

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

**Final Report**  
**Blended Cement Proficiency Samples**  
**Number 63 and Number 64**

May 2009



May 8, 2009

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

**SUBJECT: Final Report on Blended Cement Proficiency Samples No. 63 and No. 64**

Following is the final report for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2009. Both cements were an ASTM C595 Blended Hydraulic Cement. Sample No 63 was a Type IS (20) and No. 64 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/>.

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

**Additional samples of these two cements and other CCRL samples are available for purchase.**

These samples may be useful for equipment verification, technician training, and research. Contact CCRL for availability and price.

It is presently anticipated that the next Blended Cement Proficiency Samples will be distributed in February 2010.

Sincerely,

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

Enclosure

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

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

**SUBJECT: Explanation of Final Report on Results of Tests for Blended Cement Proficiency Samples No. 63 and No. 64**

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 2009. 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 62<sup>nd</sup> 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.

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

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

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) and compressive strength mortar (test no. 230). Air content flows in the range of  $87.5 \pm 7.5$  are satisfactory,

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

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 requires that sulfur trioxide ( $\text{SO}_3$ ) and loss on ignition (LOI) be corrected for sulfur (S) when the cement being analyzed contain slag. For this pair of samples,  $\text{SO}_3$  and LOI were separated into two groups, data corrected for S and data not corrected for S. The test results of laboratories that did not indicate if their results were corrected or uncorrected were not included in the statistical analysis.

### **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  $\pm 1$  for that particular test. As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM  
 Blended Cement Proficiency Samples No. 63 and No. 64  
 Final Report - Chemical Results  
 May 8, 2009

SUMMARY OF RESULTS

Test		#Labs	Sample No. 63			Sample No. 64		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Silicon Dioxide	prcnt	86	21.50	0.68	3.18	23.32	0.85	3.65
Silicon Dioxide	prcnt	* 80	21.56	0.27	1.26	23.42	0.37	1.56
Aluminum Oxide	prcnt	84	5.44	0.20	3.61	5.90	0.25	4.22
Aluminum Oxide	prcnt	* 81	5.42	0.16	2.97	5.89	0.18	3.11
Ferric Oxide	prcnt	85	2.53	0.12	4.95	2.85	0.13	4.70
Ferric Oxide	prcnt	* 77	2.51	0.050	2.01	2.83	0.063	2.21
Calcium Oxide	prcnt	85	60.03	1.30	2.16	58.59	0.78	1.33
Calcium Oxide	prcnt	* 80	60.19	0.48	0.789	58.58	0.54	0.916
Magnesium Oxide	prcnt	85	4.49	0.17	3.71	4.51	0.29	6.50
Magnesium Oxide	prcnt	* 80	4.48	0.12	2.69	4.46	0.14	3.05
Sulfur Trioxide <sup>1</sup>	prcnt	22	2.67	0.15	5.80	2.43	0.25	10.46
		<sup>1</sup> (Corrected for S)						
Sulfur Trioxide <sup>2</sup>	prcnt	45	2.83	0.14	4.88	2.70	0.22	7.99
Sulfur Trioxide <sup>2</sup>	prcnt	* 44	2.83	0.14	4.87	2.68	0.19	7.06
		<sup>2</sup> (Uncorrected for S)						
Loss on Ignition <sup>1</sup>	prcnt	21	1.64	0.11	6.57	0.66	0.18	27.65
		<sup>1</sup> (Corrected for S)						
Loss on Ignition <sup>2</sup>	prcnt	46	1.53	0.12	8.19	0.39	0.17	43.76
Loss on Ignition <sup>2</sup>	prcnt	* 44	1.52	0.11	7.51	0.37	0.12	33.04
		<sup>2</sup> (Uncorrected for S)						

CONTINUED ON NEXT PAGE

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

Silicon Dioxide	50 51 14 24 176 3320
Aluminum Oxide	50 3320 3431
Ferric Oxide	50 1 176 3297 3320 3409 20 3431
Calcium Oxide	24 50 3249 3320 3431
Magnesium Oxide	47 2466 20 2463 3320
Sulfur Trioxide <sup>2</sup>	3320
Loss on Ignition <sup>2</sup>	690 694

NOTE: Laboratories not responding to email indicating if SO3 and LOI were corrected for S were not included in the statistical analysis. See following pages for list of laboratories not included.

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 63 and No. 64  
Final Report - Chemical Results  
May 8, 2009

SUMMARY OF RESULTS

Test		#Labs	Sample No. 63			Sample No. 64		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Sodium Oxide	prcnt	78	0.102	0.029	28.3	0.123	0.032	26.5
Potassium Oxide	prcnt	81	0.84	0.059	7.06	0.66	0.097	14.80
Potassium Oxide	prcnt *	74	0.84	0.030	3.55	0.66	0.024	3.65
Titanium Dioxide	prcnt	67	0.29	0.021	7.20	0.28	0.023	8.06
Titanium Dioxide	prcnt *	60	0.29	0.008	2.84	0.29	0.009	3.17
Phosphorus Pent	prcnt	70	0.192	0.026	13.8	0.110	0.019	17.3
Phosphorus Pent	prcnt *	61	0.194	0.007	3.40	0.105	0.005	4.30
Zinc Oxide	prcnt	22	0.007	0.0019	28.1	0.006	0.0018	28.6
Manganic Oxide	prcnt	46	0.145	0.0089	6.18	0.490	0.0314	6.42
Manganic Oxide	prcnt *	44	0.145	0.0084	5.75	0.494	0.0243	4.92
Sulfide Sulfur	prcnt	27	0.292	0.36	124.8	0.346	0.32	93.2
Sulfide Sulfur	prcnt *	23	0.149	0.11	72.8	0.222	0.12	52.5
Chloride	prcnt	29	0.015	0.032	210	0.014	0.015	108
Chloride	prcnt *	25	0.007	0.0022	34.0	0.009	0.0029	34.2
Insoluble Residue	prcnt	78	0.42	0.14	32.5	0.16	0.12	77.7
Insoluble Residue	prcnt *	77	0.41	0.129	31.2	0.15	0.086	59.5
Chromium Oxide	prcnt	24	0.012	0.0038	31.0	0.014	0.0080	57.3
Chromium Oxide	prcnt *	21	0.013	0.0018	14.4	0.012	0.0013	11.3

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

Potassium Oxide	2251 3320 50 176 207 3297 3431
Titanium Dioxide	169 176 207 47 3247 3297 3409
Phosphorus Pentoxide	176 2463 2476 1251 1799 2466 3233 3247 3431
Manganic Oxide	3297 3431
Sulfide Sulfur	22 24 74 1657
Chloride	309 354 2476 2477
Insoluble Residue	3431
Chromium Oxide	2463 2462 2476

### Sulfur Trioxide Analysis

The following laboratories submitted test results for SO<sub>3</sub>. Their test results were not included in the statistical analysis because they did not respond to an email requesting information on correcting SO<sub>3</sub> for S.

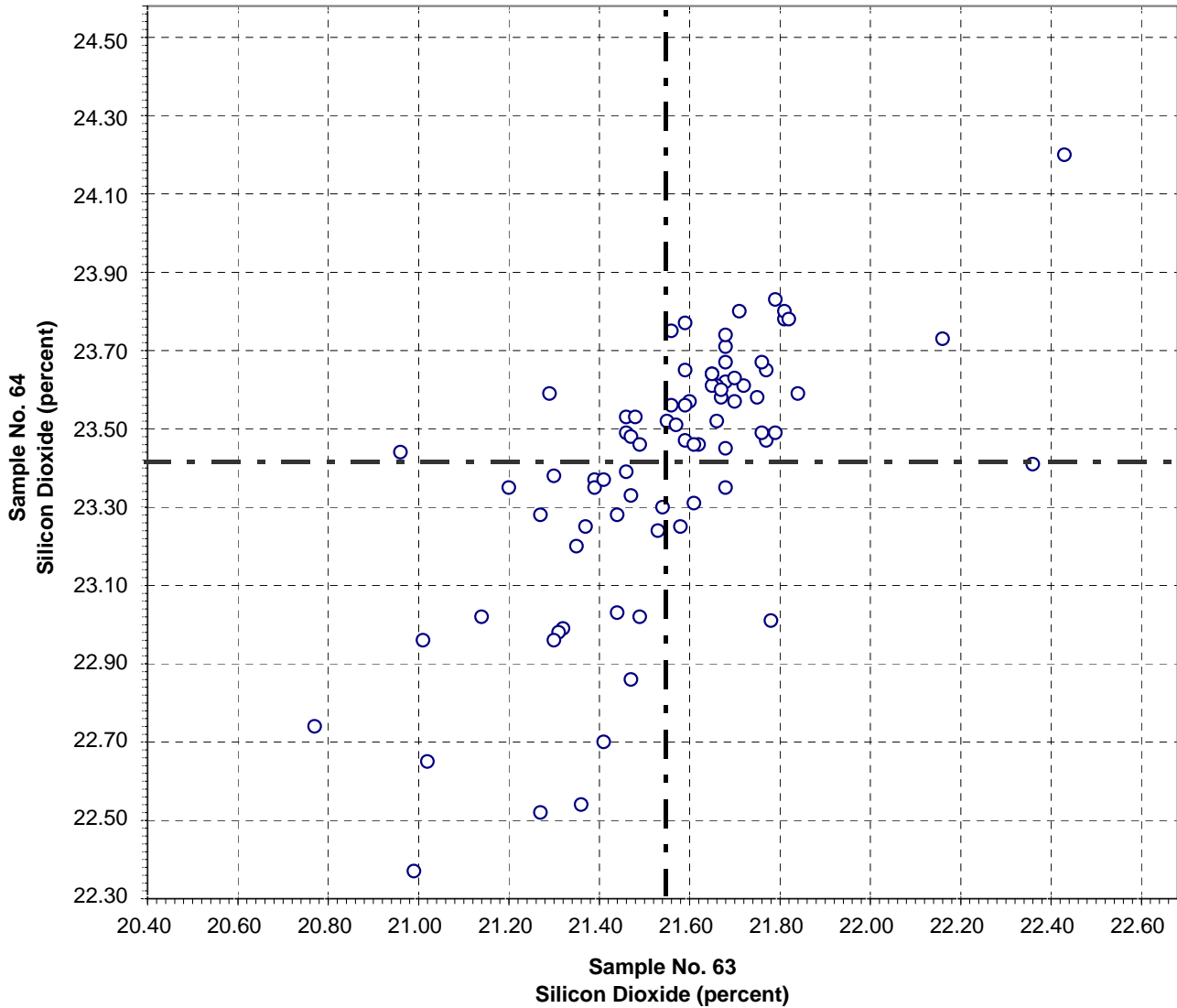
28	309
36	413
43	691
92	2462
126	2463
169	2476
176	3059
181	3249
207	3431
209	

### Loss on Ignition

The following laboratories submitted test results for LOI. Their test results were not included in the statistical analysis because they did not respond to an email requesting information on correcting LOI for S.

2	309
36	413
43	691
52	2462
92	2463
126	2465
169	2466
176	2476
181	3059
207	3249
209	3431

**CCRL Proficiency Sample Program  
Silicon Dioxide  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 10      Silicon Dioxide      79 Points**

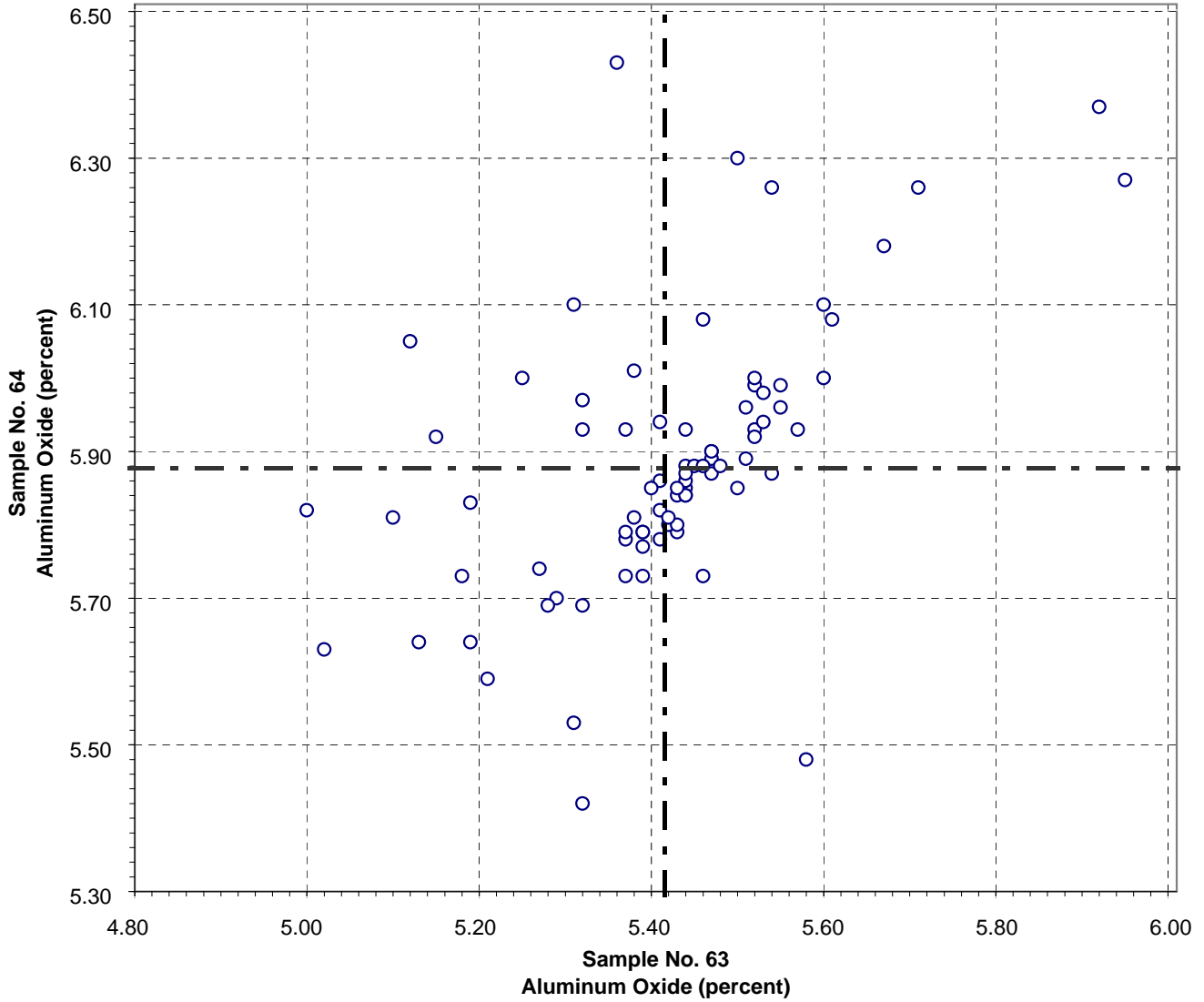
Sample No. 63    Ave 21.56    S.D. 0.27    C.V. 1.26  
 Sample No. 64    Ave 23.42    S.D. 0.37    C.V. 1.56

Labs eliminated: 50, 51, 14, 24, 176, 3320

Labs off Diagram: 497



**CCRL Proficiency Sample Program  
Aluminum Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**

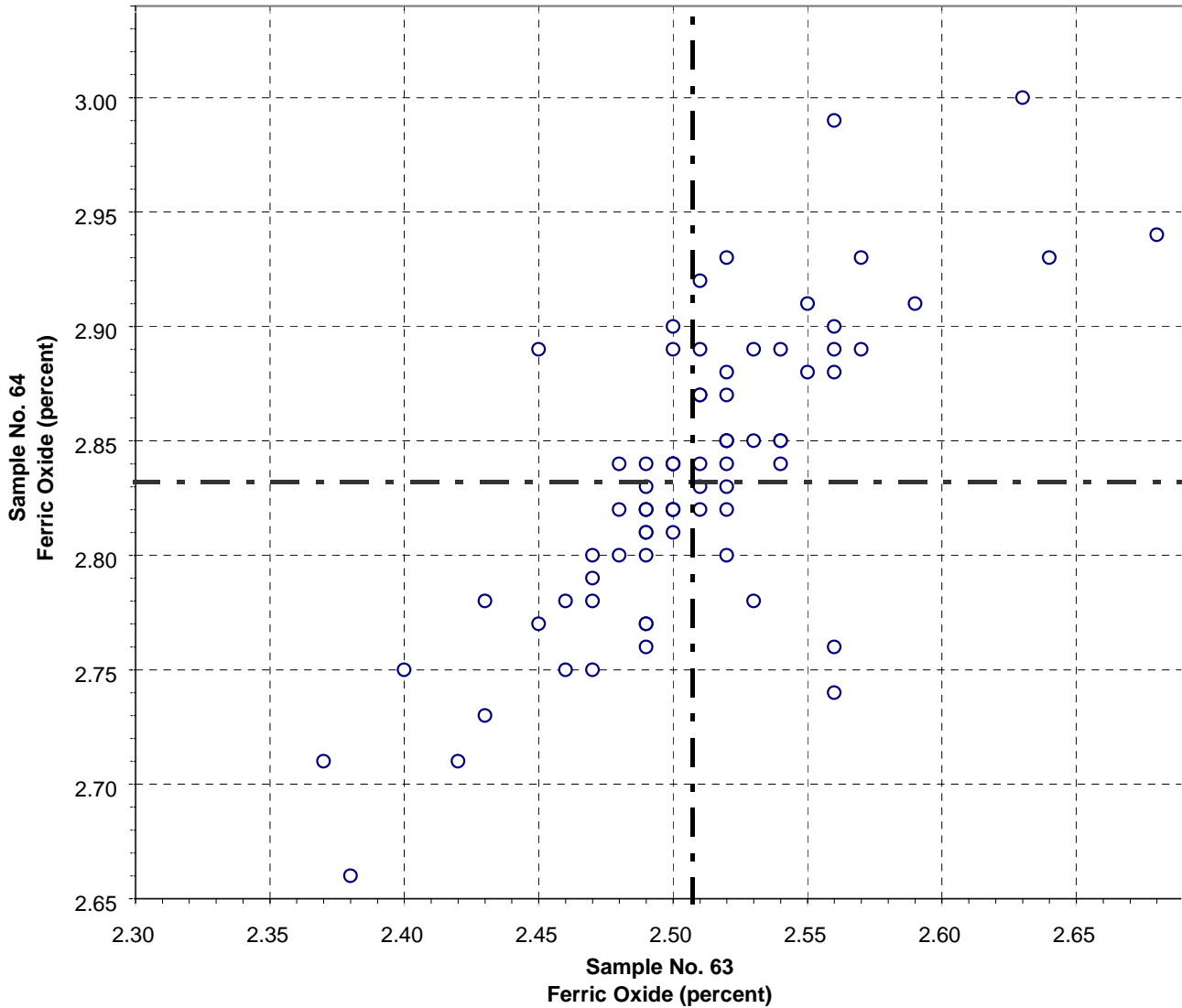


**Test No. 21      Aluminum Oxide      81 Points**

Sample No. 63    Ave 5.42    S.D. 0.16    C.V. 2.97  
 Sample No. 64    Ave 5.89    S.D. 0.18    C.V. 3.11

Labs eliminated: 50, 3320, 3431

**CCRL Proficiency Sample Program  
 Ferric Oxide  
 BLENDED CEMENT Samples No. 63 and No. 64**

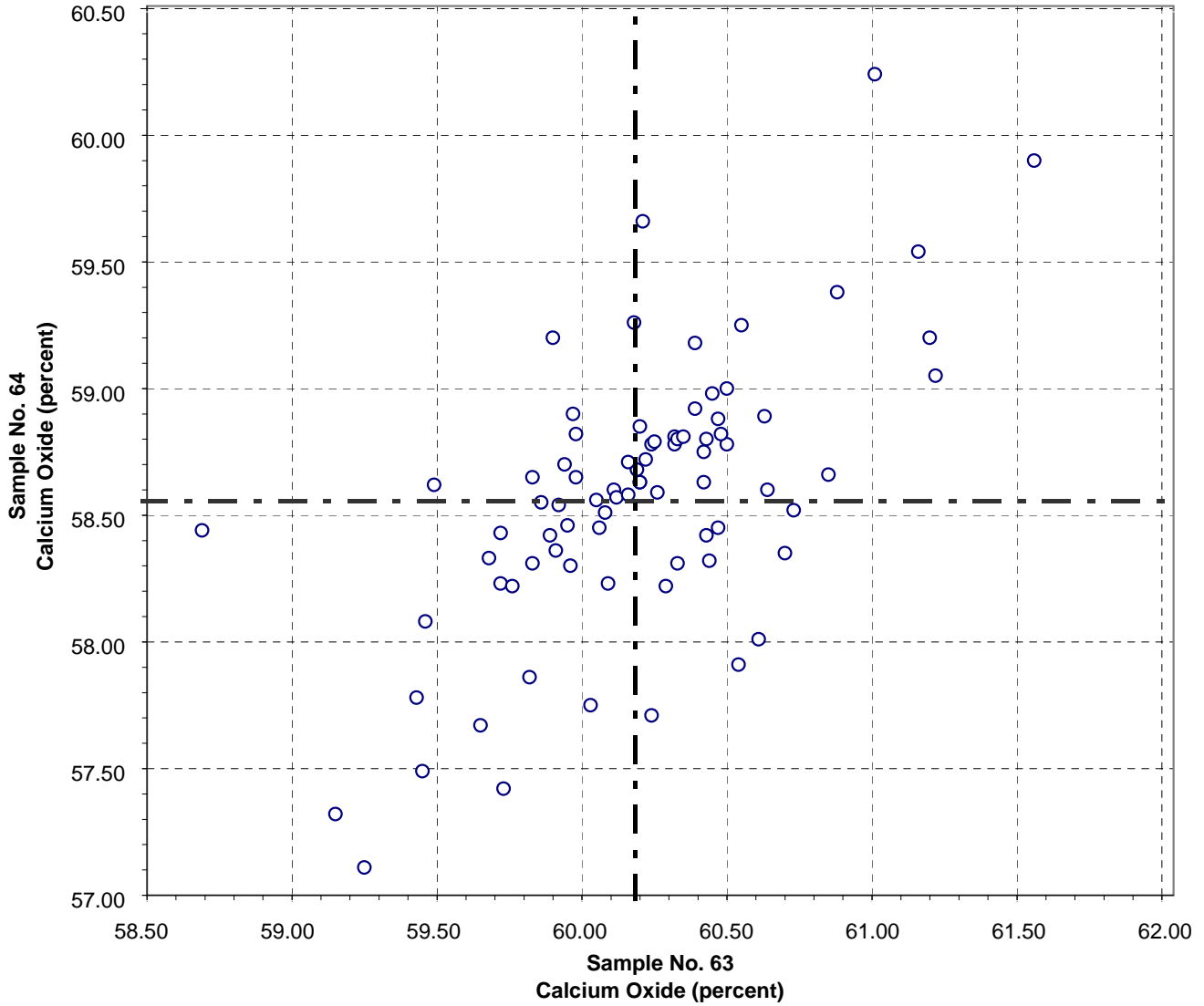


**Test No. 30      Ferric Oxide      77 Points**

Sample No. 63    Ave 2.51    S.D. 0.050    C.V. 2.01  
 Sample No. 64    Ave 2.83    S.D. 0.063    C.V. 2.21

