CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Blended Cement Proficiency Samples
Number 71 and Number 72

April 2013

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

May 1, 2013

TO: Participants in the CCRL Blended Cement Proficiency Sample Program

SUBJECT: Final Report on Blended Cement Proficiency Samples No. 71 and No. 72

Following is the final report for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2013. Both cements were an ASTM C595 Blended Hydraulic Cement. Sample No 71 was a Type IL (10) and No. 72 was a Type IL (14).

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 2014.

Sincerely,

Robin K. Haupt

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

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. 71 and No. 72

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 2013. 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. Participants in the secondary chemical analysis should note that laboratory ratings are assigned using primary chemical statistics.

[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. 71 and No. 72

Final Report – Chemical Results
May 1, 2013

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.71 Average	S.D.	C.V.	Sample No. 72 Average	S.D.	C.V.
Silicon Dioxide (**percent**)							
	104	17.94	0.37	2.1	17.75	0.38	2.1
	*102	17.92	0.35	1.9	17.73	0.34	1.9
* Labs Eliminated - 38, 3059							
Aluminum Oxide (**percent**)							
	101	4.43	0.16	3.6	4.28	0.25	5.8
	*91	4.41	0.09	2.1	4.25	0.09	2.2
* Labs Eliminated - 36, 42, 53, 124, 176, 975, 3059, 3297, 3503, 3504							
Ferric Oxide (**percent**)							
	103	3.49	0.13	3.8	2.90	0.16	5.4
	*96	3.51	0.08	2.4	2.88	0.07	2.5
* Labs Eliminated - 50, 51, 52, 124, 205, 3059, 3409							
Calcium Oxide (**percent**)							
	102	62.89	1.00	1.6	62.05	2.00	3.2
	*99	62.90	0.87	1.4	62.21	1.04	1.7
* Labs Eliminated - 20, 3503, 3695							
Magnesium Oxide (**percent**)							
	104	1.46	0.25	17.4	3.07	0.69	22.4
	*92	1.42	0.07	4.6	3.09	0.09	2.9
* Labs Eliminated - 1, 20, 43, 53, 124, 176, 205, 1715, 3059, 3431, 3503, 3504							
Sulfur Trioxide (**percent**)							
	106	3.11	0.22	7.1	3.29	0.18	5.6
	*101	3.10	0.09	2.8	3.29	0.10	3.0
* Labs Eliminated - 20, 38, 43, 53, 181							
Loss on Ignition (**percent**)							
	108	5.84	0.54	9.2	6.28	0.57	9.0
	*102	5.90	0.11	1.8	6.34	0.09	1.4
* Labs Eliminated - 28, 38, 53, 124, 413, 690							

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Chemical Results
May 1, 2013

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.71 Average	S.D.	C.V.	Sample No. 72 Average	S.D.	C.V.
Sodium Oxide (**percent**)							
	92	0.171	0.076	44	0.080	0.085	106
	*87	0.165	0.037	23	0.067	0.031	46
* Labs Eliminated - 50, 205, 2360, 2465, 3235							
Potassium Oxide (**percent**)							
	97	0.44	0.05	12.5	0.45	0.07	14.8
	*91	0.44	0.01	3.4	0.46	0.01	3.2
* Labs Eliminated - 50, 176, 840, 2360, 2465, 3297							
Titanium Dioxide (**percent**)							
	81	0.28	0.016	5.9	0.26	0.017	6.7
	*79	0.28	0.010	3.5	0.25	0.013	5.1
* Labs Eliminated - 53, 148							
Phosphorus Pentoxide (**percent**)							
	84	0.189	0.028	14.8	0.058	0.038	65.4
	*72	0.189	0.006	3.0	0.050	0.005	9.4
* Labs Eliminated - 34, 53, 124, 158, 205, 413, 2462, 2463, 2466, 3059, 3233, 3235							
Zinc Oxide (**percent**)							
	41	0.131	0.010	7.3	0.011	0.020	181
	*39	0.131	0.005	3.9	0.008	0.002	22
* Labs Eliminated - 148, 205							
Manganic Oxide (**percent**)							
	64	0.127	0.021	16.4	0.059	0.026	43.4
	*55	0.127	0.005	4.1	0.056	0.003	5.9
* Labs Eliminated - 3, 124, 148, 205, 413, 932, 2360, 2462, 2466							
Chloride (**percent**)							
	47	0.017	0.006	39	0.009	0.009	101
	*46	0.017	0.006	39	0.007	0.004	49
* Labs Eliminated - 1657							

CCRL PROFICIENCY SAMPLE PROGRAM

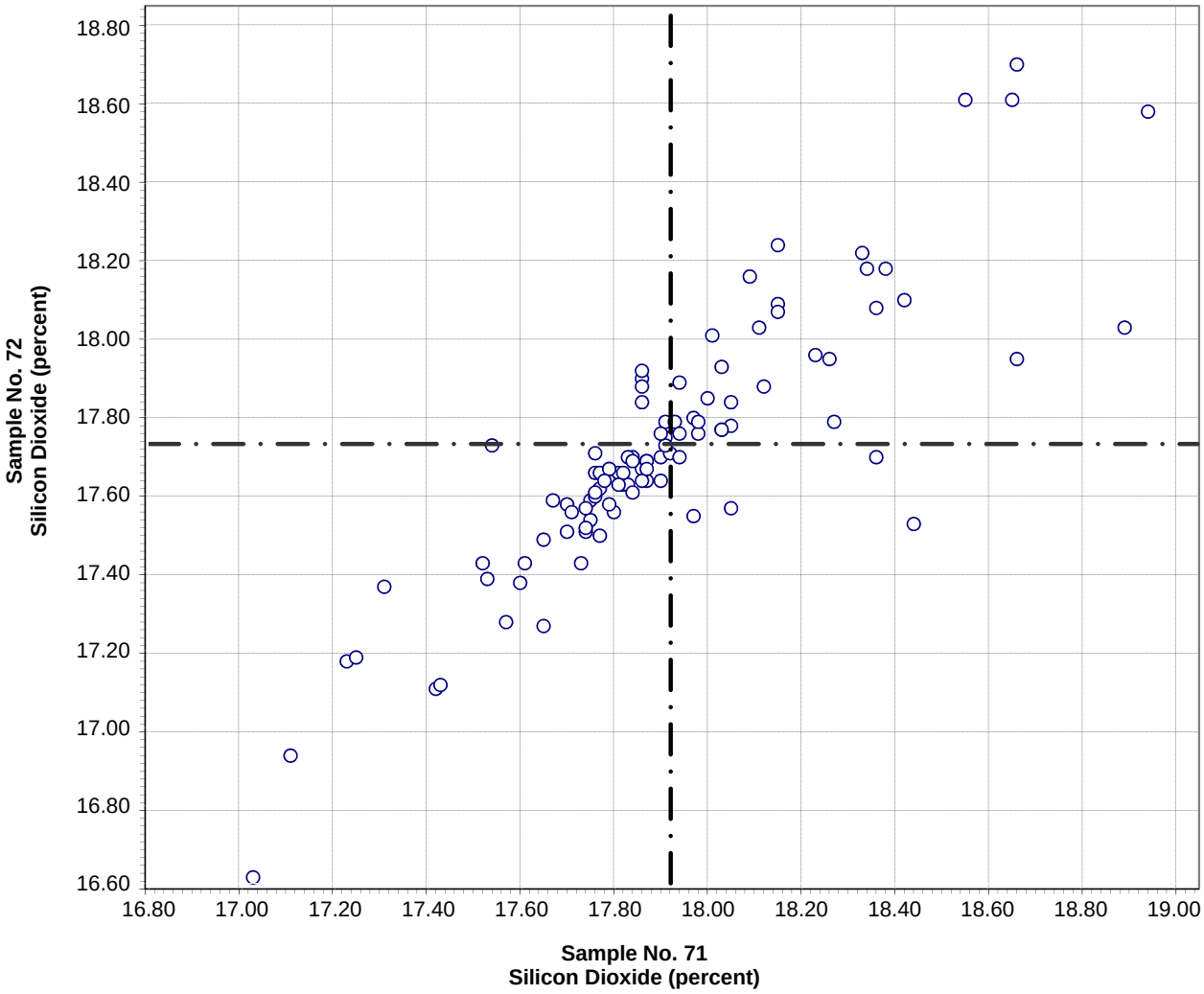
Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Chemical Results
May 1, 2013

SUMMARY OF RESULTS

		Sample No.71			Sample No. 72		
Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Insoluble Residue (**percent**)							
	96	0.47	0.12	26	0.37	0.17	44
	*91	0.47	0.10	21	0.36	0.11	32
* Labs Eliminated - 24, 36, 181, 2360, 3233							
Chromium Oxide (**percent**)							
	37	0.024	0.008	34	0.008	0.004	44
	*32	0.022	0.003	12	0.008	0.001	17
* Labs Eliminated - 24, 34, 148, 205, 2462							

CCRL Proficiency Sample Program
Silicon Dioxide
BLENDED CEMENT Samples No. 71 and No. 72



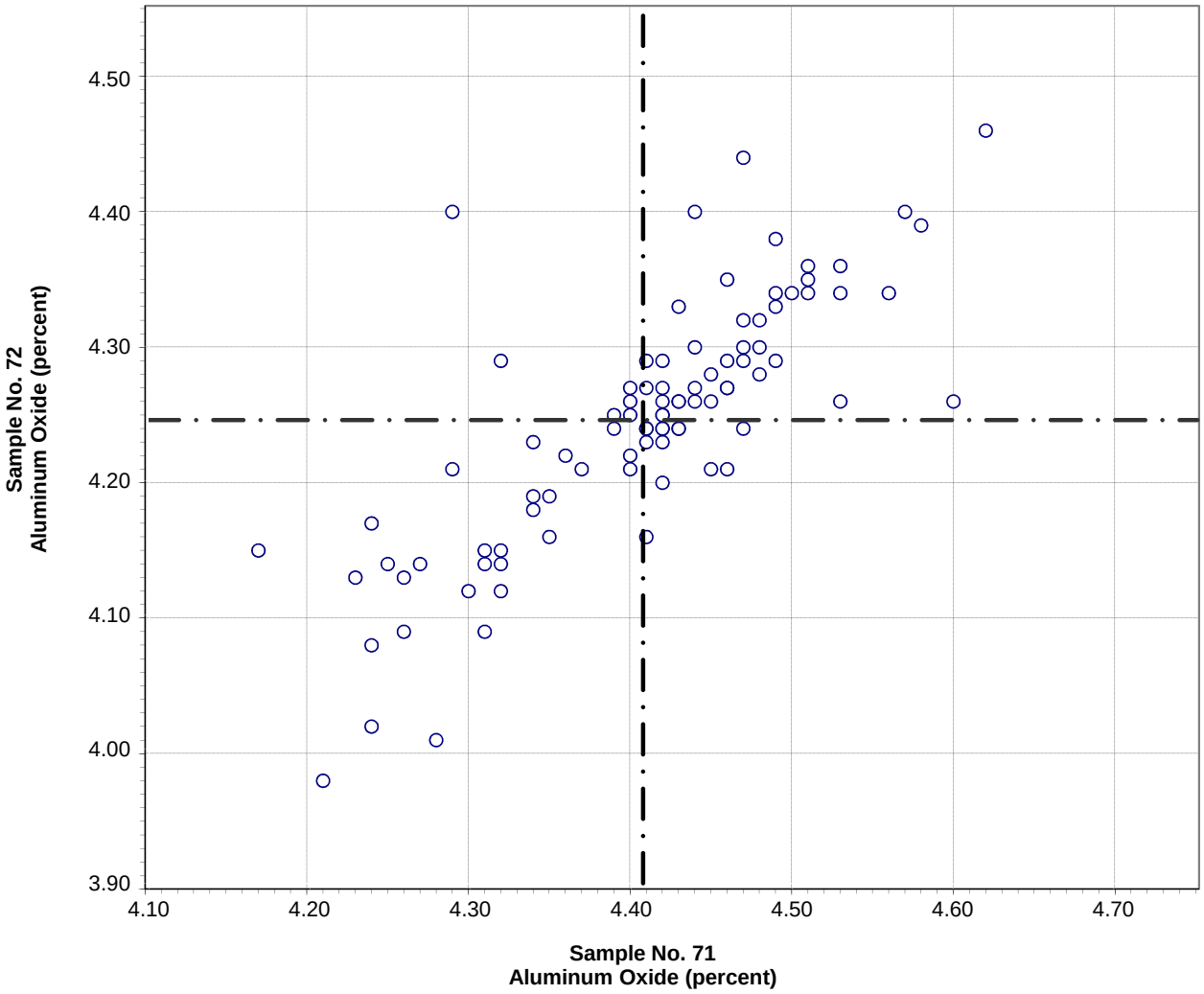
Test No. 10 Silicon Dioxide 101 Points

Sample No. 71	Ave	17.92	S.D.	0.35	C.V.	1.9
Sample No. 72	Ave	17.73	S.D.	0.34	C.V.	1.9

Labs Eliminated: 38, 3059

Labs off Diagram: 53

CCRL Proficiency Sample Program
Aluminum Oxide
BLENDED CEMENT Samples No. 71 and No. 72

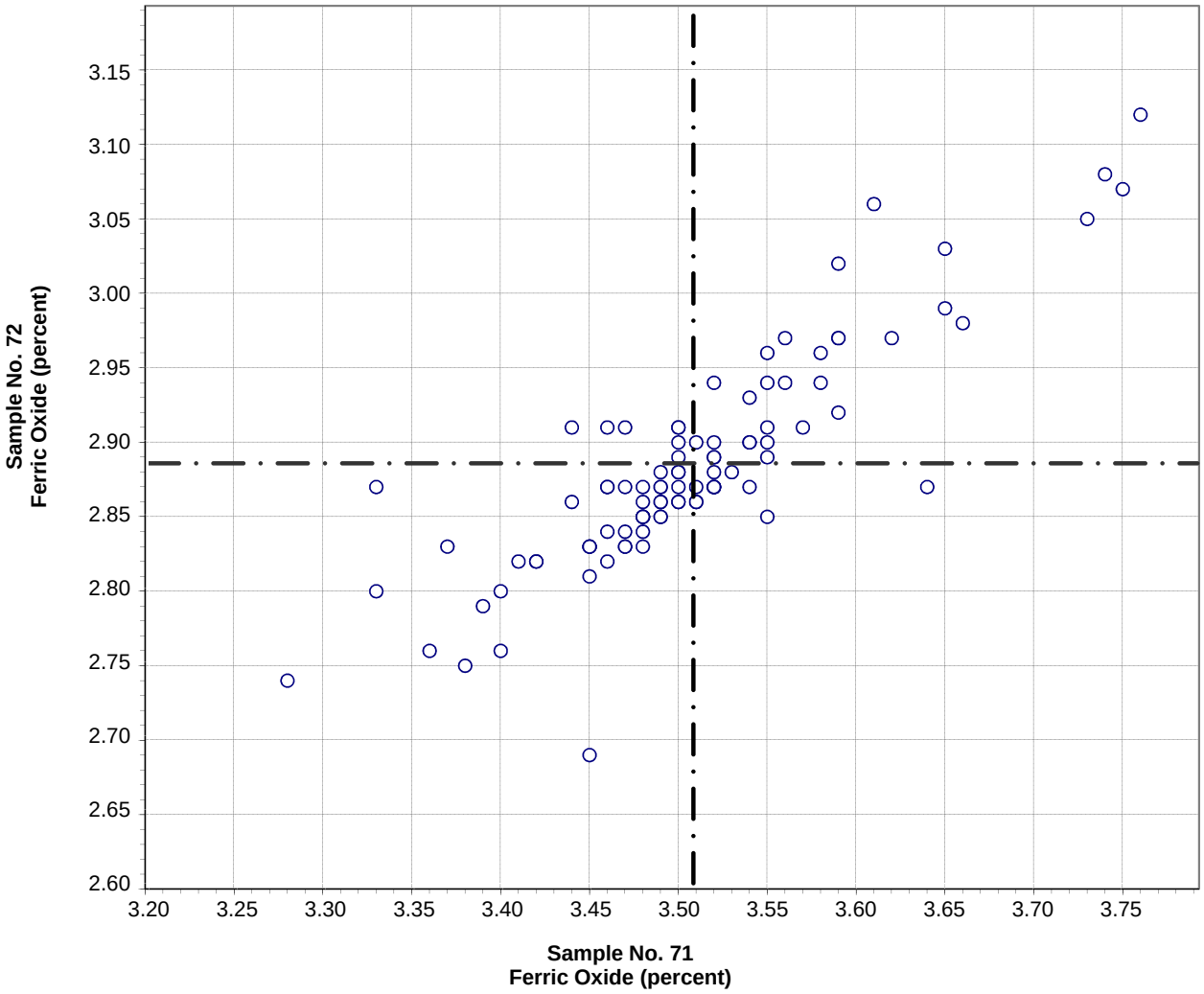


Test No. 21 Aluminum Oxide 91 Points

Sample No. 71	Ave	4.41	S.D.	0.09	C.V.	2.1
Sample No. 72	Ave	4.25	S.D.	0.09	C.V.	2.2

Labs Eliminated: 36, 42, 53, 124, 176, 975, 3059, 3297, 3503, 3504

CCRL Proficiency Sample Program
Ferric Oxide
BLENDED CEMENT Samples No. 71 and No. 72

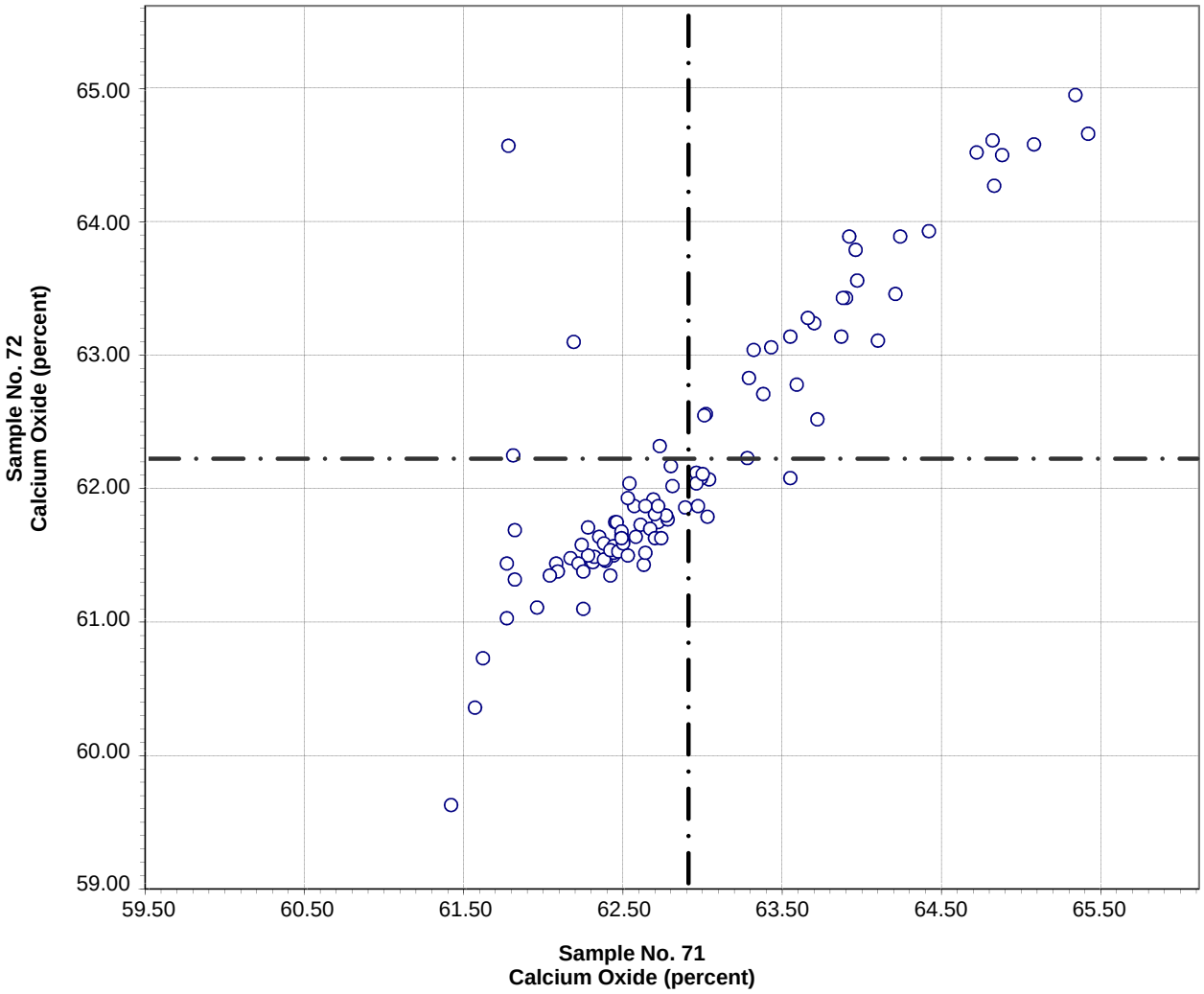


Test No. 30 Ferric Oxide 96 Points

Sample No. 71	Ave	3.51	S.D.	0.08	C.V. 2.4
Sample No. 72	Ave	2.88	S.D.	0.07	C.V. 2.5

