

CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report

Portland Cement Proficiency Samples

Number 205 and Number 206



CCRL
Cement and Concrete
Reference Laboratory

August 2017

www.ccril.us



CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

August 31, 2017

To: Participants in the CCRL Portland Cement Proficiency Sample Program

SUBJECT: Final Report on Portland Cement Proficiency Samples No. 205 and No. 206

Following is the final report for the current pair of CCRL **Portland Cement** Proficiency Samples which were distributed in June 2017. Portland Cement Samples No. 205 was an ASTM C150 meeting the specifications of Type I. Portland Cement No. 206 was an ASTM C150 meeting the specifications of Type I and Type II, and contained an inorganic processing addition.

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://www.ccrl.us/>. Additional information is provided in the following pages.

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 Portland Cement Proficiency Samples will be distributed in January 2018.

Sincerely,

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

To: Participants in the CCRL Portland Cement Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor PSP

SUBJECT: Explanation of Final Report on Results of Tests for Portland Cement Proficiency Samples No. 205 and No. 206

This letter, and the material included with it, constitutes the final report, and summary of results for the current pair of Portland Cement Proficiency Samples, which were distributed in June 2017. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of general Scatter Diagrams. Your unique laboratory number is displayed at the top of the individual Table of Results.

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine [View Document](#), and "Statistical Aspects of the Cement Testing Program" by W.J. Youden [View Document](#), which can be found in Volume 59, Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Each laboratory receives an individualized Table of Results. The Table of Results shows the, test title, and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples.

Laboratory ratings, shown in the Table of Results for the individual laboratory, were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

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

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

Participants subscribing to the primary chemical analysis portion of this report should note that the statistics were calculated using data obtained by wet methods, and rapid methods of chemical analysis. 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 ± 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

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.*

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
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|------|------|---------|------|------|
| Silicon Dioxide (percent) | | | | | | | |
| | 220 | 20.90 | 0.36 | 1.71 | 19.64 | 0.27 | 1.37 |
| | *215 | 20.91 | 0.26 | 1.26 | 19.64 | 0.21 | 1.08 |
| * Labs Eliminated - 15, 24, 50, 206, 1644 | | | | | | | |
| Aluminum Oxide (percent) | | | | | | | |
| | 219 | 4.32 | 0.11 | 2.6 | 5.16 | 0.11 | 2.2 |
| | *215 | 4.32 | 0.10 | 2.4 | 5.16 | 0.10 | 1.9 |
| * Labs Eliminated - 8, 15, 42, 698 | | | | | | | |
| Ferric Oxide (percent) | | | | | | | |
| | 218 | 3.01 | 0.06 | 1.9 | 3.37 | 0.06 | 1.9 |
| | *209 | 3.00 | 0.04 | 1.4 | 3.37 | 0.04 | 1.3 |
| * Labs Eliminated - 15, 206, 883, 2463, 3059, 3368, 4099, 4137, 4251 | | | | | | | |
| Calcium Oxide (percent) | | | | | | | |
| | 220 | 64.44 | 0.55 | 0.86 | 61.94 | 0.61 | 0.98 |
| | *214 | 64.44 | 0.42 | 0.66 | 61.90 | 0.39 | 0.64 |
| * Labs Eliminated - 8, 15, 42, 47, 2437, 4099 | | | | | | | |
| Magnesium Oxide (percent) | | | | | | | |
| | 220 | 1.50 | 0.07 | 4.4 | 3.84 | 0.14 | 3.5 |
| | *213 | 1.50 | 0.05 | 3.3 | 3.84 | 0.10 | 2.7 |
| * Labs Eliminated - 14, 125, 206, 493, 779, 4080, 4099 | | | | | | | |
| Sulfur Trioxide (percent) | | | | | | | |
| | 219 | 2.97 | 0.07 | 2.5 | 3.46 | 0.09 | 2.6 |
| | *212 | 2.97 | 0.06 | 2.1 | 3.47 | 0.08 | 2.2 |
| * Labs Eliminated - 15, 35, 203, 2116, 2360, 2934, 3279 | | | | | | | |
| Loss on Ignition (percent) | | | | | | | |
| | 221 | 1.52 | 0.17 | 10.9 | 1.57 | 0.15 | 9.8 |
| | *208 | 1.51 | 0.08 | 5.3 | 1.55 | 0.10 | 6.5 |
| * Labs Eliminated - 8, 34, 35, 42, 56, 95, 134, 457, 881, 2683, 3368, 4099, 4155 | | | | | | | |

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|-------|------|---------|-------|------|
| Sodium Oxide (percent) | | | | | | | |
| | 209 | 0.175 | 0.078 | 44 | 0.149 | 0.043 | 29 |
| | *194 | 0.169 | 0.024 | 14 | 0.148 | 0.027 | 18 |
| * Labs Eliminated - 14, 35, 41, 99, 134, 137, 407, 494, 1942, 2360, 2465, 2490, 3607, 4099, 4251 | | | | | | | |
| Potassium Oxide (percent) | | | | | | | |
| | 213 | 0.543 | 0.022 | 4.0 | 0.649 | 0.045 | 6.9 |
| | *203 | 0.545 | 0.013 | 2.5 | 0.653 | 0.016 | 2.5 |
| * Labs Eliminated - 36, 50, 407, 1435, 2463, 2466, 4099, 4131, 4138, 4251 | | | | | | | |
| Strontium Oxide (percent) | | | | | | | |
| | 108 | 0.171 | 0.030 | 17.7 | 0.087 | 0.022 | 25.5 |
| | *96 | 0.171 | 0.005 | 3.1 | 0.087 | 0.003 | 3.7 |
| * Labs Eliminated - 15, 84, 101, 116, 206, 219, 491, 493, 494, 1916, 2463, 4137 | | | | | | | |
| Titanium Dioxide (percent) | | | | | | | |
| | 175 | 0.24 | 0.014 | 5.9 | 0.29 | 0.054 | 18.6 |
| | *166 | 0.24 | 0.007 | 3.0 | 0.28 | 0.008 | 2.8 |
| * Labs Eliminated - 246, 407, 493, 698, 2412, 2490, 2491, 4099, 4137 | | | | | | | |
| Phosphorus Pentoxide (percent) | | | | | | | |
| | 174 | 0.073 | 0.022 | 30.4 | 0.046 | 0.019 | 42.4 |
| | *154 | 0.071 | 0.004 | 5.4 | 0.044 | 0.005 | 10.2 |
| * Labs Eliminated - 8, 41, 48, 60, 78, 90, 206, 219, 247, 407, 494, 1079, 2463, 2466, 2491, 3059, 3255, 3279, 4099, 4131 | | | | | | | |
| Zinc Oxide (percent) | | | | | | | |
| | 108 | 0.010 | 0.005 | 49.1 | 0.020 | 0.005 | 25.4 |
| | *101 | 0.010 | 0.002 | 16.2 | 0.020 | 0.002 | 7.9 |
| * Labs Eliminated - 19, 78, 101, 491, 493, 684, 2463 | | | | | | | |
| Manganic Oxide (percent) | | | | | | | |
| | 148 | 0.120 | 0.020 | 16.3 | 0.030 | 0.012 | 40.5 |
| | *137 | 0.121 | 0.005 | 4.1 | 0.029 | 0.003 | 12.0 |
| * Labs Eliminated - 41, 84, 94, 181, 203, 284, 493, 2466, 2484, 3297, 4099 | | | | | | | |

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

| Test (unit) | Sample No.205 | | | | Sample No. 206 | | |
|---------------------------------------|--|---------|-------|------|----------------|-------|------|
| | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
| Chloride (percent) | | | | | | | |
| | 133 | 0.009 | 0.007 | 78 | 0.015 | 0.007 | 50 |
| | *128 | 0.008 | 0.004 | 47 | 0.014 | 0.006 | 40 |
| | * Labs Eliminated - 219, 667, 692, 886, 2360 | | | | | | |
| Insoluble Residue (percent) | | | | | | | |
| | 205 | 0.39 | 0.28 | 71 | 0.27 | 0.35 | 133 |
| | *192 | 0.34 | 0.08 | 24 | 0.22 | 0.09 | 40 |
| | * Labs Eliminated - 4, 34, 47, 146, 222, 246, 2465, 2466, 3249, 3368, 3413, 4155, 4251 | | | | | | |
| Free Lime (percent) | | | | | | | |
| | 165 | 0.76 | 0.18 | 24 | 0.98 | 0.23 | 23 |
| | *161 | 0.74 | 0.15 | 20 | 0.97 | 0.23 | 23 |
| | * Labs Eliminated - 124, 132, 457, 493 | | | | | | |
| Chromium Oxide (percent) | | | | | | | |
| | 101 | 0.017 | 0.046 | 274 | 0.012 | 0.006 | 52 |
| | *93 | 0.011 | 0.003 | 30 | 0.011 | 0.003 | 26 |
| | * Labs Eliminated - 78, 116, 415, 493, 883, 3368, 3752, 4099 | | | | | | |
| Tricalcium Silicate (percent) | | | | | | | |
| | 187 | 60.6 | 3.4 | 5.7 | 53.7 | 3.7 | 6.8 |
| | *179 | 60.4 | 2.4 | 3.9 | 53.5 | 2.2 | 4.1 |
| | * Labs Eliminated - 8, 15, 42, 50, 206, 247, 284, 2352 | | | | | | |
| Dicalcium Silicate (percent) | | | | | | | |
| | 186 | 13.8 | 3.2 | 22.9 | 15.9 | 2.7 | 17.0 |
| | *175 | 13.9 | 2.2 | 15.5 | 15.9 | 1.9 | 11.8 |
| | * Labs Eliminated - 15, 24, 42, 50, 134, 206, 247, 284, 698, 1644, 2352 | | | | | | |
| Tricalcium Aluminate (percent) | | | | | | | |
| | 187 | 6.2 | 0.60 | 9.6 | 8.0 | 0.38 | 4.8 |
| | *180 | 6.2 | 0.26 | 4.1 | 8.0 | 0.25 | 3.1 |
| | * Labs Eliminated - 8, 42, 94, 698, 3238, 3607, 4251 | | | | | | |

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

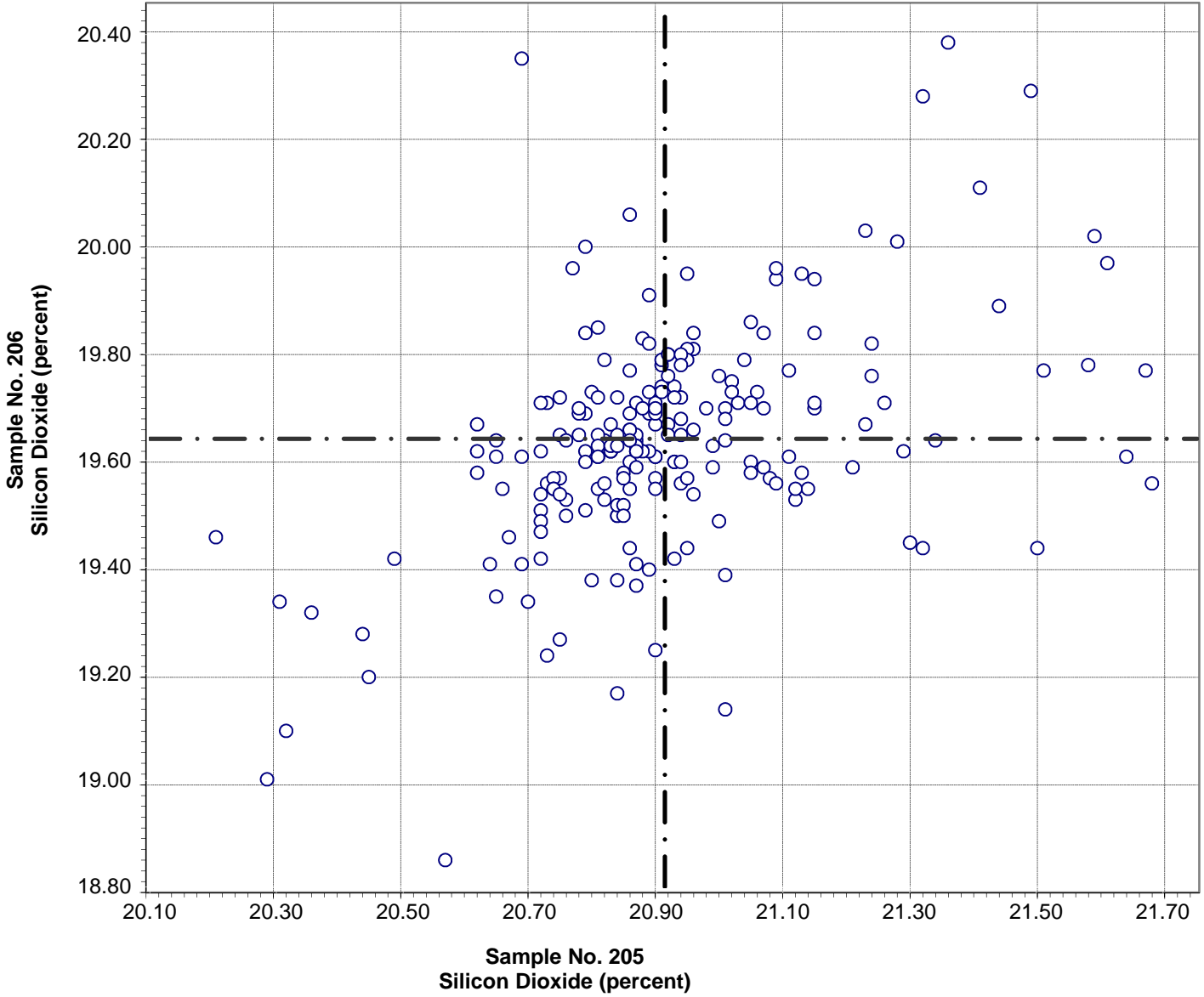
Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|------|------|---------|------|------|
| Tetracalcium Aluminoferrite (percent) | | | | | | | |
| | 186 | 9.0 | 0.20 | 2.2 | 10.3 | 0.46 | 4.4 |
| | *176 | 9.0 | 0.14 | 1.6 | 10.3 | 0.15 | 1.4 |

* Labs Eliminated - 15, 139, 206, 883, 975, 3238, 3368, 3707, 4137, 4251

**CCRL Proficiency Sample Program
Silicon Dioxide
PORTLAND CEMENT Samples No. 205 and No. 206**



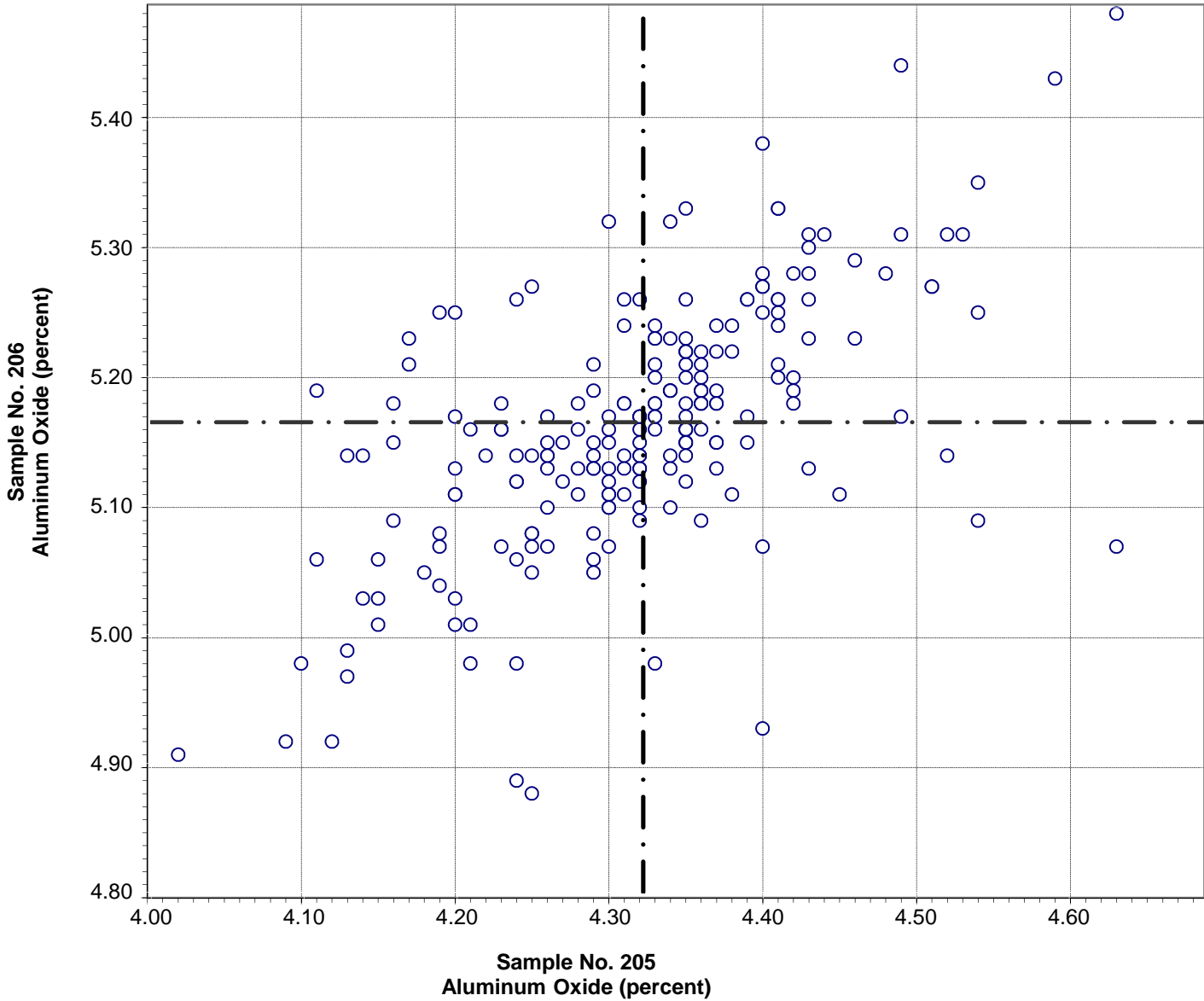
Test No. 10 Silicon Dioxide 212 Points

| | | | |
|----------------|-----------|-----------|-----------|
| Sample No. 205 | Ave 20.91 | S.D. 0.26 | C.V. 1.26 |
| Sample No. 206 | Ave 19.64 | S.D. 0.21 | C.V. 1.08 |

Labs Eliminated: 15, 24, 50, 206, 1644

Labs off Diagram: 284, 7, 4099

**CCRL Proficiency Sample Program
Aluminum Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**



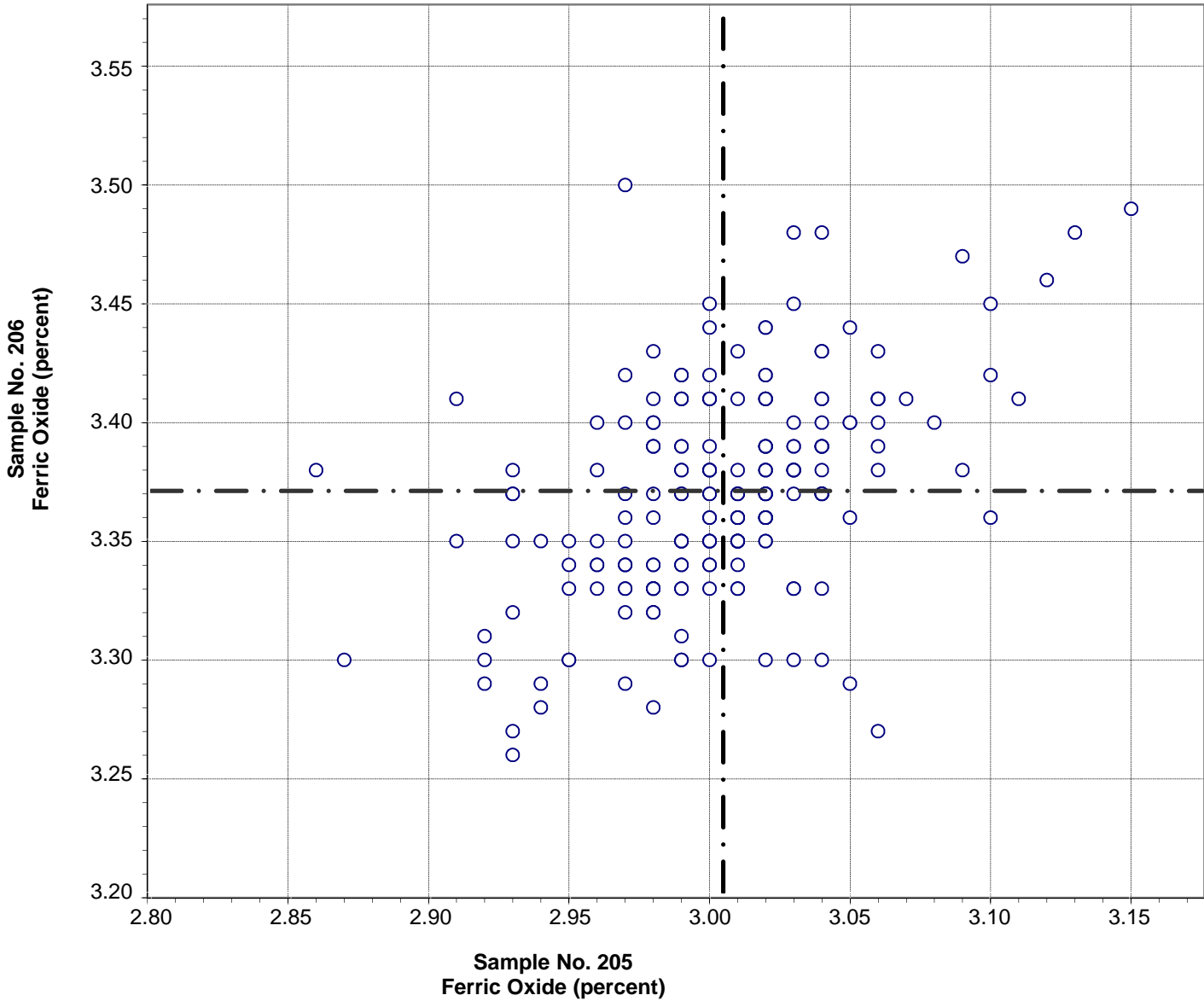
Test No. 21 Aluminum Oxide 214 Points

| | | | |
|----------------|----------|-----------|----------|
| Sample No. 205 | Ave 4.32 | S.D. 0.10 | C.V. 2.4 |
| Sample No. 206 | Ave 5.16 | S.D. 0.10 | C.V. 1.9 |

Labs Eliminated: 8, 15, 42, 698

Labs off Diagram: 206

**CCRL Proficiency Sample Program
 Ferric Oxide
 PORTLAND CEMENT Samples No. 205 and No. 206**

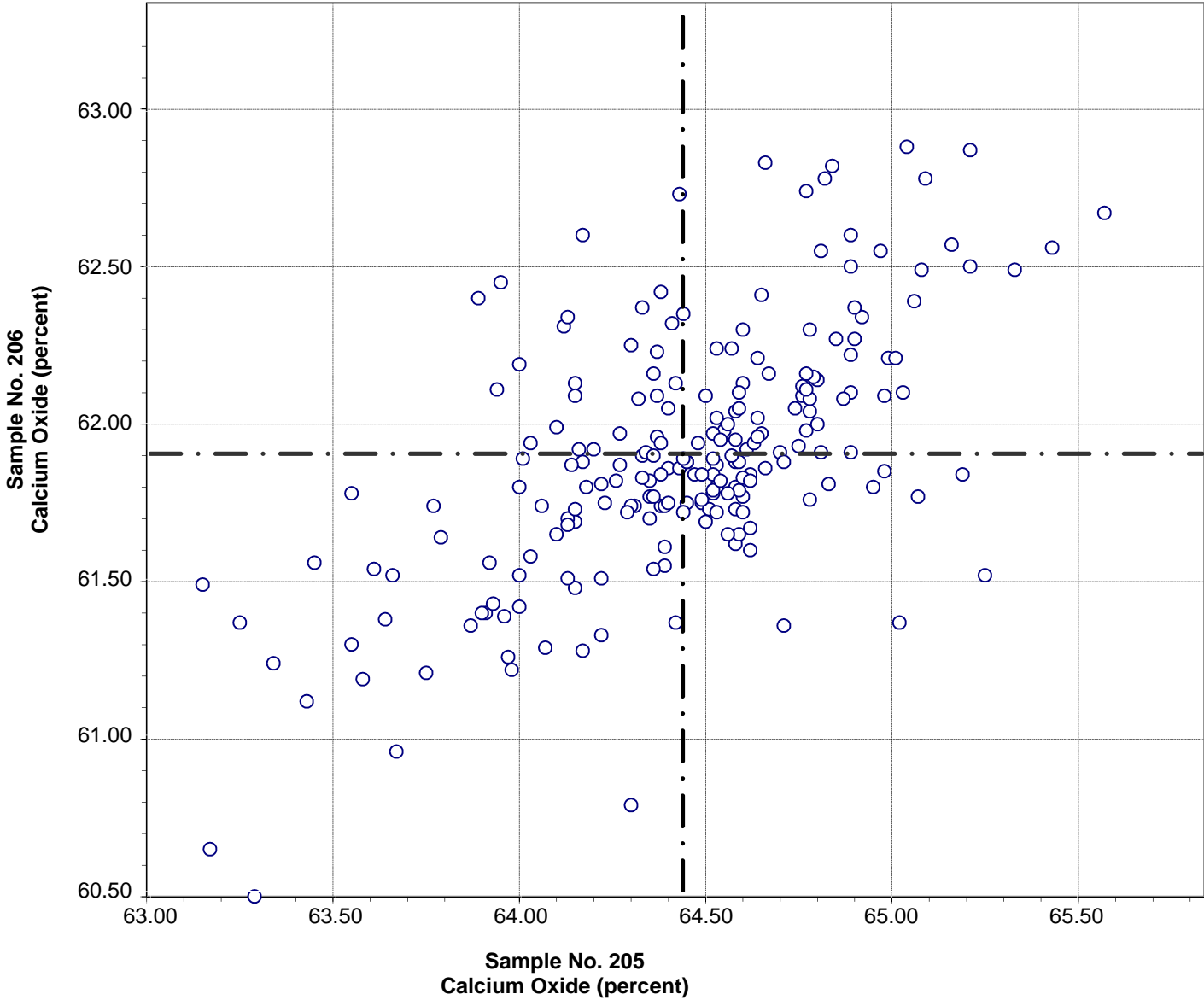


Test No. 30 Ferric Oxide 209 Points

| | | | |
|----------------|----------|-----------|----------|
| Sample No. 205 | Ave 3.00 | S.D. 0.04 | C.V. 1.4 |
| Sample No. 206 | Ave 3.37 | S.D. 0.04 | C.V. 1.3 |

