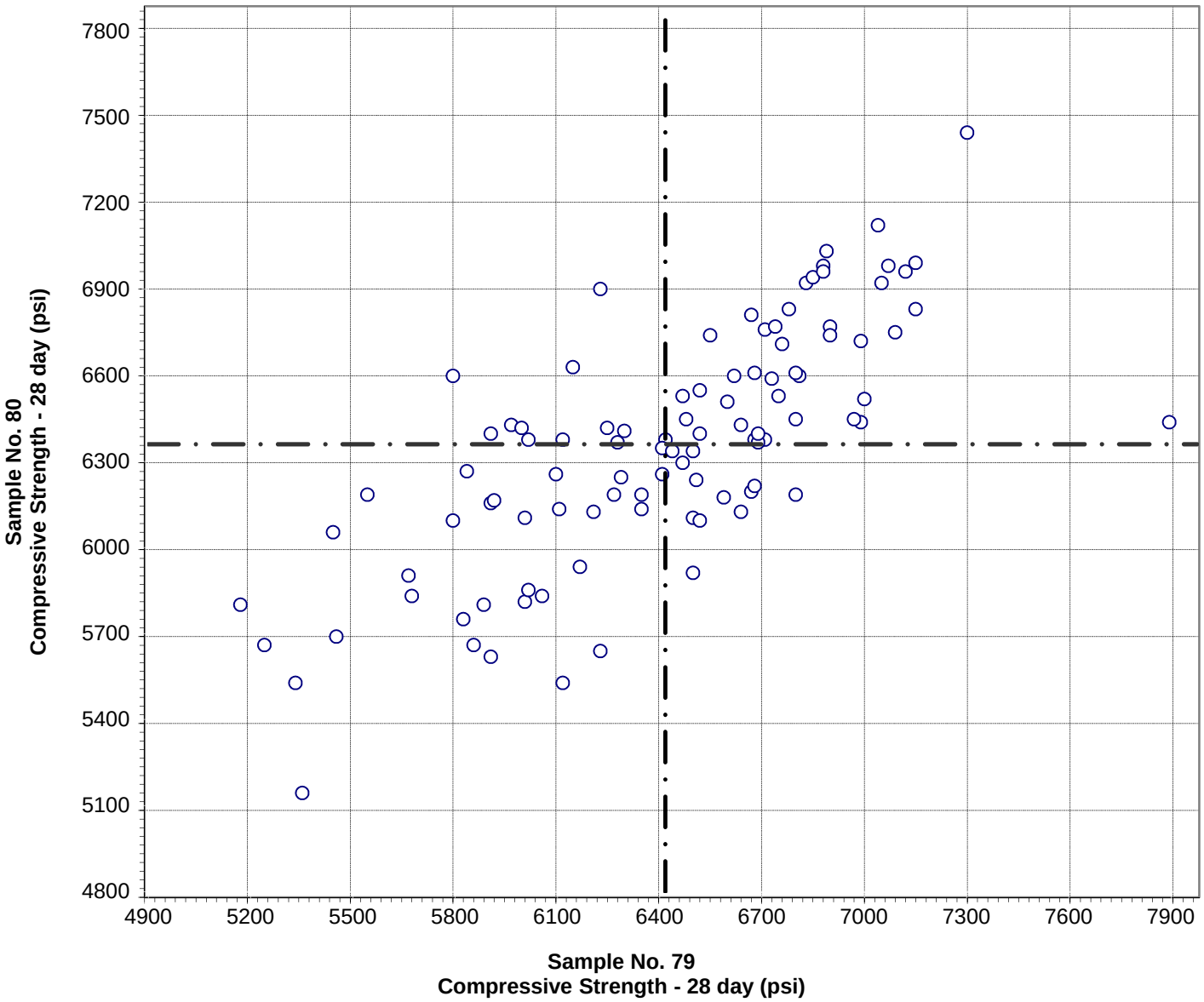


Test No. 210 Compressive Strength - 7 day 106 Points

Sample No. 79	Ave	4721	S.D.	310	C.V.	6.6
Sample No. 80	Ave	4564	S.D.	290	C.V.	6.4

Labs Eliminated: 33

CCRL Proficiency Sample Program
Compressive Strength - 28 day
BLENDED CEMENT Samples No. 79 and No. 80