Labs eliminated: 50, 1, 176, 3297, 3320, 3409, 20, 3431

**CCRL Proficiency Sample Program  
Calcium Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**

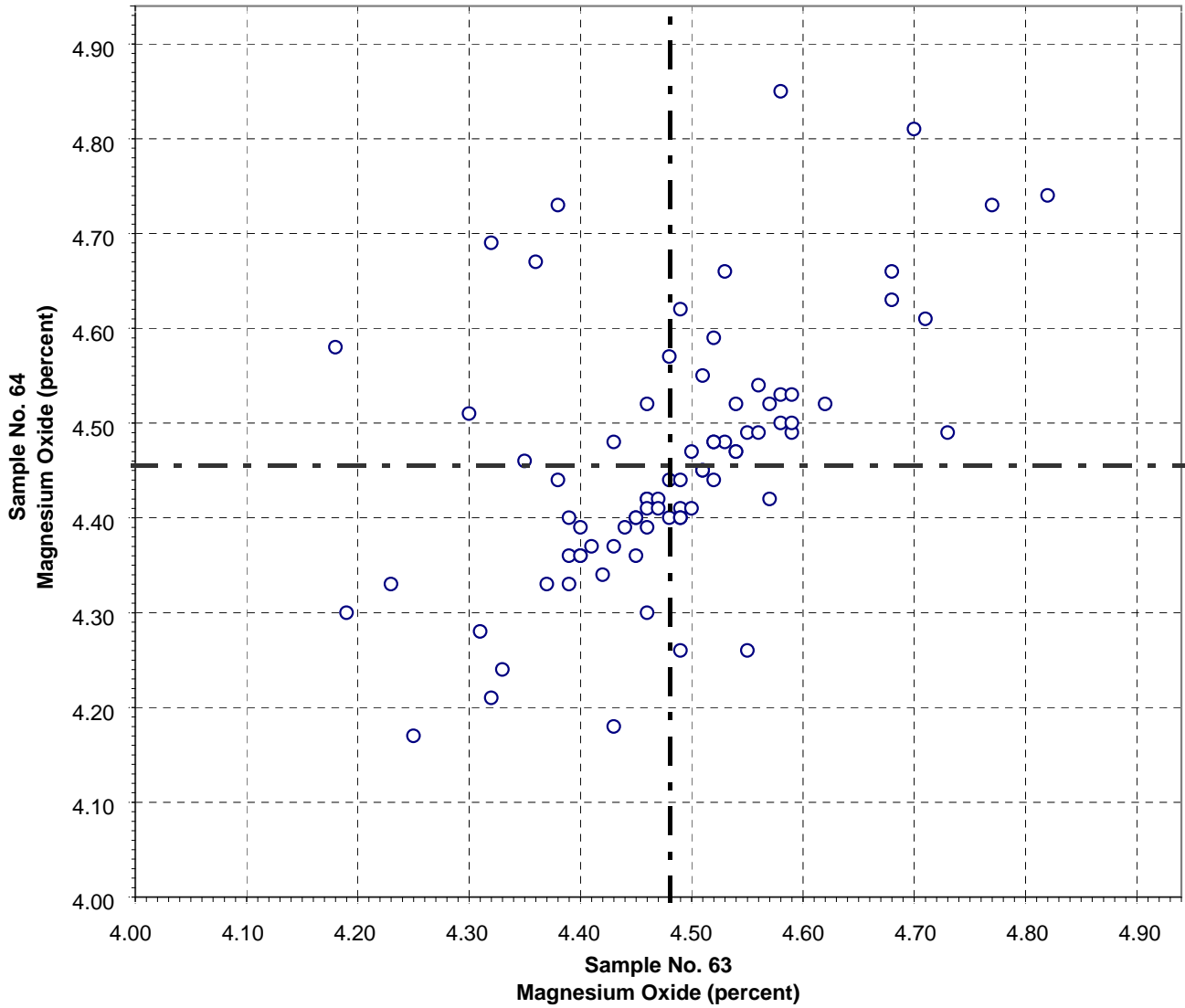


**Test No. 40      Calcium Oxide      80 Points**

Sample No. 63    Ave 60.19    S.D. 0.48    C.V. 0.789  
 Sample No. 64    Ave 58.58    S.D. 0.54    C.V. 0.916

Labs eliminated: 24, 50, 3249, 3320, 3431

**CCRL Proficiency Sample Program  
Magnesium Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**

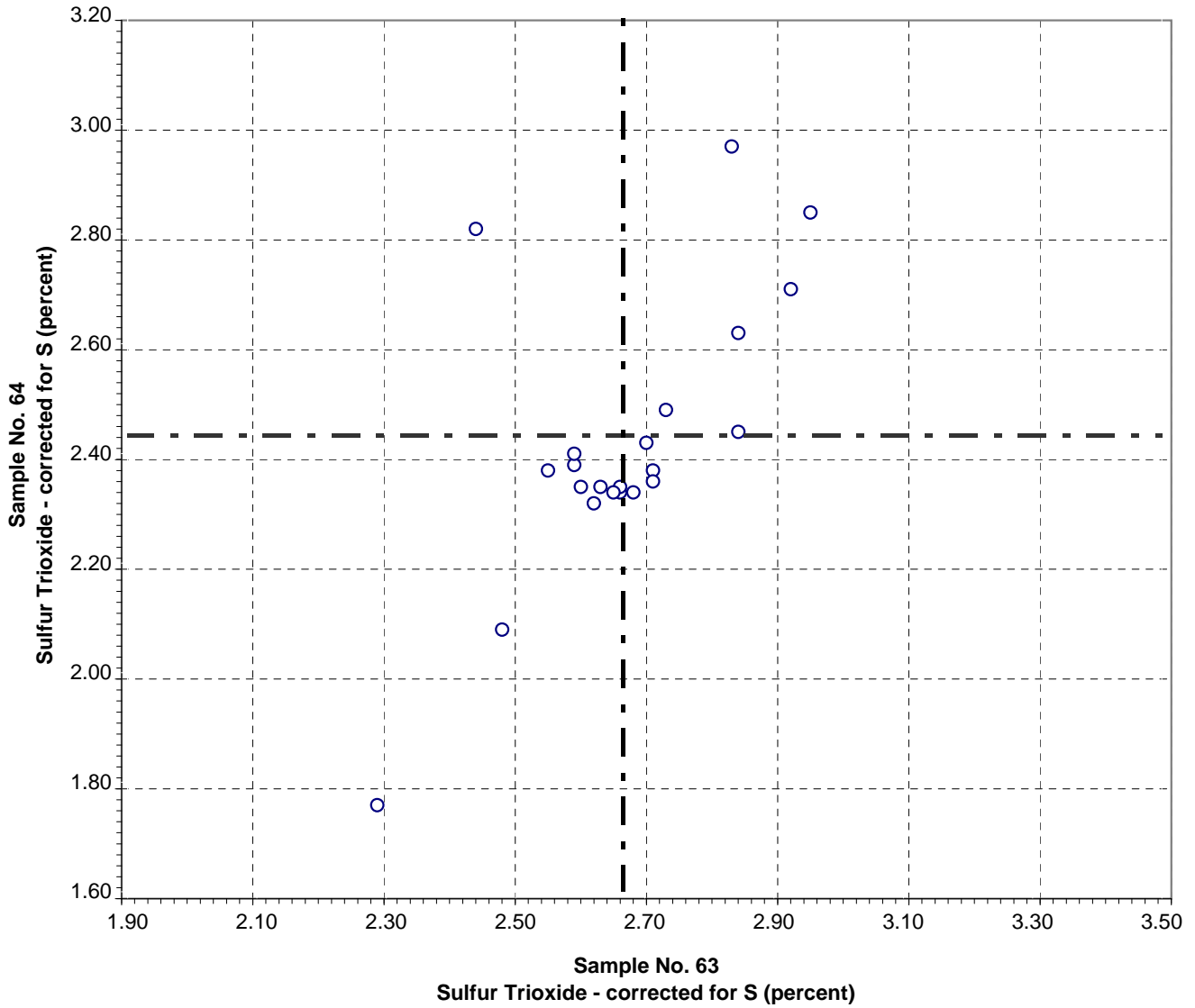


**Test No. 50      Magnesium Oxide      80 Points**

Sample No. 63    Ave 4.48    S.D. 0.12    C.V. 2.69  
 Sample No. 64    Ave 4.46    S.D. 0.14    C.V. 3.05

Labs eliminated: 47, 2466, 20, 2463, 3320

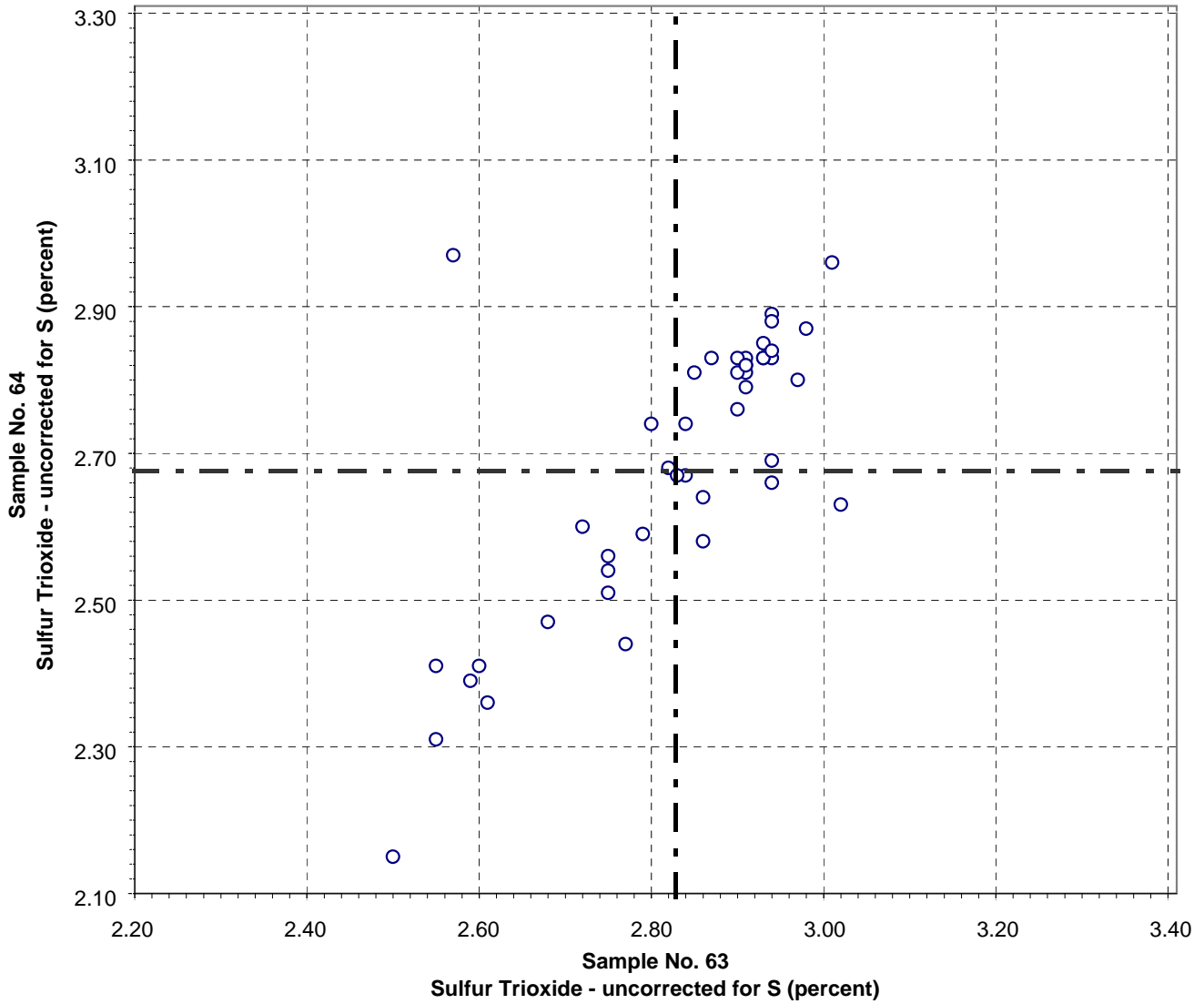
**CCRL Proficiency Sample Program  
Sulfur Trioxide - corrected for S  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 61      Sulfur Trioxide - corrected for S      22 Points**

Sample No. 63    Ave 2.67    S.D. 0.15    C.V. 5.80  
 Sample No. 64    Ave 2.43    S.D. 0.25    C.V. 10.46

**CCRL Proficiency Sample Program  
Sulfur Trioxide - uncorrected for S  
BLENDED CEMENT Samples No. 63 and No. 64**

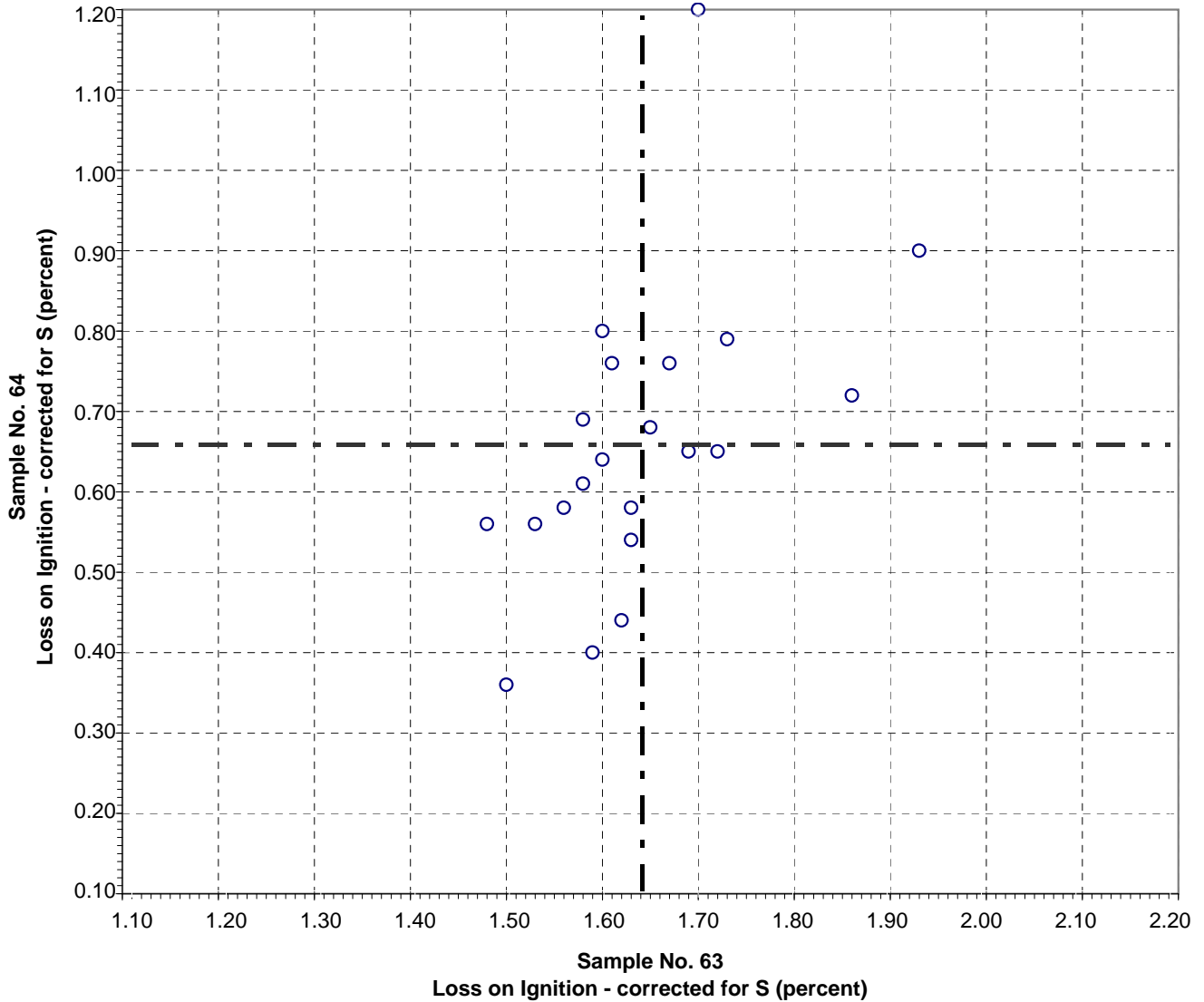


**Test No. 62      Sulfur Trioxide - uncorrected for S      44 Points**

Sample No. 63    Ave 2.83    S.D. 0.14    C.V. 4.87  
 Sample No. 64    Ave 2.68    S.D. 0.19    C.V. 7.06

Labs eliminated: 3320

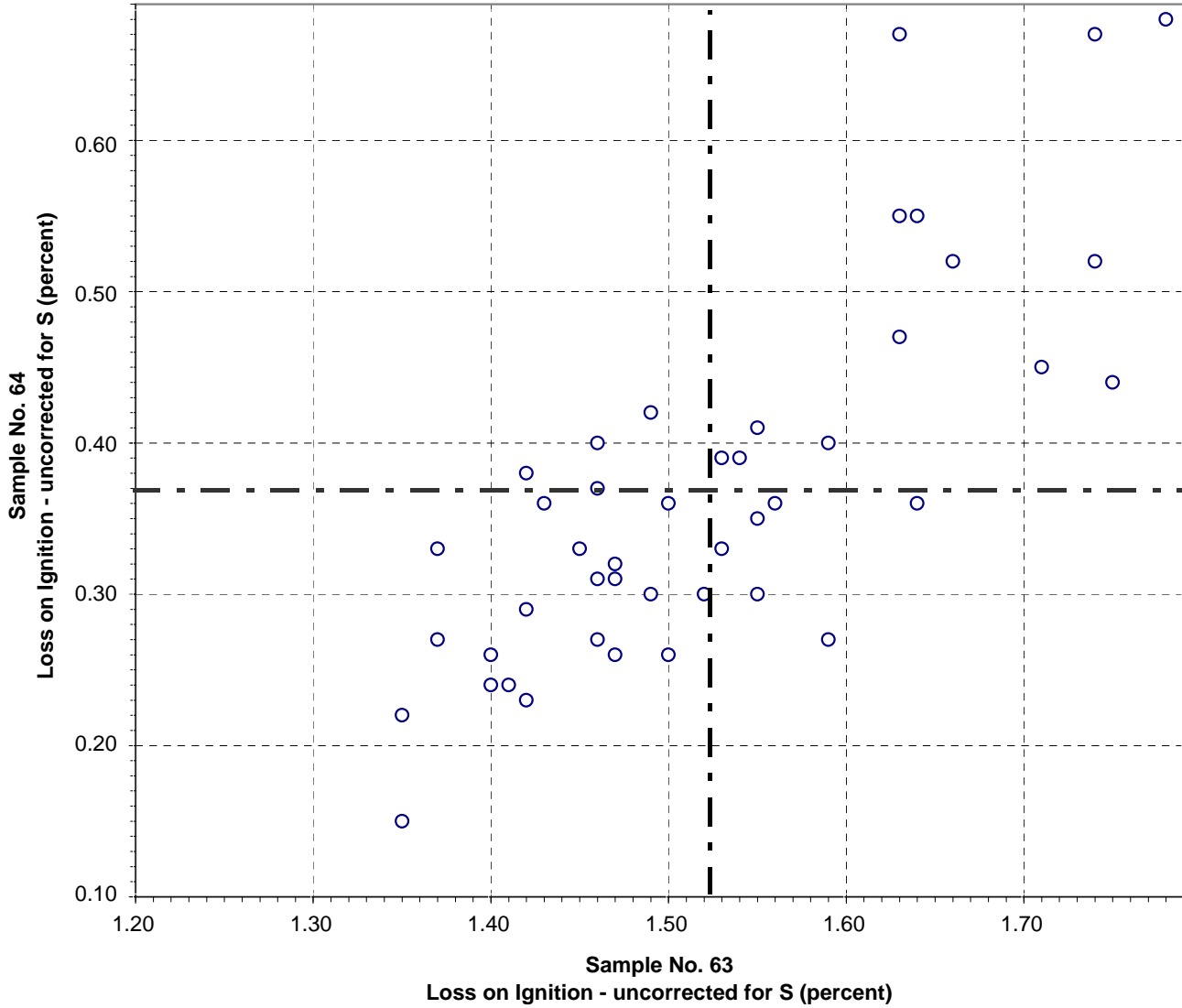
**CCRL Proficiency Sample Program  
Loss on Ignition - corrected for S  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 71      Loss on Ignition - corrected for S      21 Points**