Labs Eliminated: 50, 51, 52, 124, 205, 3059, 3409

CCRL Proficiency Sample Program
Calcium Oxide
BLENDED CEMENT Samples No. 71 and No. 72

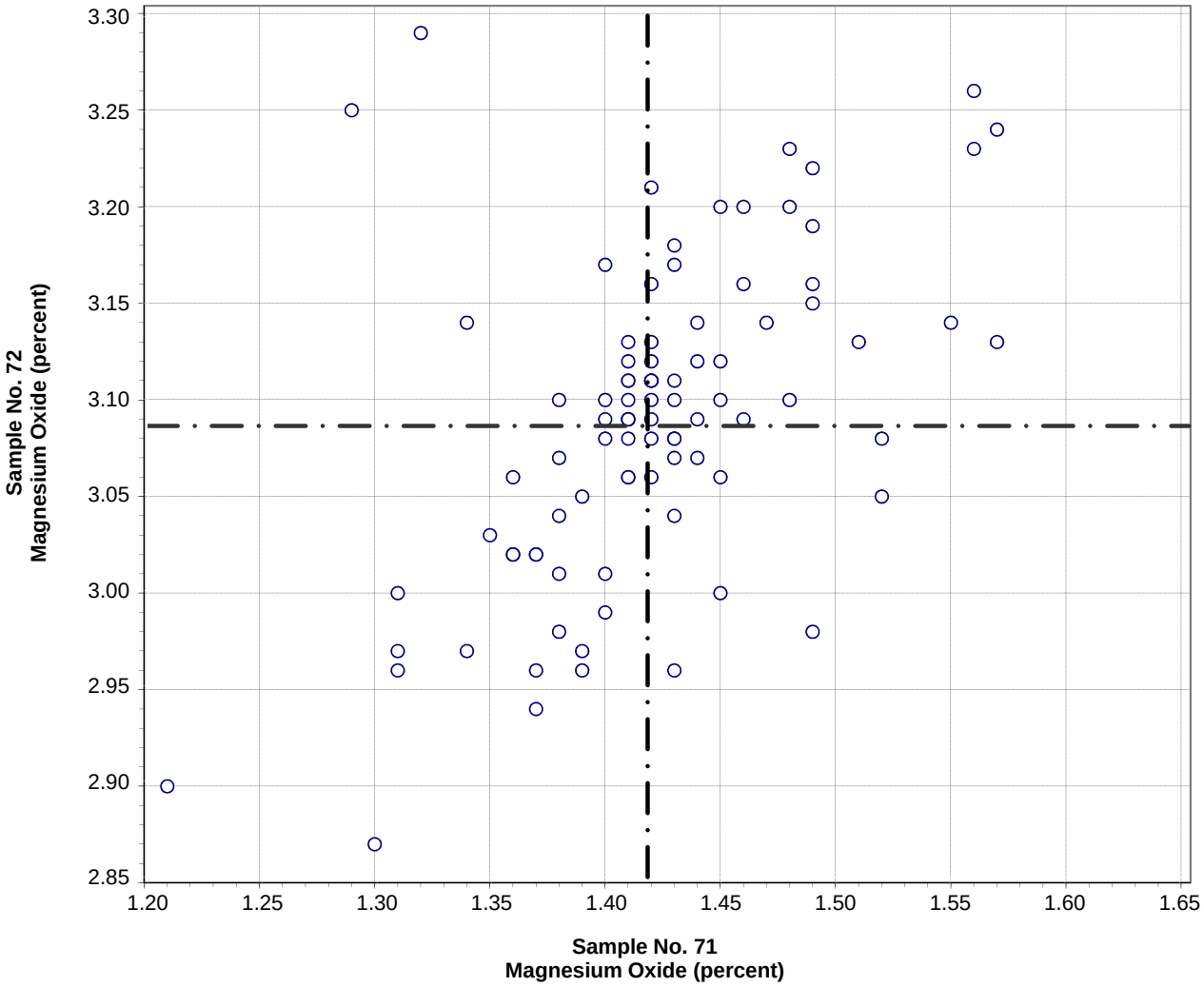


Test No. 40 Calcium Oxide 99 Points

Sample No. 71	Ave	62.90	S.D.	0.87	C.V. 1.4
Sample No. 72	Ave	62.21	S.D.	1.04	C.V. 1.7

Labs Eliminated: 20, 3503, 3695

CCRL Proficiency Sample Program
Magnesium Oxide
BLENDED CEMENT Samples No. 71 and No. 72



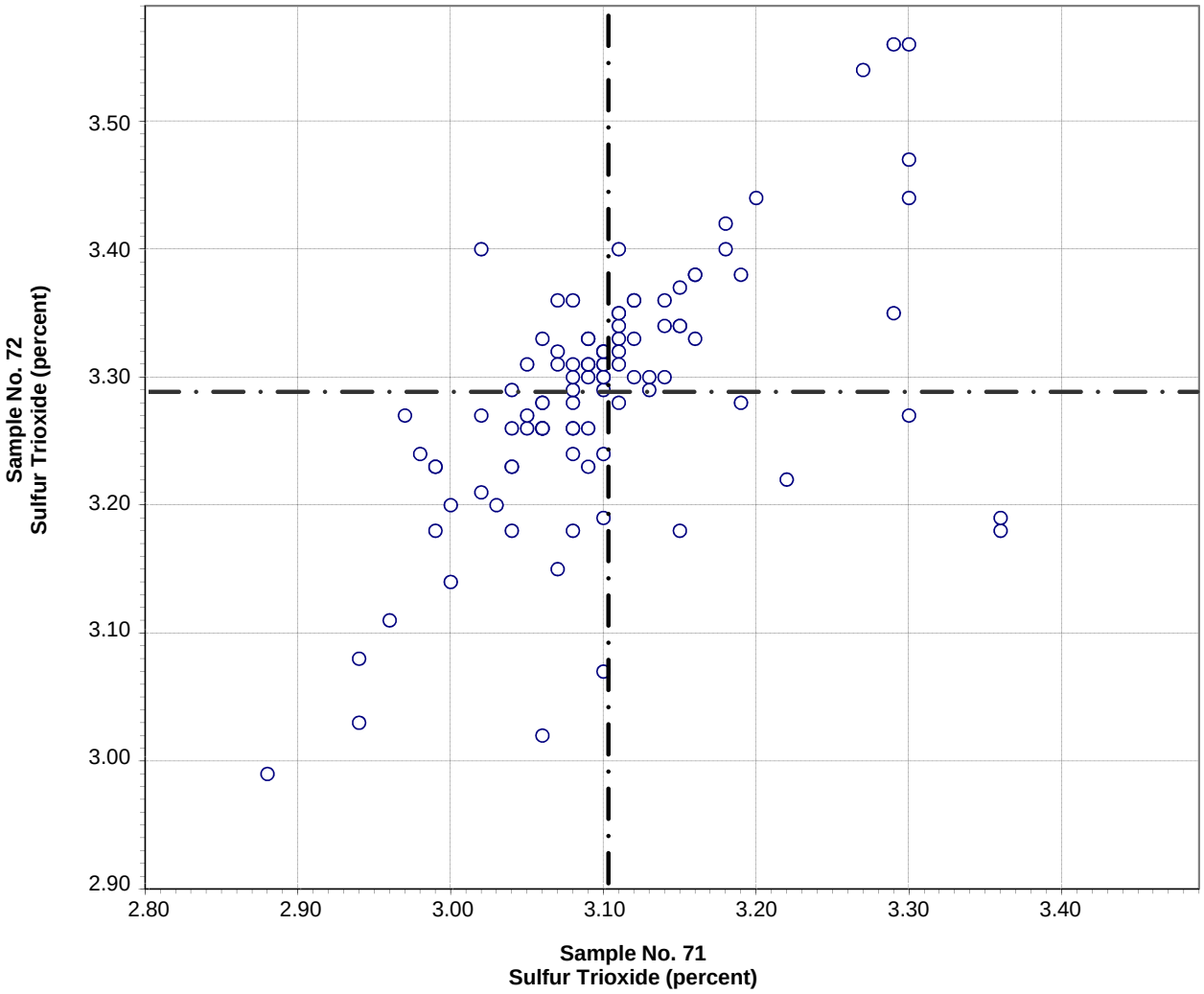
Test No. 50 Magnesium Oxide 91 Points

Sample No. 71	Ave	1.42	S.D.	0.07	C.V. 4.6
Sample No. 72	Ave	3.09	S.D.	0.09	C.V. 2.9

Labs Eliminated: 1, 20, 43, 53, 124, 176, 205, 1715, 3059, 3431, 3503, 3504

Labs off Diagram: 413

CCRL Proficiency Sample Program
Sulfur Trioxide
BLENDED CEMENT Samples No. 71 and No. 72

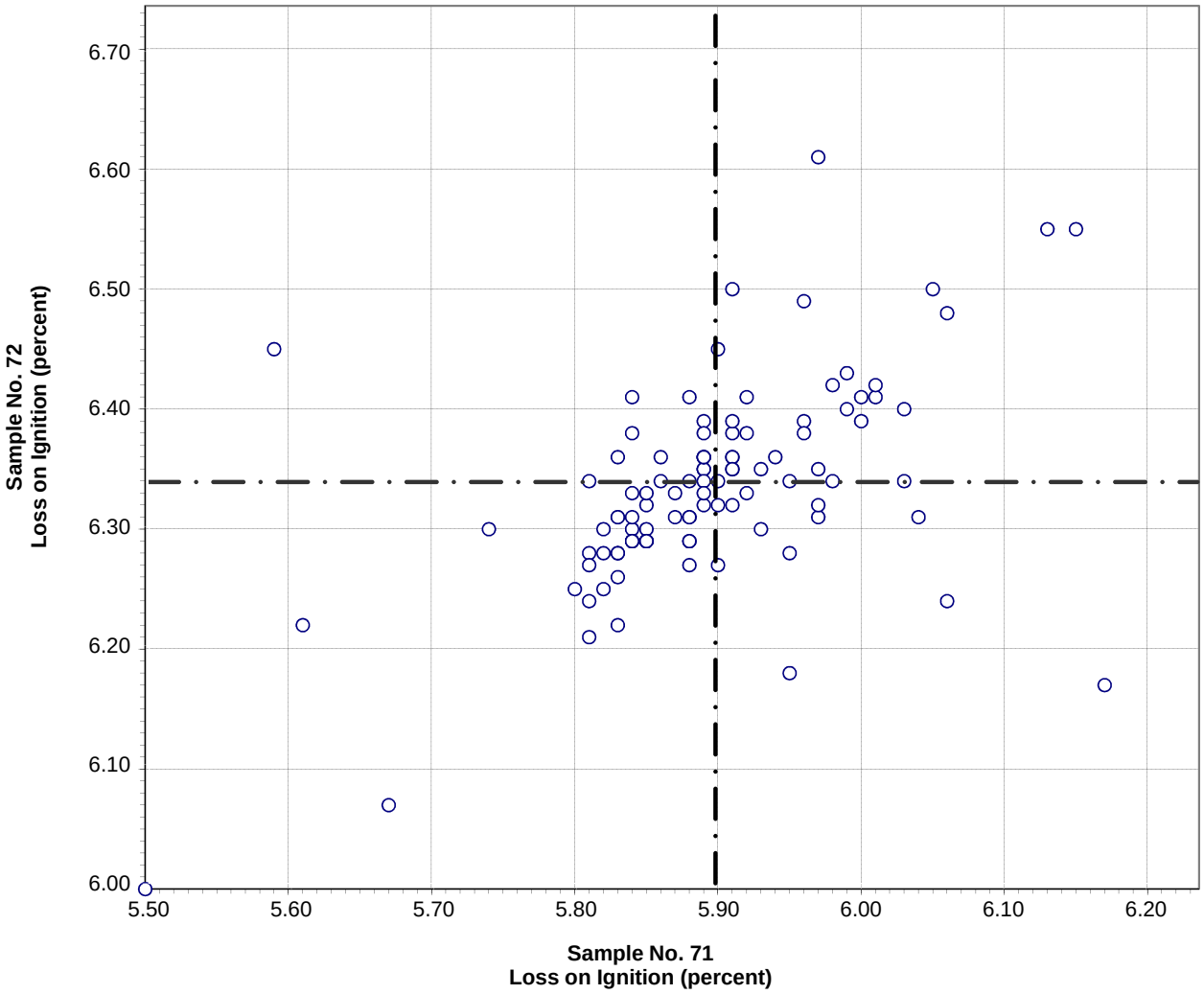


Test No. 60 Sulfur Trioxide 101 Points

Sample No. 71	Ave	3.10	S.D.	0.09	C.V.	2.8
Sample No. 72	Ave	3.29	S.D.	0.10	C.V.	3.0

Labs Eliminated: 20, 38, 43, 53, 181

CCRL Proficiency Sample Program
Loss on Ignition
BLENDED CEMENT Samples No. 71 and No. 72



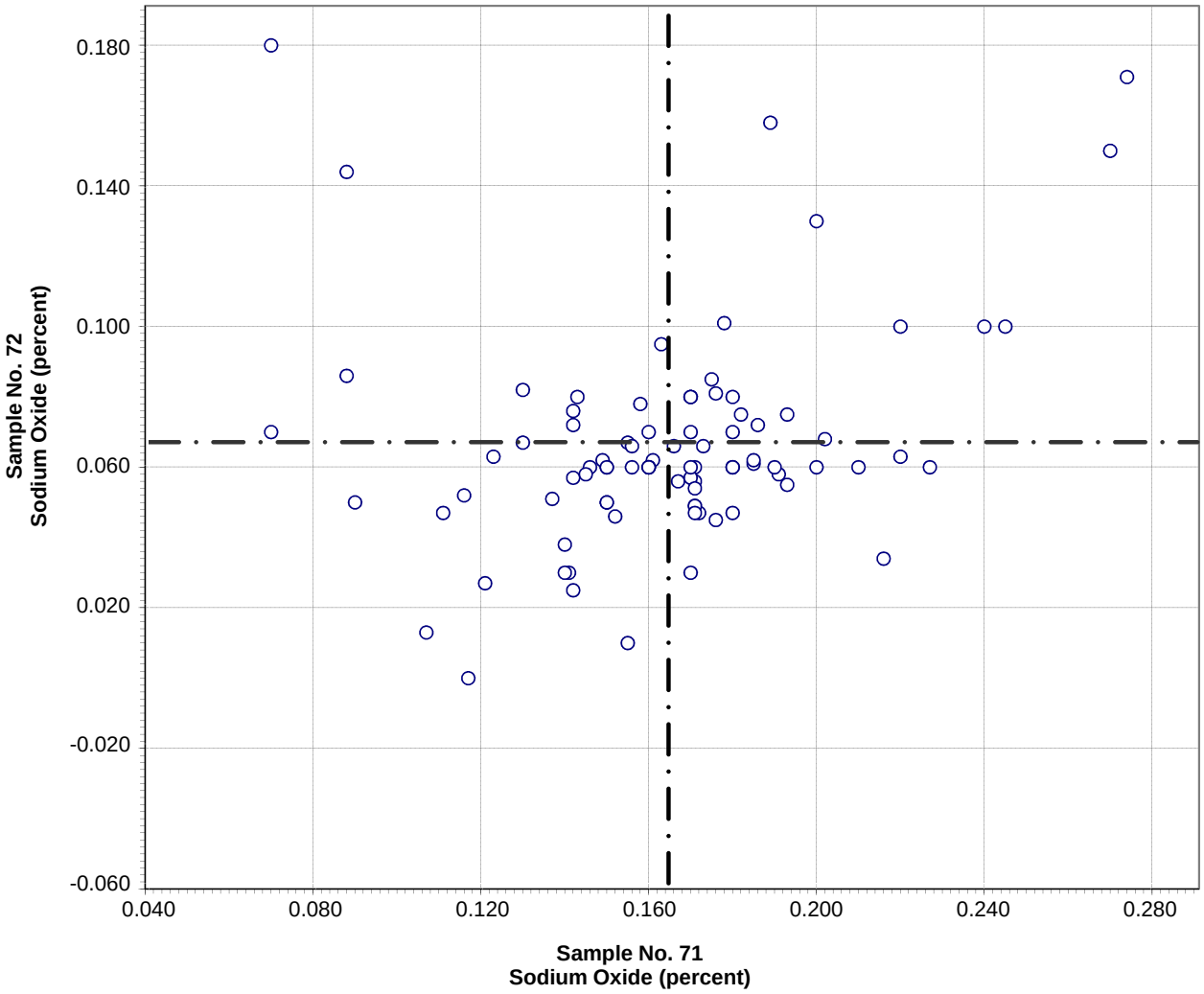
Test No. 70 Loss on Ignition 101 Points

Sample No. 71	Ave	5.90	S.D.	0.11	C.V.	1.8
Sample No. 72	Ave	6.34	S.D.	0.09	C.V.	1.4

Labs Eliminated: 28, 38, 53, 124, 413, 690

Labs off Diagram: 3297

CCRL Proficiency Sample Program
Sodium Oxide
BLENDED CEMENT Samples No. 71 and No. 72