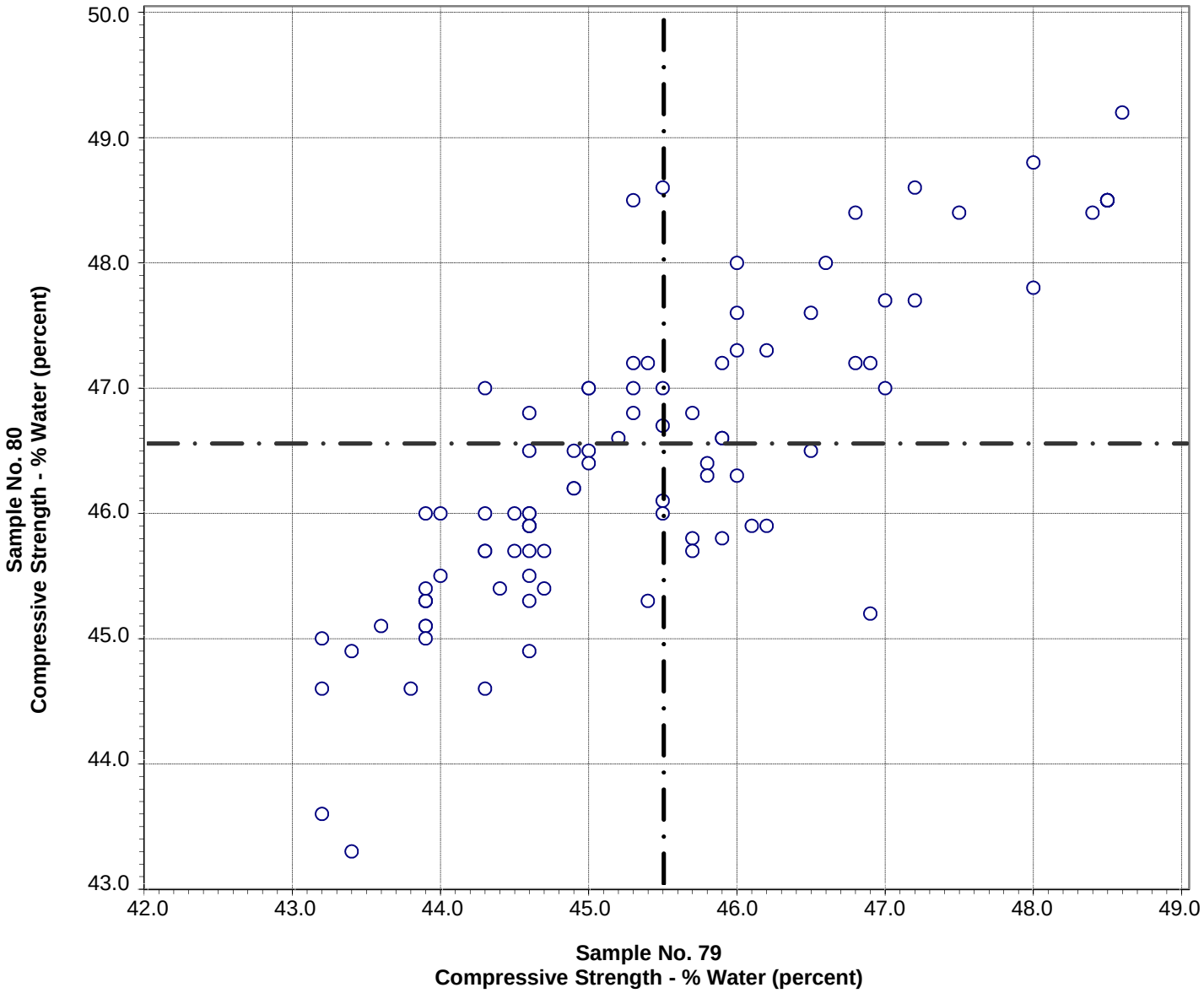


Test No. 211 Compressive Strength - 28 day 100 Points

Sample No. 79	Ave	6416	S.D.	501	C.V.	7.8
Sample No. 80	Ave	6360	S.D.	408	C.V.	6.4

Labs Eliminated: 33

CCRL Proficiency Sample Program
Compressive Strength - % Water
BLENDED CEMENT Samples No. 79 and No. 80



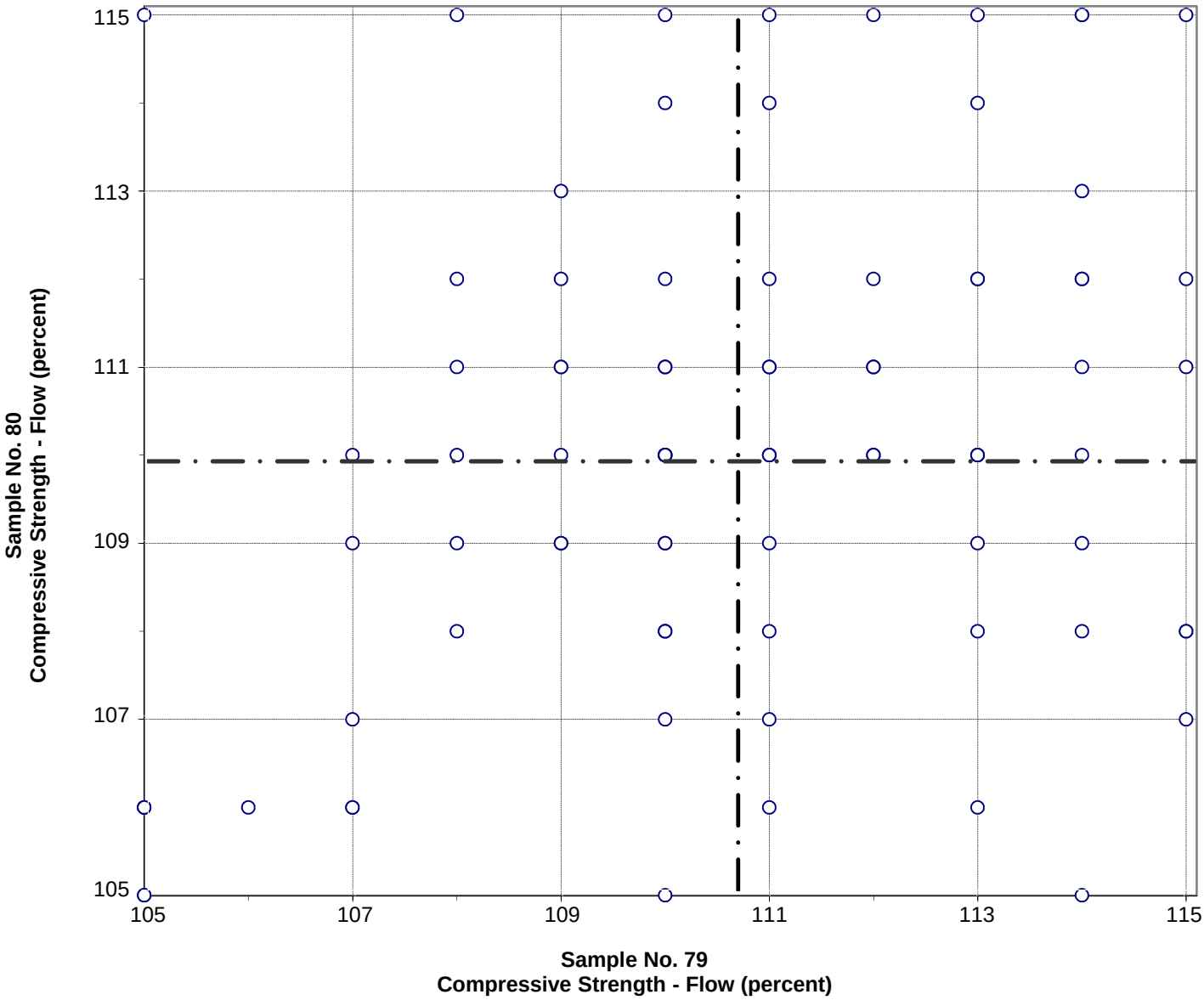
Test No. 220 Compressive Strength - % Water 96 Points