Labs Eliminated: 15, 206, 883, 2463, 3059, 3368, 4099, 4137, 4251

**CCRL Proficiency Sample Program
Calcium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

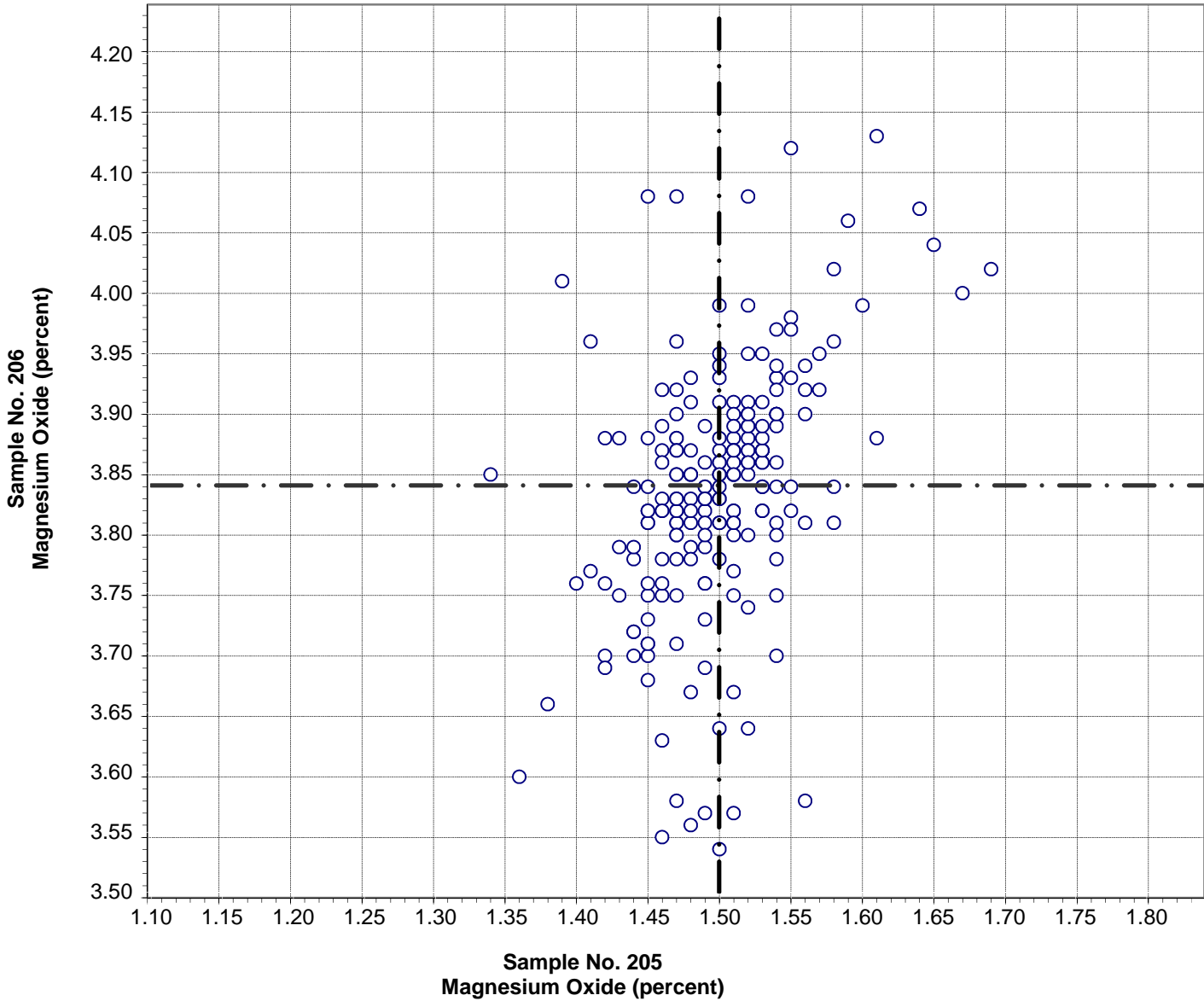


Test No. 40 Calcium Oxide 214 Points

| | | | |
|----------------|-----------|-----------|-----------|
| Sample No. 205 | Ave 64.44 | S.D. 0.42 | C.V. 0.66 |
| Sample No. 206 | Ave 61.90 | S.D. 0.39 | C.V. 0.64 |

Labs Eliminated: 8, 15, 42, 47, 2437, 4099

**CCRL Proficiency Sample Program
Magnesium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

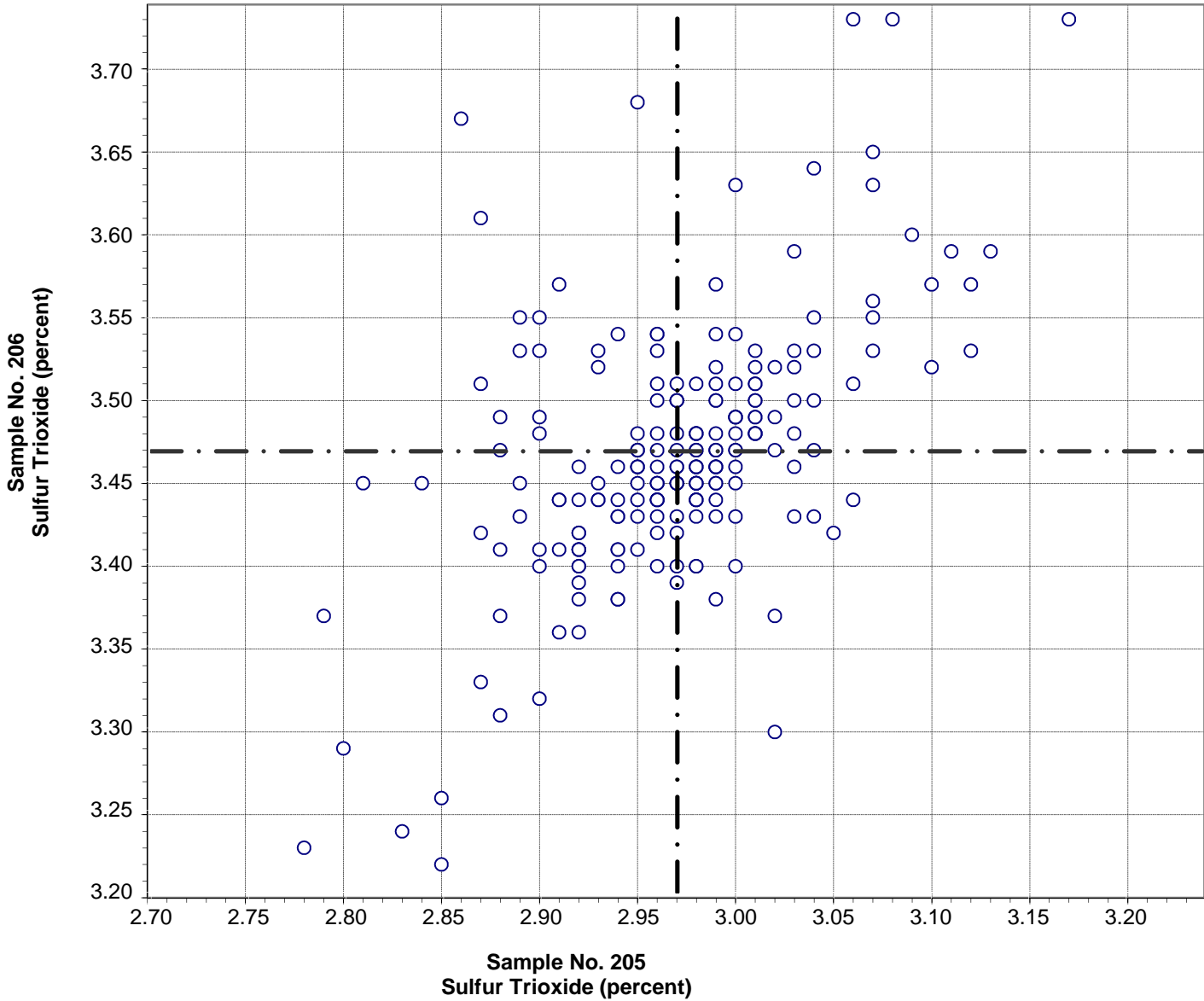


Test No. 50 Magnesium Oxide 213 Points

| | | | |
|----------------|----------|-----------|----------|
| Sample No. 205 | Ave 1.50 | S.D. 0.05 | C.V. 3.3 |
| Sample No. 206 | Ave 3.84 | S.D. 0.10 | C.V. 2.7 |

Labs Eliminated: 14, 125, 206, 493, 779, 4080, 4099

**CCRL Proficiency Sample Program
Sulfur Trioxide
PORTLAND CEMENT Samples No. 205 and No. 206**

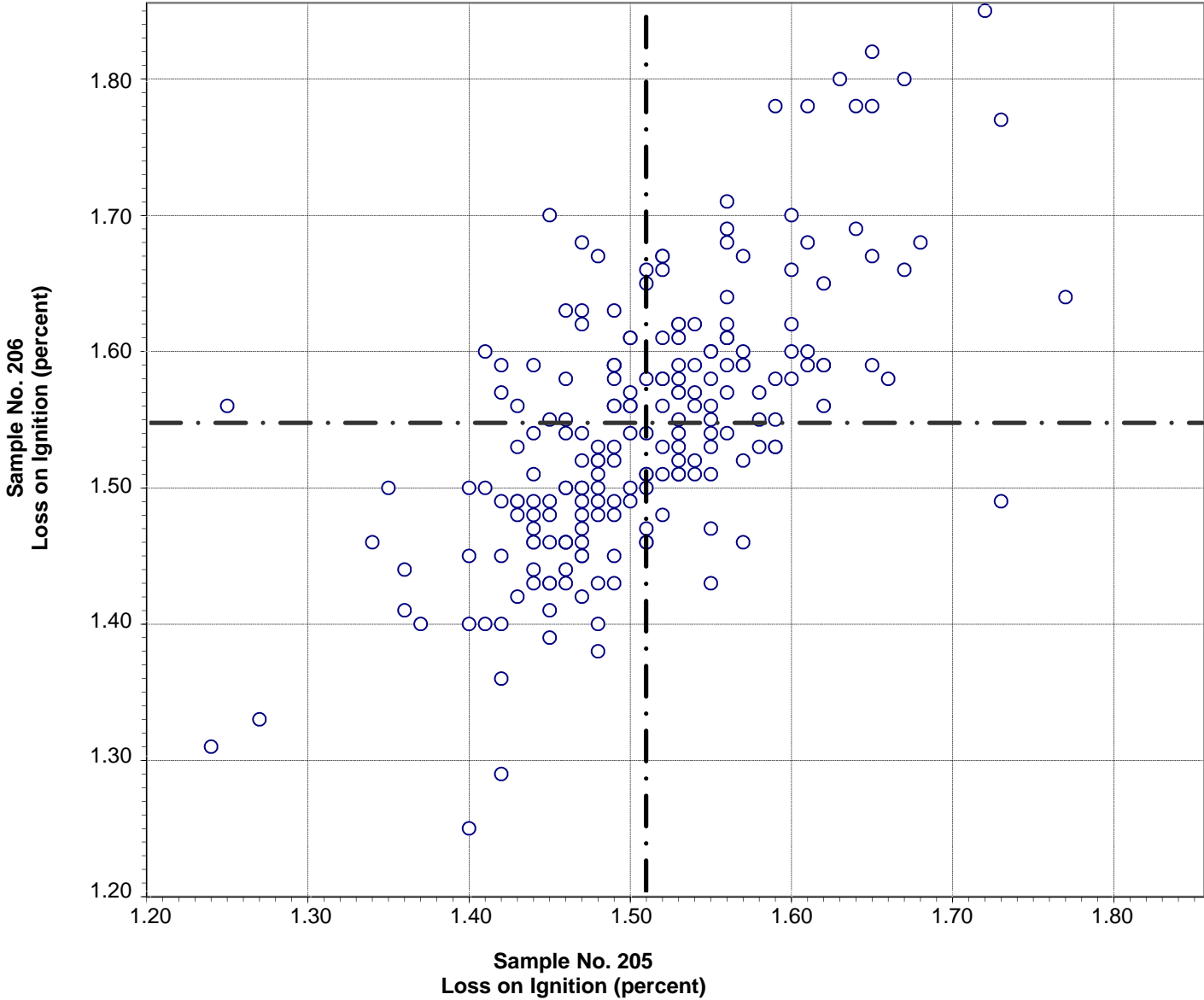


Test No. 60 Sulfur Trioxide 212 Points

| | | | |
|----------------|----------|-----------|----------|
| Sample No. 205 | Ave 2.97 | S.D. 0.06 | C.V. 2.1 |
| Sample No. 206 | Ave 3.47 | S.D. 0.08 | C.V. 2.2 |

Labs Eliminated: 15, 35, 203, 2116, 2360, 2934, 3279

**CCRL Proficiency Sample Program
Loss on Ignition
PORTLAND CEMENT Samples No. 205 and No. 206**



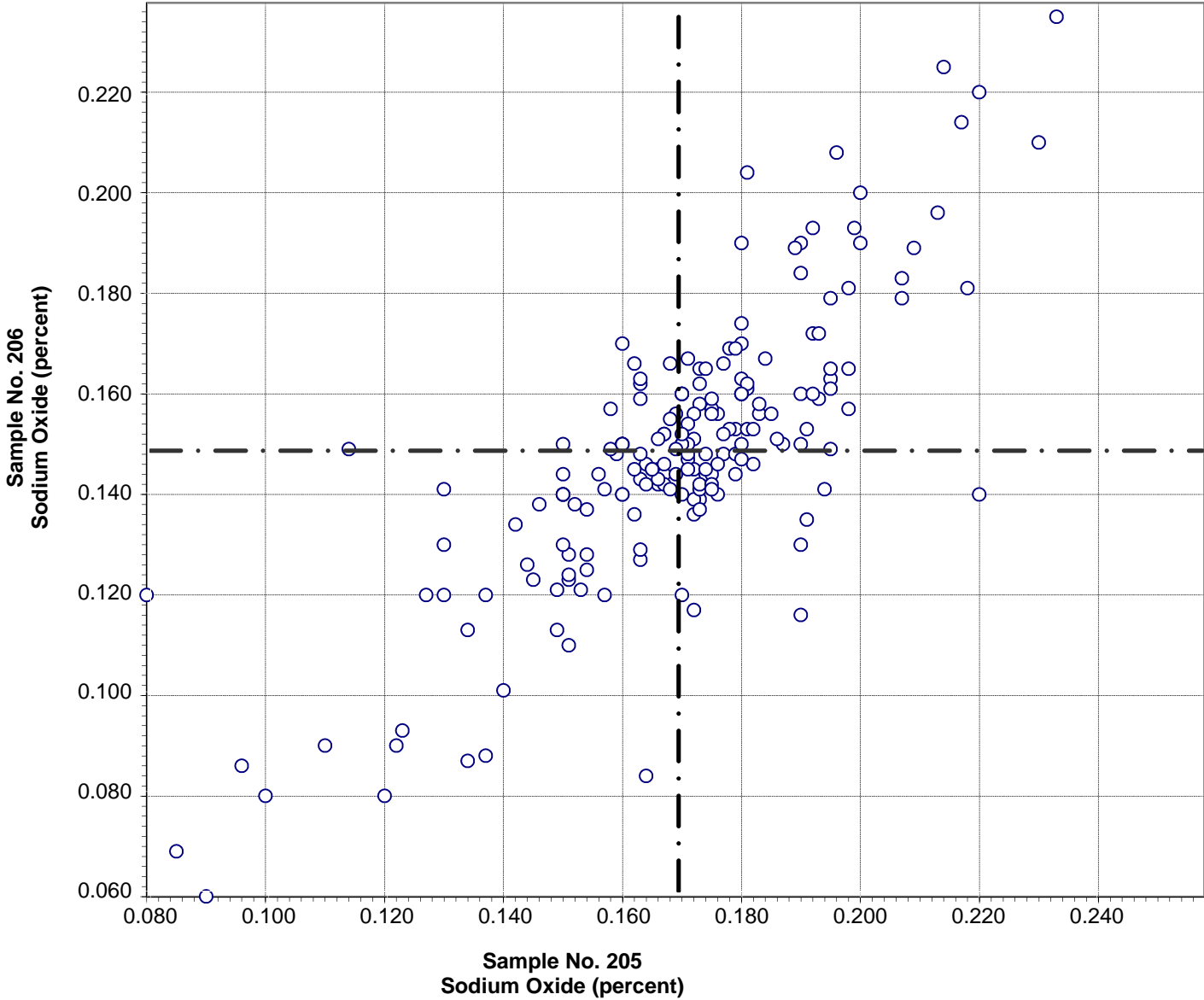
Test No. 70 Loss on Ignition 207 Points

| | | | |
|----------------|----------|-----------|----------|
| Sample No. 205 | Ave 1.51 | S.D. 0.08 | C.V. 5.3 |
| Sample No. 206 | Ave 1.55 | S.D. 0.10 | C.V. 6.5 |

Labs Eliminated: 8, 34, 35, 42, 56, 95, 134, 457, 881, 2683, 3368, 4099, 4155

Labs off Diagram: 125

**CCRL Proficiency Sample Program
Sodium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

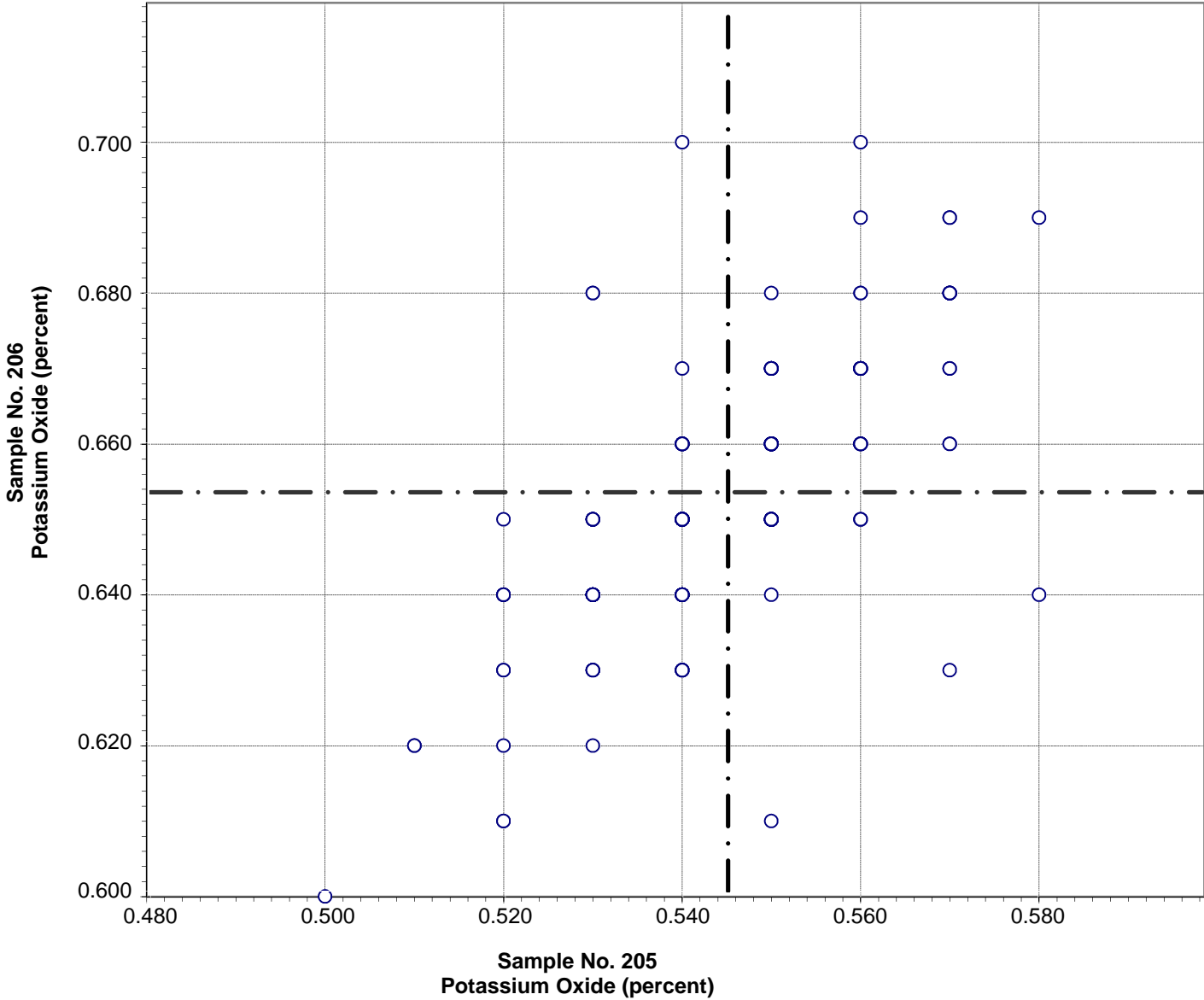


Test No. 90 Sodium Oxide 194 Points

| | | | |
|----------------|-----------|------------|---------|
| Sample No. 205 | Ave 0.169 | S.D. 0.024 | C.V. 14 |
| Sample No. 206 | Ave 0.148 | S.D. 0.027 | C.V. 18 |

Labs Eliminated: 14, 35, 41, 99, 134, 137, 407, 494, 1942, 2360, 2465, 2490, 3607, 4099, 4251

**CCRL Proficiency Sample Program
Potassium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

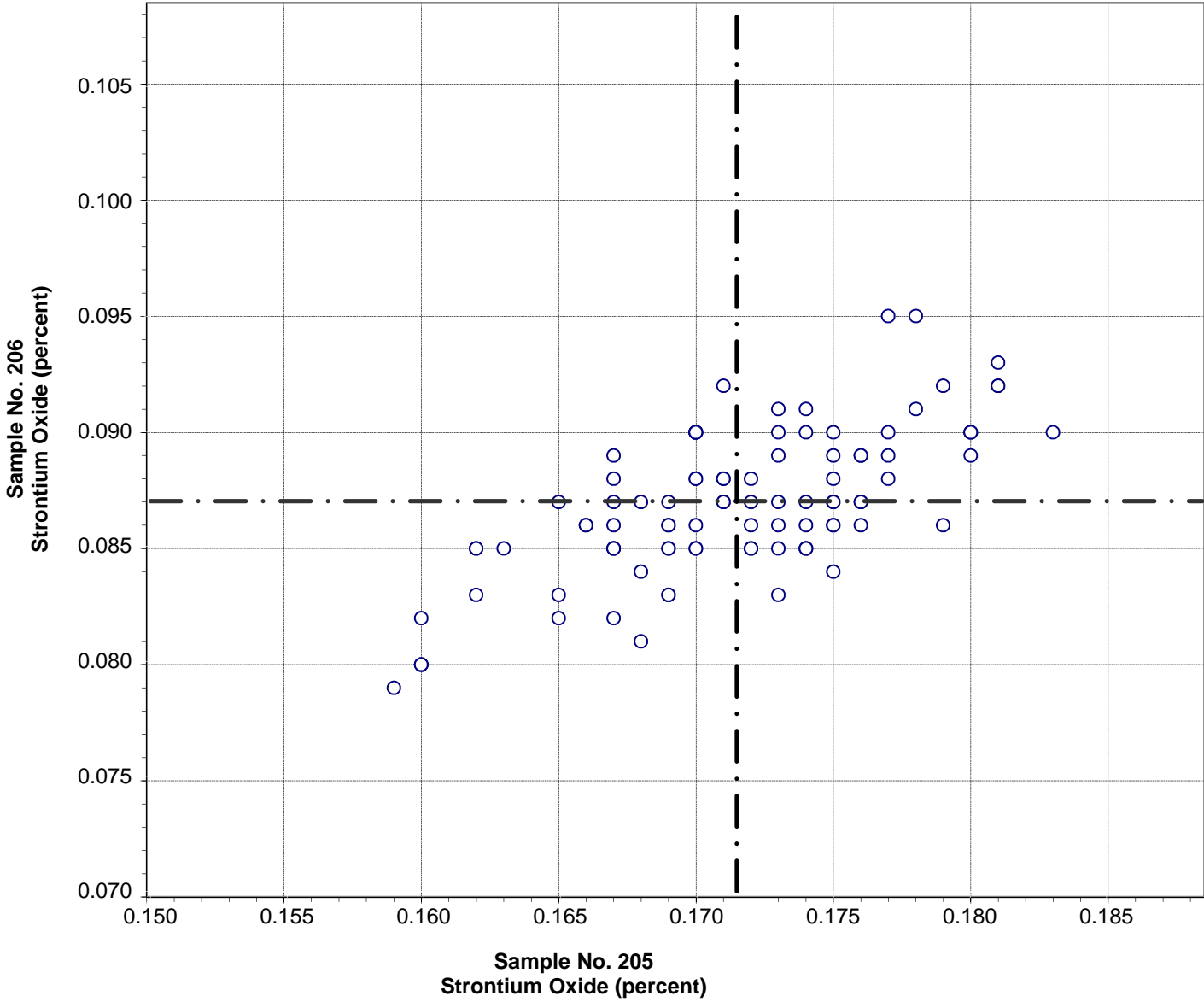


Test No. 100 Potassium Oxide 203 Points

| | | | |
|----------------|-----------|------------|----------|
| Sample No. 205 | Ave 0.545 | S.D. 0.013 | C.V. 2.5 |
| Sample No. 206 | Ave 0.653 | S.D. 0.016 | C.V. 2.5 |