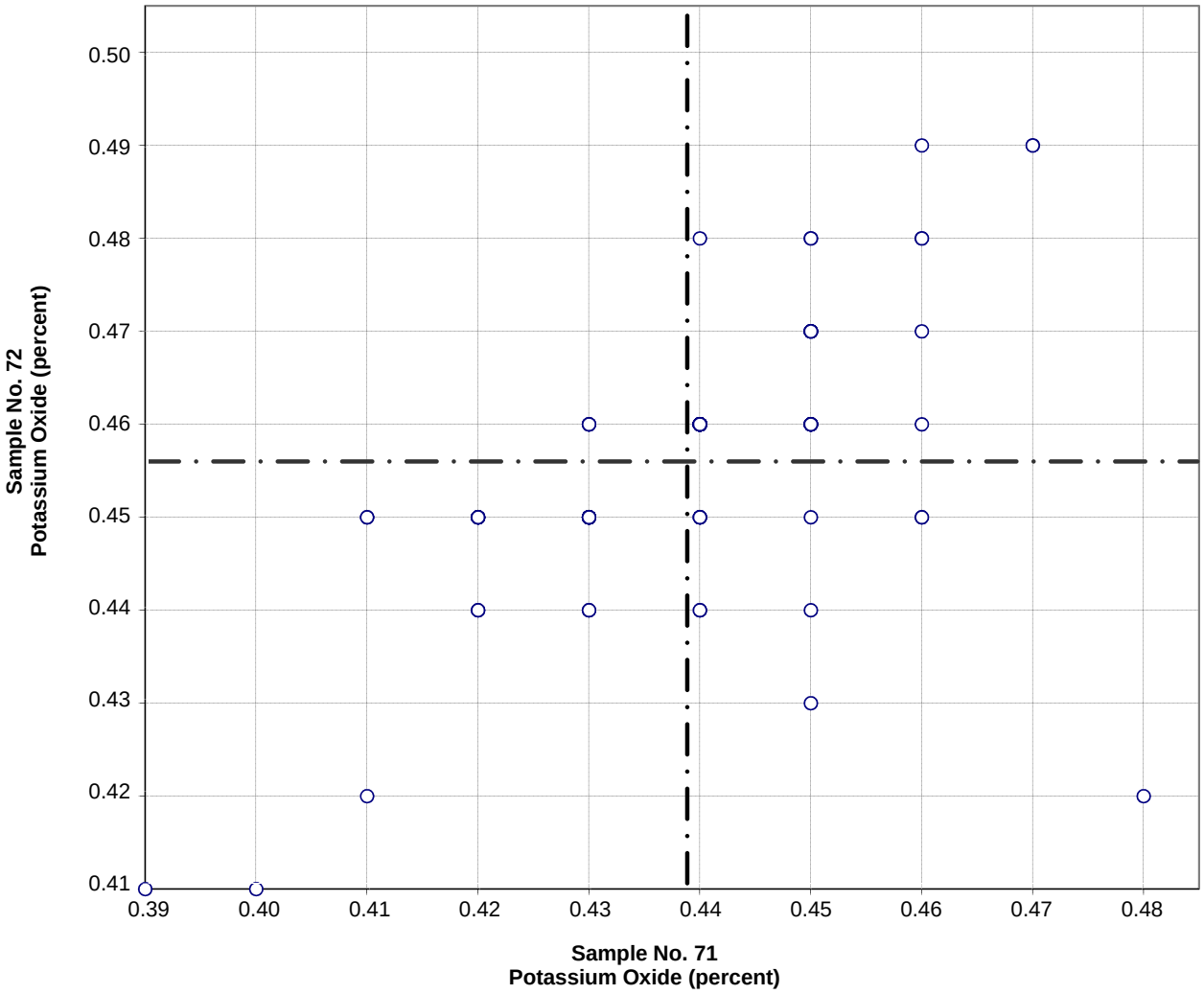


Test No. 90 Sodium Oxide 87 Points

Sample No. 71	Ave	0.165	S.D.	0.037	C.V.	23
Sample No. 72	Ave	0.067	S.D.	0.031	C.V.	46

Labs Eliminated: 50, 205, 2360, 2465, 3235

CCRL Proficiency Sample Program
Potassium Oxide
BLENDED CEMENT Samples No. 71 and No. 72

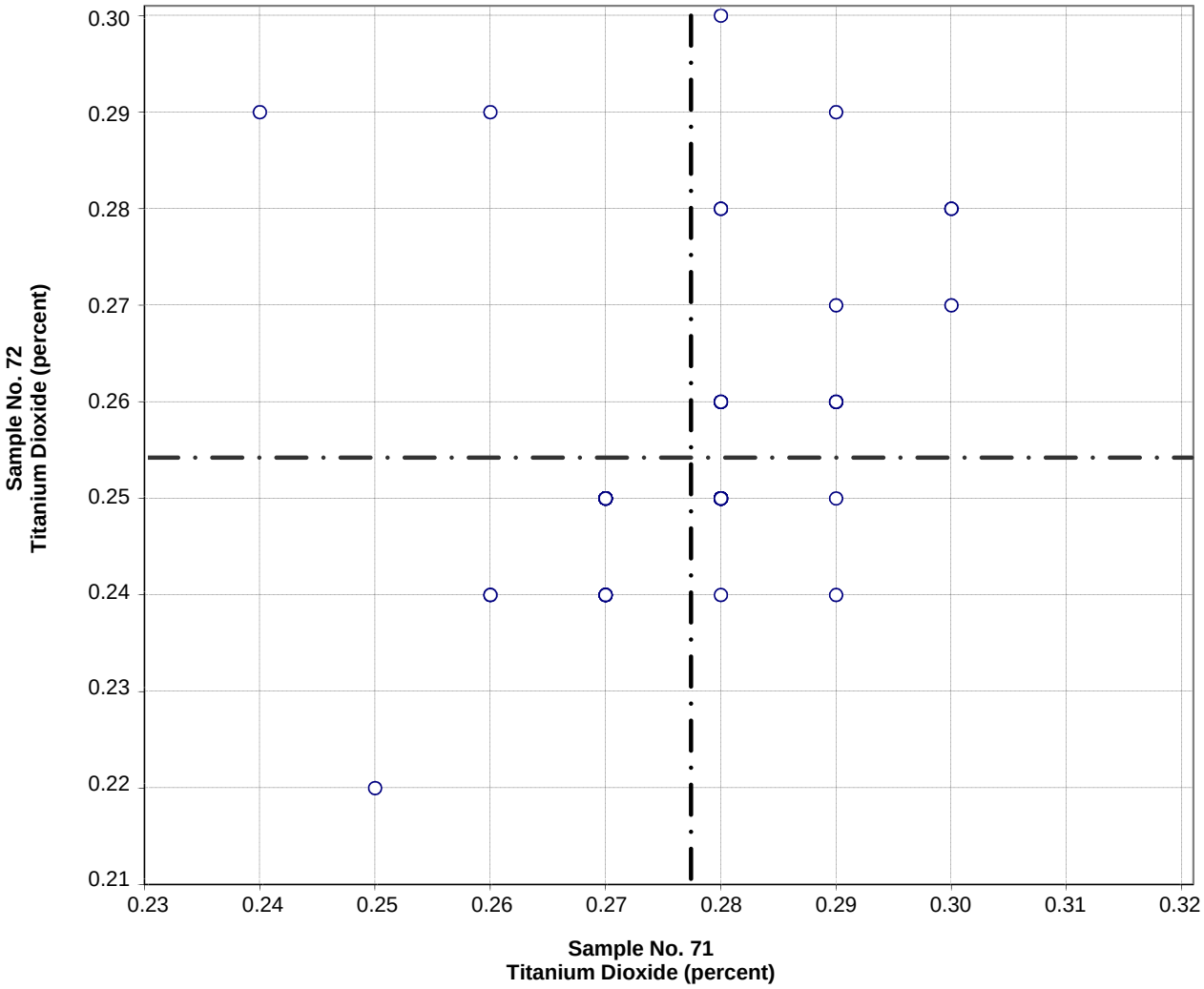


Test No. 100 Potassium Oxide 91 Points

Sample No. 71	Ave	0.44	S.D.	0.01	C.V.	3.4
Sample No. 72	Ave	0.46	S.D.	0.01	C.V.	3.2

Labs Eliminated: 50, 176, 840, 2360, 2465, 3297

CCRL Proficiency Sample Program
Titanium Dioxide
BLENDED CEMENT Samples No. 71 and No. 72

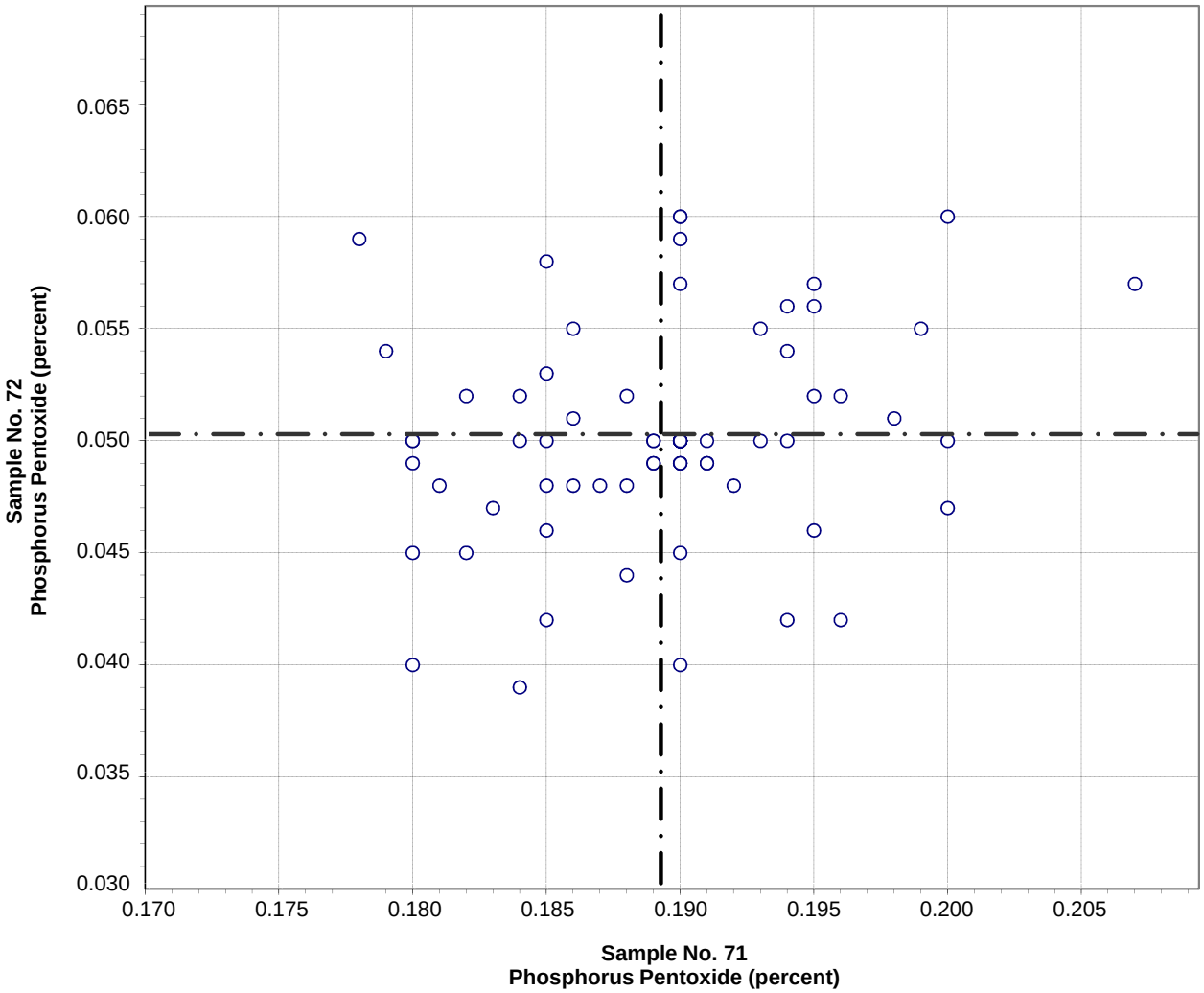


Test No. 103 Titanium Dioxide 79 Points

Sample No. 71	Ave	0.28	S.D.	0.010	C.V.	3.5
Sample No. 72	Ave	0.25	S.D.	0.013	C.V.	5.1

Labs Eliminated: 53, 148

CCRL Proficiency Sample Program
Phosphorus Pentoxide
BLENDED CEMENT Samples No. 71 and No. 72

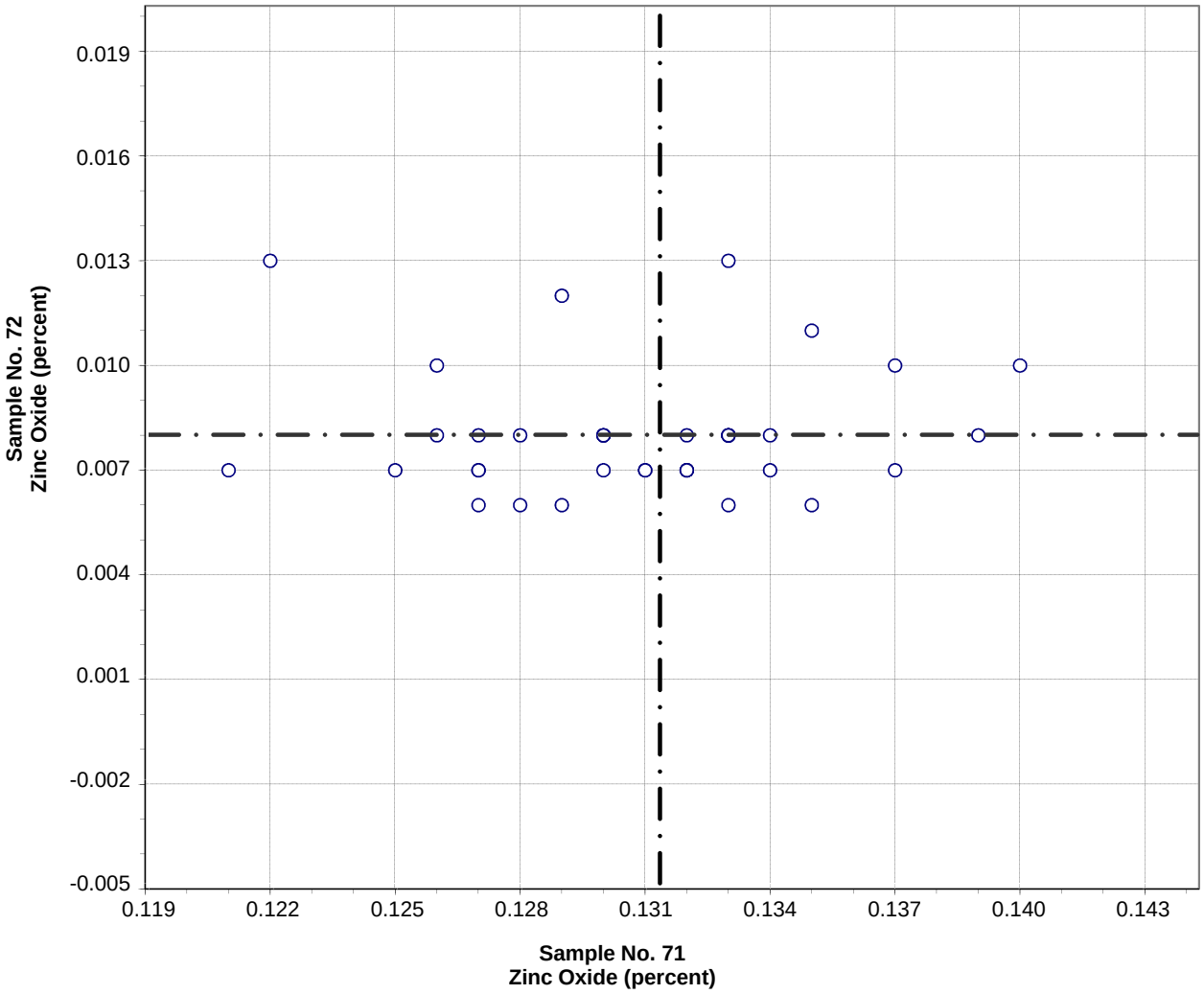


Test No. 102 Phosphorus Pentoxide 72 Points

Sample No. 71	Ave	0.189	S.D.	0.006	C.V.	3.0
Sample No. 72	Ave	0.050	S.D.	0.005	C.V.	9.4

Labs Eliminated: 34, 53, 124, 158, 205, 413, 2462, 2463, 2466, 3059, 3233, 3235

CCRL Proficiency Sample Program
Zinc Oxide
BLENDED CEMENT Samples No. 71 and No. 72



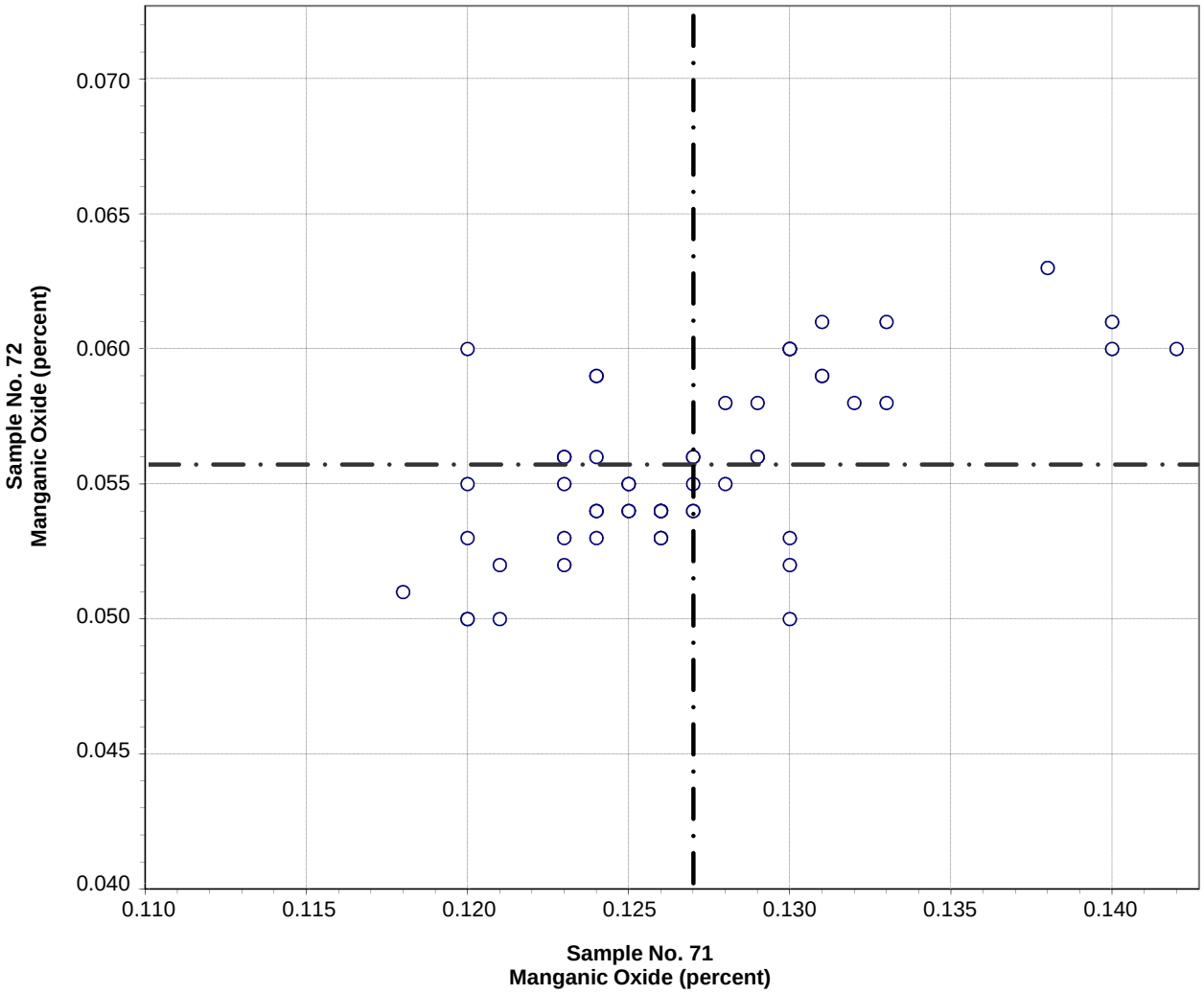
Test No. 99 Zinc Oxide 38 Points

Sample No. 71	Ave	0.131	S.D.	0.005	C.V.	3.9
Sample No. 72	Ave	0.008	S.D.	0.002	C.V.	22

Labs Eliminated: 148, 205

Labs off Diagram: 53

CCRL Proficiency Sample Program
Manganic Oxide
BLENDED CEMENT Samples No. 71 and No. 72