Sample No. 79	Ave	45.5	S.D.	1.4	C.V.	3.2
Sample No. 80	Ave	46.5	S.D.	1.3	C.V.	2.9

Labs Eliminated: 124, 354, 958, 2463, 3930

Labs off Diagram: 3913

CCRL Proficiency Sample Program
Compressive Strength - Flow
BLENDED CEMENT Samples No. 79 and No. 80



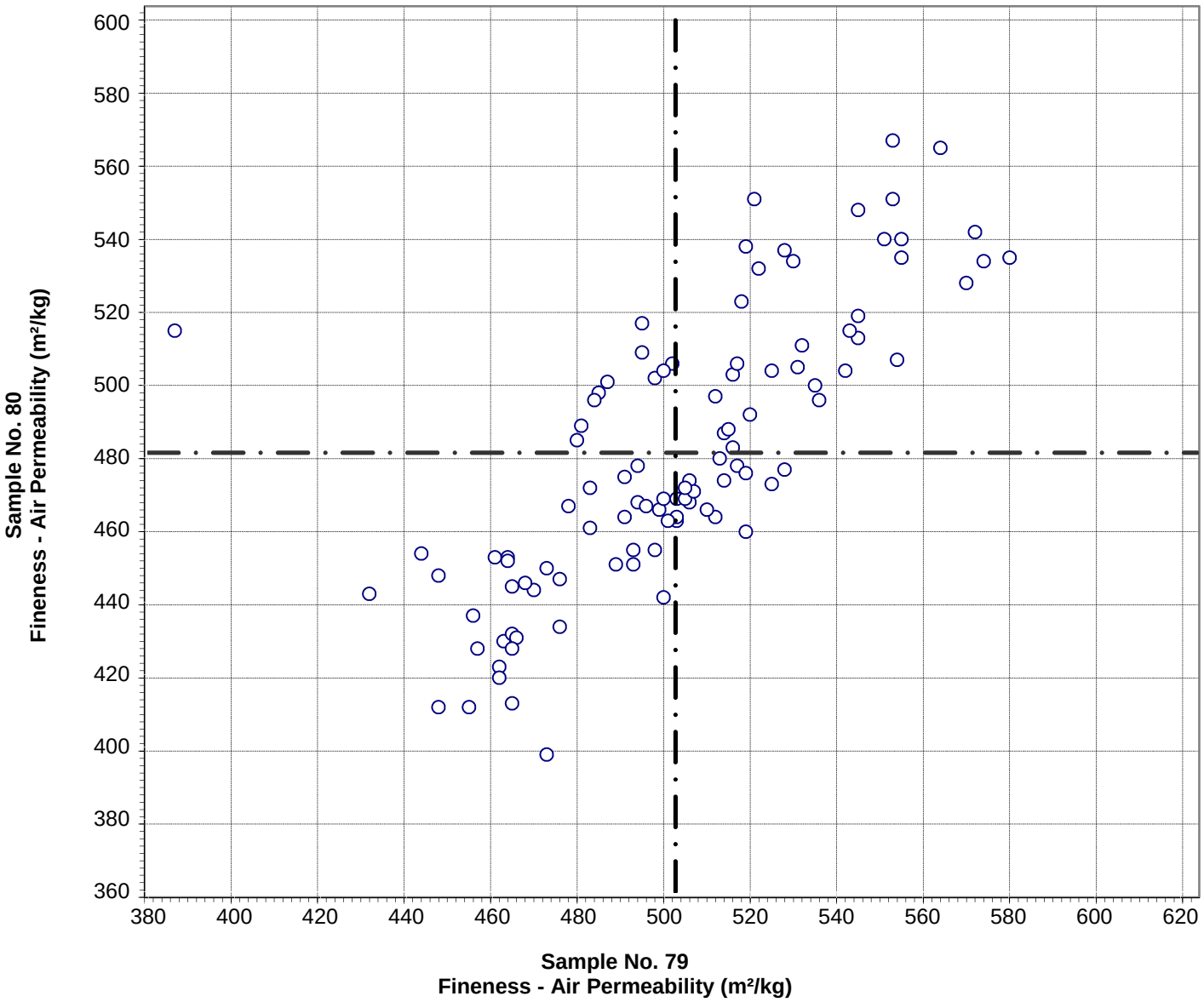
Test No. 230 Compressive Strength - Flow 93 Points

