CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Pozzolan Proficiency Samples
Number 43 and Number 44

October 2008

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CCRL
Cement and Concrete Reference Laboratory

www.ccrl.us

October 23, 2008

TO: Participants in the CCRL Pozzolan Proficiency Sample Program

SUBJECT: Pozzolan Proficiency Samples No. 43 and No. 44

Following is the final report for the pair of CCRL **Pozzolan** Proficiency Samples which were distributed in July 2008. Both samples were a Class F fly ash.

This report consists of two parts and each part must be downloaded from our website located at: http://www.ccrl.us/. One part contains general information that consists of a statistical Summary of Results, a set of Scatter Diagrams, and other associated information. The second part is laboratory specific information that consists of the Table of Results containing test results and ratings for your laboratory.

Calcium Oxide - Depending on the method of analysis used by a laboratory , the values for CaO may contain BaO and SrO or may be CaO only. This report separate CaO into two groups, CaO only and CaO with BaO and SrO.

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 samples 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 Pozzolan Proficiency Samples will be distributed in July 2009.

Sincerely,

Robin K. Haupt

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

To: Participants in the CCRL Pozzolan Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests on Pozzolan Proficiency Samples No. 43 and No. 44

This memo and the material included with it constitute the final report and summary of results for the current pair of Pozzolan Proficiency Samples, which were distributed in July 2008. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of 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.

Table of Results - Laboratory Ratings

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.

The ratings for the individual laboratory were determined in the manner described by Crandall and Blaine using a rating scale 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.

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

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, which 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 test results reported, and then with one or more outlying test results omitted. Sometimes, two or more recalculations with laboratories omitted, have been performed 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 participation in chemical and/or physical tests.

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 may indicate strong evidence of bias in many cases.

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficiency Samples No. 43 and No. 44
Final Report - Chemical Results
October 23, 2008

SUMMARY OF RESULTS

				Sample No. 43			Sample No. 44		
Test			#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Moisture Content	prcnt		63	0.06	0.038	60.1	0.11	0.070	62.1
Moisture Content	prcnt	*	62	0.06	0.032	51.5	0.11	0.049	46.4
Silicon Dioxide	prcnt		56	52.32	2.9	5.49	61.38	3.0	4.82
Silicon Dioxide	prcnt	*	51	51.96	1.3	2.48	61.49	1.7	2.75
Al_2O_3 w/minor[1]	prcnt		25	20.03	1.3	6.43	17.94	1.3	7.41
Al_2O_3 w/minor[1]	prcnt	*	23	19.79	0.80	4.03	17.68	0.99	5.63
[1](P_2O_3 & TiO_2 included)									
Al_2O_3 wo/minor[2]	prcnt		51	18.55	1.0	5.58	16.74	1.1	6.46
Al_2O_3 wo/minor[2]	prcnt	*	49	18.44	0.76	4.14	16.62	0.93	5.57
[2](P_2O_3 & TiO_2 not included)									
Ferric Oxide	prcnt		55	8.46	1.08	12.8	4.80	0.72	15.0
Ferric Oxide	prcnt	*	51	8.60	0.33	3.83	4.73	0.29	6.19
CaO w/minor[3]	prcnt		22	13.35	1.6	12.0	7.66	1.3	17.2
CaO w/minor[3]	prcnt	*	20	13.53	0.38	2.82	7.29	0.39	5.28
[3](SrO & BaO included)									
CaO wo/minor[4]	prcnt		47	12.89	1.06	8.25	7.05	0.86	12.26
CaO wo/minor[4]	prcnt	*	44	13.04	0.41	3.16	6.88	0.27	4.00
[4](SrO & BaO not included)									
Magnesium Oxide	prcnt		60	2.74	0.32	11.7	2.41	0.29	12.1
Magnesium Oxide	prcnt	*	57	2.73	0.20	7.19	2.43	0.20	8.33

CONTINUED ON NEXT PAGE

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

Moisture Content	2522
Silicon Dioxide	3 158 125 2295 2350
Al_2O_3 w/minor	126 2295
Al_2O_3 wo/minor	126 2295
Ferric Oxide	126 158 125 2295
CaO w/minor	158 2295
CaO wo/minor	125 176 2295
Magnesium Oxide	20 52 3135

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficiency Samples No. 43 and No. 44
Final Report - Chemical Results
October 23, 2008

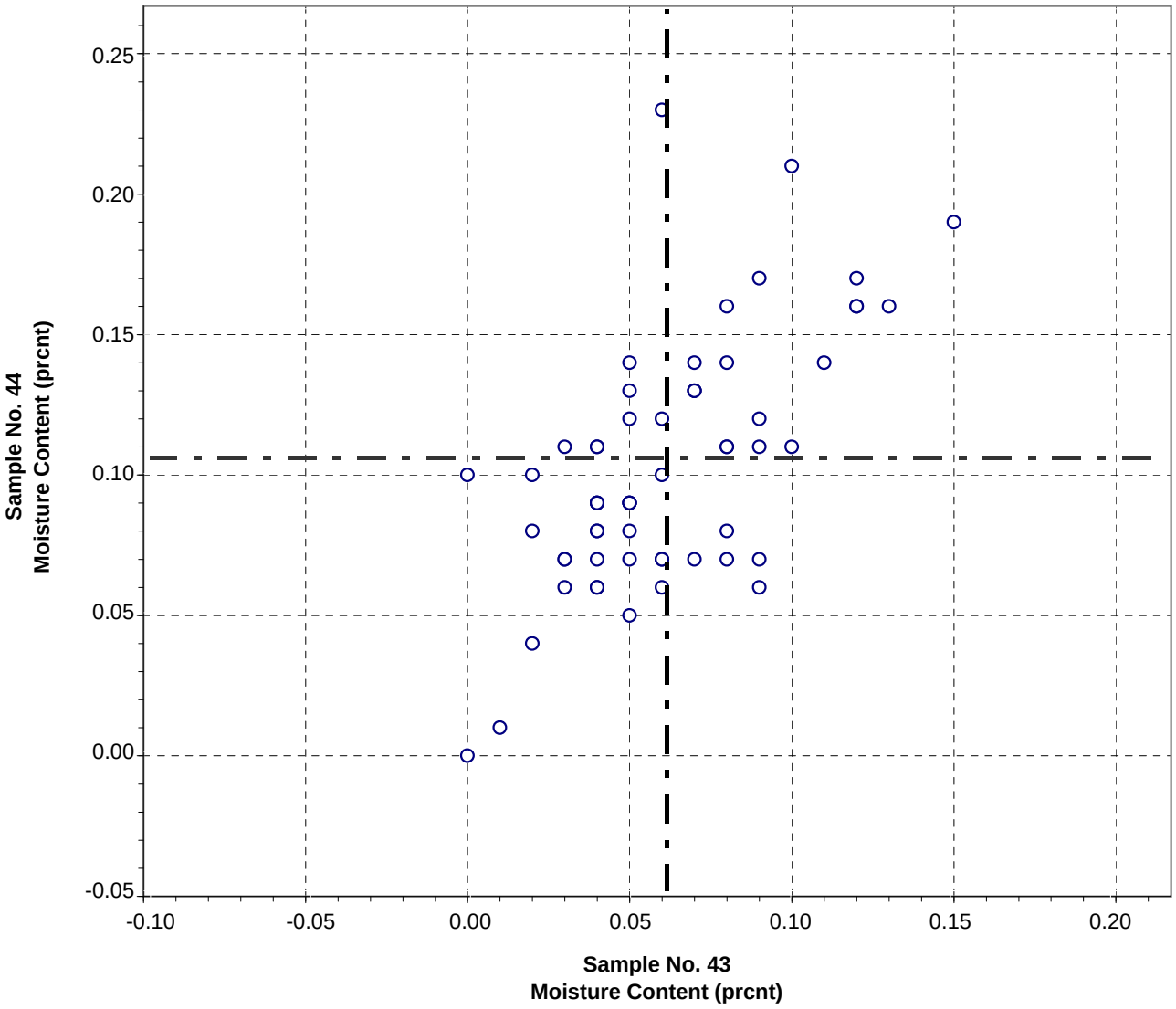
SUMMARY OF RESULTS

			Sample No. 43			Sample No. 44		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Sulfur Trioxide	prcnt	64	0.65	0.26	40.3	0.67	0.74	109.2
Sulfur Trioxide	prcnt	* 61	0.63	0.072	11.4	0.59	0.080	13.7
Loss on Ignition	prcnt	74	0.17	0.29	168.0	0.41	0.23	55.6
Loss on Ignition	prcnt	* 68	0.11	0.058	54.0	0.38	0.093	24.3
Sodium Oxide	prcnt	56	0.57	0.17	29.6	2.85	0.53	18.5
Sodium Oxide	prcnt	* 51	0.54	0.067	12.51	2.88	0.190	6.61
Potassium Oxide	prcnt	58	1.20	0.14	11.32	1.53	0.14	9.50
Potassium Oxide	prcnt	* 55	1.18	0.059	5.00	1.52	0.089	5.82
Available Na_2O	prcnt	30	0.28	0.27	98.5	1.47	1.04	70.6
Available Na_2O	prcnt	* 28	0.22	0.068	31.5	1.24	0.345	27.8
Available K_2O	prcnt	30	0.47	0.42	89.2	0.66	0.54	81.0
Available K_2O	prcnt	* 28	0.38	0.15	40.5	0.54	0.21	38.6
Available Alkali	prcnt	28	0.48	0.16	32.1	1.62	0.47	28.9

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

Sulfur Trioxide	15 29 1379
Loss on Ignition	2295 169 207 58 2522 3135
Sodium Oxide	125 176 48 1038 2295
Potassium Oxide	25 176 2295
Available Sodium Oxide	207 2522
Available Potassium Oxide	207 2522

CCRL Proficiency Sample Program
Moisture Content
POZZOLAN Samples No. 43 and No. 44



