

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Blended Cement Proficiency Samples
Number 67 and Number 68

May 2011



May 6, 2011

To: Participants in the CCRL Blended Cement Proficiency Sample Program

SUBJECT: Final Report on Blended Cement Proficiency Samples No. 67 and No. 68

Following is the final report for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2011. Both cements were an ASTM C595 Blended Hydraulic Cement. Sample No 67 was a Type IS (40) and No. 68 was a Type IS (20).

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/>.

Note on SO₃ and Loss on Ignition (LOI) test results: For Type IS cement SO₃ and LOI results should be corrected for Sulfide Sulfur (S). Initial data analysis showed that test results corrected and uncorrected for sulfide sulfur had been submitted. An email was sent to participants requesting additional information on these tests. The test results of labs that responded to the email were grouped as corrected or uncorrected for S and assigned laboratory rating. Laboratories not responding were not assigned laboratory ratings for SO₃ and LOI.

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 2012.

Sincerely,

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. 67 and No. 68

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Blended Cement Proficiency Samples, which were distributed in February 2011. 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.

Please note that individual laboratory ratings were not given for the flow of air content mortar (test no. 190)

¹Youden, 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.*

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.

Sulfur Trioxide and Loss on Ignition - C595 and C114 require that sulfur trioxide (SO_3) and loss on ignition (LOI) be corrected for sulfur (S) when the cement being analyzed contains slag. For this pair of samples, SO_3 and LOI were separated into three groups, all data, data corrected for S, and data not corrected for S. The laboratories that did not indicate if their results were corrected or uncorrected were not assigned laboratory ratings.

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. 67 and No. 68
Final Report - Chemical Results
May 6, 2011

SUMMARY OF RESULTS

Test	Sample No. 67					Sample No. 68		
	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.	
Silicon Dioxide	% 89	25.36	0.90	3.6	22.60	0.40	1.8	
Silicon Dioxide	% * 79	25.36	0.36	1.4	22.63	0.24	1.1	
Aluminum Oxide	% 88	7.50	0.37	5.0	5.72	0.21	3.6	
Aluminum Oxide	% * 81	7.45	0.17	2.3	5.70	0.10	1.8	
Ferric Oxide	% 90	1.89	0.12	6.3	3.44	0.10	2.9	
Ferric Oxide	% * 84	1.88	0.08	4.1	3.44	0.05	1.5	
Calcium Oxide	% 86	52.75	1.12	2.1	59.35	0.67	1.1	
Calcium Oxide	% * 81	52.81	0.50	0.95	59.36	0.36	0.61	
Magnesium Oxide	% 89	5.46	0.54	10	3.24	0.27	8.3	
Magnesium Oxide	% * 82	5.54	0.21	3.7	3.23	0.10	3.2	
Sulfur Trioxide ¹	% 76	3.20	0.77	24	2.86	0.59	21	
Sulfur Trioxide ¹	% * 70	3.19	0.47	15	2.85	0.15	5.2	
¹ (All SO ₃ data)								
Sulfur Trioxide ²	% 25	2.85	0.61	21	2.72	0.34	12	
Sulfur Trioxide ²	% * 23	2.99	0.38	13	2.79	0.14	5.0	
² (Corrected for S)								
Sulfur Trioxide ³	% 29	3.58	0.95	27	3.03	0.77	25	
Sulfur Trioxide ³	% * 25	3.48	0.43	12	2.95	0.14	4.9	
³ (NOT corrected for S)								

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

Silicon Dioxide 39 52 169 3059 42 176 284 690 3233 3409

Aluminum Oxide 50 169 246 2360 176 694 3431

Ferric Oxide 42 169 2360 2 694 3431

Calcium Oxide 50 169 207 694 2360

Magnesium Oxide 1799 2360 43 53 2463 3233 3431

Sulfur Trioxide - All data 24 53 40 51 1799 3250

Sulfur Trioxide - Corrected 51 3250

Sulfur Trioxide - Uncorrected 24 51 40 53

CCRL PROFICIENCY SAMPLE PROGRAM
 Blended Cement Proficiency Samples No. 67 and No. 68
 Final Report - Chemical Results
 May 6, 2011

SUMMARY OF RESULTS

Test	#Labs	Sample No. 67			Sample No. 68		
		Average	S.D.	C.V.	Average	S.D.	C.V.
Loss on Ignition ¹	% 76	1.54	0.55	36	1.25	0.34	27
Loss on Ignition ¹ ¹ (All LOI data)	% * 73	1.53	0.41	27	1.24	0.17	14
Loss on Ignition ²	% 24	1.72	0.50	29	1.25	0.30	24
Loss on Ignition ² ² (Corrected for S)	% * 22	1.83	0.33	18	1.33	0.15	11
Loss on Ignition ³	% 28	1.34	0.61	46	1.23	0.46	37
Loss on Ignition ³ ³ (NOT corrected for S)	% * 27	1.23	0.11	9.3	1.15	0.13	12
Sodium Oxide	% 82	0.346	0.083	24	0.182	0.053	29
Sodium Oxide	% * 74	0.360	0.046	13	0.179	0.035	19
Potassium Oxide	% 86	0.78	0.04	5.3	0.51	0.21	41
Potassium Oxide	% * 80	0.79	0.03	3.8	0.49	0.02	4.5
Titan Dioxide	% 69	0.37	0.05	13	0.35	0.05	13
Titan Dioxide	% * 67	0.37	0.02	4.2	0.36	0.01	3.2
Phosphorus Pent	% 70	0.150	0.022	15	0.201	0.027	14
Phosphorus Pent	% * 68	0.151	0.009	6.2	0.203	0.012	5.8

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

Loss on Ignition - All data 20 958 3320
 Loss on Ignition - Corrected 20 3320
 Loss on Ignition - Uncorrected 958
 Sodium Oxide 694 2463 3185 53 413 1657 2466 3235
 Potassium Oxide 169 176 354 975 2360 2463
 Titanium Dioxide 169 3320
 Phosphorus Pentoxide 169 3320

CCRL PROFICIENCY SAMPLE PROGRAM
 Blended Cement Proficiency Samples No. 67 and No. 68
 Final Report - Chemical Results
 May 6, 2011

SUMMARY OF RESULTS

Test	#Labs	Sample No. 67			Sample No. 68		
		Average	S.D.	C.V.	Average	S.D.	C.V.
Zinc Oxide	% 30	0.037	0.010	28	0.058	0.016	27
Zinc Oxide	% * 27	0.039	0.003	6.7	0.062	0.002	2.8
Manganic Oxide	% 52	0.281	0.044	16	0.213	0.040	19
Manganic Oxide	% * 50	0.287	0.018	6.4	0.214	0.012	5.5
Sulfide Sulfur	% 31	0.447	0.340	76	0.120	0.110	89
Sulfide Sulfur	% * 27	0.332	0.136	41	0.096	0.057	59
Chloride	% 30	0.015	0.013	86	0.013	0.006	50
Chloride	% * 29	0.013	0.006	49	0.013	0.006	51
Insoluble Residue	% 79	0.41	0.26	64	0.37	0.16	44
Insoluble Residue	% * 71	0.36	0.09	26	0.34	0.10	30
Chromium Oxide	% 27	0.011	0.010	95	0.022	0.007	30
Chromium Oxide	% * 22	0.009	0.002	22	0.024	0.001	6.2

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

Zinc Oxide 10 176 3320

Manganic Oxide 105 3320

Sulfide Sulfur 19 2462 22 3232

Chloride 158

Insoluble Residue 695 36 2360 691 694 20 246 3409

Chromium Oxide 2466 10 2462 284 3320

Sulfur Trioxide Analysis

The following laboratories submitted test results for SO₃. Their test results were only included in the statistical analysis of 'All SO₃' data because they did not respond to an email requesting information on correcting SO₃ for S. Laboratory ratings were not assigned to these laboratories.

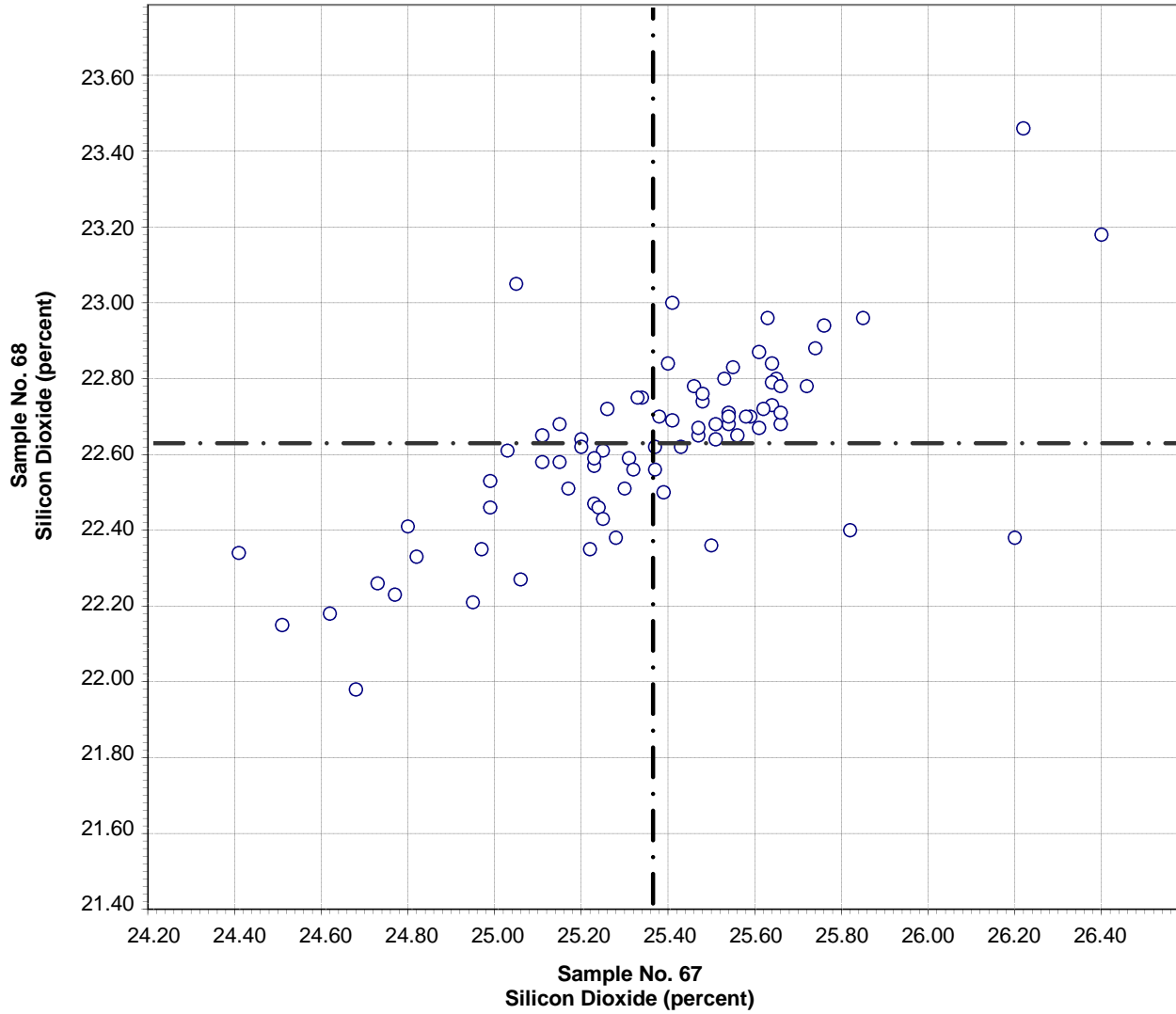
2	176	2463
9	207	2466
10	343	2490
11	354	2975
36	497	3059
38	691	3232
47	698	3233
74	1799	3235
105	2251	3250
158	2360	3431

Loss on Ignition

The following laboratories submitted test results for LOI. Their test results were only included in the statistical analysis of 'All LOI' data because they did not respond to an email requesting information on correcting LOI for S. Laboratory ratings were not assigned to these laboratories.

2	207	2466
9	343	2490
10	354	2975
11	497	3059
36	691	3185
38	698	3232
47	1799	3233
74	2251	3235
105	2360	3250
158	2463	3431
176		

**CCRL Proficiency Sample Program
Silicon Dioxide
BLENDED CEMENT Samples No. 67 and No. 68**

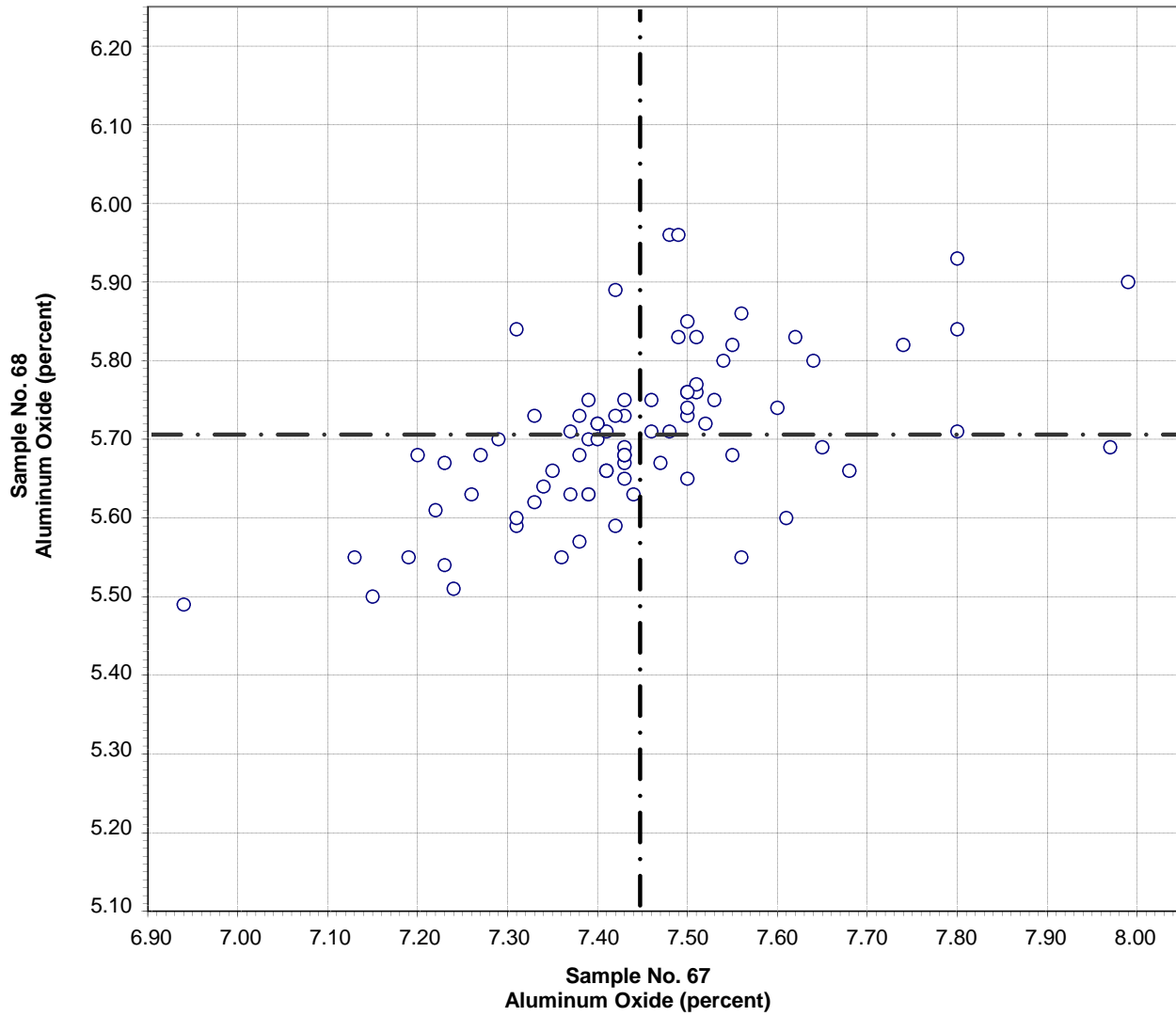


Test No. 10 Silicon Dioxide 79 Points

Sample No. 67	Ave 25.36	S.D. 0.36	C.V. 1.4
Sample No. 68	Ave 22.63	S.D. 0.24	C.V. 1.1

Labs eliminated: 39, 52, 169, 3059, 42, 176, 284, 690, 3233, 3409

**CCRL Proficiency Sample Program
Aluminum Oxide
BLENDED CEMENT Samples No. 67 and No. 68**



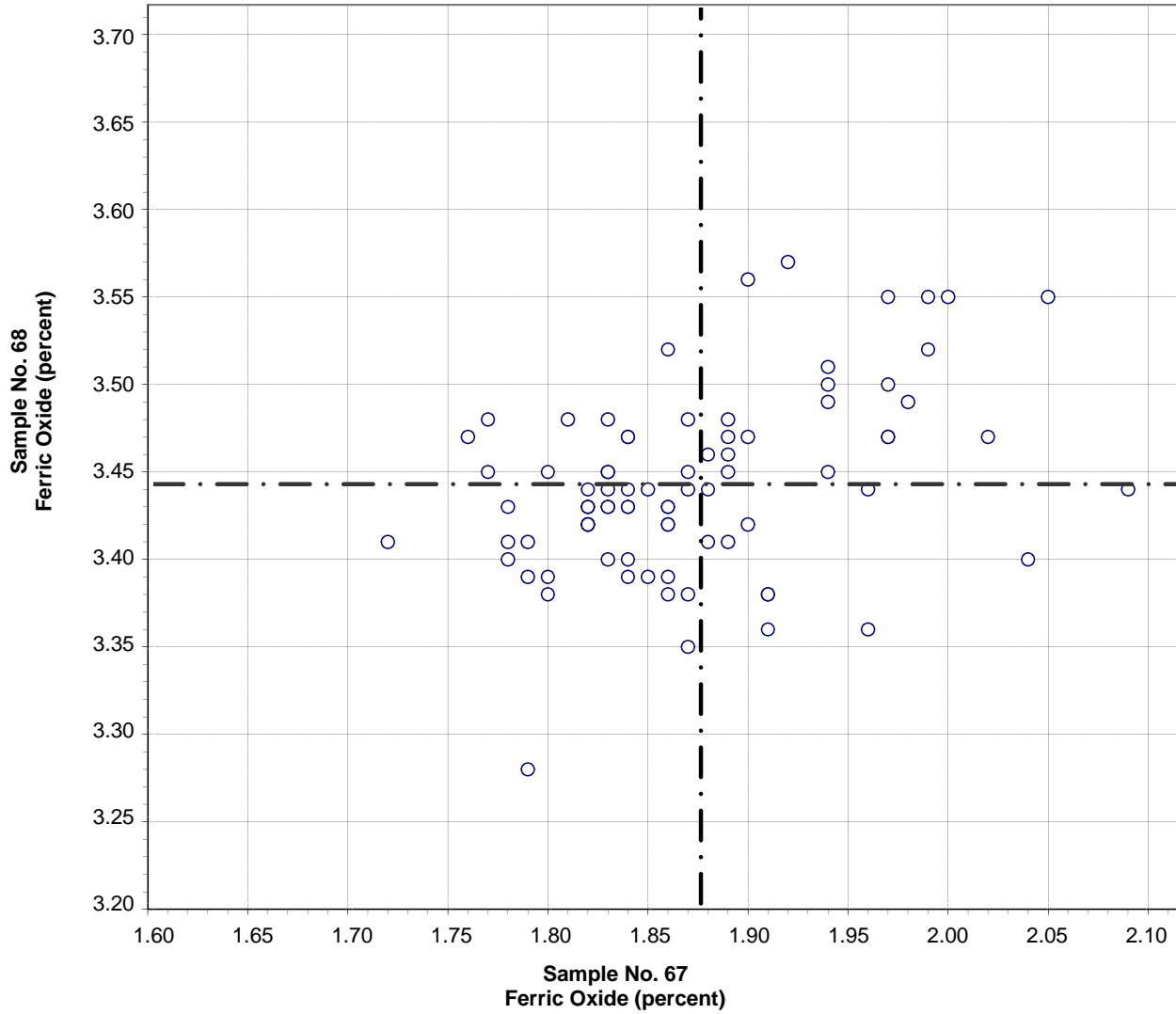
Test No. 21 Aluminum Oxide 81 Points

Sample No. 67 Ave 7.45 S.D. 0.17 C.V. 2.3

Sample No. 68 Ave 5.70 S.D. 0.10 C.V. 1.8

Labs eliminated: 50, 169, 246, 2360, 176, 694, 3431

**CCRL Proficiency Sample Program
 Ferric Oxide
 BLENDED CEMENT Samples No. 67 and No. 68**



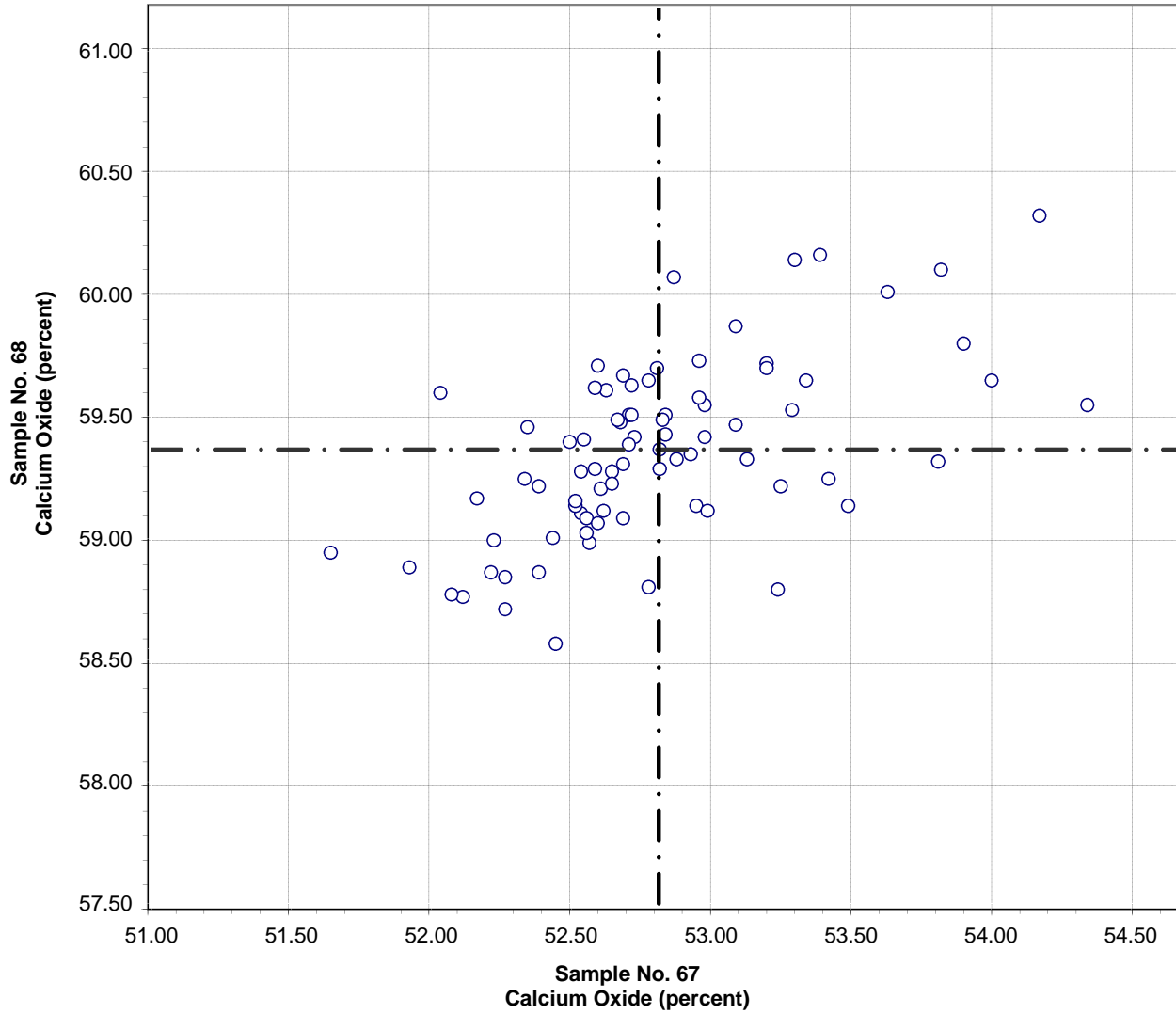
Test No. 30 Ferric Oxide 83 Points

Sample No. 67 Ave 1.88 S.D. 0.08 C.V. 4.1
 Sample No. 68 Ave 3.44 S.D. 0.05 C.V. 1.5