Sample No. 63    Ave 1.64    S.D. 0.11    C.V. 6.57  
 Sample No. 64    Ave 0.66    S.D. 0.18    C.V. 27.65

**CCRL Proficiency Sample Program  
Loss on Ignition - uncorrected for S  
BLENDED CEMENT Samples No. 63 and No. 64**



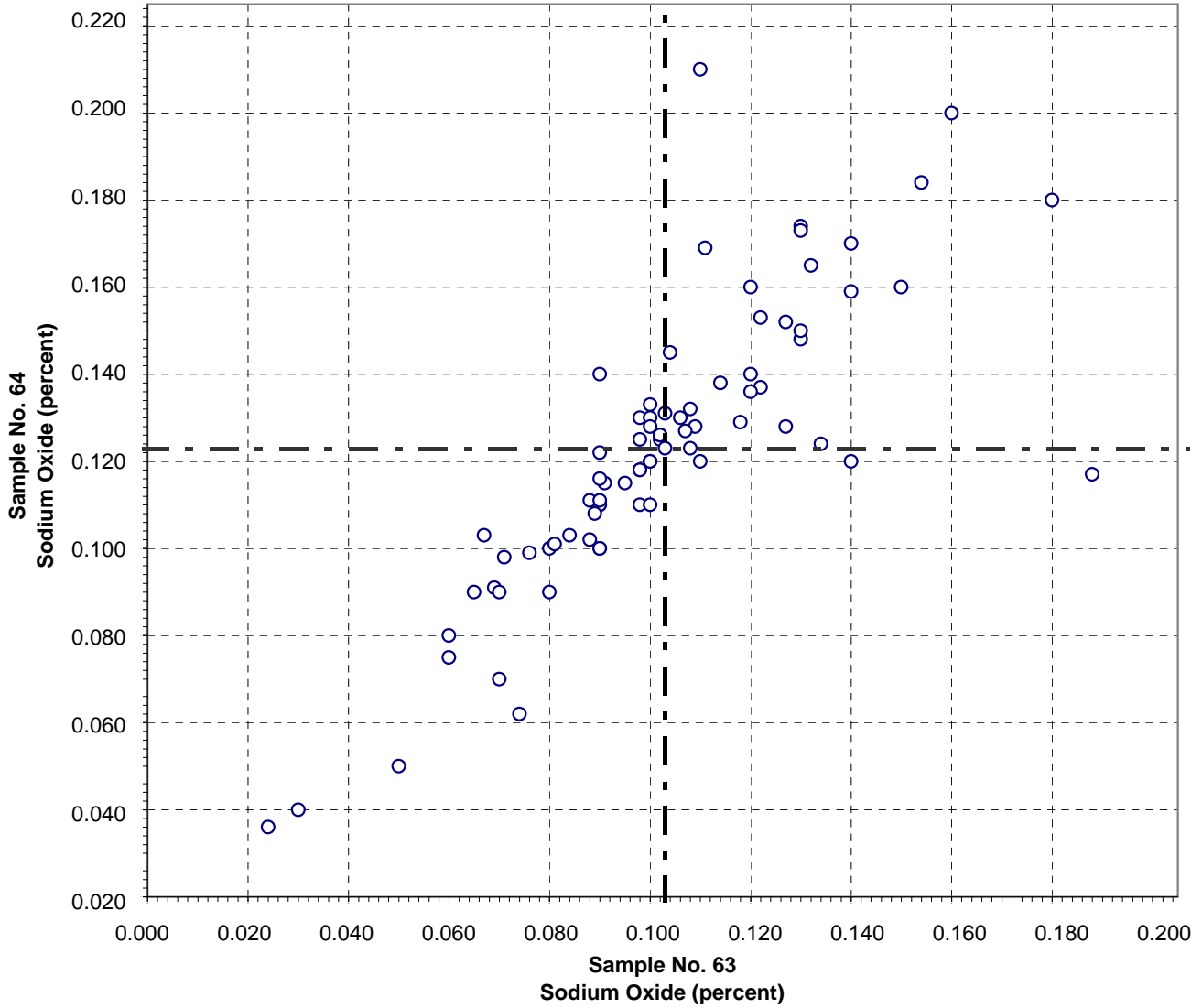
**Test No. 72      Loss on Ignition - uncorrected for S      44 Points**

Sample No. 63   Ave 1.52   S.D. 0.11   C.V. 7.51  
 Sample No. 64   Ave 0.37   S.D. 0.12   C.V. 33.04

Labs eliminated: 690, 694



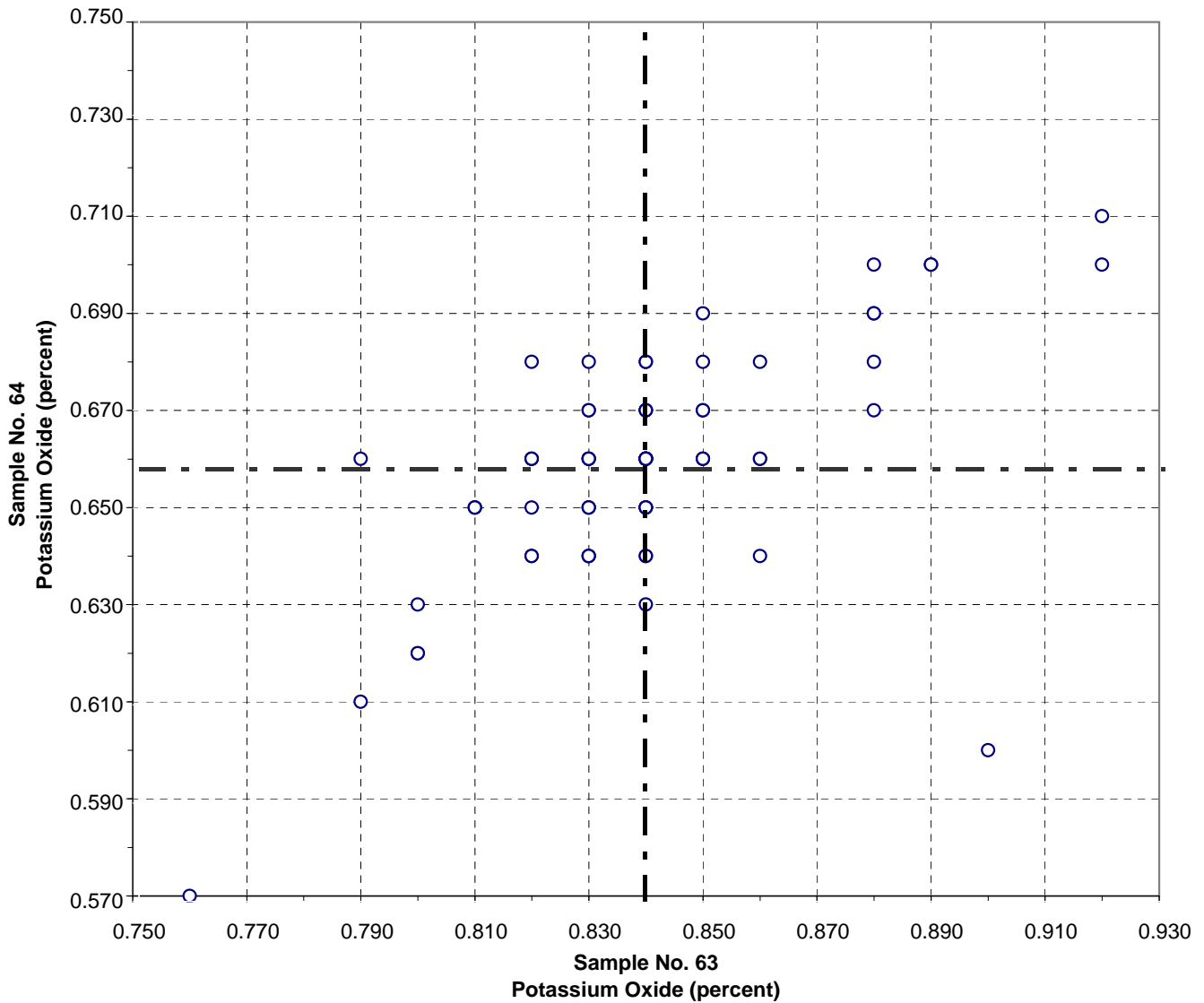
**CCRL Proficiency Sample Program  
Sodium Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 90      Sodium Oxide      78 Points

Sample No. 63	Ave 0.102	S.D. 0.029	C.V. 28.3
Sample No. 64	Ave 0.123	S.D. 0.032	C.V. 26.5

**CCRL Proficiency Sample Program  
Potassium Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**



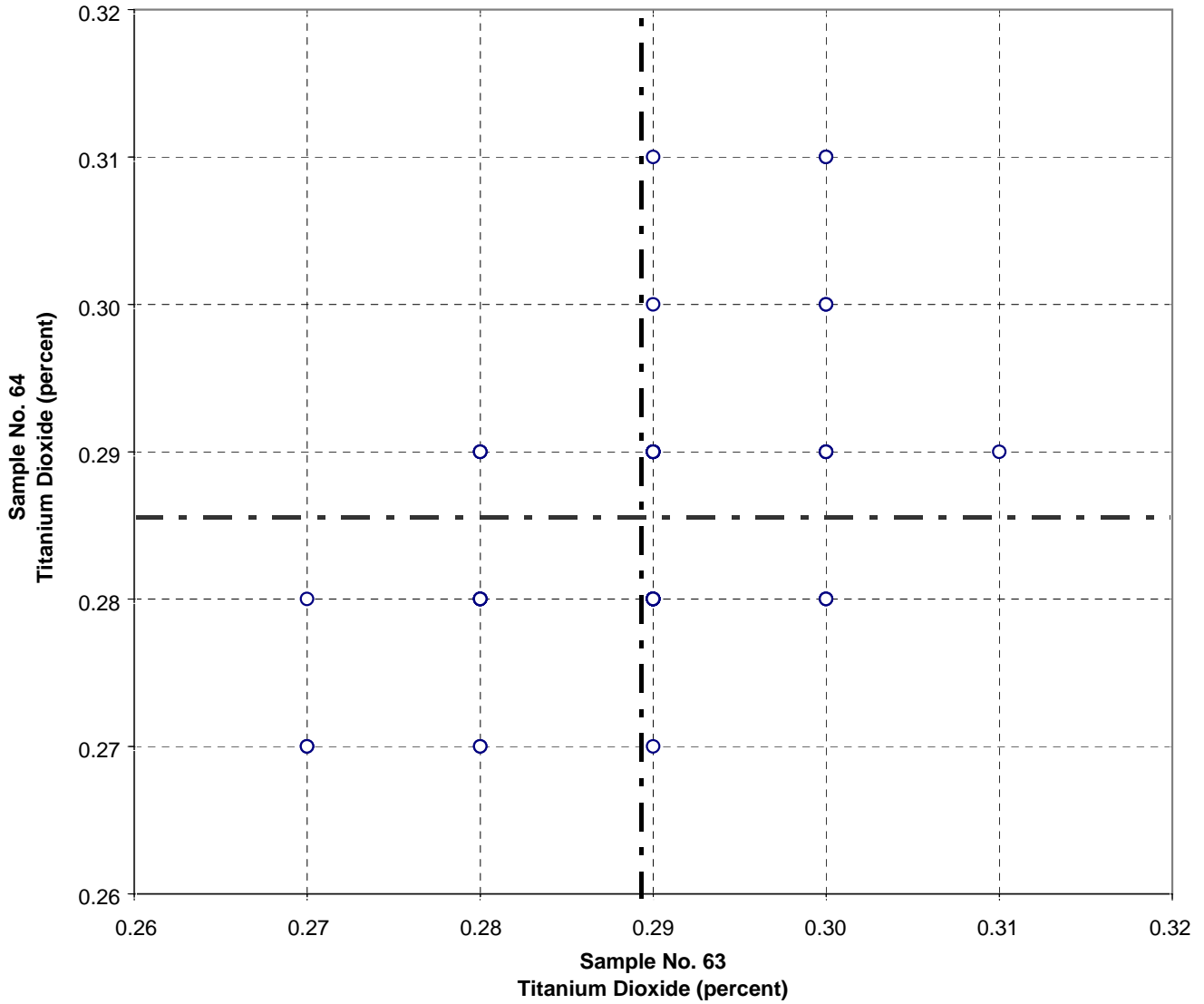
Test No. 100      Potassium Oxide      73 Points

Sample No. 63    Ave 0.84    S.D. 0.030    C.V. 3.55  
 Sample No. 64    Ave 0.66    S.D. 0.024    C.V. 3.65

Labs eliminated: 2251, 3320, 50, 176, 207, 3297, 3431

Labs off Diagram: 3247

**CCRL Proficiency Sample Program  
Titanium Dioxide  
BLENDED CEMENT Samples No. 63 and No. 64**

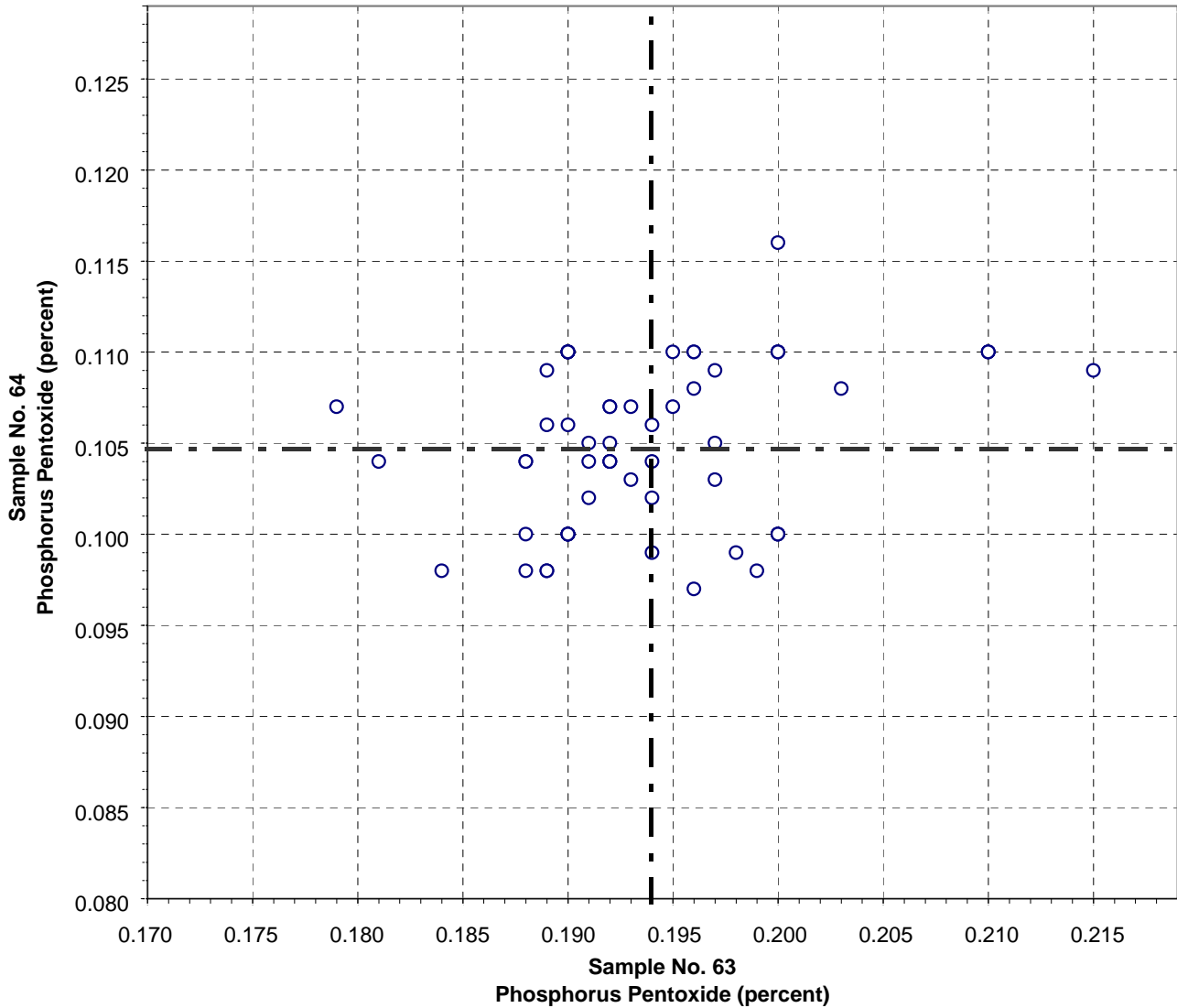


**Test No. 103      Titanium Dioxide      60 Points**

Sample No. 63   Ave 0.29   S.D. 0.008   C.V. 2.84  
 Sample No. 64   Ave 0.29   S.D. 0.009   C.V. 3.17

Labs eliminated: 169, 176, 207, 47, 3247, 3297, 3409

**CCRL Proficiency Sample Program  
Phosphorus Pentoxide  
BLENDED CEMENT Samples No. 63 and No. 64**

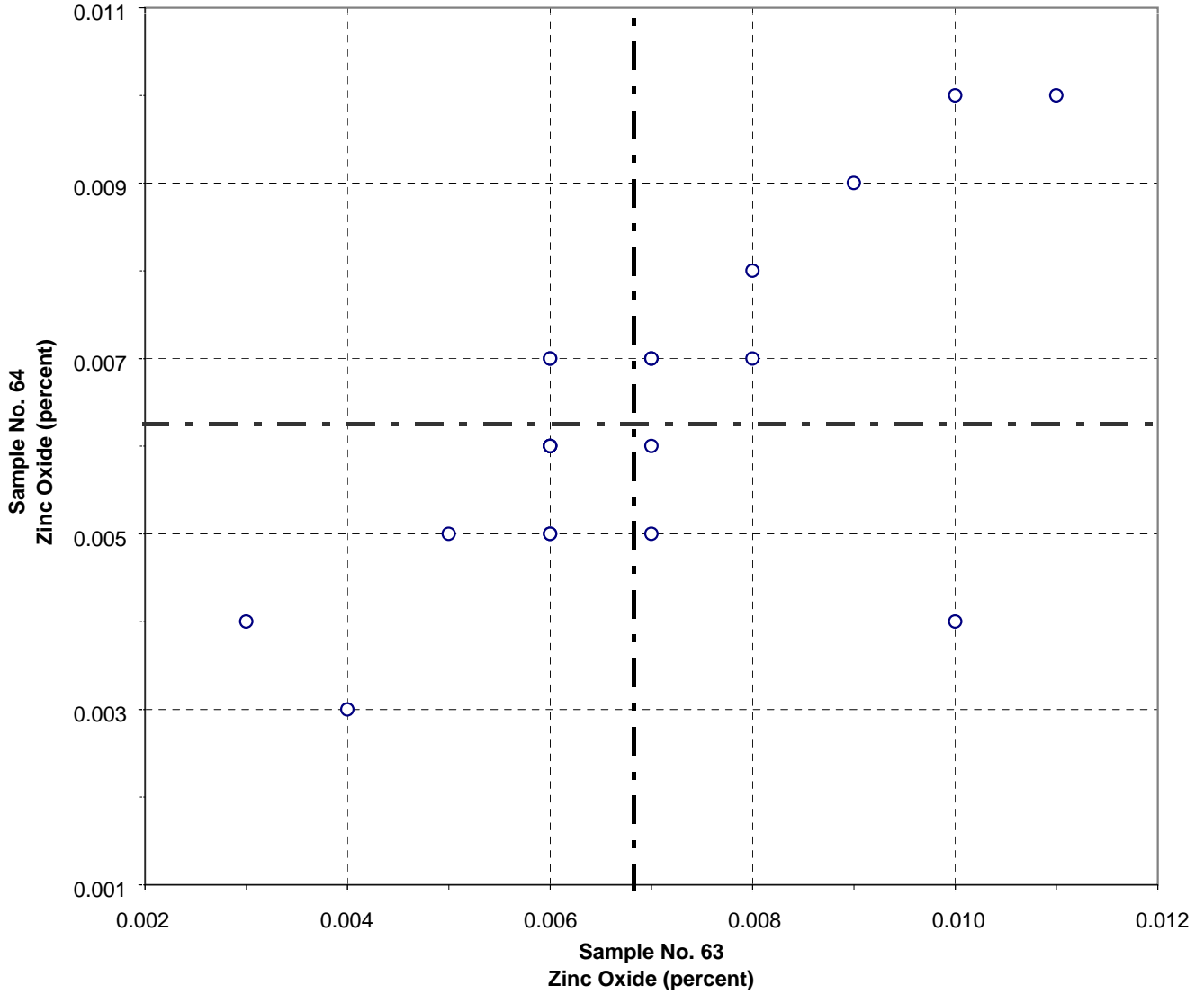


Test No. 102      Phosphorus Pentoxide      61 Points

Sample No. 63    Ave 0.194    S.D. 0.007    C.V. 3.40  
 Sample No. 64    Ave 0.105    S.D. 0.005    C.V. 4.30