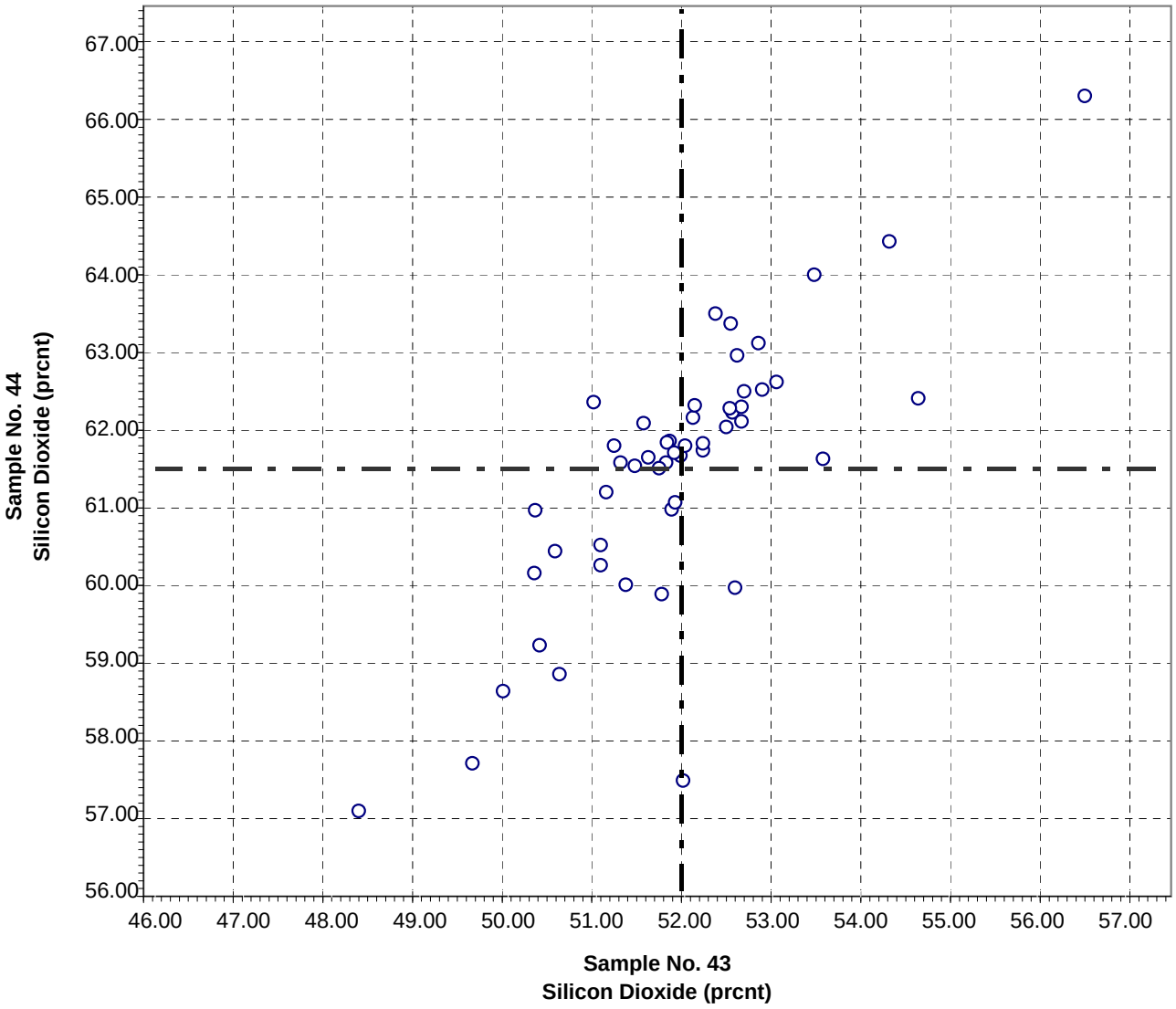
Test No. 5 Moisture Content 61 Points

Sample No. 43	Ave	0.06	S.D.	0.032	C.V. 51.5
Sample No. 44	Ave	0.11	S.D.	0.049	C.V. 46.4

Labs eliminated: 2522

Labs off Diagram: 126

CCRL Proficiency Sample Program
Silicon Dioxide
POZZOLAN Samples No. 43 and No. 44

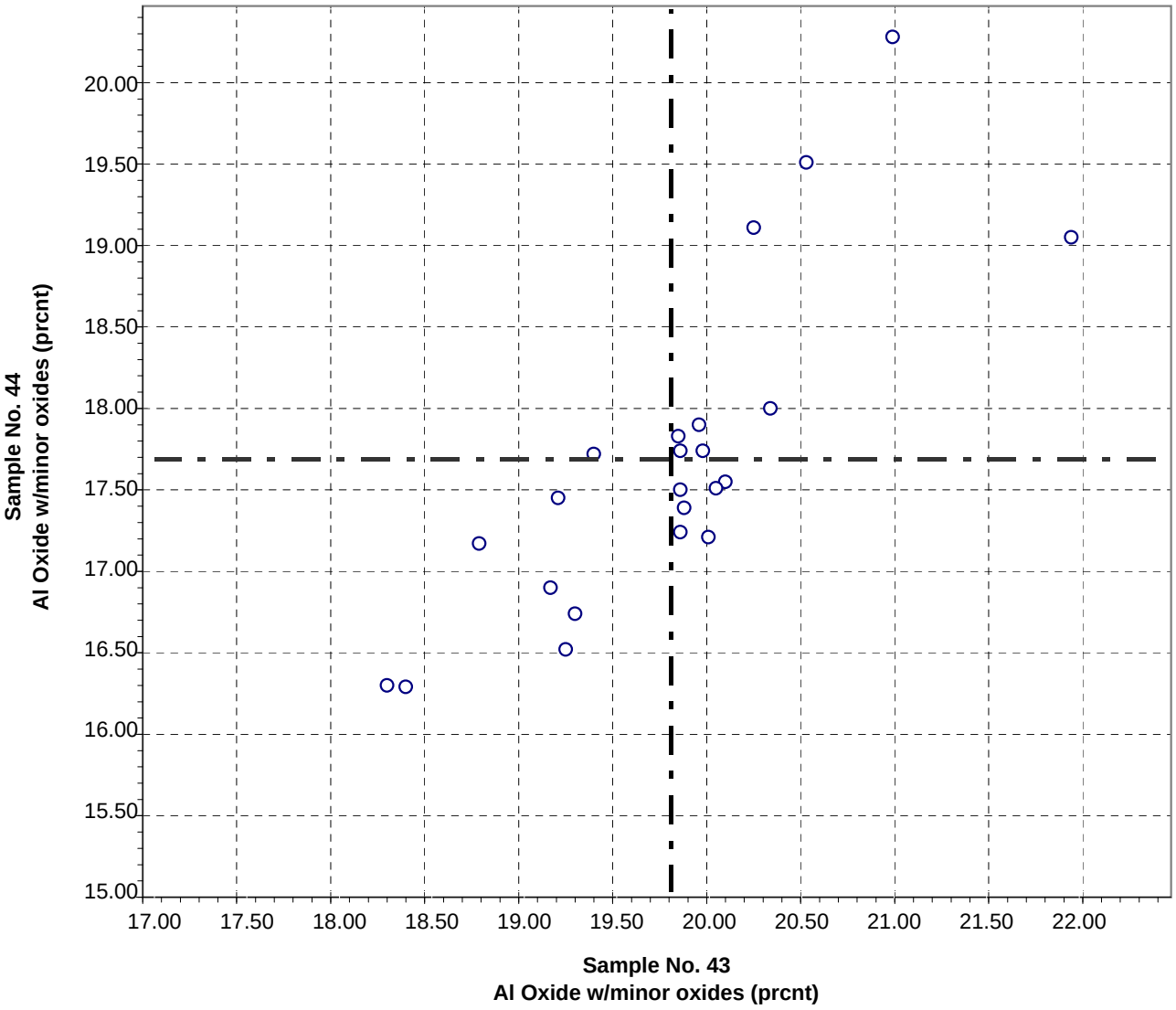


Test No. 10 Silicon Dioxide 51 Points

Sample No. 43	Ave	51.96	S.D.	1.3	C.V.	2.48
Sample No. 44	Ave	61.49	S.D.	1.7	C.V.	2.75

Labs eliminated: 3, 158, 125, 2295, 2350

CCRL Proficiency Sample Program
Aluminum Oxide (minor oxides included)
POZZOLAN Samples No. 43 and No. 44

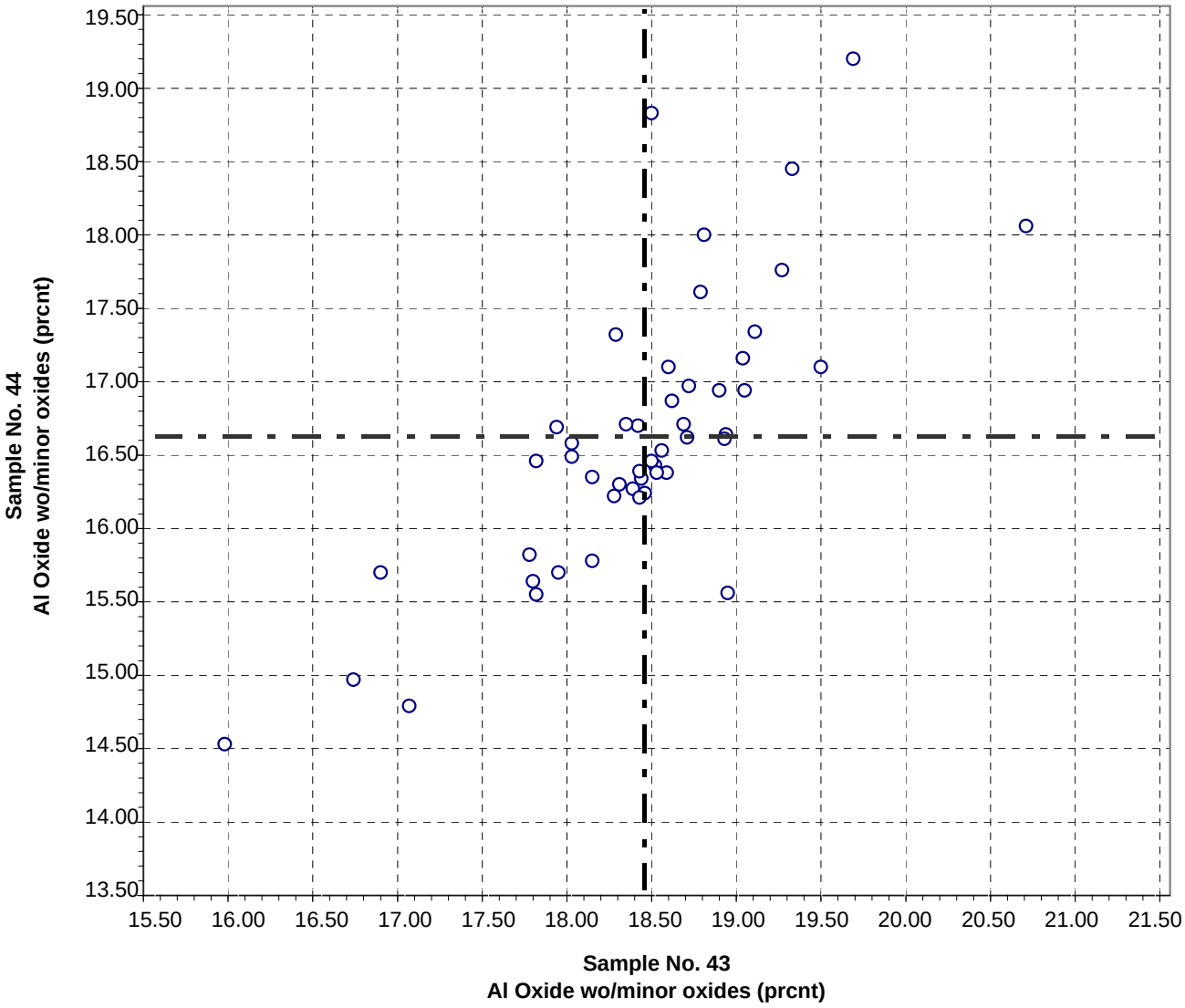


Test No. 20 Aluminum Oxide (minor oxides included) 23 Points

Sample No. 43	Ave	19.79	S.D.	0.80	C.V. 4.03
Sample No. 44	Ave	17.68	S.D.	0.99	C.V. 5.63