Sample No. 79	Ave	111	S.D.	2.6	C.V. 2.4
Sample No. 80	Ave	110	S.D.	2.8	C.V. 2.6

Labs Eliminated: 3, 38, 43, 47, 246, 958, 3413, 3910

Labs off Diagram: 22, 42

CCRL Proficiency Sample Program
Fineness - Air Permeability
BLENDED CEMENT Samples No. 79 and No. 80

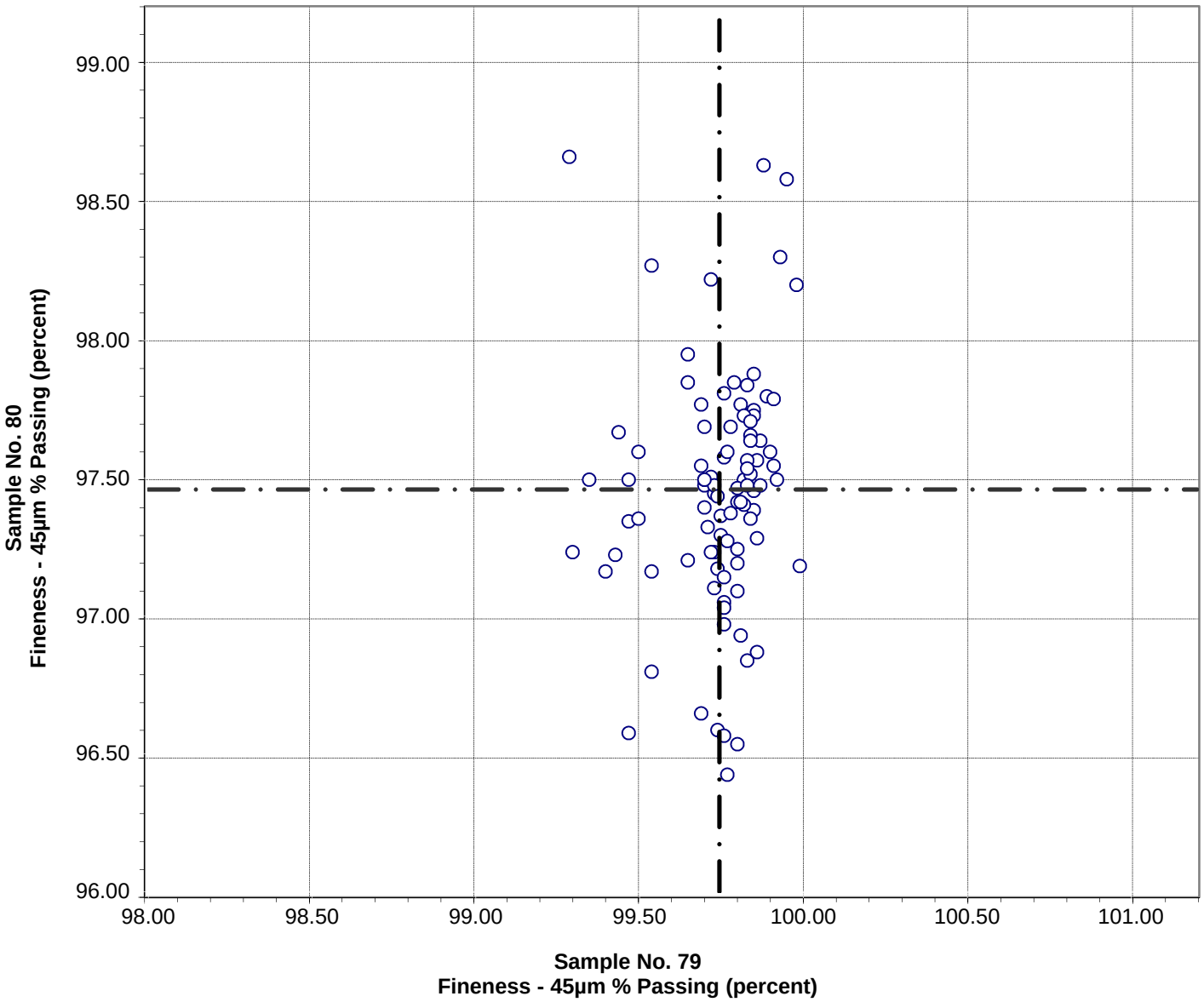


Test No. 270 Fineness - Air Permeability 102 Points

Sample No. 79	Ave	503	S.D.	34	C.V. 6.8
Sample No. 80	Ave	481	S.D.	38	C.V. 7.9

Labs Eliminated: 110

CCRL Proficiency Sample Program
Fineness - 45µm % Passing
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 281 Fineness - 45µm % Passing 93 Points

Sample No. 79	Ave	99.74	S.D.	0.15	C.V. 0.15
Sample No. 80	Ave	97.46	S.D.	0.42	C.V. 0.44