Labs eliminated: 176, 2463, 2476, 1251, 1799, 2466, 3233, 3247, 3431

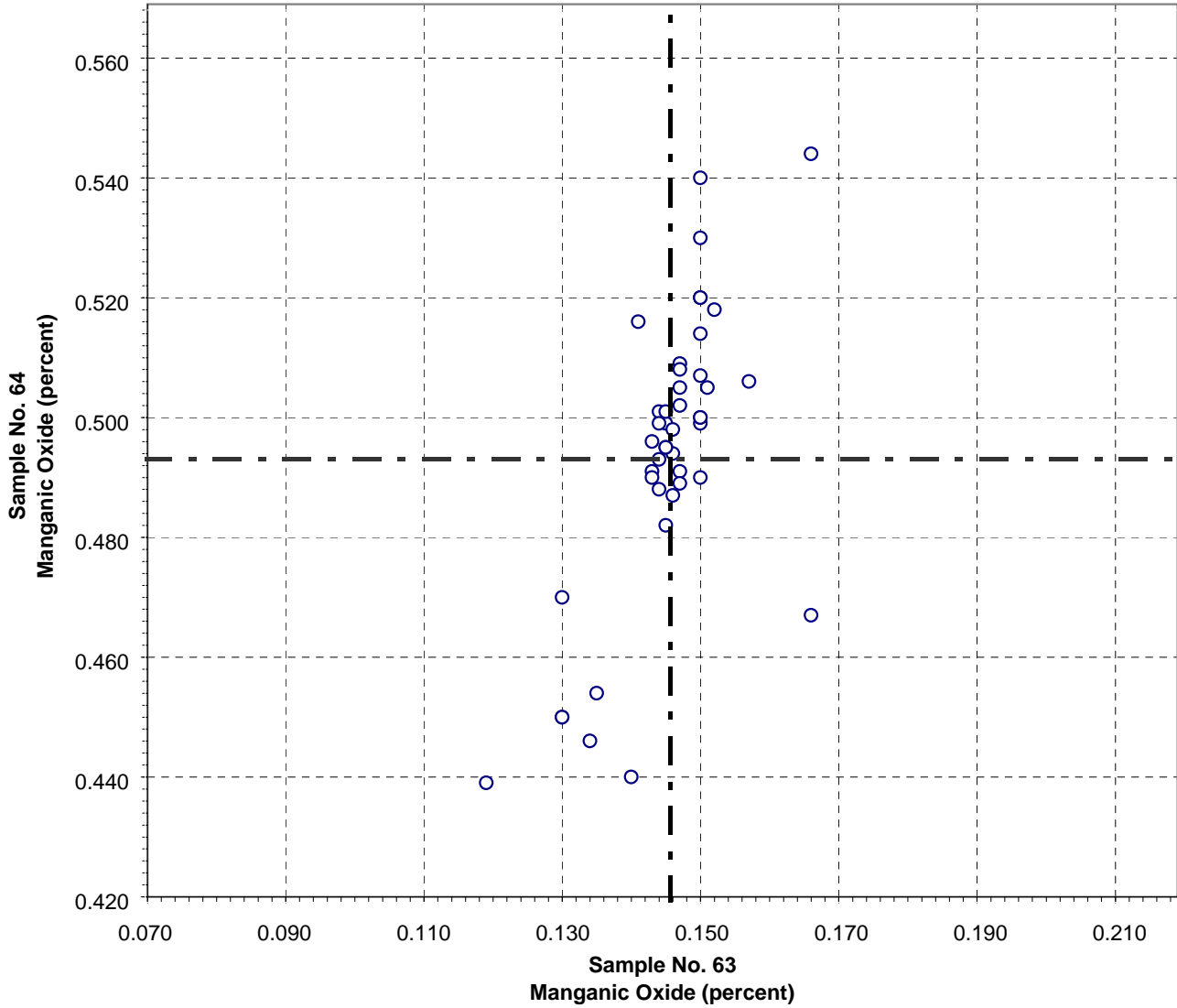
**CCRL Proficiency Sample Program  
Zinc Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 99      Zinc Oxide      22 Points

Sample No. 63	Ave 0.007	S.D. 0.0019	C.V. 28.1
Sample No. 64	Ave 0.006	S.D. 0.0018	C.V. 28.6

**CCRL Proficiency Sample Program  
Manganic Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**

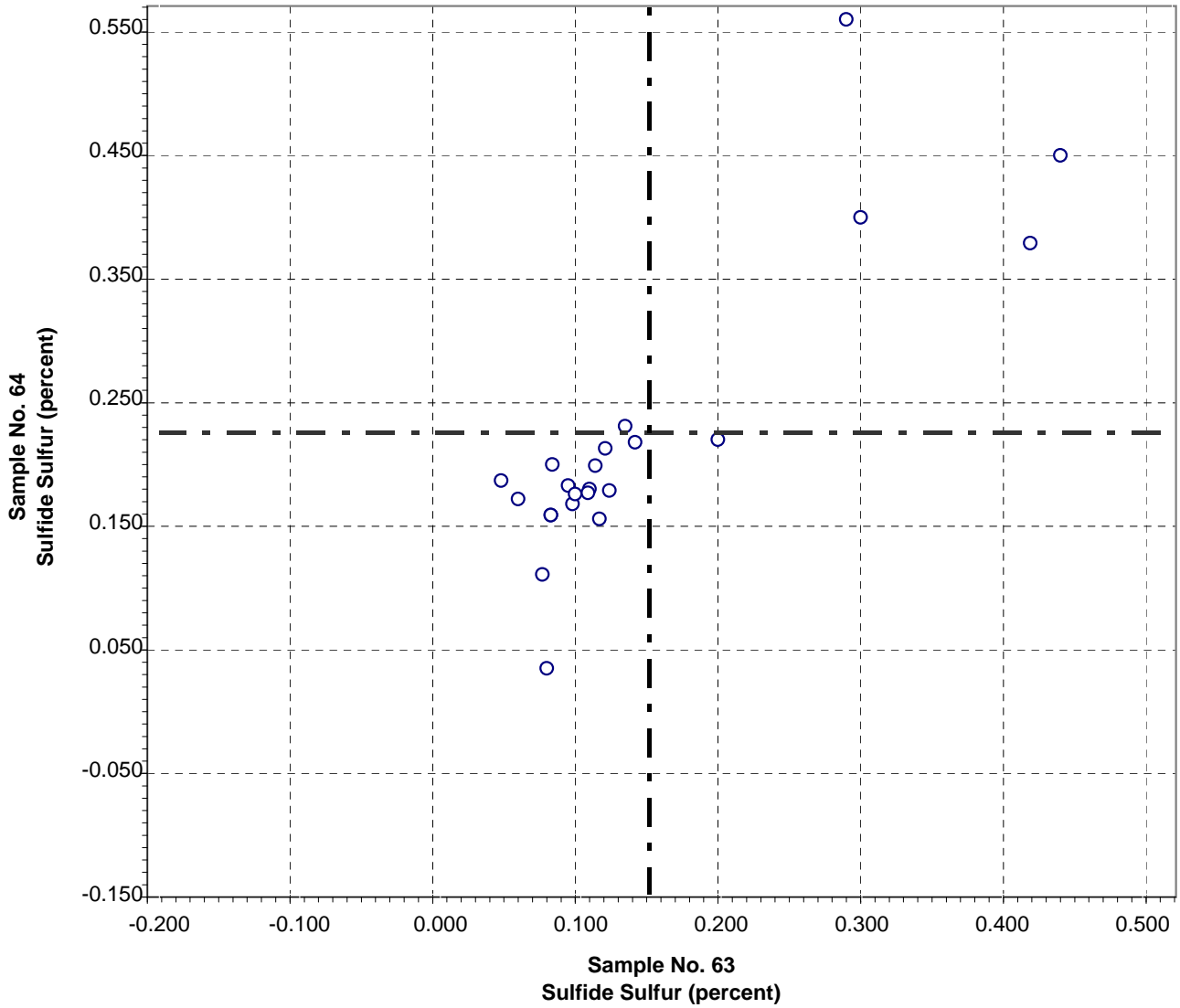


Test No. 101      Manganic Oxide      44 Points

Sample No. 63	Ave 0.145	S.D. 0.0084	C.V. 5.75
Sample No. 64	Ave 0.494	S.D. 0.0243	C.V. 4.92

Labs eliminated: 3297, 3431

**CCRL Proficiency Sample Program  
Sulfide Sulfur  
BLENDED CEMENT Samples No. 63 and No. 64**

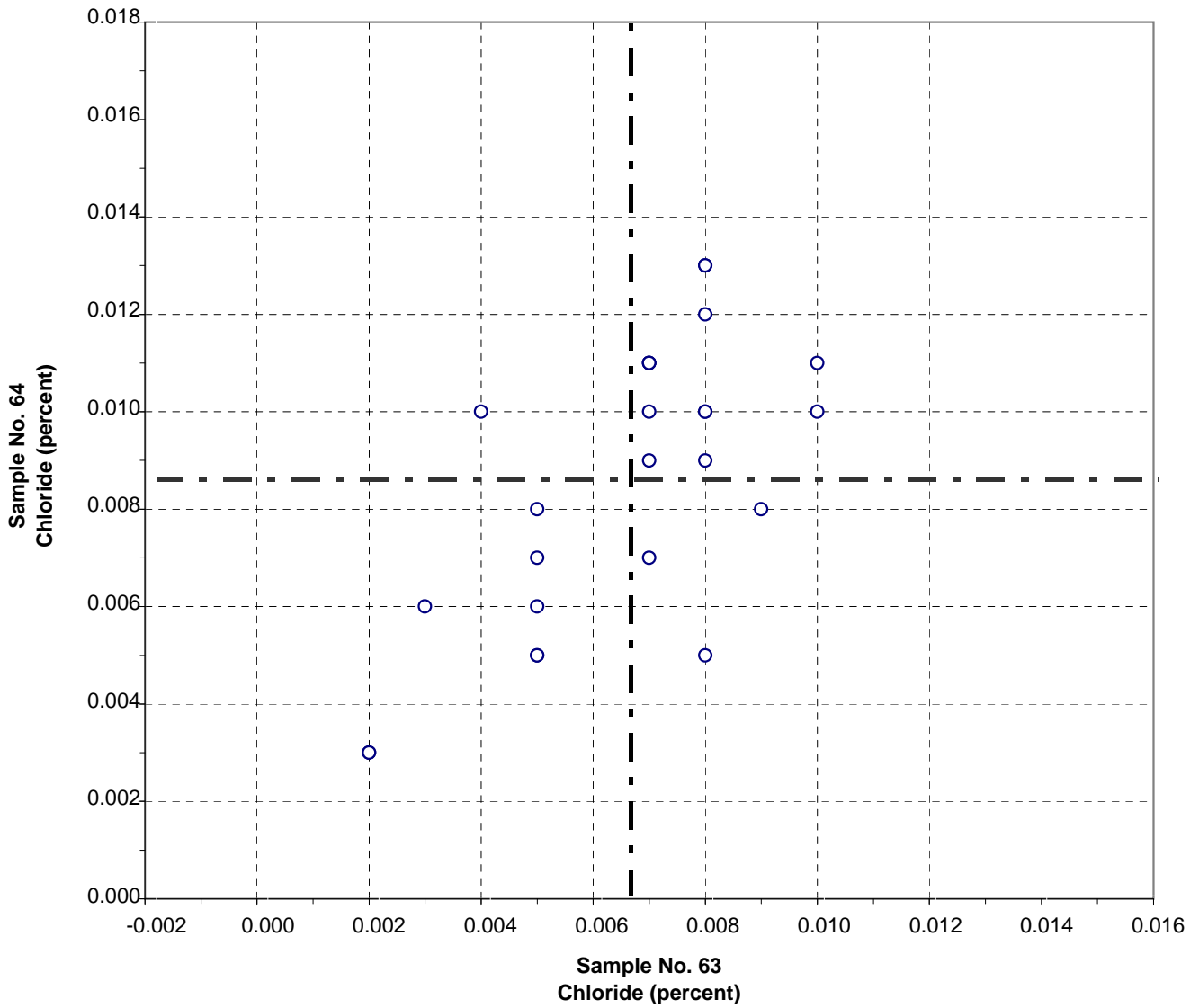


**Test No. 65      Sulfide Sulfur      23 Points**

Sample No. 63	Ave 0.149	S.D. 0.11	C.V. 72.8
Sample No. 64	Ave 0.222	S.D. 0.12	C.V. 52.5

Labs eliminated: 22, 24, 74, 1657

**CCRL Proficiency Sample Program  
Chloride  
BLENDED CEMENT Samples No. 63 and No. 64**



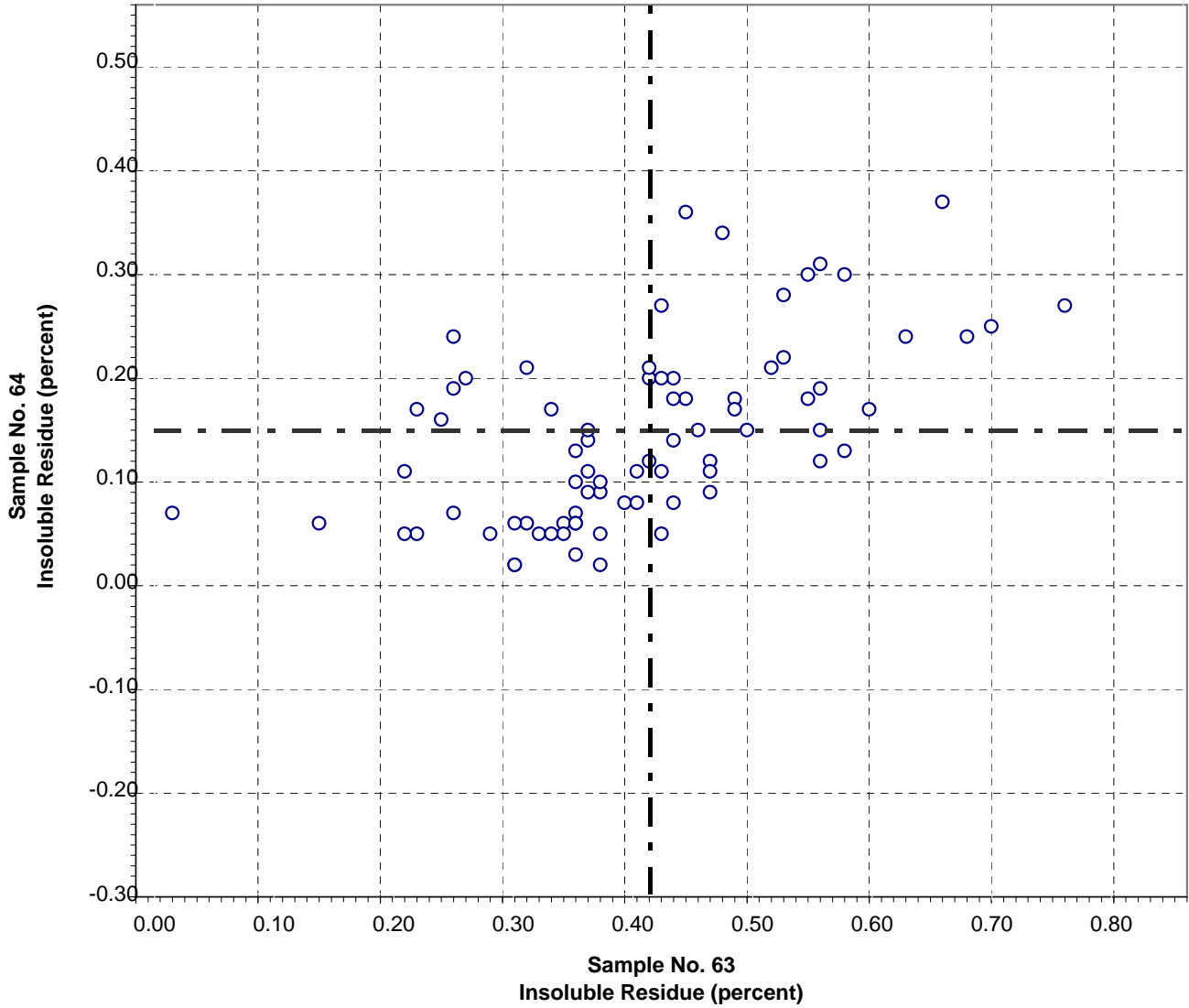
Test No. 104      Chloride      25 Points

Sample No. 63    Ave 0.007    S.D. 0.0022    C.V. 34.0  
 Sample No. 64    Ave 0.009    S.D. 0.0029    C.V. 34.2

Labs eliminated: 309, 354, 2476, 2477



**CCRL Proficiency Sample Program  
Insoluble Residue  
BLENDED CEMENT Samples No. 63 and No. 64**

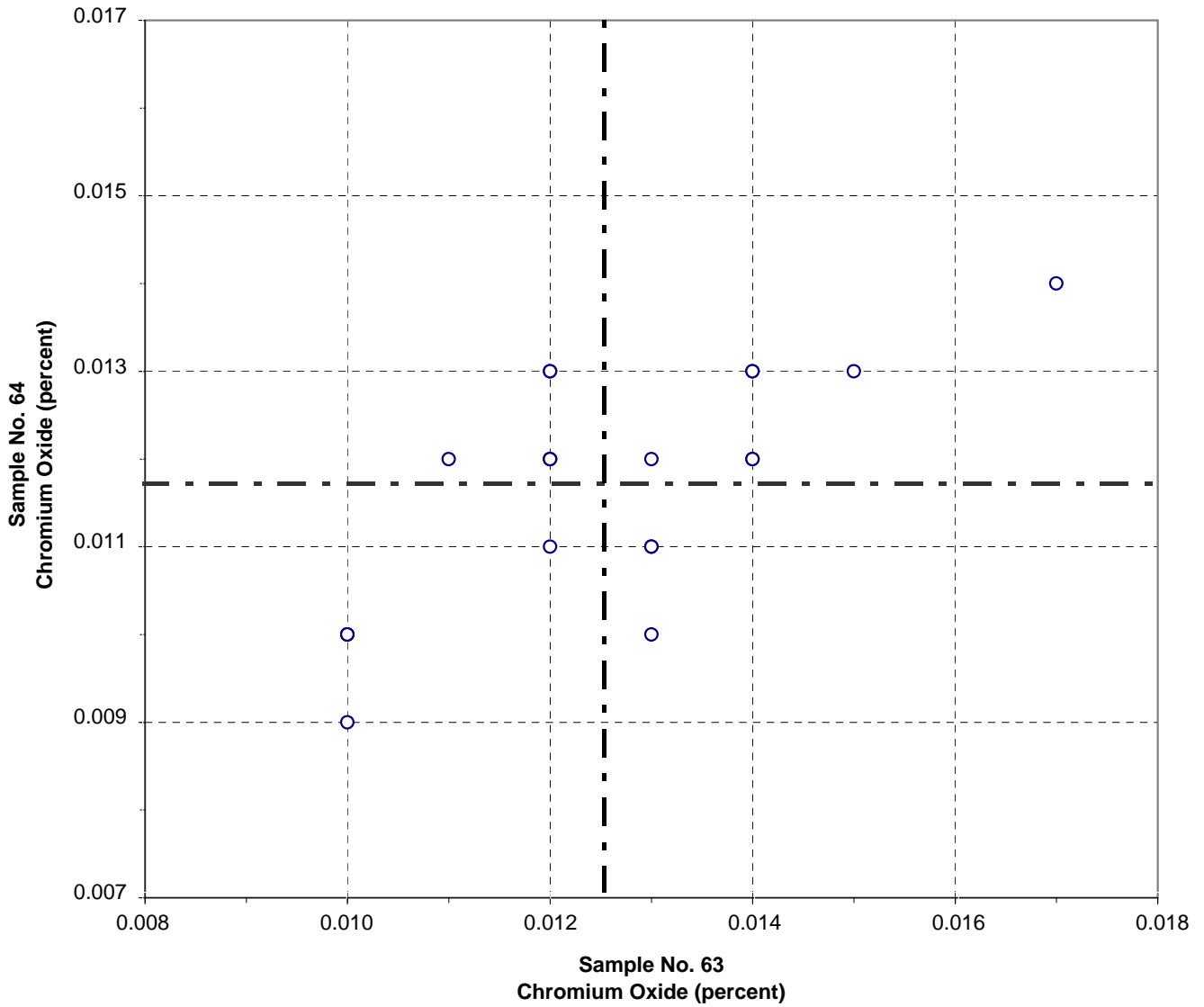


**Test No. 80      Insoluble Residue      77 Points**

Sample No. 63	Ave 0.41	S.D. 0.129	C.V. 31.2
Sample No. 64	Ave 0.15	S.D. 0.086	C.V. 59.5

Labs eliminated: 3431

**CCRL Proficiency Sample Program  
Chromium Oxide  
BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 105

Chromium Oxide

21 Points

Sample No. 63 Ave 0.013 S.D. 0.0018 C.V. 14.4

Sample No. 64 Ave 0.012 S.D. 0.0013 C.V. 11.3

Labs eliminated: 2463, 2462, 2476

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 63 and No. 64  
Final Report - Physical Results  
May 8, 2009