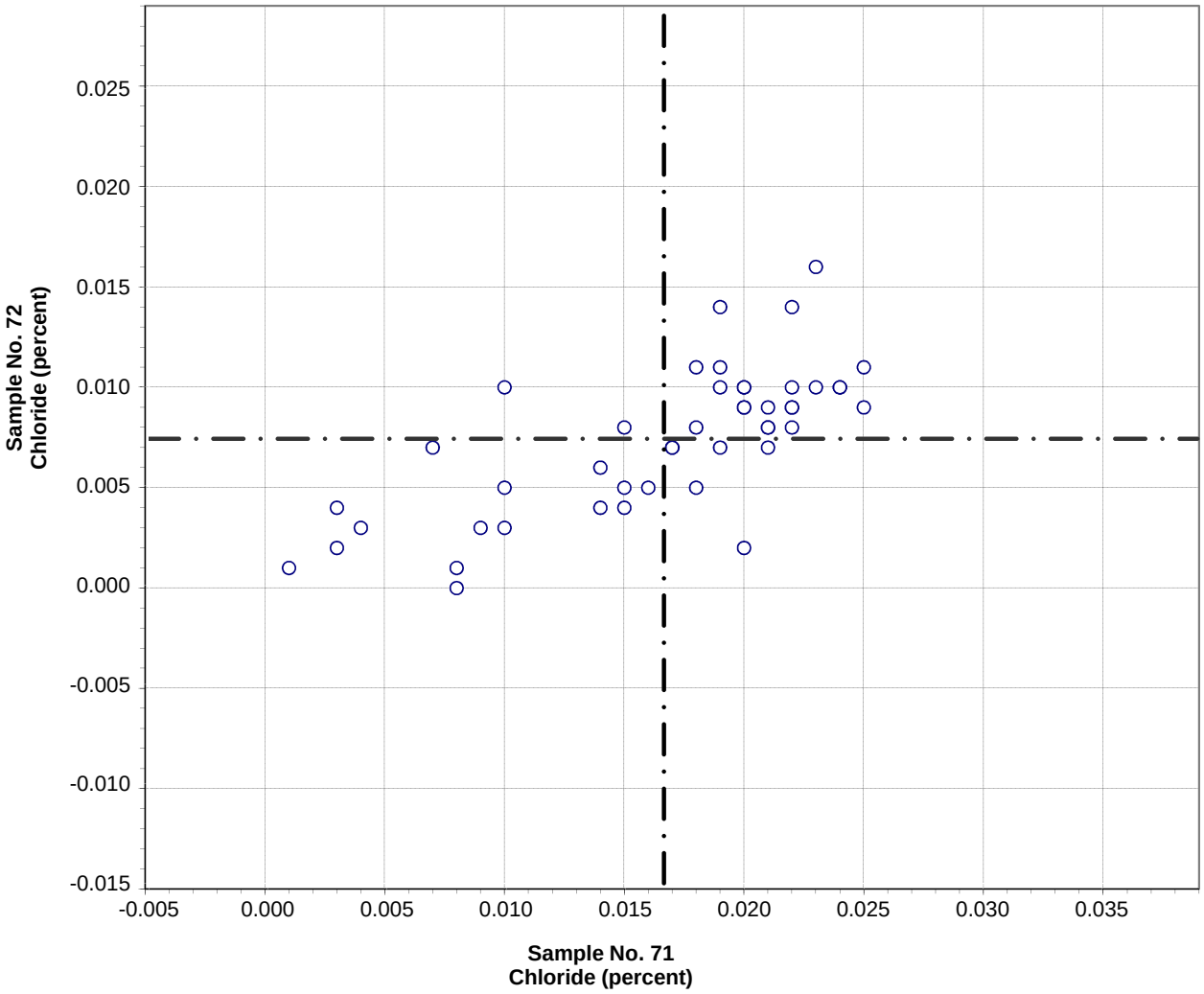


Test No. 101 Manganic Oxide 55 Points

Sample No. 71	Ave	0.127	S.D.	0.005	C.V.	4.1
Sample No. 72	Ave	0.056	S.D.	0.003	C.V.	5.9

Labs Eliminated: 3, 124, 148, 205, 413, 932, 2360, 2462, 2466

CCRL Proficiency Sample Program
Chloride
BLENDED CEMENT Samples No. 71 and No. 72

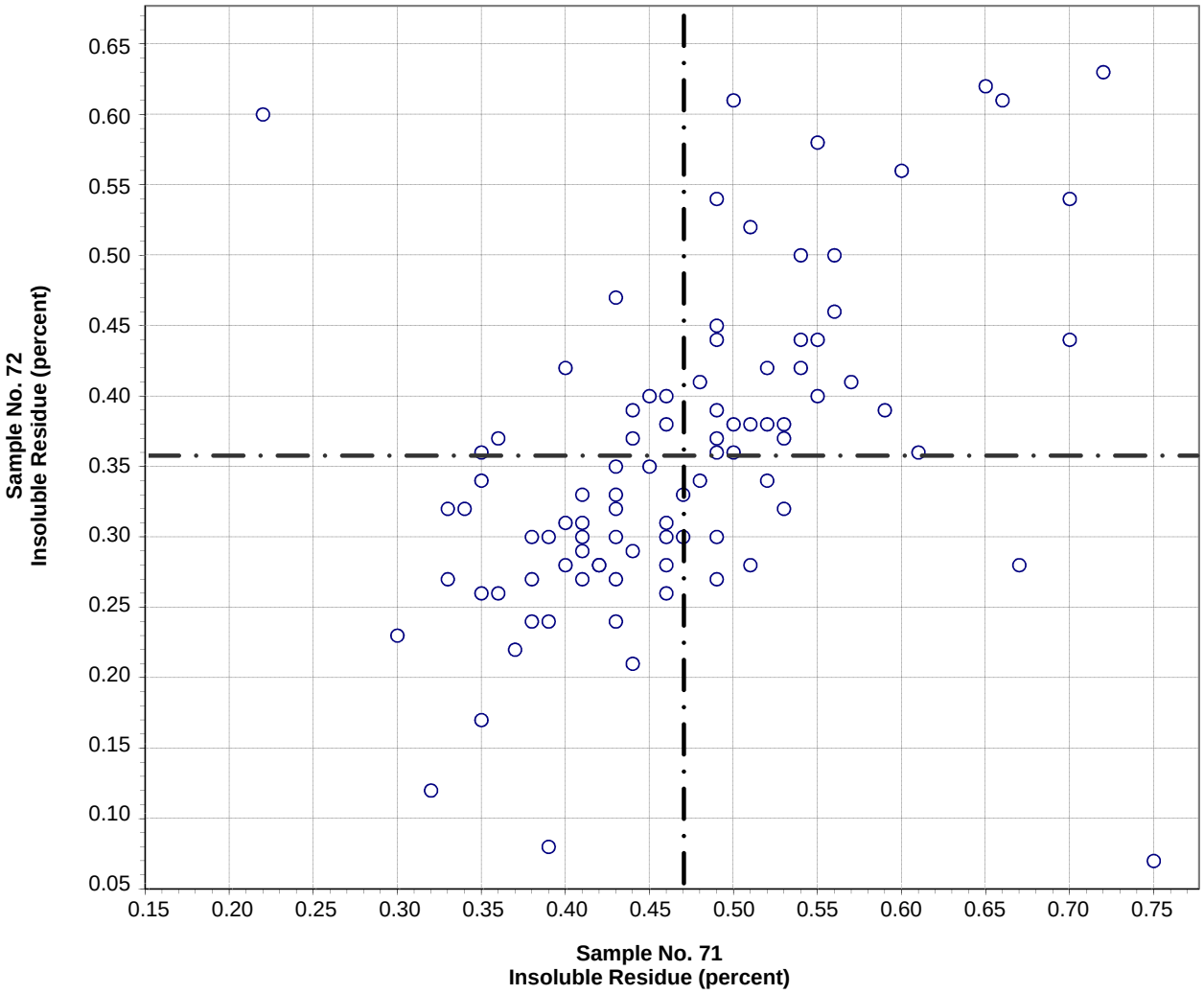


Test No. 104 Chloride 46 Points

Sample No. 71	Ave	0.017	S.D.	0.006	C.V.	39
Sample No. 72	Ave	0.007	S.D.	0.004	C.V.	49

Labs Eliminated: 1657

CCRL Proficiency Sample Program
Insoluble Residue
BLENDED CEMENT Samples No. 71 and No. 72

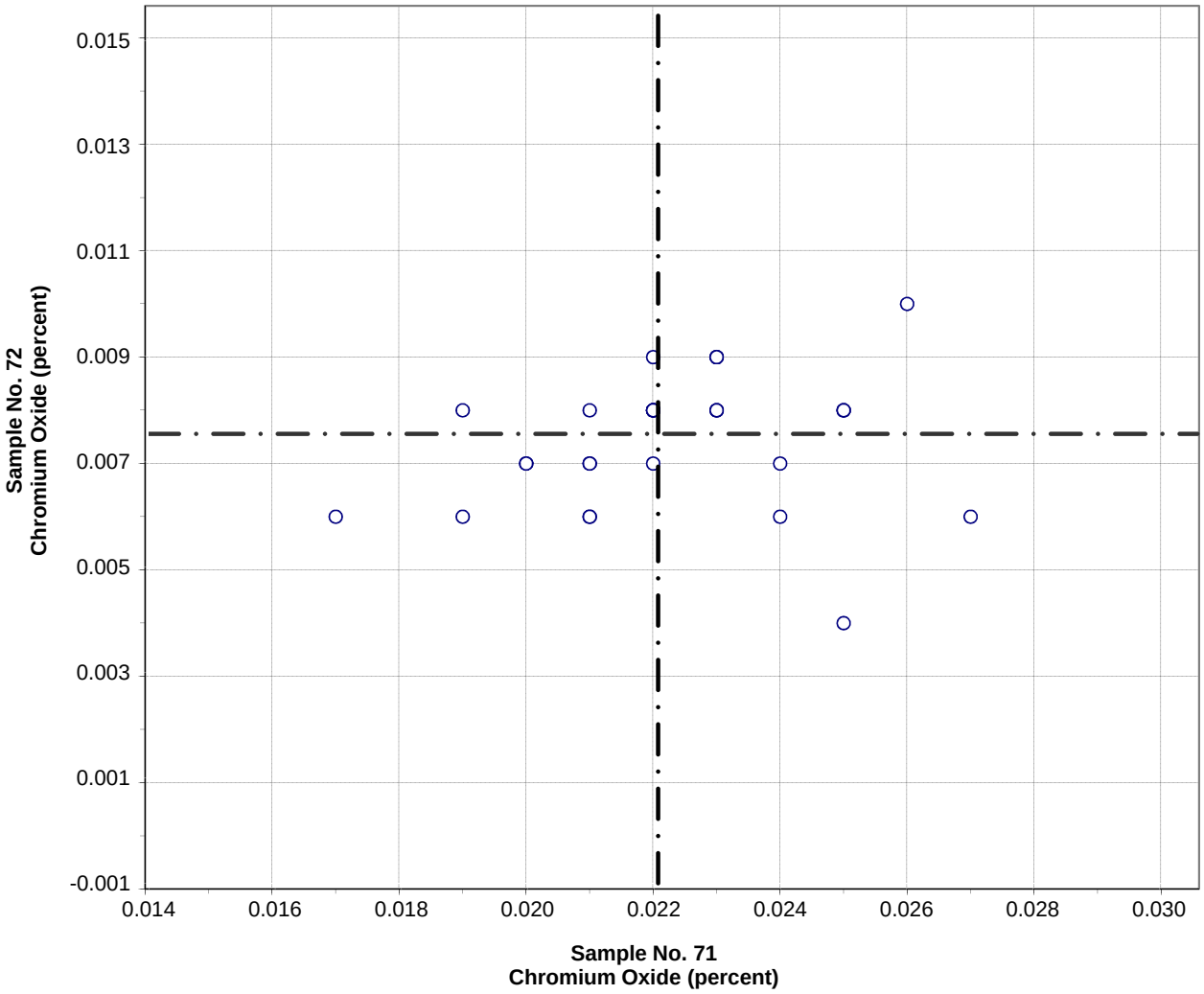


Test No. 80 Insoluble Residue 91 Points

Sample No. 71	Ave	0.47	S.D.	0.10	C.V. 21
Sample No. 72	Ave	0.36	S.D.	0.11	C.V. 32

Labs Eliminated: 24, 36, 181, 2360, 3233

CCRL Proficiency Sample Program
Chromium Oxide
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 105 Chromium Oxide 31 Points

Sample No. 71	Ave	0.022	S.D.	0.003	C.V. 12
Sample No. 72	Ave	0.008	S.D.	0.001	C.V. 17

Labs Eliminated: 24, 34, 148, 205, 2462

Labs off Diagram: 10

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Physical Results
May 1, 2013

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.71 Average	S.D.	C.V.	Sample No. 72 Average	S.D.	C.V.
Normal Consistency - Water (**percent**)							
	111	26.5	2.6	9.8	26.4	2.6	9.7
	*107	26.8	0.6	2.3	26.7	0.5	1.8
* Labs Eliminated - 38, 1455, 3247, 3504							
Vicat Time of Set - Initial (**min**)							
	110	138	17	13	109	22	20
	*107	138	16	12	107	13	13
* Labs Eliminated - 181, 207, 1455							
Vicat Time of Set - Final (**min**)							
	103	244	34	14	202	25	12
	*102	245	32	13	202	25	12
* Labs Eliminated - 207							
Autoclave Expansion (**percent**)							
	100	-0.04	0.04	-121	0.03	0.04	136
	*90	-0.04	0.03	76	0.03	0.01	46
* Labs Eliminated - 1, 39, 43, 126, 148, 982, 2490, 3059, 3503, 3504							
Air Content % (**percent**)							
	90	8.6	1.3	15	5.7	1.3	23
	*86	8.5	1.1	12	5.6	1.0	19
* Labs Eliminated - 1, 39, 3245, 3297							
Air Content - Water (**percent**)							
	91	68.6	8.2	12.0	69.3	8.3	12.0
	*88	69.9	2.2	3.2	70.6	2.3	3.3
* Labs Eliminated - 3059, 3503, 3504							
Air Content - Flow (**percent**)							
	91	89	5.5	6.2	87	4.8	5.5
	*87	88	3.7	4.2	86	3.1	3.6
* Labs Eliminated - 158, 691, 3059, 3504							

CCRL PROFICIENCY SAMPLE PROGRAM

Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Physical Results
May 1, 2013

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.71 Average	S.D.	C.V.	Sample No. 72 Average	S.D.	C.V.
Specific Gravity							
	90	3.09	0.08	2.5	3.08	0.09	2.8
	*83	3.10	0.03	1.0	3.10	0.03	1.1
* Labs Eliminated - 7, 9, 37, 40, 125, 1956, 3503							
Compressive Strength - 3 day (psi)							
	114	4025	303	7.5	4585	362	7.9
	*113	4037	276	6.8	4595	348	7.6
* Labs Eliminated - 958							
Compressive Strength - 7 day (psi)							
	114	4973	387	7.8	5562	425	7.6
	*110	4986	340	6.8	5592	370	6.6
* Labs Eliminated - 38, 39, 51, 619							
Compressive Strength - 28 day (psi)							
	106	6228	456	7.3	6652	456	6.9
	*104	6225	449	7.2	6652	413	6.2
* Labs Eliminated - 9, 3431							
Compressive Strength - Water (percent)							
	110	49.3	4.8	9.8	49.4	4.9	10.0
	*104	48.7	1.1	2.3	48.8	1.3	2.6
* Labs Eliminated - 9, 39, 74, 309, 691, 840							
Compressive Strength - Flow (percent)							
	111	109	4.6	4.2	109	4.7	4.3
	*103	110	2.5	2.3	110	2.5	2.3
* Labs Eliminated - 34, 40, 47, 125, 180, 413, 691, 958							

CCRL PROFICIENCY SAMPLE PROGRAM

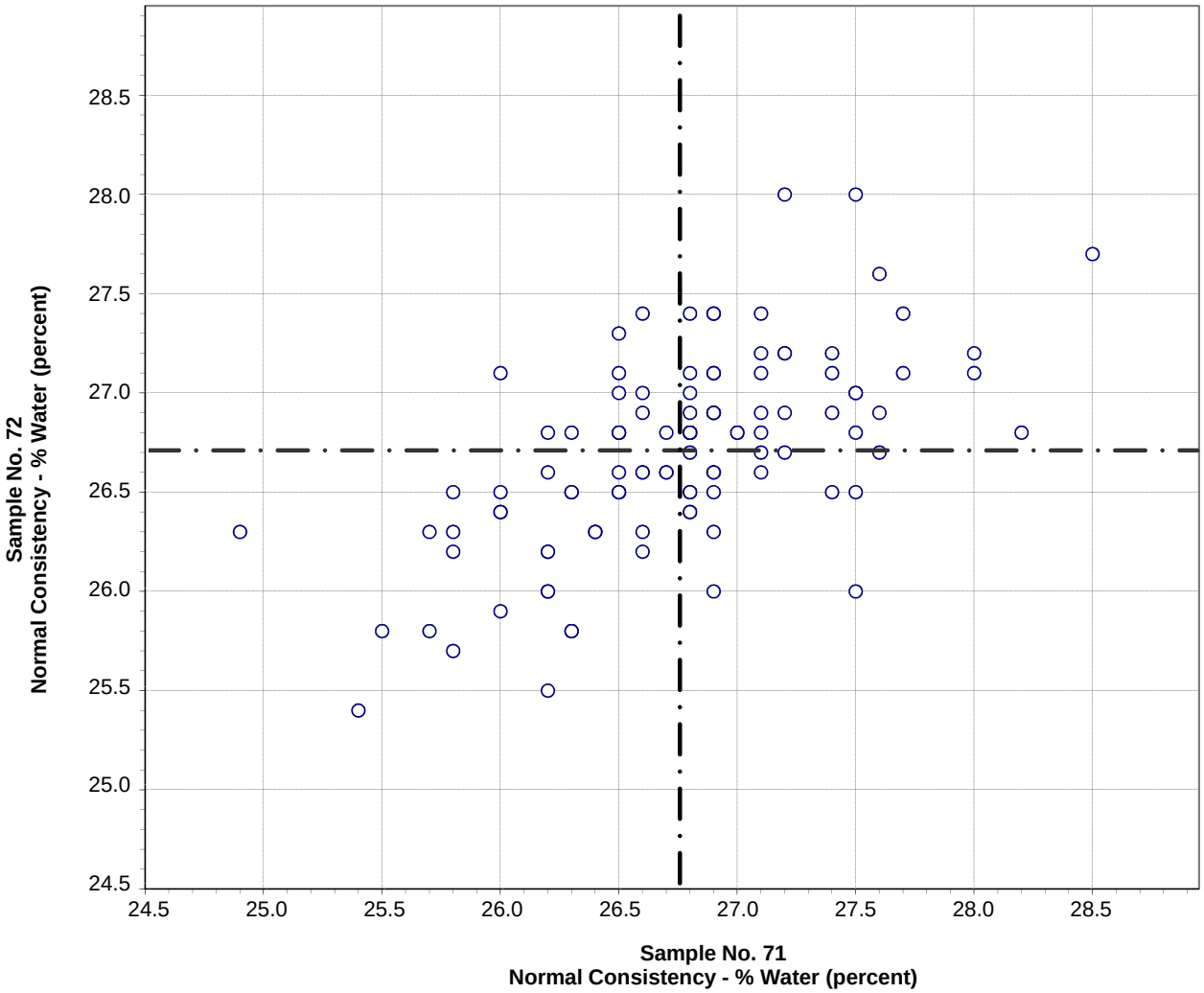
Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Physical Results
May 1, 2013

SUMMARY OF RESULTS

		Sample No.71			Sample No. 72		
Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Fineness - Air Permeability (**cm²/g**)							
	106	4961	334	6.7	5979	430	7.2
	*98	4975	197	4.0	6050	262	4.3
* Labs Eliminated - 46, 51, 105, 354, 1956, 2975, 3247, 3707							
Fineness - 45µm % Passing (**percent**)							
	108	97.82	0.58	0.60	99.35	0.47	0.48
	*101	97.90	0.36	0.37	99.43	0.17	0.17
* Labs Eliminated - 9, 20, 47, 148, 413, 840, 3707							

CCRL Proficiency Sample Program
Normal Consistency - % Water
BLENDED CEMENT Samples No. 71 and No. 72