Labs eliminated: 42, 169, 2360, 2, 694, 3431

Labs off Diagram: 2463

**CCRL Proficiency Sample Program
Calcium Oxide
BLENDED CEMENT Samples No. 67 and No. 68**

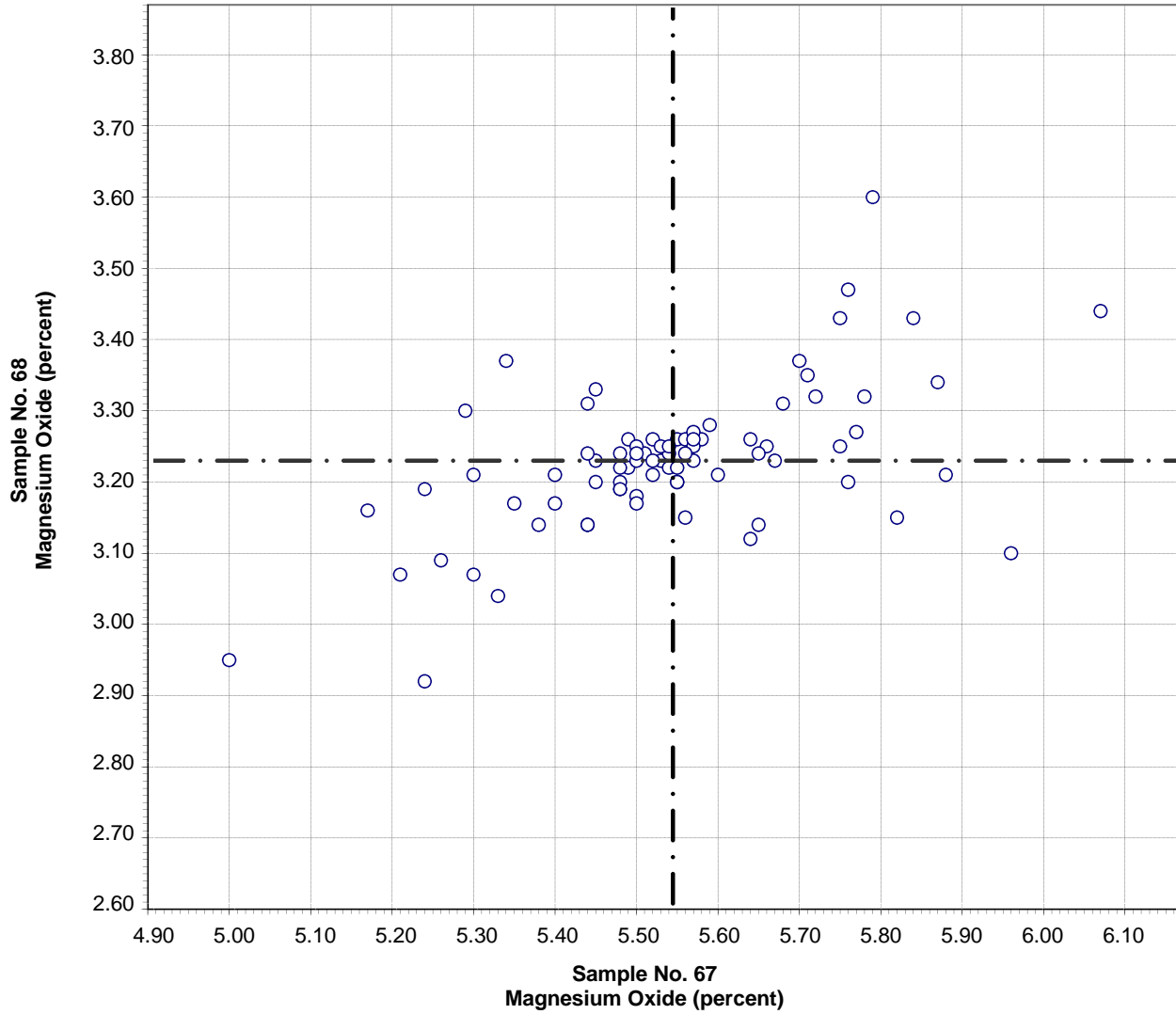


Test No. 40 Calcium Oxide 81 Points

Sample No. 67	Ave 52.81	S.D. 0.50	C.V. 0.95
Sample No. 68	Ave 59.36	S.D. 0.36	C.V. 0.61

Labs eliminated: 50, 169, 207, 694, 2360

**CCRL Proficiency Sample Program
Magnesium Oxide
BLENDED CEMENT Samples No. 67 and No. 68**



Test No. 50 Magnesium Oxide 80 Points

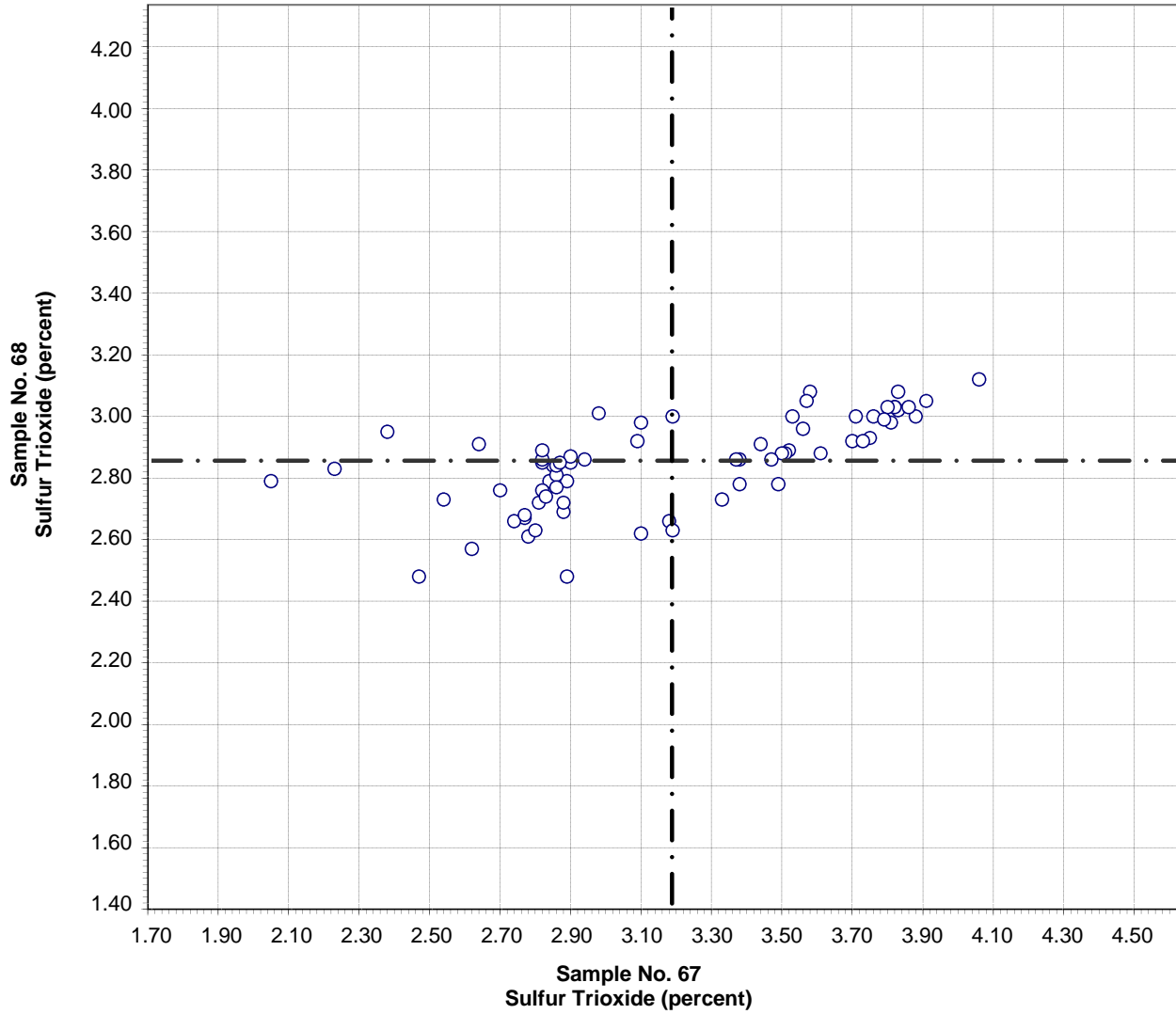
Sample No. 67 Ave 5.54 S.D. 0.21 C.V. 3.7

Sample No. 68 Ave 3.23 S.D. 0.10 C.V. 3.2

Labs eliminated: 1799, 2360, 43, 53, 2463, 3233, 3431

Labs off Diagram: 440, 690

CCRL Proficiency Sample Program
Sulfur Trioxide - All Data
BLENDED CEMENT Samples No. 67 and No. 68

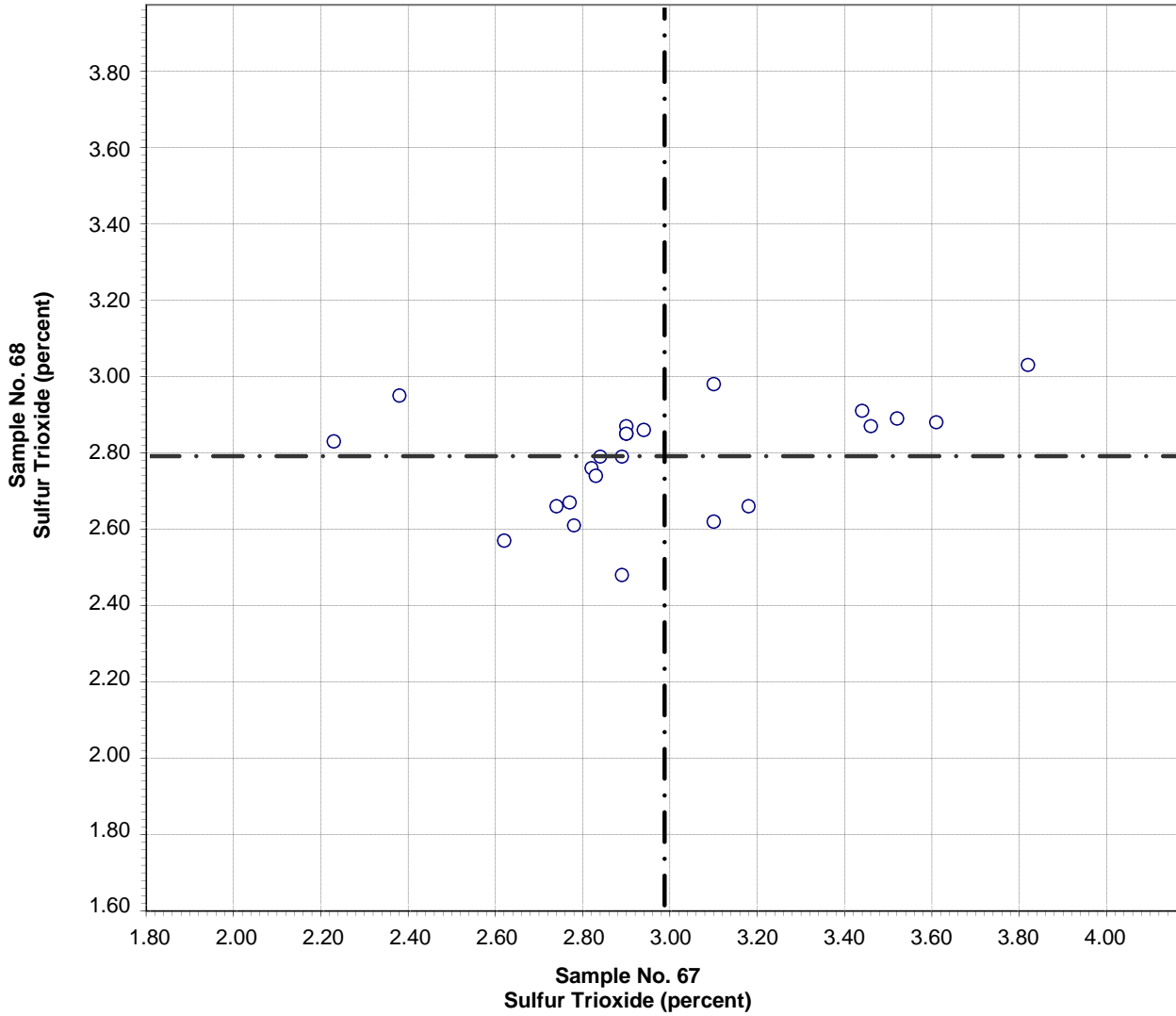


Test No. 60 Sulfur Trioxide - All Data 70 Points

Sample No. 67	Ave 3.19	S.D. 0.47	C.V. 15
Sample No. 68	Ave 2.85	S.D. 0.15	C.V. 5.2

Labs eliminated: 24, 53, 40, 51, 1799, 3250

**CCRL Proficiency Sample Program
Sulfur Trioxide - Corrected for S
BLENDED CEMENT Samples No. 67 and No. 68**

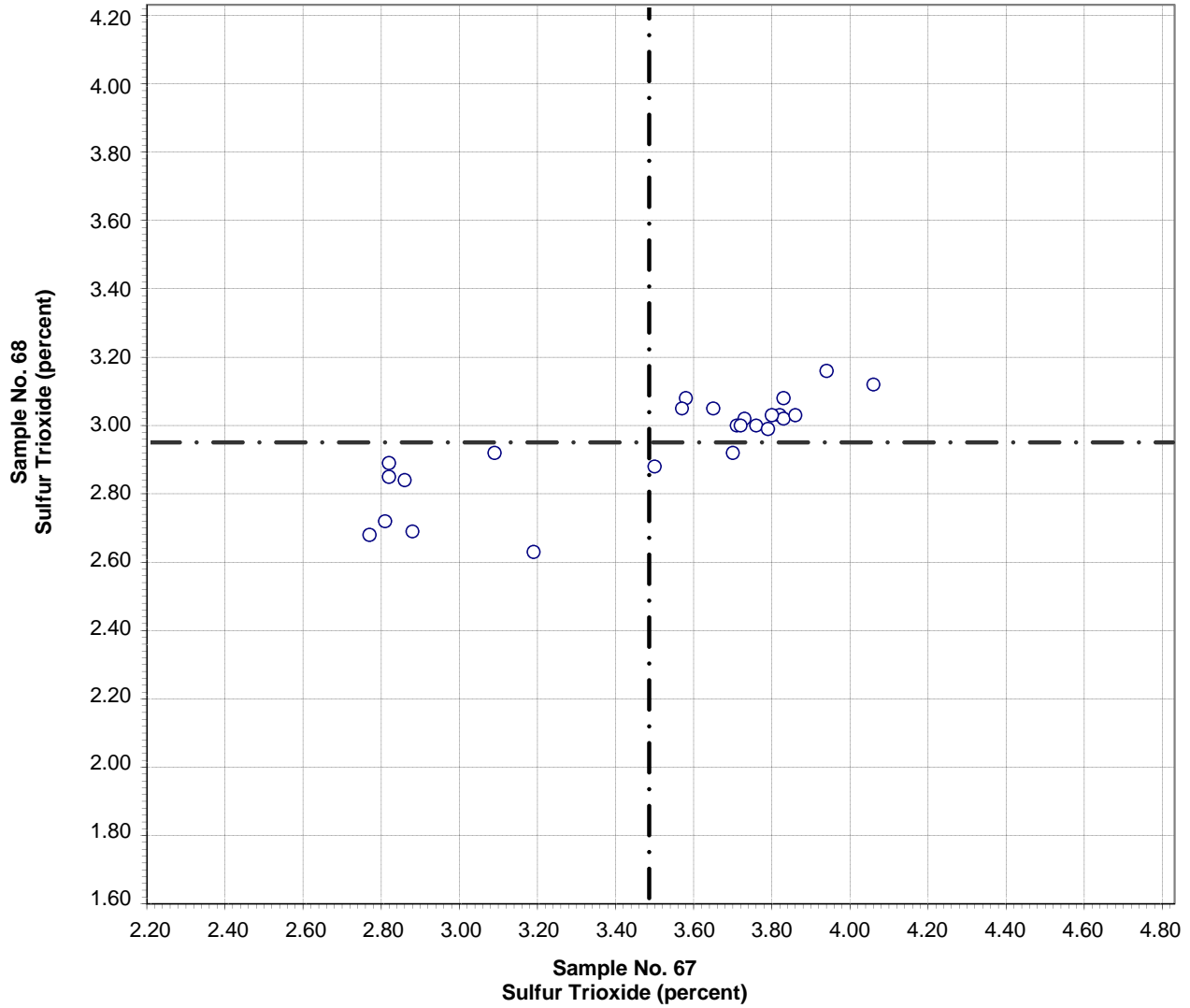


Test No. 61 Sulfur Trioxide - Corrected for S 23 Points

Sample No. 67 Ave 2.99 S.D. 0.38 C.V. 13
 Sample No. 68 Ave 2.79 S.D. 0.14 C.V. 5.0

Labs eliminated: 51, 3250

**CCRL Proficiency Sample Program
Sulfur Trioxide - Uncorrected for S
BLENDED CEMENT Samples No. 67 and No. 68**

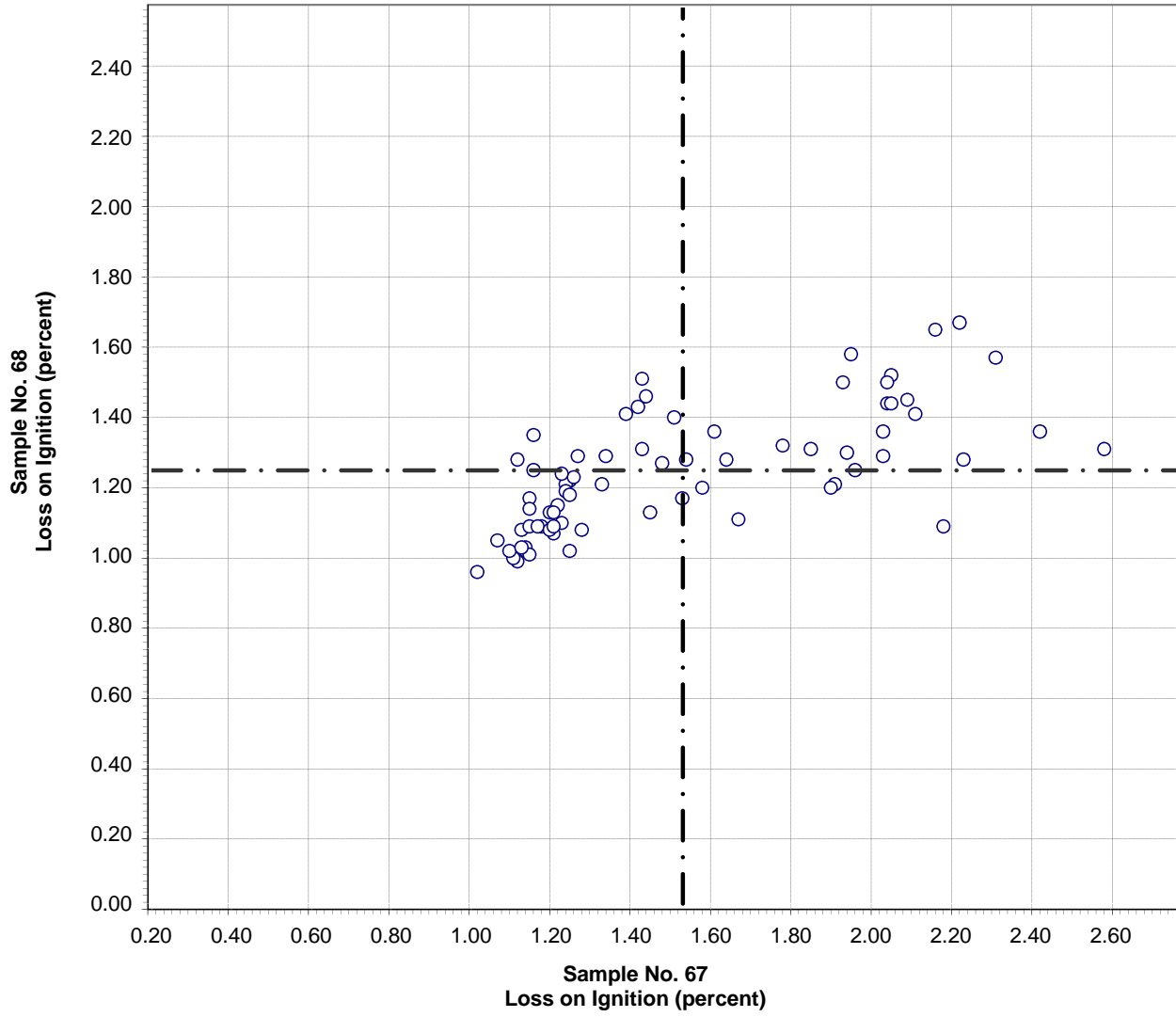


Test No. 62 Sulfur Trioxide - Uncorrected for S 25 Points

Sample No. 67 Ave 3.48 S.D. 0.43 C.V. 12
 Sample No. 68 Ave 2.95 S.D. 0.14 C.V. 4.9