SUMMARY OF RESULTS

Test		#Labs	Sample No. 63			Sample No. 64		
			Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	prcnt	97	24.4	3.5	14.3	25.1	3.4	13.4
N.C. Water	prcnt	* 93	24.4	0.42	1.74	25.1	0.47	1.86
Vicat TS Initial	min	94	112	18.4	16.4	108	21.6	20.0
Vicat TS Initial	min	* 87	110	15.9	14.5	103	14.0	13.5
Vicat TS Final	min	89	218	41.6	19.1	214	40.3	18.9
Vicat TS Final	min	* 88	216	39.2	18.1	212	37.4	17.6
Autoclave Expan	prcnt	90	0.05	0.033	61.8	0.03	0.022	74.9
Autoclave Expan	prcnt	* 86	0.05	0.018	33.9	0.03	0.015	54.3
Air Content	prcnt	76	7.9	1.2	15.7	8.5	1.1	13.4
AC Mix Water	prcnt	77	68.2	3.4	5.01	67.8	3.4	5.03
AC Mix Water	prcnt	* 76	68.4	2.6	3.88	68.0	2.6	3.89
AC Flow	prcnt	77	86	3.2	3.78	88	3.4	3.83
Specific Gravity		73	3.10	0.037	1.20	3.13	0.046	1.47
Specific Gravity		* 71	3.10	0.036	1.18	3.13	0.038	1.22

CONTINUED ON NEXT PAGE

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

N.C. Water	958 38 2463 3431
Vicat TS Initial	38 255 25 46 2251 3287 3409
Vicat TS Final	38
Autoclave Expansion	20 50 181 2352
AC Mix Water	3431
Specific Gravity	51 96

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 63 and No. 64  
Final Report - Physical Results  
May 8, 2009

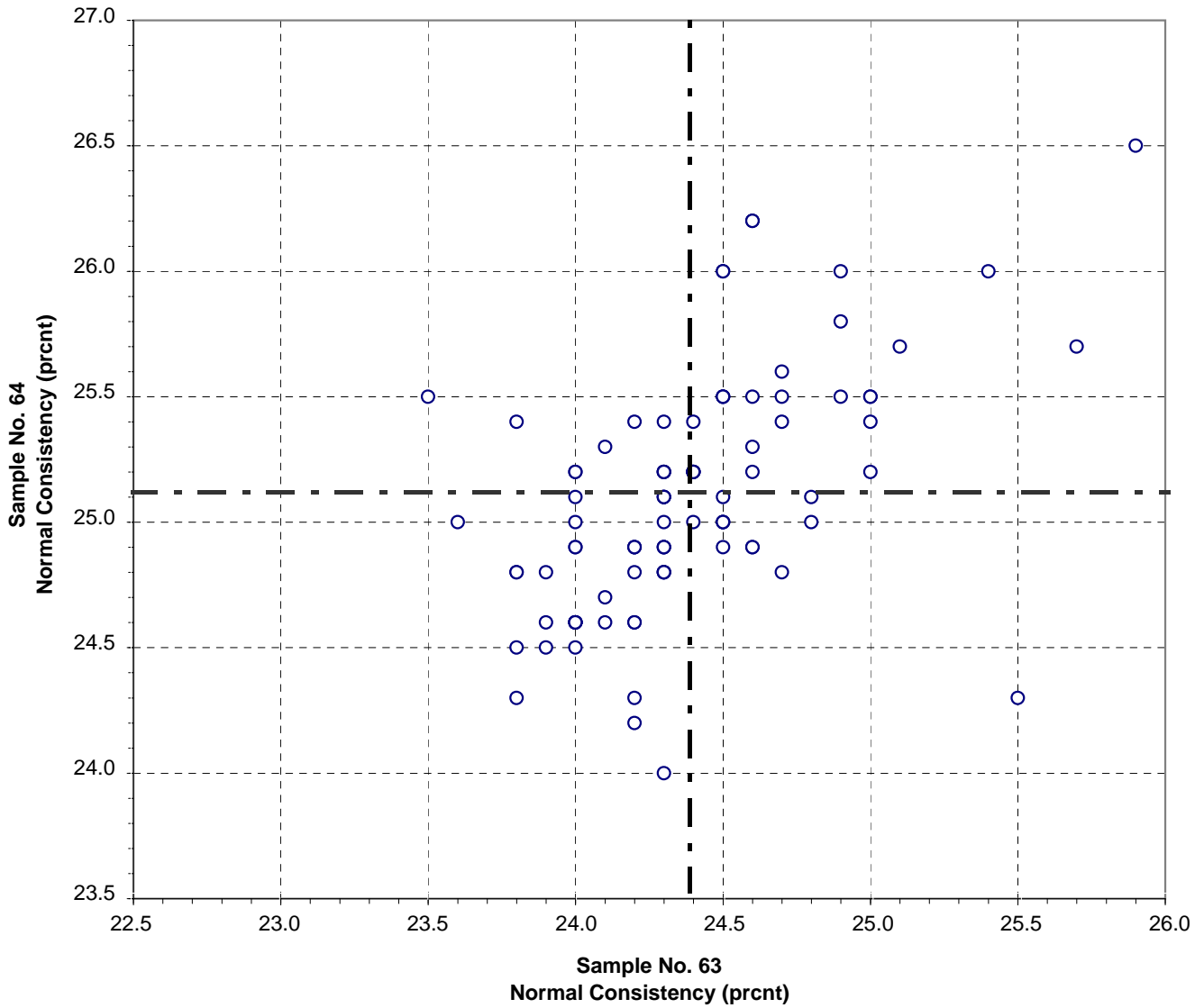
SUMMARY OF RESULTS

Test		#Labs	Sample No. 63			Sample No. 64		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Comp Str, 3 day	psi	99	3530	304.2	8.62	3018	277.5	9.19
Comp Str, 3 day	psi	* 96	3550	254.9	7.18	3010	265.8	8.83
Comp Str, 7 day	psi	96	4371	321.9	7.36	4352	338.3	7.77
Comp Str, 28 day	psi	89	5519	430.9	7.81	6458	577.7	8.94
Comp Str, 28 day	psi	* 88	5505	412.6	7.49	6438	548.3	8.52
CS Mix Water	prcnt	92	47.6	2.0	4.15	47.2	2.2	4.75
CS Mix Water	prcnt	* 90	47.8	1.3	2.77	47.4	1.5	3.12
Comp Str Flow	prcnt	97	110	3.4	3.11	112	3.3	3.00
Comp Str Flow	prcnt	* 90	110	2.9	2.63	111	2.6	2.33
<b>FINENESS</b>								
Air Permeability	cm <sup>2</sup> /g	94	4211	222	5.3	4100	212	5.2
Air Permeability	cm <sup>2</sup> /g	* 90	4241	174	4.1	4121	177	4.3
45µm Sieve	prcnt	91	89.56	2.0	2.18	94.10	1.2	1.27
45µm Sieve	prcnt	* 85	89.41	1.39	1.56	94.16	0.80	0.85

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

Comp Str, 28 day            3320  
 Comp Str, 3 day            2 694 3247  
 CS Mix Water              80 2477  
 Comp Str Flow             14 19 35 38 126 309 2463  
 Fineness - Air Permeability 497 690 14 3320  
 Fineness - 45µm Sieve    25 51 126 181 2477 3247

**CCRL Proficiency Sample Program  
Normal Consistency - % Water  
BLENDED CEMENT Samples No. 63 and No. 64**



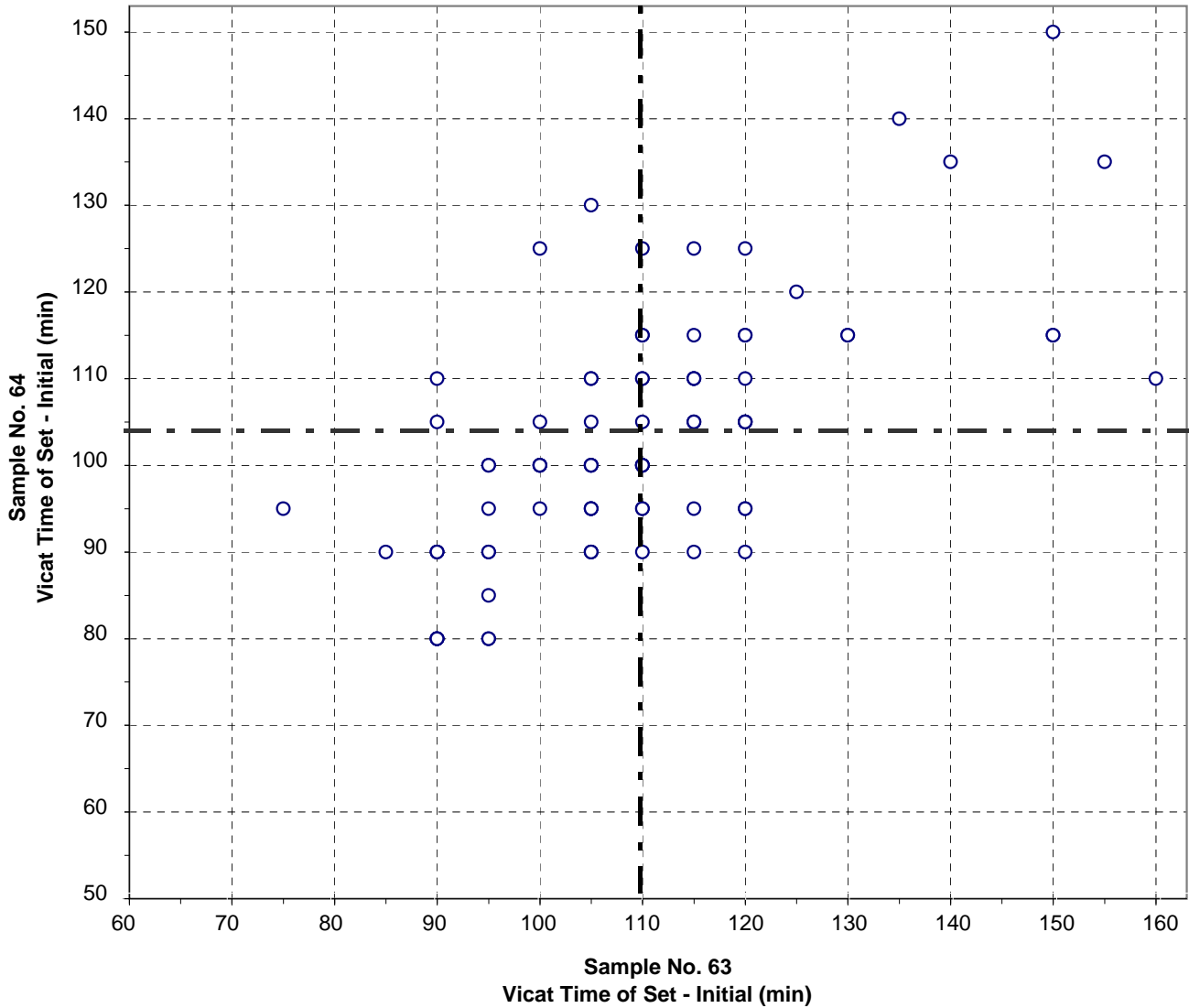
**Test No. 110      Normal Consistency - % Water      93 Points**

Sample No. 63    Ave 24.4    S.D. 0.42    C.V. 1.74

Sample No. 64    Ave 25.1    S.D. 0.47    C.V. 1.86

Labs eliminated: 958, 38, 2463, 3431

**CCRL Proficiency Sample Program  
 Vicat Time of Set - Initial  
 BLENDED CEMENT Samples No. 63 and No. 64**

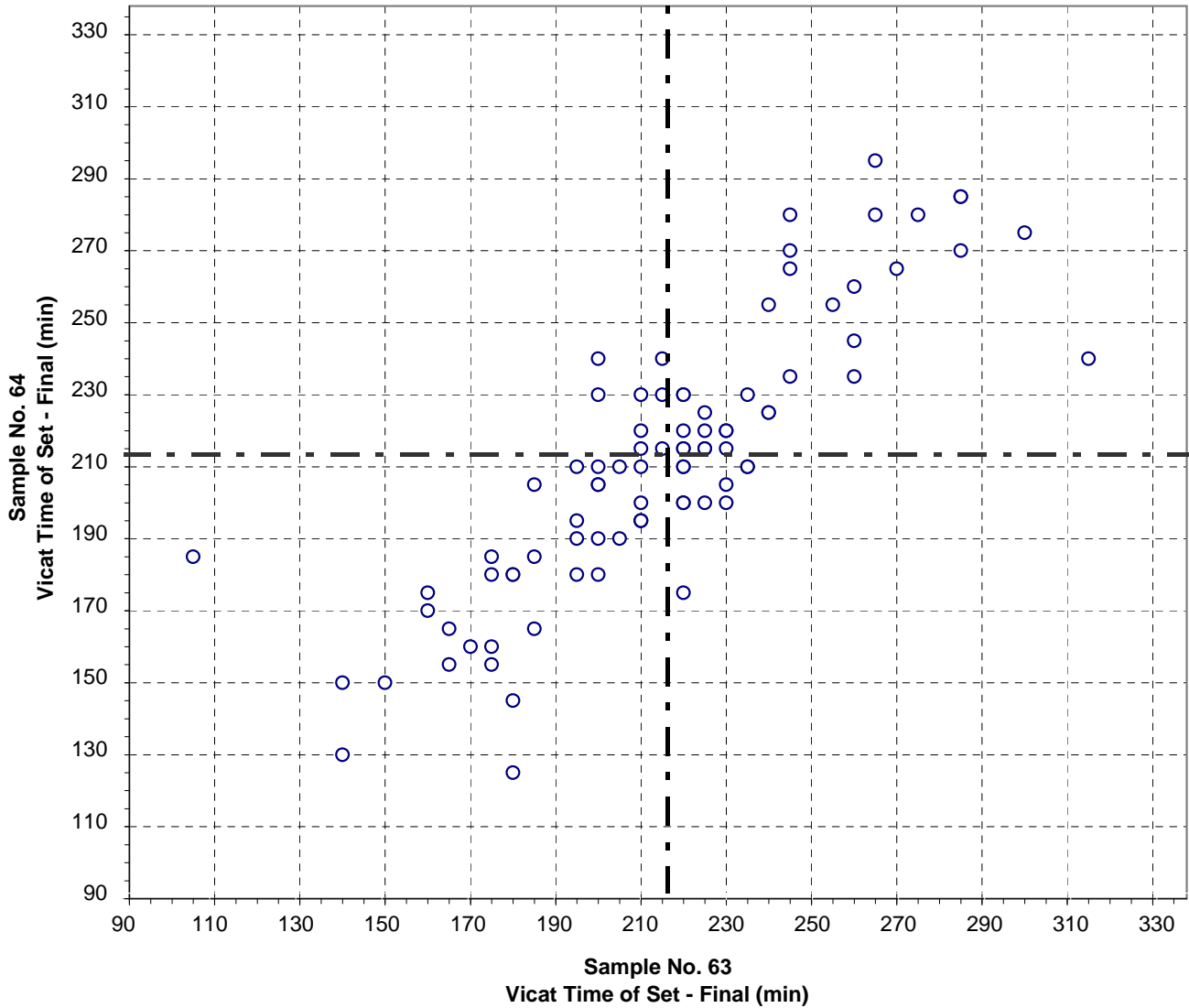


**Test No. 120      Vicat Time of Set - Initial      87 Points**

Sample No. 63    Ave 110    S.D. 15.9    C.V. 14.5  
 Sample No. 64    Ave 103    S.D. 14.0    C.V. 13.5

Labs eliminated: 38, 255, 25, 46, 2251, 3287, 3409

**CCRL Proficiency Sample Program  
 Vicat Time of Set - Final  
 BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 121

Vicat Time of Set - Final

87 Points

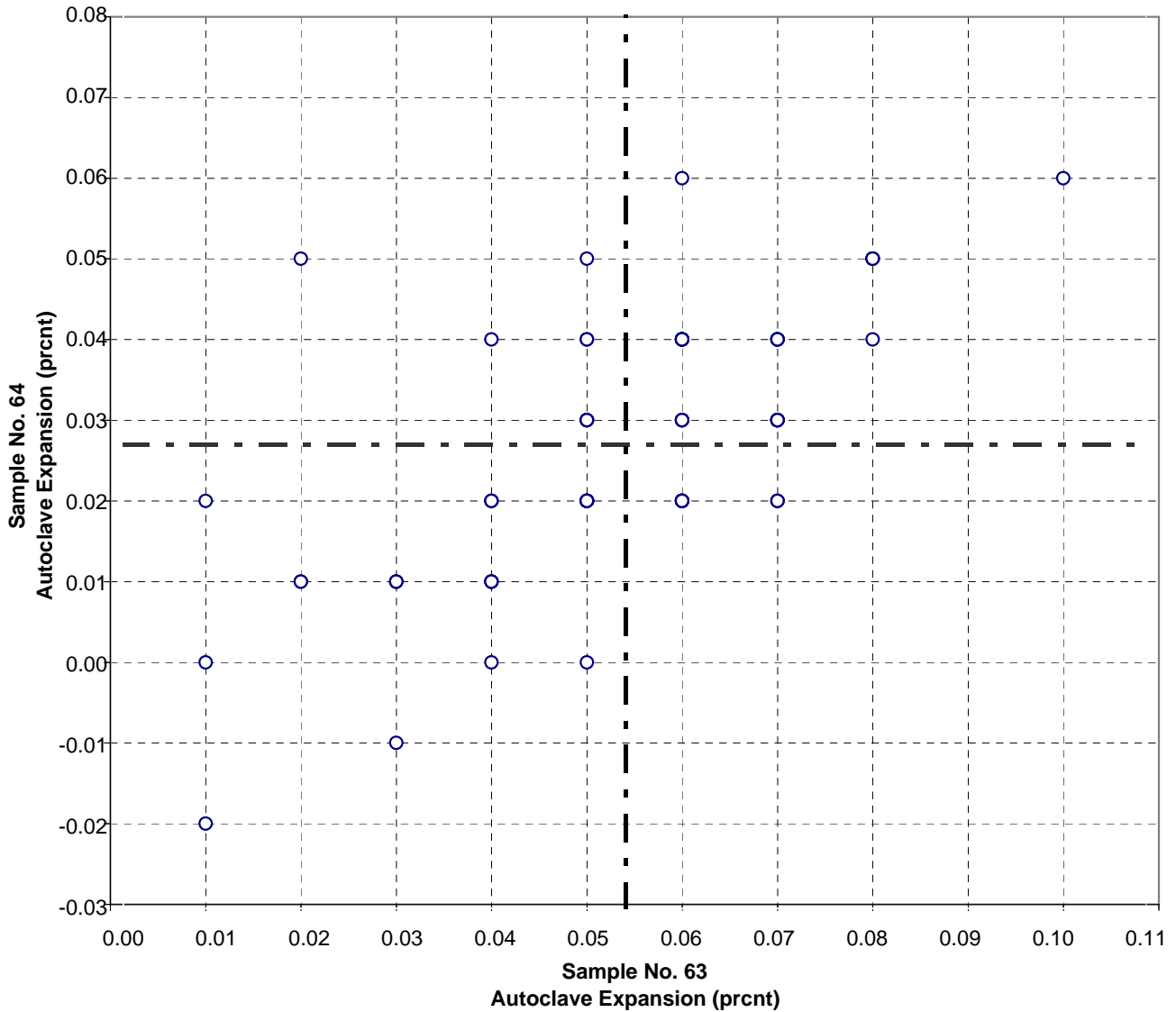
Sample No. 63 Ave 216 S.D. 39.2 C.V. 18.1

Sample No. 64 Ave 212 S.D. 37.4 C.V. 17.6

Labs eliminated: 38

Labs off Diagram: 255

**CCRL Proficiency Sample Program  
Autoclave Expansion  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 160      Autoclave Expansion      85 Points**

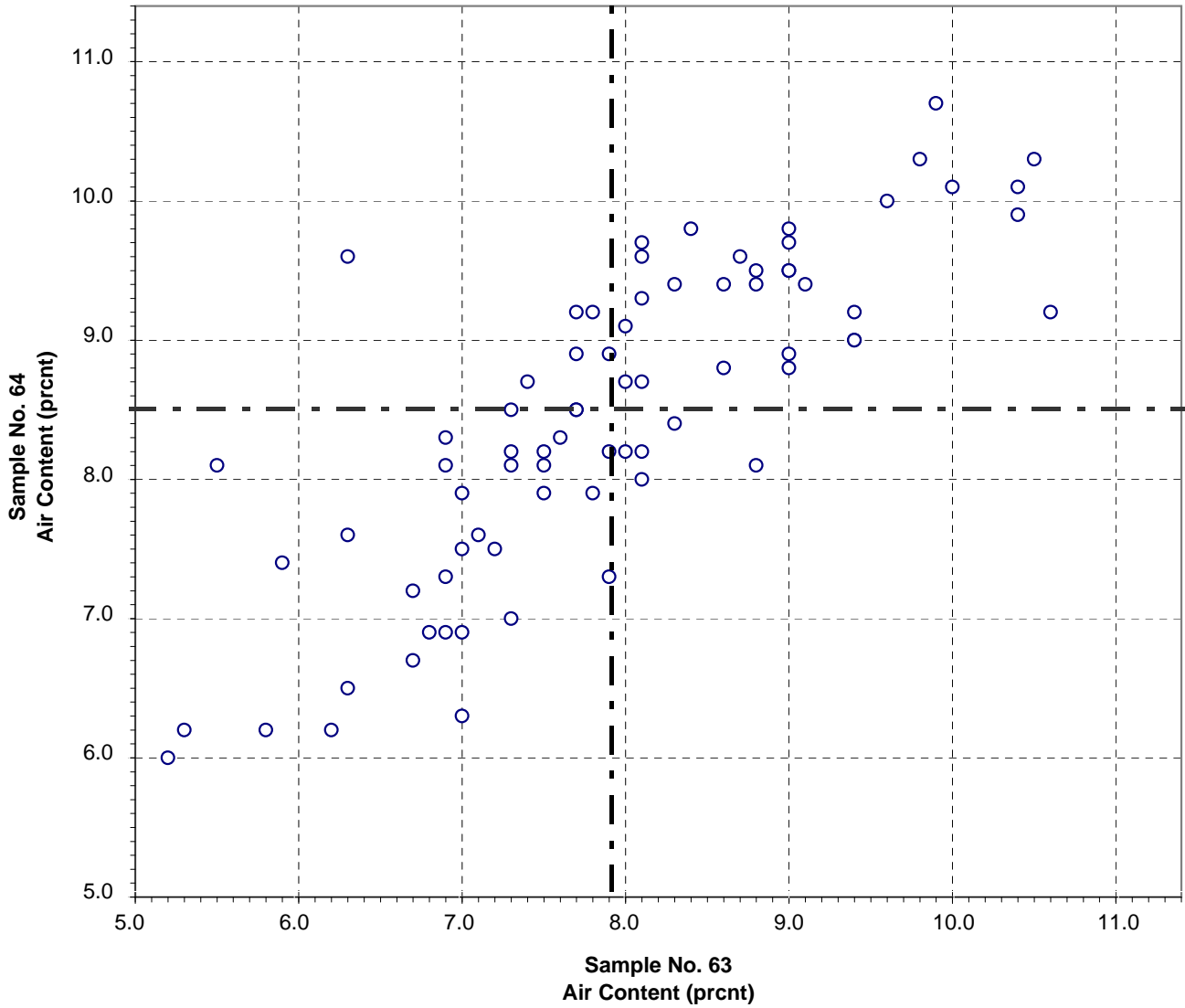
Sample No. 63    Ave 0.05    S.D. 0.018    C.V. 33.9  
 Sample No. 64    Ave 0.03    S.D. 0.015    C.V. 54.3