Labs Eliminated: 36, 50, 407, 1435, 2463, 2466, 4099, 4131, 4138, 4251

**CCRL Proficiency Sample Program
Strontium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

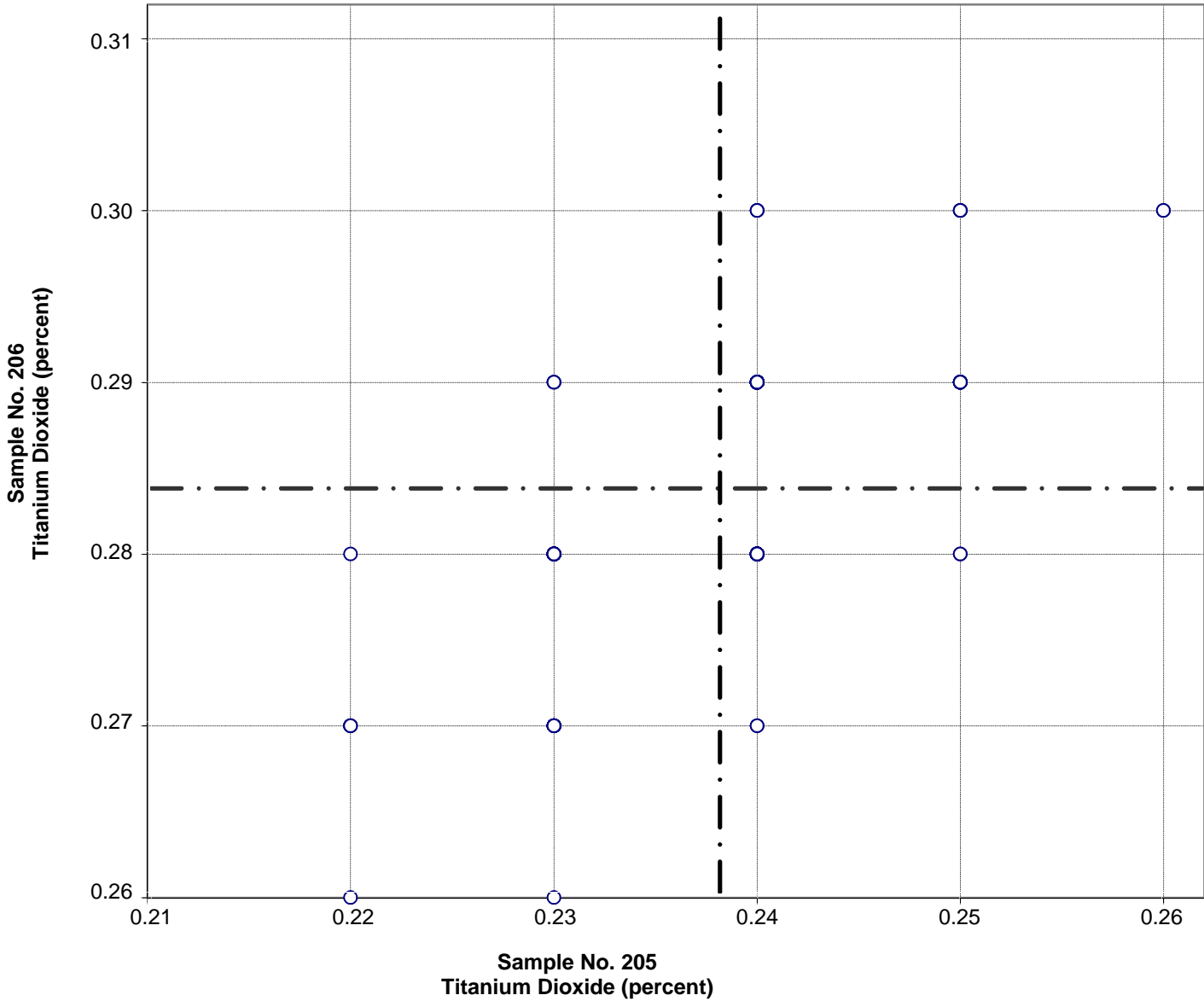


Test No. 92 Strontium Oxide 96 Points

| | | | |
|----------------|-----------|------------|----------|
| Sample No. 205 | Ave 0.171 | S.D. 0.005 | C.V. 3.1 |
| Sample No. 206 | Ave 0.087 | S.D. 0.003 | C.V. 3.7 |

Labs Eliminated: 15, 84, 101, 116, 206, 219, 491, 493, 494, 1916, 2463, 4137

**CCRL Proficiency Sample Program
Titanium Dioxide
PORTLAND CEMENT Samples No. 205 and No. 206**

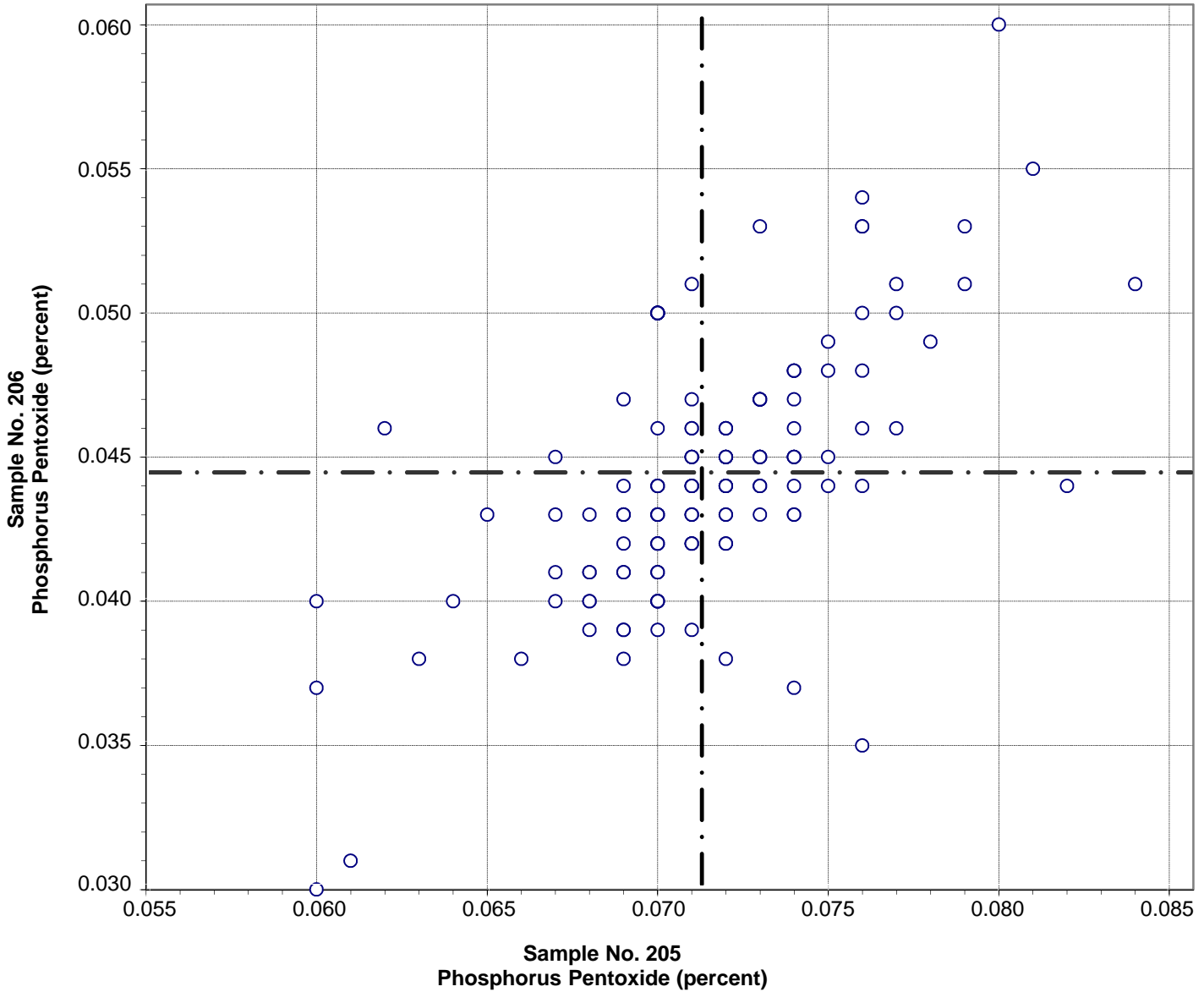


Test No. 103 Titanium Dioxide 166 Points

| | | | |
|----------------|----------|------------|----------|
| Sample No. 205 | Ave 0.24 | S.D. 0.007 | C.V. 3.0 |
| Sample No. 206 | Ave 0.28 | S.D. 0.008 | C.V. 2.8 |

Labs Eliminated: 246, 407, 493, 698, 2412, 2490, 2491, 4099, 4137

**CCRL Proficiency Sample Program
Phosphorus Pentoxide
PORTLAND CEMENT Samples No. 205 and No. 206**



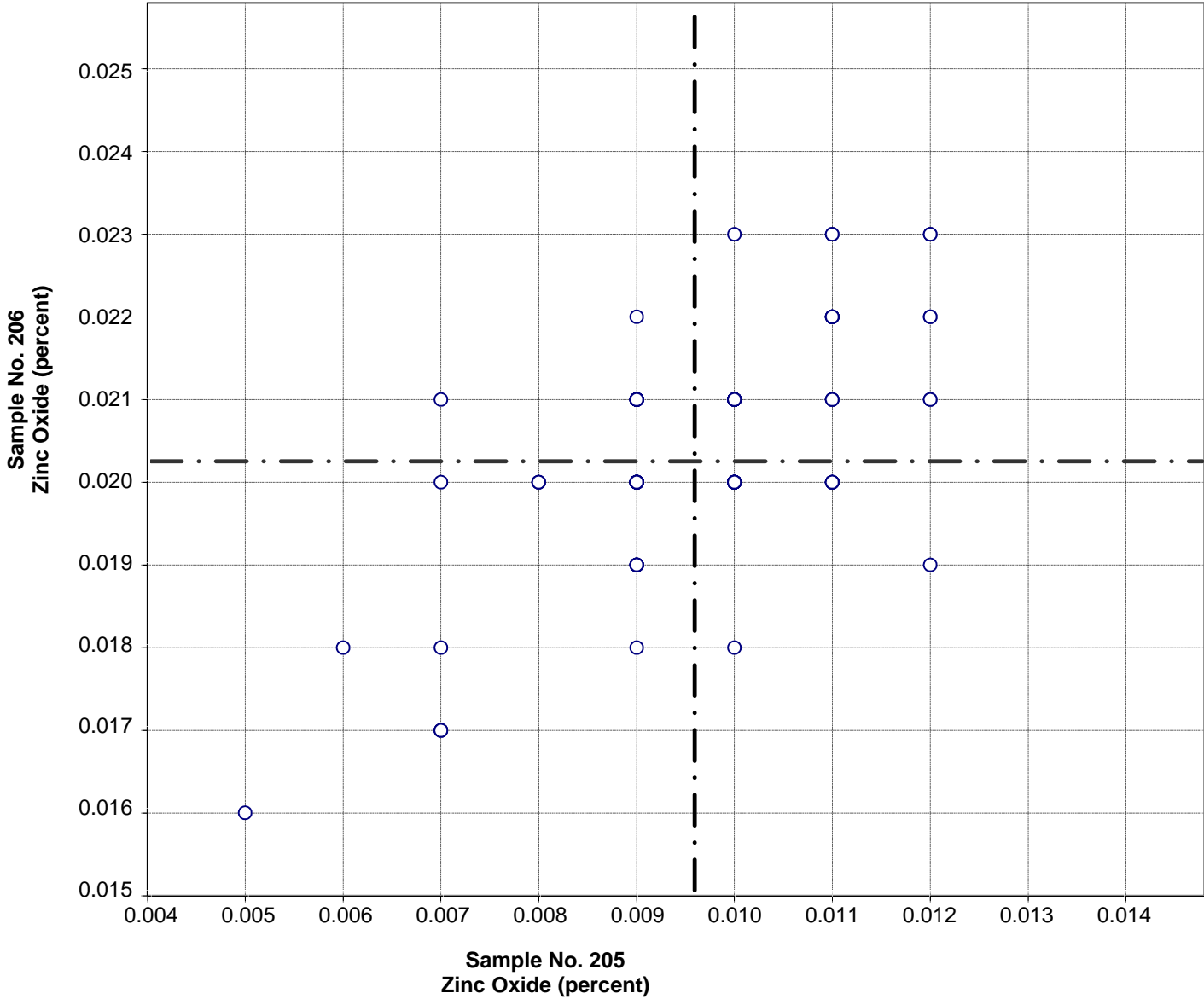
Test No. 102 Phosphorus Pentoxide 153 Points

| | | | |
|----------------|-----------|------------|-----------|
| Sample No. 205 | Ave 0.071 | S.D. 0.004 | C.V. 5.4 |
| Sample No. 206 | Ave 0.044 | S.D. 0.005 | C.V. 10.2 |

Labs Eliminated: 8, 41, 48, 60, 78, 90, 206, 219, 247, 407, 494, 1079, 2463, 2466, 2491, 3059, 3255, 3279, 4099, 4131

Labs off Diagram: 134

**CCRL Proficiency Sample Program
Zinc Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**



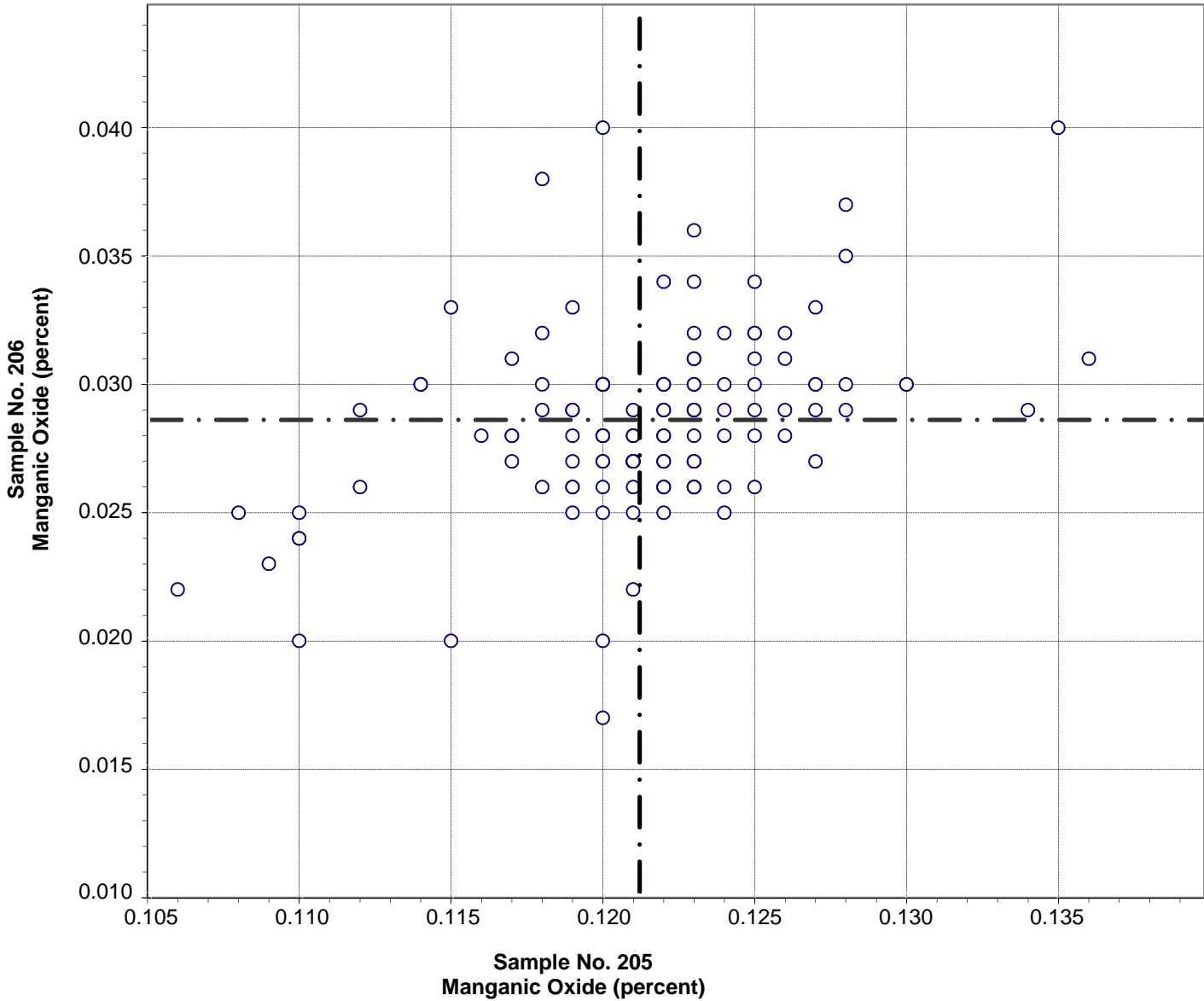
Test No. 99 Zinc Oxide 98 Points

| | | | |
|----------------|-----------|------------|-----------|
| Sample No. 205 | Ave 0.010 | S.D. 0.002 | C.V. 16.2 |
| Sample No. 206 | Ave 0.020 | S.D. 0.002 | C.V. 7.9 |

Labs Eliminated: 19, 78, 101, 491, 493, 684, 2463

Labs off Diagram: 440, 768, 4099

**CCRL Proficiency Sample Program
Manganic Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**



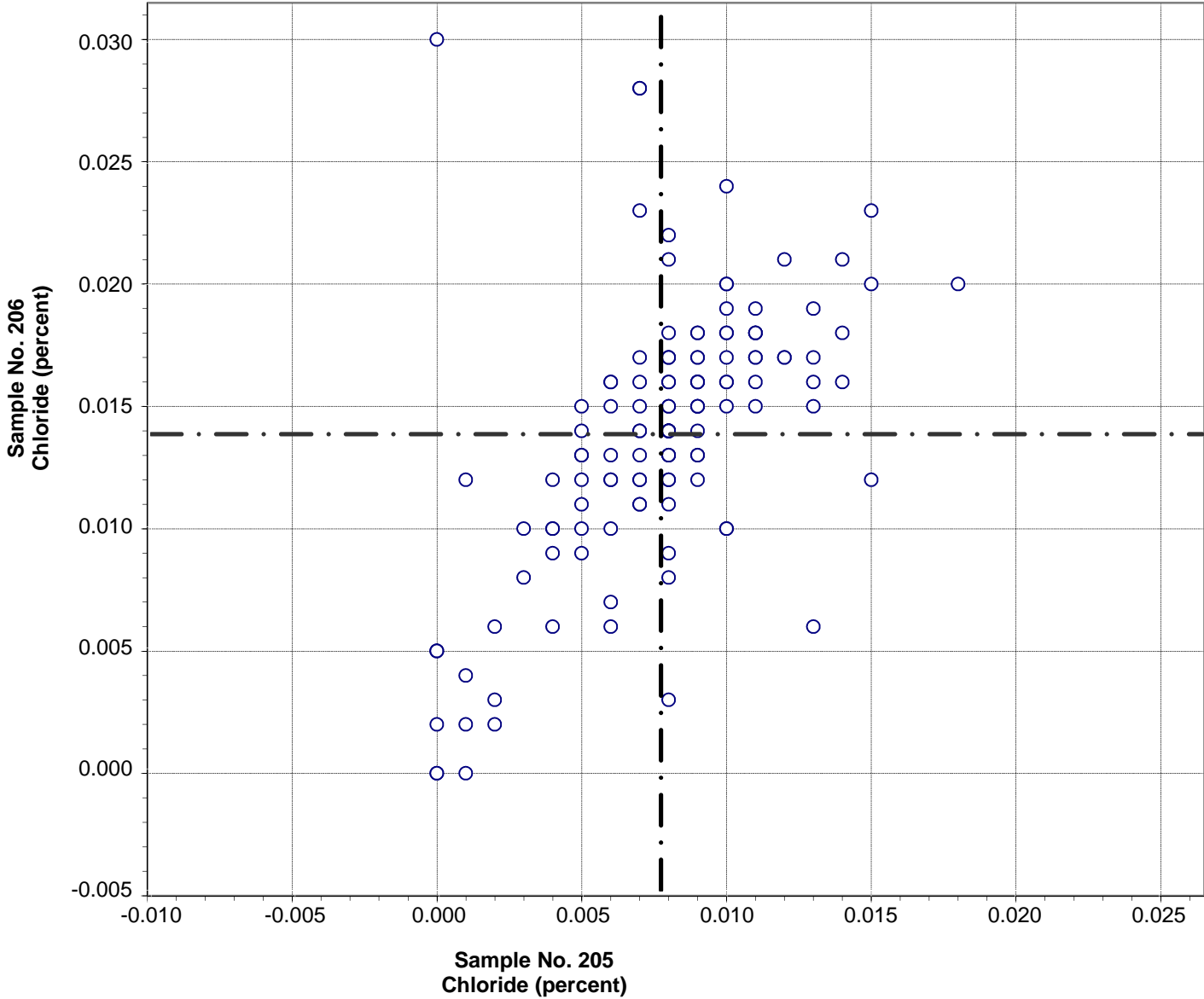
Test No. 101 Manganic Oxide 136 Points

| | | | |
|----------------|-----------|------------|-----------|
| Sample No. 205 | Ave 0.121 | S.D. 0.005 | C.V. 4.1 |
| Sample No. 206 | Ave 0.029 | S.D. 0.003 | C.V. 12.0 |

Labs Eliminated: 41, 84, 94, 181, 203, 284, 493, 2466, 2484, 3297, 4099

Labs off Diagram: 4138

**CCRL Proficiency Sample Program
Chloride
PORTLAND CEMENT Samples No. 205 and No. 206**

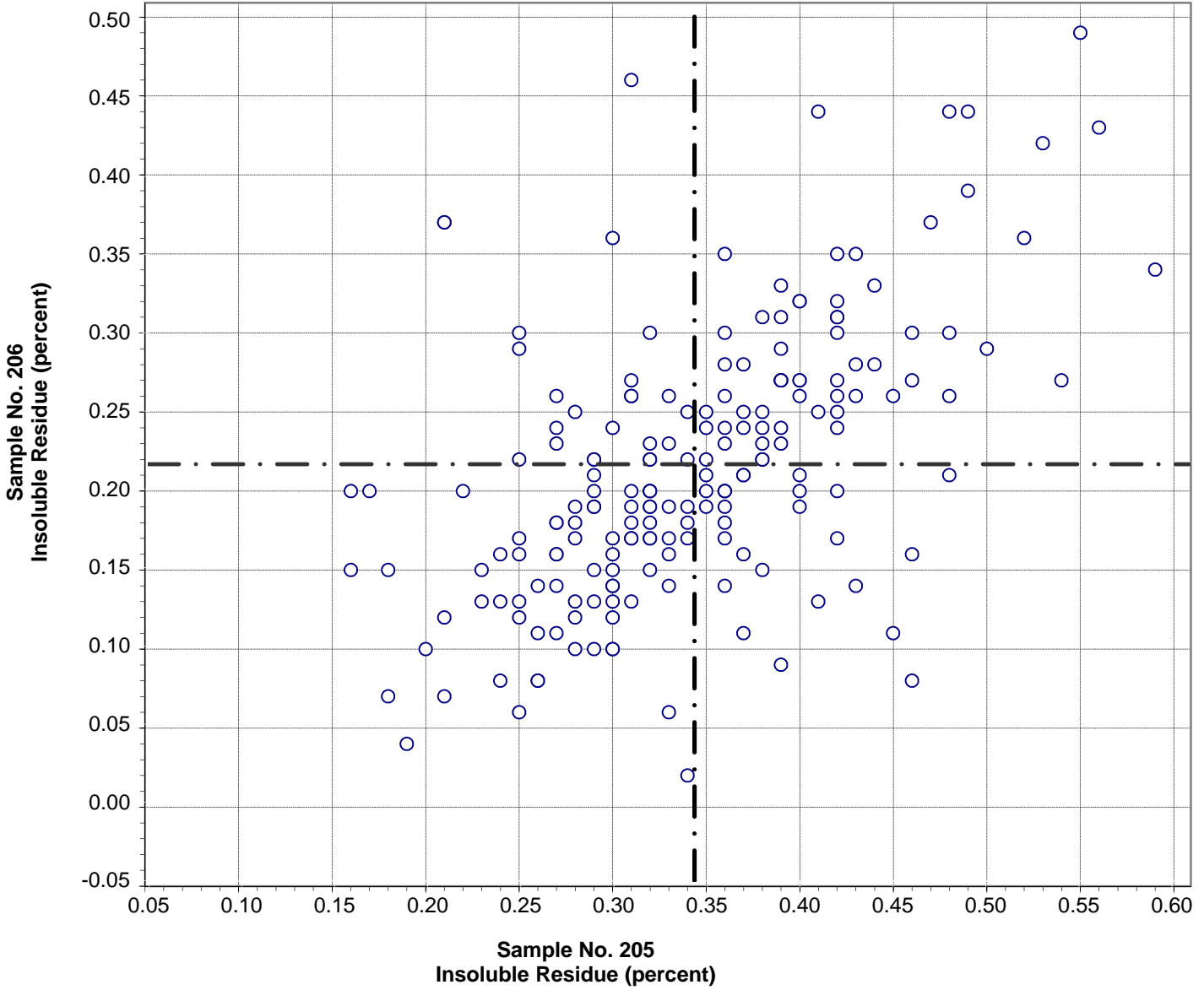


Test No. 104 Chloride 128 Points

| | | | |
|----------------|-----------|------------|---------|
| Sample No. 205 | Ave 0.008 | S.D. 0.004 | C.V. 47 |
| Sample No. 206 | Ave 0.014 | S.D. 0.006 | C.V. 40 |