Labs eliminated: 126, 2295

CCRL Proficiency Sample Program
Aluminum Oxide (minor oxides excluded)
POZZOLAN Samples No. 43 and No. 44

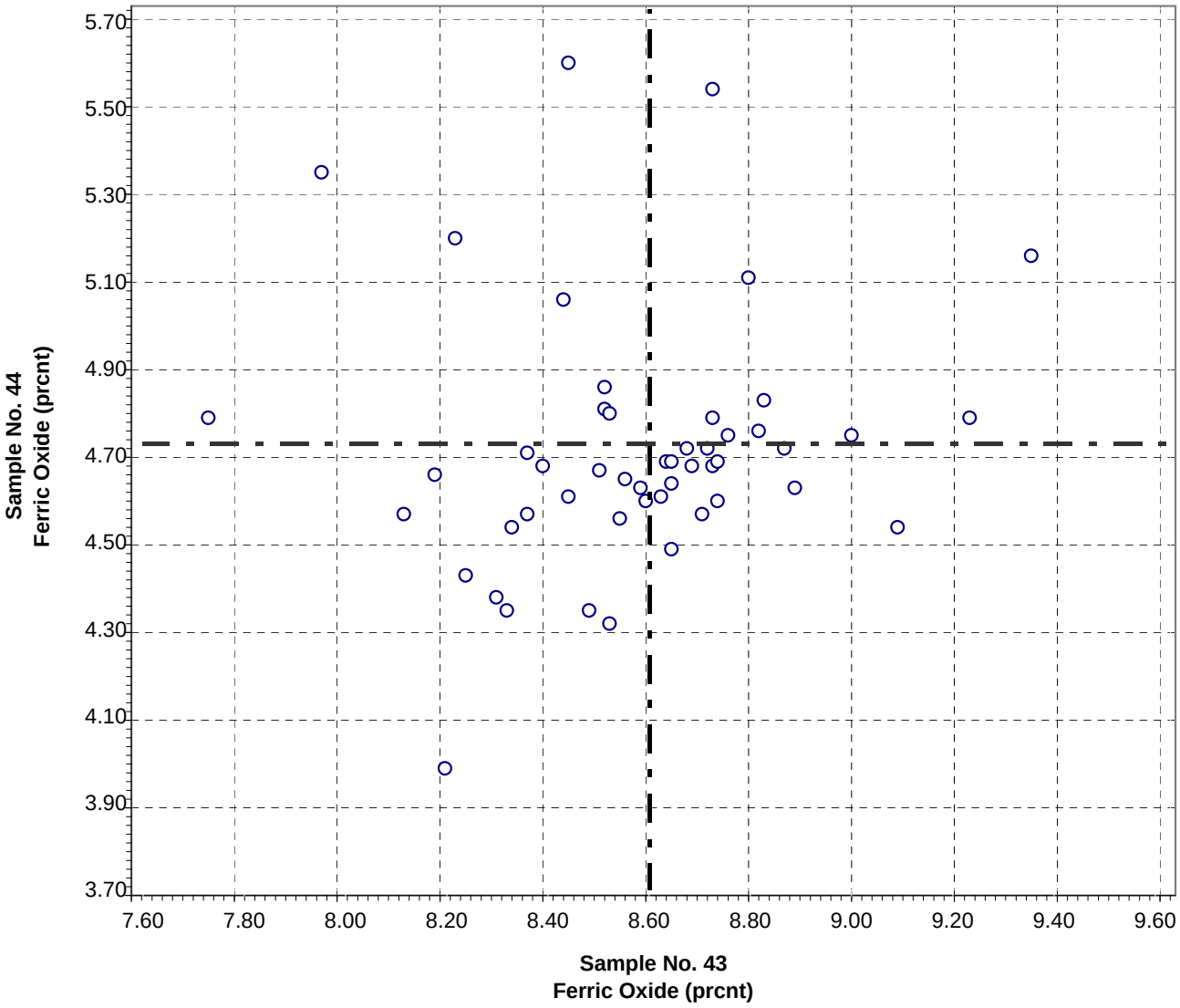


Test No. 21 Aluminum Oxide (minor oxides excluded) 49 Points

Sample No. 43	Ave	18.44	S.D.	0.76	C.V. 4.14
Sample No. 44	Ave	16.62	S.D.	0.93	C.V. 5.57

Labs eliminated: 126, 2295

CCRL Proficiency Sample Program
Ferric Oxide
POZZOLAN Samples No. 43 and No. 44



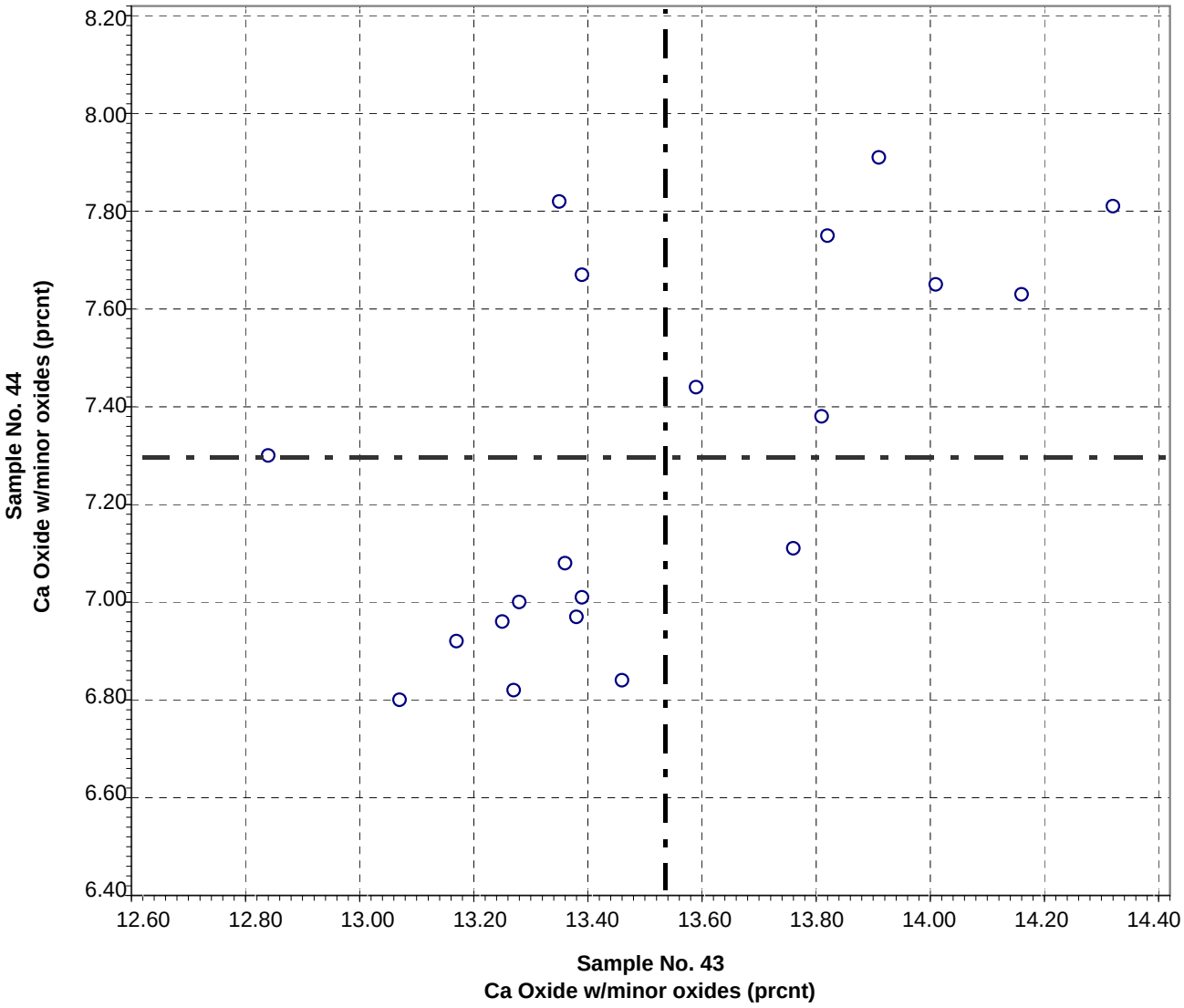
Test No. 30 Ferric Oxide 50 Points

Sample No. 43	Ave	8.60	S.D.	0.33	C.V.	3.83
Sample No. 44	Ave	4.73	S.D.	0.29	C.V.	6.19

Labs eliminated: 126, 158, 125, 2295

Labs off Diagram: 881

CCRL Proficiency Sample Program
Calcium Oxide (minor oxides included)
POZZOLAN Samples No. 43 and No. 44