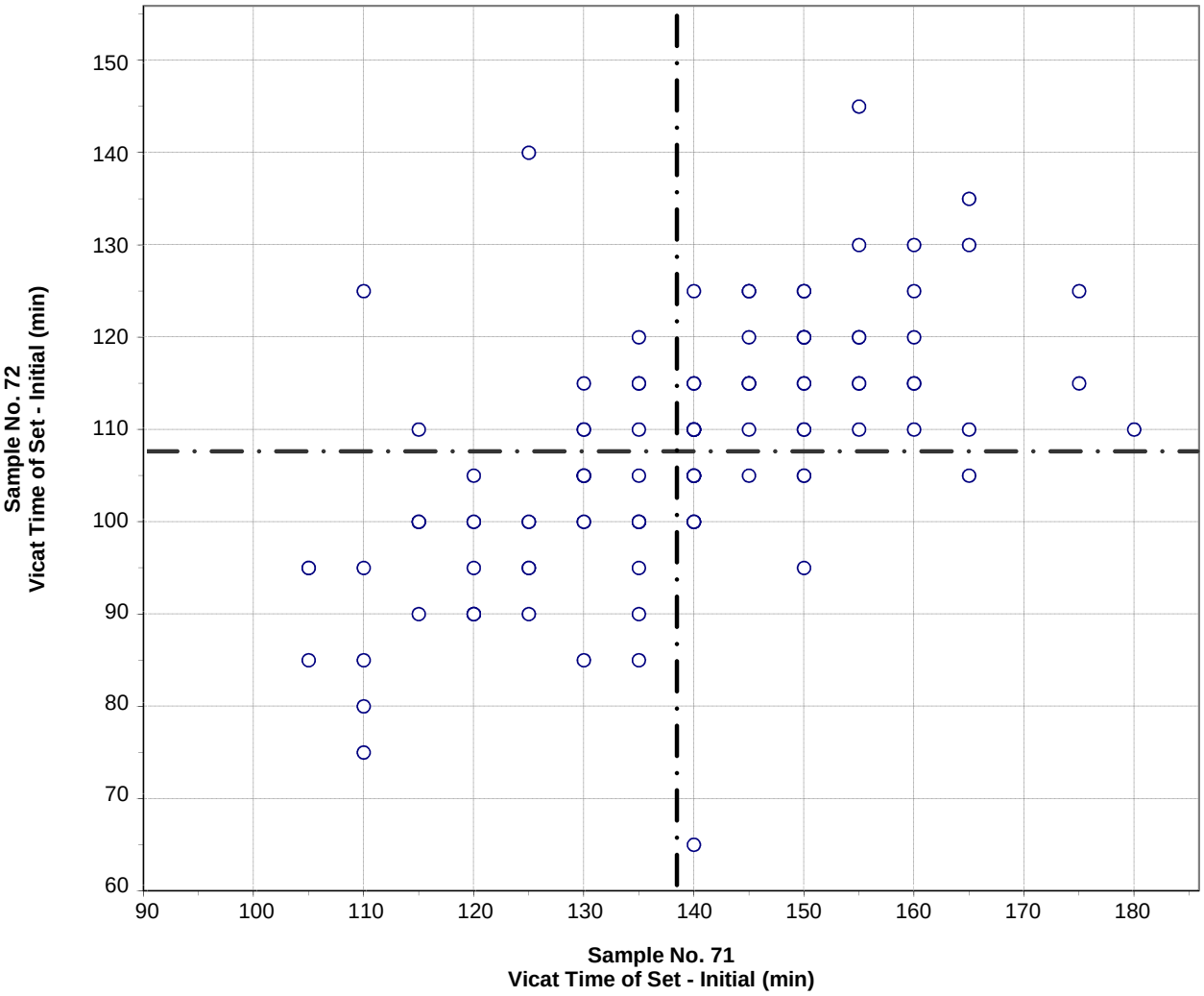


Test No. 110 Normal Consistency - % Water 107 Points

Sample No. 71	Ave	26.8	S.D.	0.6	C.V. 2.3
Sample No. 72	Ave	26.7	S.D.	0.5	C.V. 1.8

Labs Eliminated: 38, 1455, 3247, 3504

CCRL Proficiency Sample Program
Vicat Time of Set - Initial
BLENDED CEMENT Samples No. 71 and No. 72

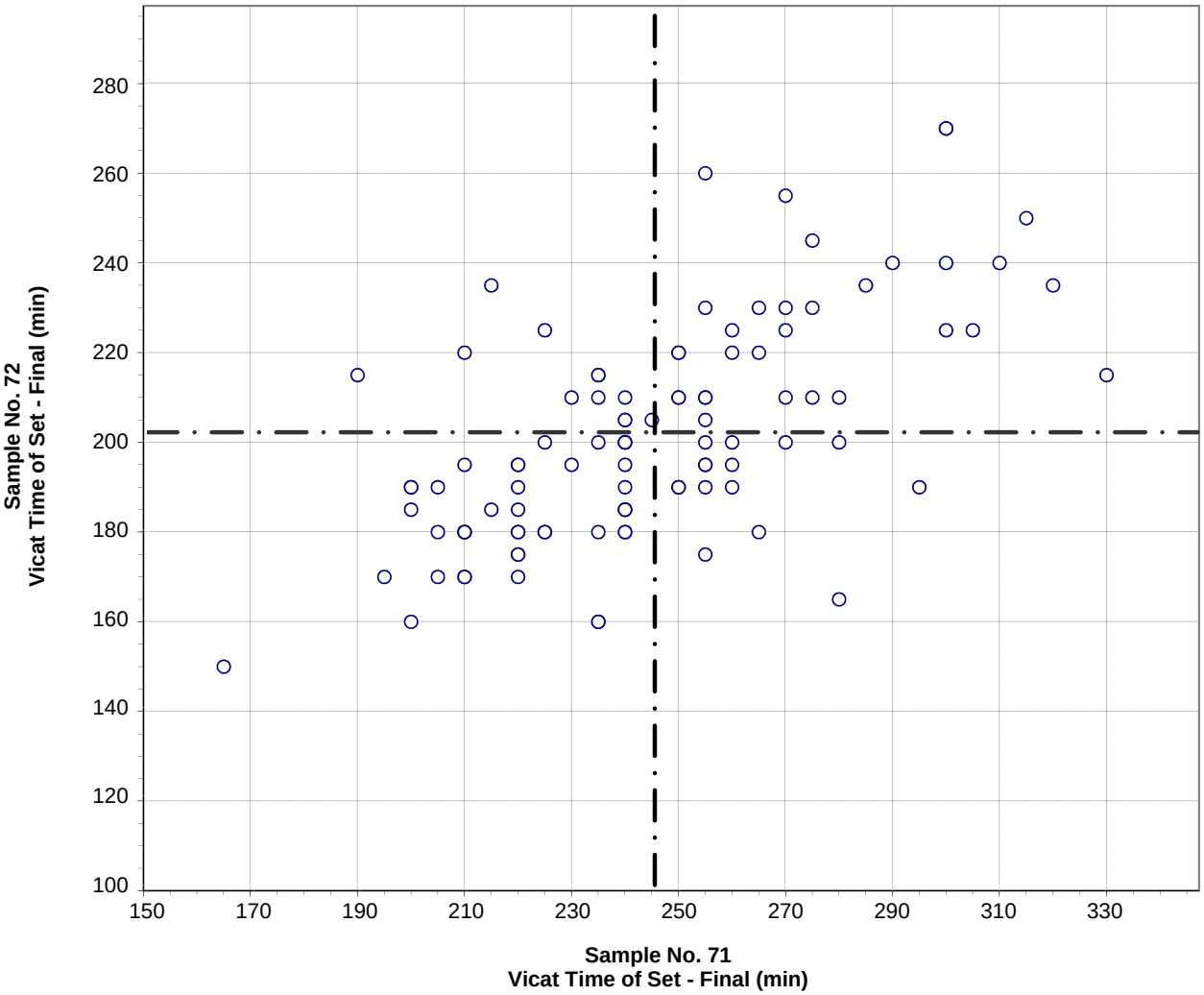


Test No. 120 Vicat Time of Set - Initial 107 Points

Sample No. 71	Ave	138	S.D.	16	C.V. 12
Sample No. 72	Ave	107	S.D.	13	C.V. 13

Labs Eliminated: 181, 207, 1455

CCRL Proficiency Sample Program
Vicat Time of Set - Final
BLENDED CEMENT Samples No. 71 and No. 72

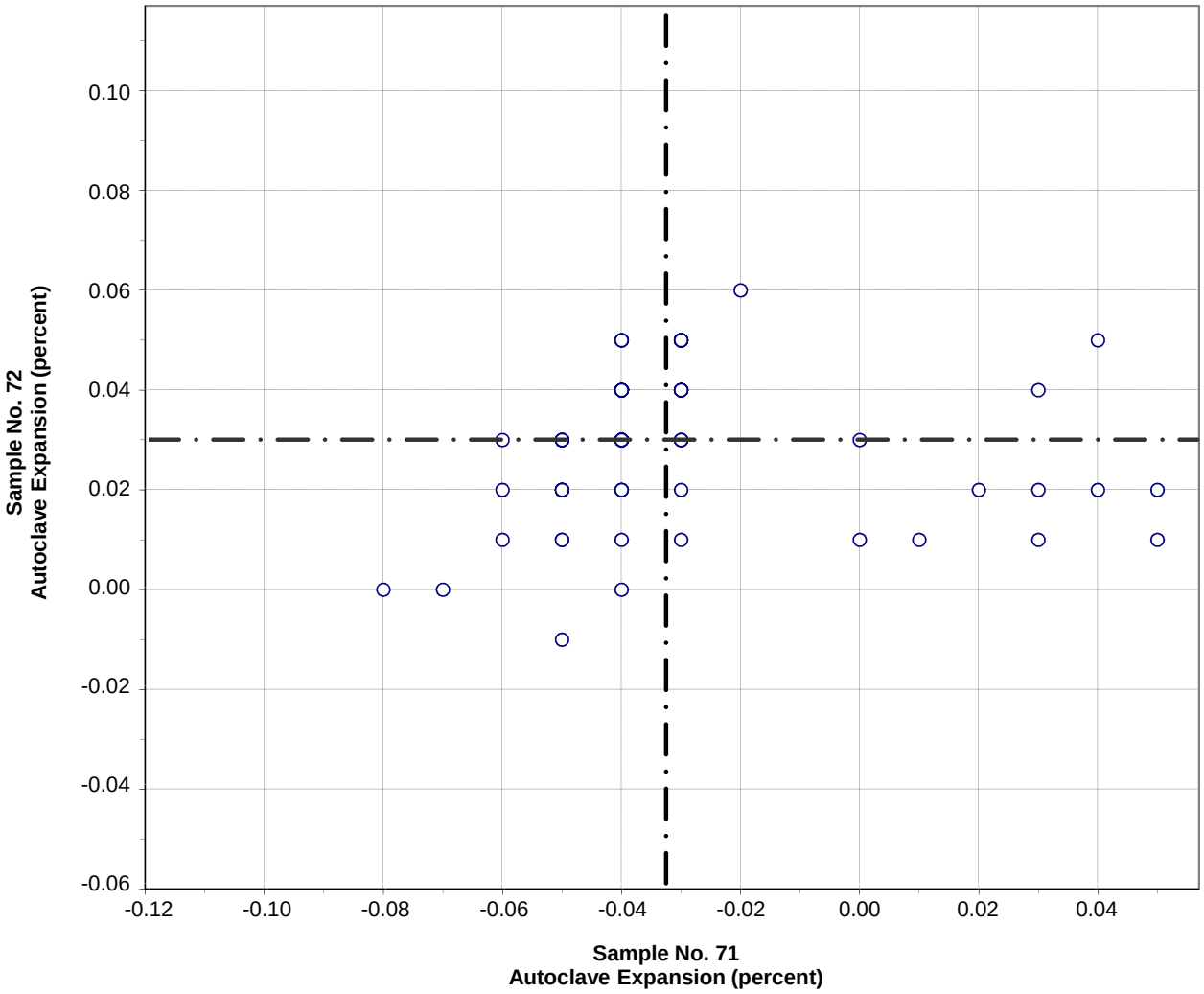


Test No. 121 Vicat Time of Set - Final 102 Points

Sample No. 71	Ave	245	S.D.	32	C.V. 13
Sample No. 72	Ave	202	S.D.	25	C.V. 12

Labs Eliminated: 207

CCRL Proficiency Sample Program
Autoclave Expansion
BLENDED CEMENT Samples No. 71 and No. 72

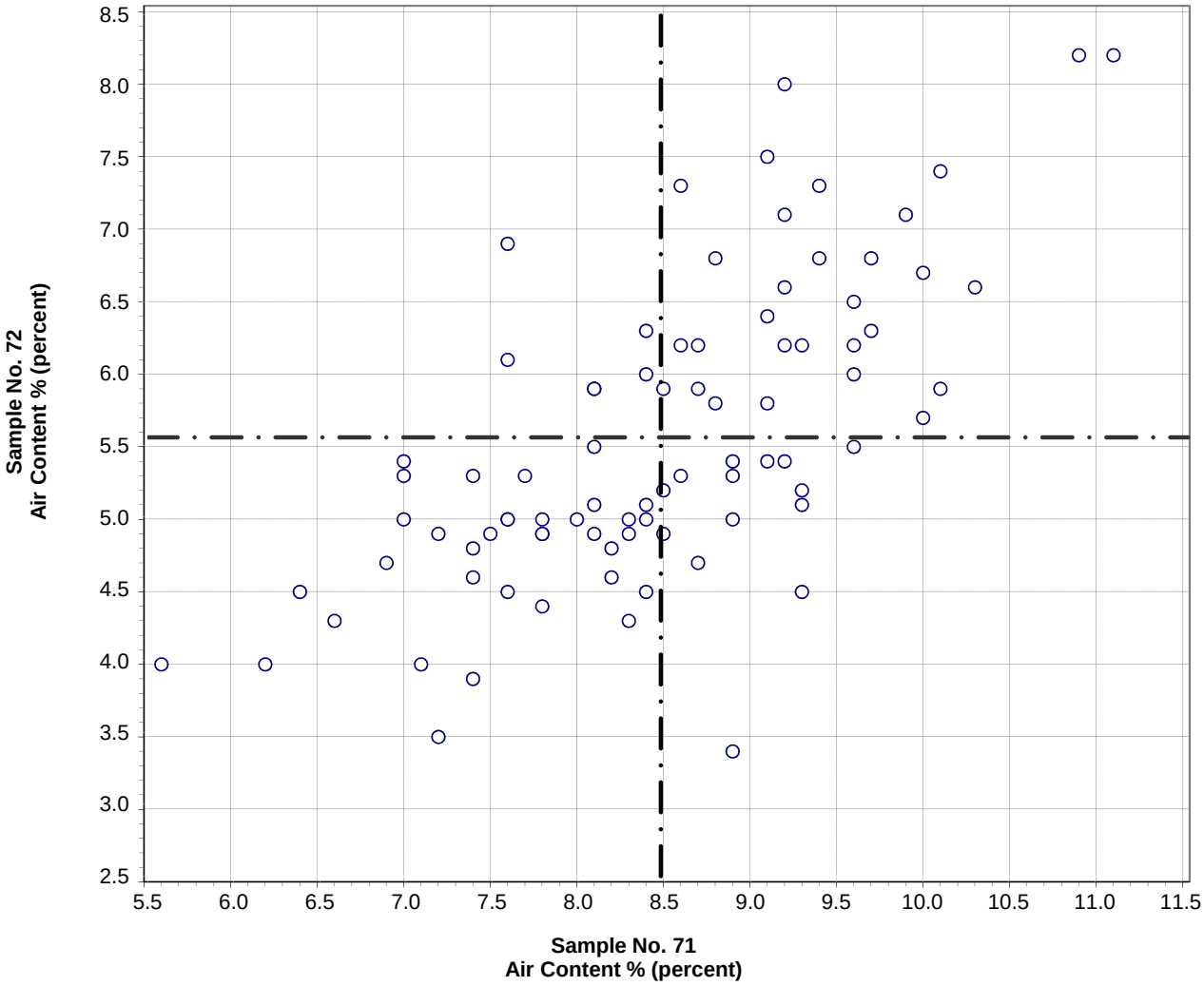


Test No. 160 Autoclave Expansion 90 Points

Sample No. 71 Ave -0.04 S.D. 0.03 C.V. 76
Sample No. 72 Ave 0.03 S.D. 0.01 C.V. 46

Labs Eliminated: 1, 39, 43, 126, 148, 982, 2490, 3059, 3503, 3504

CCRL Proficiency Sample Program
Air Content %
BLENDED CEMENT Samples No. 71 and No. 72

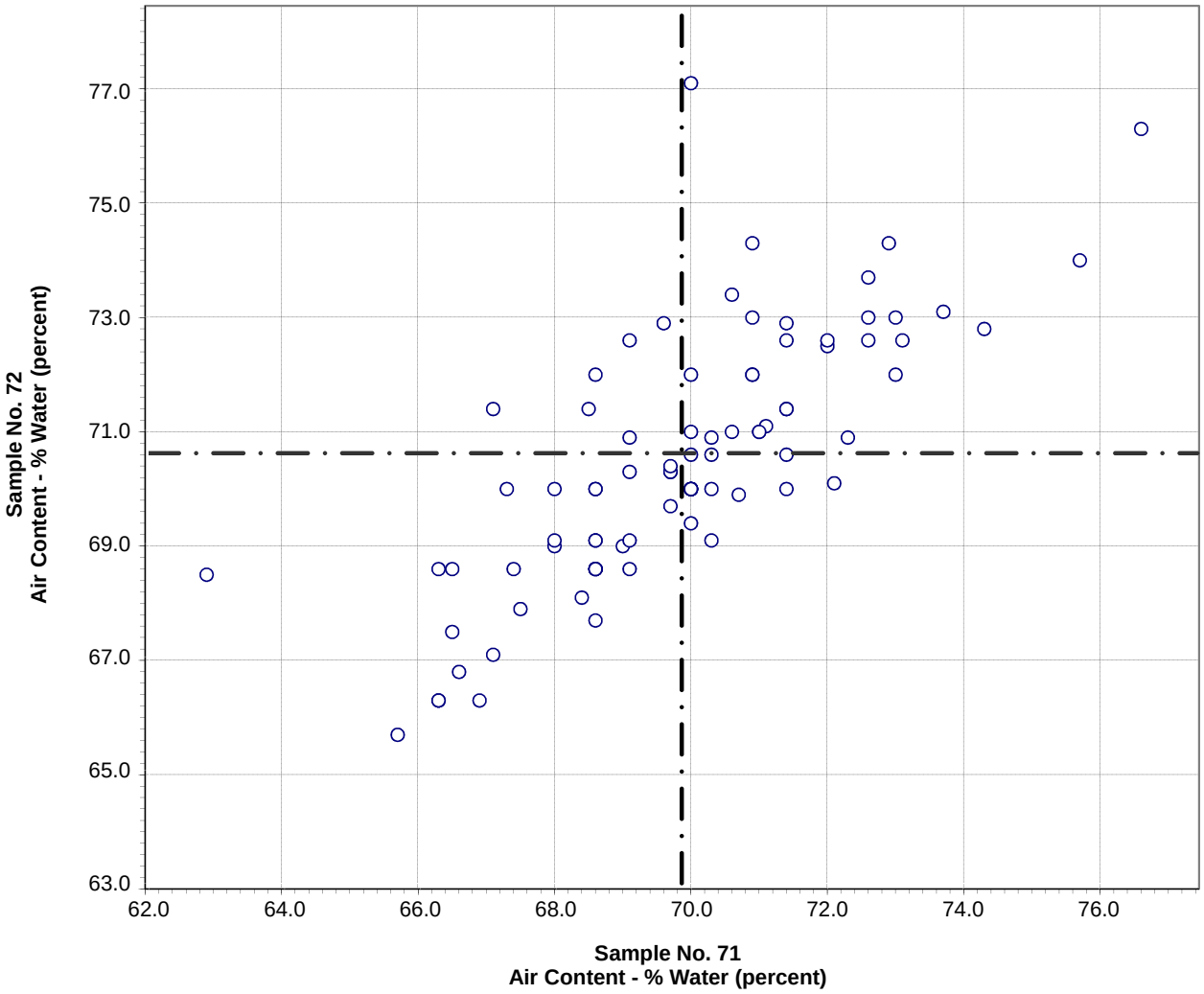


Test No. 170 Air Content % 86 Points

Sample No. 71	Ave	8.5	S.D.	1.1	C.V. 12
Sample No. 72	Ave	5.6	S.D.	1.0	C.V. 19

Labs Eliminated: 1, 39, 3245, 3297

CCRL Proficiency Sample Program
Air Content - % Water
BLENDED CEMENT Samples No. 71 and No. 72