Labs eliminated: 24, 51, 40, 53

**CCRL Proficiency Sample Program
Loss on Ignition - All Data
BLENDED CEMENT Samples No. 67 and No. 68**

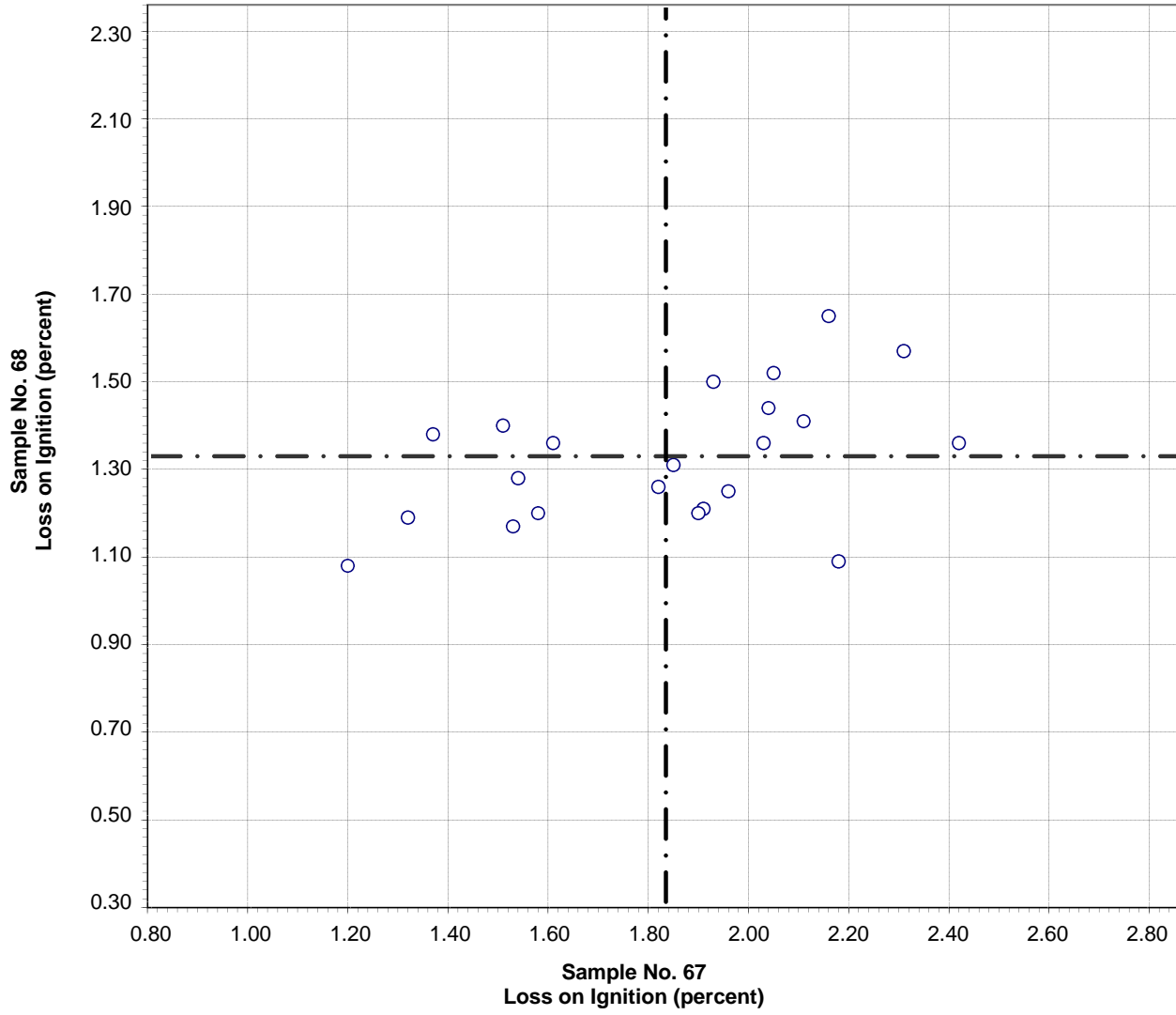


Test No. 70 Loss on Ignition - All Data 73 Points

Sample No. 67	Ave 1.53	S.D. 0.41	C.V. 27
Sample No. 68	Ave 1.25	S.D. 0.17	C.V. 14

Labs eliminated: 20, 958, 3320

**CCRL Proficiency Sample Program
Loss on Ignition - Corrected for S
BLENDED CEMENT Samples No. 67 and No. 68**

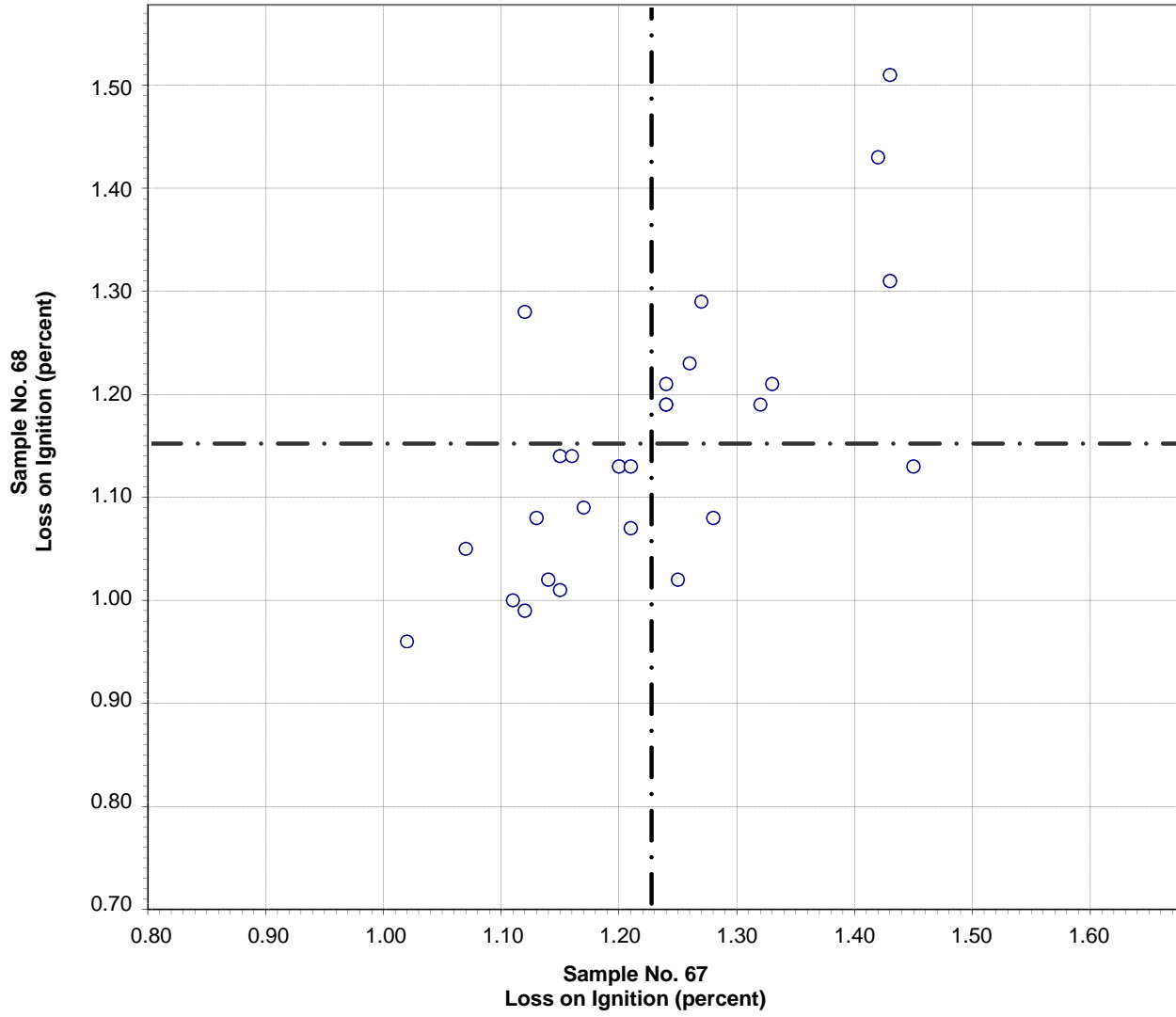


Test No. 71 Loss on Ignition - Corrected for S 22 Points

Sample No. 67 Ave 1.83 S.D. 0.33 C.V. 18
 Sample No. 68 Ave 1.33 S.D. 0.15 C.V. 11

Labs eliminated: 20, 3320

**CCRL Proficiency Sample Program
Loss on Ignition - Uncorrected for S
BLENDED CEMENT Samples No. 67 and No. 68**

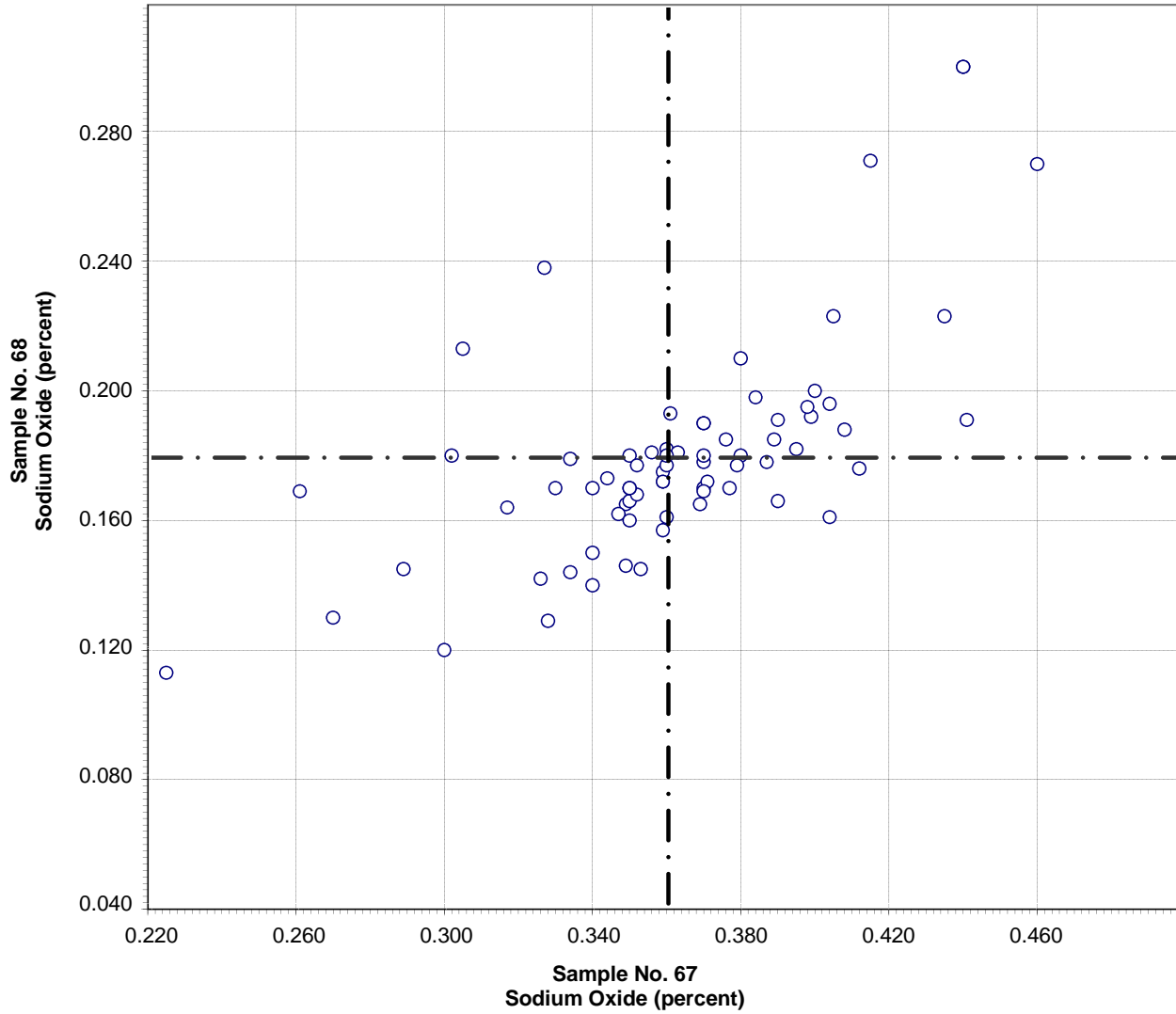


Test No. 72 Loss on Ignition - Uncorrected for S 27 Points

Sample No. 67 Ave 1.23 S.D. 0.11 C.V. 9.3
 Sample No. 68 Ave 1.15 S.D. 0.13 C.V. 12

Labs eliminated: 958

CCRL Proficiency Sample Program
Sodium Oxide
BLENDED CEMENT Samples No. 67 and No. 68



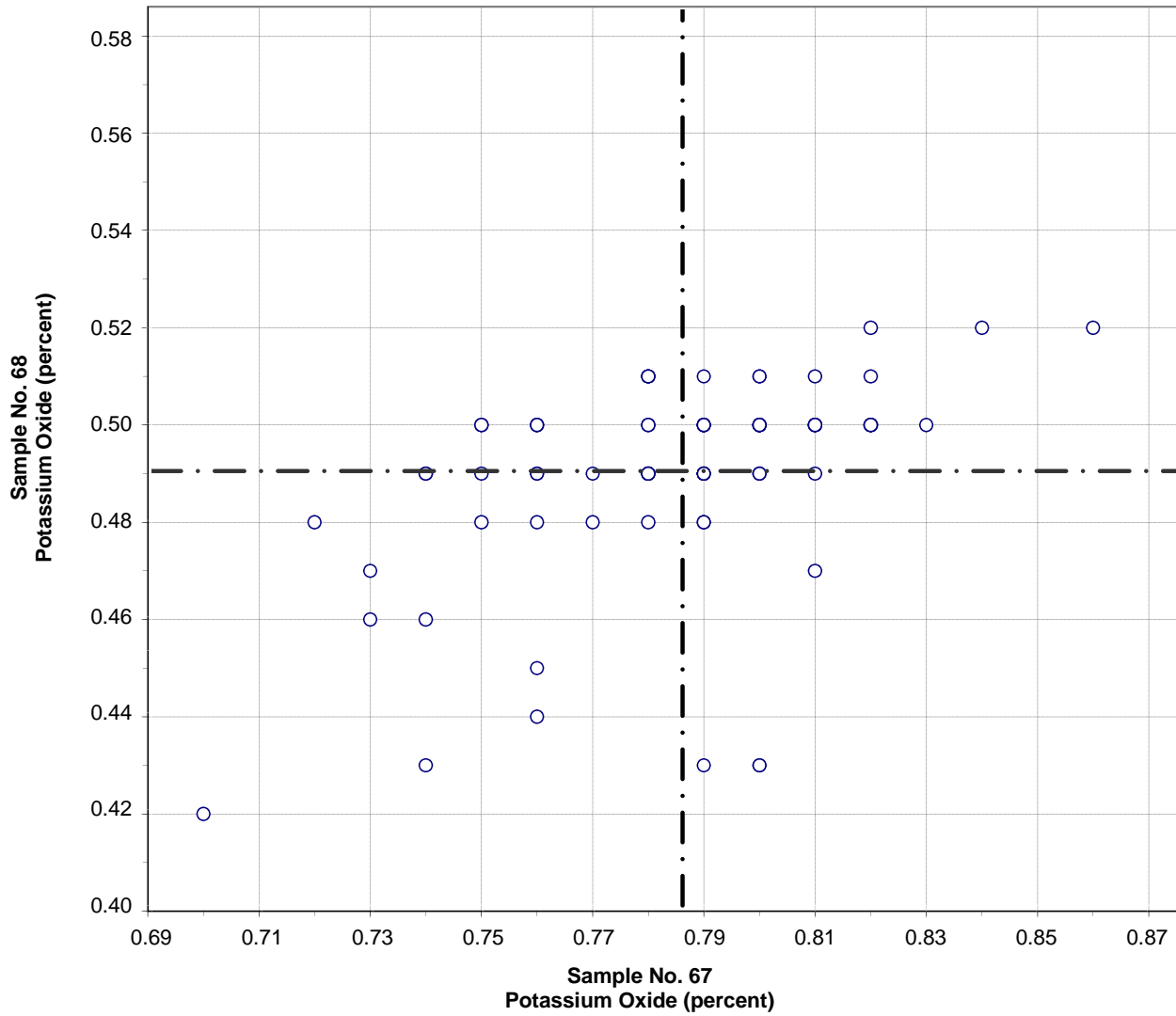
Test No. 90 Sodium Oxide 73 Points

Sample No. 67	Ave 0.360	S.D. 0.046	C.V. 13
Sample No. 68	Ave 0.179	S.D. 0.035	C.V. 19

Labs eliminated: 694, 2463, 3185, 53, 413, 1657, 2466, 3235

Labs off Diagram: 176

**CCRL Proficiency Sample Program
Potassium Oxide
BLENDED CEMENT Samples No. 67 and No. 68**



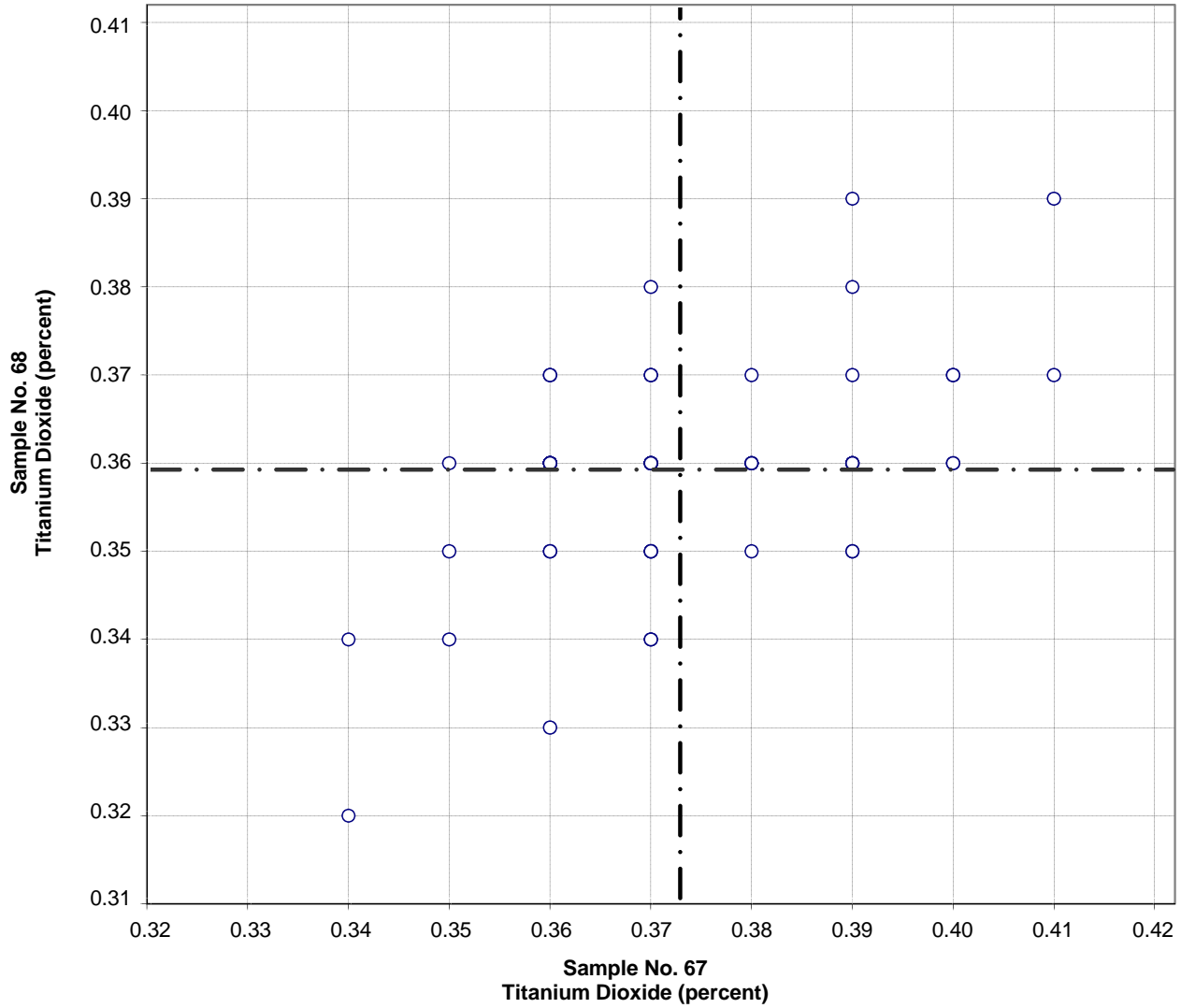
Test No. 100 Potassium Oxide 79 Points

Sample No. 67 Ave 0.79 S.D. 0.03 C.V. 3.8
 Sample No. 68 Ave 0.49 S.D. 0.02 C.V. 4.5

Labs eliminated: 169, 176, 354, 975, 2360, 2463

Labs off Diagram: 50

**CCRL Proficiency Sample Program
Titanium Dioxide
BLENDED CEMENT Samples No. 67 and No. 68**

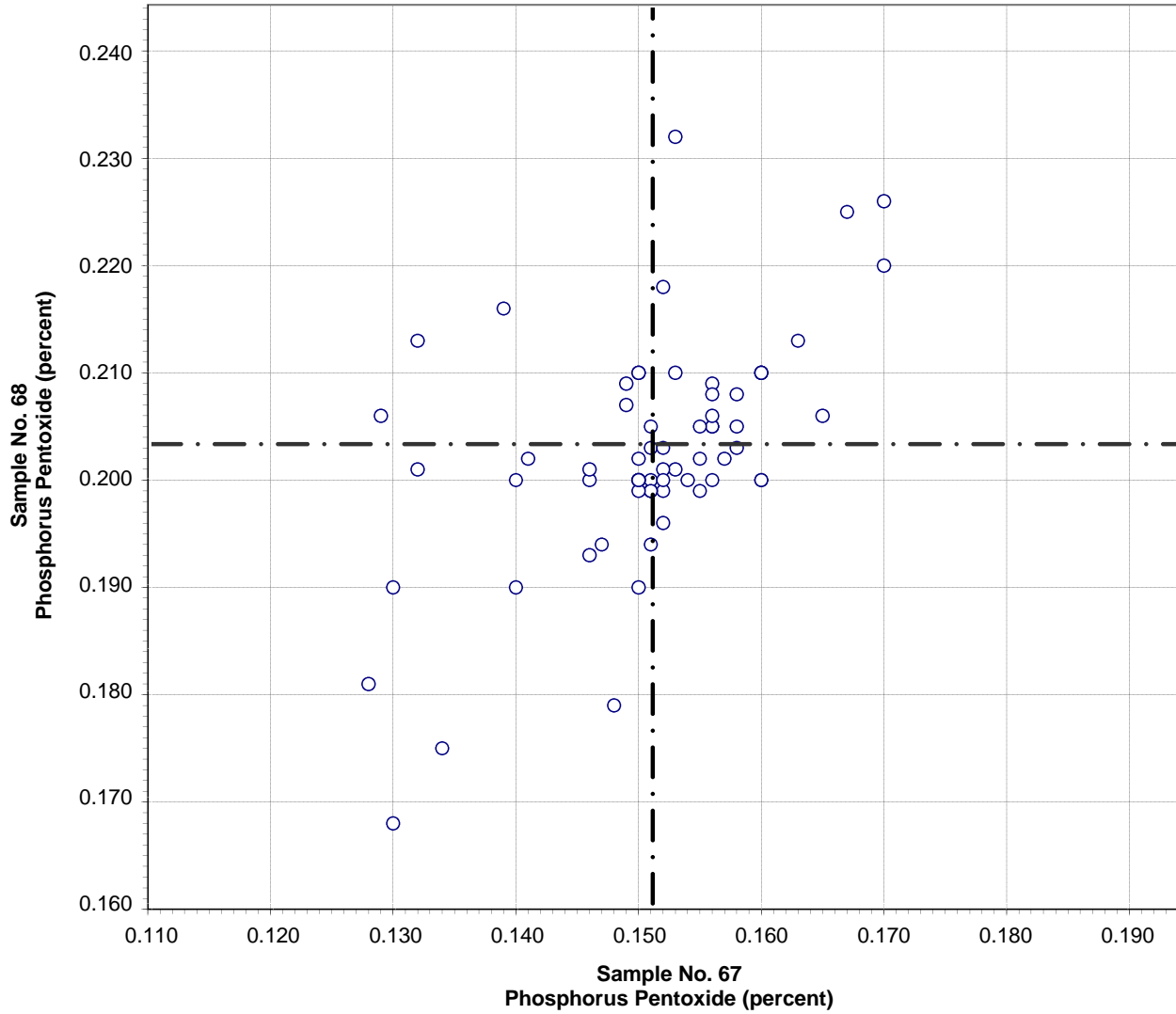


Test No. 103 Titanium Dioxide 67 Points

Sample No. 67	Ave 0.37	S.D. 0.016	C.V. 4.2
Sample No. 68	Ave 0.36	S.D. 0.011	C.V. 3.2