Labs eliminated: 20, 50, 181, 2352

Labs off Diagram: 690



**CCRL Proficiency Sample Program**  
**Air Content %**  
**BLENDED CEMENT Samples No. 63 and No. 64**



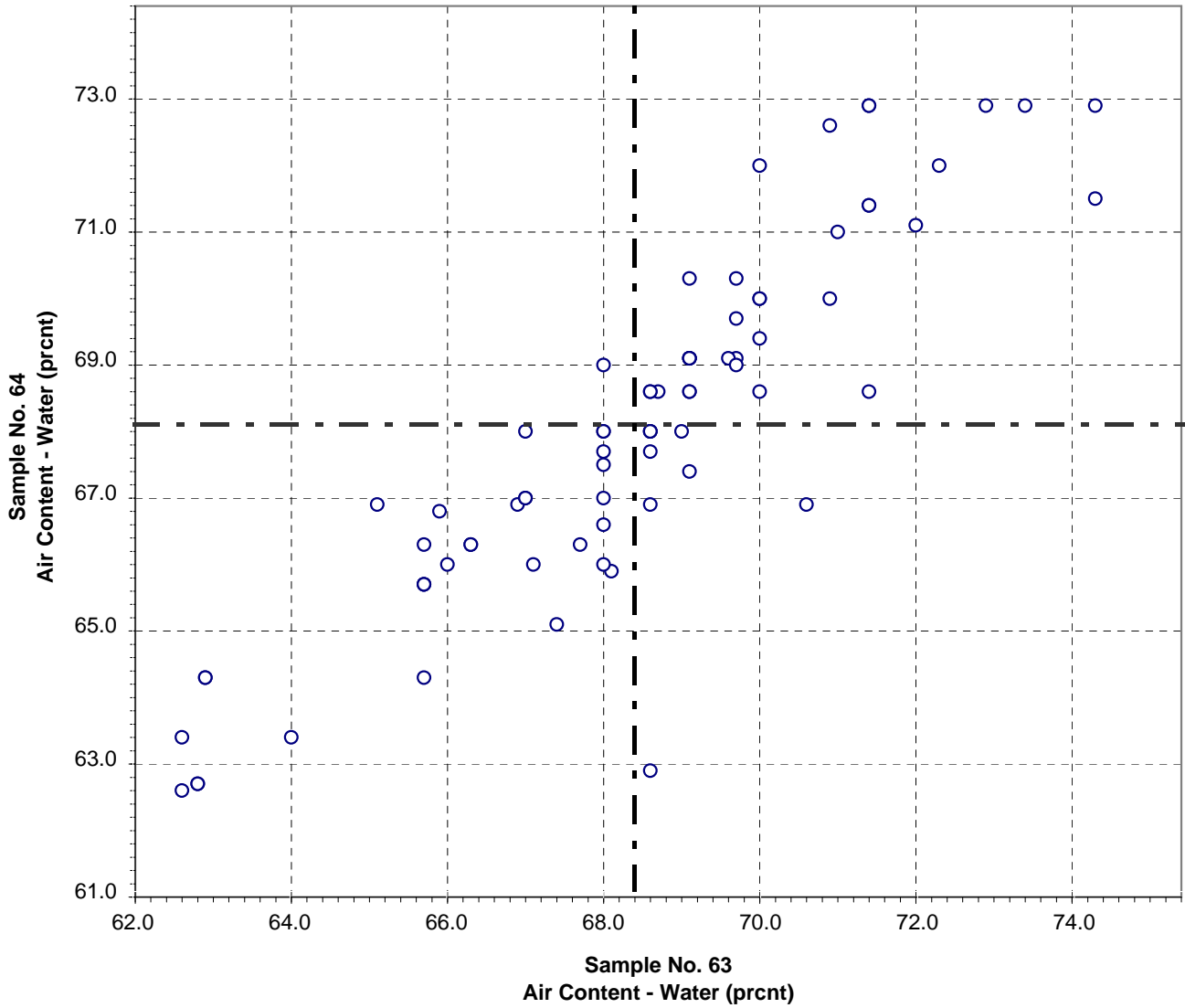
Test No. 170

Air Content %

76 Points

Sample No. 63	Ave 7.9	S.D. 1.2	C.V. 15.7
Sample No. 64	Ave 8.5	S.D. 1.1	C.V. 13.4

**CCRL Proficiency Sample Program  
Air Content - % Water  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 180**

**Air Content - % Water**

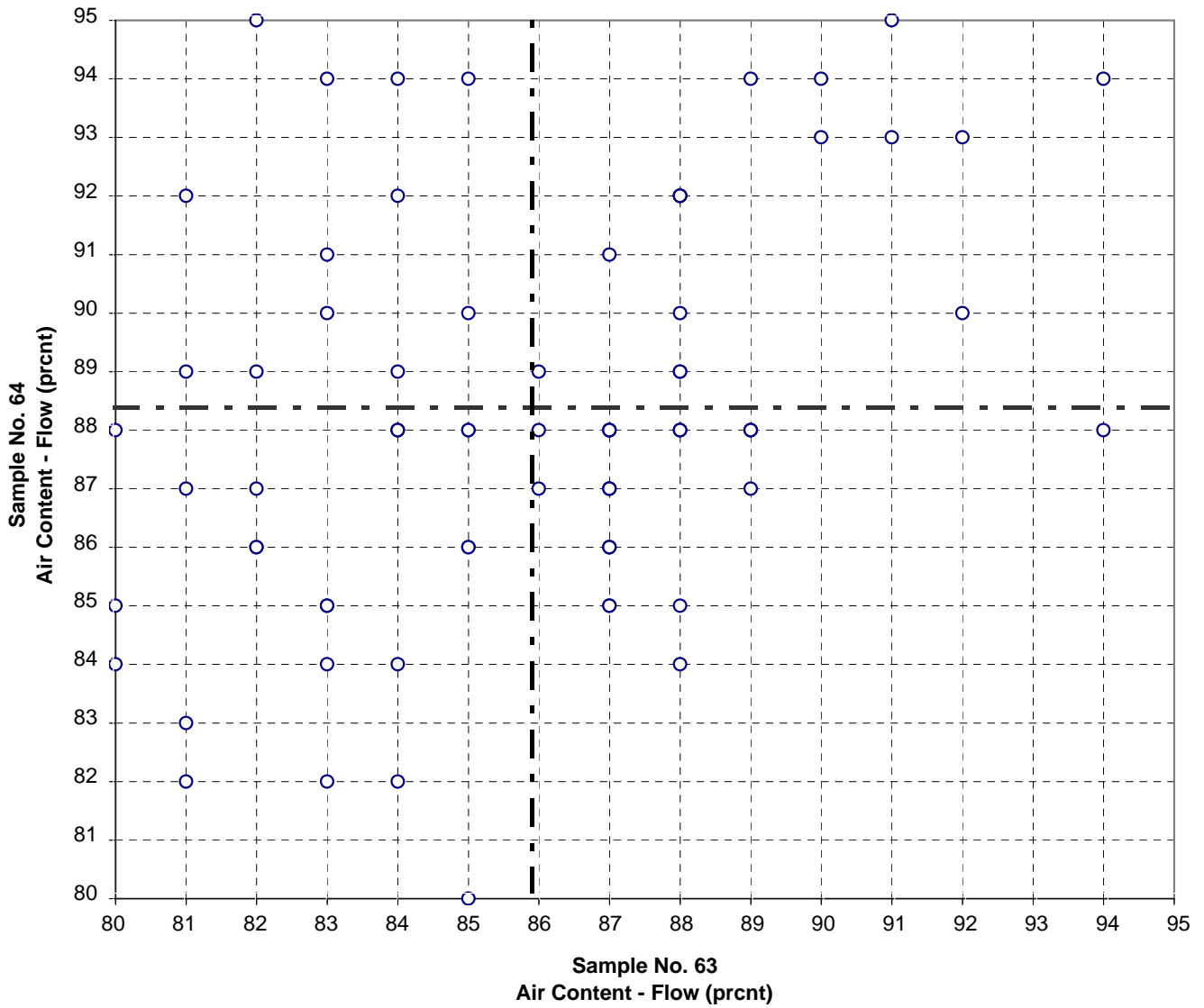
**76 Points**

Sample No. 63 Ave 68.4 S.D. 2.6 C.V. 3.88

Sample No. 64 Ave 68.0 S.D. 2.6 C.V. 3.89

Labs eliminated: 3431

**CCRL Proficiency Sample Program  
Air Content - Flow  
BLENDED CEMENT Samples No. 63 and No. 64**



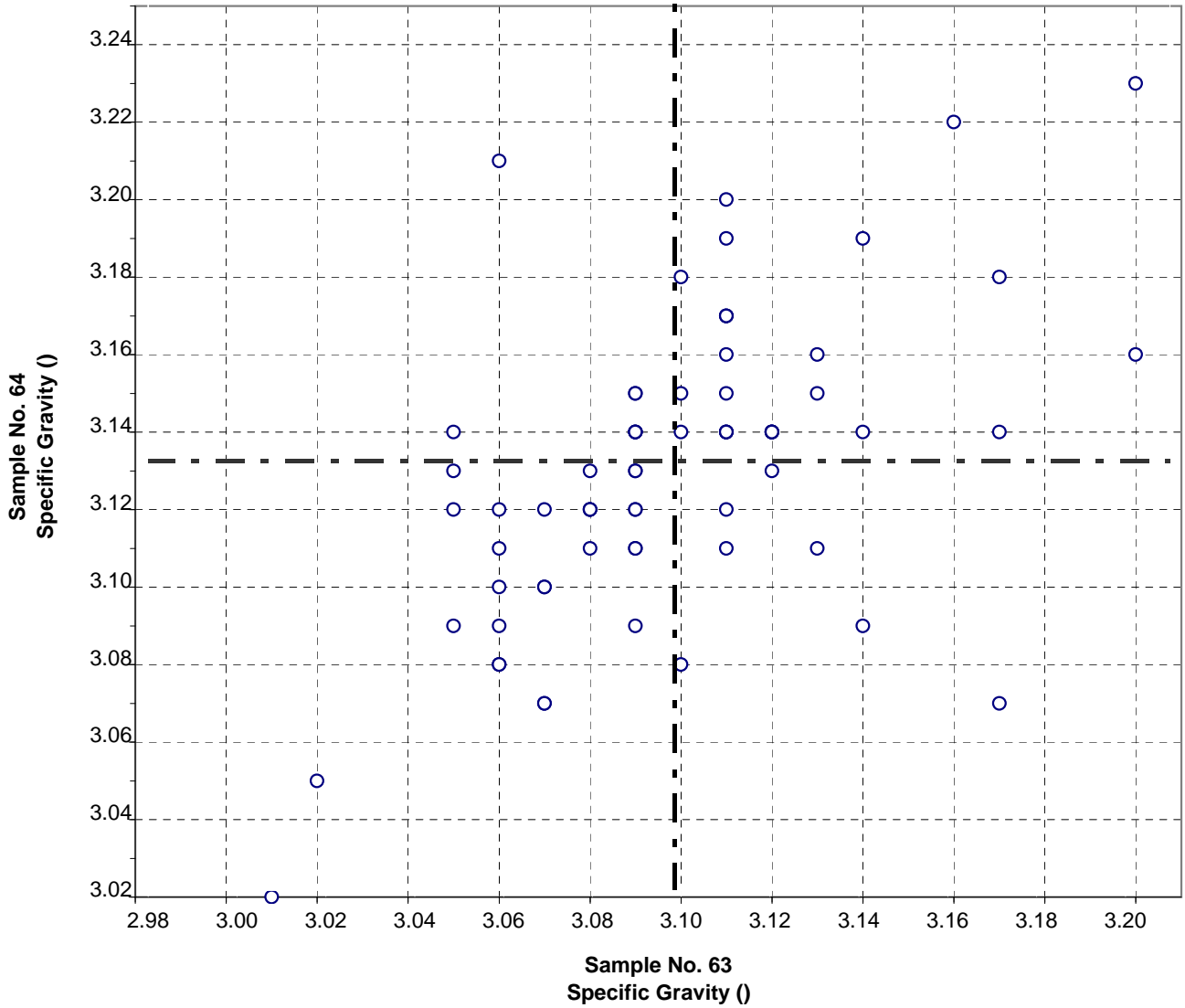
Test No. 190

Air Content - Flow

77 Points

Sample No. 63	Ave 86	S.D. 3.2	C.V. 3.78
Sample No. 64	Ave 88	S.D. 3.4	C.V. 3.83

**CCRL Proficiency Sample Program  
Specific Gravity  
BLENDED CEMENT Samples No. 63 and No. 64**

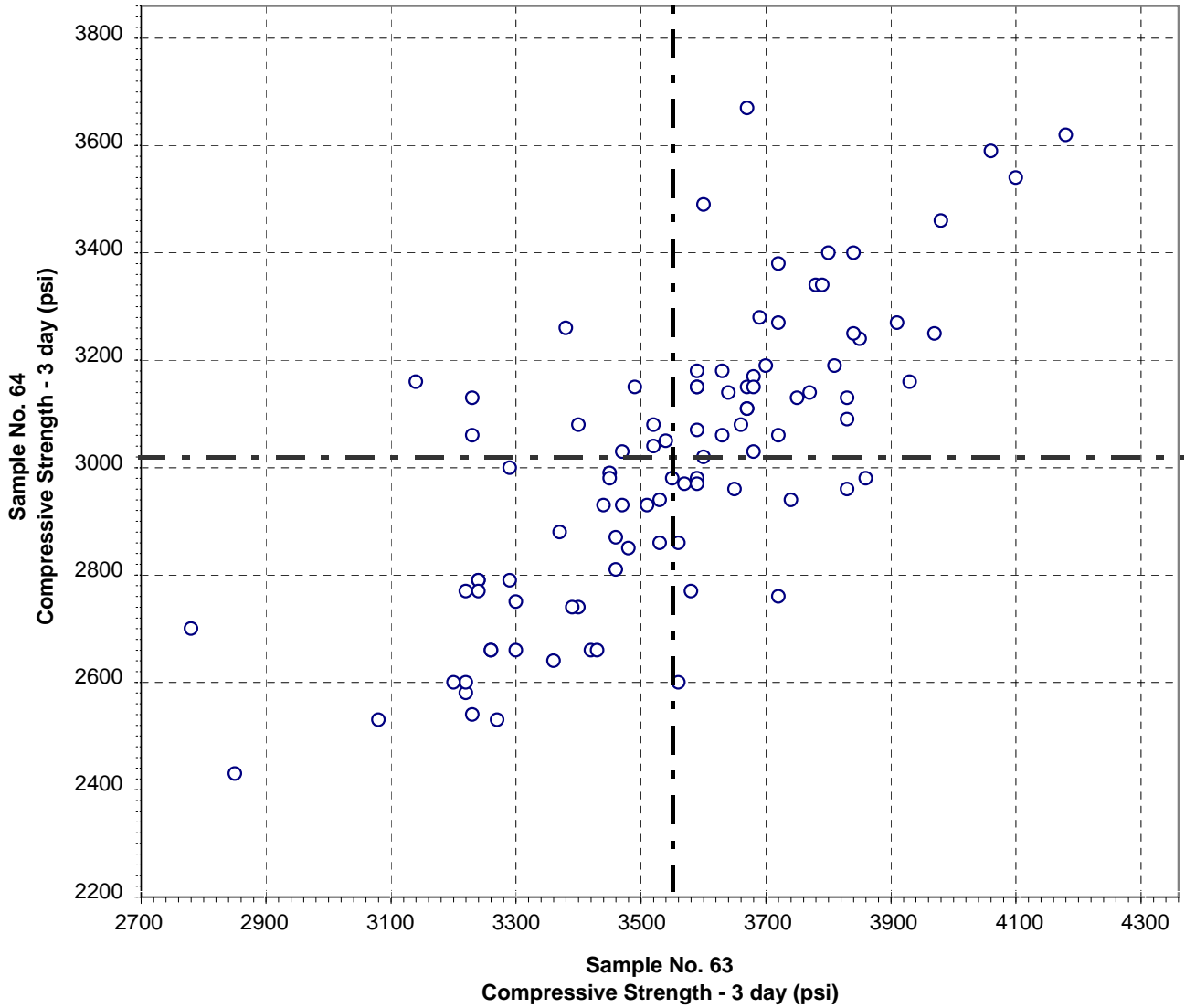


Test No. 310      Specific Gravity      71 Points

Sample No. 63	Ave 3.10	S.D. 0.036	C.V. 1.18
Sample No. 64	Ave 3.13	S.D. 0.038	C.V. 1.22

Labs eliminated: 51, 96

**CCRL Proficiency Sample Program  
Compressive Strength - 3 day  
BLENDED CEMENT Samples No. 63 and No. 64**



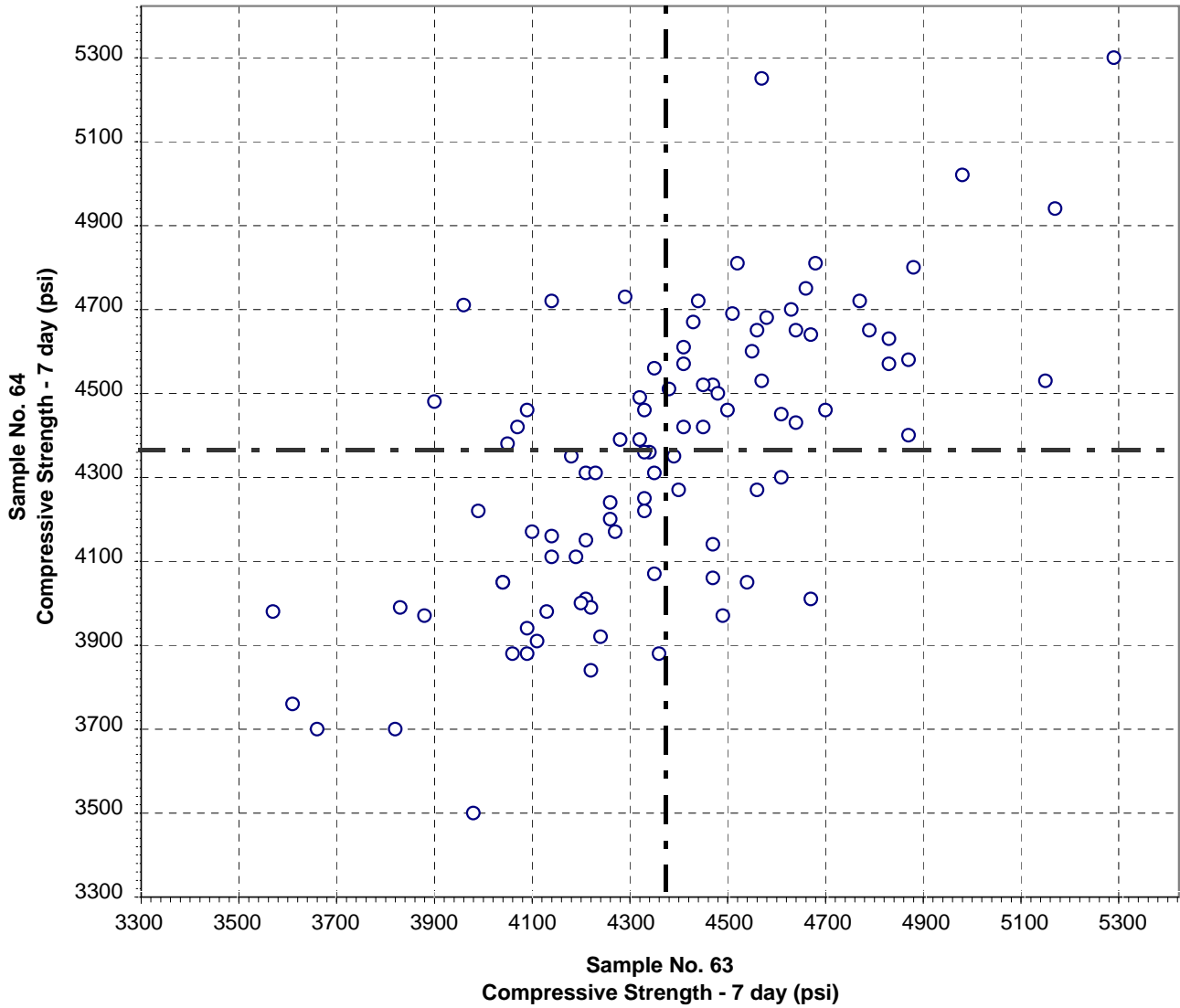
**Test No. 200      Compressive Strength - 3 day      96 Points**