Labs Eliminated: 219, 667, 692, 886, 2360

**CCRL Proficiency Sample Program
Insoluble Residue
PORTLAND CEMENT Samples No. 205 and No. 206**

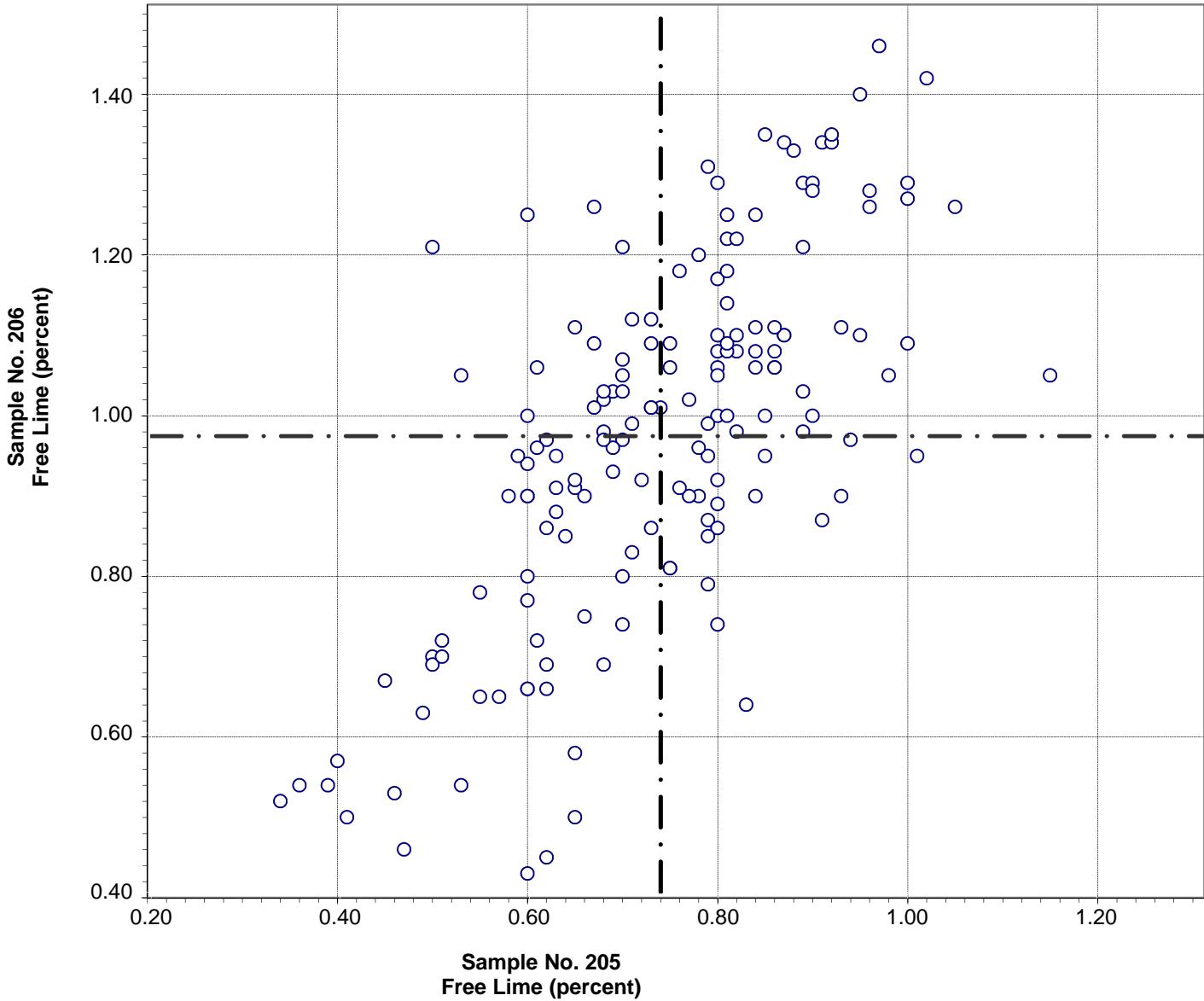


Test No. 80 Insoluble Residue 192 Points

| | | | |
|----------------|----------|-----------|---------|
| Sample No. 205 | Ave 0.34 | S.D. 0.08 | C.V. 24 |
| Sample No. 206 | Ave 0.22 | S.D. 0.09 | C.V. 40 |

Labs Eliminated: 4, 34, 47, 146, 222, 246, 2465, 2466, 3249, 3368, 3413, 4155, 4251

**CCRL Proficiency Sample Program
Free Lime
PORTLAND CEMENT Samples No. 205 and No. 206**

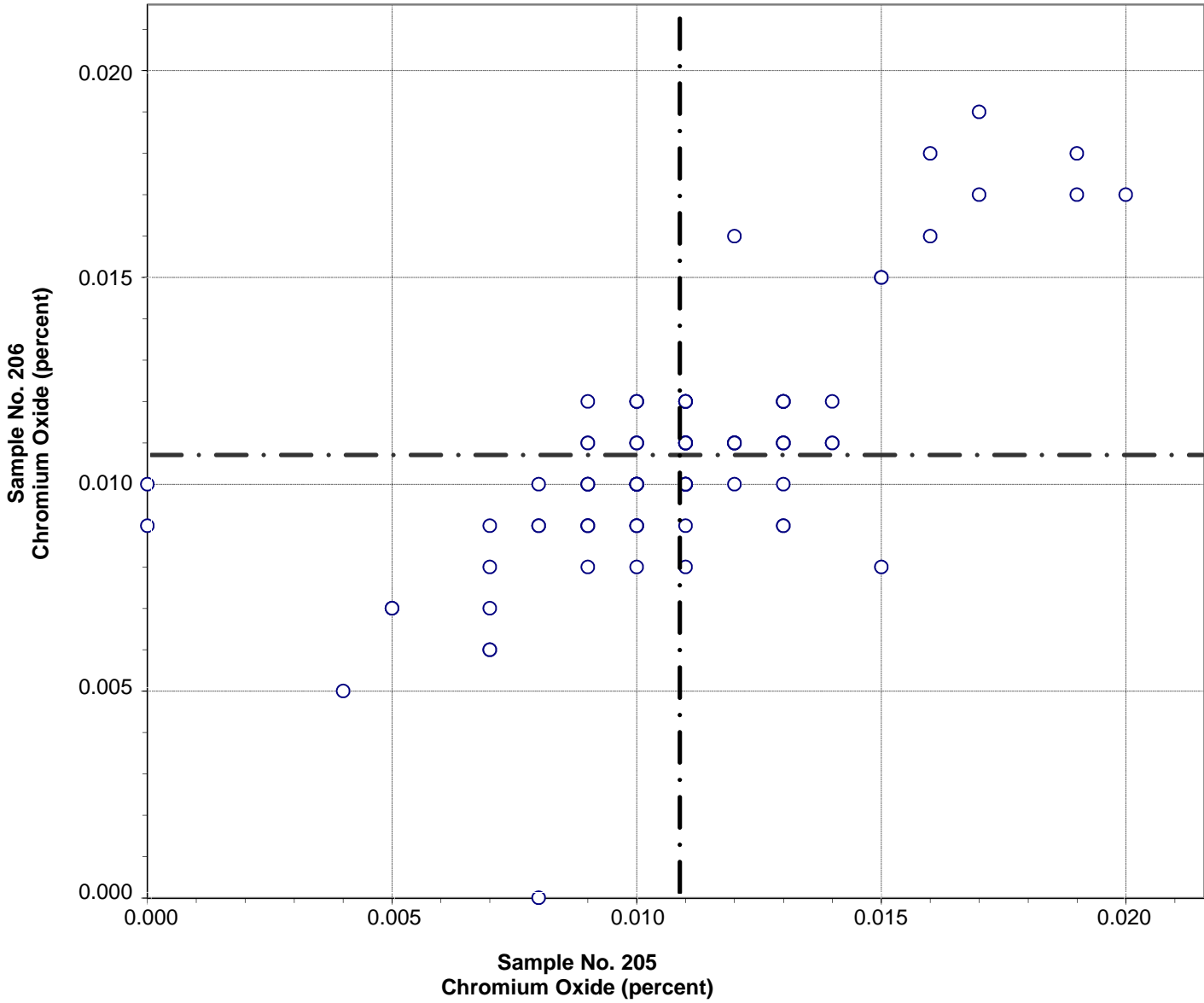


Test No. 41 Free Lime 161 Points

| | | | |
|----------------|----------|-----------|---------|
| Sample No. 205 | Ave 0.74 | S.D. 0.15 | C.V. 20 |
| Sample No. 206 | Ave 0.97 | S.D. 0.23 | C.V. 23 |

Labs Eliminated: 124, 132, 457, 493

**CCRL Proficiency Sample Program
Chromium Oxide
PORTLAND CEMENT Samples No. 205 and No. 206**

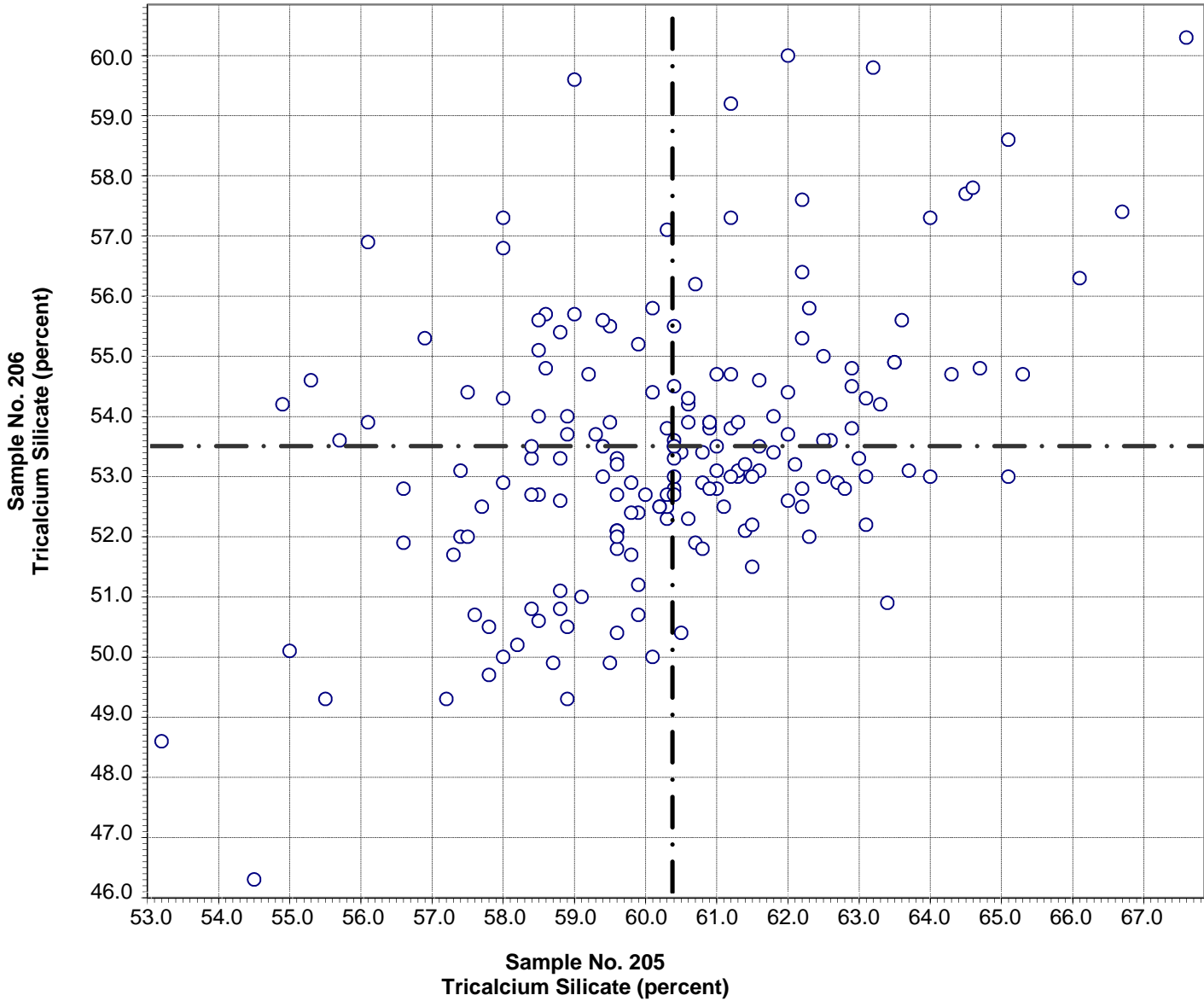


Test No. 105 Chromium Oxide 93 Points

| | | | |
|----------------|-----------|------------|---------|
| Sample No. 205 | Ave 0.011 | S.D. 0.003 | C.V. 30 |
| Sample No. 206 | Ave 0.011 | S.D. 0.003 | C.V. 26 |

Labs Eliminated: 78, 116, 415, 493, 883, 3368, 3752, 4099

**CCRL Proficiency Sample Program
Tricalcium Silicate
PORTLAND CEMENT Samples No. 205 and No. 206**

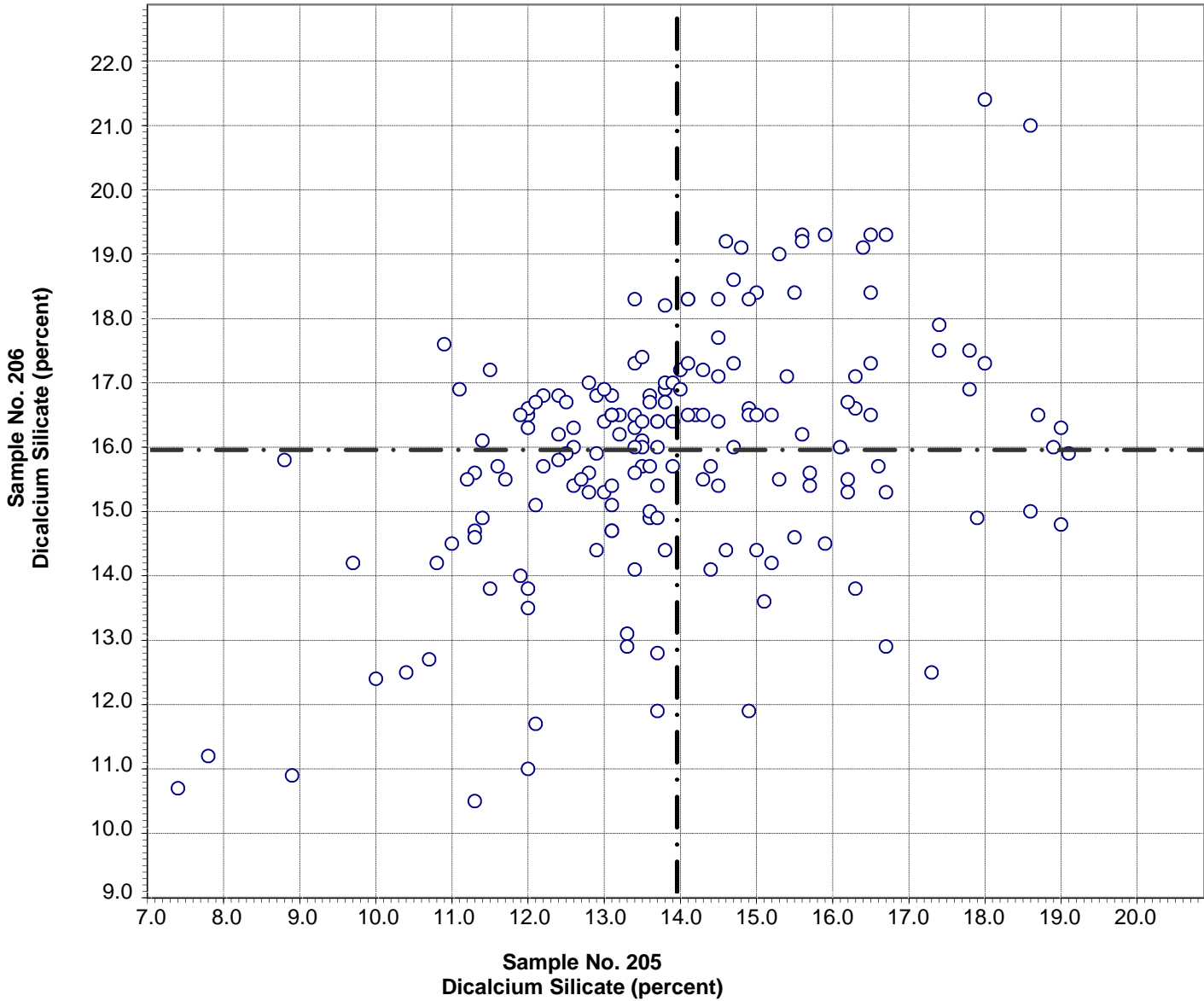


Test No. 106 Tricalcium Silicate 179 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 60.4 | S.D. 2.4 | C.V. 3.9 |
| Sample No. 206 | Ave 53.5 | S.D. 2.2 | C.V. 4.1 |

Labs Eliminated: 8, 15, 42, 50, 206, 247, 284, 2352

**CCRL Proficiency Sample Program
Dicalcium Silicate
PORTLAND CEMENT Samples No. 205 and No. 206**

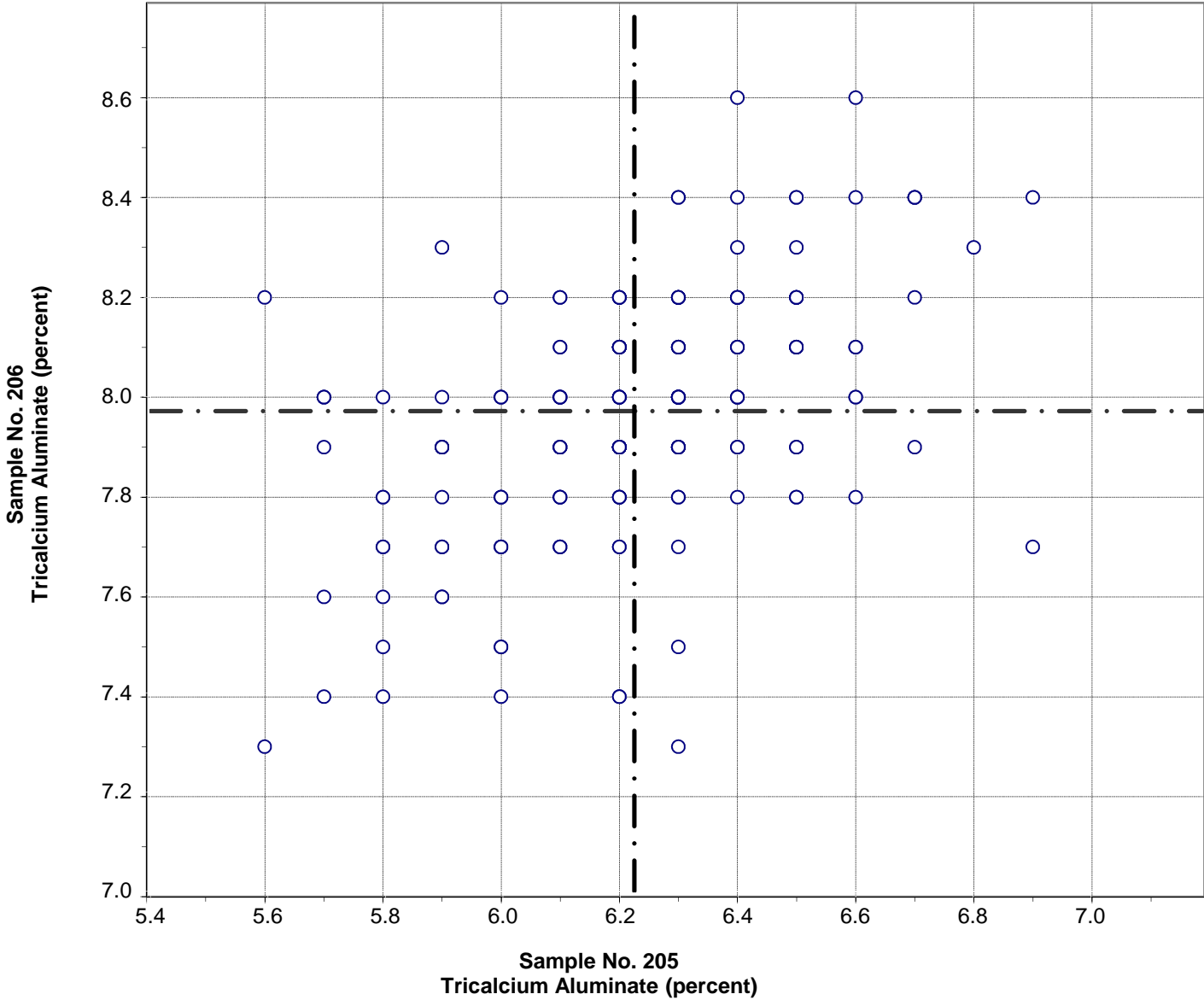


Test No. 107 Dicalcium Silicate 175 Points

| | | | |
|----------------|----------|----------|-----------|
| Sample No. 205 | Ave 13.9 | S.D. 2.2 | C.V. 15.5 |
| Sample No. 206 | Ave 15.9 | S.D. 1.9 | C.V. 11.8 |

Labs Eliminated: 15, 24, 42, 50, 134, 206, 247, 284, 698, 1644, 2352

**CCRL Proficiency Sample Program
Tricalcium Aluminate
PORTLAND CEMENT Samples No. 205 and No. 206**



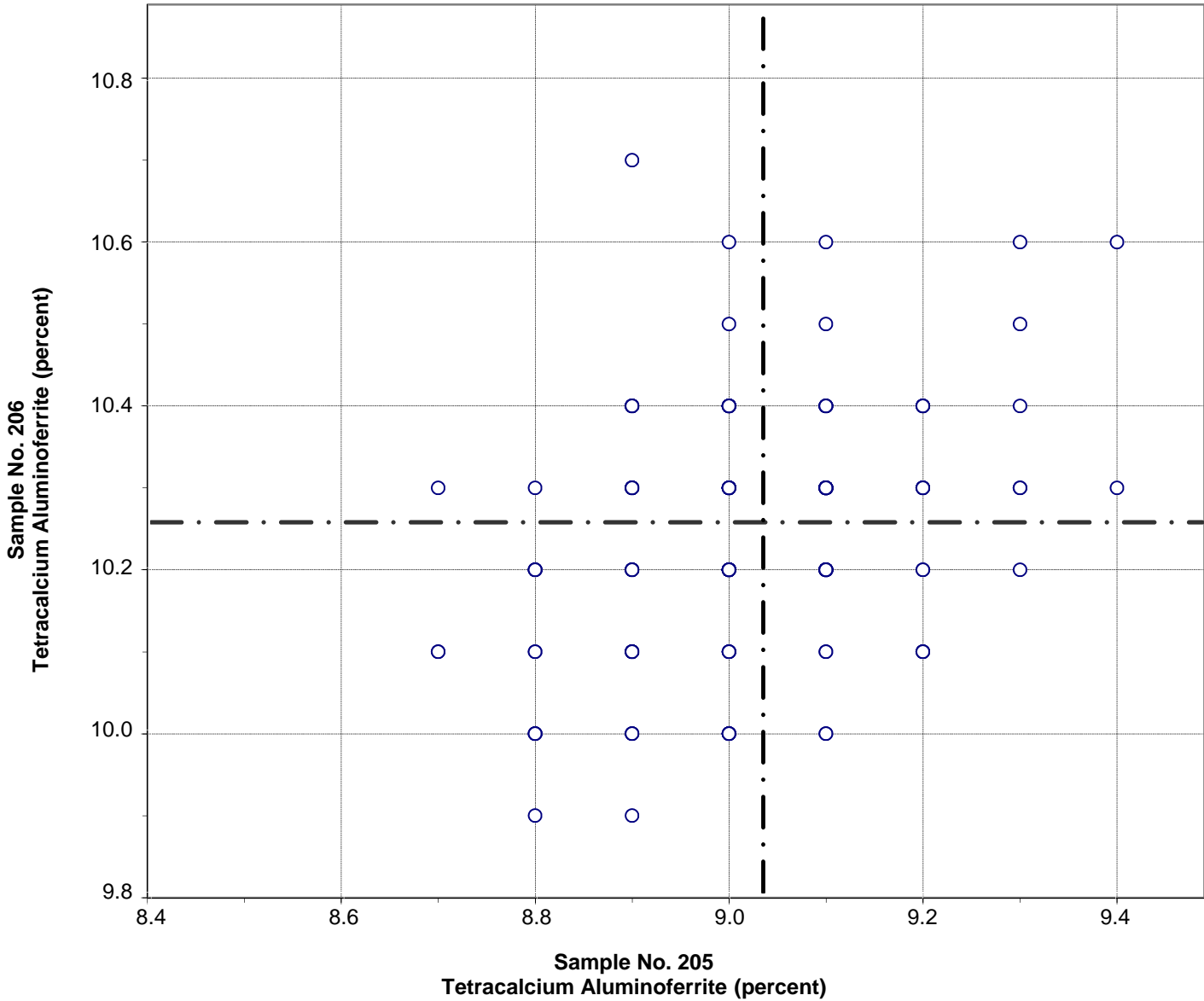
Test No. 108 Tricalcium Aluminate 179 Points

| | | | |
|----------------|---------|-----------|----------|
| Sample No. 205 | Ave 6.2 | S.D. 0.26 | C.V. 4.1 |
| Sample No. 206 | Ave 8.0 | S.D. 0.25 | C.V. 3.1 |

Labs Eliminated: 8, 42, 94, 698, 3238, 3607, 4251

Labs off Diagram: 66

**CCRL Proficiency Sample Program
Tetracalcium Aluminoferrite
PORTLAND CEMENT Samples No. 205 and No. 206**



Test No. 109 Tetracalcium Aluminoferrite 173 Points

Sample No. 205 Ave 9.0 S.D. 0.14 C.V. 1.6
 Sample No. 206 Ave 10.3 S.D. 0.15 C.V. 1.4

Labs Eliminated: 15, 139, 206, 883, 975, 3238, 3368, 3707, 4137, 4251

Labs off Diagram: 8, 42, 1054

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|-------|------|---------|-------|------|
| Normal Consistency - % Water (percent) | | | | | | | |
| | 240 | 25.9 | 1.88 | 7.30 | 25.6 | 1.85 | 7.20 |
| | *234 | 26.0 | 0.47 | 1.80 | 25.7 | 0.39 | 1.50 |
| * Labs Eliminated - 1, 35, 690, 4051, 4080, 4097 | | | | | | | |
| Vicat Time of Set - Initial (minutes) | | | | | | | |
| | 236 | 137 | 14 | 10 | 146 | 21 | 14 |
| | *229 | 137 | 11 | 8 | 145 | 17 | 12 |
| * Labs Eliminated - 69, 90, 116, 243, 457, 840, 4137 | | | | | | | |
| Vicat Time of Set - Final (minutes) | | | | | | | |
| | 227 | 235 | 29 | 13 | 251 | 33 | 13 |
| | *224 | 235 | 25 | 11 | 250 | 28 | 11 |
| * Labs Eliminated - 34, 69, 457 | | | | | | | |
| Gillmore Time of Set - Initial (minutes) | | | | | | | |
| | 137 | 170 | 20 | 12 | 181 | 26 | 14 |
| | *135 | 169 | 19 | 11 | 180 | 25 | 14 |
| * Labs Eliminated - 176, 840 | | | | | | | |
| Gillmore Time of Set - Final (minutes) | | | | | | | |
| | 138 | 264 | 35 | 13 | 282 | 36 | 13 |
| | *136 | 262 | 31 | 12 | 281 | 34 | 12 |
| * Labs Eliminated - 41, 1054 | | | | | | | |
| False Set - Paste Method (percent) | | | | | | | |
| | 187 | 81 | 9.6 | 11.9 | 76 | 10.9 | 14.3 |
| | *184 | 82 | 8.7 | 10.6 | 76 | 10.5 | 13.7 |
| * Labs Eliminated - 103, 176, 493 | | | | | | | |
| Autoclave Expansion (percent) | | | | | | | |
| | 225 | -0.03 | 0.046 | -121 | 0.07 | 0.067 | 92 |
| | *211 | -0.03 | 0.026 | 71 | 0.07 | 0.034 | 46 |
| * Labs Eliminated - 15, 25, 78, 84, 103, 143, 156, 203, 205, 221, 491, 684, 1773, 3413 | | | | | | | |