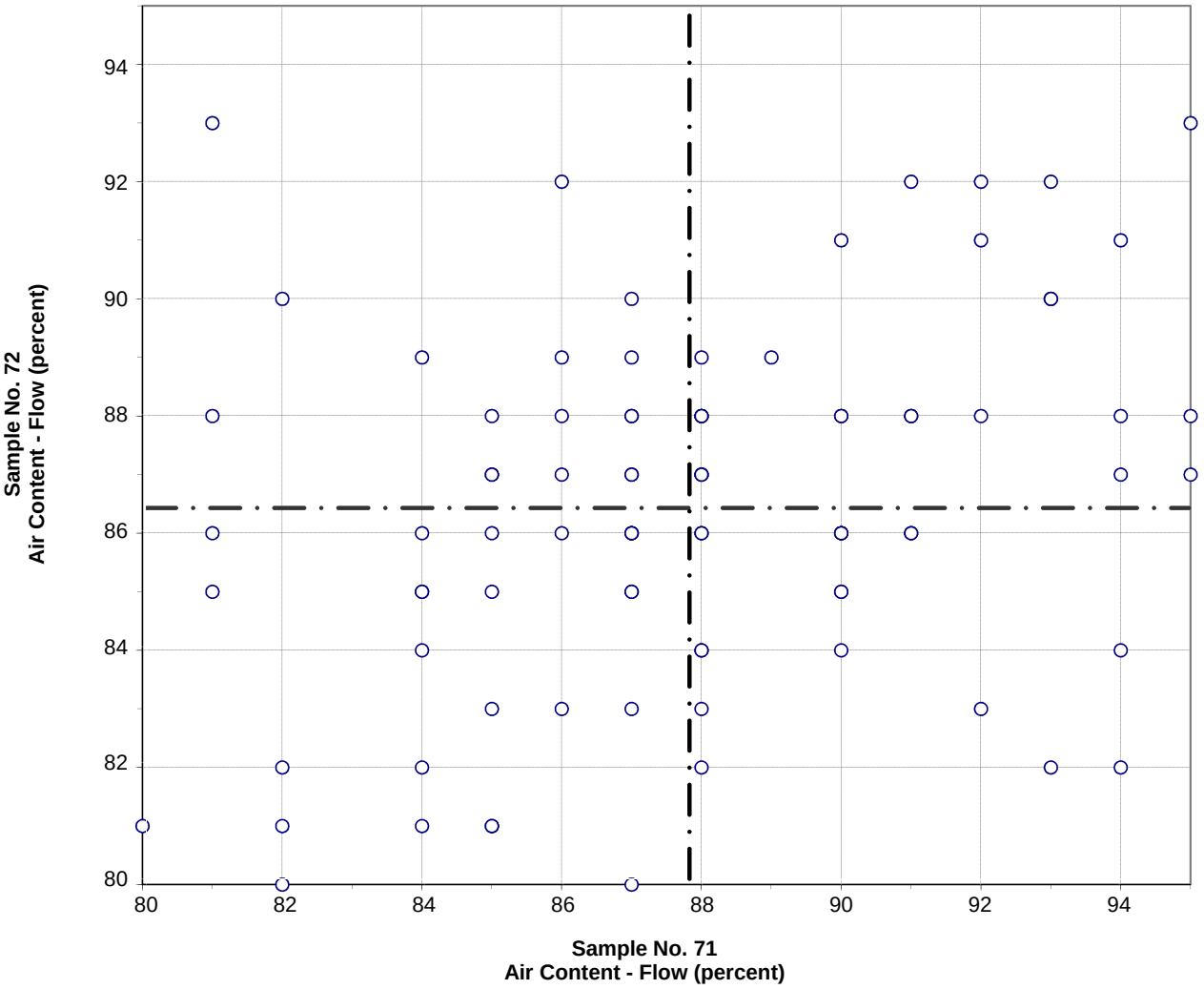
Test No. 180 Air Content - % Water 87 Points

Sample No. 71	Ave	69.9	S.D.	2.2	C.V. 3.2
Sample No. 72	Ave	70.6	S.D.	2.3	C.V. 3.3

Labs Eliminated: 3059, 3503, 3504

Labs off Diagram: 25

CCRL Proficiency Sample Program
Air Content - Flow
BLENDED CEMENT Samples No. 71 and No. 72

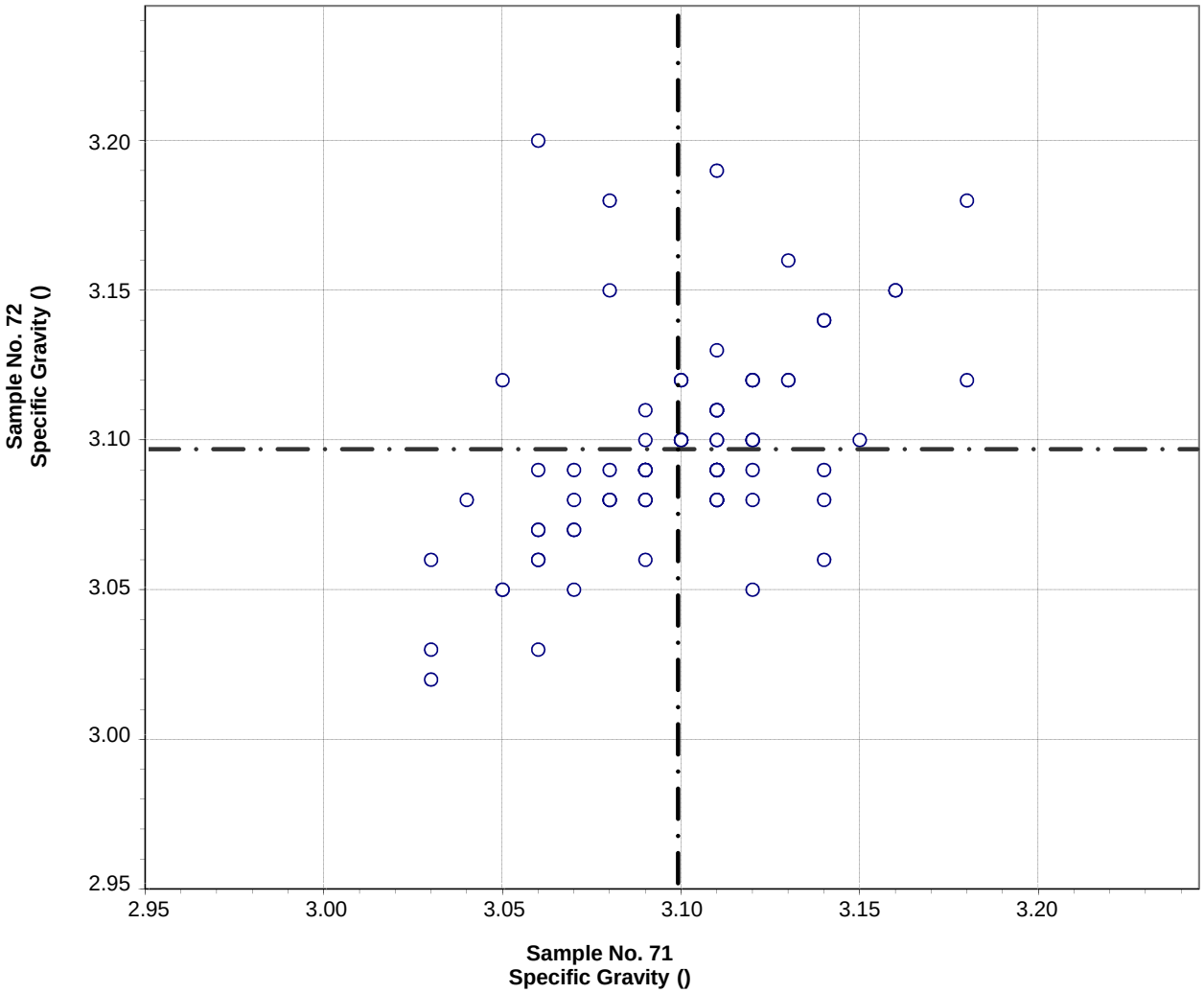


Test No. 190 Air Content - Flow 87 Points

Sample No. 71	Ave	88	S.D.	3.7	C.V. 4.2
Sample No. 72	Ave	86	S.D.	3.1	C.V. 3.6

Labs Eliminated: 158, 691, 3059, 3504

CCRL Proficiency Sample Program
Specific Gravity
BLENDED CEMENT Samples No. 71 and No. 72

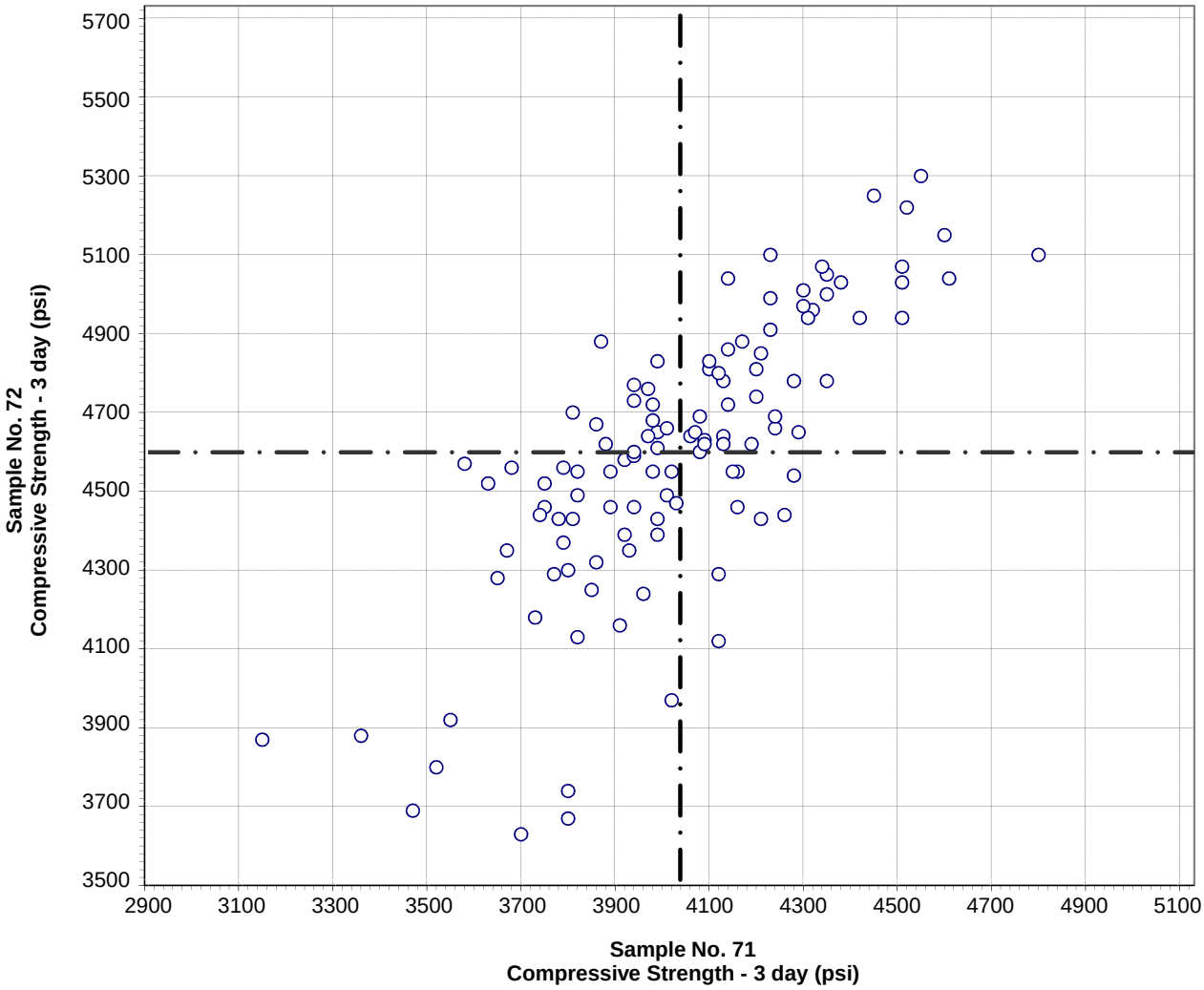


Test No. 310 Specific Gravity 83 Points

Sample No. 71	Ave	3.10	S.D.	0.03	C.V.	1.0
Sample No. 72	Ave	3.10	S.D.	0.03	C.V.	1.1

Labs Eliminated: 7, 9, 37, 40, 125, 1956, 3503

CCRL Proficiency Sample Program
Compressive Strength - 3 day
BLENDED CEMENT Samples No. 71 and No. 72

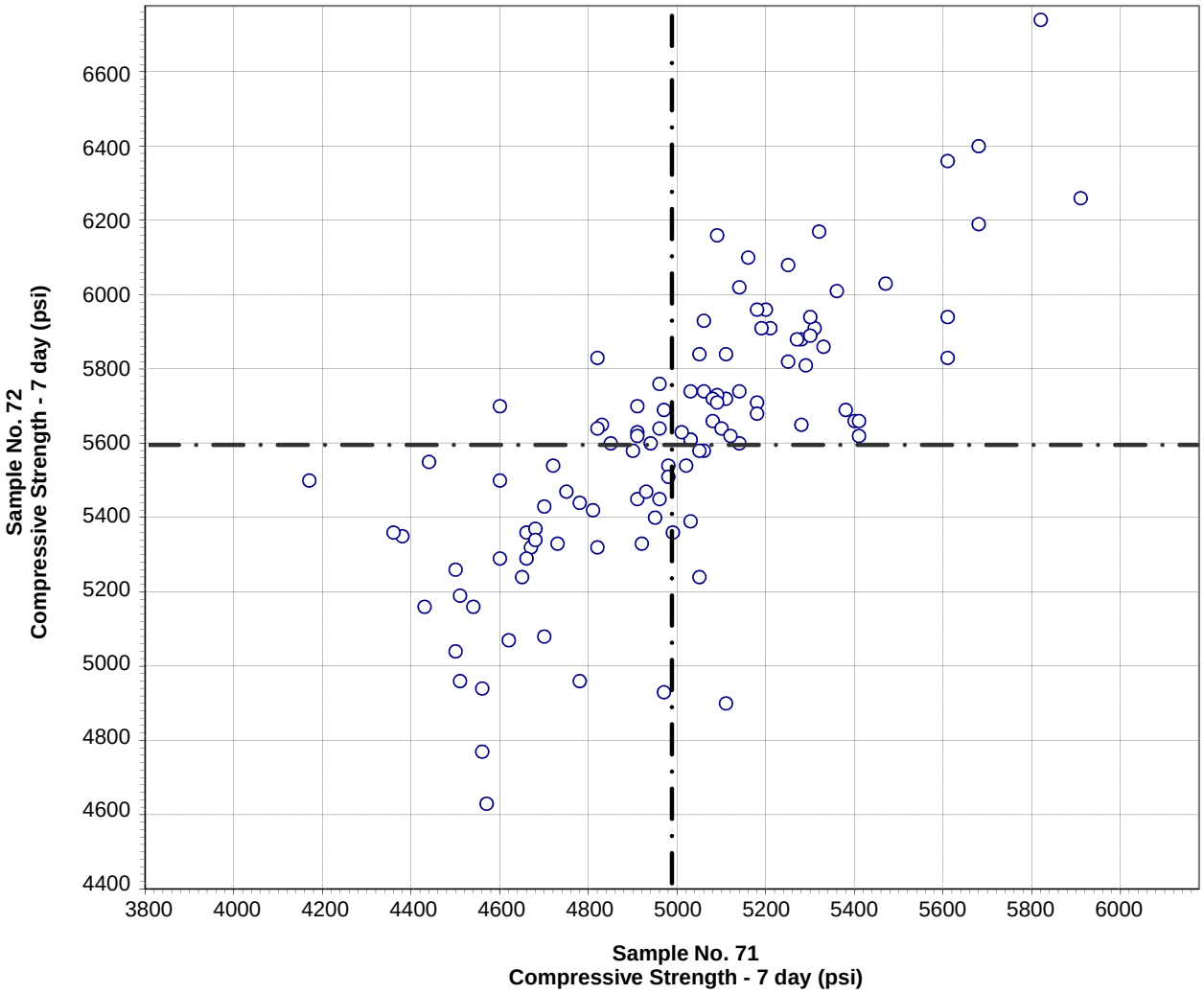


Test No. 200 Compressive Strength - 3 day 113 Points

Sample No. 71	Ave	4037	S.D.	276	C.V.	6.8
Sample No. 72	Ave	4595	S.D.	348	C.V.	7.6

Labs Eliminated: 958

CCRL Proficiency Sample Program
Compressive Strength - 7 day
BLENDED CEMENT Samples No. 71 and No. 72



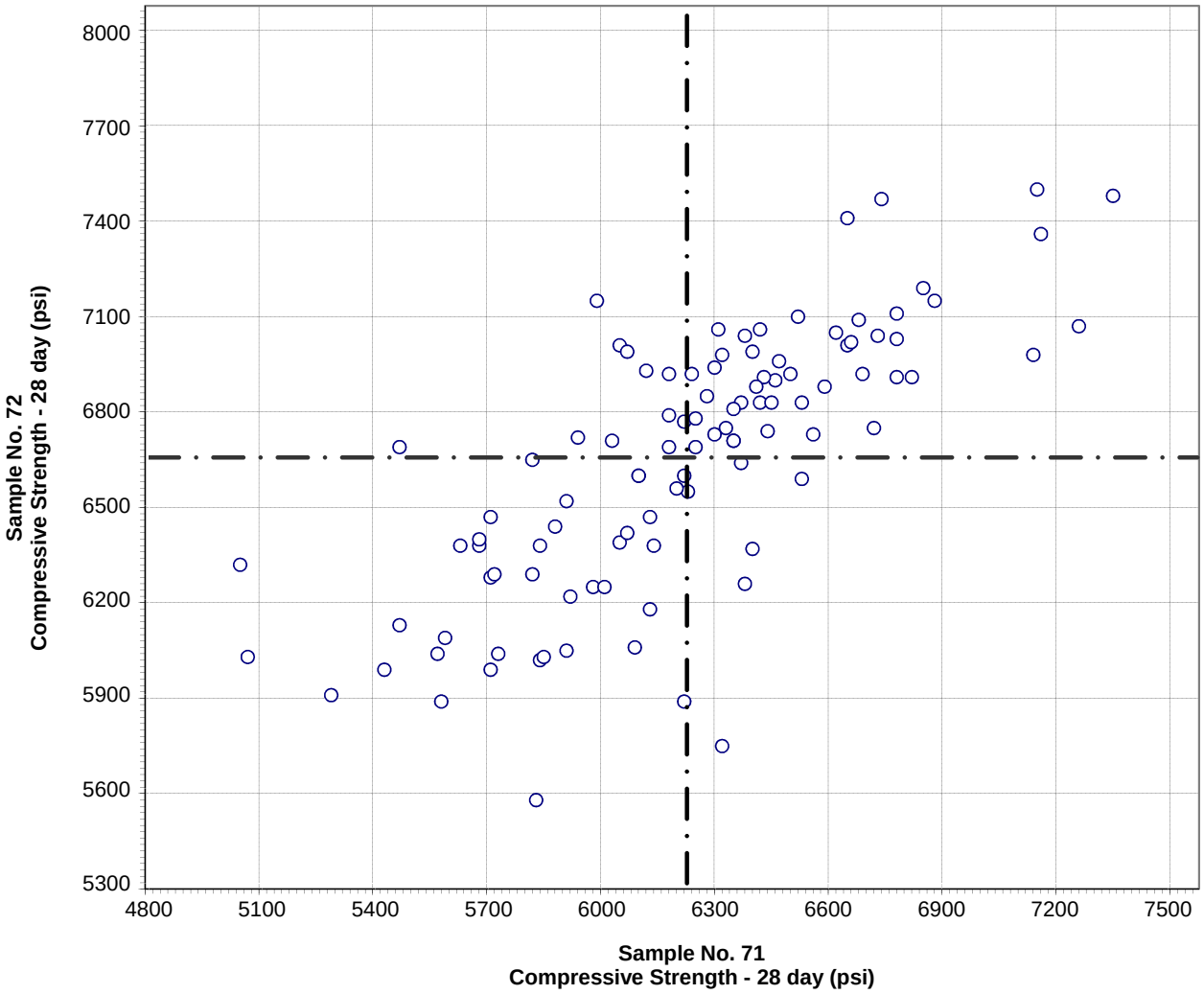
Test No. 210 Compressive Strength - 7 day 109 Points