Sample No. 63    Ave 3550    S.D. 254.9    C.V. 7.18

Sample No. 64    Ave 3010    S.D. 265.8    C.V. 8.83

Labs eliminated: 2, 694, 3247

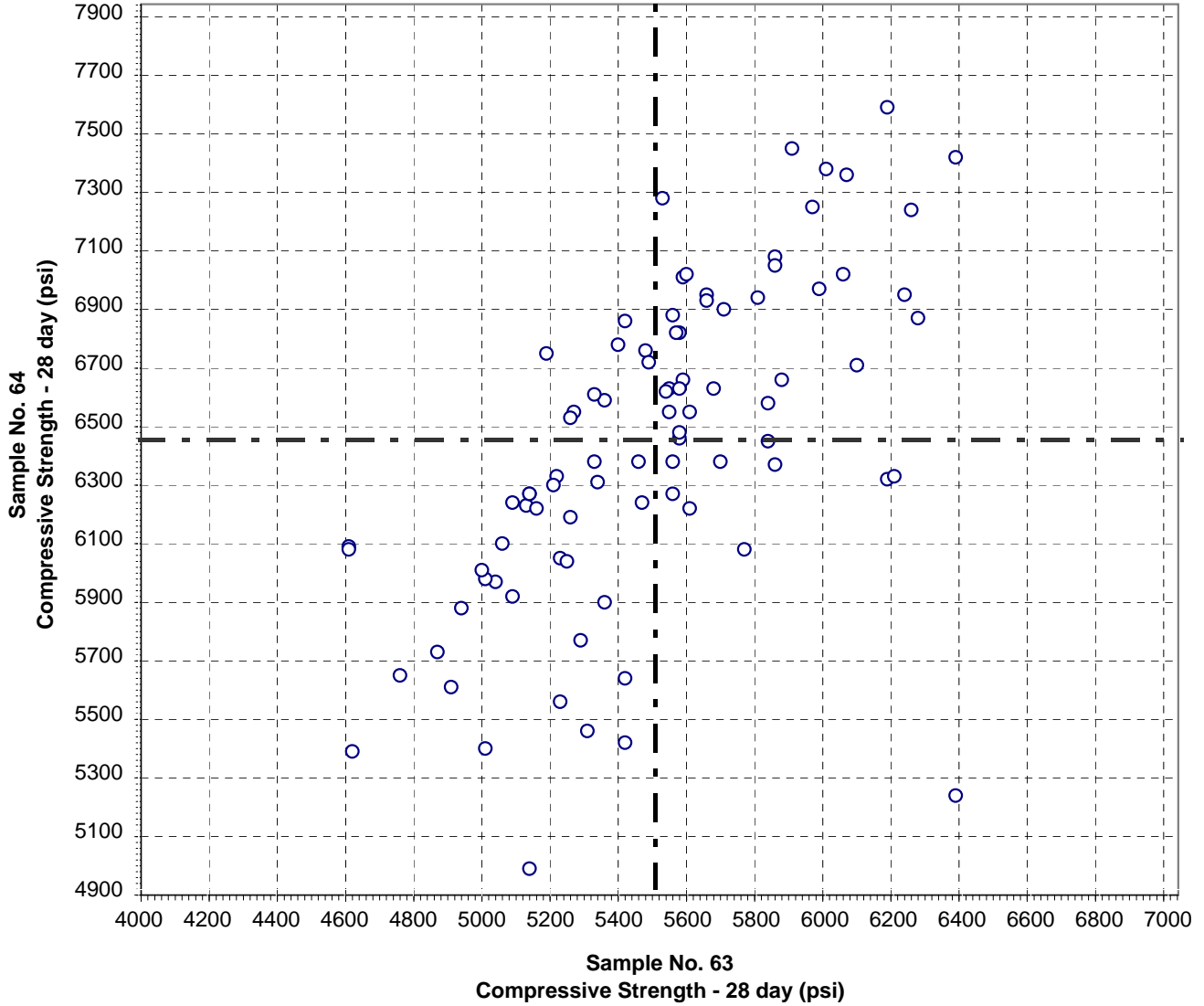
**CCRL Proficiency Sample Program  
Compressive Strength - 7 day  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 210      Compressive Strength - 7 day      96 Points**

Sample No. 63	Ave 4371	S.D. 321.9	C.V. 7.36
Sample No. 64	Ave 4352	S.D. 338.3	C.V. 7.77

**CCRL Proficiency Sample Program  
Compressive Strength - 28 day  
BLENDED CEMENT Samples No. 63 and No. 64**

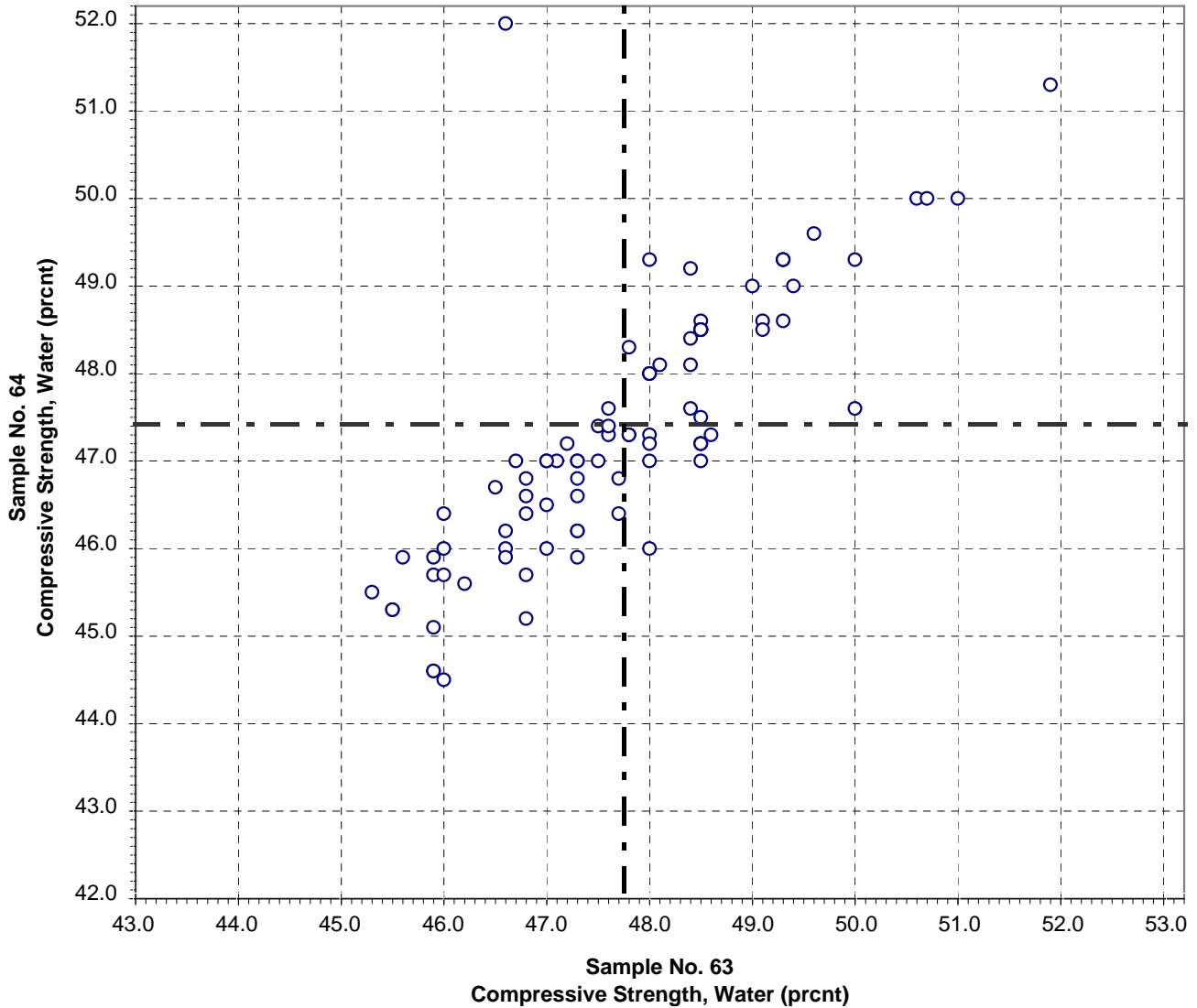


**Test No. 211      Compressive Strength - 28 day      88 Points**

Sample No. 63   Ave 5505   S.D. 412.6   C.V. 7.49  
 Sample No. 64   Ave 6438   S.D. 548.3   C.V. 8.52

Labs eliminated: 3320

**CCRL Proficiency Sample Program  
Compressive Strength - % Water  
BLENDED CEMENT Samples No. 63 and No. 64**



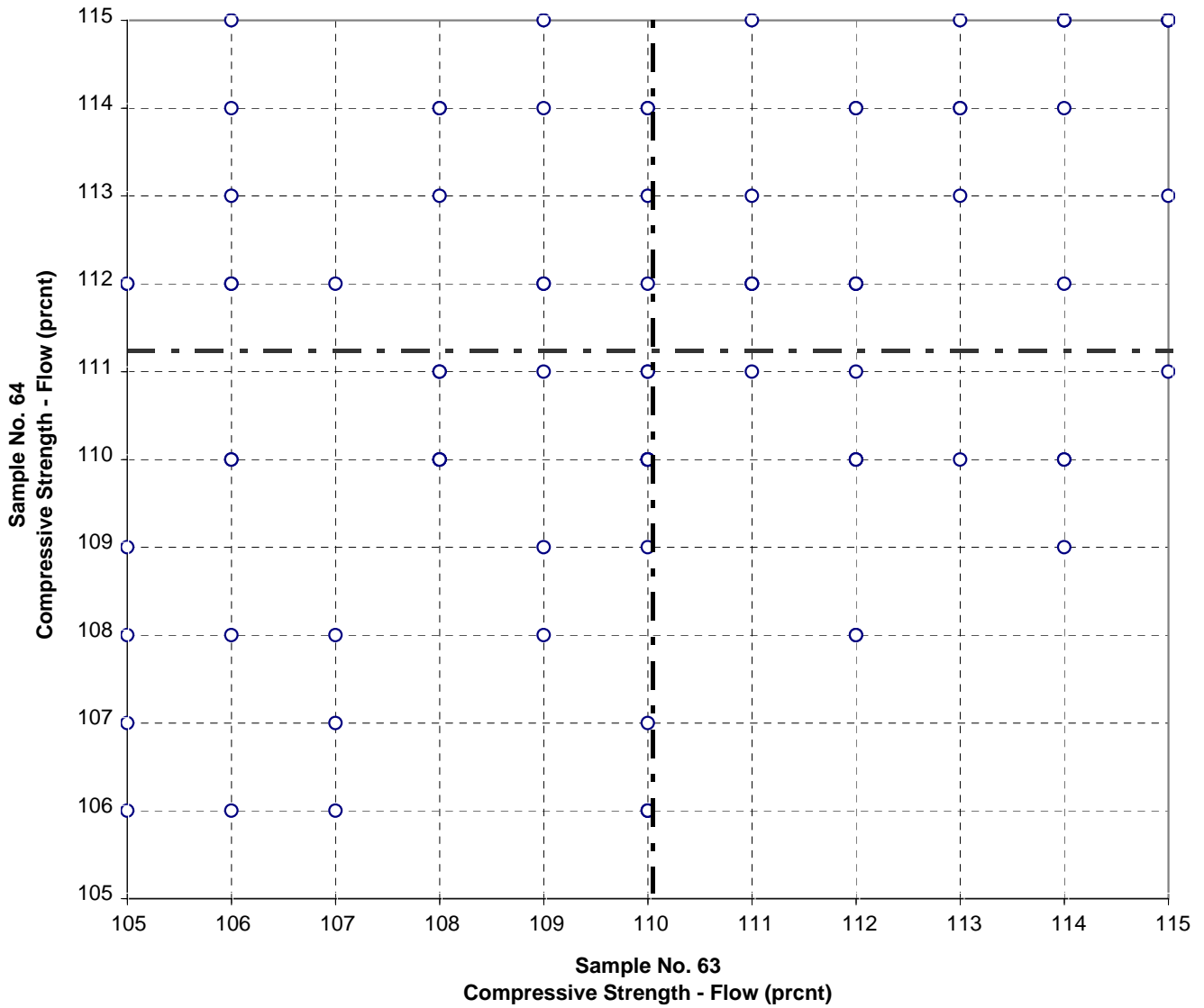
**Test No. 220      Compressive Strength - % Water      90 Points**

Sample No. 63    Ave 47.8    S.D. 1.3    C.V. 2.77  
 Sample No. 64    Ave 47.4    S.D. 1.5    C.V. 3.12

Labs eliminated: 80, 2477



**CCRL Proficiency Sample Program  
Compressive Strength - Flow  
BLENDED CEMENT Samples No. 63 and No. 64**



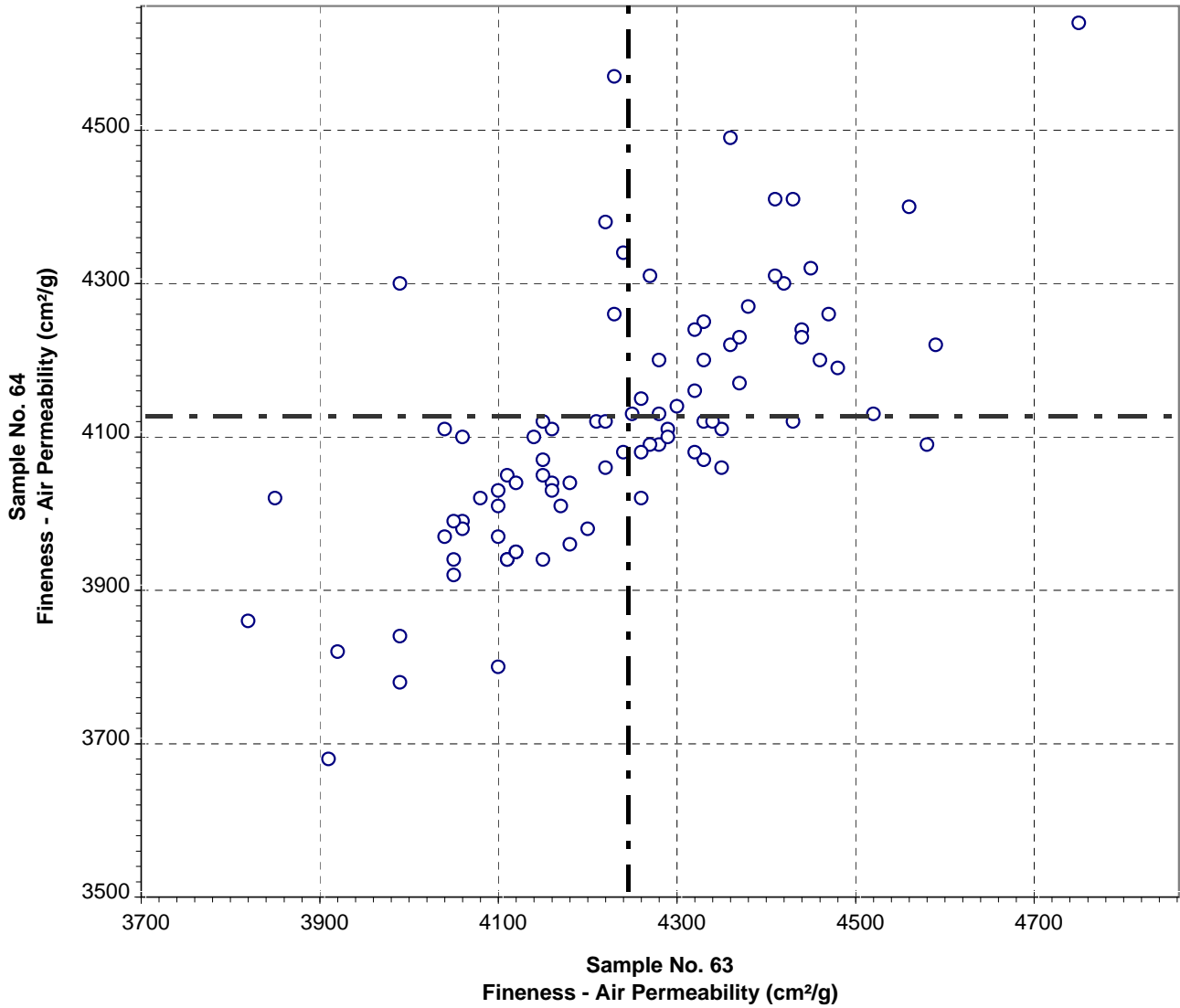
**Test No. 230      Compressive Strength - Flow      90 Points**

Sample No. 63    Ave 110    S.D. 2.9    C.V. 2.63

Sample No. 64    Ave 111    S.D. 2.6    C.V. 2.33

Labs eliminated: 14, 19, 35, 38, 126, 309, 2463

**CCRL Proficiency Sample Program  
Fineness - Air Permeability  
BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 270

Fineness - Air Permeability

89 Points

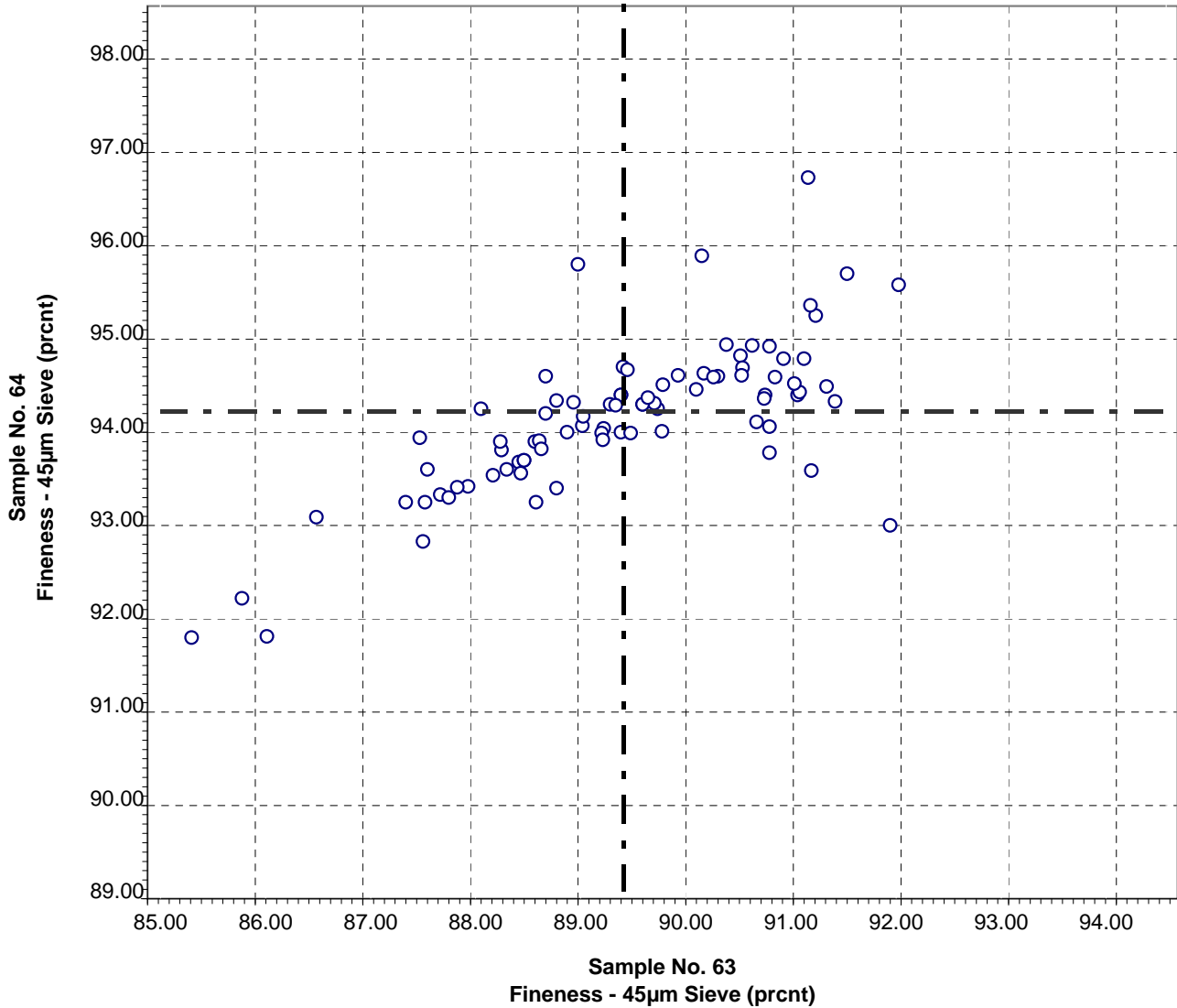
Sample No. 63 Ave 4241 S.D. 174 C.V. 4.1

Sample No. 64 Ave 4121 S.D. 177 C.V. 4.3

Labs eliminated: 497, 690, 14, 3320

Labs off Diagram: 10

**CCRL Proficiency Sample Program  
Fineness - 45µm % Passing  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 281      Fineness - 45µm % Passing      85 Points**