Labs Eliminated: 22, 35, 38, 246, 413, 474, 694, 958, 975, 3930, 4051

CCRL PROFICIENCY SAMPLE PROGRAM

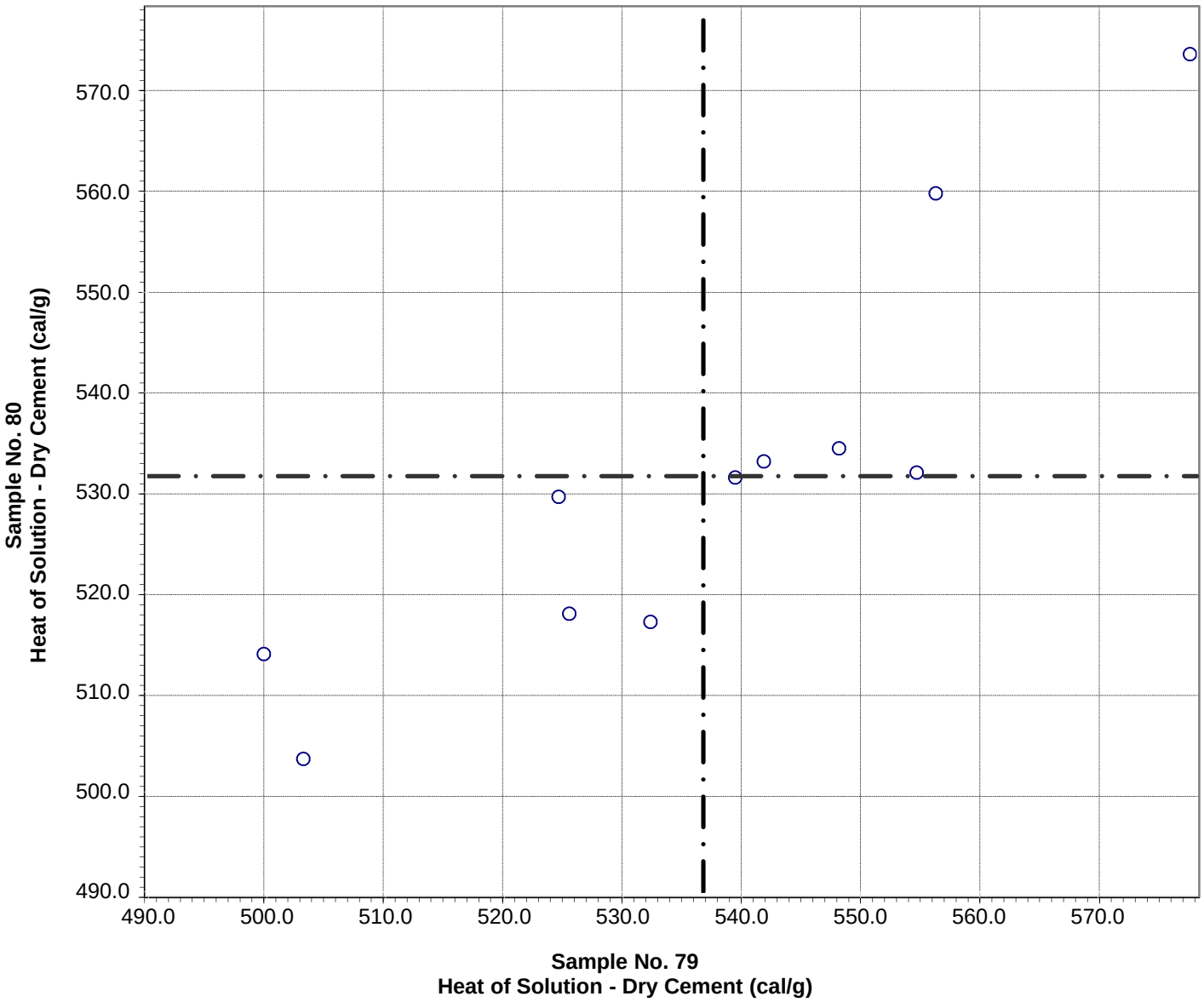
Blended Cement Proficiency Samples No. 79 and No. 80

Final Report – Heat of Hydration Results
April 25, 2017

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.79 Average	S.D.	C.V.	Sample No. 80 Average	S.D.	C.V.
Heat of Solution - Dry Cement (**cal/g**)							
	11	536.7	23.0	4.3	531.6	20.1	3.8
No Labs Eliminated for This Test							
Heat of Solution - 7 day (**cal/g**)							
	11	467.8	17.4	3.7	461.8	17.1	3.7
No Labs Eliminated for This Test							
Heat of Solution - 28 day (**cal/g**)							
	9	456.8	18.4	4.03	454.3	22.6	4.98
No Labs Eliminated for This Test							
Heat of Hydration - 7 day (**cal/g**)							
	12	69.4	10.0	14.4	70.6	6.0	8.5
No Labs Eliminated for This Test							
Heat of Hydration - 28 day (**cal/g**)							
	9	76.6	7.7	10.1	78.5	6.7	8.5
No Labs Eliminated for This Test							