Labs eliminated: 169, 3320

**CCRL Proficiency Sample Program
Phosphorus Pentoxide
BLENDED CEMENT Samples No. 67 and No. 68**



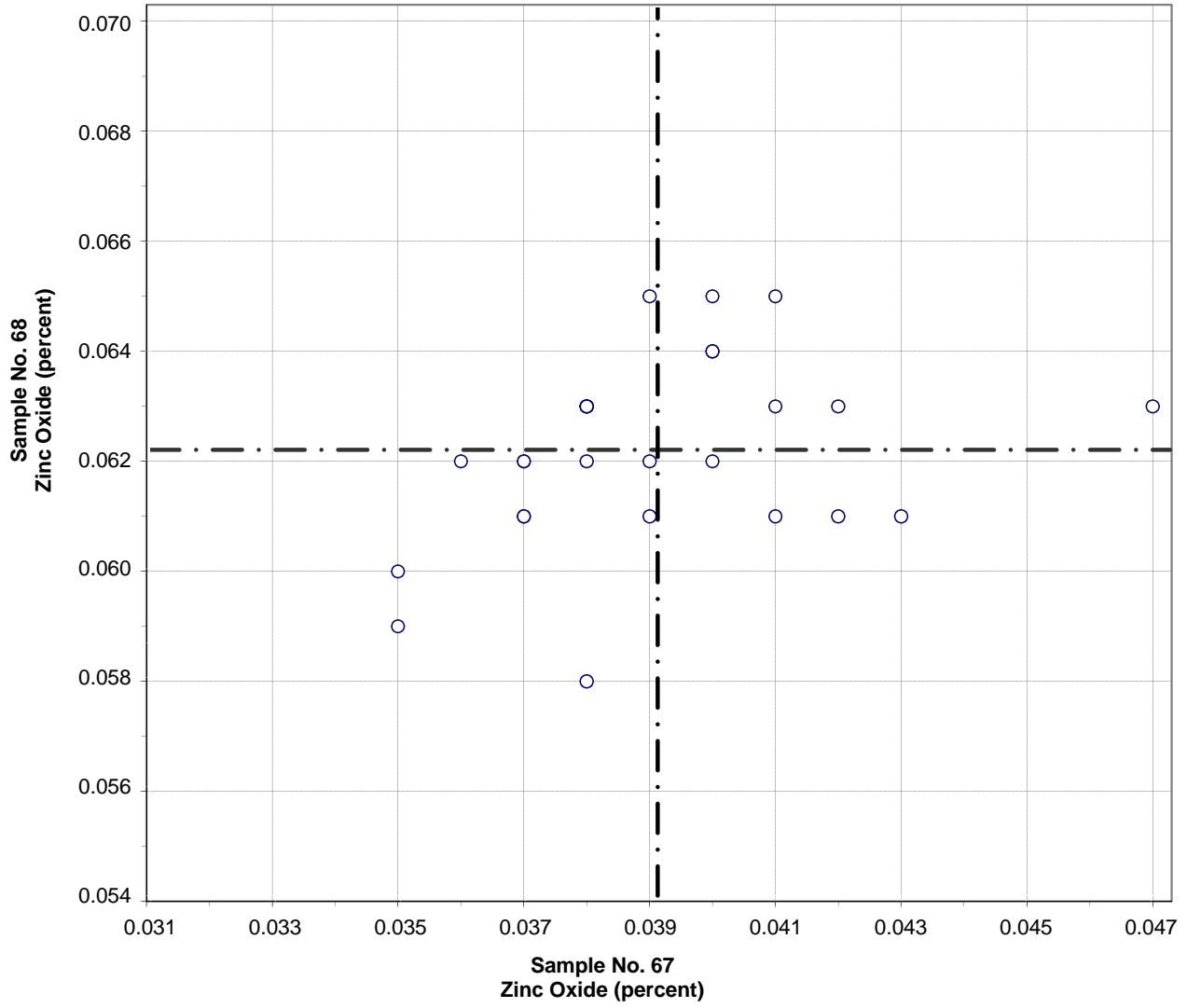
Test No. 102 Phosphorus Pentoxide 67 Points

Sample No. 67	Ave 0.151	S.D. 0.009	C.V. 6.2
Sample No. 68	Ave 0.203	S.D. 0.012	C.V. 5.8

Labs eliminated: 169, 3320

Labs off Diagram: 53

**CCRL Proficiency Sample Program
Zinc Oxide
BLENDED CEMENT Samples No. 67 and No. 68**

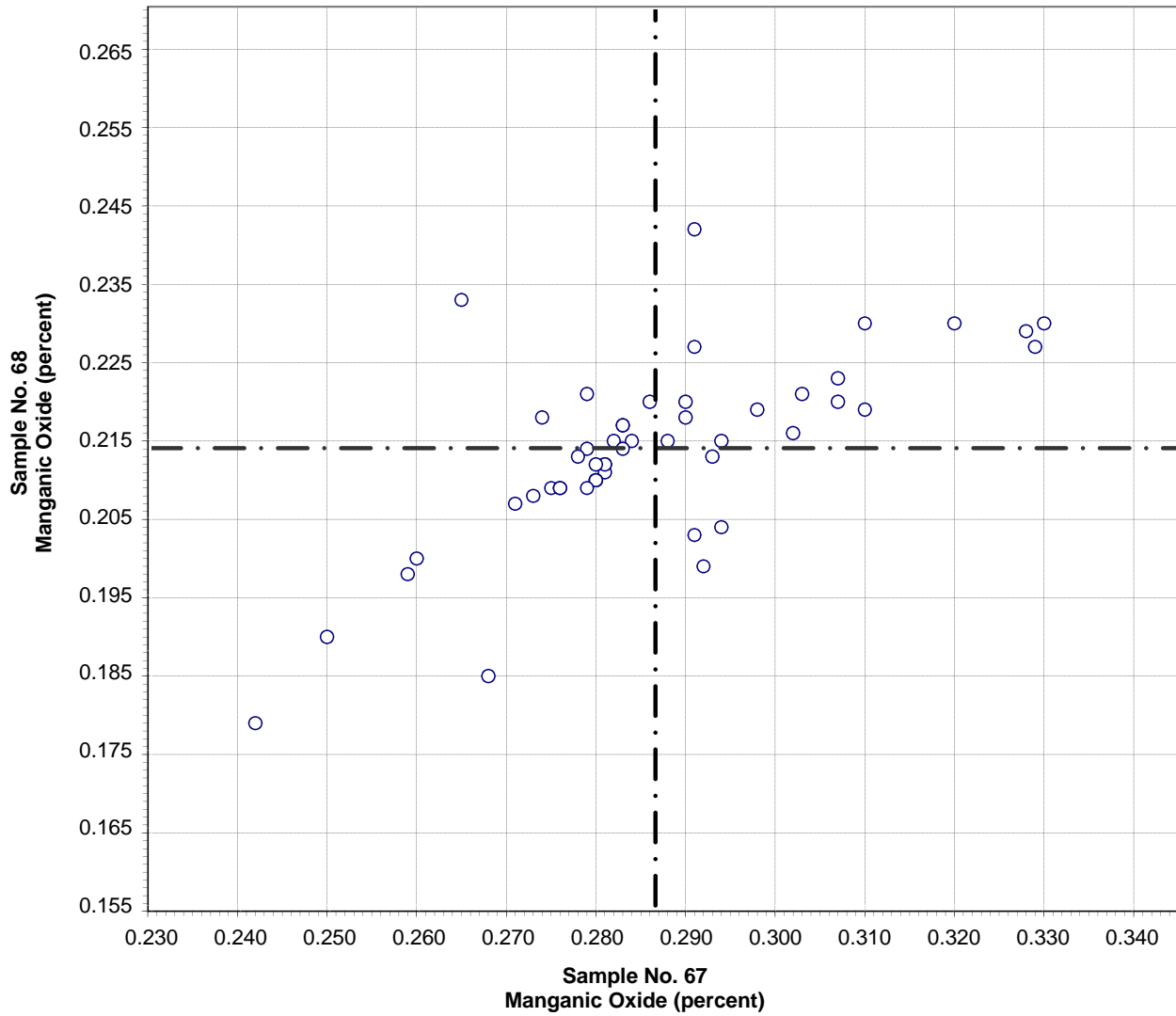


Test No. 99 Zinc Oxide 27 Points

Sample No. 67	Ave 0.039	S.D. 0.003	C.V. 6.7
Sample No. 68	Ave 0.062	S.D. 0.002	C.V. 2.8

Labs eliminated: 10, 176, 3320

**CCRL Proficiency Sample Program
Manganic Oxide
BLENDED CEMENT Samples No. 67 and No. 68**

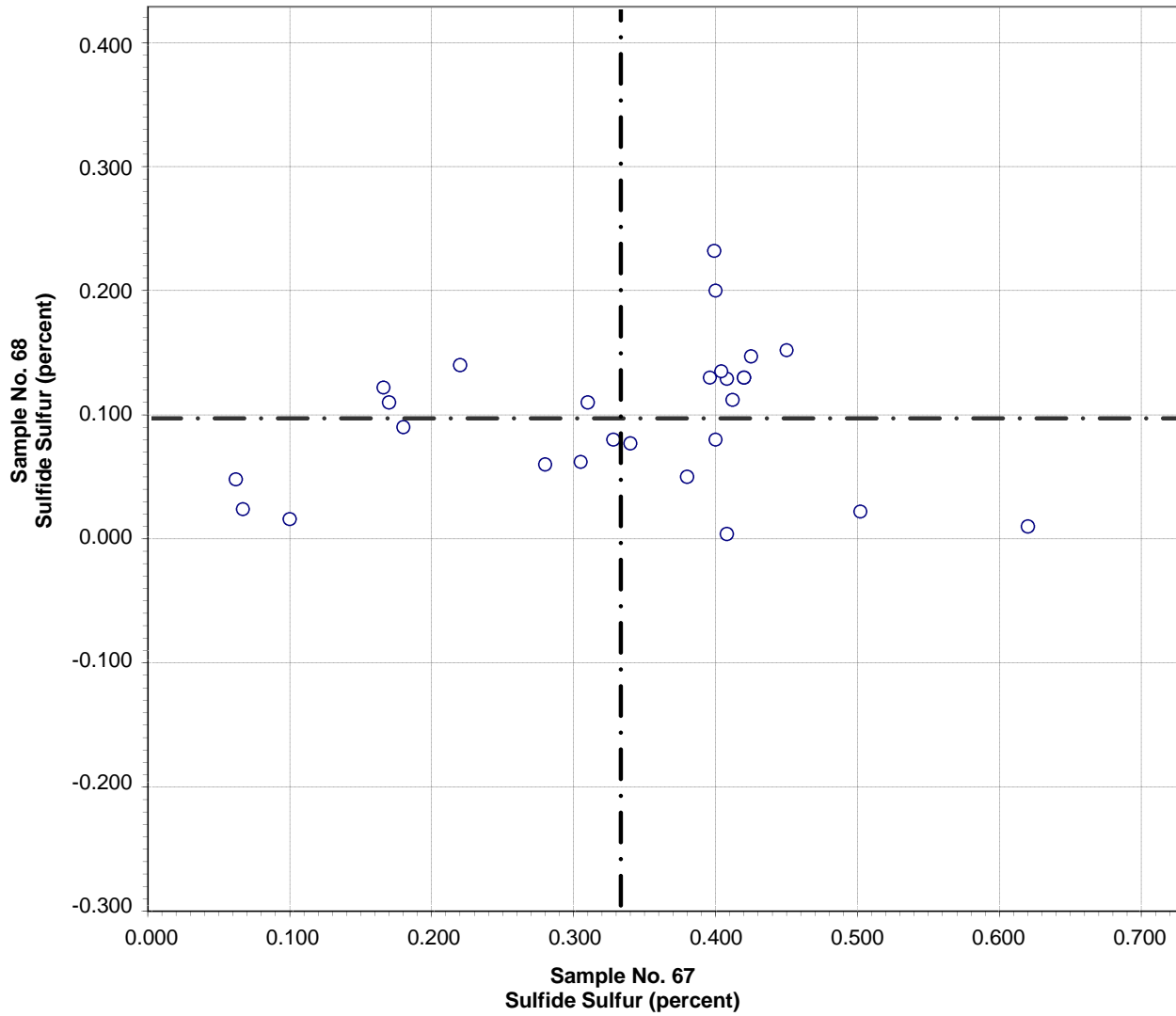


Test No. 101 Manganic Oxide 50 Points

Sample No. 67	Ave 0.287	S.D. 0.018	C.V. 6.4
Sample No. 68	Ave 0.214	S.D. 0.012	C.V. 5.5

Labs eliminated: 105, 3320

**CCRL Proficiency Sample Program
Sulfide Sulfur
BLENDED CEMENT Samples No. 67 and No. 68**

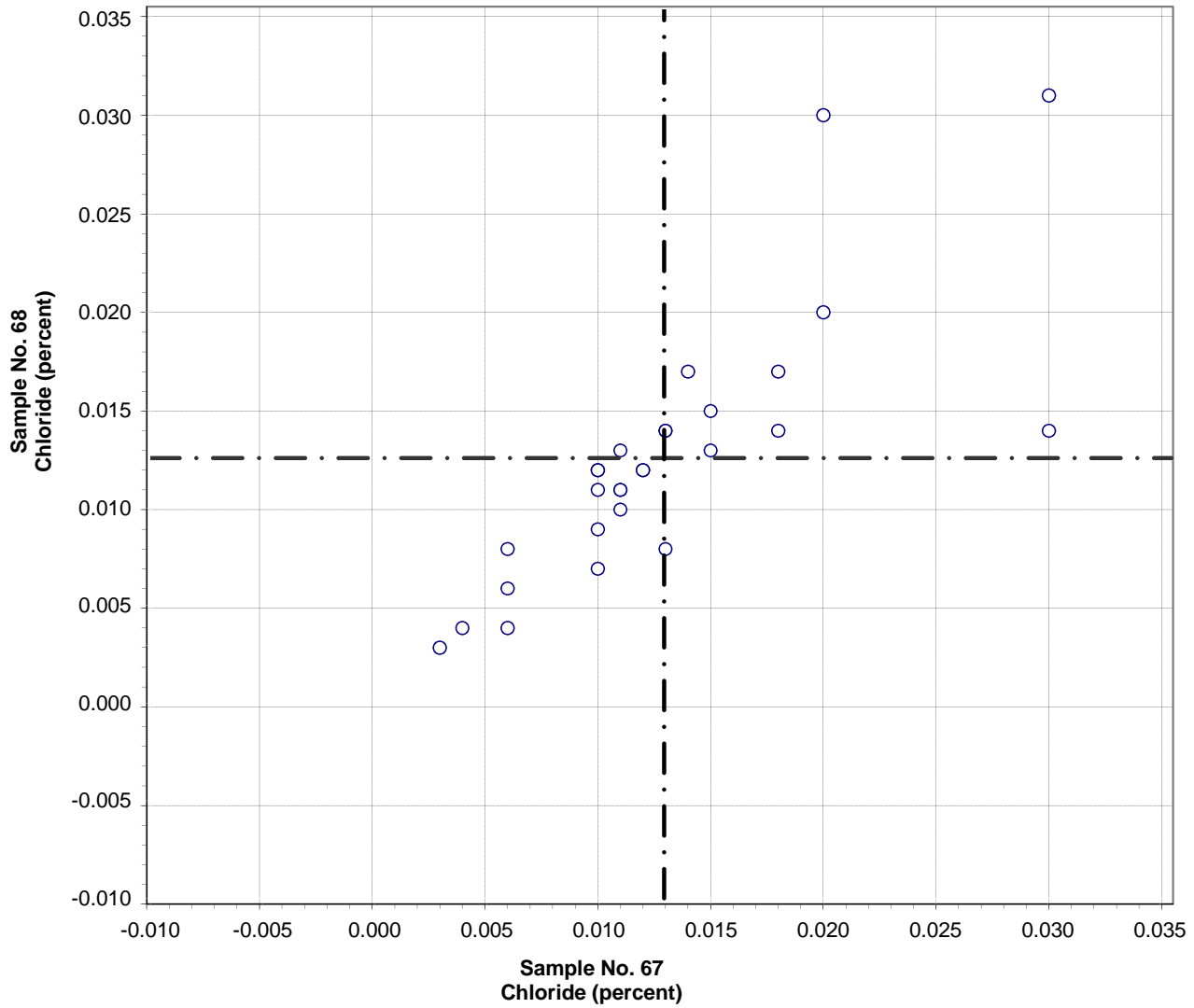


Test No. 65 Sulfide Sulfur 27 Points

Sample No. 67	Ave 0.332	S.D. 0.136	C.V. 41
Sample No. 68	Ave 0.096	S.D. 0.057	C.V. 59

Labs eliminated: 19, 2462, 22, 3232

**CCRL Proficiency Sample Program
Chloride
BLENDED CEMENT Samples No. 67 and No. 68**

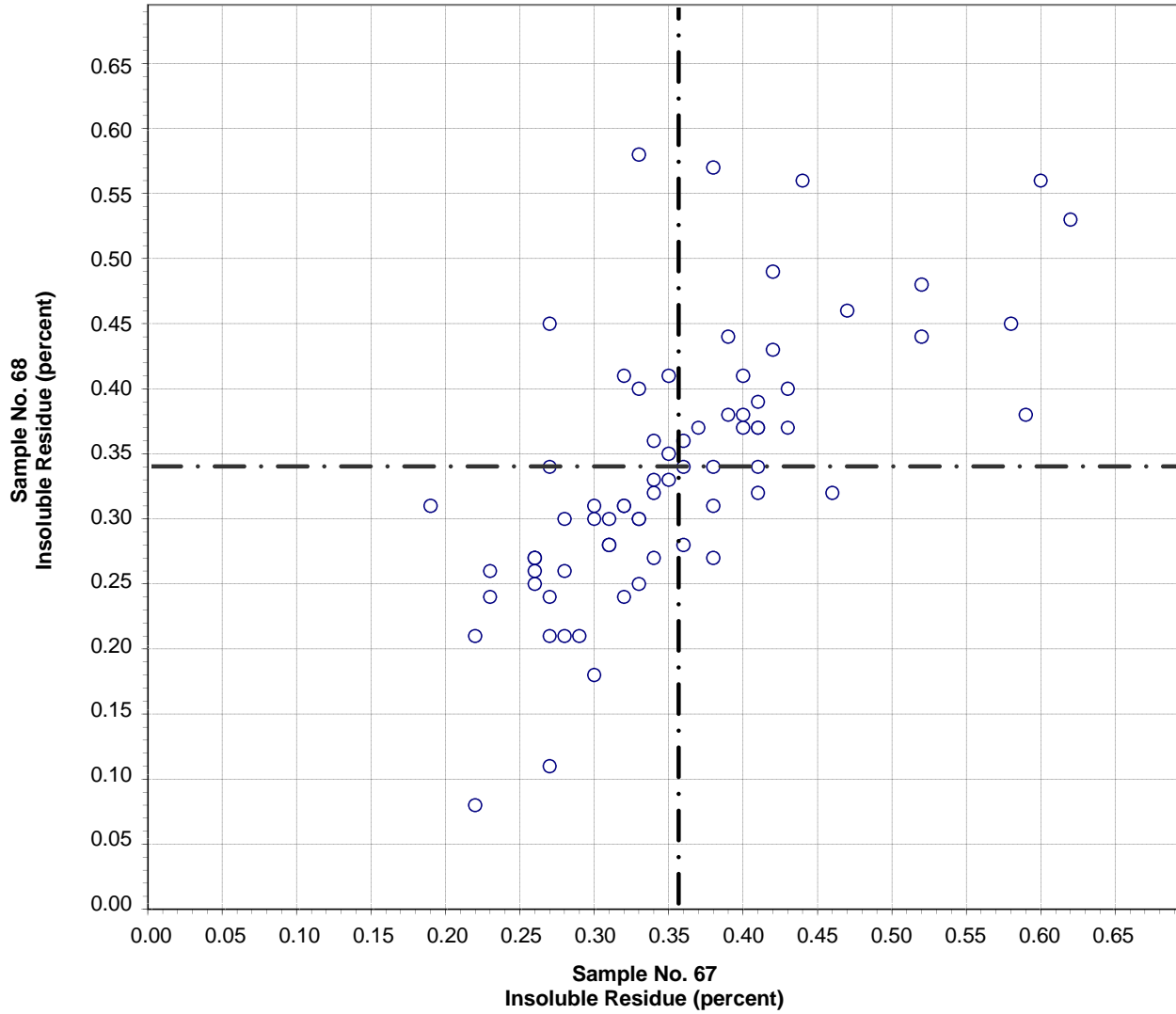


Test No. 104 Chloride 29 Points

Sample No. 67	Ave 0.013	S.D. 0.006	C.V. 49
Sample No. 68	Ave 0.013	S.D. 0.006	C.V. 51