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|------|------|---------|------|------|
| Air Content % (percent) | | | | | | | |
| | 226 | 9.1 | 1.2 | 13 | 9.3 | 1.2 | 13 |
| | *224 | 9.2 | 1.1 | 12 | 9.3 | 1.1 | 12 |
| * Labs Eliminated - 52, 1644 | | | | | | | |
| Air Content - % Water (percent) | | | | | | | |
| | 219 | 67.9 | 8.6 | 12.7 | 67.5 | 8.6 | 12.7 |
| | *212 | 69.0 | 2.3 | 3.3 | 68.6 | 2.4 | 3.5 |
| * Labs Eliminated - 35, 146, 159, 309, 407, 1644, 4131 | | | | | | | |
| Air Content - Flow (percent) | | | | | | | |
| | 220 | 87 | 3.3 | 3.7 | 88 | 3.6 | 4.1 |
| No Labs Eliminated for This Test | | | | | | | |
| Compressive Strength - 3 day (psi) | | | | | | | |
| | 244 | 3987 | 336 | 8.4 | 3773 | 326 | 8.6 |
| | *237 | 4017 | 271 | 6.8 | 3798 | 254 | 6.7 |
| * Labs Eliminated - 30, 35, 48, 51, 103, 205, 640 | | | | | | | |
| Compressive Strength - 7 day (psi) | | | | | | | |
| | 244 | 4885 | 338 | 6.9 | 4844 | 333 | 6.9 |
| | *240 | 4903 | 309 | 6.3 | 4860 | 300 | 6.2 |
| * Labs Eliminated - 30, 103, 640, 1222 | | | | | | | |
| Compressive Strength - 28 day (psi) | | | | | | | |
| | 235 | 6300 | 504 | 8.0 | 6108 | 448 | 7.3 |
| | *231 | 6327 | 429 | 6.8 | 6130 | 408 | 6.7 |
| * Labs Eliminated - 3, 30, 203, 1222 | | | | | | | |
| Compressive Strength - Flow (percent) | | | | | | | |
| | 221 | 116 | 12 | 10.5 | 114 | 12 | 10.5 |
| | *217 | 116 | 10 | 8.8 | 114 | 10 | 8.5 |
| * Labs Eliminated - 46, 94, 407, 2490 | | | | | | | |

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

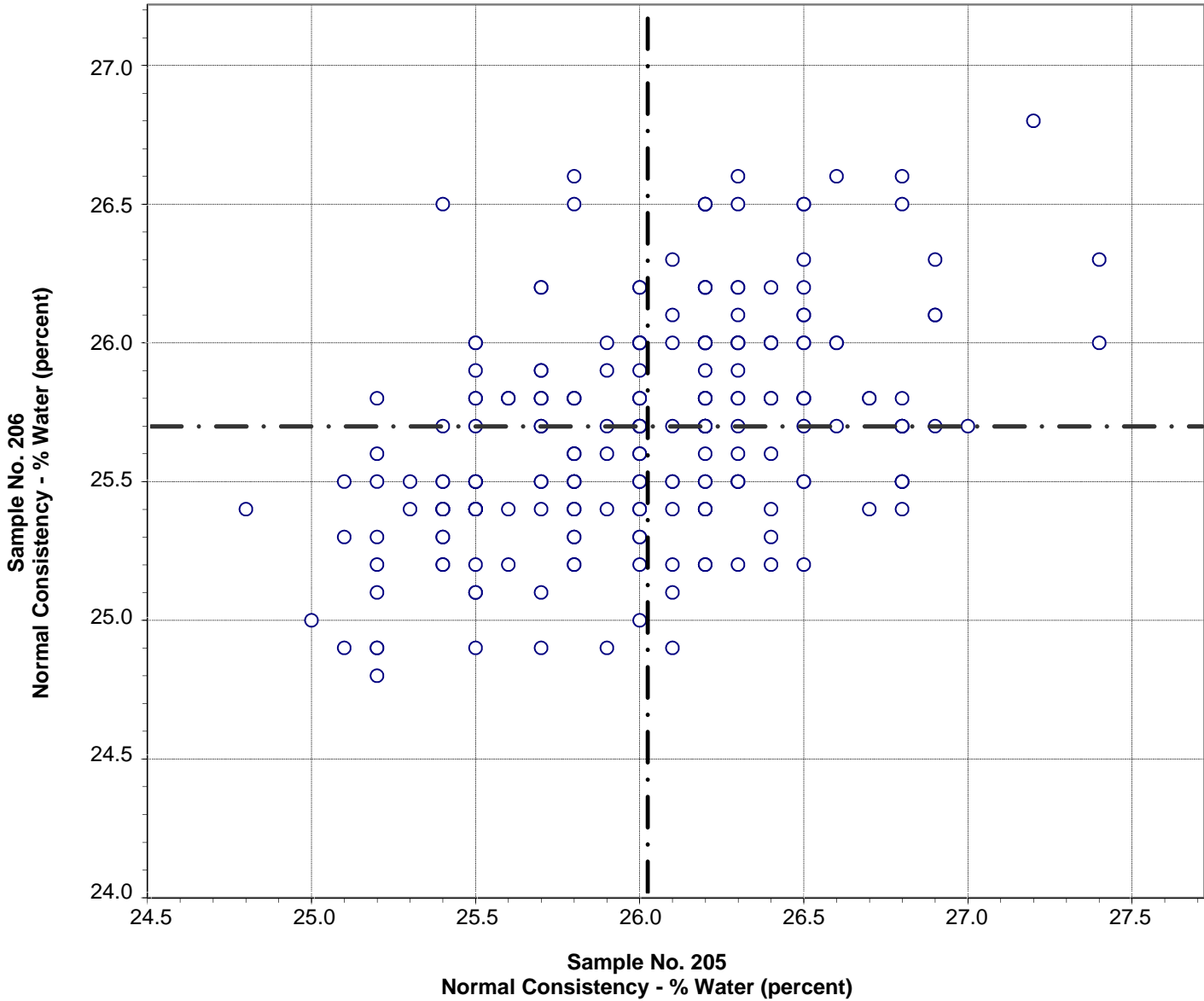
SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|-------|------|---------|-------|------|
| Fineness - Air Permeability (m²/kg) | | | | | | | |
| | 237 | 381 | 16 | 4.3 | 395 | 15 | 3.8 |
| | *229 | 381 | 10 | 2.6 | 396 | 11 | 2.7 |
| * Labs Eliminated - 3, 51, 222, 415, 474, 3245, 3658, 4051 | | | | | | | |
| Fineness - 45µm Sieve (percent) | | | | | | | |
| | 222 | 96.79 | 0.67 | 0.69 | 96.79 | 0.70 | 0.72 |
| | *215 | 96.83 | 0.52 | 0.53 | 96.86 | 0.53 | 0.55 |
| * Labs Eliminated - 35, 64, 116, 148, 474, 2481, 3245 | | | | | | | |
| C1038 Mortar Bar Expansion (percent) | | | | | | | |
| | 158 | 0.008 | 0.027 | 334 | 0.004 | 0.020 | 505 |
| | *150 | 0.005 | 0.003 | 67 | 0.006 | 0.003 | 60 |
| * Labs Eliminated - 99, 125, 203, 205, 221, 491, 497, 4051 | | | | | | | |

**CCRL Proficiency Sample Program
Normal Consistency - % Water
PORTLAND CEMENT Samples No. 205 and No. 206**

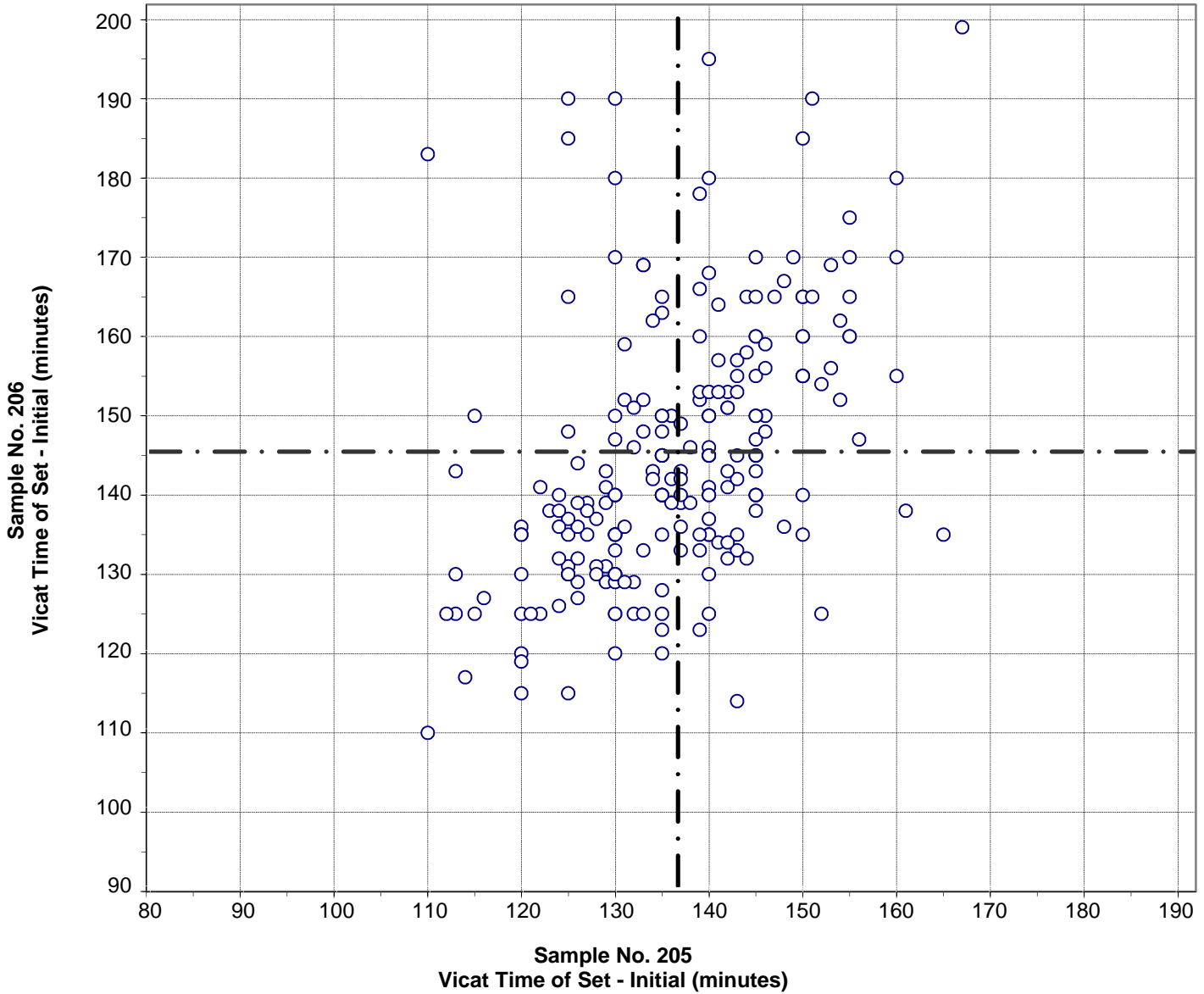


Test No. 110 Normal Consistency - % Water 234 Points

| | | | |
|----------------|----------|-----------|-----------|
| Sample No. 205 | Ave 26.0 | S.D. 0.47 | C.V. 1.80 |
| Sample No. 206 | Ave 25.7 | S.D. 0.39 | C.V. 1.50 |

Labs Eliminated: 1, 35, 690, 4051, 4080, 4097

CCRL Proficiency Sample Program
Vicat Time of Set - Initial
PORTLAND CEMENT Samples No. 205 and No. 206



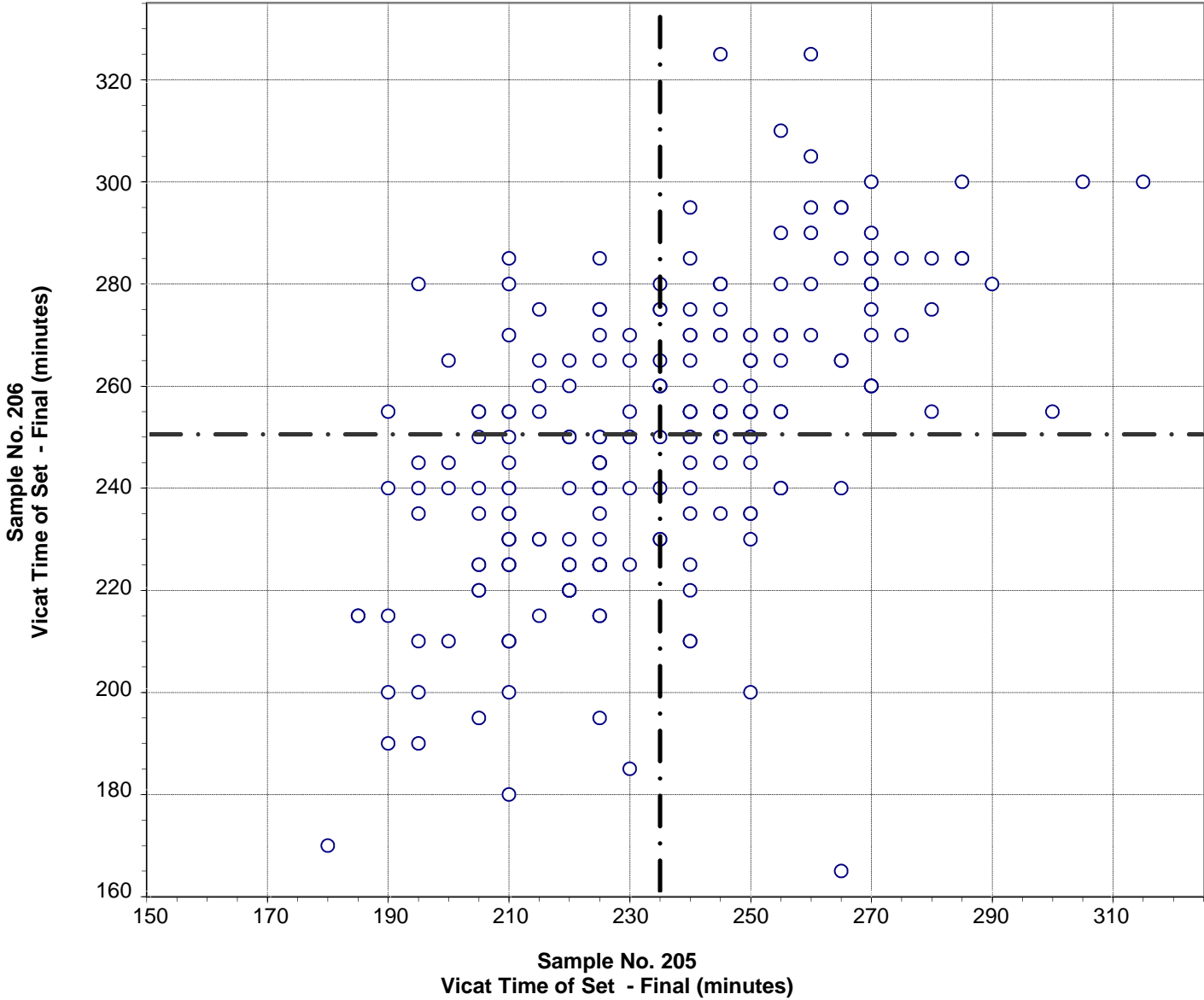
Test No. 120 Vicat Time of Set - Initial 228 Points

| | | | |
|----------------|---------|---------|---------|
| Sample No. 205 | Ave 137 | S.D. 11 | C.V. 8 |
| Sample No. 206 | Ave 145 | S.D. 17 | C.V. 12 |

Labs Eliminated: 69, 90, 116, 243, 457, 840, 4137

Labs off Diagram: 41

CCRL Proficiency Sample Program
Vicat Time of Set - Final
PORTLAND CEMENT Samples No. 205 and No. 206

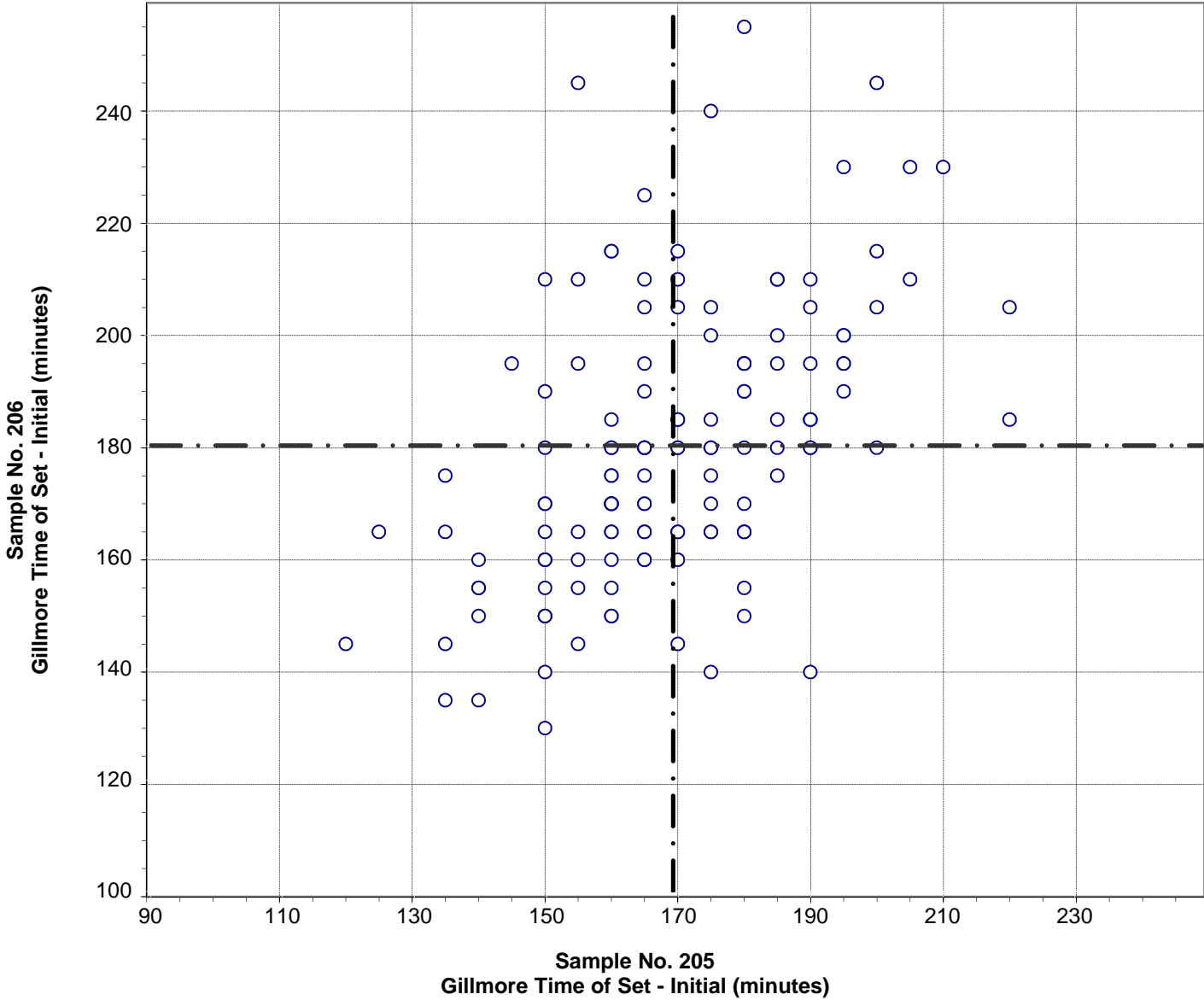


Test No. 121 Vicat Time of Set - Final 224 Points

| | | | |
|----------------|---------|---------|---------|
| Sample No. 205 | Ave 235 | S.D. 25 | C.V. 11 |
| Sample No. 206 | Ave 250 | S.D. 28 | C.V. 11 |

Labs Eliminated: 34, 69, 457

**CCRL Proficiency Sample Program
Gillmore Time of Set - Initial
PORTLAND CEMENT Samples No. 205 and No. 206**

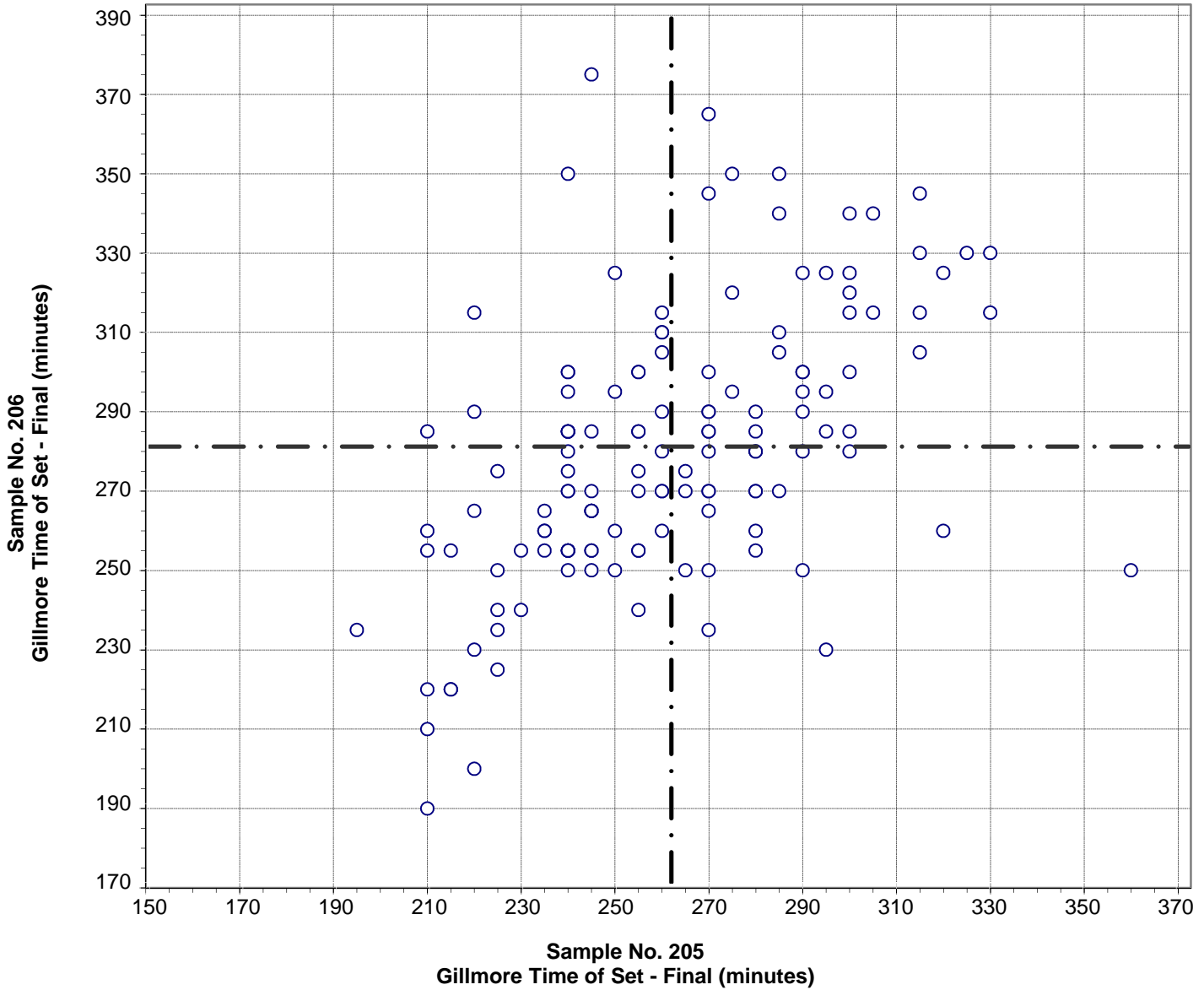


Test No. 130 Gillmore Time of Set - Initial 135 Points

| | | | |
|----------------|---------|---------|---------|
| Sample No. 205 | Ave 169 | S.D. 19 | C.V. 11 |
| Sample No. 206 | Ave 180 | S.D. 25 | C.V. 14 |

Labs Eliminated: 176, 840

**CCRL Proficiency Sample Program
Gillmore Time of Set - Final
PORTLAND CEMENT Samples No. 205 and No. 206**

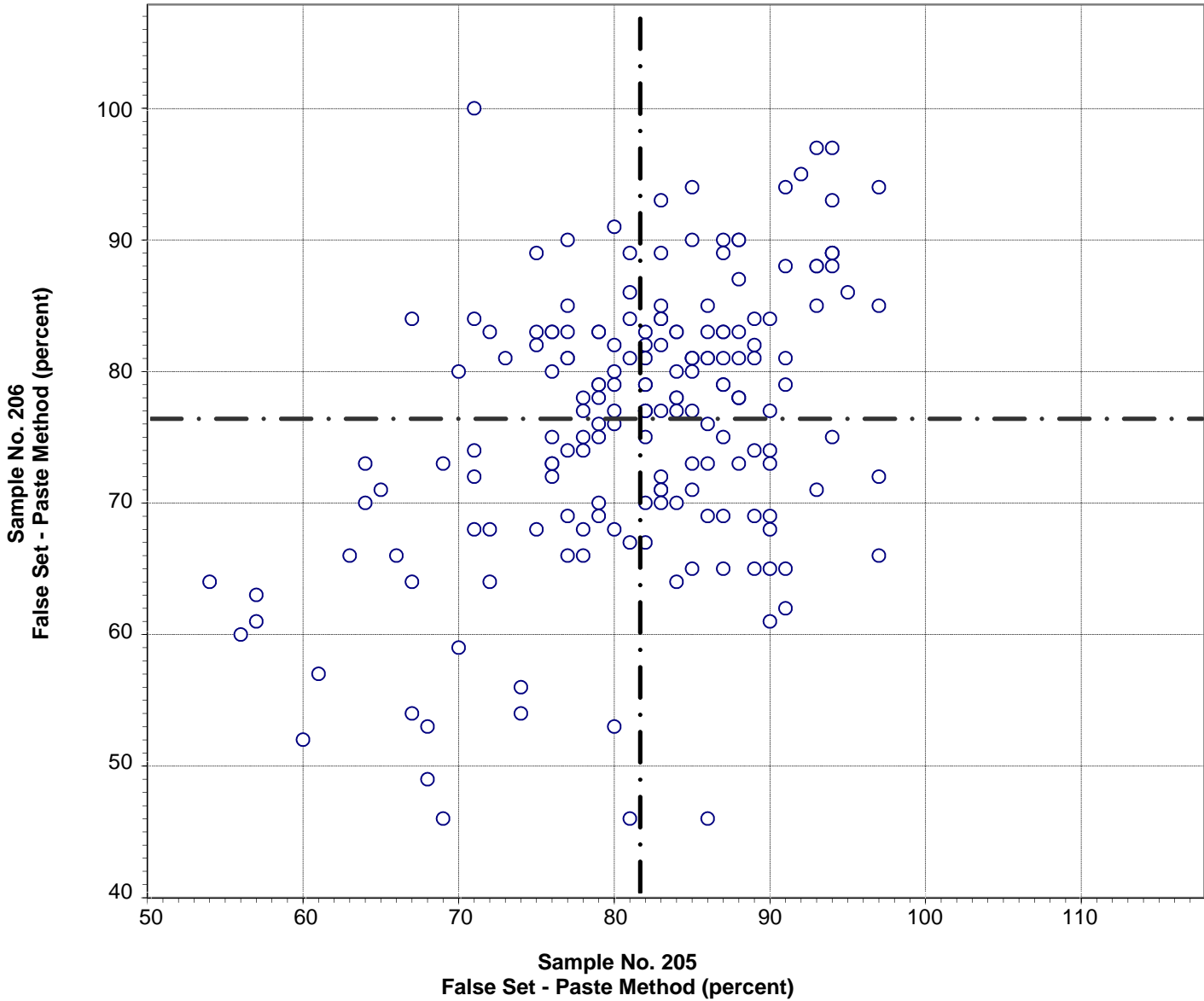


Test No. 140 Gillmore Time of Set - Final 136 Points

| | | | |
|----------------|---------|---------|---------|
| Sample No. 205 | Ave 262 | S.D. 31 | C.V. 12 |
| Sample No. 206 | Ave 281 | S.D. 34 | C.V. 12 |