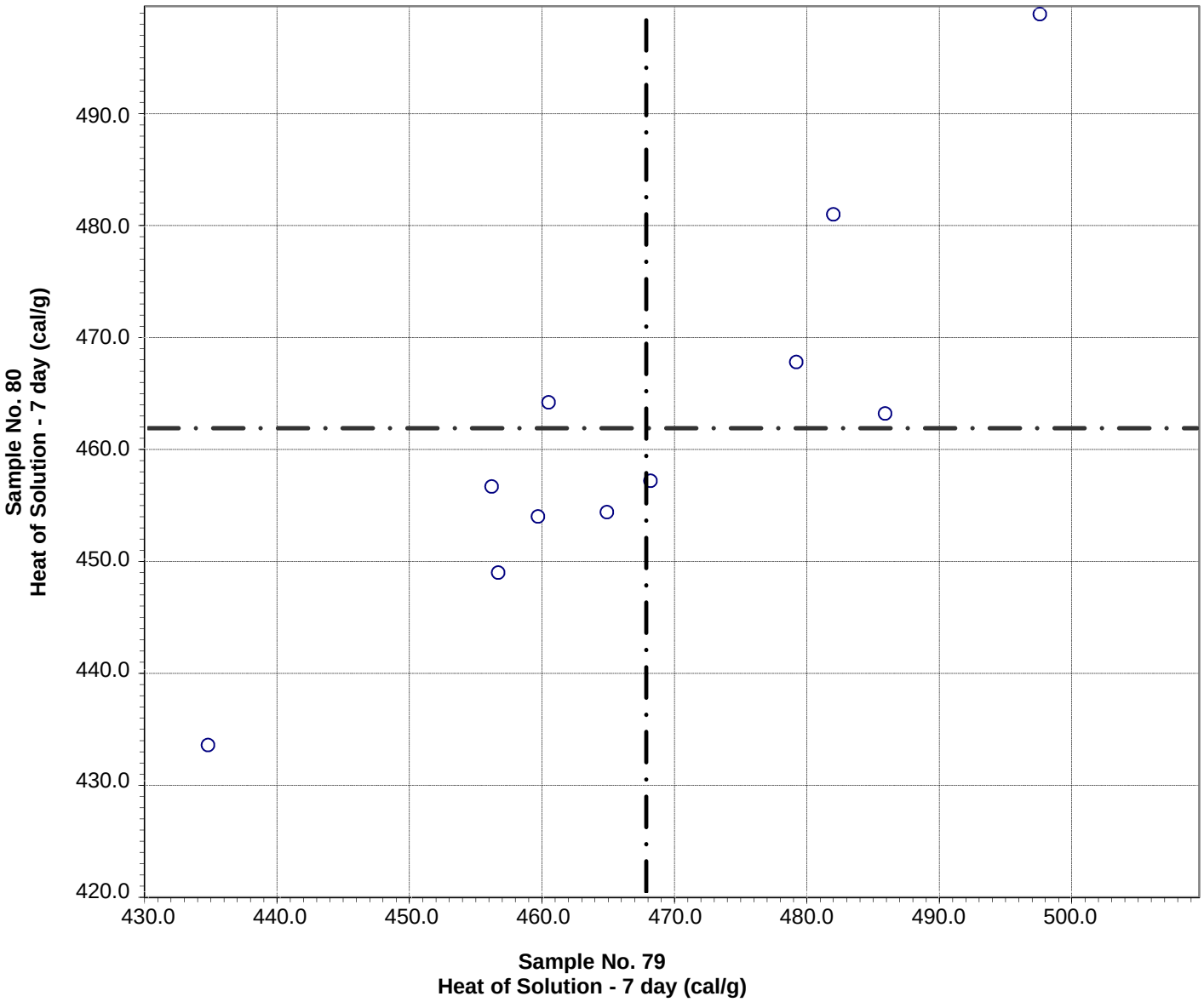
CCRL Proficiency Sample Program
Heat of Solution - Dry Cement
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 291 Heat of Solution - Dry Cement 11 Points

Sample No. 79	Ave	536.7	S.D.	23.0	C.V.	4.3
Sample No. 80	Ave	531.6	S.D.	20.1	C.V.	3.8