Labs eliminated: 158

**CCRL Proficiency Sample Program
Insoluble Residue
BLENDED CEMENT Samples No. 67 and No. 68**

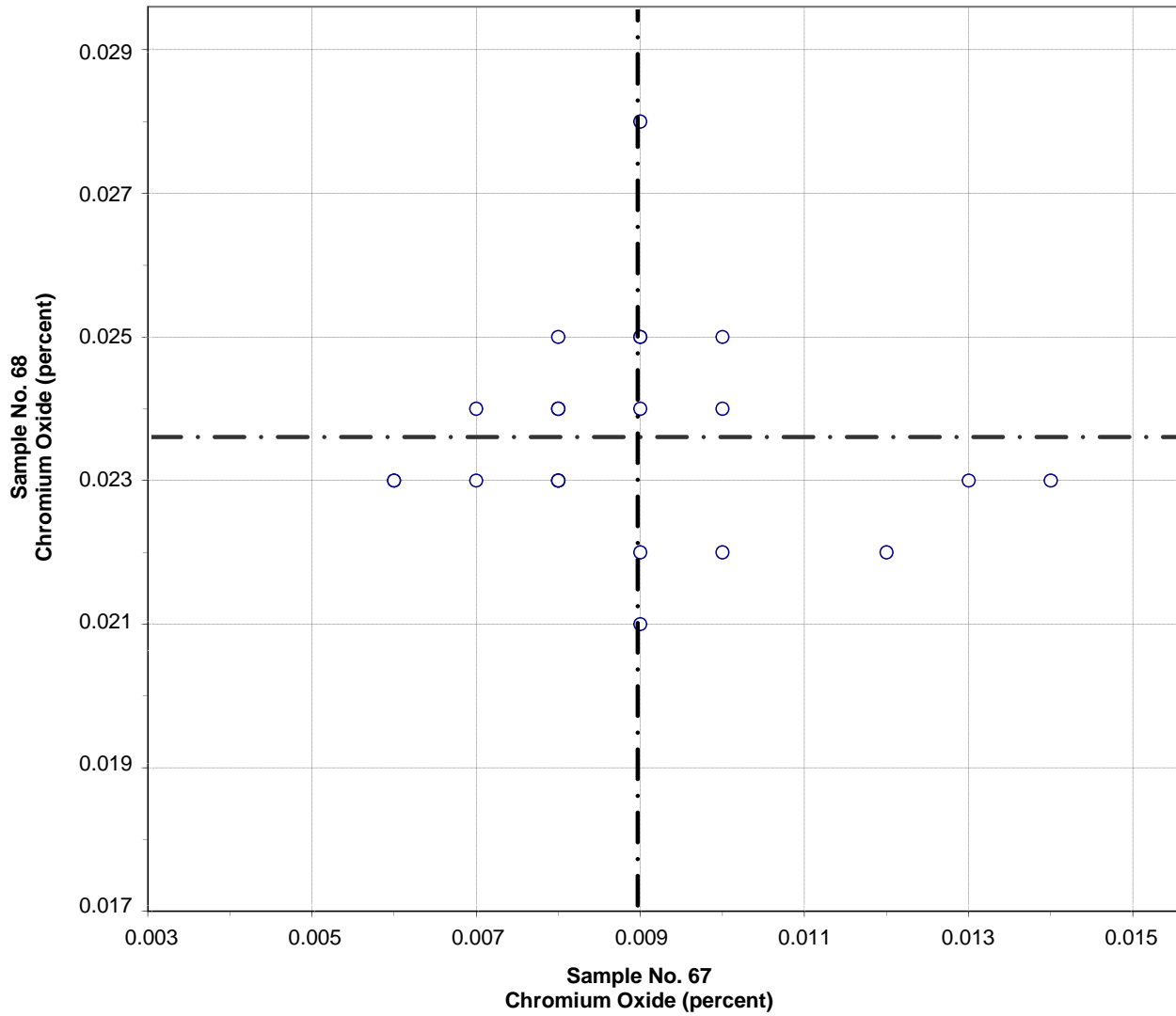


Test No. 80 Insoluble Residue 71 Points

Sample No. 67	Ave 0.36	S.D. 0.09	C.V. 26
Sample No. 68	Ave 0.34	S.D. 0.10	C.V. 30

Labs eliminated: 695, 36, 2360, 691, 694, 20, 246, 3409

**CCRL Proficiency Sample Program
Chromium Oxide
BLENDED CEMENT Samples No. 67 and No. 68**



Test No. 105 Chromium Oxide 22 Points

Sample No. 67	Ave 0.009	S.D. 0.002	C.V. 22
Sample No. 68	Ave 0.024	S.D. 0.001	C.V. 6.2

Labs eliminated: 2466, 10, 2462, 284, 3320

CCRL PROFICIENCY SAMPLE PROGRAM
 Blended Cement Proficiency Samples No. 67 and No. 68
 Final Report - Physical Results
 May 6, 2011

SUMMARY OF RESULTS

Test		#Labs	Sample No. 67			Sample No. 68		
			Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	%	101	27.3	2.5	9.3	27.5	0.55	2.0
N.C. Water	%	* 99	27.6	0.44	1.6	27.5	0.46	1.7
Vicat TS Initial	min	100	156	17	11	98	20	20
Vicat TS Initial	min	* 95	157	14	8.7	96	15	15
Vicat TS Final	min	96	263	31	12	203	34	17
Vicat TS Final	min	* 95	264	31	12	204	33	16
Autoclave Expan	%	91	0.02	0.04	234	-0.02	0.03	191
Autoclave Expan	%	* 89	0.01	0.02	166	-0.01	0.02	156
Air Content	%	78	7.2	1.1	15	6.2	1.2	20
AC Mix Water	%	77	69.5	3.4	4.9	69.7	3.7	5.3
AC Mix Water	%	* 75	69.7	2.0	2.9	69.8	2.3	3.2
AC Flow	%	78	87	4.5	5.2	86	4.6	5.3
AC Flow	%	* 76	87	3.2	3.7	86	3.6	4.1
Specific Gravity		80	3.01	0.06	2.1	3.10	0.04	1.2
Specific Gravity		* 77	3.02	0.04	1.4	3.10	0.04	1.2

CONTINUED ON NEXT PAGE

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

Normal Consistency 169 2295
 Vicat TS initial 181 38 50 1773 2251
 Vicat TS Final 51
 Autoclave Expansion 958 3320
 Air Content - Water 51 2295
 Air Content - Flow 2 2295
 Specific Gravity 92 440 691

CCRL PROFICIENCY SAMPLE PROGRAM
 Blended Cement Proficiency Samples No. 67 and No. 68
 Final Report - Physical Results
 May 6, 2011

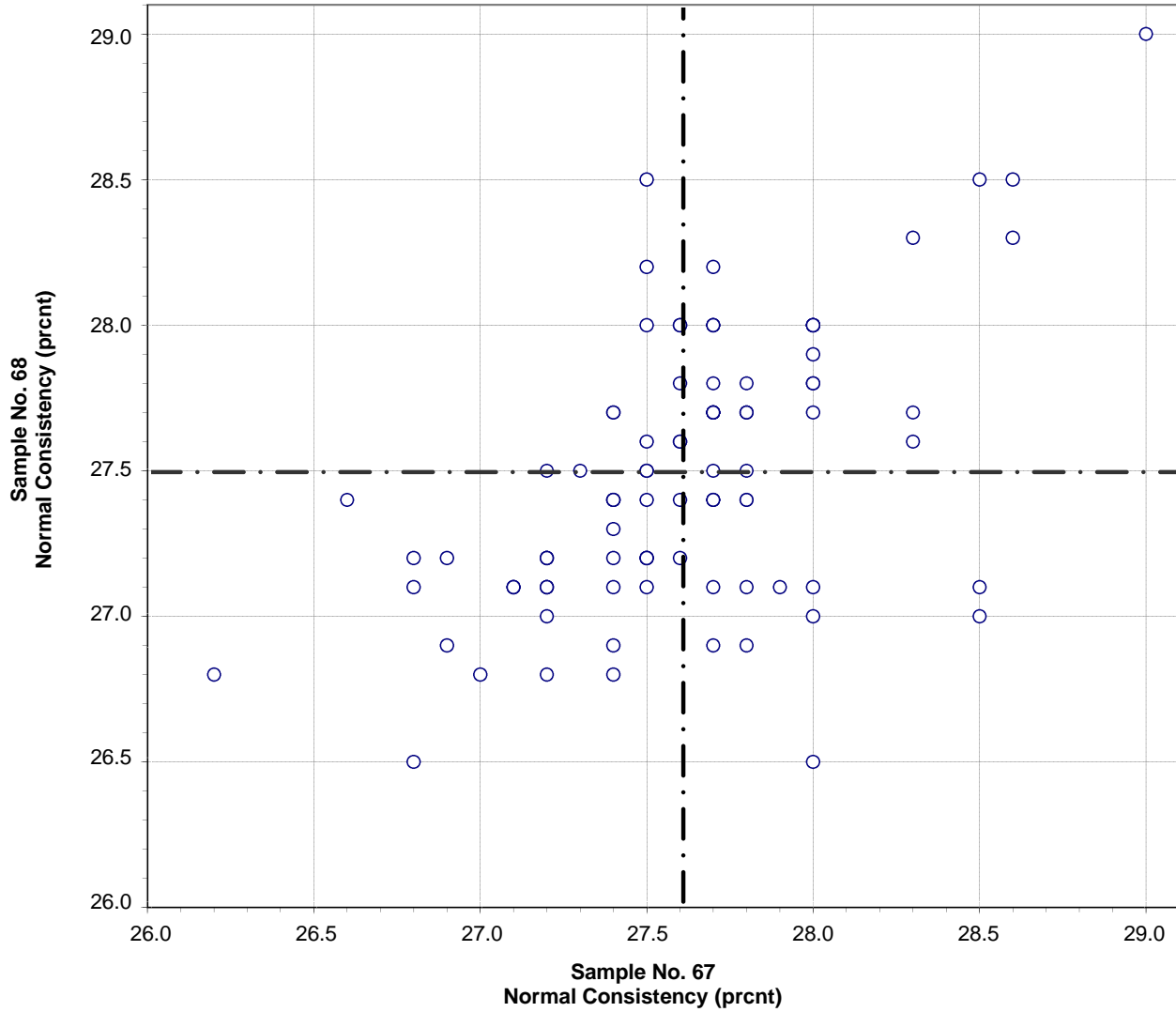
SUMMARY OF RESULTS

Test	#Labs	Sample No. 67			Sample No. 68			
		Average	S.D.	C.V.	Average	S.D.	C.V.	
Comp Str, 3 day	psi	100	3637	324	8.9	4130	326	7.9
Comp Str, 3 day	psi *	98	3664	259	7.1	4155	275	6.6
Comp Str, 7 day	psi	100	5296	420	7.9	5059	349	6.9
Comp Str, 7 day	psi *	96	5314	363	6.8	5083	296	5.8
Comp Str, 28 day	psi	94	7098	549	7.7	6858	466	6.8
Comp Str, 28 day	psi *	91	7151	471	6.6	6888	408	5.9
CS, Mix Water	%	97	48.3	2.3	4.7	48.4	2.1	4.3
CS, Mix Water	% *	92	48.1	1.1	2.3	48.2	0.9	1.9
Comp Str, Flow	%	97	110	3.8	3.4	109	3.6	3.3
Comp Str, Flow	% *	95	110	2.8	2.6	110	2.7	2.5
FINENESS								
Air Permeability	cm ² /g	91	5322	556	10	4763	393	8.3
Air Permeability	cm ² /g *	86	5399	293	5.4	4825	255	5.3
45µm Sieve	%	96	98.36	0.88	0.90	98.82	0.66	0.66
45µm Sieve	% *	89	98.48	0.28	0.28	98.92	0.19	0.20

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

Specific Gravity 92 440 691
 Comp. Strength, 3 day 52 2477
 Comp. Strength, 7 day 52 2477 9 3247
 Comp. Strength, 28 day 51 52 497
 Comp. Strength, Mix Water 74 24 38 105 2477
 Comp. Strength, Flow 47 116
 Fineness - Air Permeability 2 14 51 958 3247
 Fineness - 45µm Sieve 39 413 70 116 982 2295 3431

**CCRL Proficiency Sample Program
Normal Consistency - % Water
BLENDED CEMENT Samples No. 67 and No. 68**



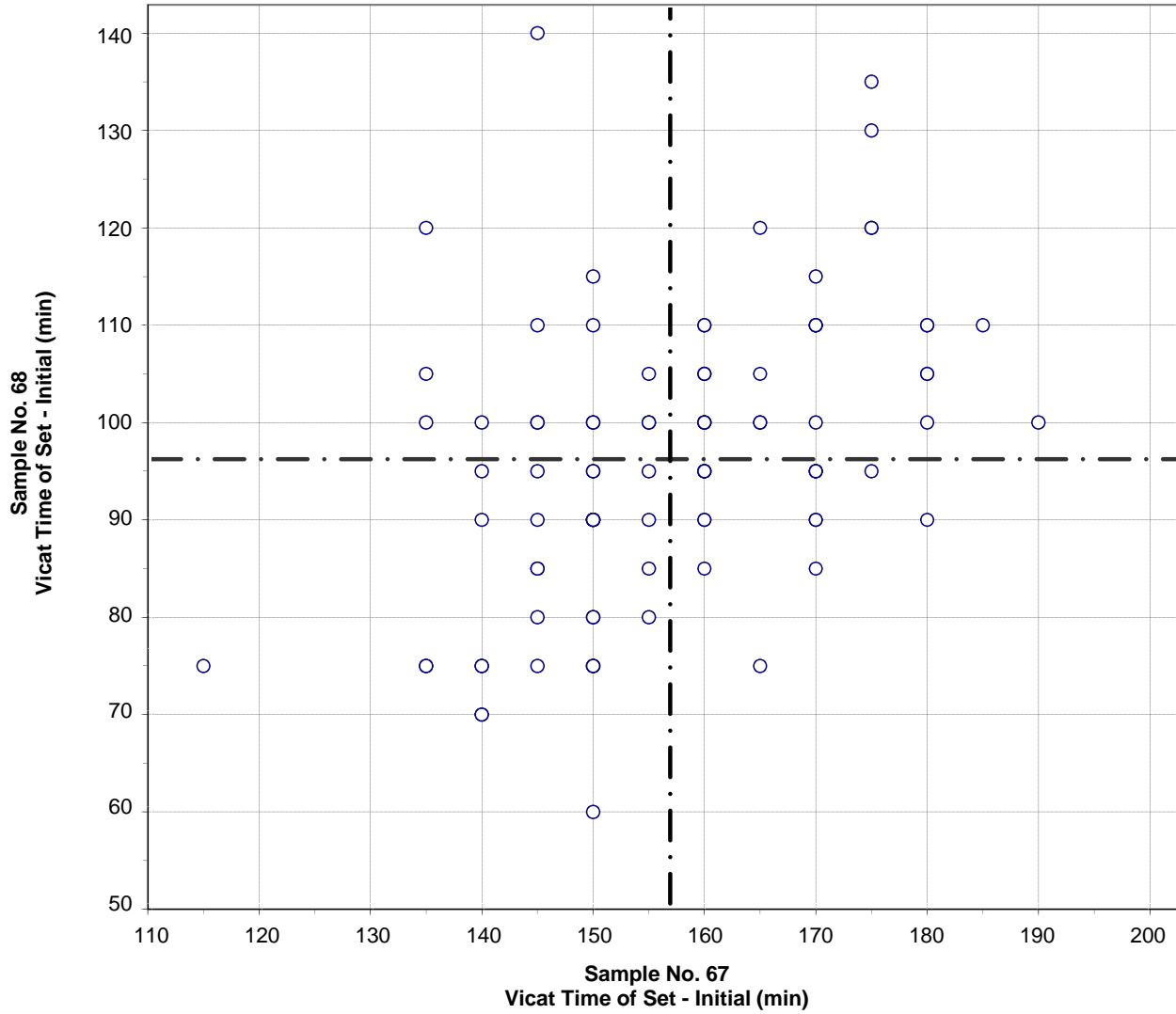
Test No. 110 Normal Consistency - % Water 99 Points