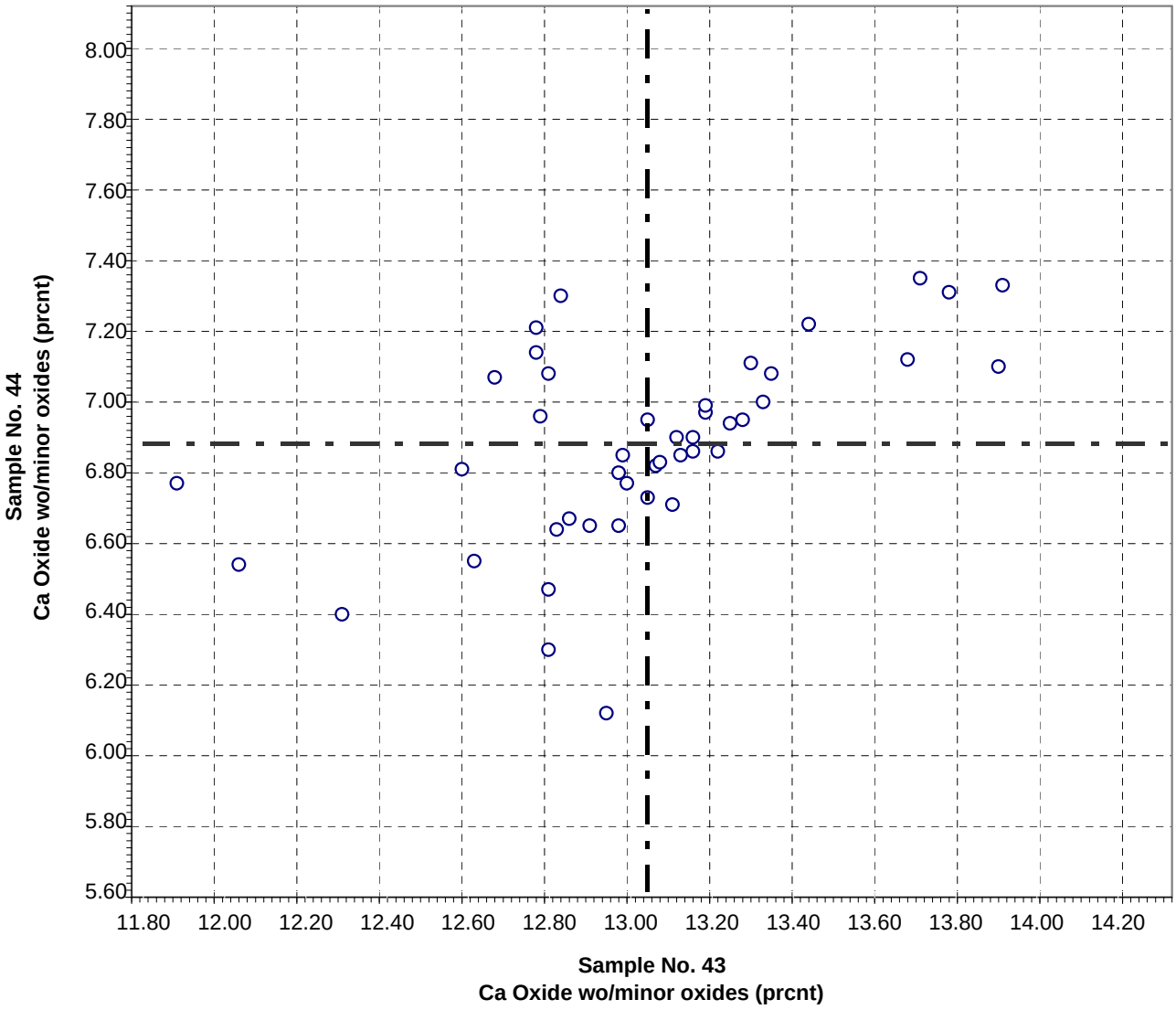


Test No. 40 Calcium Oxide (minor oxides included) 20 Points

Sample No. 43	Ave 13.53	S.D. 0.38	C.V. 2.82
Sample No. 44	Ave 7.29	S.D. 0.39	C.V. 5.28

Labs eliminated: 158, 2295

CCRL Proficiency Sample Program
Calcium Oxide (minor oxides excluded)
POZZOLAN Samples No. 43 and No. 44

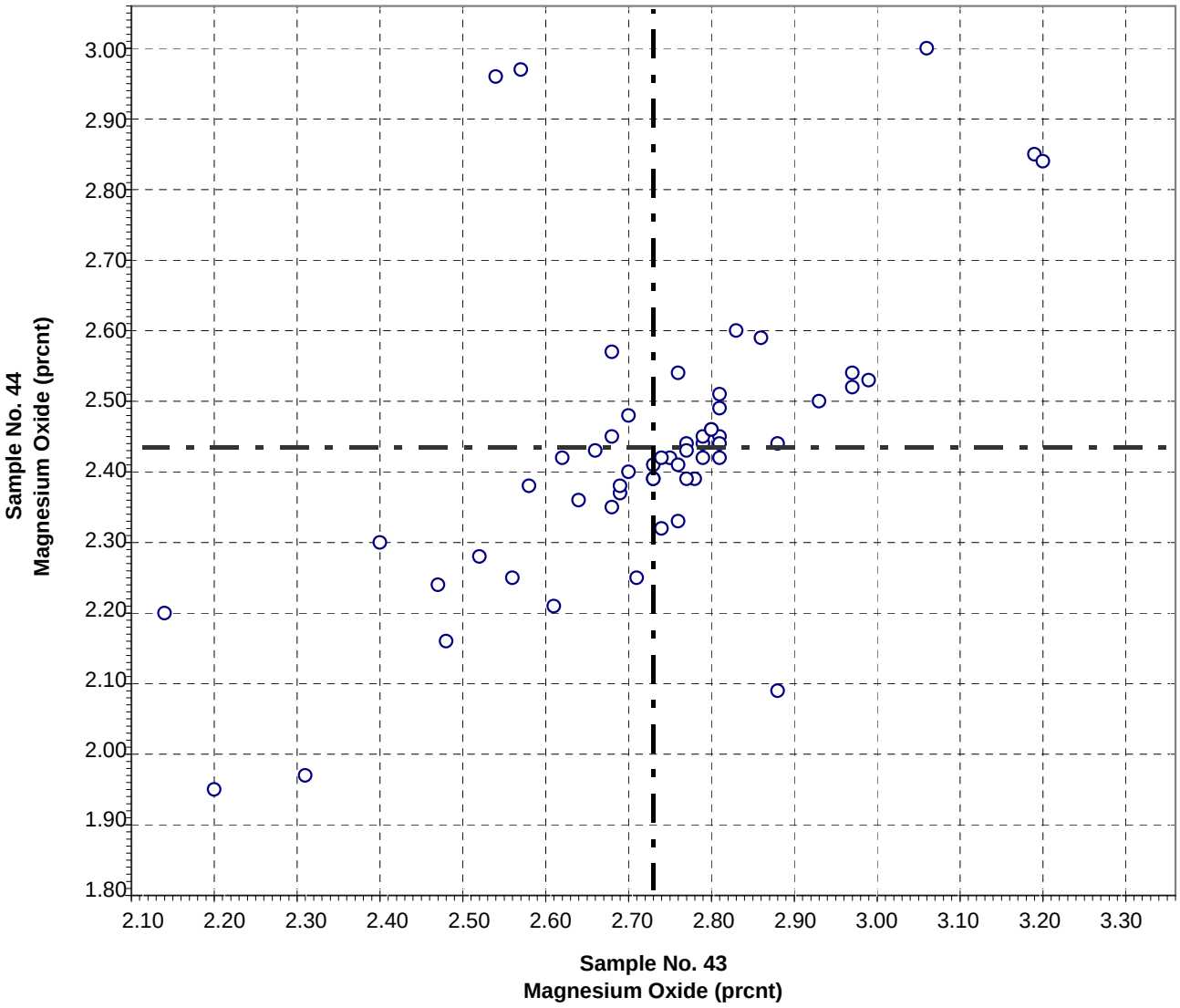


Test No. 42 Calcium Oxide (minor oxides excluded) 44 Points

Sample No. 43 Ave 13.04 S.D. 0.41 C.V. 3.16
Sample No. 44 Ave 6.88 S.D. 0.27 C.V. 4.00

Labs eliminated: 125, 176, 2295

CCRL Proficiency Sample Program
Magnesium Oxide
POZZOLAN Samples No. 43 and No. 44