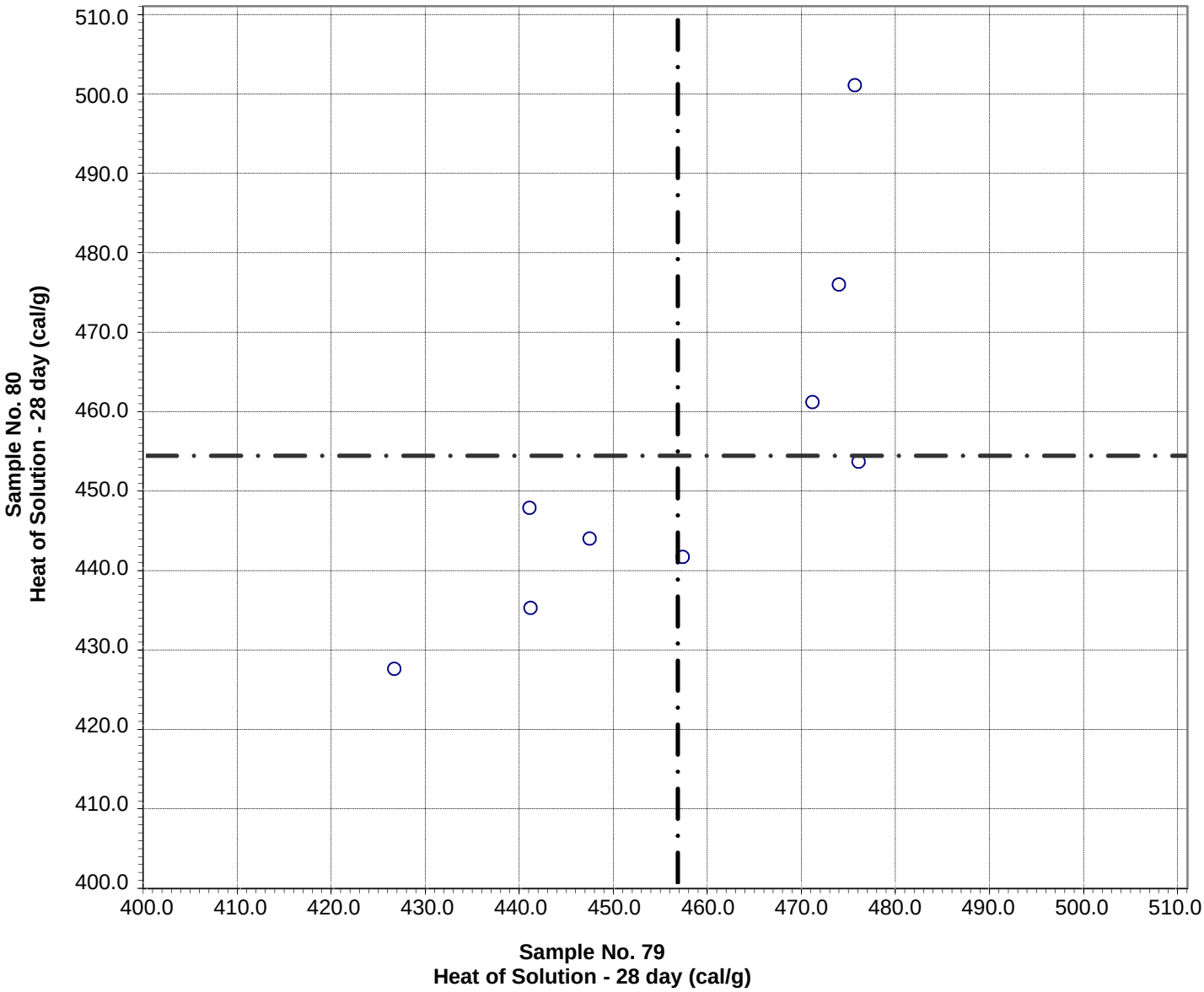
CCRL Proficiency Sample Program
Heat of Solution - 7 day
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 292 Heat of Solution - 7 day 11 Points

Sample No. 79	Ave	467.8	S.D.	17.4	C.V.	3.7
Sample No. 80	Ave	461.8	S.D.	17.1	C.V.	3.7

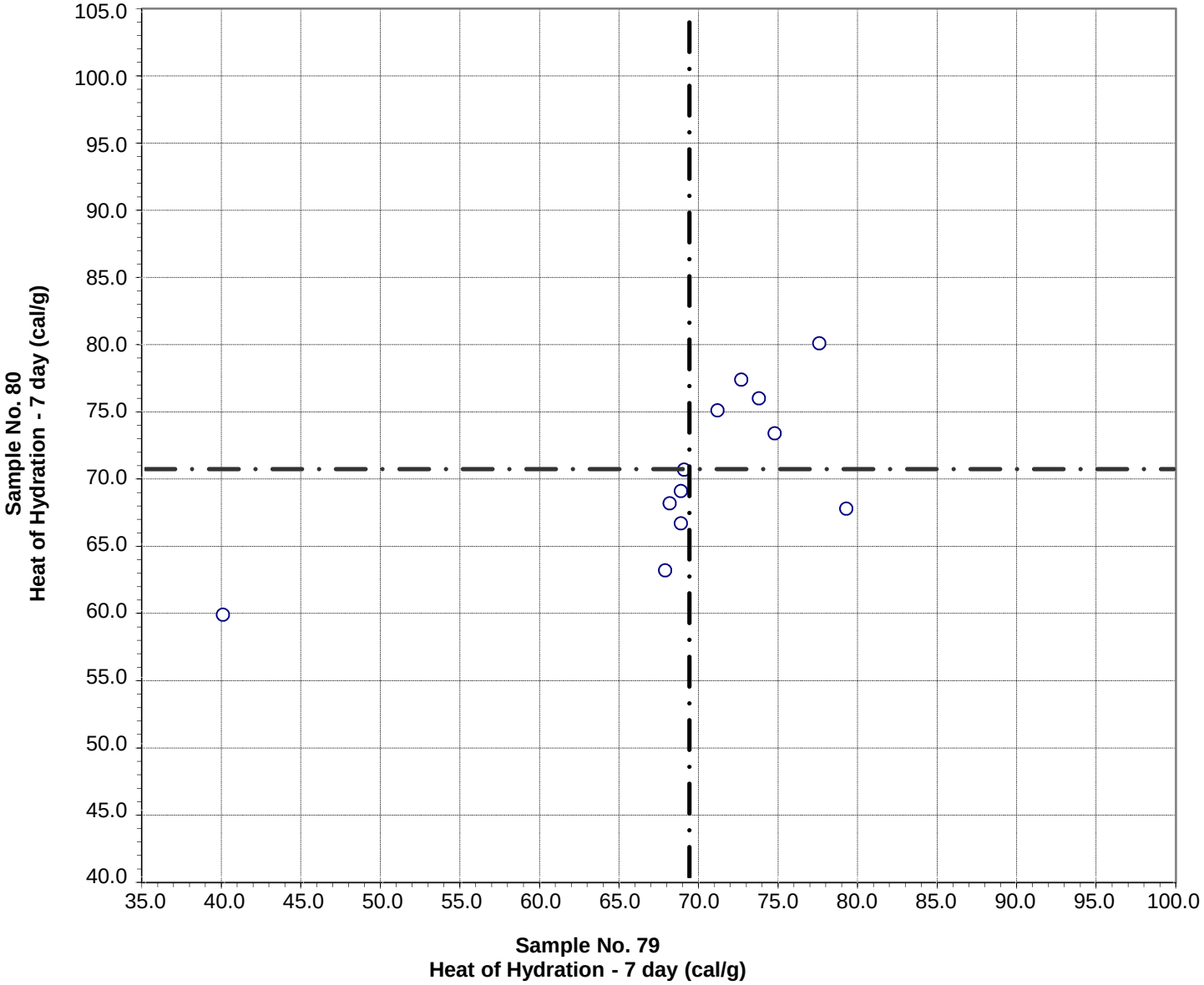
CCRL Proficiency Sample Program
Heat of Solution - 28 day
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 301 Heat of Solution - 28 day 9 Points