Sample No. 67 Ave 27.6 S.D. 0.4 C.V. 1.6

Sample No. 68 Ave 27.5 S.D. 0.5 C.V. 1.7

Labs eliminated: 169, 2295

**CCRL Proficiency Sample Program
 Vicat Time of Set - Initial
 BLENDED CEMENT Samples No. 67 and No. 68**

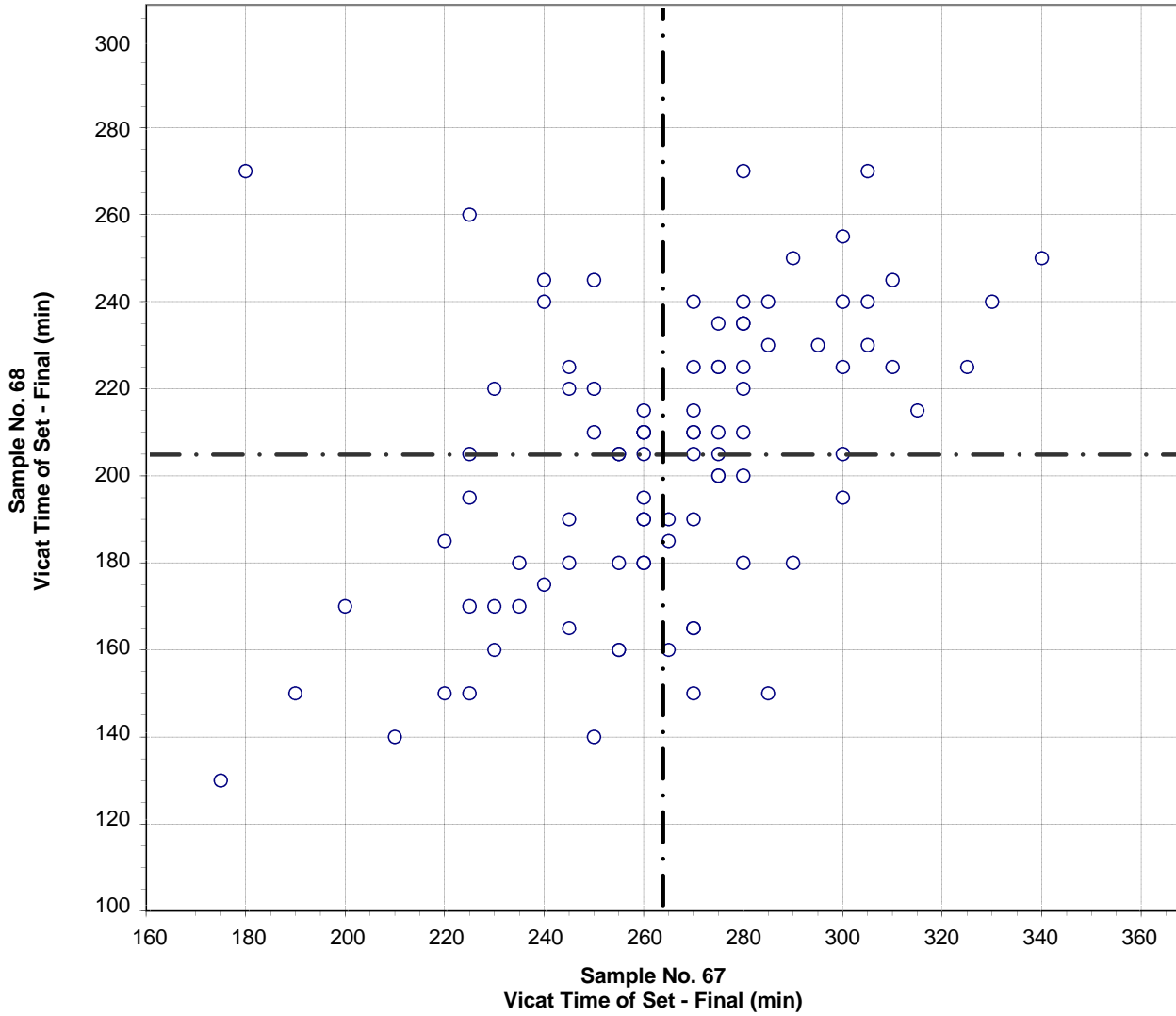


Test No. 120 Vicat Time of Set - Initial 95 Points

Sample No. 67 Ave 157 S.D. 14 C.V. 8.7
 Sample No. 68 Ave 96 S.D. 15 C.V. 15

Labs eliminated: 181, 38, 50, 1773, 2251

**CCRL Proficiency Sample Program
 Vicat Time of Set - Final
 BLENDED CEMENT Samples No. 67 and No. 68**

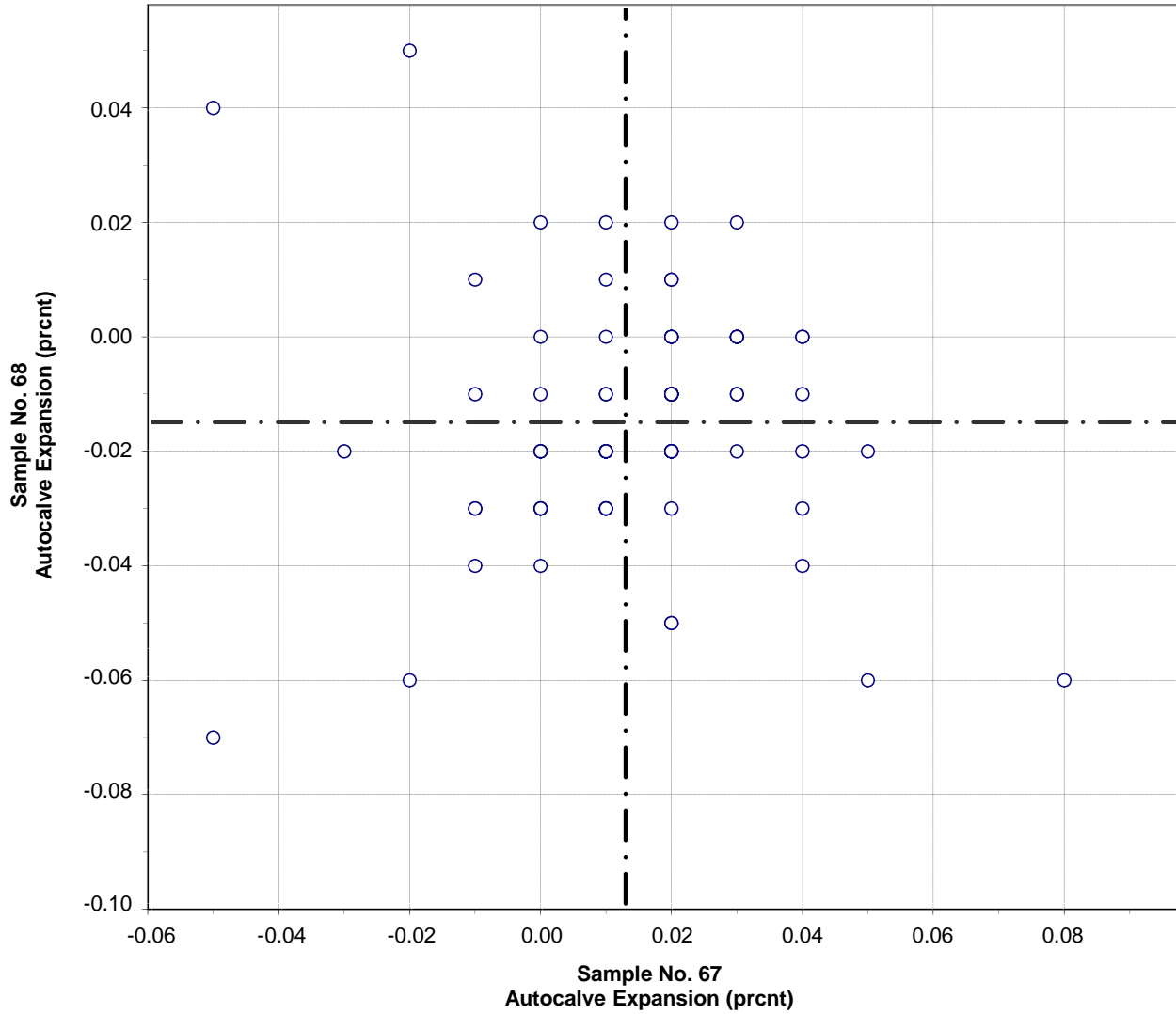


Test No. 121 Vicat Time of Set - Final 95 Points

Sample No. 67	Ave 264	S.D. 31	C.V. 12
Sample No. 68	Ave 205	S.D. 33	C.V. 16

Labs eliminated: 51

**CCRL Proficiency Sample Program
Autoclave Expansion
BLENDED CEMENT Samples No. 67 and No. 68**



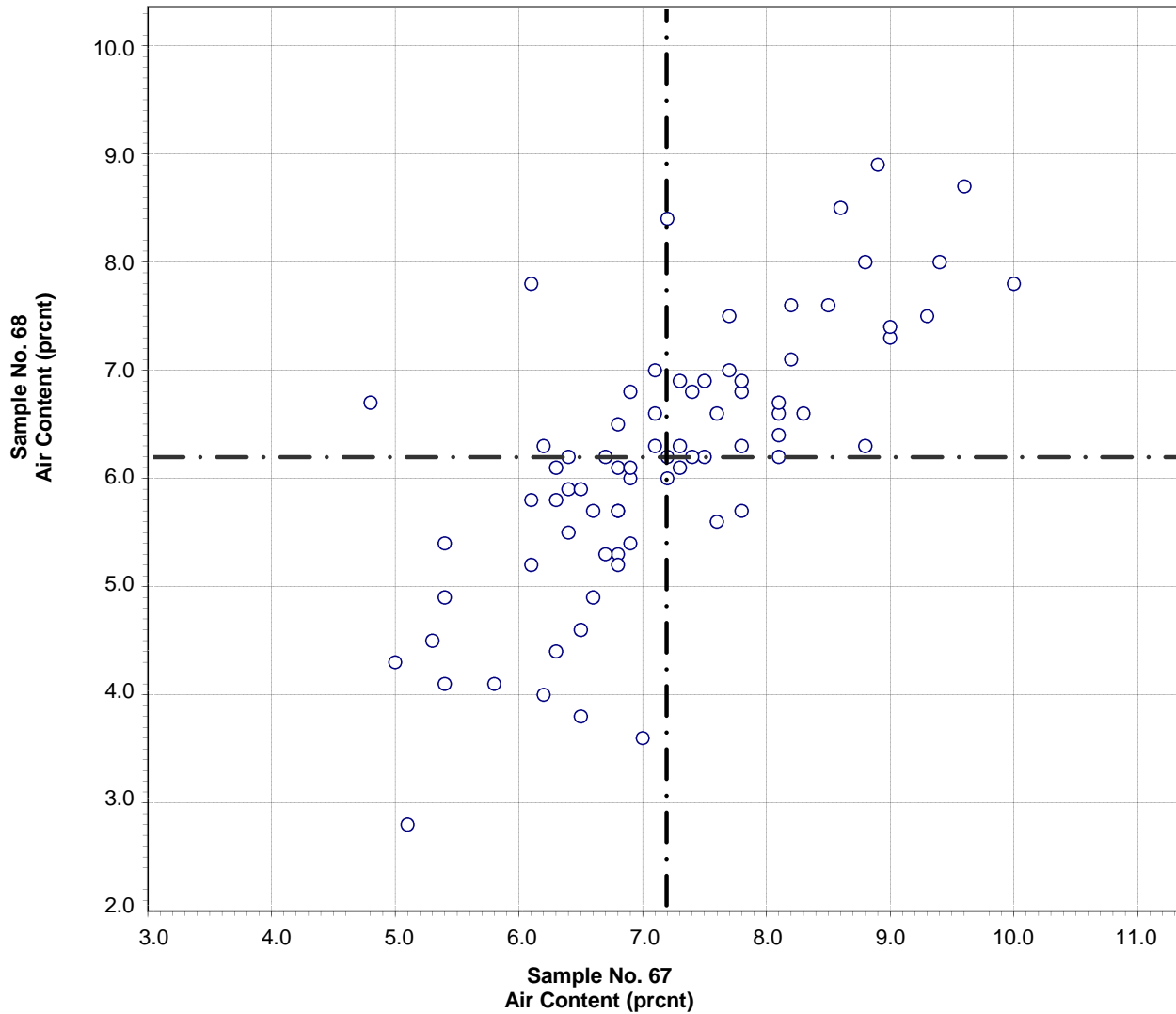
Test No. 160 Autoclave Expansion 87 Points

Sample No. 67	Ave 0.01	S.D. 0.02	C.V. 166
Sample No. 68	Ave -0.01	S.D. 0.02	C.V. 156

Labs eliminated: 958, 3320

Labs off Diagram: 3, 2490

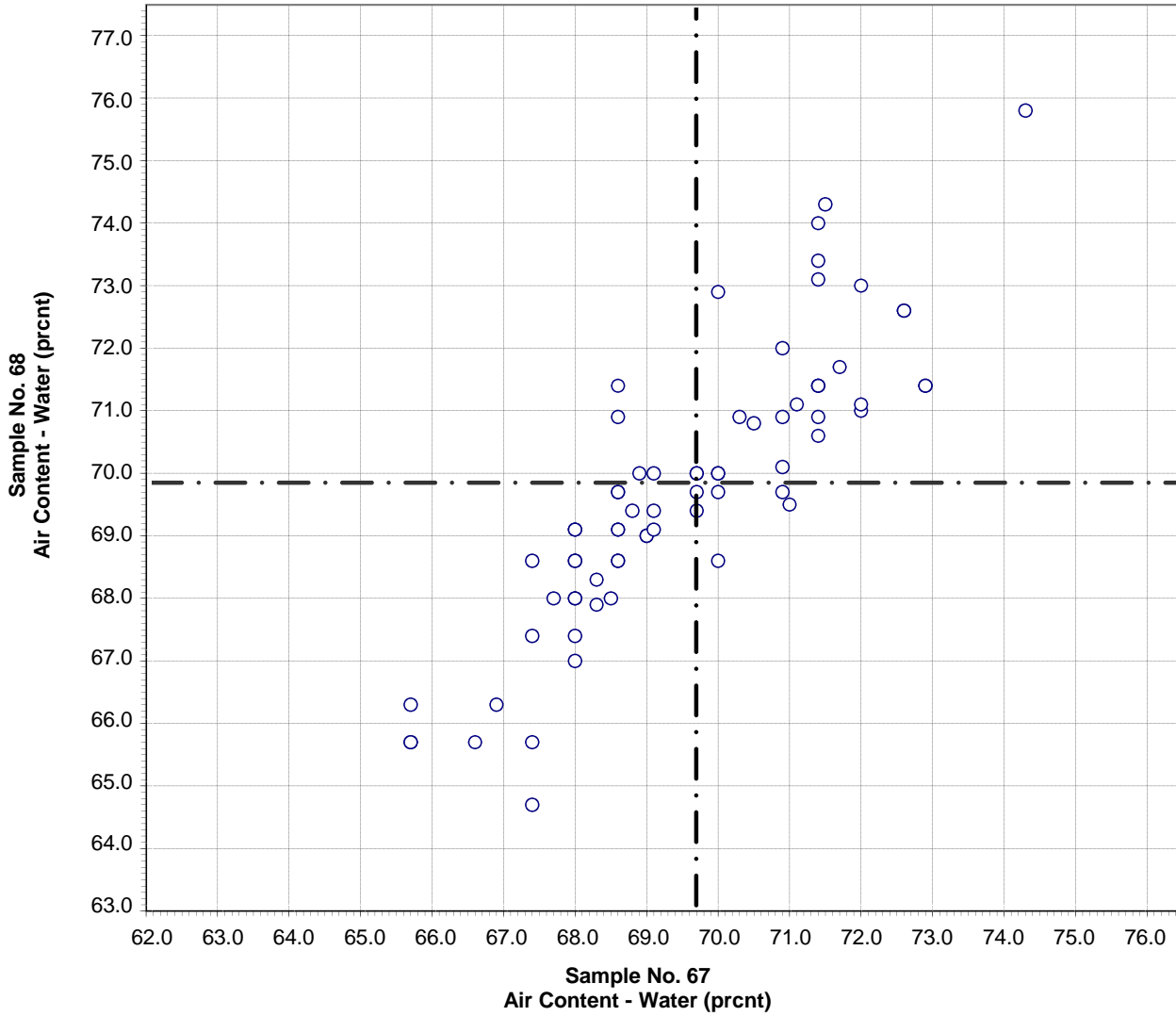
CCRL Proficiency Sample Program
Air Content %
BLENDED CEMENT Samples No. 67 and No. 68



Test No. 170 Air Content % 78 Points

Sample No. 67	Ave 7.2	S.D. 1.1	C.V. 15
Sample No. 68	Ave 6.2	S.D. 1.2	C.V. 20

**CCRL Proficiency Sample Program
Air Content - % Water
BLENDED CEMENT Samples No. 67 and No. 68**



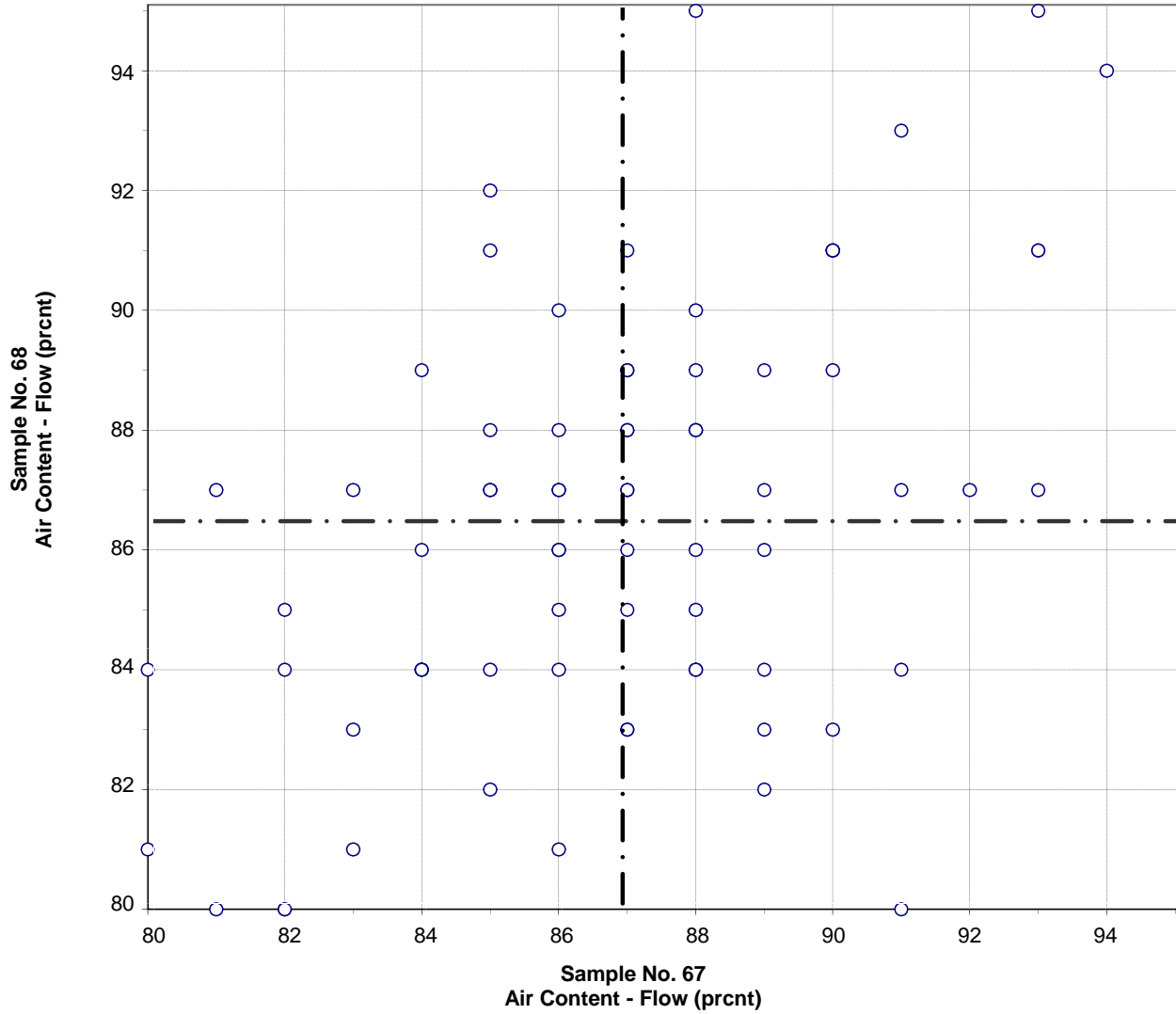
Test No. 180 Air Content - % Water 74 Points

Sample No. 67	Ave 69.7	S.D. 2.0	C.V. 2.9
Sample No. 68	Ave 69.8	S.D. 2.3	C.V. 3.2

Labs eliminated: 51, 2295

Labs off Diagram: 309

CCRL Proficiency Sample Program
Air Content - Flow
BLENDED CEMENT Samples No. 67 and No. 68

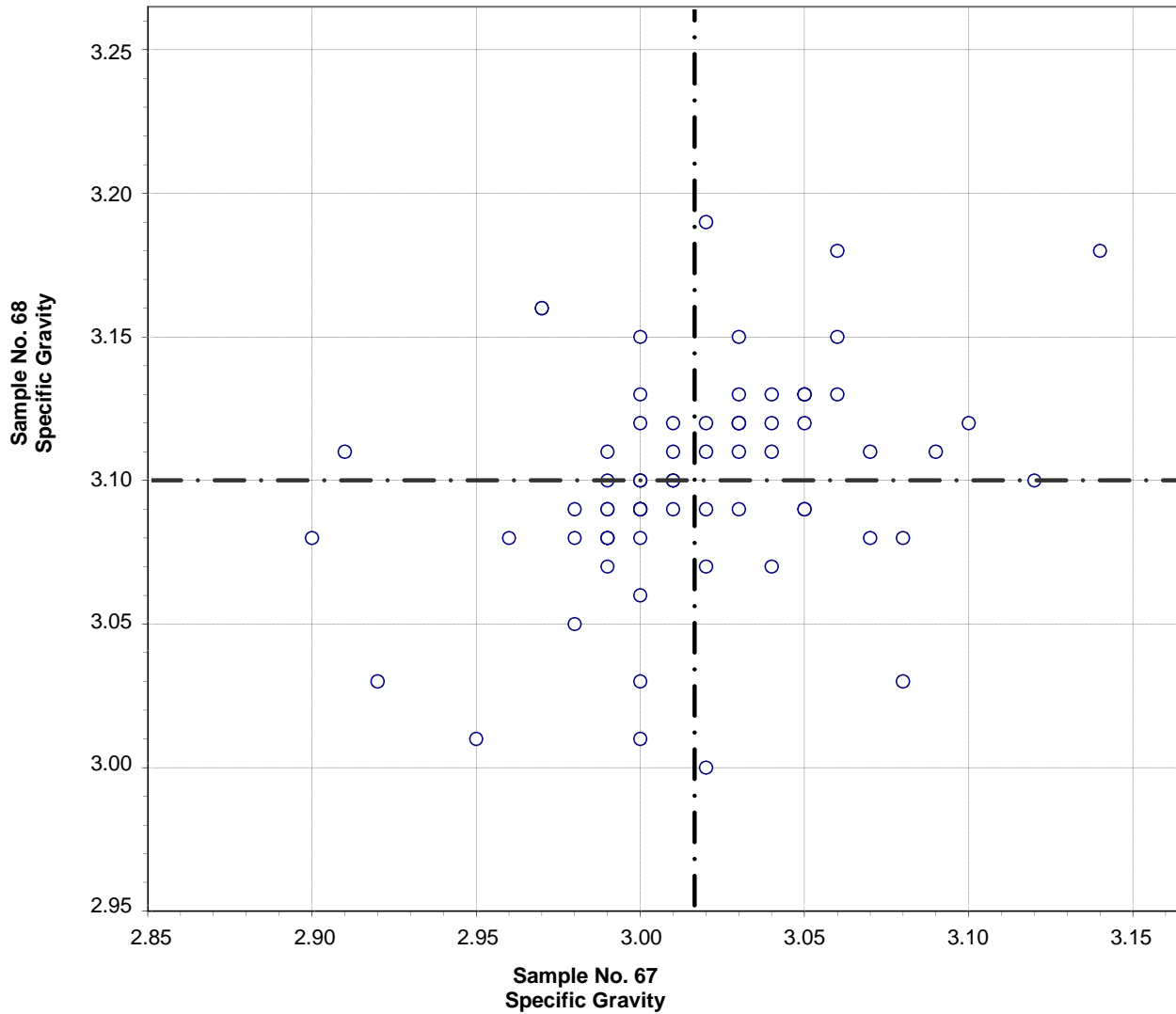


Test No. 190 Air Content - Flow 76 Points

Sample No. 67	Ave 87	S.D. 3.2	C.V. 3.7
Sample No. 68	Ave 86	S.D. 3.6	C.V. 4.1

Labs eliminated: 2, 2295

**CCRL Proficiency Sample Program
Specific Gravity
BLENDED CEMENT Samples No. 67 and No. 68**

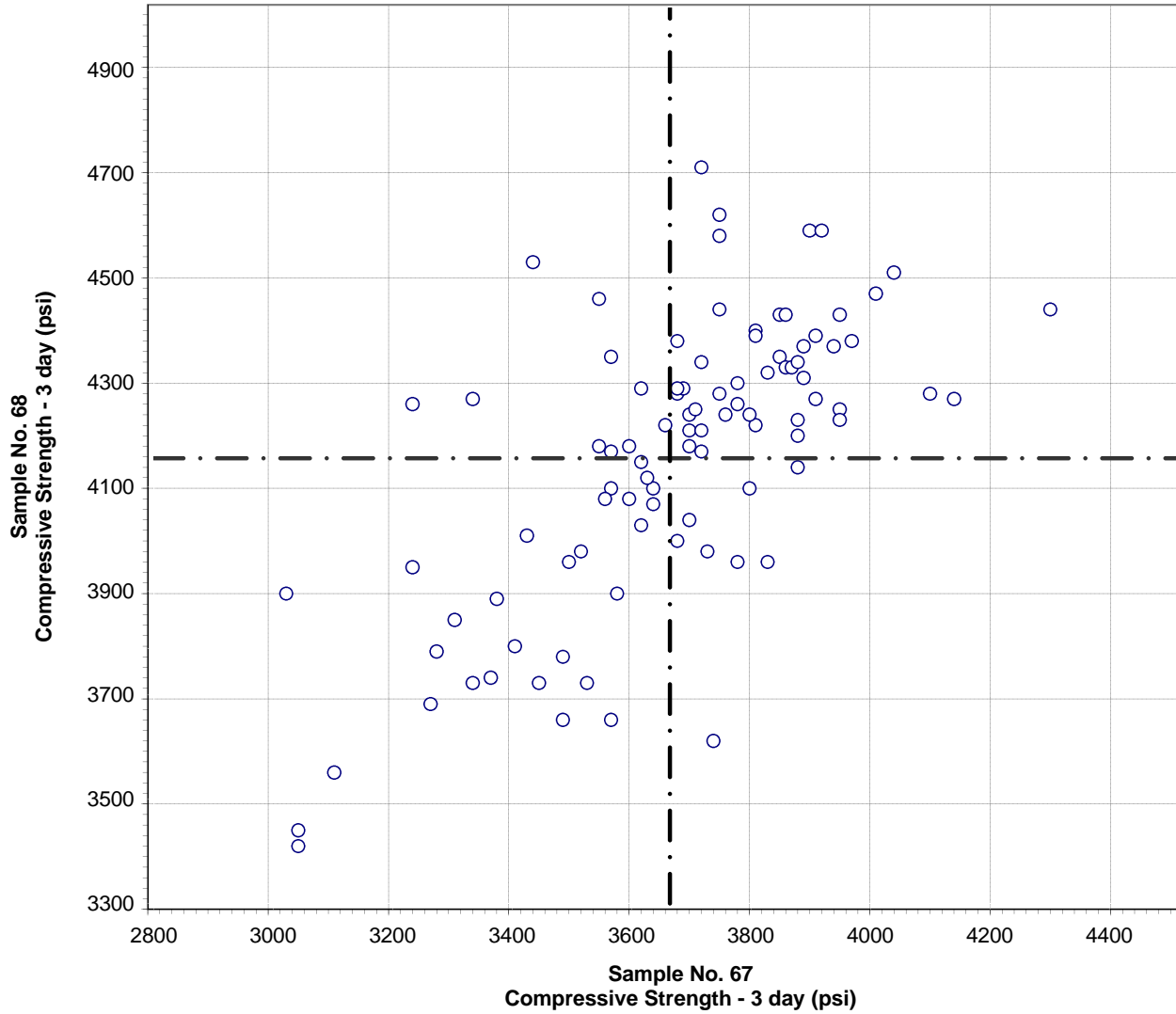


Test No. 310 Specific Gravity 77 Points

Sample No. 67	Ave 3.02	S.D. 0.04	C.V. 1.4
Sample No. 68	Ave 3.10	S.D. 0.04	C.V. 1.2