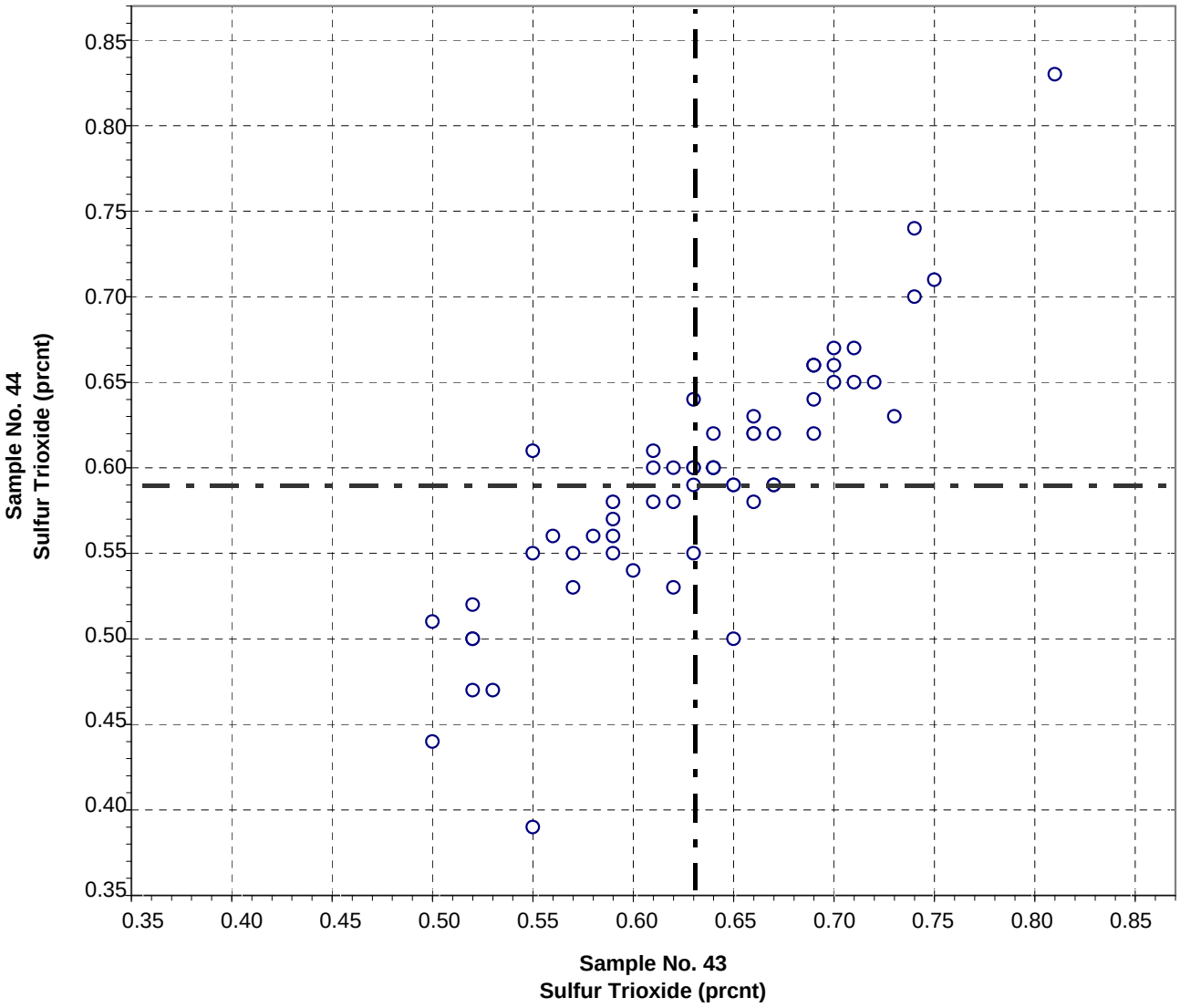


Test No. 50 Magnesium Oxide 57 Points

Sample No. 43	Ave	2.73	S.D.	0.20	C.V. 7.19
Sample No. 44	Ave	2.43	S.D.	0.20	C.V. 8.33

Labs eliminated: 20, 52, 3135

CCRL Proficiency Sample Program
Sulfur Trioxide
POZZOLAN Samples No. 43 and No. 44



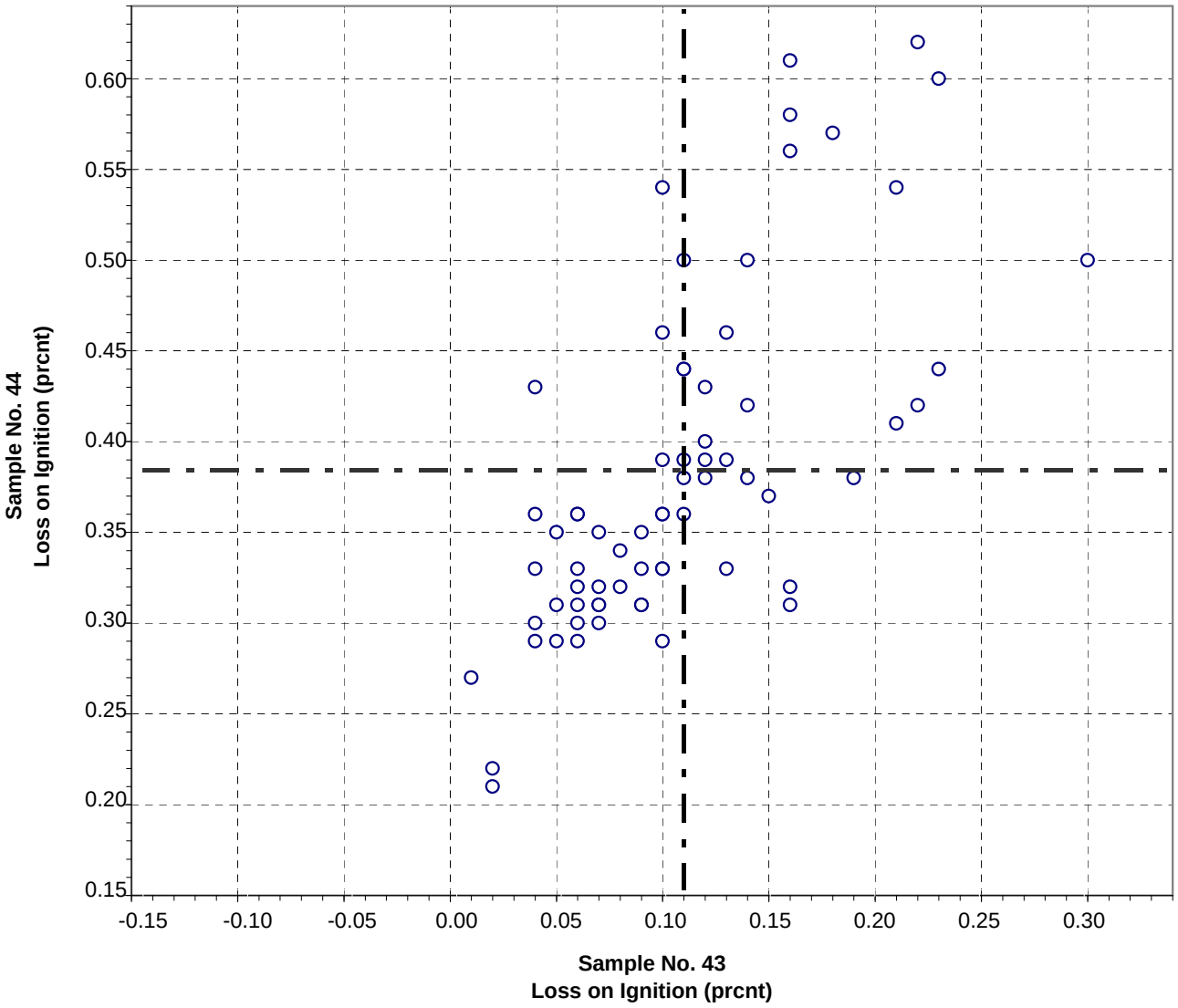
Test No. 60 Sulfur Trioxide 60 Points

Sample No. 43	Ave	0.63	S.D.	0.072	C.V.	11.4
Sample No. 44	Ave	0.59	S.D.	0.080	C.V.	13.7

Labs eliminated: 15, 29, 1379

Labs off Diagram: 2975

CCRL Proficiency Sample Program
Loss on Ignition
POZZOLAN Samples No. 43 and No. 44

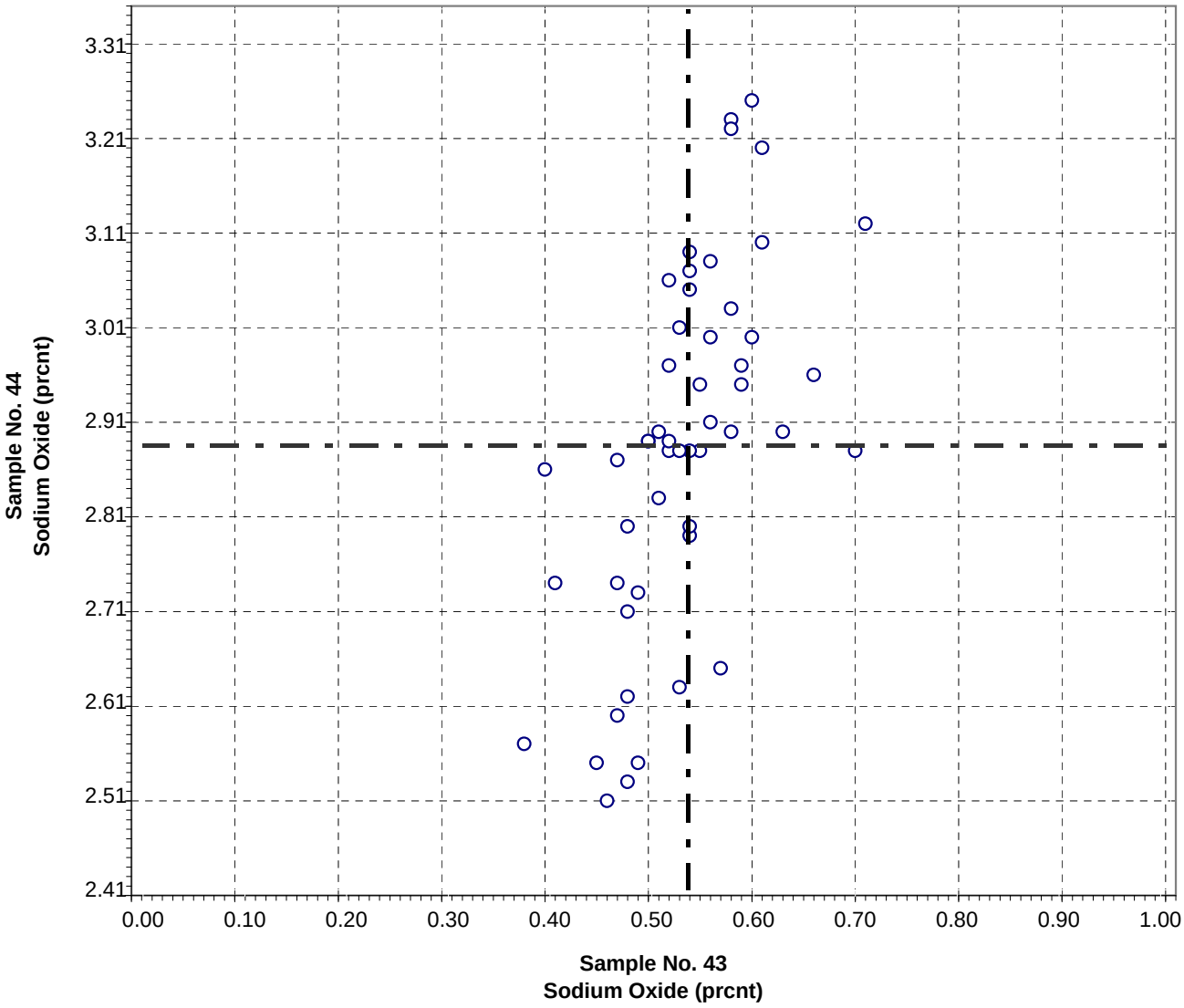


Test No. 70 Loss on Ignition 68 Points

Sample No. 43	Ave	0.11	S.D.	0.058	C.V. 54.0
Sample No. 44	Ave	0.38	S.D.	0.093	C.V. 24.3