Labs Eliminated: 41, 1054

**CCRL Proficiency Sample Program
False Set - Paste Method
PORTLAND CEMENT Samples No. 205 and No. 206**

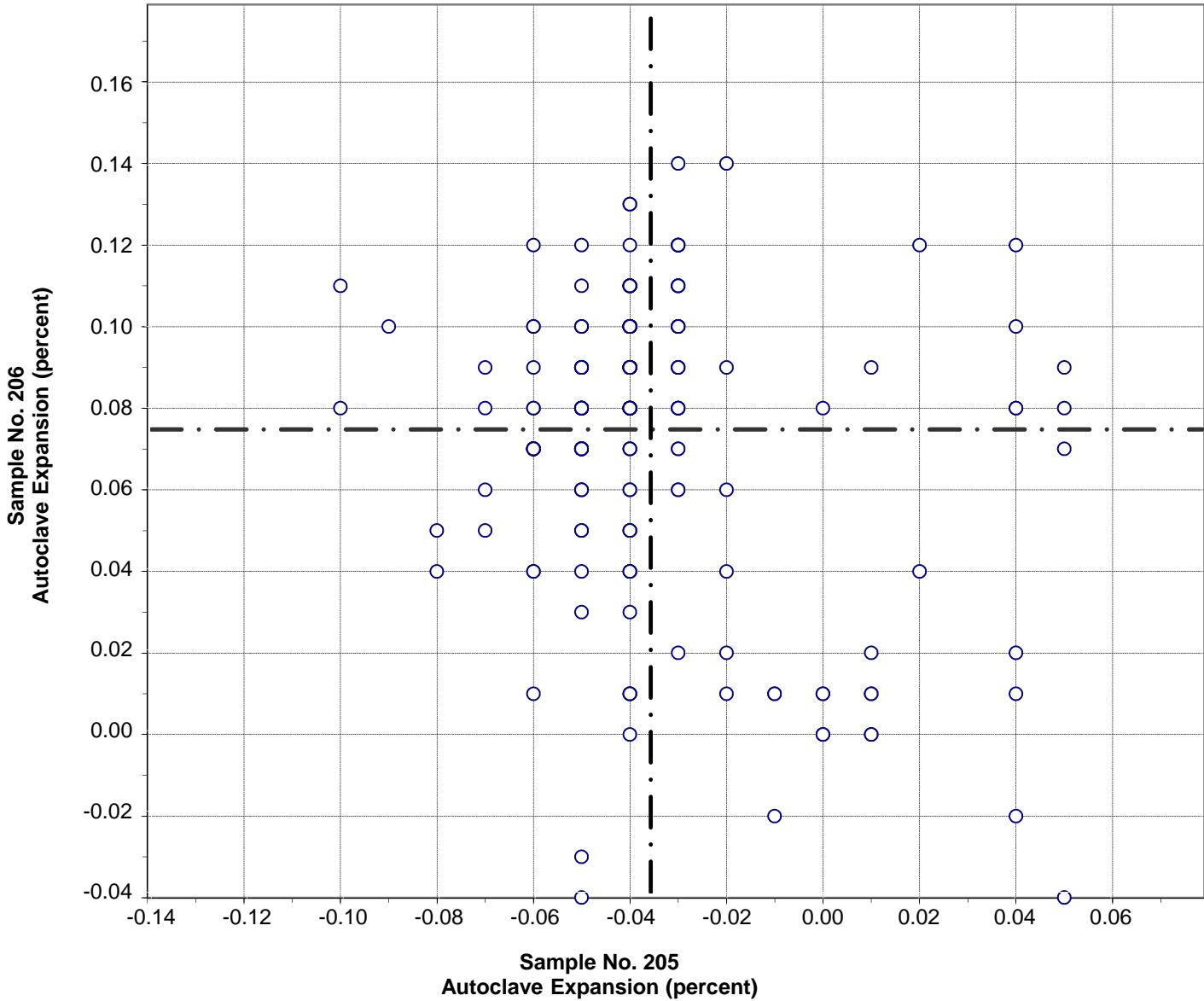


Test No. 150 False Set - Paste Method 184 Points

| | | | |
|----------------|--------|-----------|-----------|
| Sample No. 205 | Ave 82 | S.D. 8.7 | C.V. 10.6 |
| Sample No. 206 | Ave 76 | S.D. 10.5 | C.V. 13.7 |

Labs Eliminated: 103, 176, 493

**CCRL Proficiency Sample Program
Autoclave Expansion
PORTLAND CEMENT Samples No. 205 and No. 206**

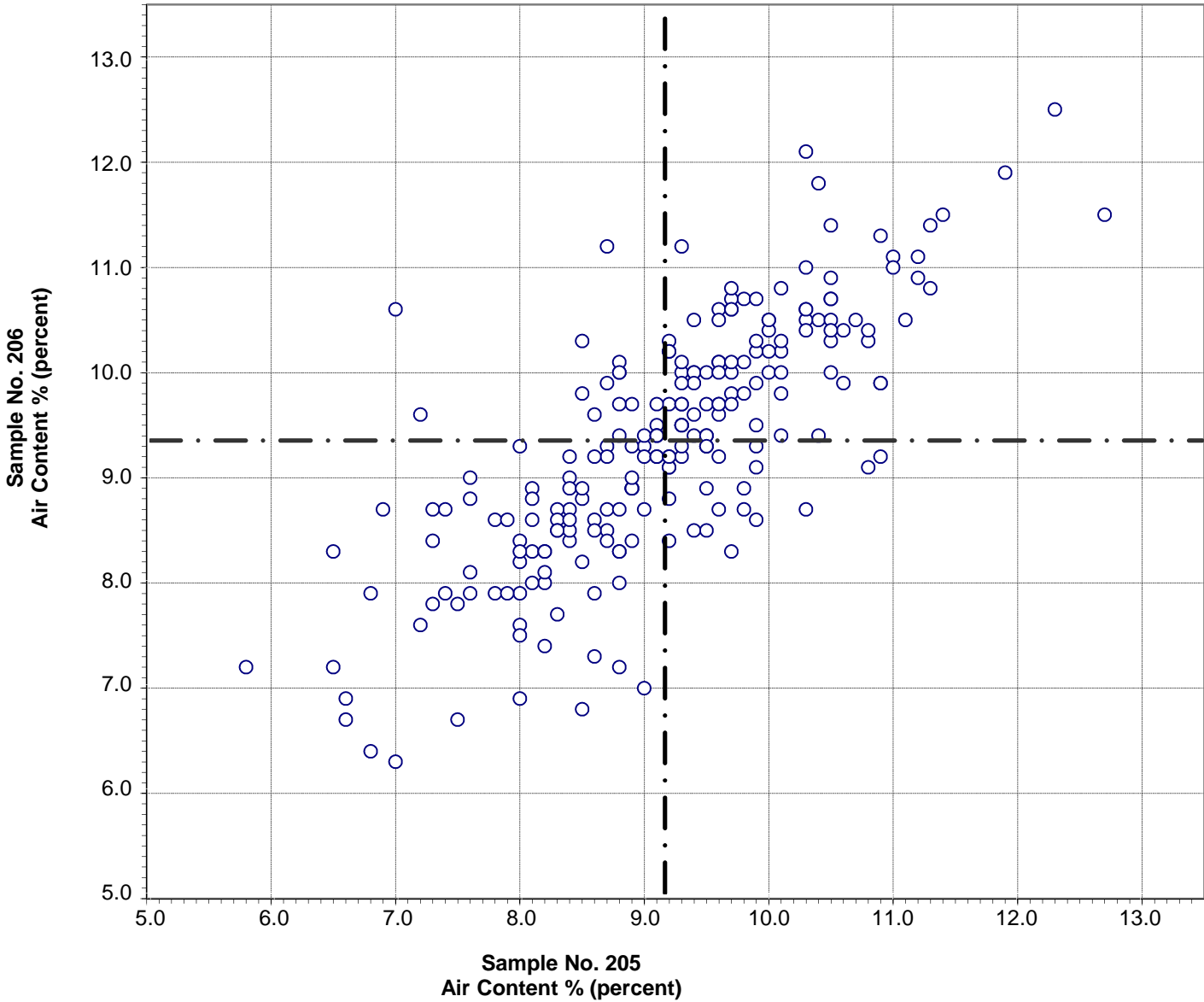


Test No. 160 Autoclave Expansion 211 Points

| | | | |
|----------------|-----------|------------|---------|
| Sample No. 205 | Ave -0.03 | S.D. 0.026 | C.V. 71 |
| Sample No. 206 | Ave 0.07 | S.D. 0.034 | C.V. 46 |

Labs Eliminated: 15, 25, 78, 84, 103, 143, 156, 203, 205, 221, 491, 684, 1773, 3413

CCRL Proficiency Sample Program
Air Content %
PORTLAND CEMENT Samples No. 205 and No. 206

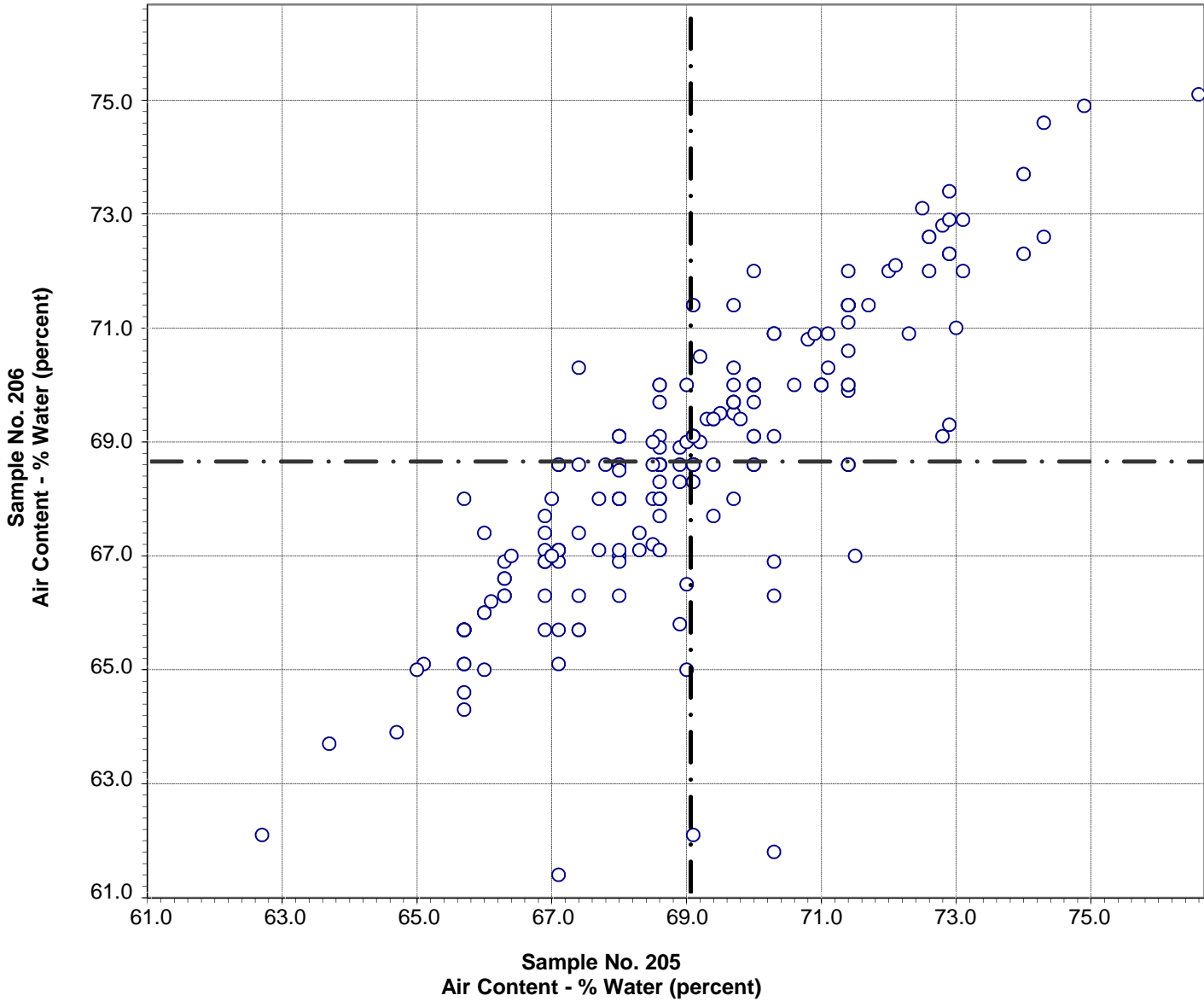


Test No. 170 Air Content % 224 Points

| | | | |
|----------------|---------|----------|---------|
| Sample No. 205 | Ave 9.2 | S.D. 1.1 | C.V. 12 |
| Sample No. 206 | Ave 9.3 | S.D. 1.1 | C.V. 12 |

Labs Eliminated: 52, 1644

CCRL Proficiency Sample Program
Air Content - % Water
PORTLAND CEMENT Samples No. 205 and No. 206



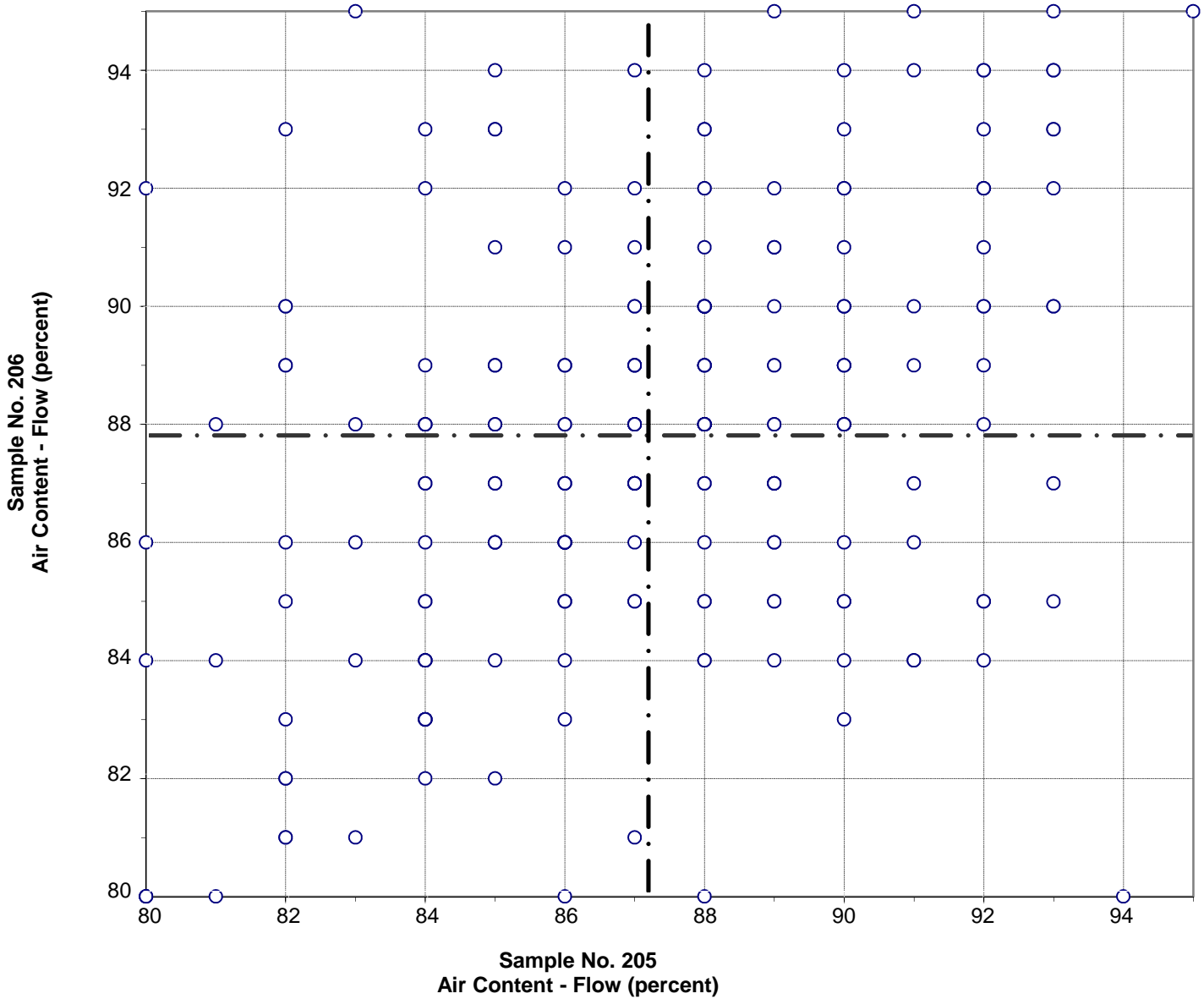
Test No. 180 Air Content - % Water 211 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 69.0 | S.D. 2.3 | C.V. 3.3 |
| Sample No. 206 | Ave 68.6 | S.D. 2.4 | C.V. 3.5 |

Labs Eliminated: 35, 146, 159, 309, 407, 1644, 4131

Labs off Diagram: 52

**CCRL Proficiency Sample Program
Air Content - Flow
PORTLAND CEMENT Samples No. 205 and No. 206**

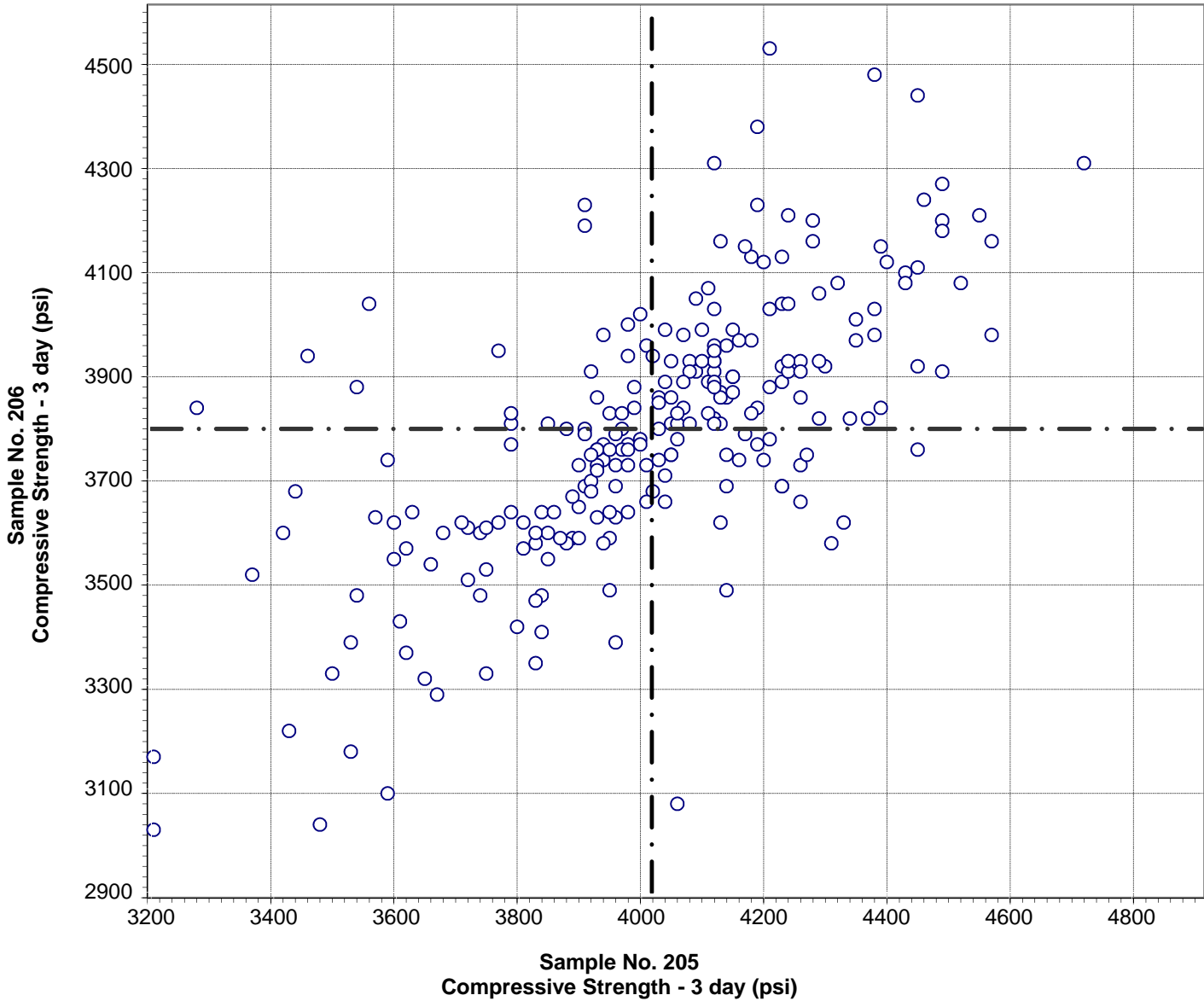


Test No. 190 Air Content - Flow 219 Points

| | | | |
|----------------|--------|----------|----------|
| Sample No. 205 | Ave 87 | S.D. 3.3 | C.V. 3.7 |
| Sample No. 206 | Ave 88 | S.D. 3.6 | C.V. 4.1 |

Labs off Diagram: 34

**CCRL Proficiency Sample Program
Compressive Strength - 3 day
PORTLAND CEMENT Samples No. 205 and No. 206**



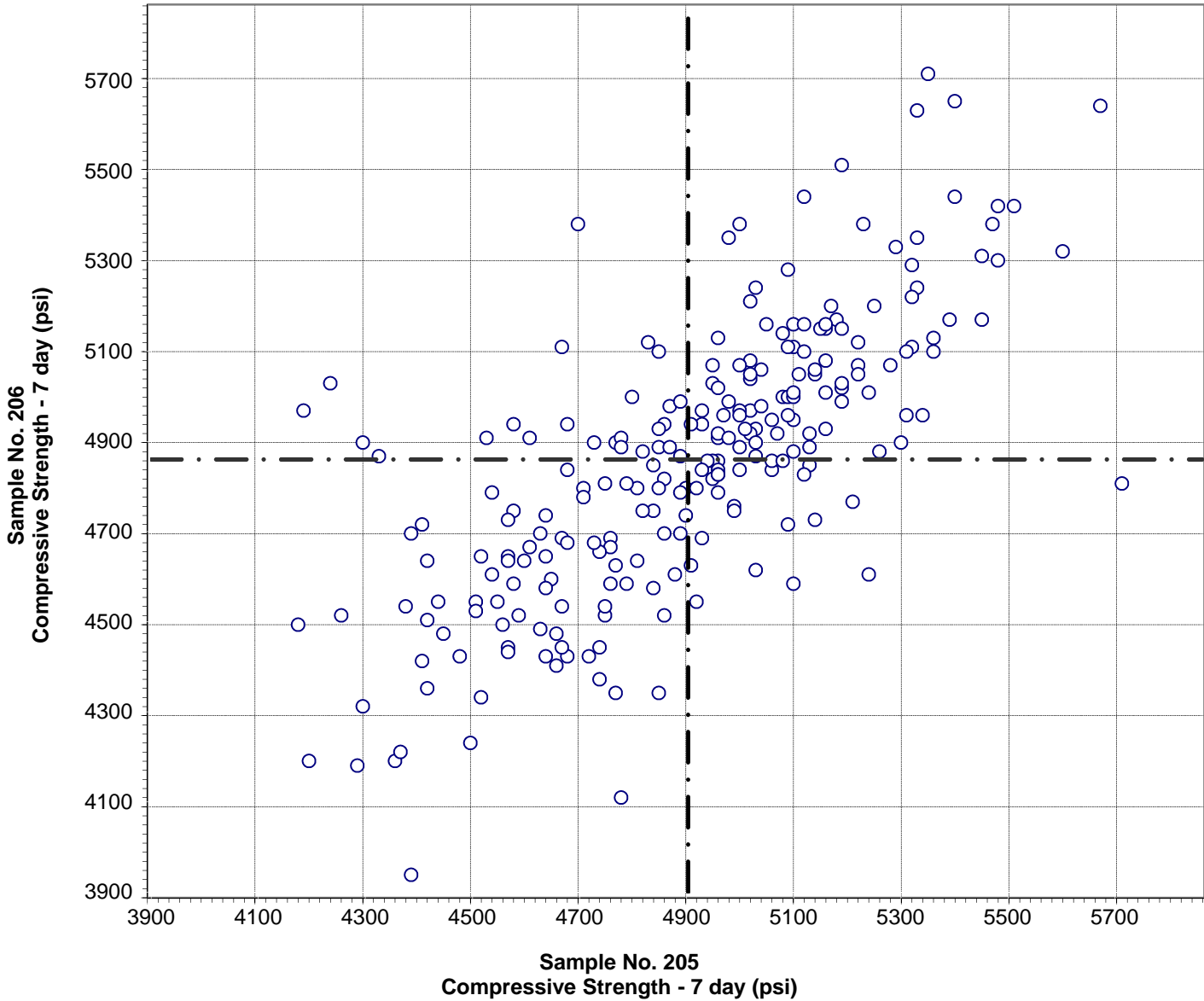
Test No. 200 Compressive Strength - 3 day 236 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 4017 | S.D. 271 | C.V. 6.8 |
| Sample No. 206 | Ave 3798 | S.D. 254 | C.V. 6.7 |

Labs Eliminated: 30, 35, 48, 51, 103, 205, 640

Labs off Diagram: 360

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
PORTLAND CEMENT Samples No. 205 and No. 206**