Labs eliminated: 92, 440, 691

**CCRL Proficiency Sample Program
Compressive Strength - 3 day
BLENDED CEMENT Samples No. 67 and No. 68**



Test No. 200 Compressive Strength - 3 day 97 Points

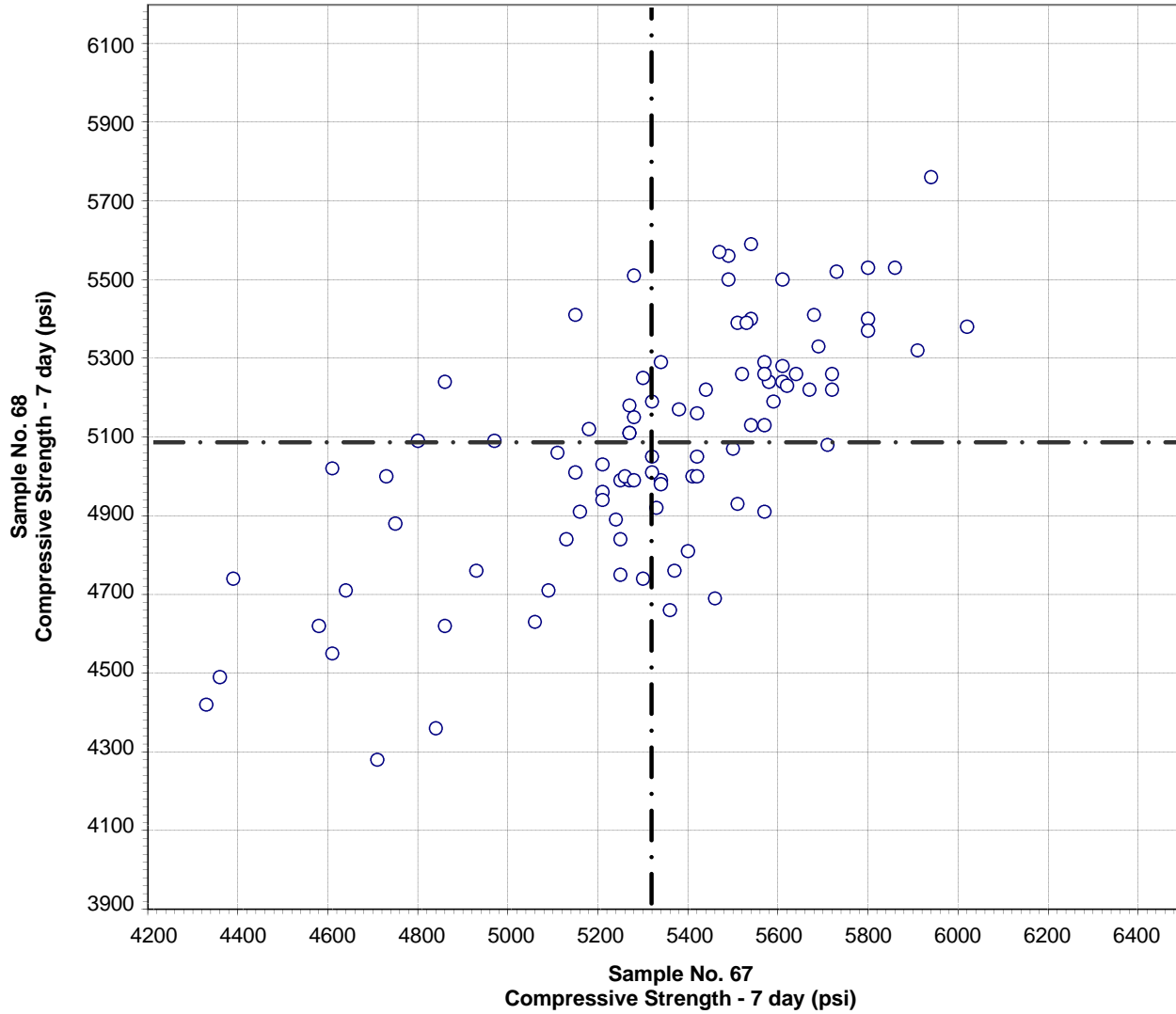
Sample No. 67 Ave 3664 S.D. 259 C.V. 7.1

Sample No. 68 Ave 4155 S.D. 275 C.V. 6.6

Labs eliminated: 52, 2477

Labs off Diagram: 2

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
BLENDED CEMENT Samples No. 67 and No. 68**



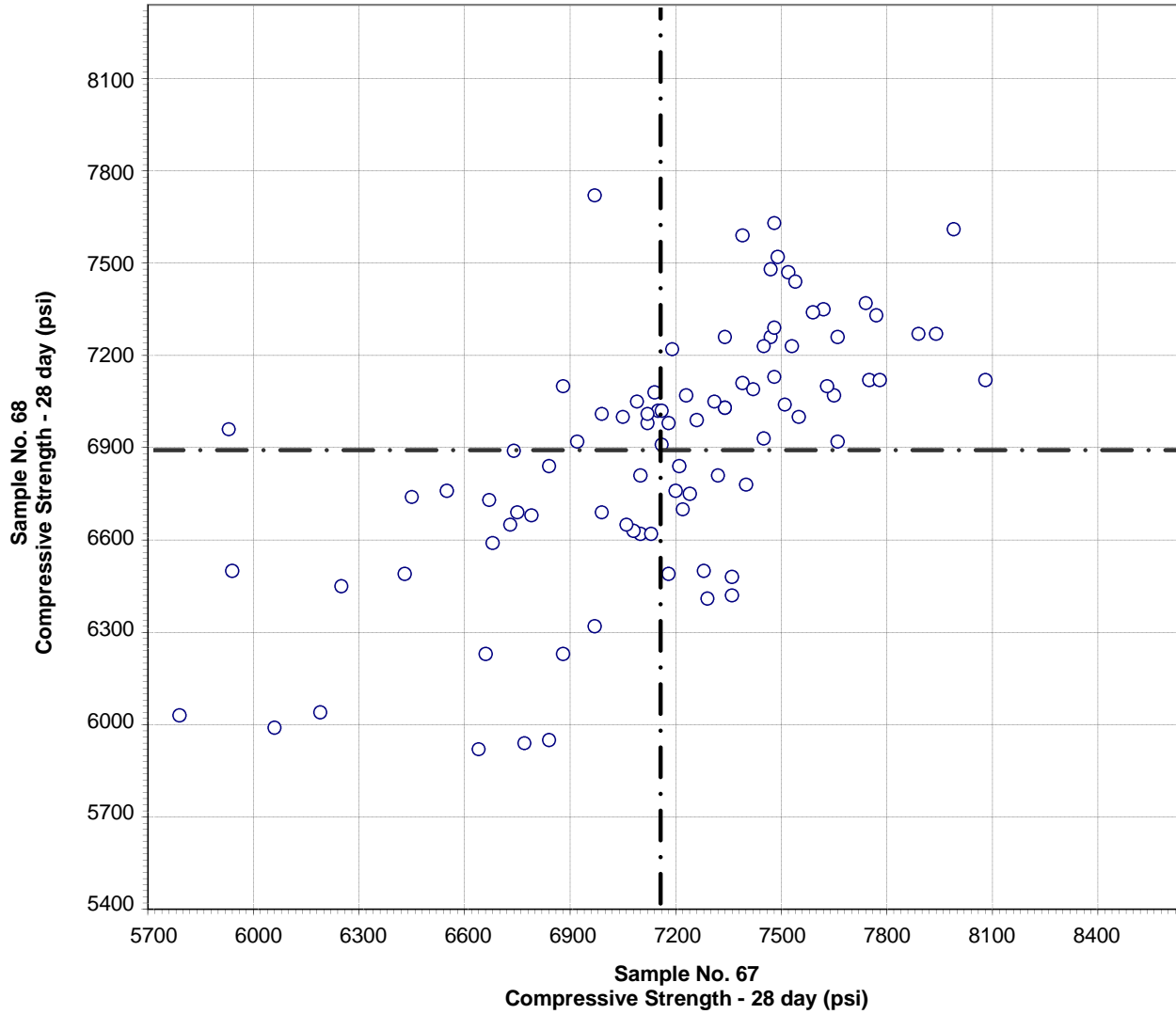
Test No. 210 Compressive Strength - 7 day 96 Points

Sample No. 67 Ave 5314 S.D. 363 C.V. 6.8

Sample No. 68 Ave 5083 S.D. 296 C.V. 5.8

Labs eliminated: 52, 2477, 9, 3247

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
BLENDED CEMENT Samples No. 67 and No. 68**



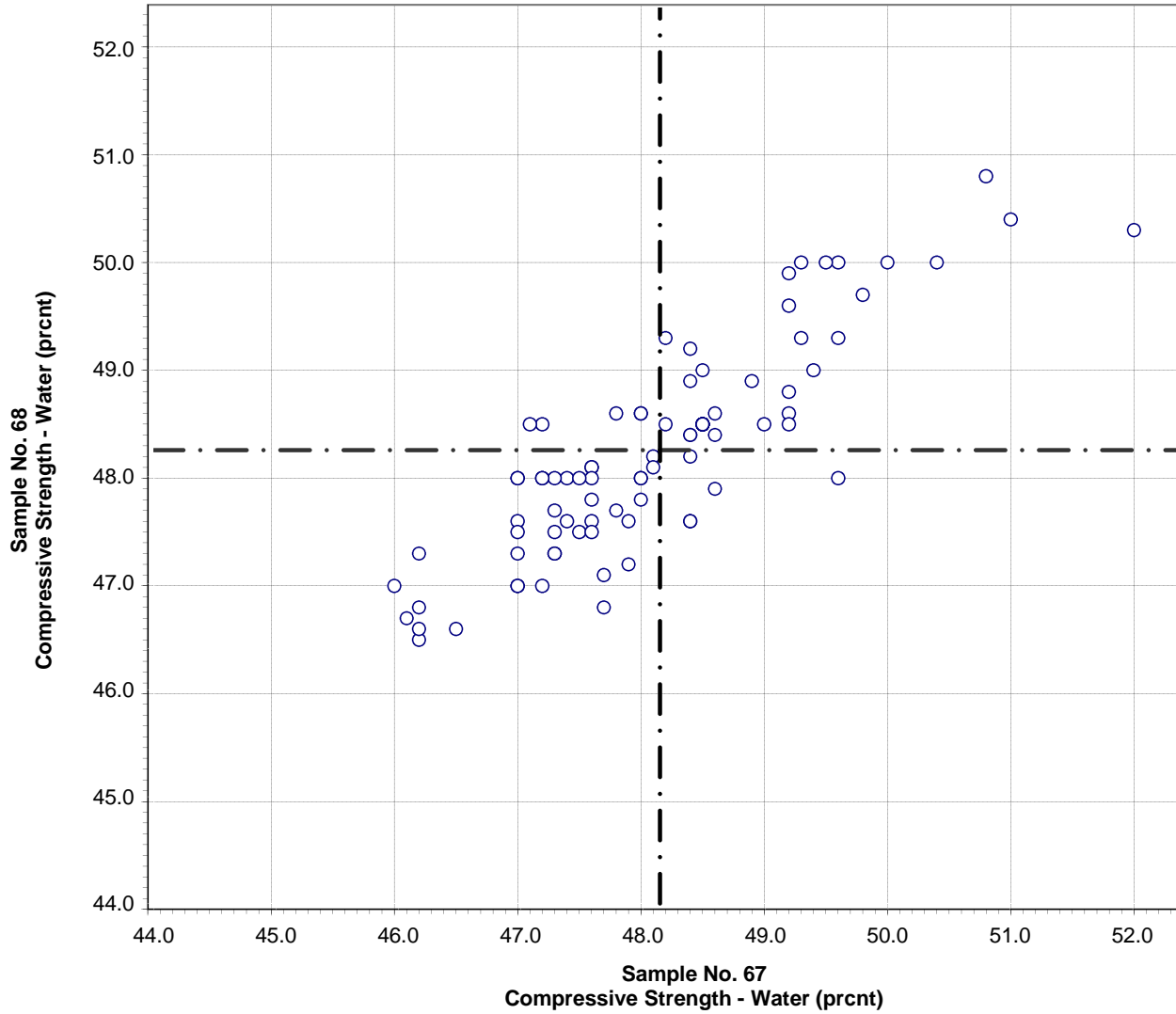
Test No. 211 Compressive Strength - 28 day 91 Points

Sample No. 67 Ave 7151 S.D. 471 C.V. 6.6

Sample No. 68 Ave 6888 S.D. 408 C.V. 5.9

Labs eliminated: 51, 52, 497

**CCRL Proficiency Sample Program
Compressive Strength - % Water
BLENDED CEMENT Samples No. 67 and No. 68**

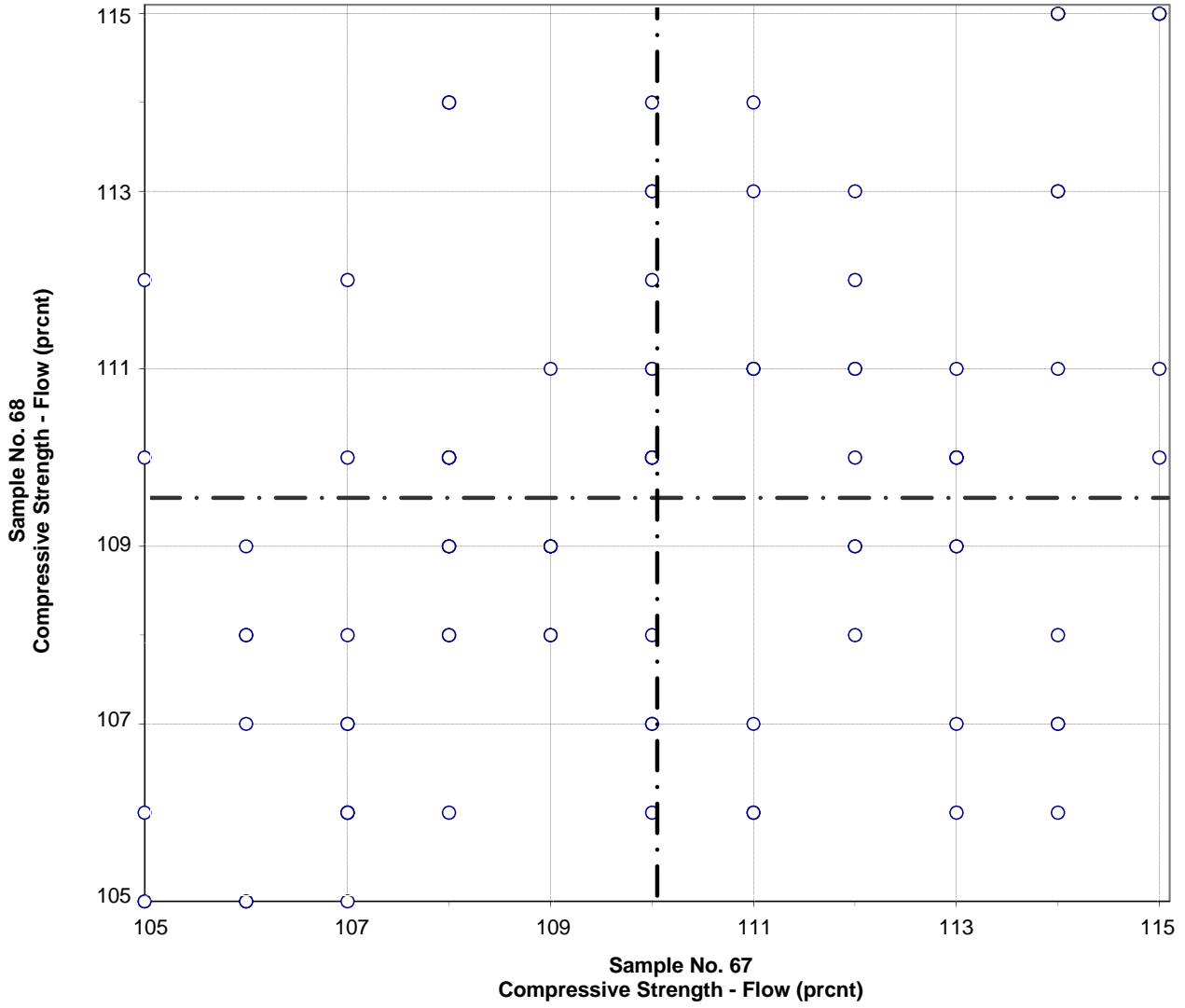


Test No. 220 Compressive Strength - % Water 92 Points

Sample No. 67 Ave 48.1 S.D. 1.1 C.V. 2.3
 Sample No. 68 Ave 48.2 S.D. 0.9 C.V. 1.9

Labs eliminated: 74, 24, 38, 105, 2477

**CCRL Proficiency Sample Program
Compressive Strength - Flow
BLENDED CEMENT Samples No. 67 and No. 68**

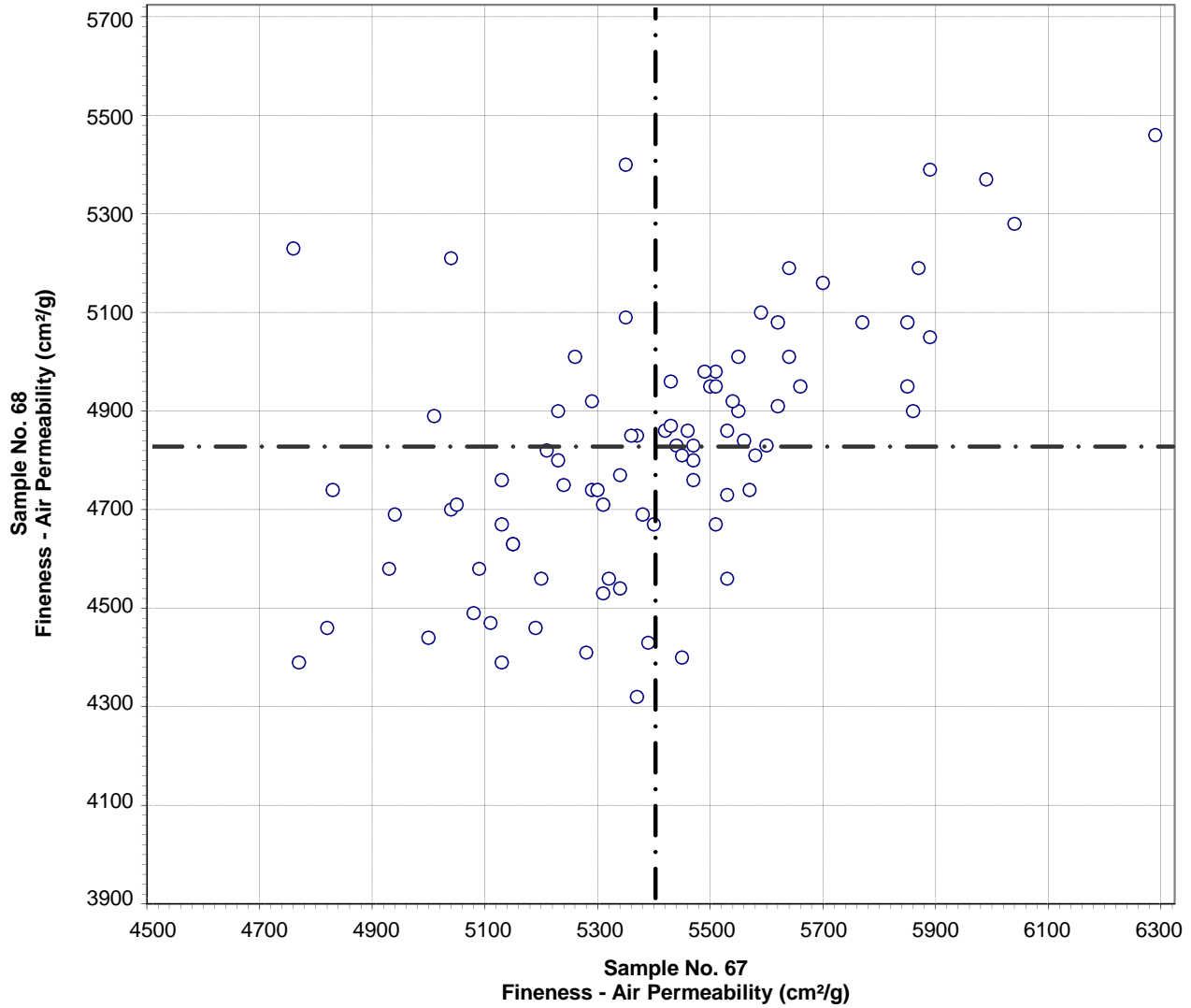


Test No. 230 Compressive Strength - Flow 95 Points

Sample No. 67 Ave 110 S.D. 2.8 C.V. 2.6
 Sample No. 68 Ave 110 S.D. 2.7 C.V. 2.5

Labs eliminated: 47, 116

**CCRL Proficiency Sample Program
Fineness - Air Permeability
BLENDED CEMENT Samples No. 67 and No. 68**

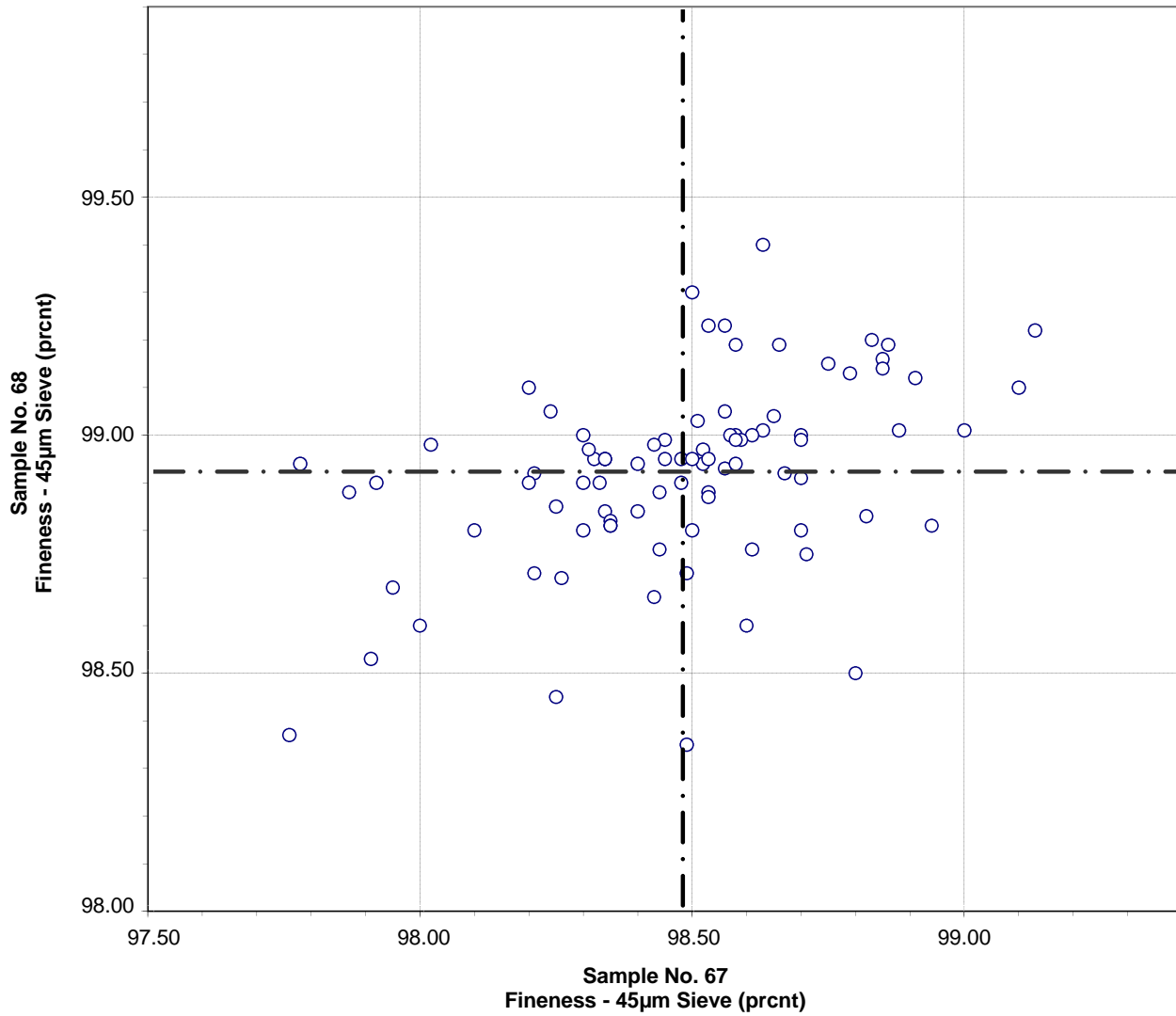


Test No. 270 Fineness - Air Permeability 86 Points

Sample No. 67	Ave 5399	S.D. 293	C.V. 5.4
Sample No. 68	Ave 4825	S.D. 255	C.V. 5.3