Sample No. 63    Ave 89.41    S.D. 1.39    C.V. 1.56  
 Sample No. 64    Ave 94.16    S.D. 0.80    C.V. 0.85

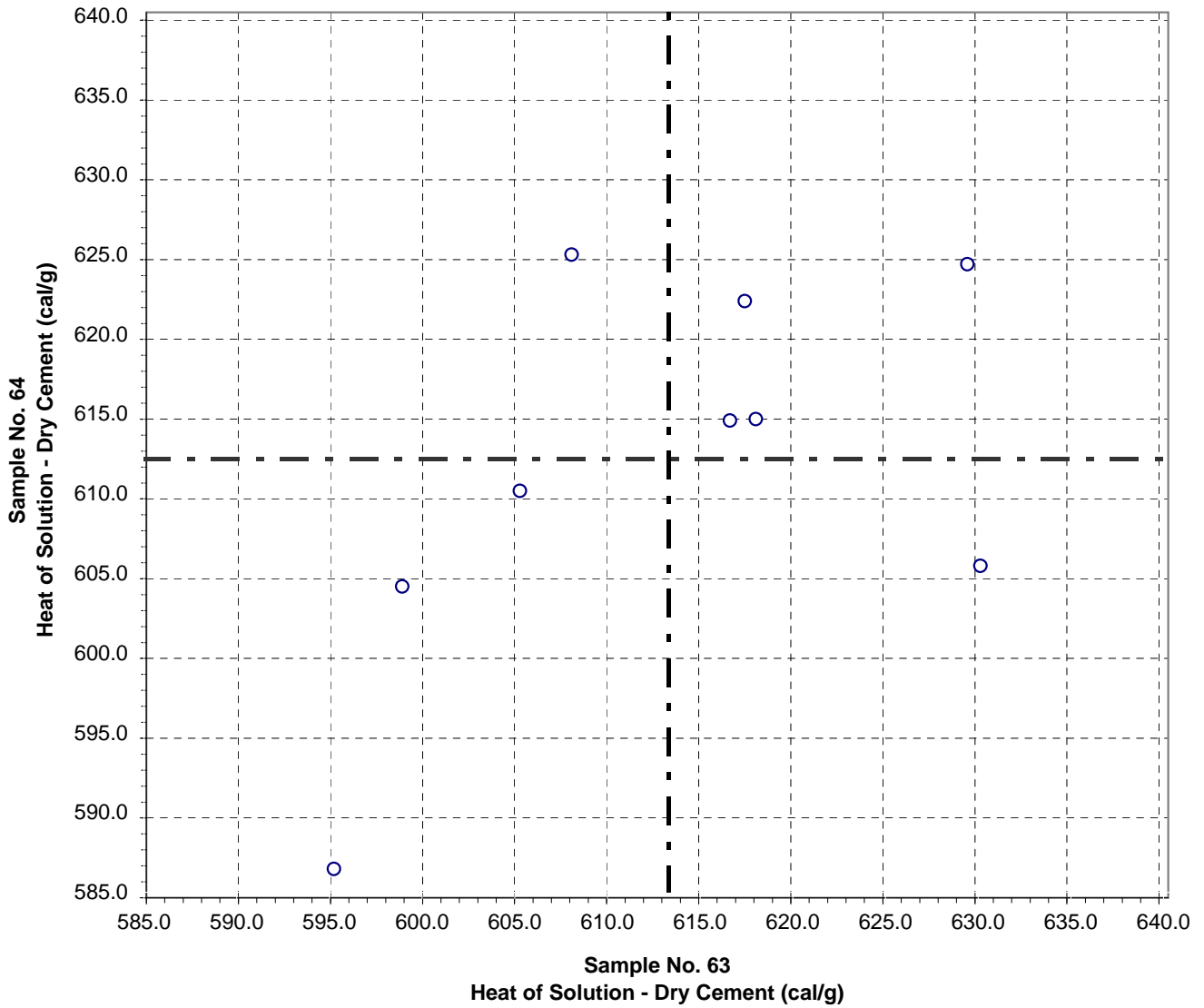
Labs eliminated: 25, 51, 126, 181, 2477, 3247

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 63 and No. 64  
Final Report - Heat of Hydration Results  
May 8, 2009

SUMMARY OF RESULTS

Test	#Labs	Sample No. 63			Sample No. 64		
		Average	S.D.	C.V.	Average	S.D.	C.V.
Heat Solution, Dry cal/g	9	613.3	12.4	2.02	612.2	12.2	2.00
Heat Sol, 7 day cal/g	9	526.8	18.6	3.54	535.4	13.9	2.59
Heat Sol, 28 day cal/g	6	524.8	9.2	1.75	525.7	8.0	1.53
Heat Hyd, 7 day cal/g	9	86.5	17.4	20.1	76.9	12.2	15.9
Heat Hyd, 28 day cal/g	6	88.9	7.2	8.09	88.7	6.8	7.66

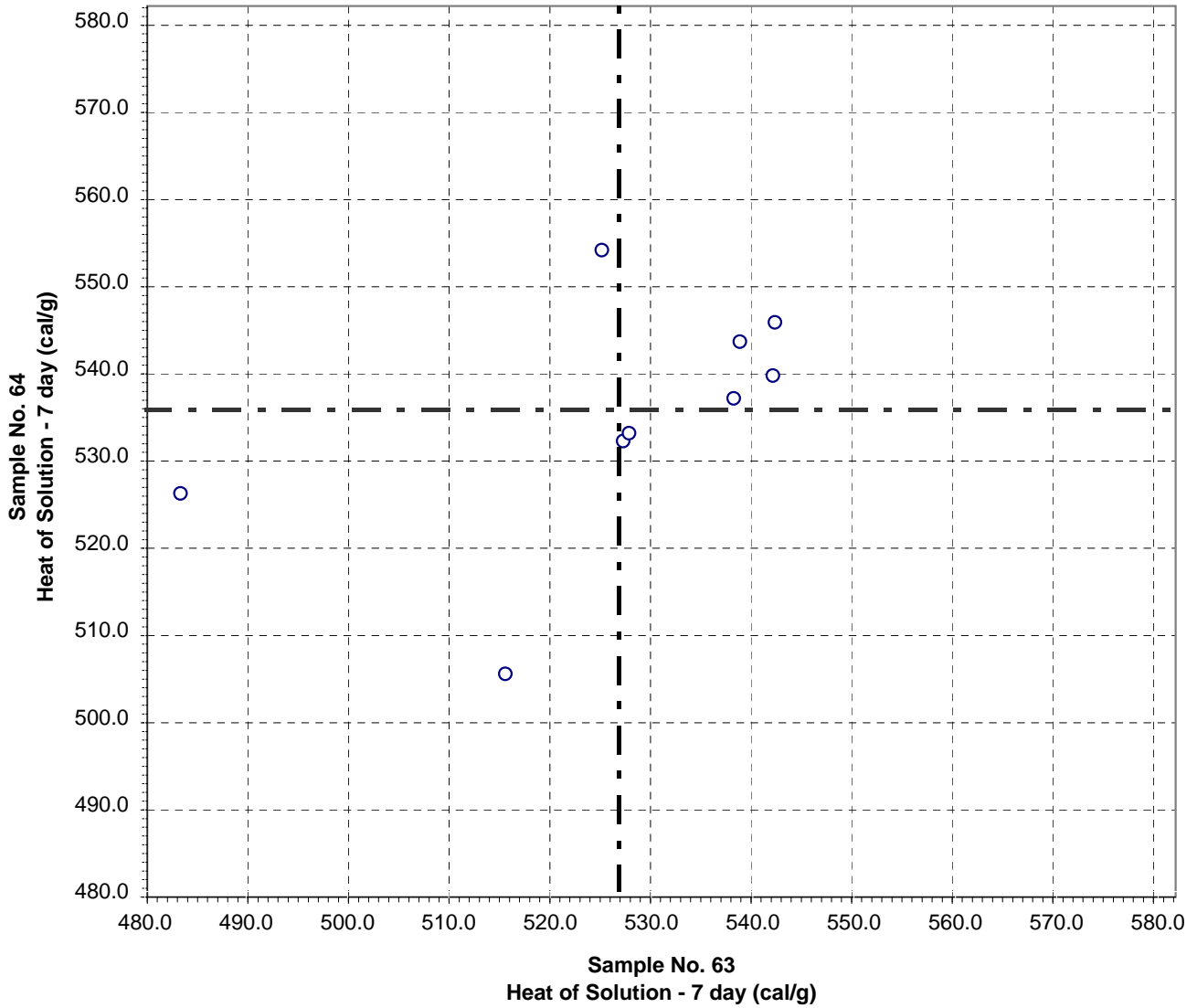
**CCRL Proficiency Sample Program  
Heat of Solution - Dry Cement  
BLENDED CEMENT Samples No. 63 and No. 64**



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

Sample No. 63	Ave 613.3	S.D. 12.4	C.V. 2.02
Sample No. 64	Ave 612.2	S.D. 12.2	C.V. 2.00

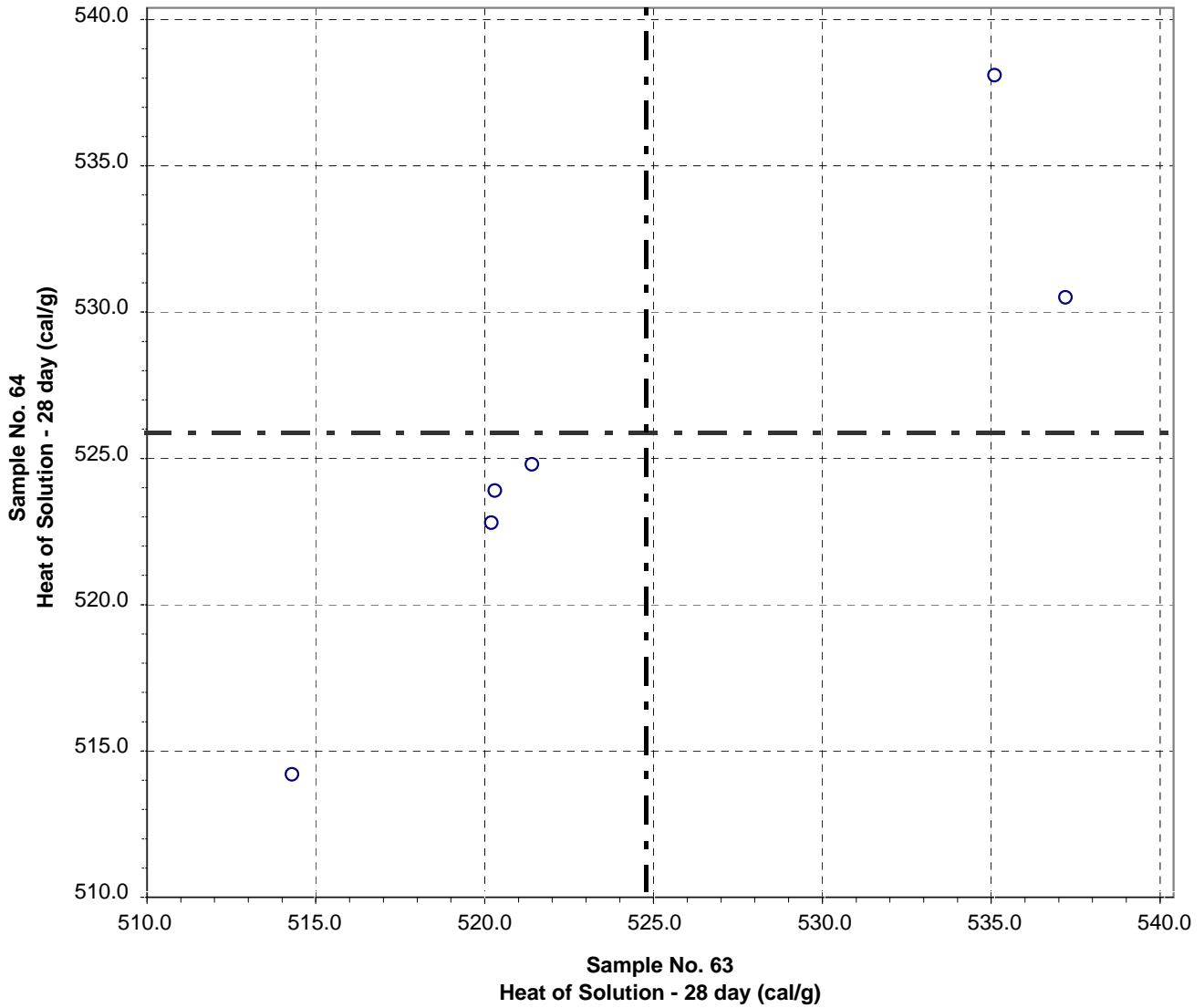
**CCRL Proficiency Sample Program**  
**Heat of Solution - 7 day**  
**BLENDED CEMENT Samples No. 63 and No. 64**



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

Sample No. 63	Ave 526.8	S.D. 18.6	C.V. 3.54
Sample No. 64	Ave 535.4	S.D. 13.9	C.V. 2.59

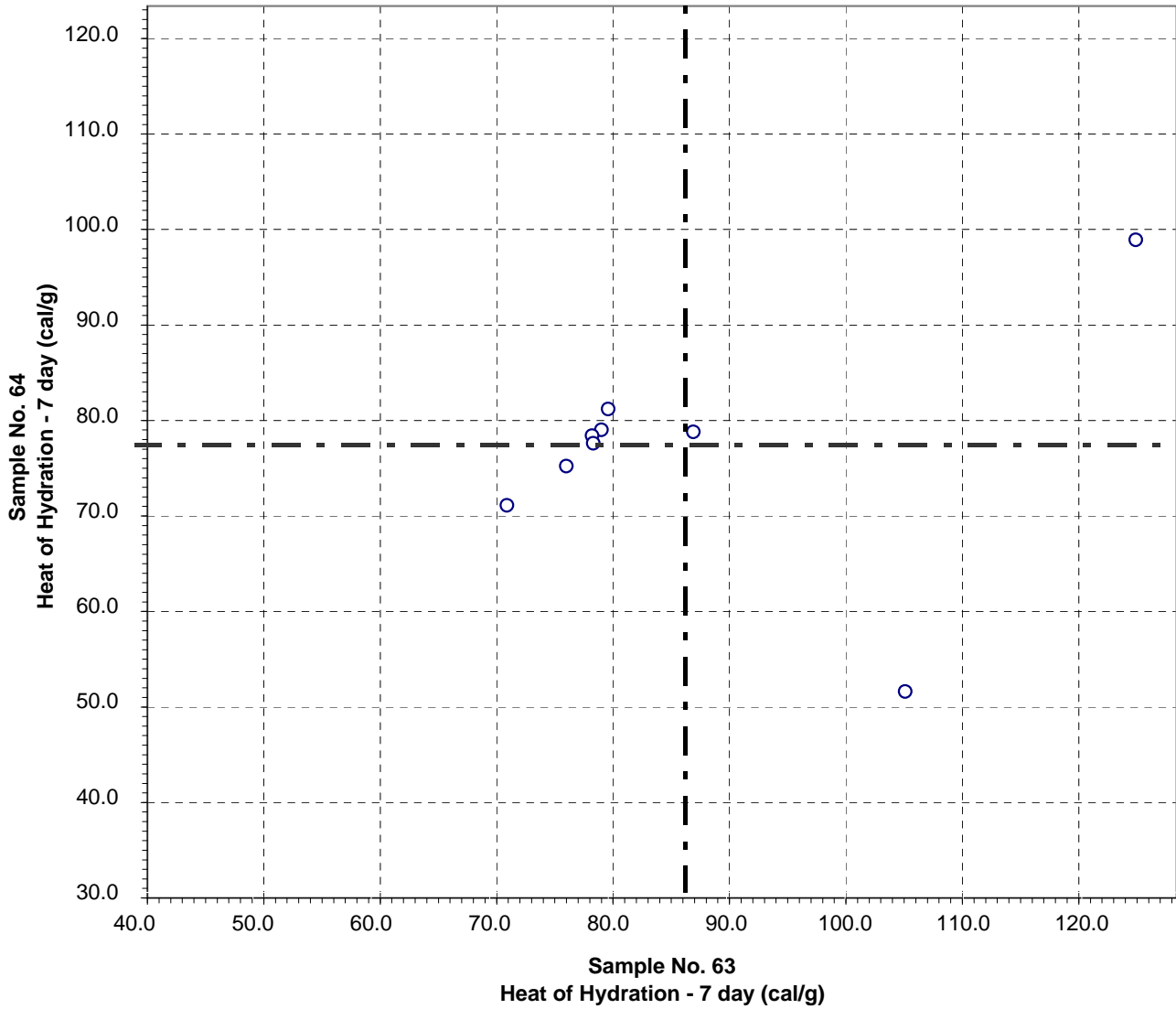
**CCRL Proficiency Sample Program**  
**Heat of Solution - 28 day**  
**BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 301      Heat of Solution - 28 day      6 Points

Sample No. 63	Ave 524.8	S.D. 9.2	C.V. 1.75
Sample No. 64	Ave 525.7	S.D. 8.0	C.V. 1.53

**CCRL Proficiency Sample Program  
Heat of Hydration - 7 day  
BLENDED CEMENT Samples No. 63 and No. 64**



Test No. 290

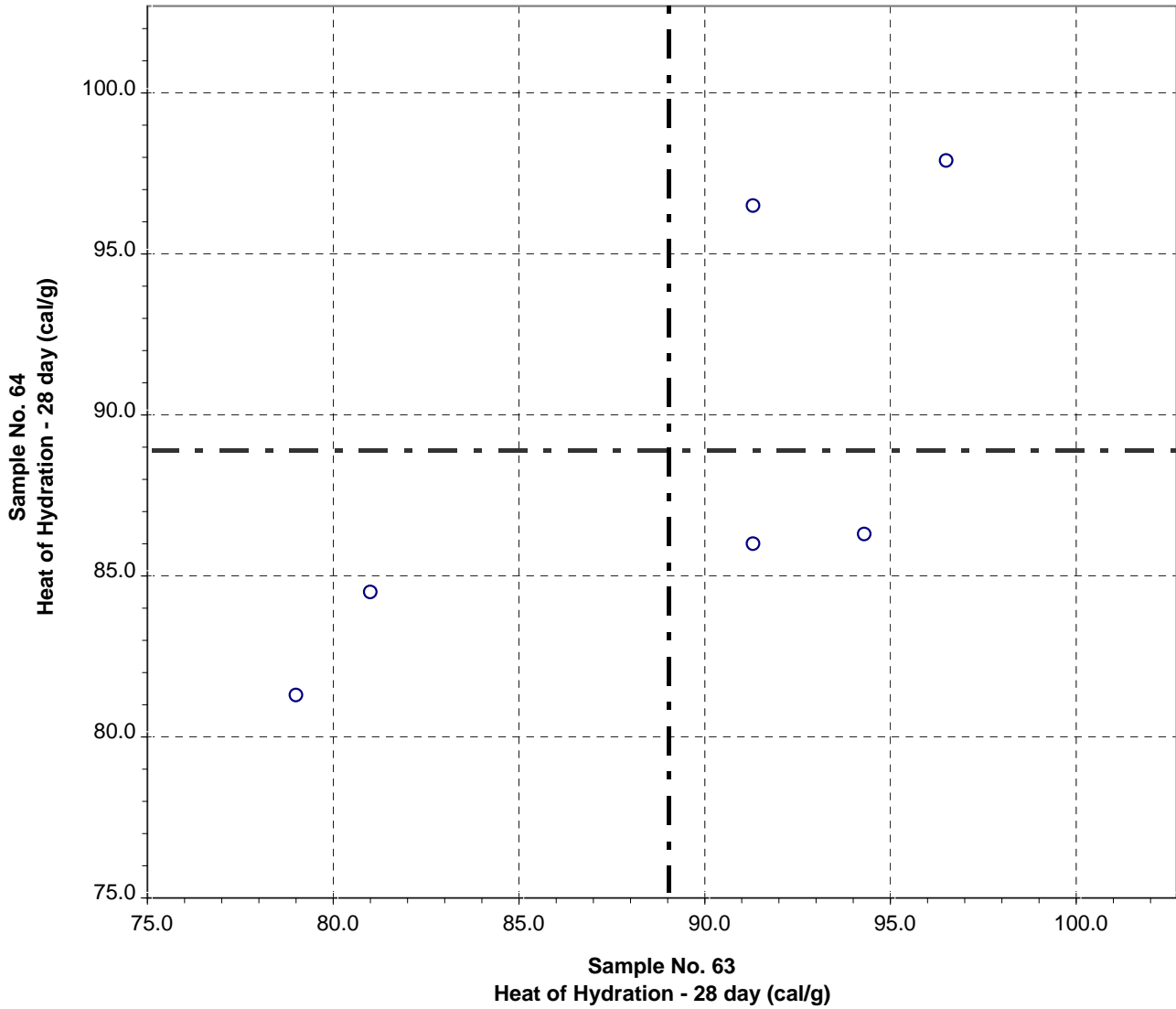
Heat of Hydration - 7 day

9 Points

Sample No. 63	Ave 86.5	S.D. 17.4	C.V. 20.1
Sample No. 64	Ave 76.9	S.D. 12.2	C.V. 15.9



**CCRL Proficiency Sample Program  
Heat of Hydration - 28 day  
BLENDED CEMENT Samples No. 63 and No. 64**



**Test No. 300      Heat of Hydration - 28 day      6 Points**

Sample No. 63	Ave 88.9	S.D. 7.2	C.V. 8.09
Sample No. 64	Ave 88.8	S.D. 6.8	C.V. 7.66