Labs eliminated: 2295, 169, 207, 58, 2522, 3135

CCRL Proficiency Sample Program
Sodium Oxide
POZZOLAN Samples No. 43 and No. 44

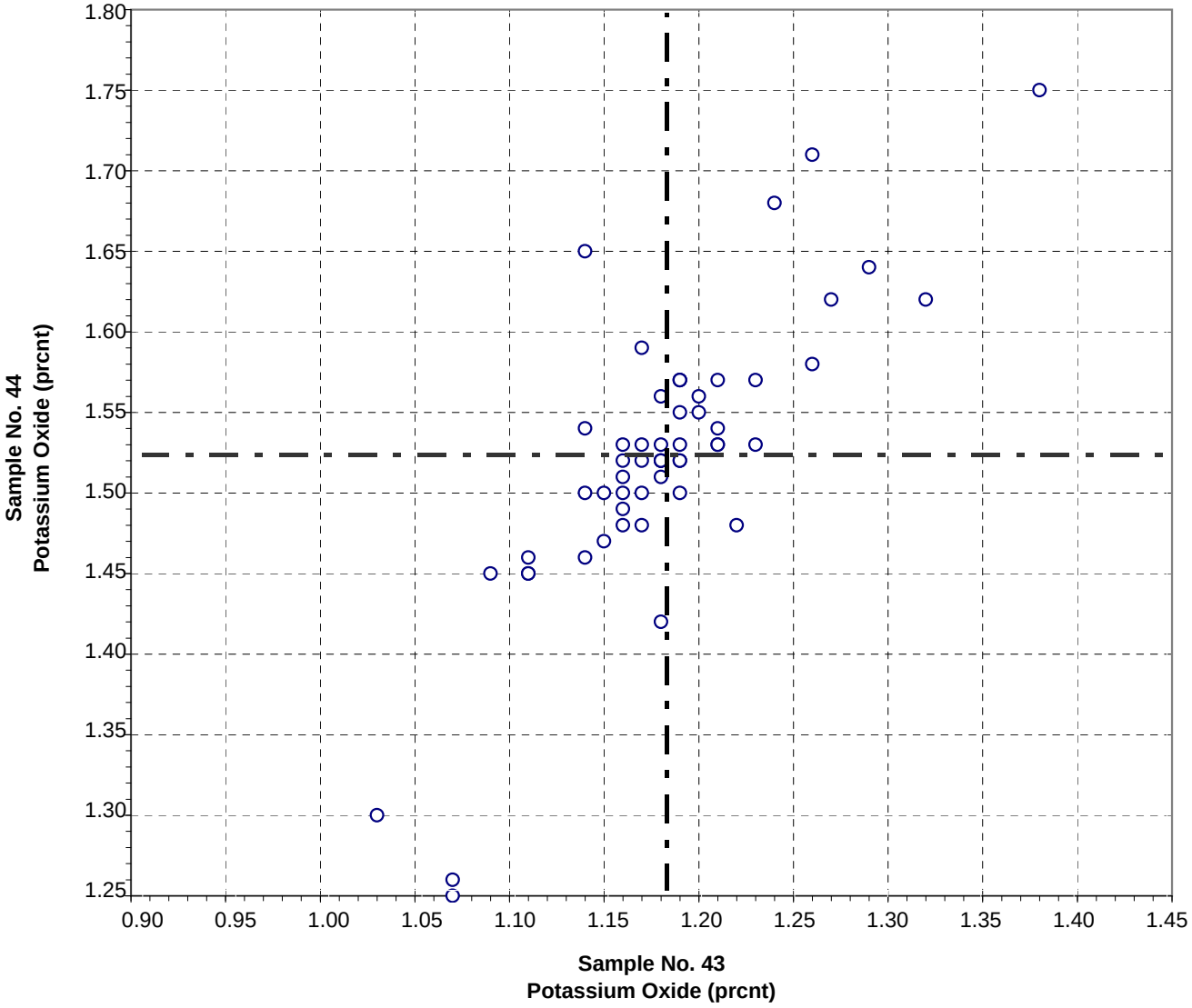


Test No. 90 Sodium Oxide 51 Points

Sample No. 43	Ave	0.54	S.D.	0.067	C.V.	12.51
Sample No. 44	Ave	2.88	S.D.	0.190	C.V.	6.61

Labs eliminated: 125, 176, 48, 1038, 2295

CCRL Proficiency Sample Program
Potassium Oxide
POZZOLAN Samples No. 43 and No. 44

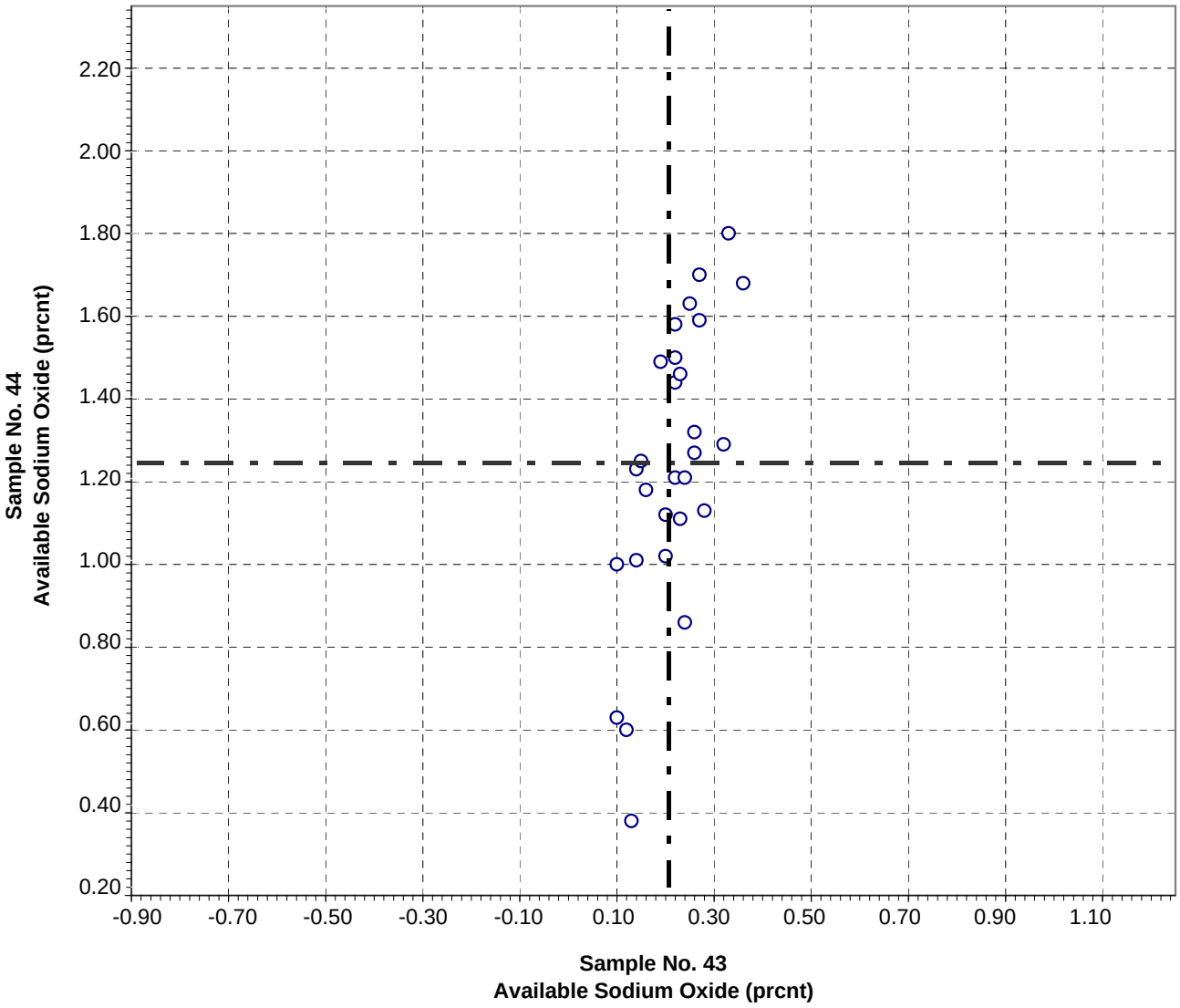


Test No. 100 Potassium Oxide 55 Points

Sample No. 43	Ave	1.18	S.D.	0.059	C.V. 5.00
Sample No. 44	Ave	1.52	S.D.	0.089	C.V. 5.82

Labs eliminated: 25, 176, 2295

CCRL Proficiency Sample Program
Available Sodium Oxide
POZZOLAN Samples No. 43 and No. 44