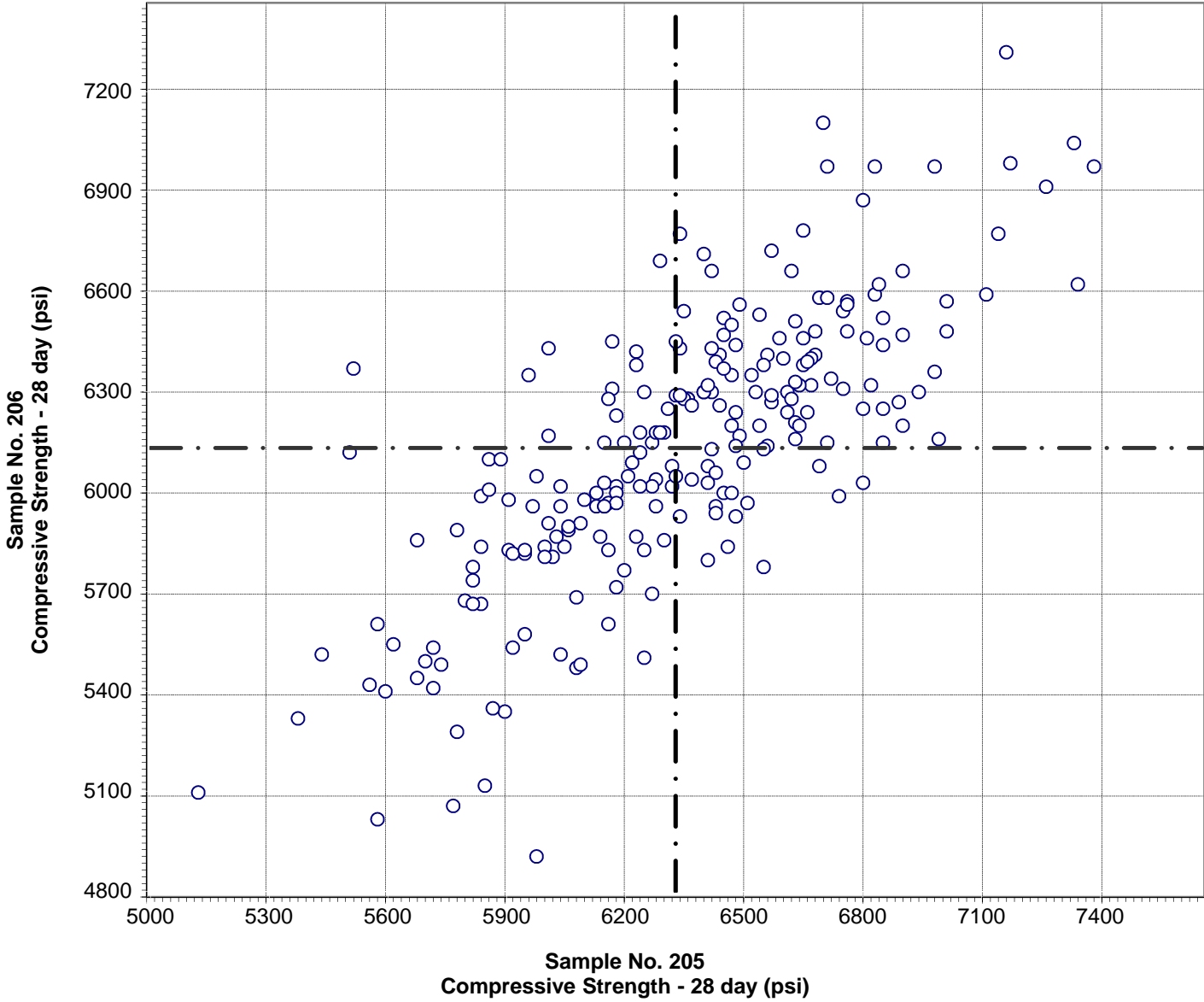
Test No. 210 Compressive Strength - 7 day 239 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 4903 | S.D. 309 | C.V. 6.3 |
| Sample No. 206 | Ave 4860 | S.D. 300 | C.V. 6.2 |

Labs Eliminated: 30, 103, 640, 1222

Labs off Diagram: 35

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
PORTLAND CEMENT Samples No. 205 and No. 206**



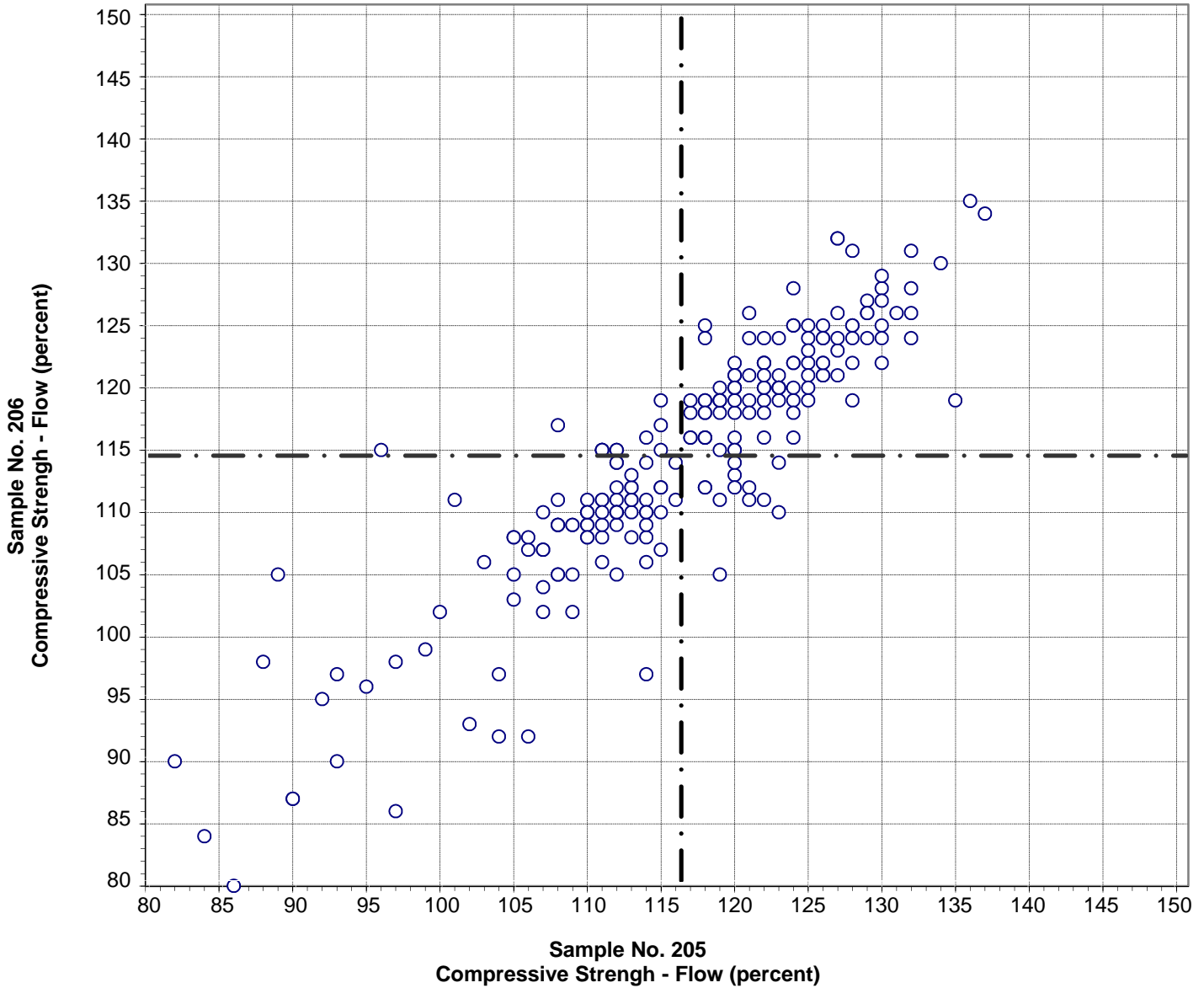
Test No. 211 Compressive Strength - 28 day 228 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 6327 | S.D. 429 | C.V. 6.8 |
| Sample No. 206 | Ave 6130 | S.D. 408 | C.V. 6.7 |

Labs Eliminated: 3, 30, 203, 1222

Labs off Diagram: 25, 49, 360

**CCRL Proficiency Sample Program
Compressive Strength - Flow
PORTLAND CEMENT Samples No. 205 and No. 206**

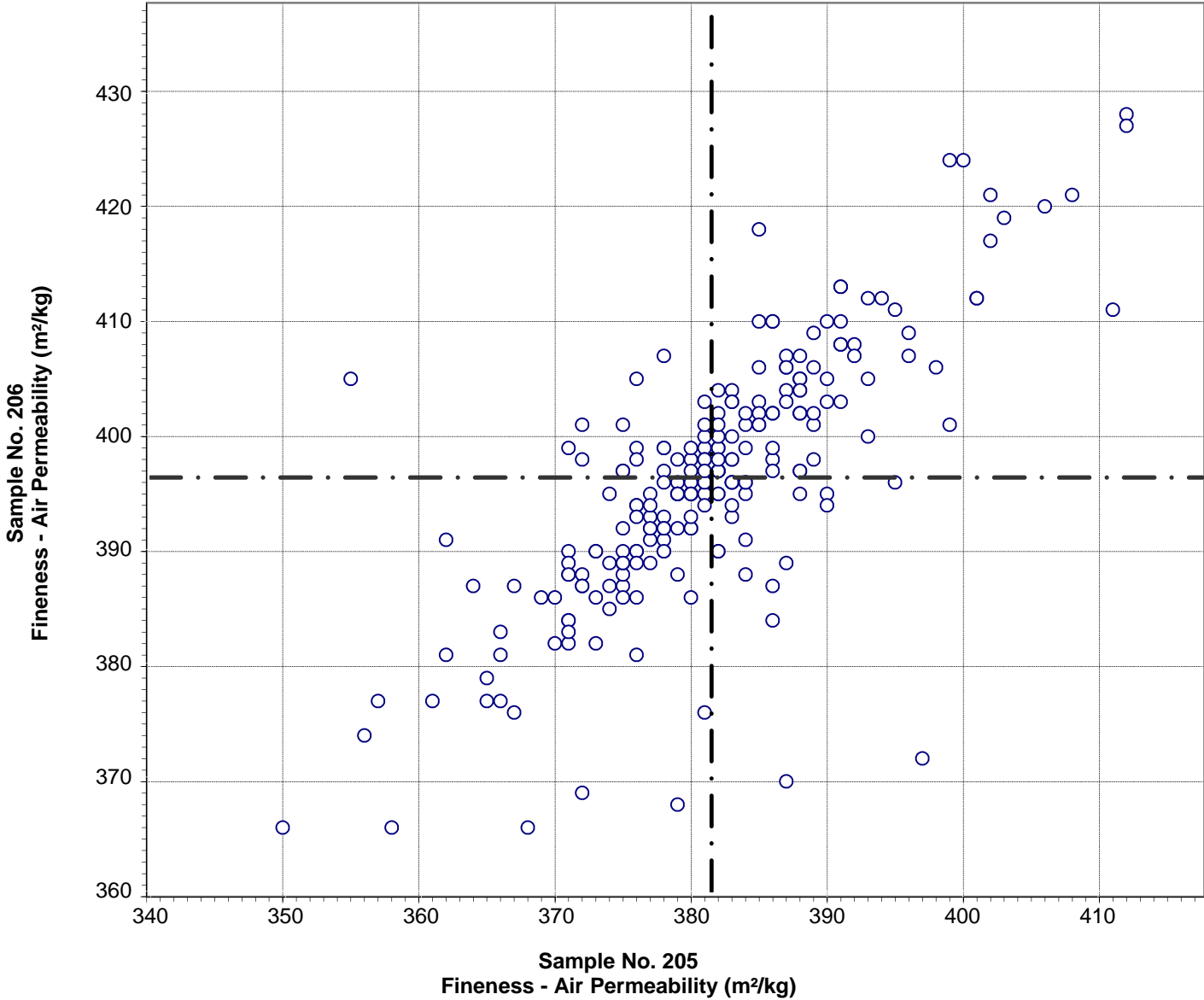


Test No. 230 Compressive Strength - Flow 217 Points

| | | | |
|----------------|---------|---------|----------|
| Sample No. 205 | Ave 116 | S.D. 10 | C.V. 8.8 |
| Sample No. 206 | Ave 114 | S.D. 10 | C.V. 8.5 |

Labs Eliminated: 46, 94, 407, 2490

**CCRL Proficiency Sample Program
Fineness - Air Permeability
PORTLAND CEMENT Samples No. 205 and No. 206**

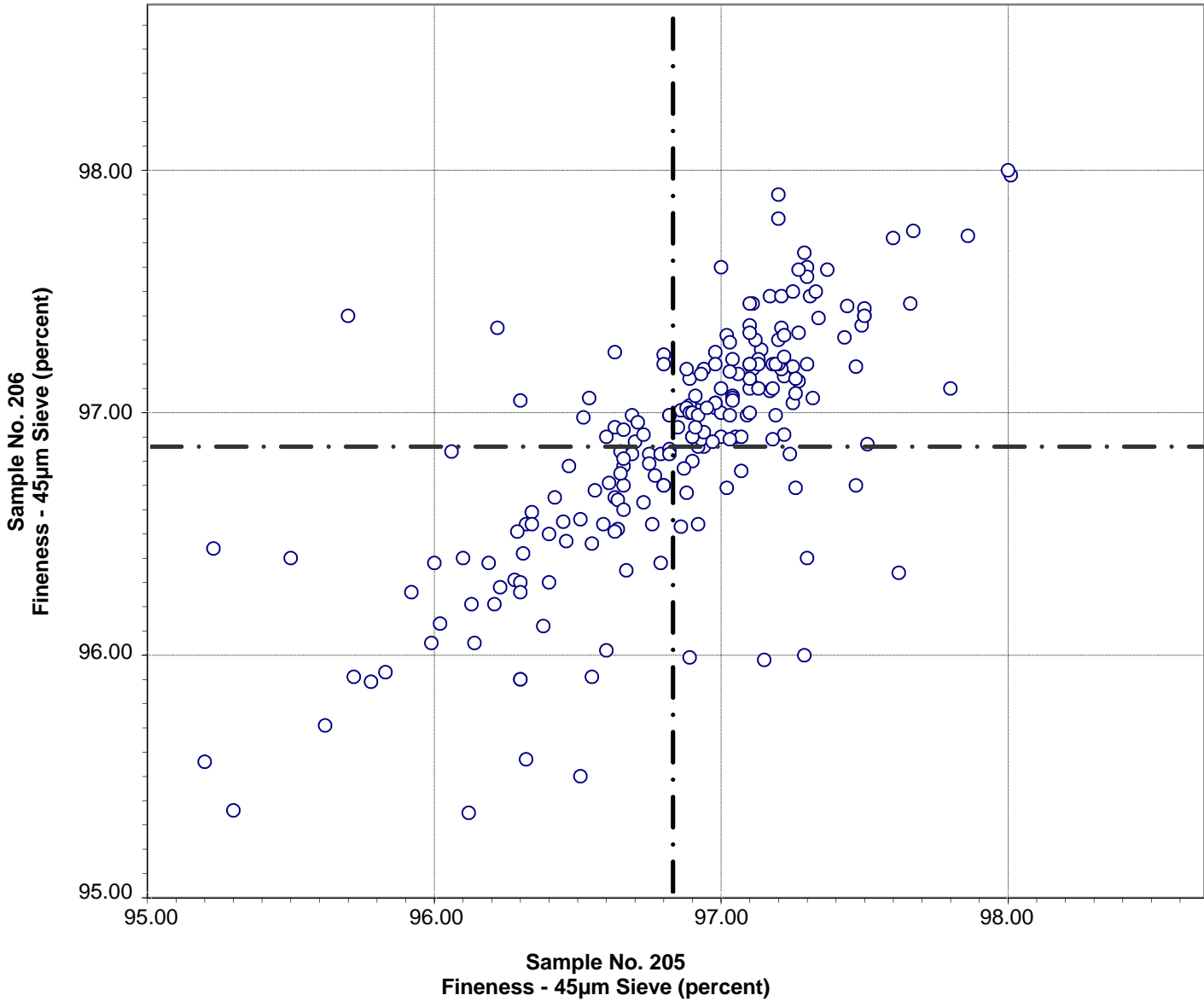


Test No. 270 Fineness - Air Permeability 229 Points

| | | | |
|----------------|---------|---------|----------|
| Sample No. 205 | Ave 381 | S.D. 10 | C.V. 2.6 |
| Sample No. 206 | Ave 396 | S.D. 11 | C.V. 2.7 |

Labs Eliminated: 3, 51, 222, 415, 474, 3245, 3658, 4051

**CCRL Proficiency Sample Program
Fineness - 45µm Sieve
PORTLAND CEMENT Samples No. 205 and No. 206**



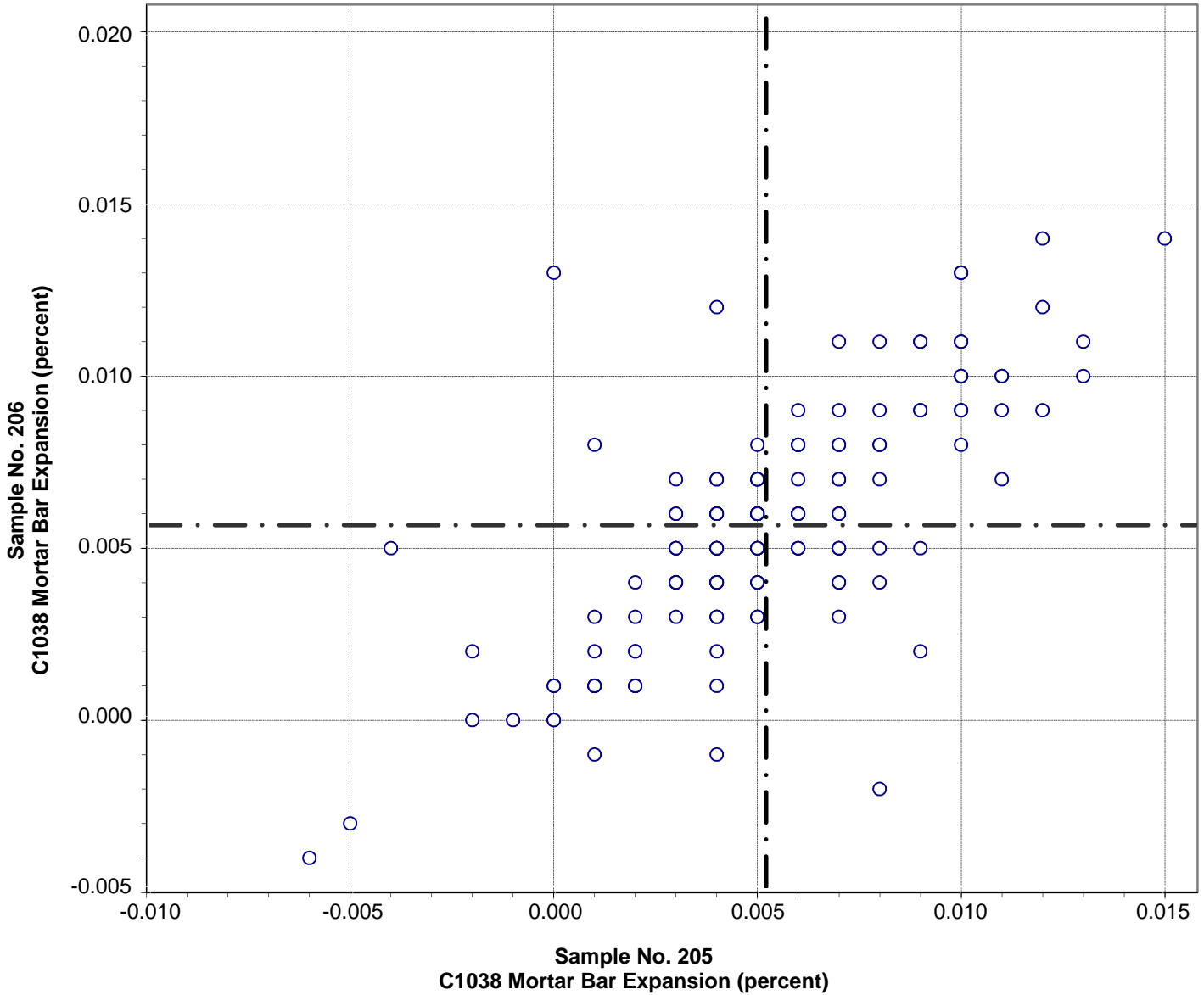
Test No. 281 Fineness - 45µm Sieve 212 Points

| | | | |
|----------------|-----------|-----------|-----------|
| Sample No. 205 | Ave 96.83 | S.D. 0.52 | C.V. 0.53 |
| Sample No. 206 | Ave 96.86 | S.D. 0.53 | C.V. 0.55 |

Labs Eliminated: 35, 64, 116, 148, 474, 2481, 3245

Labs off Diagram: 25, 36, 121

**CCRL Proficiency Sample Program
C1038 Mortar Bar Expansion
PORTLAND CEMENT Samples No. 205 and No. 206**



Test No. 400 C1038 Mortar Bar Expansion 150 Points

| | | | |
|----------------|-----------|------------|---------|
| Sample No. 205 | Ave 0.005 | S.D. 0.003 | C.V. 67 |
| Sample No. 206 | Ave 0.006 | S.D. 0.003 | C.V. 60 |

Labs Eliminated: 99, 125, 203, 205, 221, 491, 497, 4051

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 205 and No. 206

Final Report – August 31, 2017

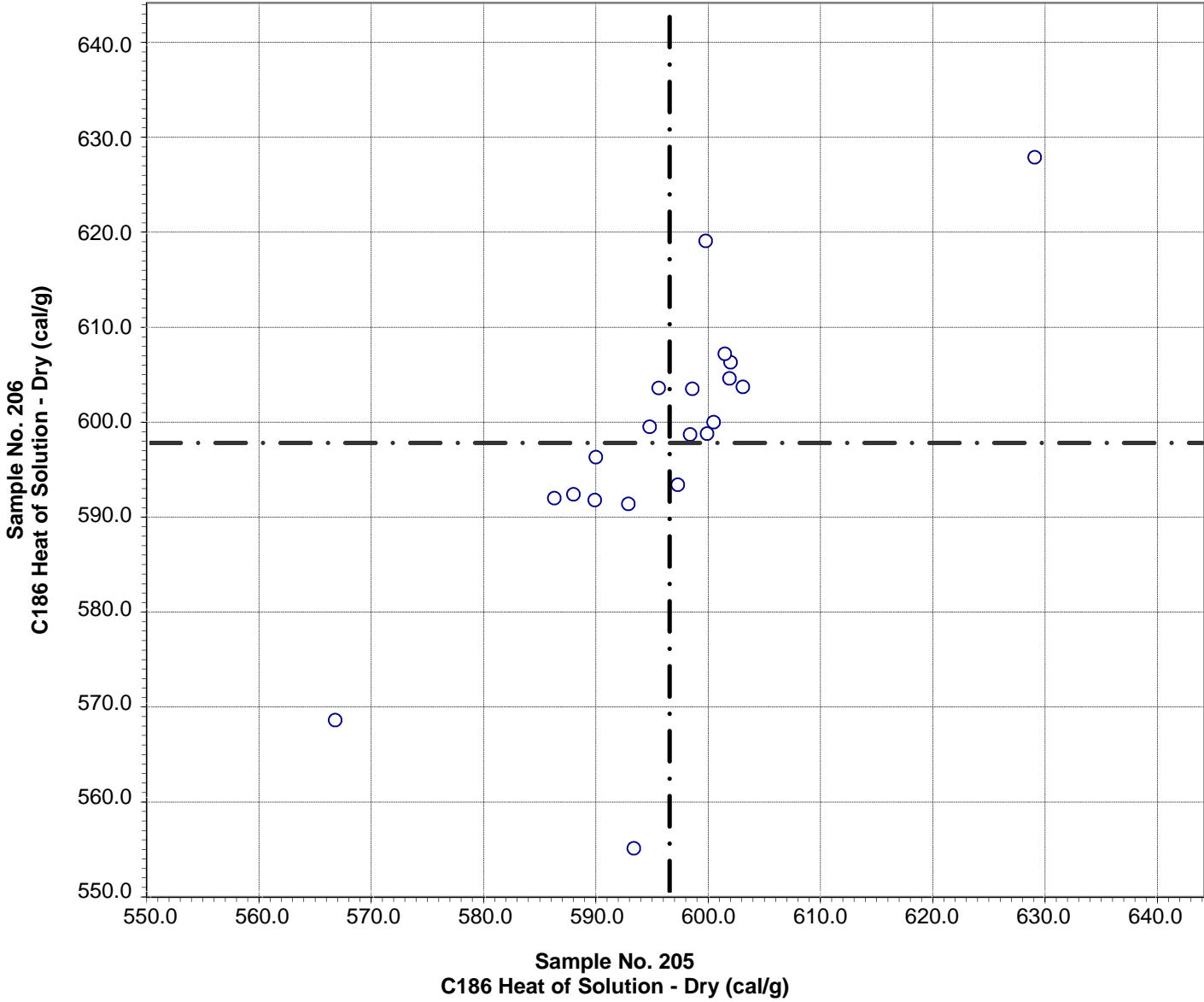
SUMMARY OF RESULTS

Sample No.205

Sample No. 206

| Test (unit) | #Labs | Average | S.D. | C.V. | Average | S.D. | C.V. |
|--|-------|---------|------|------|---------|------|------|
| C186 Heat of Solution - Dry (cal/g) | | | | | | | |
| | 21 | 588.0 | 41.4 | 7.0 | 589.0 | 42.9 | 7.3 |
| | *20 | 596.0 | 11.3 | 1.9 | 598.0 | 15.4 | 2.6 |
| * Labs Eliminated - 148 | | | | | | | |
| C186 Heat of Solution - 7 day (cal/g) | | | | | | | |
| | 21 | 513.5 | 26.6 | 5.2 | 512.7 | 25.8 | 5.0 |
| | *20 | 518.5 | 13.8 | 2.7 | 517.7 | 12.4 | 2.4 |
| * Labs Eliminated - 148 | | | | | | | |
| C186 Heat of Solution 28 day (cal/g) | | | | | | | |
| | 16 | 501.2 | 26.1 | 5.2 | 500.0 | 25.0 | 5.0 |
| | *15 | 507.1 | 11.8 | 2.3 | 505.7 | 9.9 | 2.0 |
| * Labs Eliminated - 148 | | | | | | | |
| C186 Heat of Hydration - 7 day (cal/g) | | | | | | | |
| | 24 | 78.7 | 5.0 | 6.3 | 84.0 | 5.6 | 6.6 |
| | *23 | 79.5 | 3.1 | 3.9 | 84.0 | 5.7 | 6.8 |
| * Labs Eliminated - 1644 | | | | | | | |
| C186 Heat of Hydration - 28 day (cal/g) | | | | | | | |
| | 19 | 90.5 | 10.1 | 11.1 | 93.0 | 10.6 | 11.4 |
| | *18 | 92.5 | 4.6 | 5.0 | 95.2 | 4.6 | 4.8 |
| * Labs Eliminated - 4115 | | | | | | | |
| C1702 Heat of Hydration - 3 day (J/g) | | | | | | | |
| | 16 | 290 | 69 | 24.1 | 295 | 68 | 23.3 |
| | *15 | 300 | 42 | 13.9 | 305 | 40 | 13.0 |
| * Labs Eliminated - 3605 | | | | | | | |
| C1702 Heat of Hydration - 7 day (J/g) | | | | | | | |
| | 15 | 316 | 81 | 25.7 | 345 | 85 | 24.8 |
| No Labs Eliminated for This Test | | | | | | | |