Labs eliminated: 2, 14, 51, 958, 3247

**CCRL Proficiency Sample Program
 Fineness - 45µm % Passing
 BLENDED CEMENT Samples No. 67 and No. 68**



Test No. 281 Fineness - 45µm % Passing 89 Points

Sample No. 67 Ave 98.48 S.D. 0.28 C.V. 0.28

Sample No. 68 Ave 98.92 S.D. 0.19 C.V. 0.20

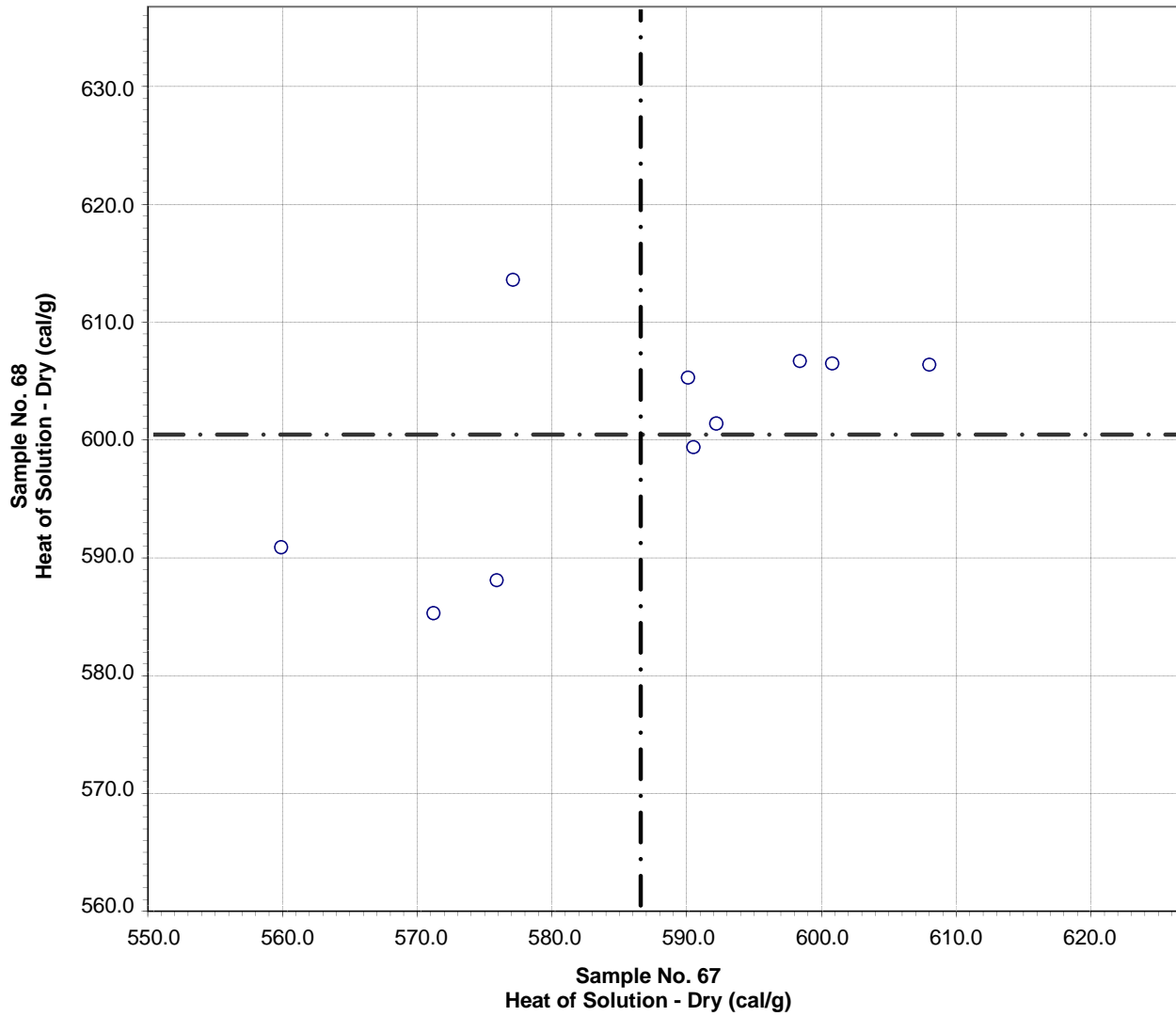
Labs eliminated: 39, 413, 70, 116, 982, 2295, 3431

CCRL PROFICIENCY SAMPLE PROGRAM
 Blended Cement Proficiency Samples No. 67 and No. 68
 Final Report - Heat of Hydration Results
 May 6, 2011

SUMMARY OF RESULTS

Test	#Labs	Sample No. 67			Sample No. 68			
		Average	S.D.	C.V.	Average	S.D.	C.V.	
Heat Solution, Dry	cal/g	10	586.4	15.0	2.5	600.4	9.3	1.6
Heat Sol, 7 day	cal/g	10	512.9	12.8	2.5	519.5	12.4	2.4
Heat Sol, 28 day	cal/g	5	508.4	4.0	0.79	507.5	12.7	2.5
Heat Hyd, 7 day	cal/g	10	73.4	5.3	7.3	80.9	9.7	12
Heat Hyd, 28 day	cal/g	5	81.4	4.8	5.8	95.0	14.9	16

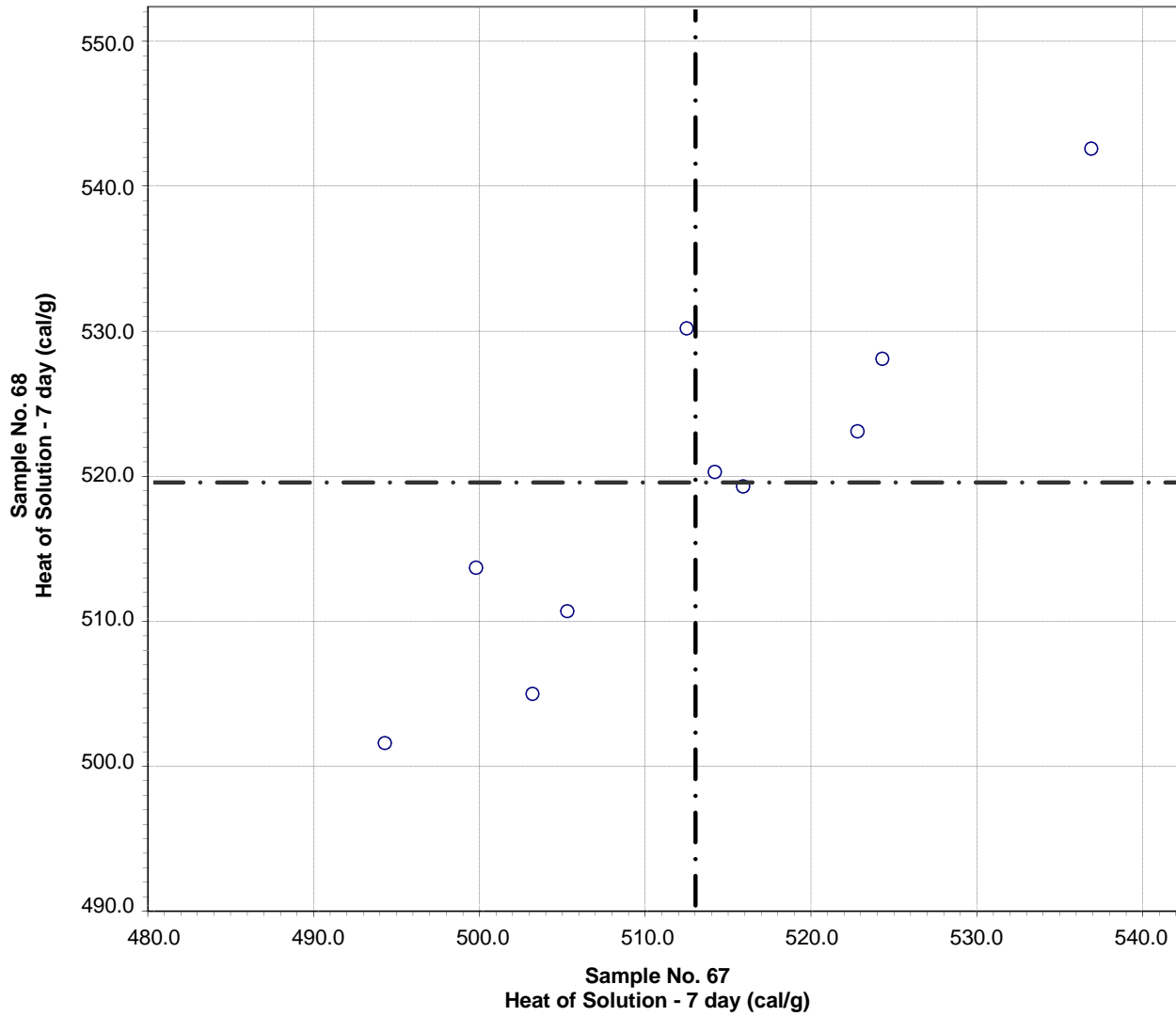
**CCRL Proficiency Sample Program
Heat of Solution - Dry Cement
BLENDED CEMENT Samples No. 67 and No. 68**



Test No. 291 Heat of Solution - Dry Cement 10 Points

Sample No. 67 Ave 586.4 S.D. 15.0 C.V. 2.5
 Sample No. 68 Ave 600.4 S.D. 9.3 C.V. 1.6

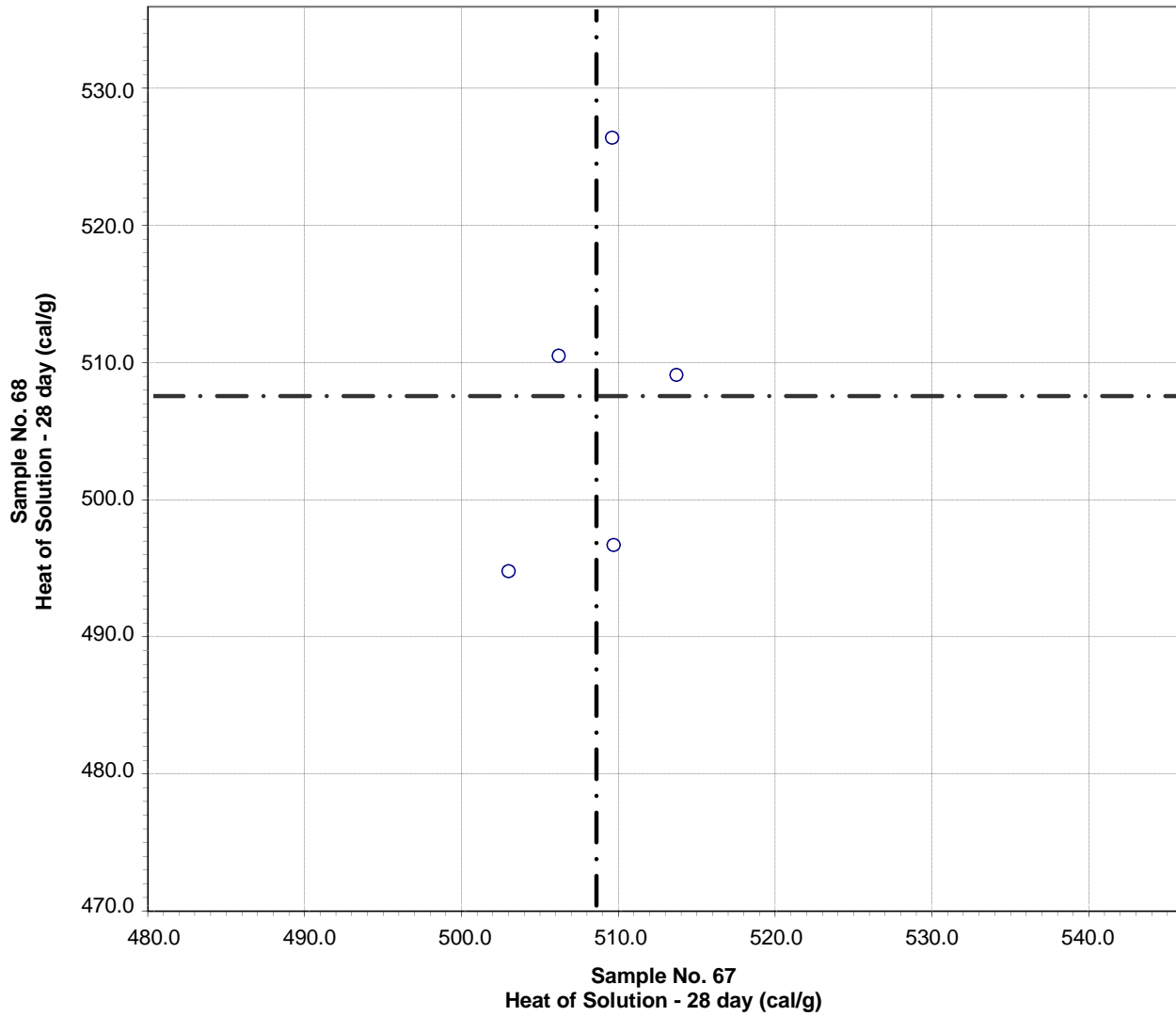
CCRL Proficiency Sample Program
Heat of Solution - 7 day
BLENDED CEMENT Samples No. 67 and No. 68



Test No. 292 Heat of Solution - 7 day 10 Points

Sample No. 67	Ave 512.9	S.D. 12.8	C.V. 2.5
Sample No. 68	Ave 519.5	S.D. 12.4	C.V. 2.4

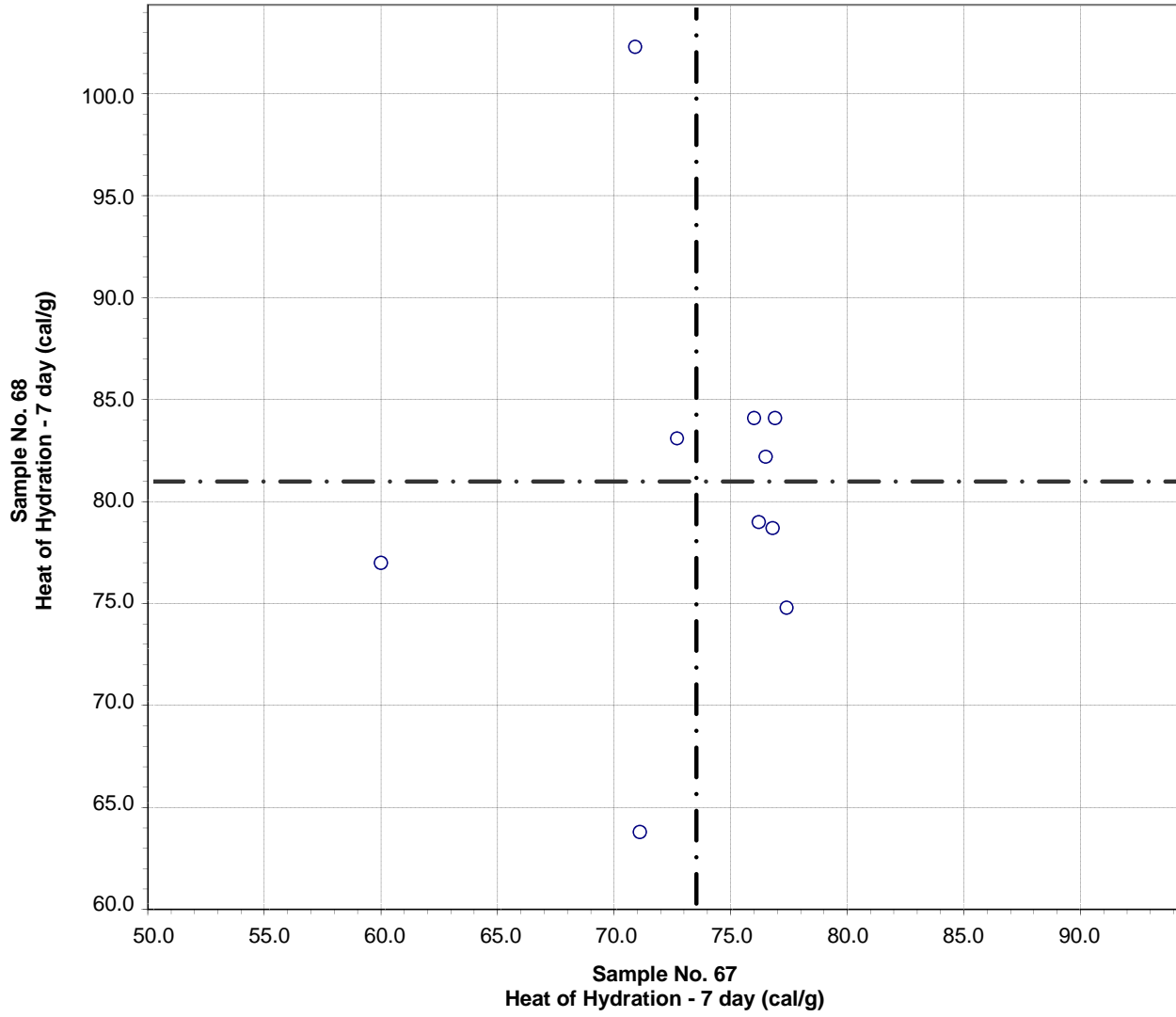
CCRL Proficiency Sample Program
Heat of Solution - 28 day
BLENDED CEMENT Samples No. 67 and No. 68



Test No. 301 Heat of Solution - 28 day 5 Points

Sample No. 67	Ave 508.4	S.D. 4.0	C.V. 0.79
Sample No. 68	Ave 507.5	S.D. 12.7	C.V. 2.5

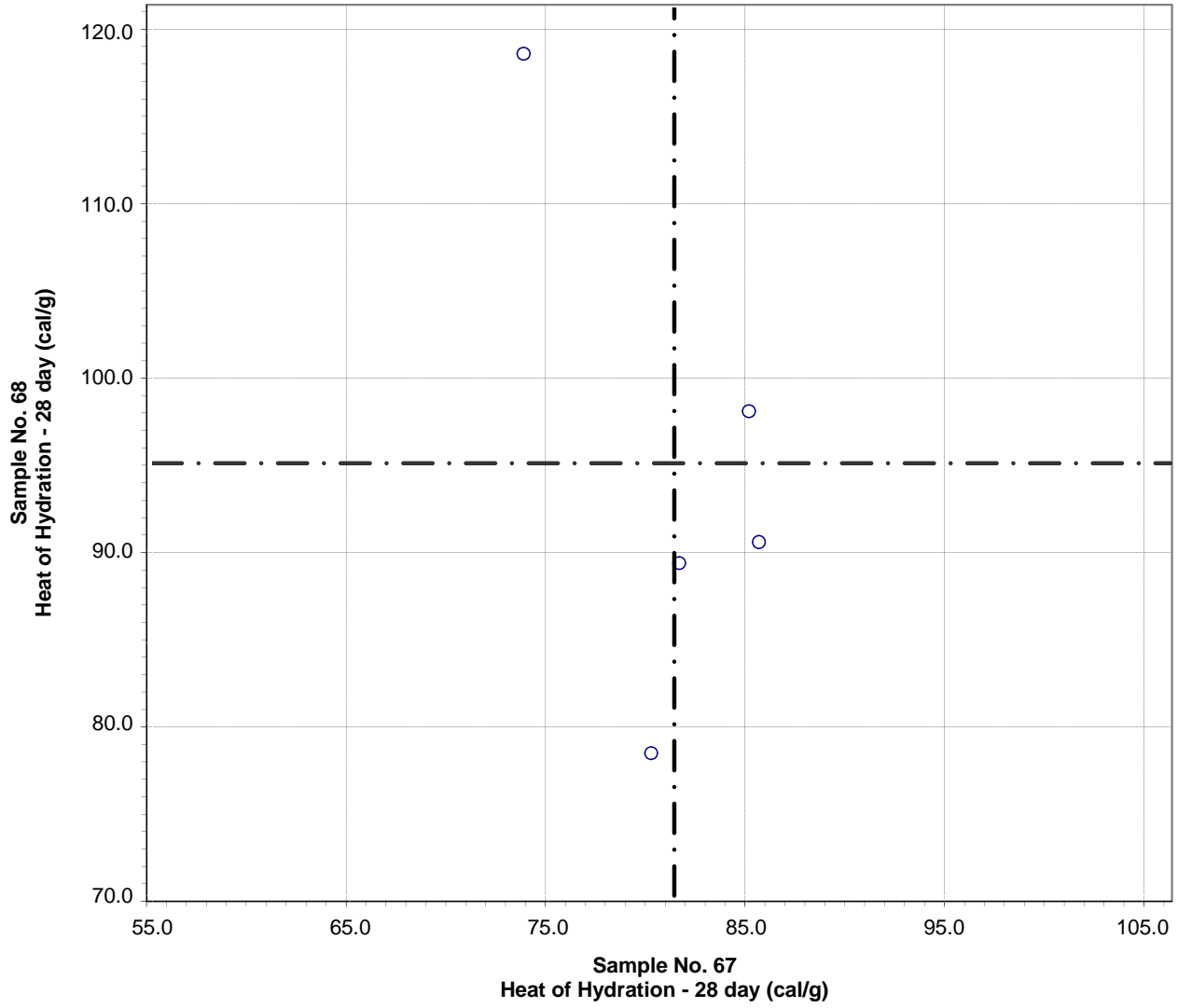
**CCRL Proficiency Sample Program
Heat of Hydration - 7 day
BLENDED CEMENT Samples No. 67 and No. 68**



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

Sample No. 67	Ave 73.4	S.D. 5.3	C.V. 7.3
Sample No. 68	Ave 80.9	S.D. 9.7	C.V. 12

CCRL Proficiency Sample Program
Heat of Hydration - 28 day
BLENDED CEMENT Samples No. 67 and No. 68



Test No. 300 Heat of Hydration - 28 day 5 Points

Sample No. 67	Ave 81.4	S.D. 4.8	C.V. 5.8
Sample No. 68	Ave 95.0	S.D. 14.9	C.V. 16