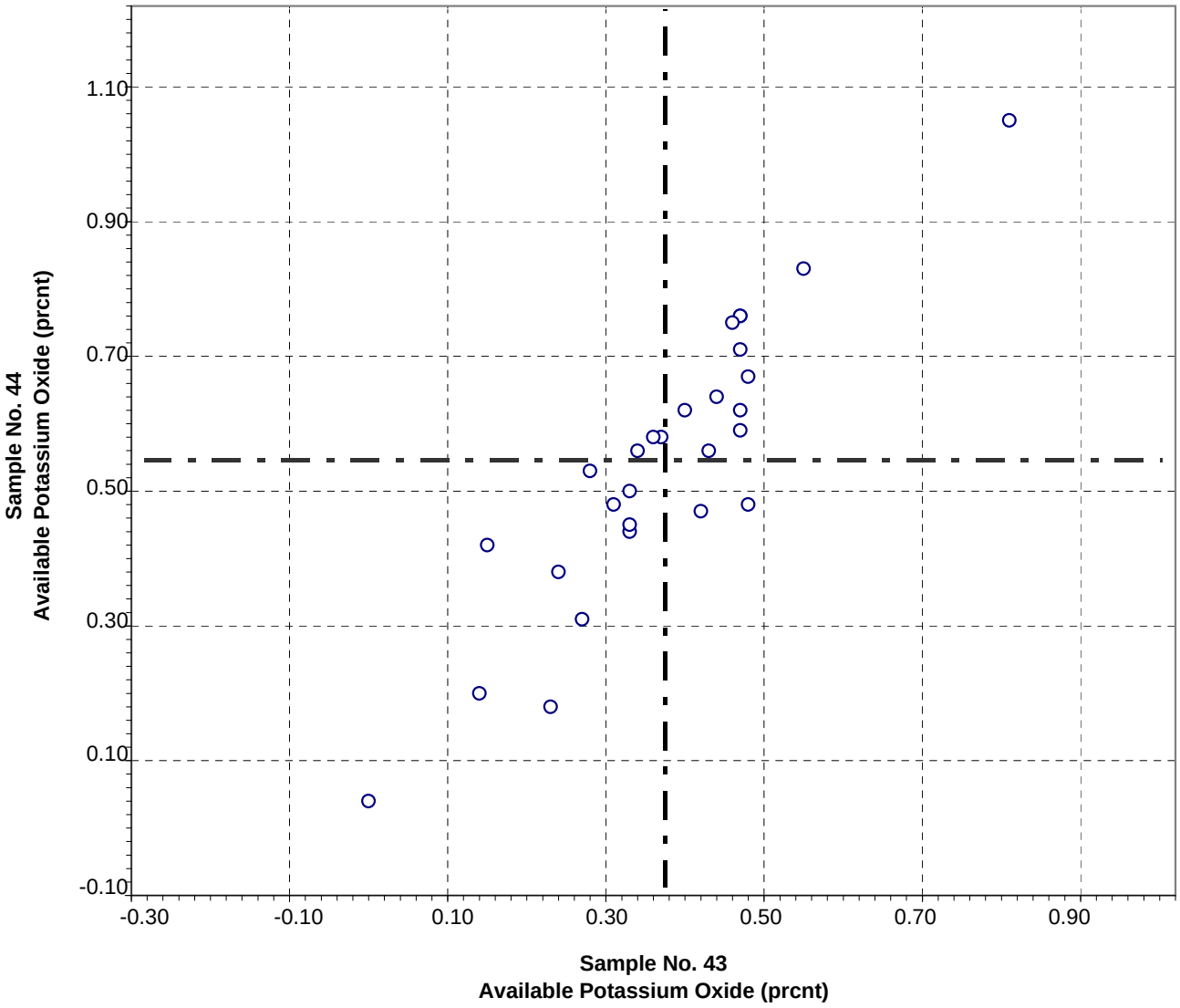


Test No. 91 Available Sodium Oxide 28 Points

Sample No. 43	Ave	0.22	S.D.	0.068	C.V. 31.5
Sample No. 44	Ave	1.24	S.D.	0.345	C.V. 27.8

Labs eliminated: 207, 2522

CCRL Proficiency Sample Program
Available Potassium Oxide
POZZOLAN Samples No. 43 and No. 44

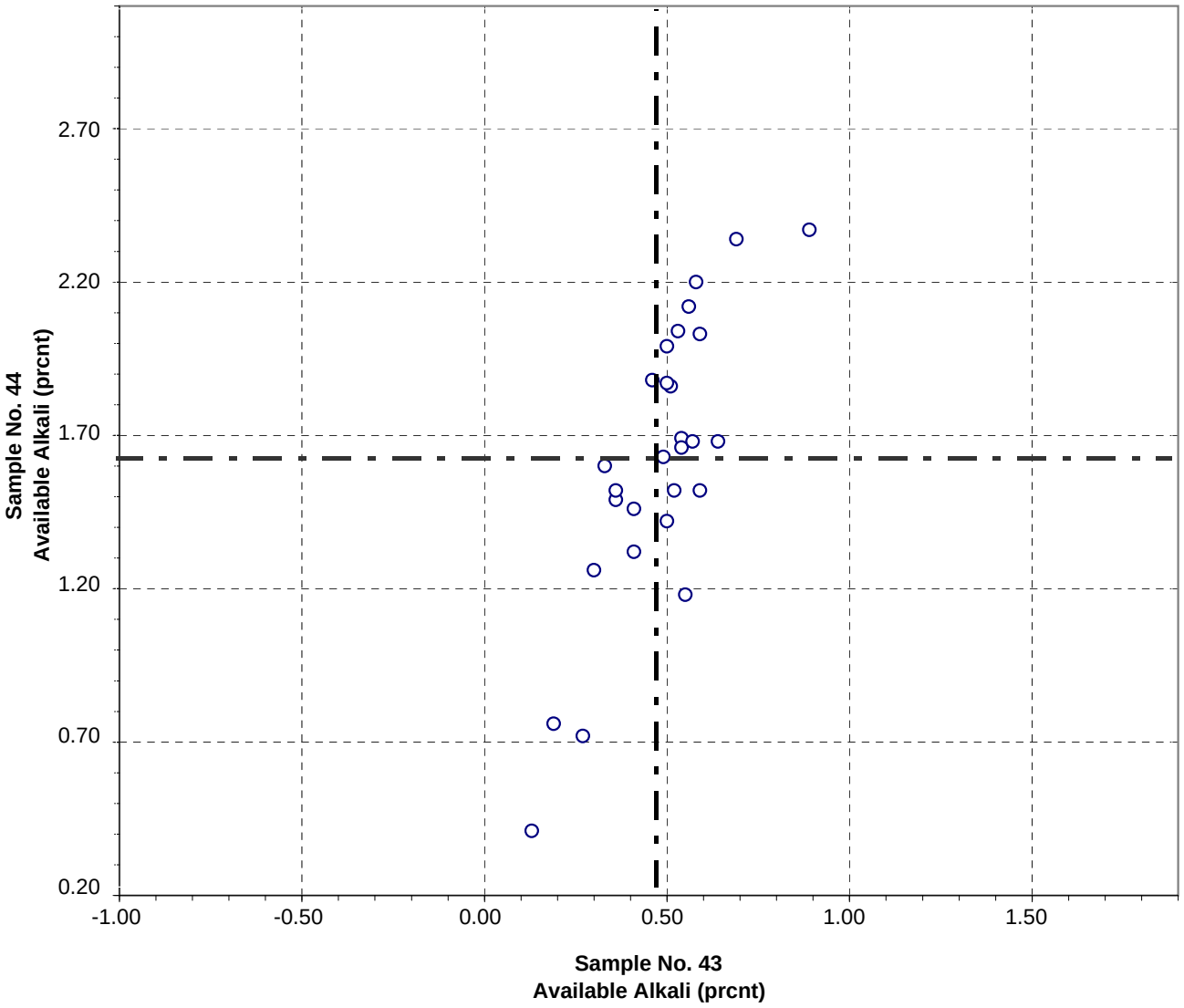


Test No. 93 Available Potassium Oxide 28 Points

Sample No. 43	Ave	0.38	S.D.	0.15	C.V. 40.5
Sample No. 44	Ave	0.54	S.D.	0.21	C.V. 38.6

Labs eliminated: 207, 2522

CCRL Proficiency Sample Program
Available Alkali
POZZOLAN Samples No. 43 and No. 44



Test No. 95 Available Alkali 28 Points

Sample No. 43	Ave	0.48	S.D.	0.16	C.V. 32.1
Sample No. 44	Ave	1.62	S.D.	0.47	C.V. 28.9

CCRL PROFICIENCY SAMPLE PROGRAM
Pozzolan Proficiency Sample No. 43 and No. 44
Final Report - Physical Results
October 23, 2008