**CCRL Proficiency Sample Program
C186 Heat of Solution - Dry
PORTLAND CEMENT Samples No. 205 and No. 206**

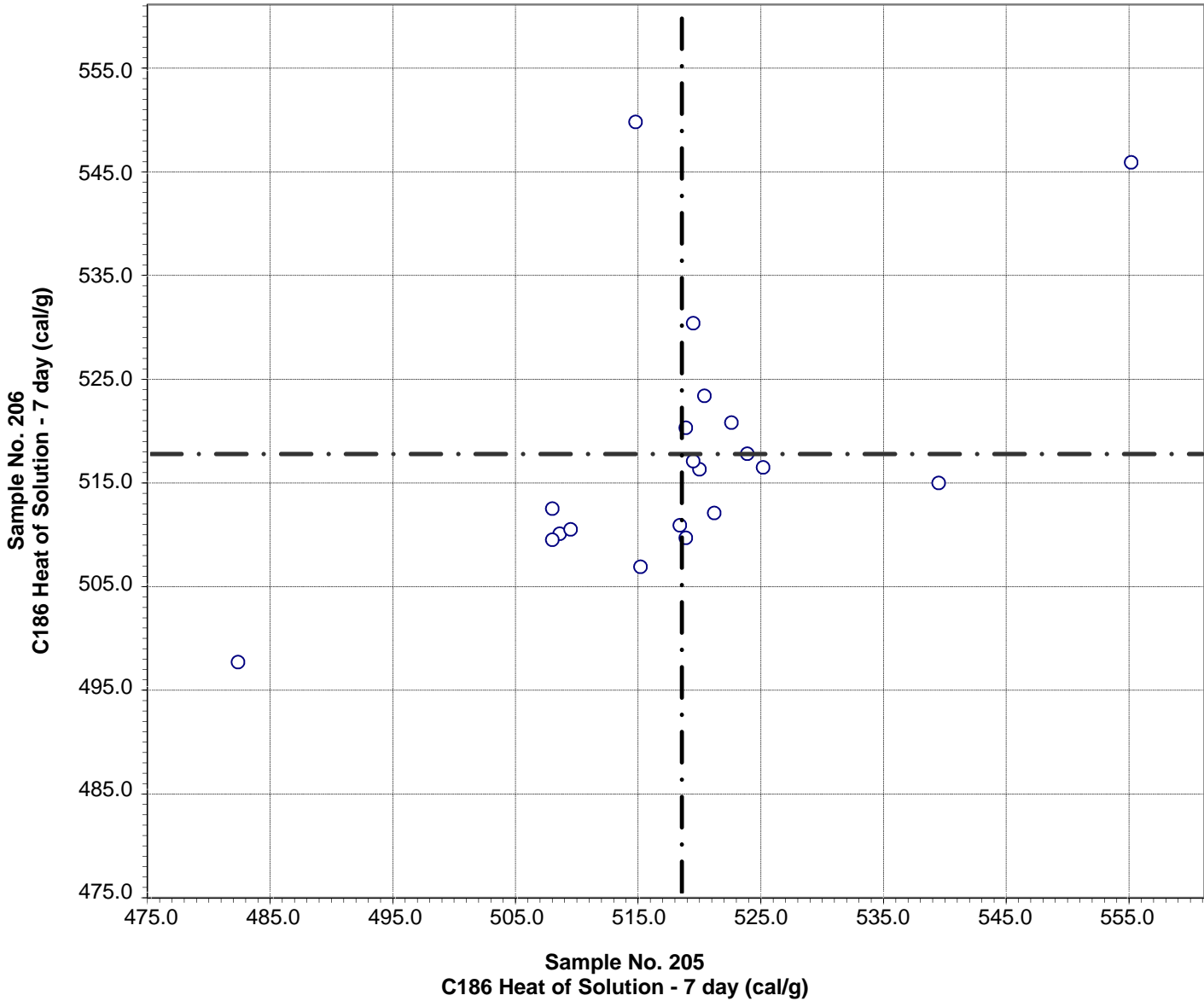


Test No. 291 C186 Heat of Solution - Dry 20 Points

| | | | |
|----------------|-----------|-----------|----------|
| Sample No. 205 | Ave 596.0 | S.D. 11.3 | C.V. 1.9 |
| Sample No. 206 | Ave 598.0 | S.D. 15.4 | C.V. 2.6 |

Labs Eliminated: 148

**CCRL Proficiency Sample Program
C186 Heat of Solution - 7 day
PORTLAND CEMENT Samples No. 205 and No. 206**

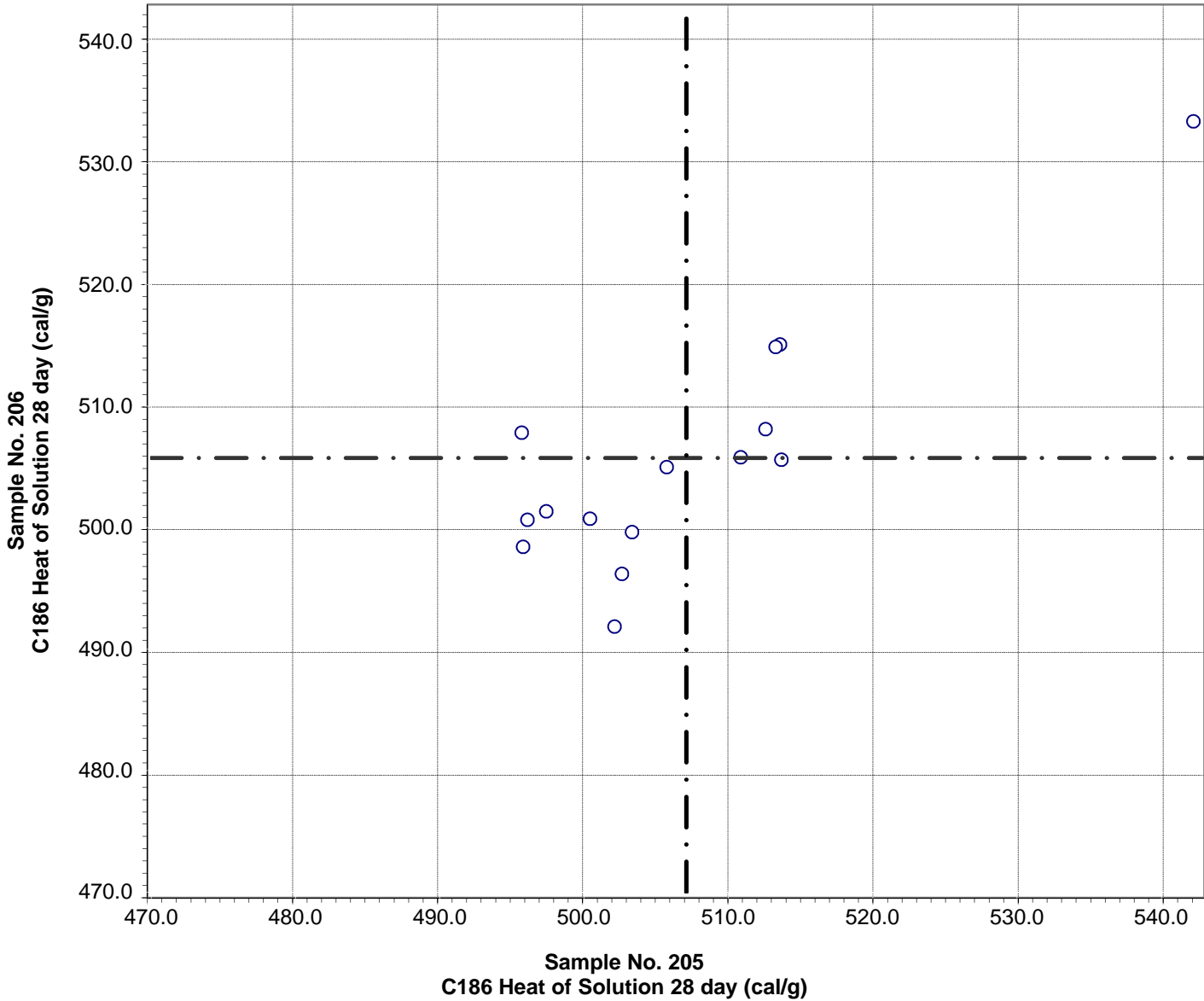


Test No. 292 C186 Heat of Solution - 7 day 20 Points

| | | | |
|----------------|-----------|-----------|----------|
| Sample No. 205 | Ave 518.5 | S.D. 13.8 | C.V. 2.7 |
| Sample No. 206 | Ave 517.7 | S.D. 12.4 | C.V. 2.4 |

Labs Eliminated: 148

**CCRL Proficiency Sample Program
C186 Heat of Solution 28 day
PORTLAND CEMENT Samples No. 205 and No. 206**

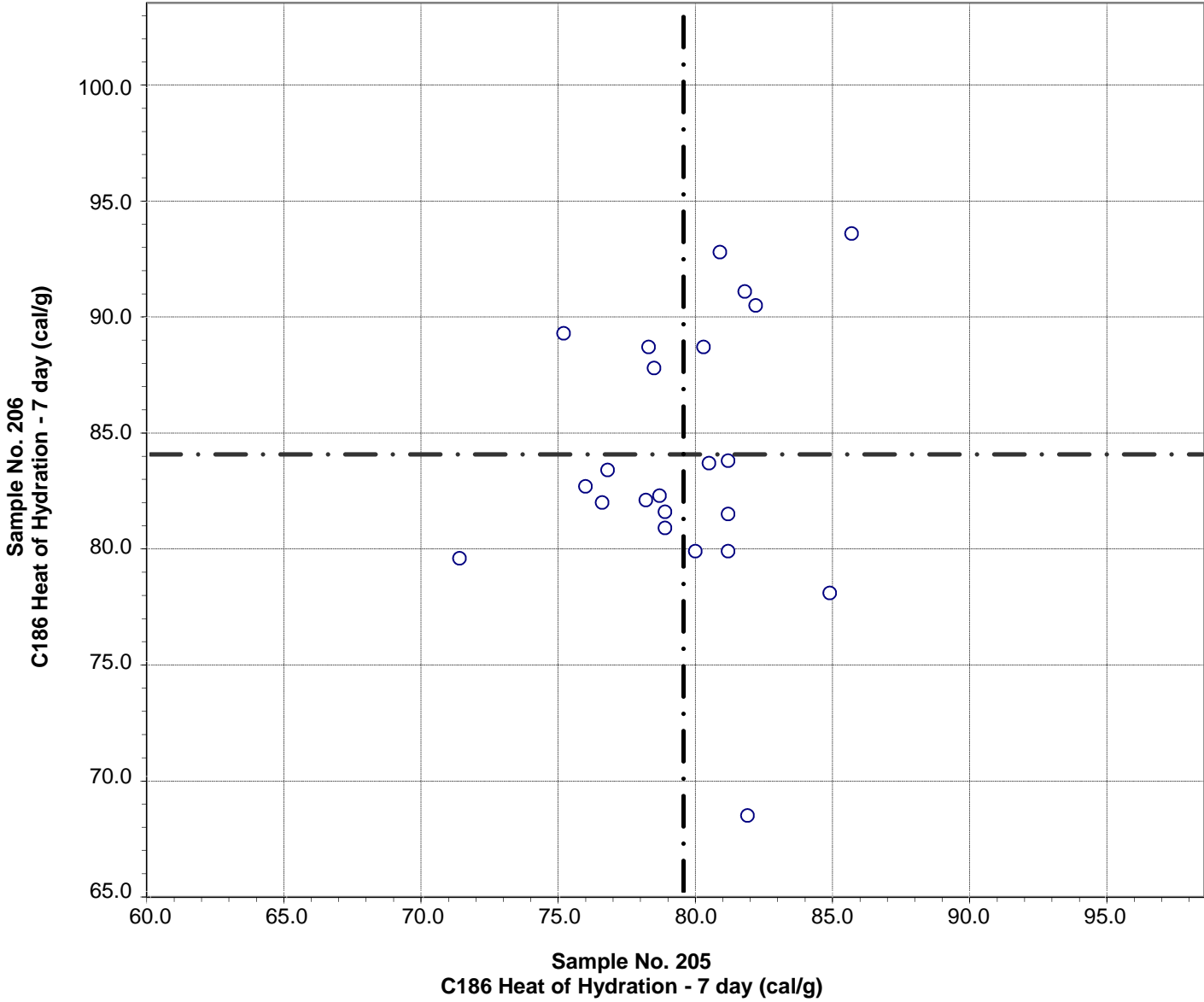


Test No. 301 C186 Heat of Solution 28 day 15 Points

| | | | |
|----------------|-----------|-----------|----------|
| Sample No. 205 | Ave 507.1 | S.D. 11.8 | C.V. 2.3 |
| Sample No. 206 | Ave 505.7 | S.D. 9.9 | C.V. 2.0 |

Labs Eliminated: 148

**CCRL Proficiency Sample Program
C186 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 205 and No. 206**

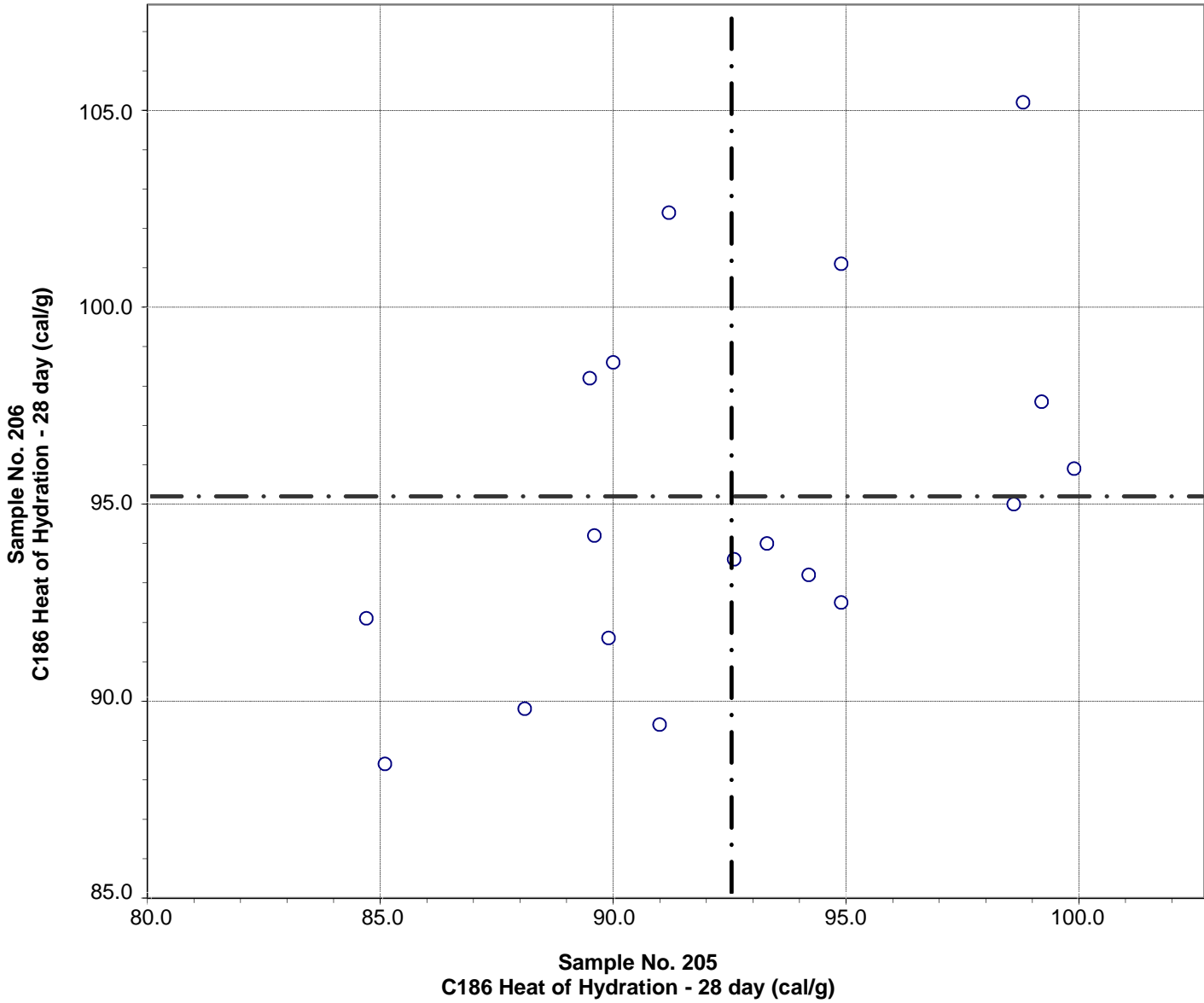


Test No. 290 C186 Heat of Hydration - 7 day 23 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 79.5 | S.D. 3.1 | C.V. 3.9 |
| Sample No. 206 | Ave 84.0 | S.D. 5.7 | C.V. 6.8 |

Labs Eliminated: 1644

**CCRL Proficiency Sample Program
C186 Heat of Hydration - 28 day
PORTLAND CEMENT Samples No. 205 and No. 206**

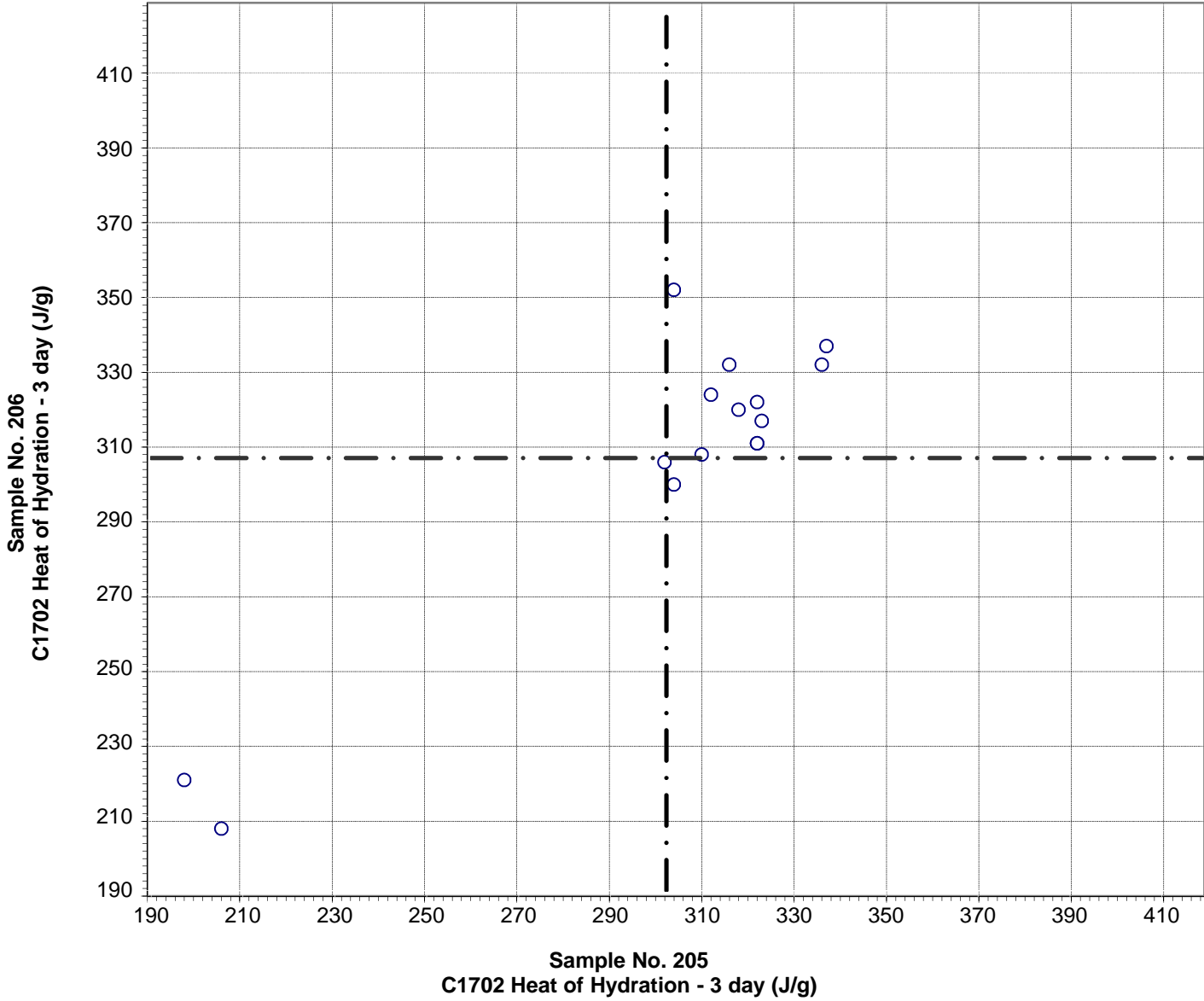


Test No. 300 C186 Heat of Hydration - 28 day 18 Points

| | | | |
|----------------|----------|----------|----------|
| Sample No. 205 | Ave 92.5 | S.D. 4.6 | C.V. 5.0 |
| Sample No. 206 | Ave 95.2 | S.D. 4.6 | C.V. 4.8 |

Labs Eliminated: 4115

CCRL Proficiency Sample Program
C1702 Heat of Hydration - 3 day
PORTLAND CEMENT Samples No. 205 and No. 206

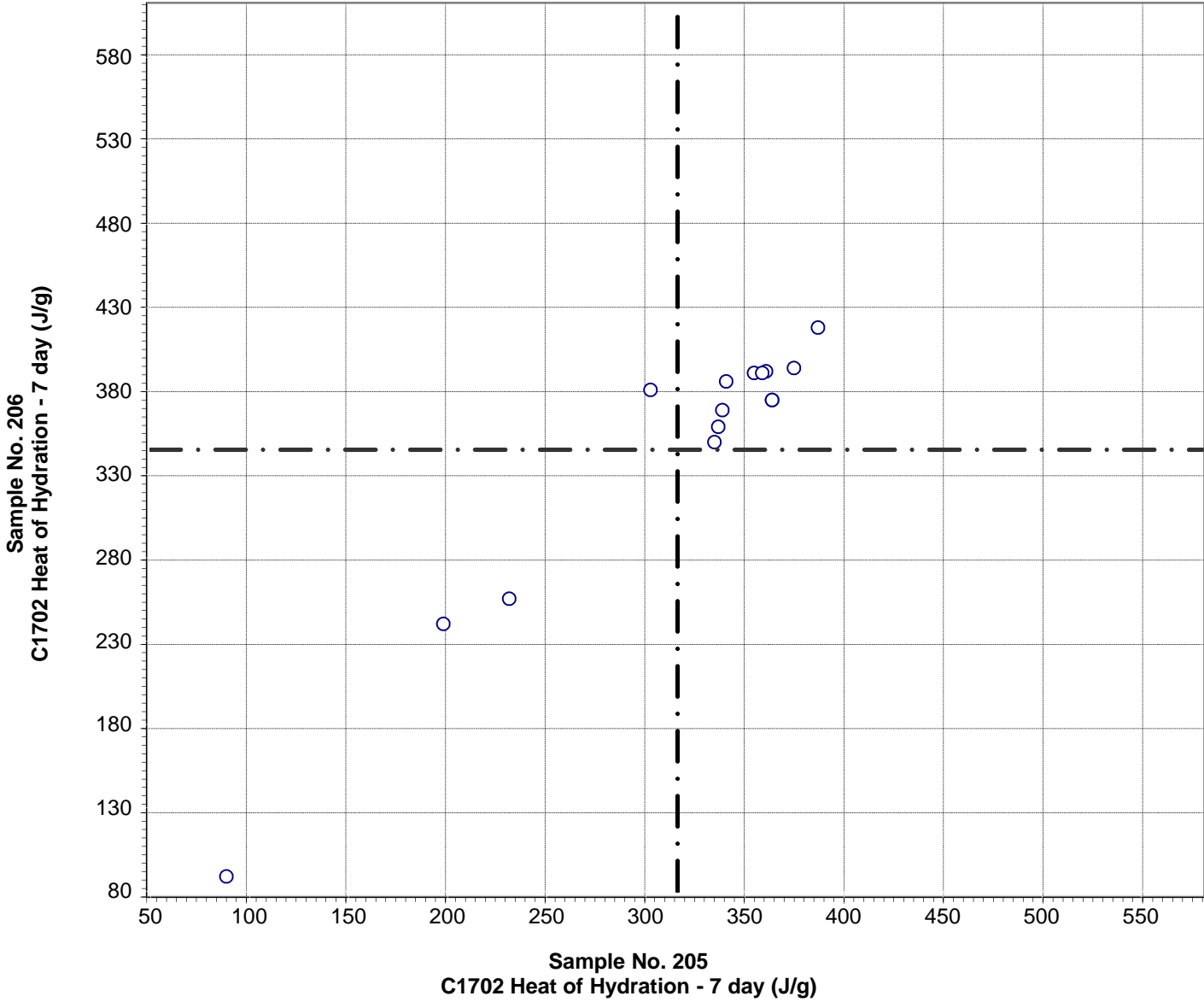


Test No. 500 C1702 Heat of Hydration - 3 day 15 Points

| | | | |
|----------------|---------|---------|-----------|
| Sample No. 205 | Ave 300 | S.D. 42 | C.V. 13.9 |
| Sample No. 206 | Ave 305 | S.D. 40 | C.V. 13.0 |

Labs Eliminated: 3605

**CCRL Proficiency Sample Program
C1702 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 205 and No. 206**



Test No. 510 C1702 Heat of Hydration - 7 day 15 Points

| | | | |
|----------------|---------|---------|-----------|
| Sample No. 205 | Ave 316 | S.D. 81 | C.V. 25.7 |
| Sample No. 206 | Ave 345 | S.D. 85 | C.V. 24.8 |