Sample No. 79	Ave	456.8	S.D.	18.4	C.V.	4.0
Sample No. 80	Ave	454.3	S.D.	22.6	C.V.	5.0

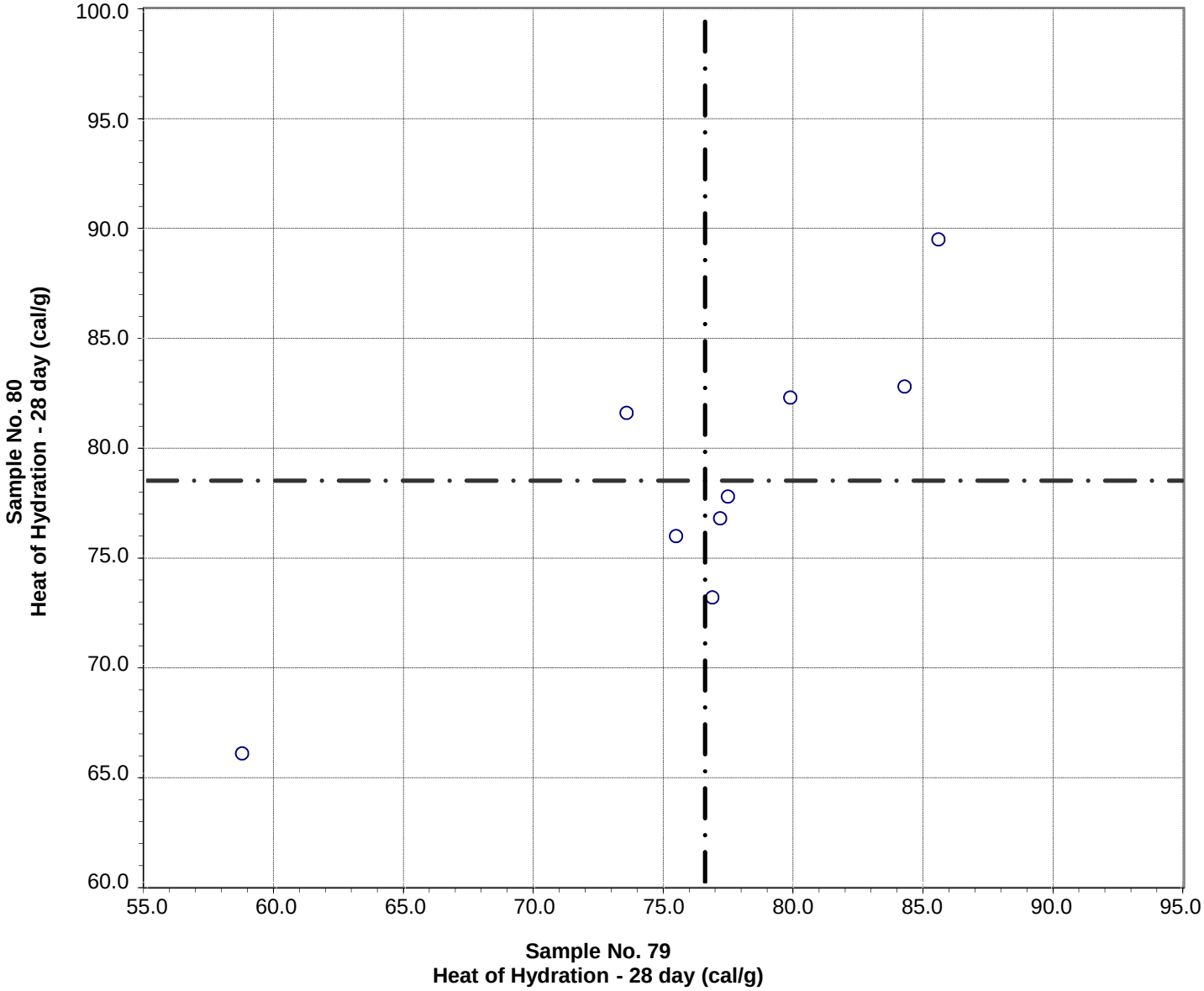
CCRL Proficiency Sample Program
Heat of Hydration - 7 day
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 290 Heat of Hydration - 7 day 12 Points

Sample No. 79	Ave	69.4	S.D.	10.0	C.V. 14.4
Sample No. 80	Ave	70.6	S.D.	6.0	C.V. 8.5

CCRL Proficiency Sample Program
Heat of Hydration - 28 day
BLENDED CEMENT Samples No. 79 and No. 80



Test No. 300 Heat of Hydration - 28 day 9 Points

Sample No. 79	Ave	76.6	S.D.	7.7	C.V.	10.1
Sample No. 80	Ave	78.5	S.D.	6.7	C.V.	8.5