Sample No. 71	Ave	4986	S.D.	340	C.V. 6.8
Sample No. 72	Ave	5592	S.D.	370	C.V. 6.6

Labs Eliminated: 38, 39, 51, 619

Labs off Diagram: 9

CCRL Proficiency Sample Program
Compressive Strength - 28 day
BLENDED CEMENT Samples No. 71 and No. 72

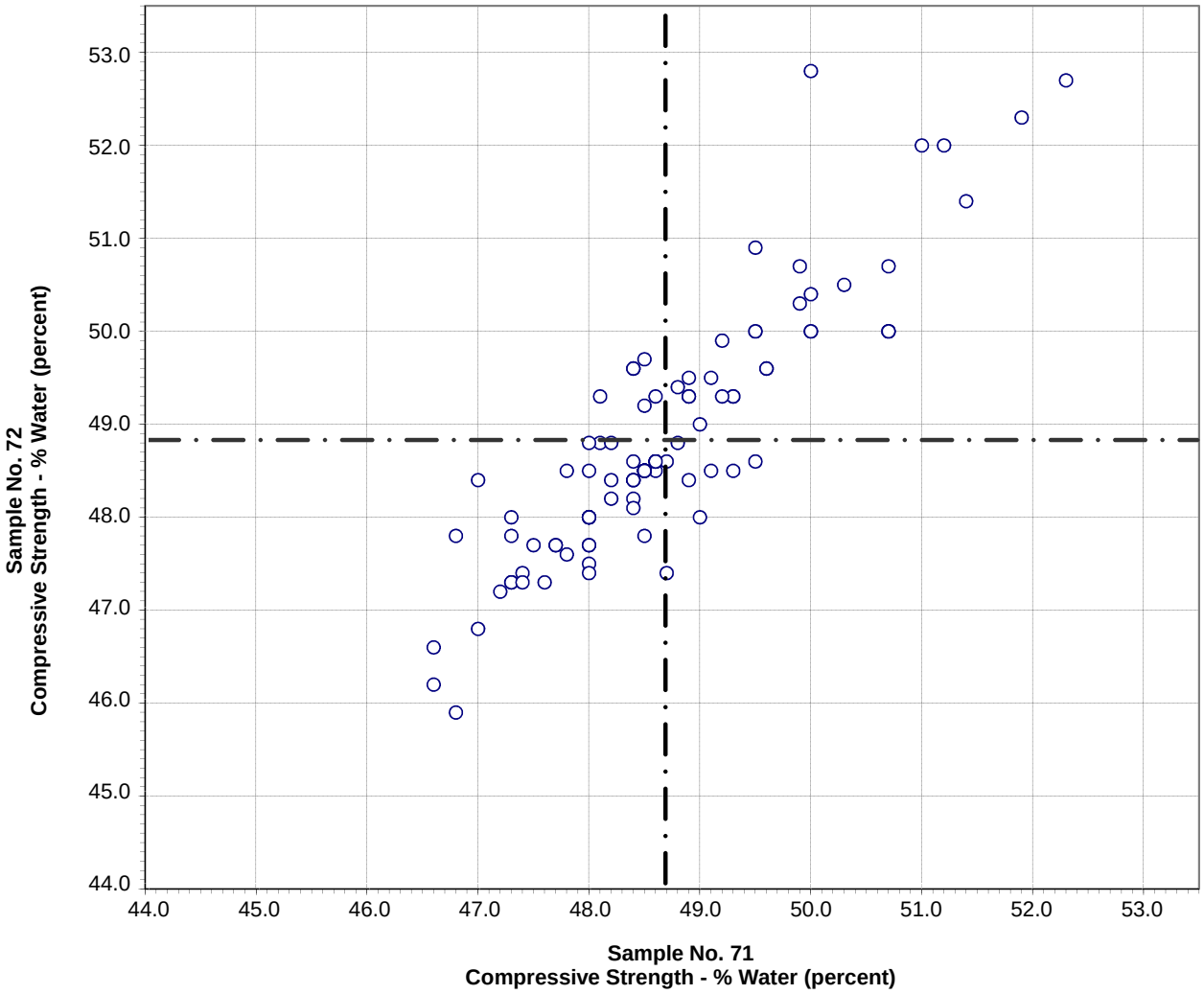


Test No. 211 Compressive Strength - 28 day 104 Points

Sample No. 71	Ave	6225	S.D.	449	C.V. 7.2
Sample No. 72	Ave	6652	S.D.	413	C.V. 6.2

Labs Eliminated: 9, 3431

CCRL Proficiency Sample Program
Compressive Strength - % Water
BLENDED CEMENT Samples No. 71 and No. 72

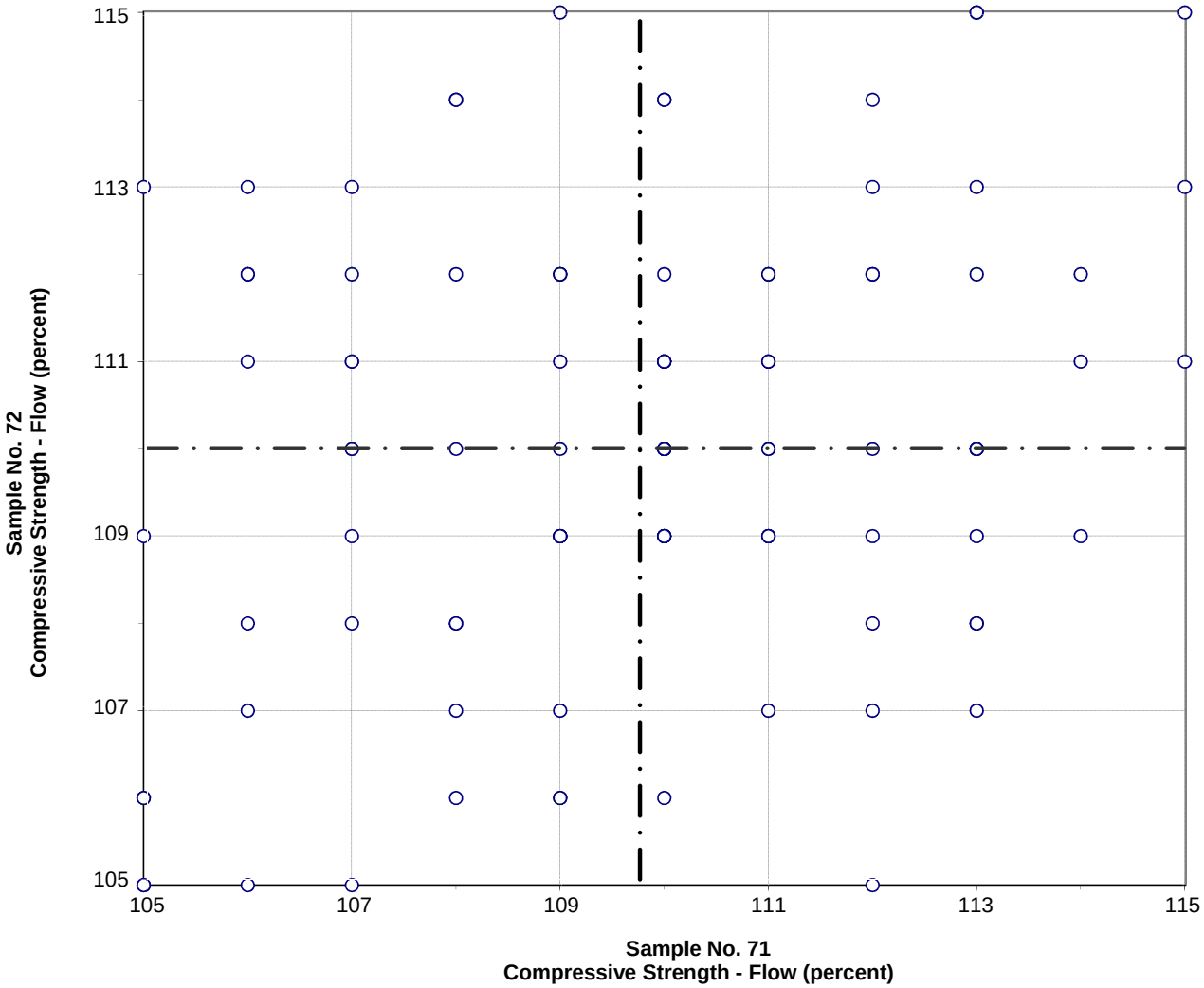


Test No. 220 Compressive Strength - % Water 104 Points

Sample No. 71	Ave	48.7	S.D.	1.1	C.V.	2.3
Sample No. 72	Ave	48.8	S.D.	1.3	C.V.	2.6

Labs Eliminated: 9, 39, 74, 309, 691, 840

CCRL Proficiency Sample Program
Compressive Strength - Flow
BLENDED CEMENT Samples No. 71 and No. 72

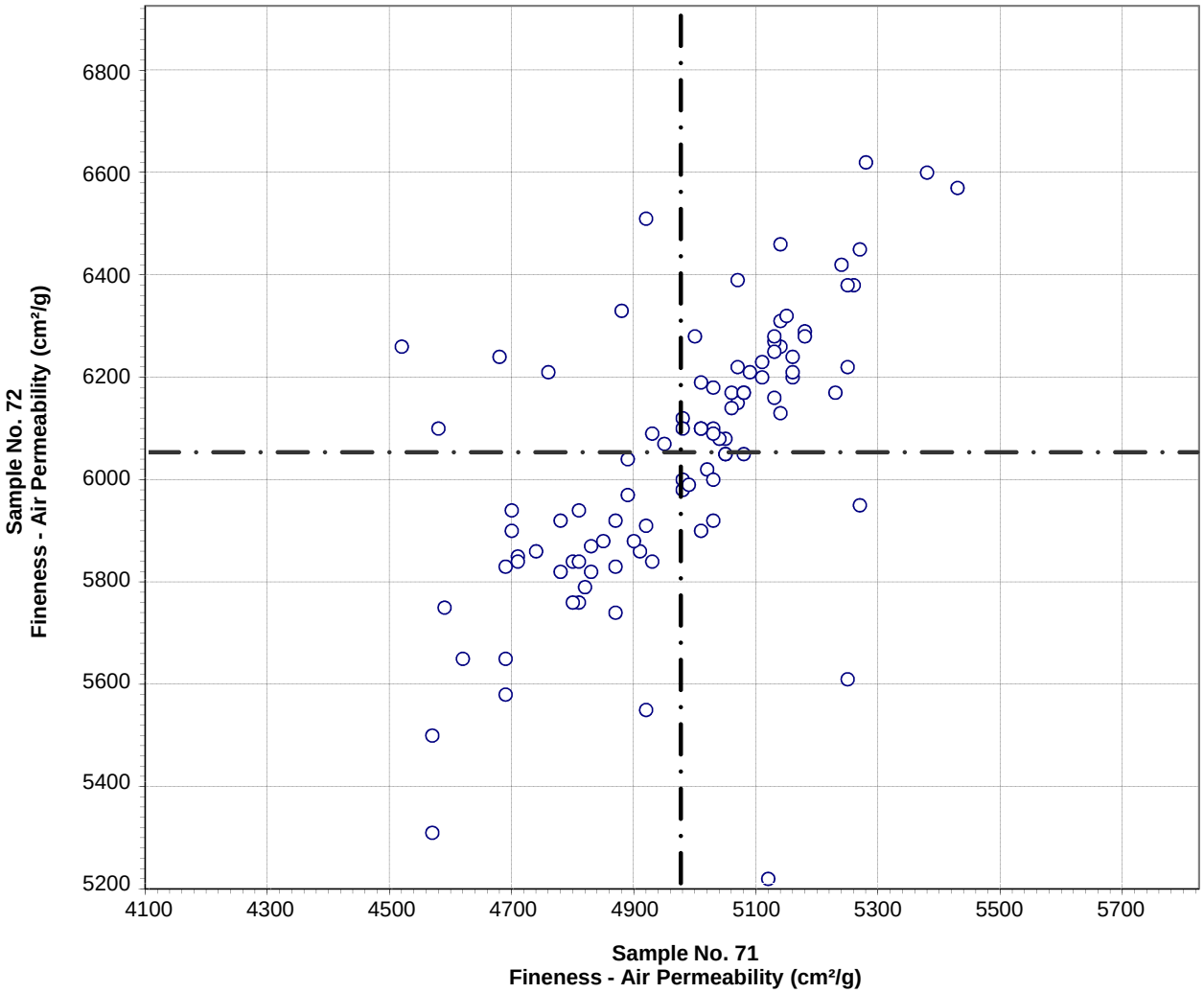


Test No. 230 Compressive Strength - Flow 103 Points

Sample No. 71	Ave	110	S.D.	2.5	C.V. 2.3
Sample No. 72	Ave	110	S.D.	2.5	C.V. 2.3

Labs Eliminated: 34, 40, 47, 125, 180, 413, 691, 958

CCRL Proficiency Sample Program
Fineness - Air Permeability
BLENDED CEMENT Samples No. 71 and No. 72

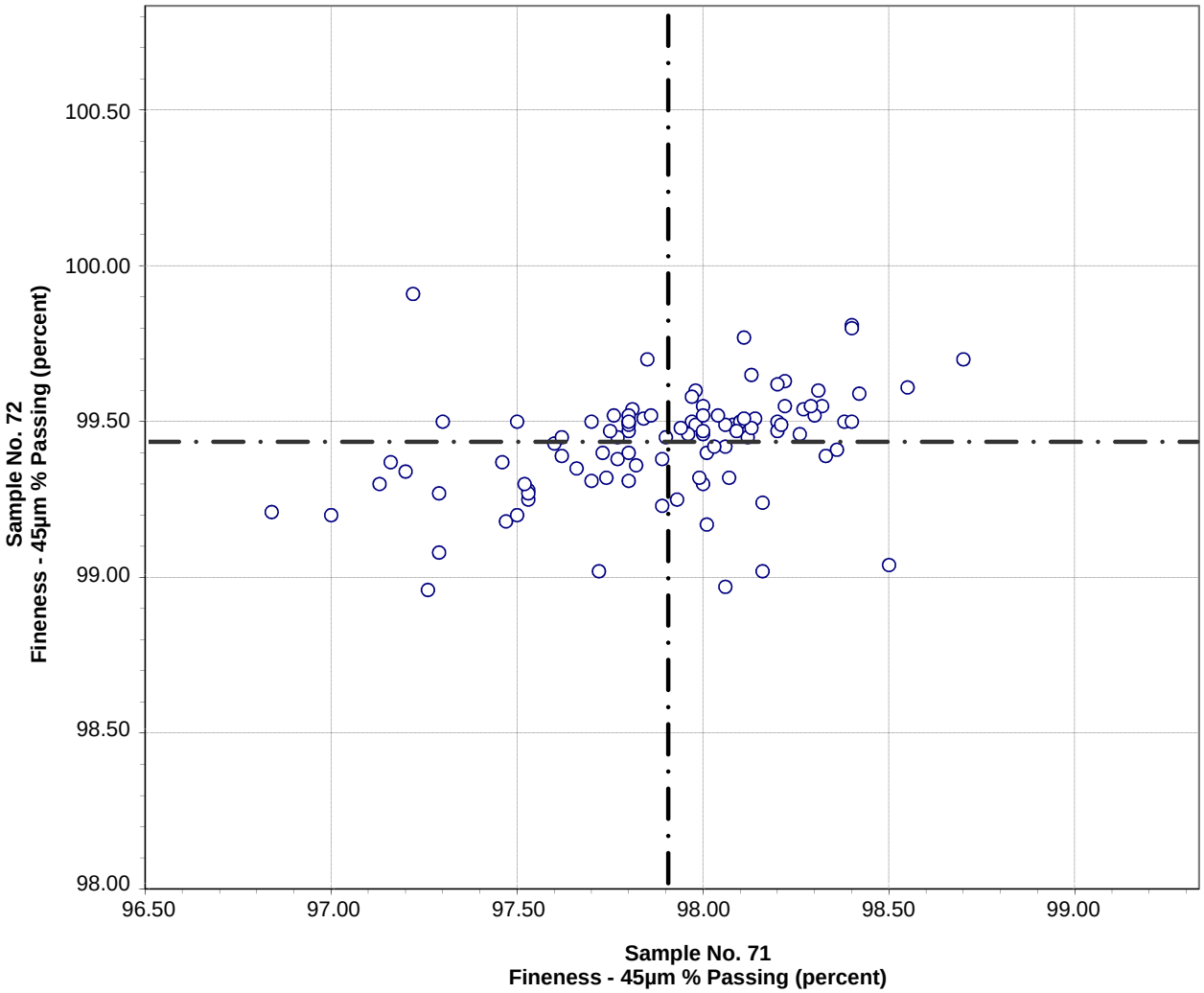


Test No. 270 Fineness - Air Permeability 98 Points

Sample No. 71	Ave	4975	S.D.	197	C.V. 4.0
Sample No. 72	Ave	6050	S.D.	262	C.V. 4.3

Labs Eliminated: 46, 51, 105, 354, 1956, 2975, 3247, 3707

CCRL Proficiency Sample Program
Fineness - 45µm % Passing
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 281 Fineness - 45µm % Passing 101 Points

Sample No. 71	Ave	97.90	S.D.	0.36	C.V. 0.37
Sample No. 72	Ave	99.43	S.D.	0.17	C.V. 0.17

Labs Eliminated: 9, 20, 47, 148, 413, 840, 3707

CCRL PROFICIENCY SAMPLE PROGRAM

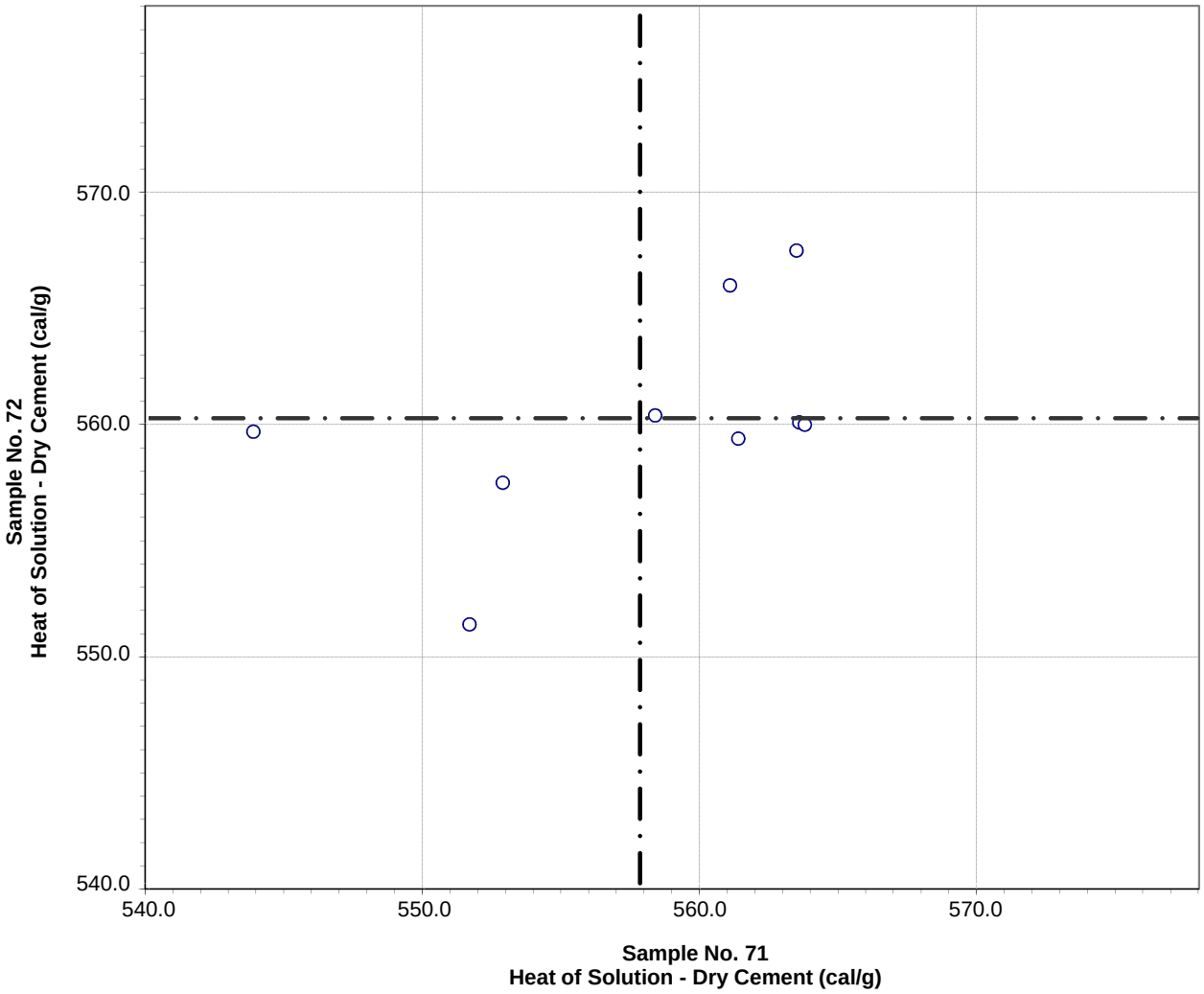
Blended Cement Proficiency Samples No. 71 and No. 72

Final Report – Heat of Hydration Results
May 1, 2013

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.71 Average	S.D.	C.V.	Sample No. 72 Average	S.D.	C.V.
Heat of Solution - Dry Cement (**cal/g**)							
	9	557.8	6.9	1.2	560.2	4.6	0.8
No Labs Eliminated for This Test							
Heat of Solution - 7 day (**cal/g**)							
	9	478.8	7.9	1.7	477.7	8.9	1.9
No Labs Eliminated for This Test							
Heat of Solution - 28 day (**cal/g**)							
	7	469.7	4.6	0.98	468.3	6.7	1.43
No Labs Eliminated for This Test							
Heat of Hydration - 7 day (**cal/g**)							
	10	78.9	10.2	13	81.2	9.2	11
No Labs Eliminated for This Test							
Heat of Hydration - 28 day (**cal/g**)							
	7	89.0	3.5	4.0	93.1	2.3	2.5
No Labs Eliminated for This Test							

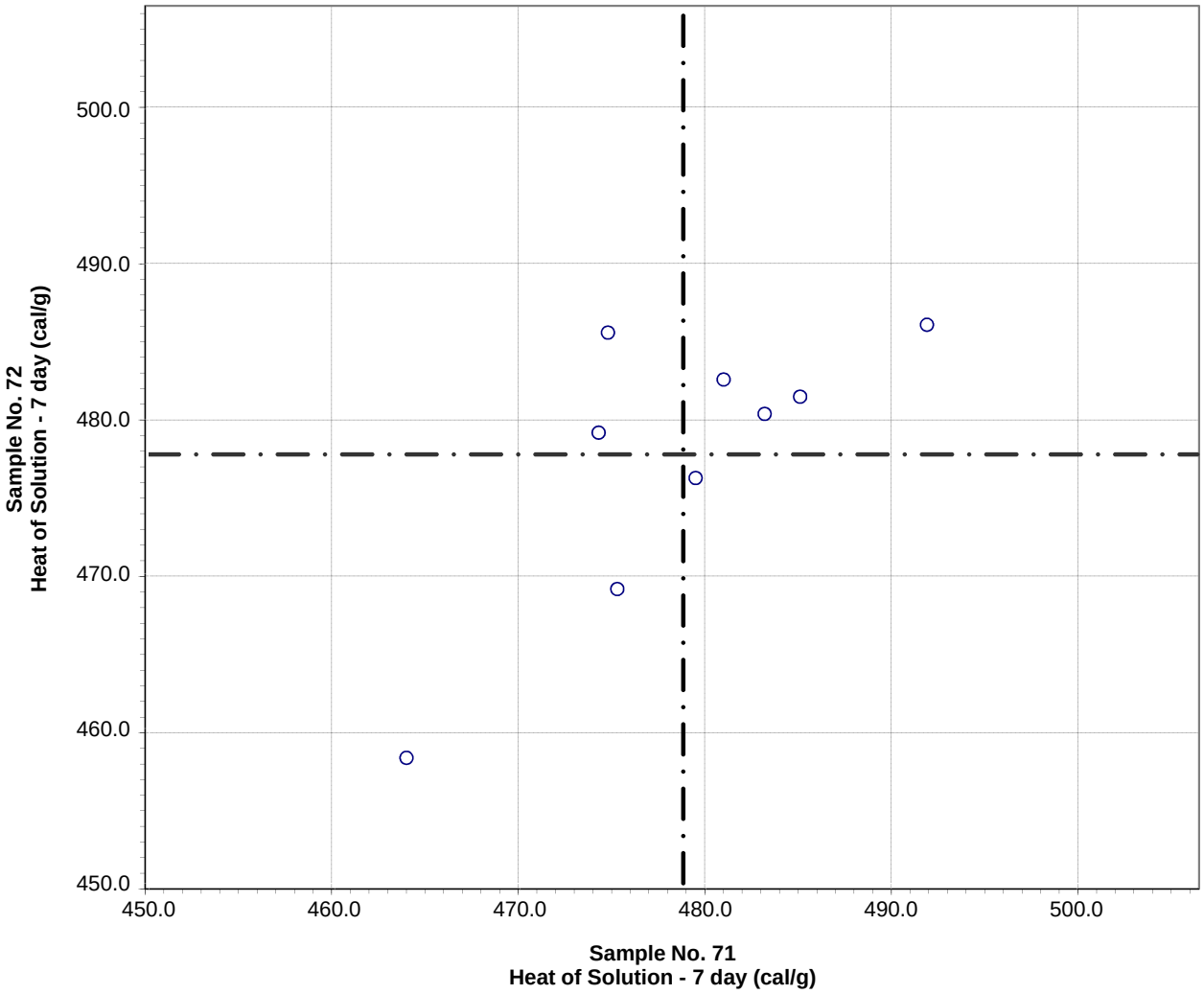
CCRL Proficiency Sample Program
Heat of Solution - Dry Cement
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 291 Heat of Solution - Dry Cement 9 Points

Sample No. 71	Ave	557.8	S.D.	6.9	C.V. 1.2
Sample No. 72	Ave	560.2	S.D.	4.6	C.V. 0.8

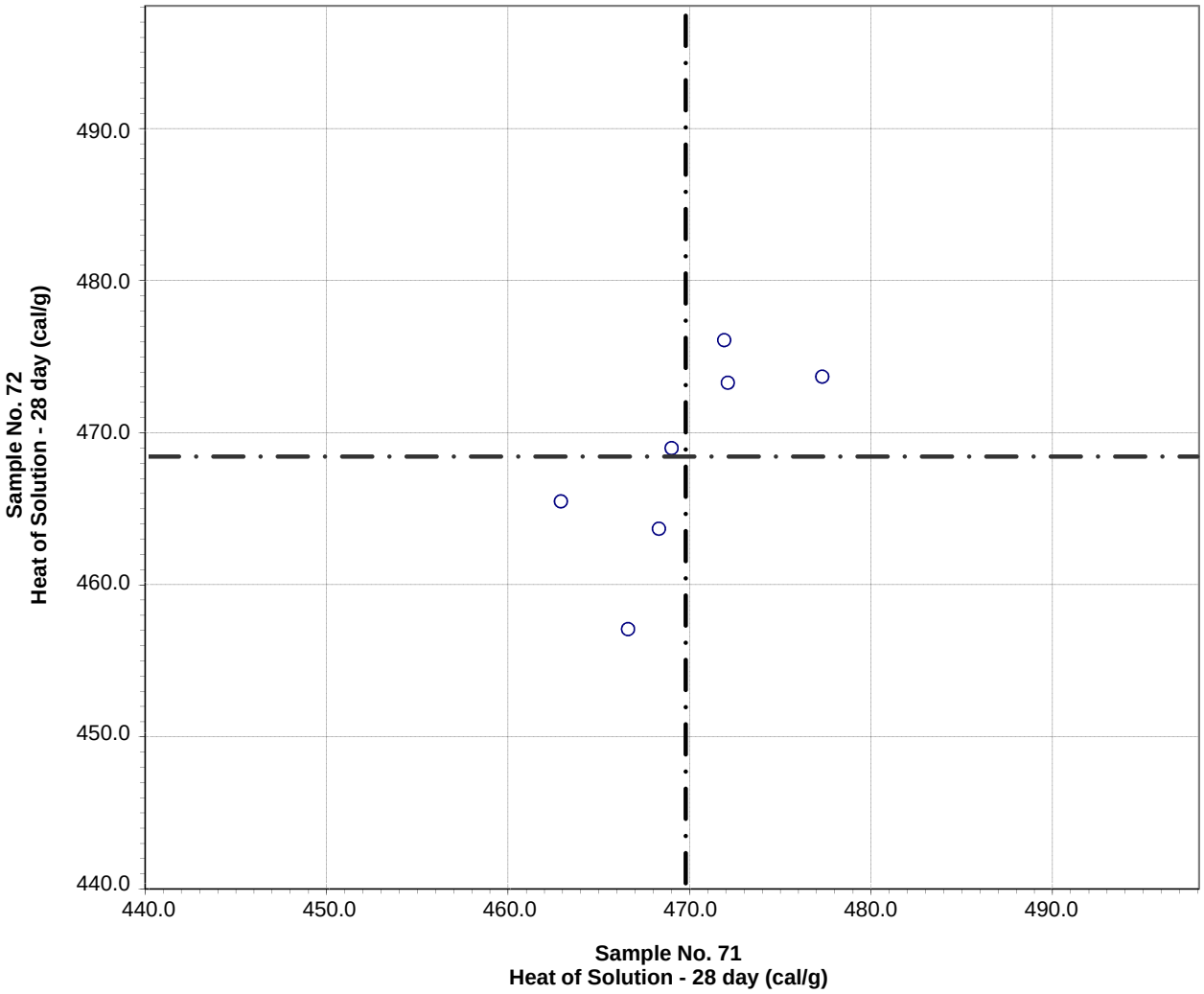
CCRL Proficiency Sample Program
Heat of Solution - 7 day
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 292 Heat of Solution - 7 day 9 Points

Sample No. 71	Ave	478.8	S.D.	7.9	C.V. 1.7
Sample No. 72	Ave	477.7	S.D.	8.9	C.V. 1.9

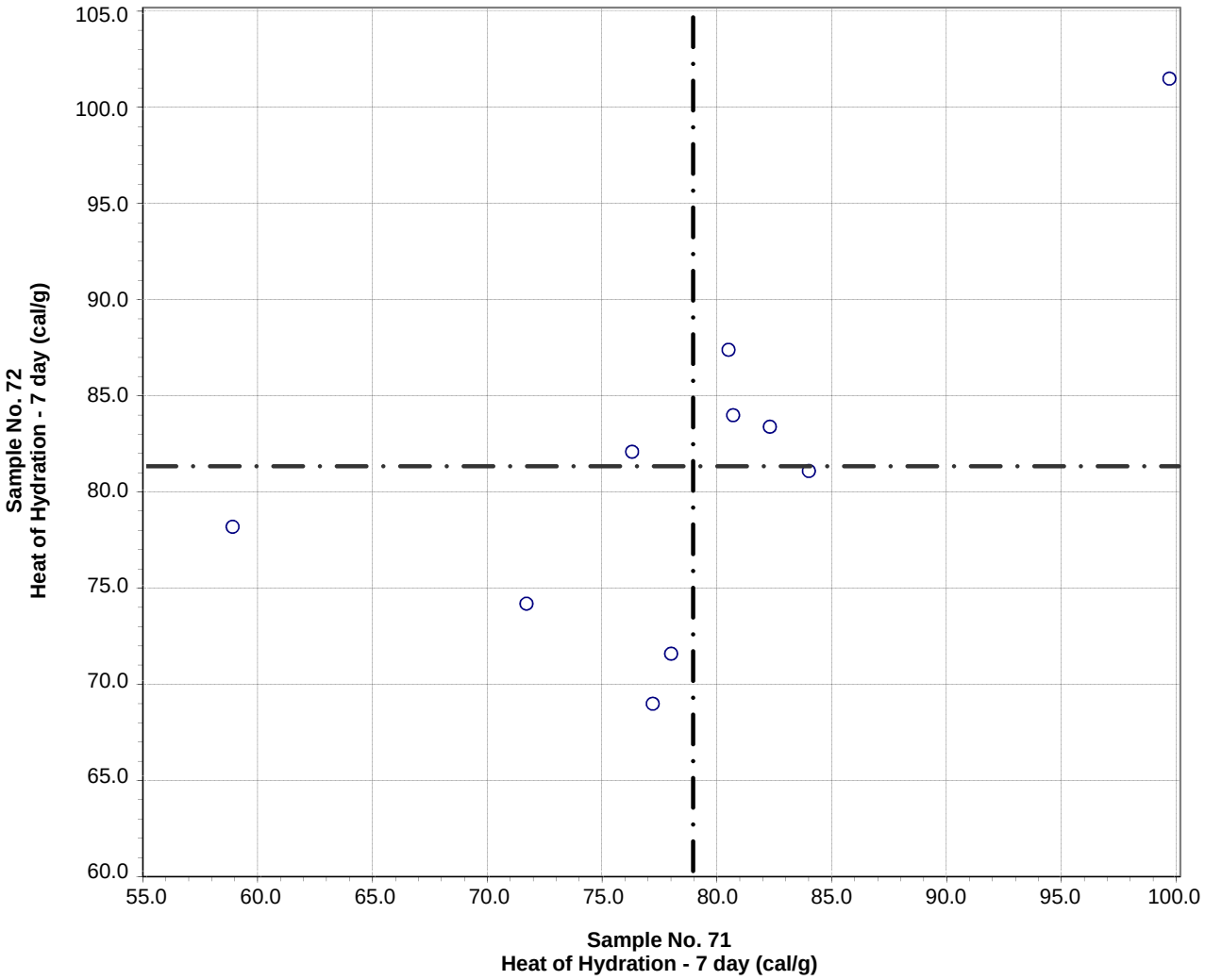
CCRL Proficiency Sample Program
Heat of Solution - 28 day
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 301 Heat of Solution - 28 day 7 Points

Sample No. 71	Ave	469.7	S.D.	4.6	C.V.	0.98
Sample No. 72	Ave	468.3	S.D.	6.7	C.V.	1.43

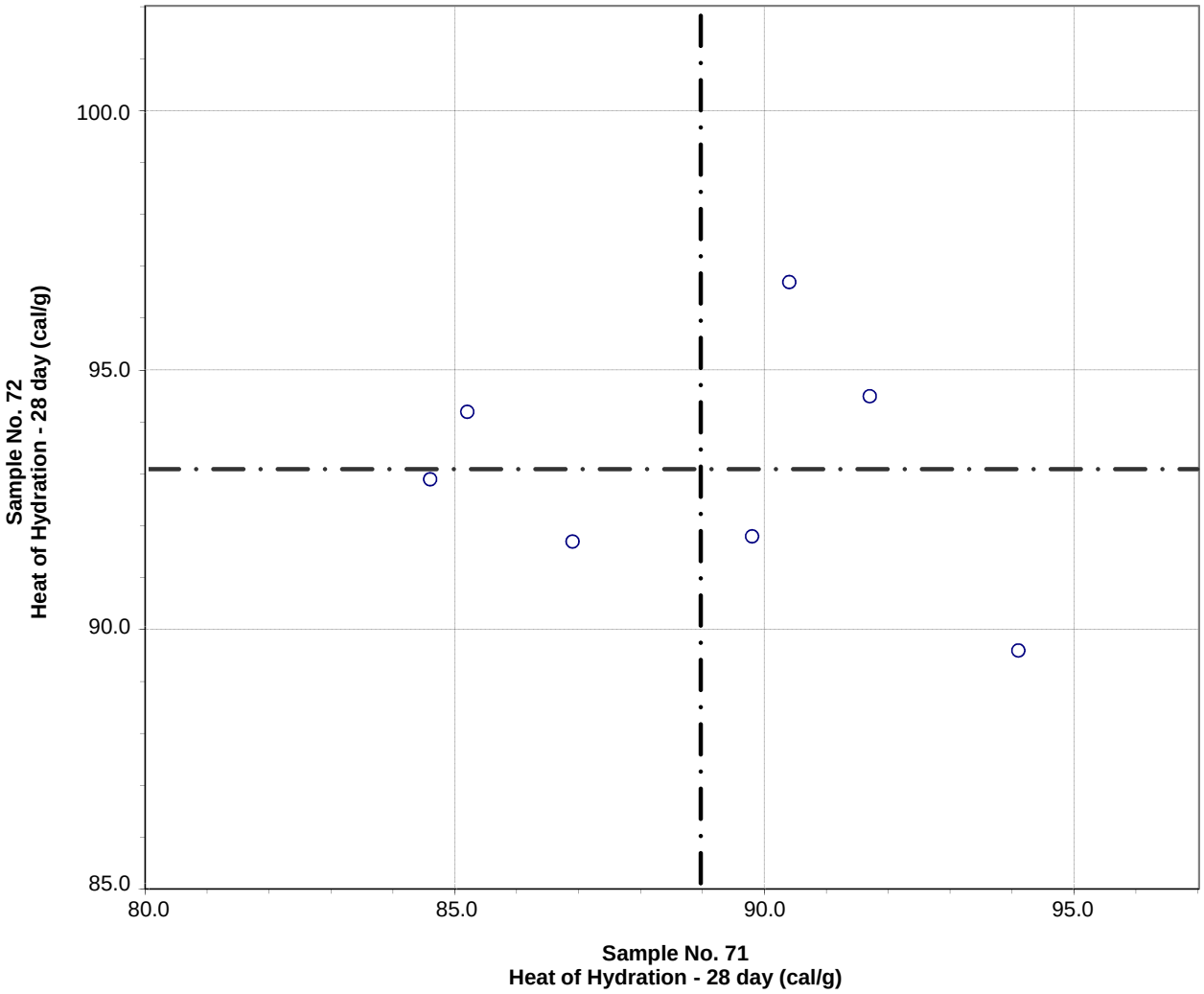
CCRL Proficiency Sample Program
Heat of Hydration - 7 day
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 290 Heat of Hydration - 7 day 10 Points

Sample No. 71	Ave 78.9	S.D. 10.2	C.V. 13
Sample No. 72	Ave 81.2	S.D. 9.2	C.V. 11

CCRL Proficiency Sample Program
Heat of Hydration - 28 day
BLENDED CEMENT Samples No. 71 and No. 72



Test No. 300 Heat of Hydration - 28 day 7 Points

Sample No. 71	Ave	89.0	S.D.	3.5	C.V.	4.0
Sample No. 72	Ave	93.1	S.D.	2.3	C.V.	2.5