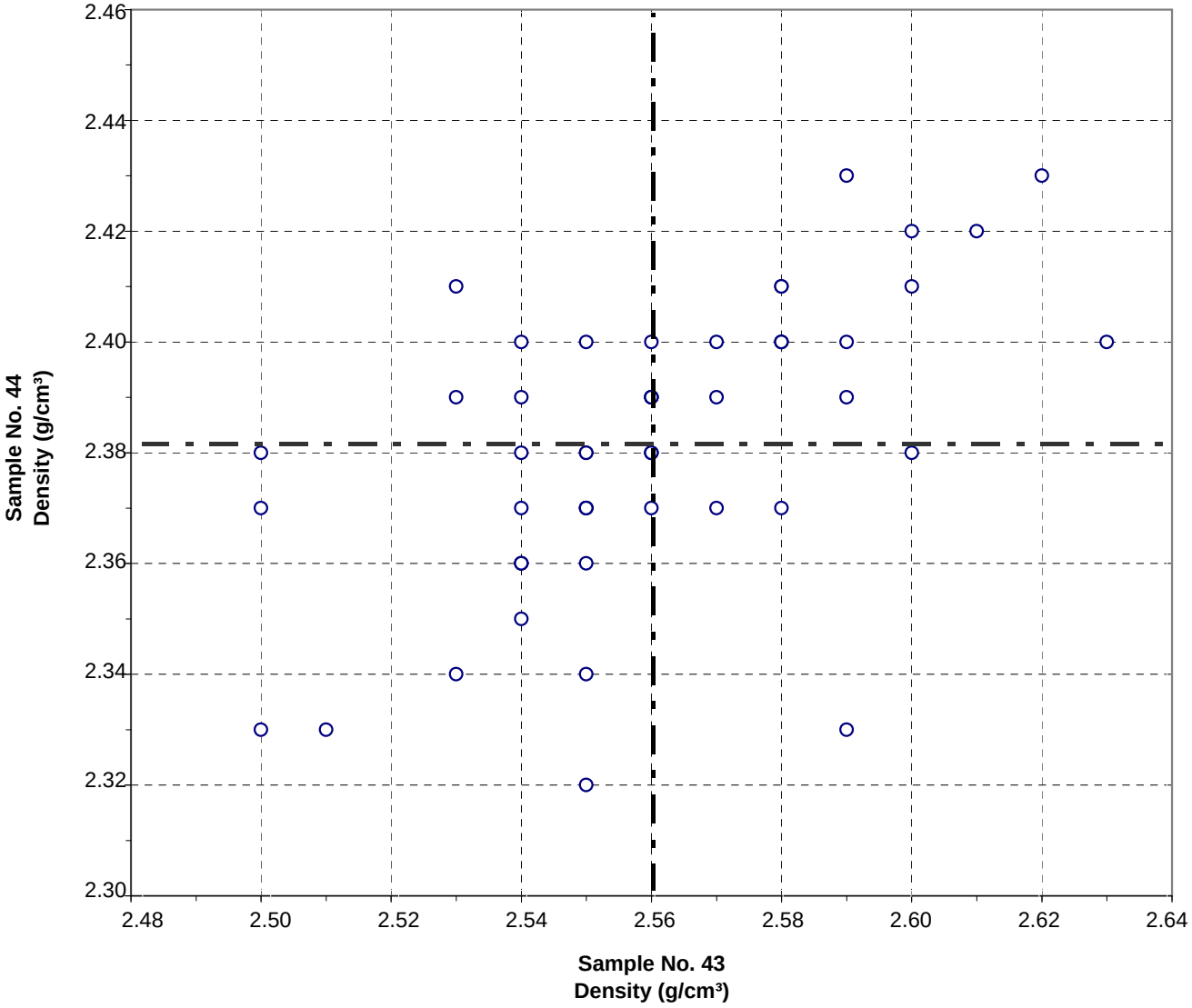
SUMMARY OF RESULTS

				Sample No. 43			Sample No. 44		
Test			#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Density	g/cm^3		58	2.56	0.032	1.24	2.40	0.083	3.47
Density	g/cm^3	*	53	2.56	0.028	1.11	2.38	0.025	1.07
45µm Sieve	prcnt		74	19.91	5.1	25.6	19.43	3.3	17.0
45µm Sieve	prcnt	*	70	19.84	2.44	12.31	19.85	1.87	9.44
Drying Shrinkage	prcnt		17	-0.007	0.016	-221.10	-0.006	0.016	-282.44
Drying Shrinkage	prcnt	*	16	-0.004	0.0069	-187.55	-0.002	0.0053	-264.58
Autocl Expan	prcnt		52	0.03	0.054	160	0.08	0.106	141
Autocl Expan	prcnt	*	48	0.02	0.013	57.1	0.06	0.016	29.5
N.C. Water	prcnt		55	22.6	0.59	2.61	23.2	0.56	2.40
Air Entrainment	prcnt		8	0.064	0.085	132	0.069	0.085	123
STRENGTH ACTIVITY INDEX (SAI) WITH PORTLAND CEMENT									
SAI 7 day	prcnt		62	83	4.5	5.38	85	4.3	5.03
SAI 28 day	prcnt		56	89	4.4	5.00	90	4.2	4.71
SAI Water	prcnt		61	91	11.7	12.9	91	11.8	12.9
SAI Water	prcnt	*	58	93	1.3	1.41	94	1.3	1.39
EFFECTIVENESS OF MINERAL ADMIXTURES IN CONTROLLING ALKALI-SILICA REACTIONS (ASR)									
Reduction Expan	prcnt		10	69	24.6	35.7	36	18.5	52.1

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

Density	125 207 1221 1435 2295
Fineness - 45µm Sieve	38 176 1323 1435
Drying Shrinkage	207
Autoclave Expansion	958 36 1435 2295
SAI Water Requirement	870 1379 2295

CCRL Proficiency Sample Program
Density
POZZOLAN Samples No. 43 and No. 44

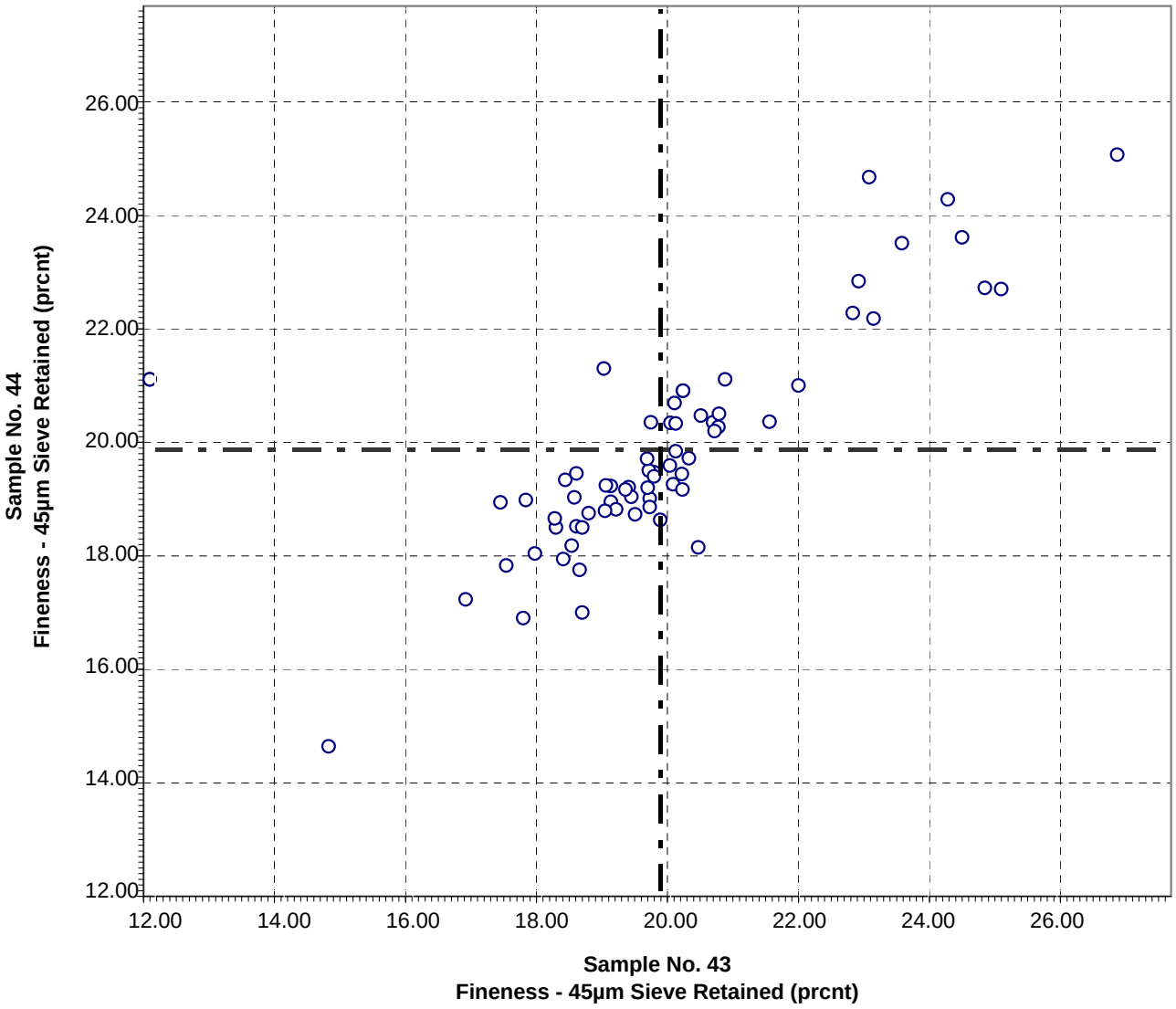


Test No. 310 Density 53 Points

Sample No. 43	Ave	2.56	S.D.	0.028	C.V.	1.11
Sample No. 44	Ave	2.38	S.D.	0.025	C.V.	1.07

Labs eliminated: 125, 207, 1221, 1435, 2295

CCRL Proficiency Sample Program
Fineness - 45µm Sieve Retained
POZZOLAN Samples No. 43 and No. 44

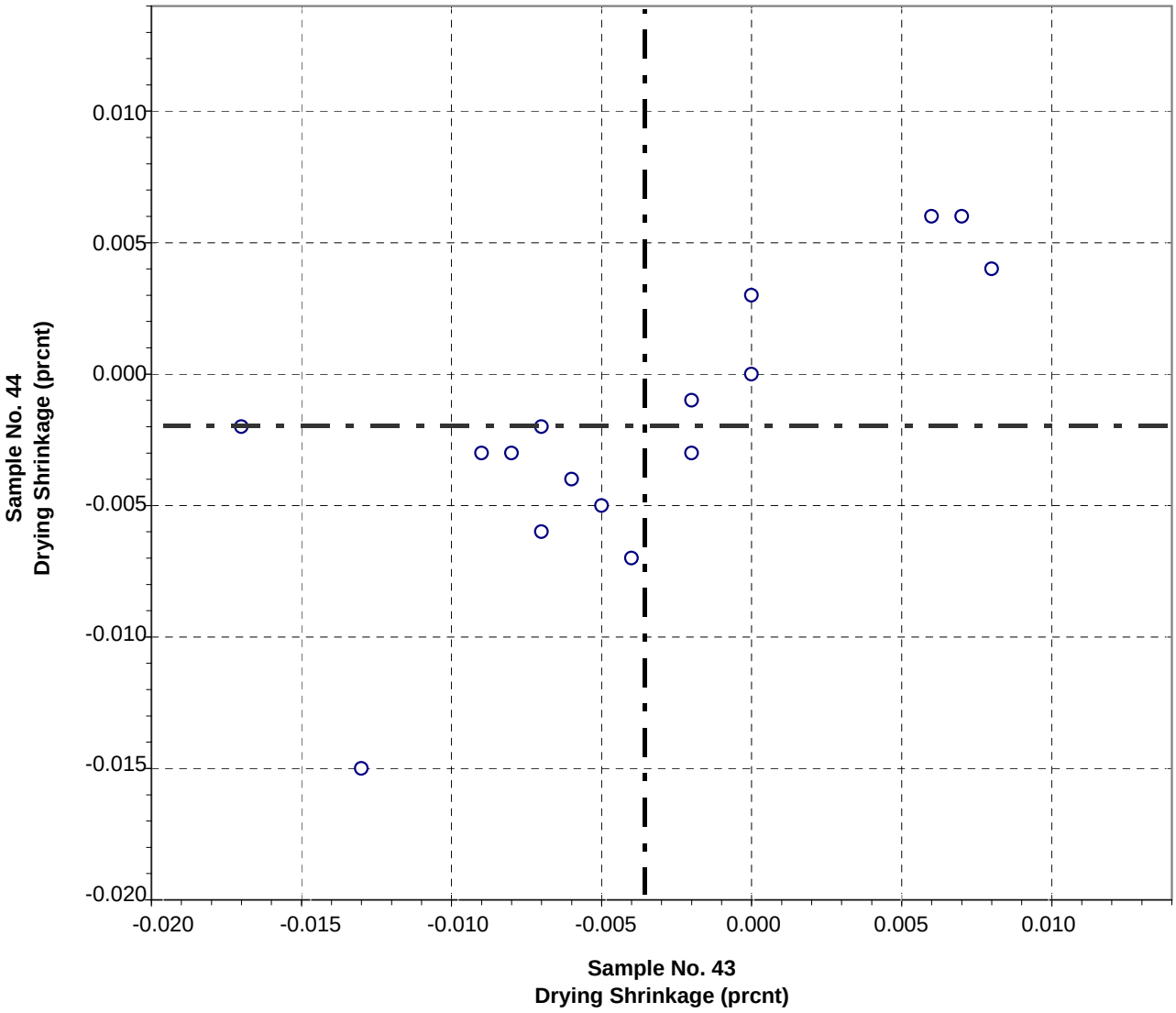


Test No. 281 Fineness - 45µm Sieve Retained 70 Points

Sample No. 43	Ave	19.84	S.D.	2.44	C.V.	12.31
Sample No. 44	Ave	19.85	S.D.	1.87	C.V.	9.44

Labs eliminated: 38, 176, 1323, 1435

CCRL Proficiency Sample Program
Drying Shrinkage
POZZOLAN Samples No. 43 and No. 44

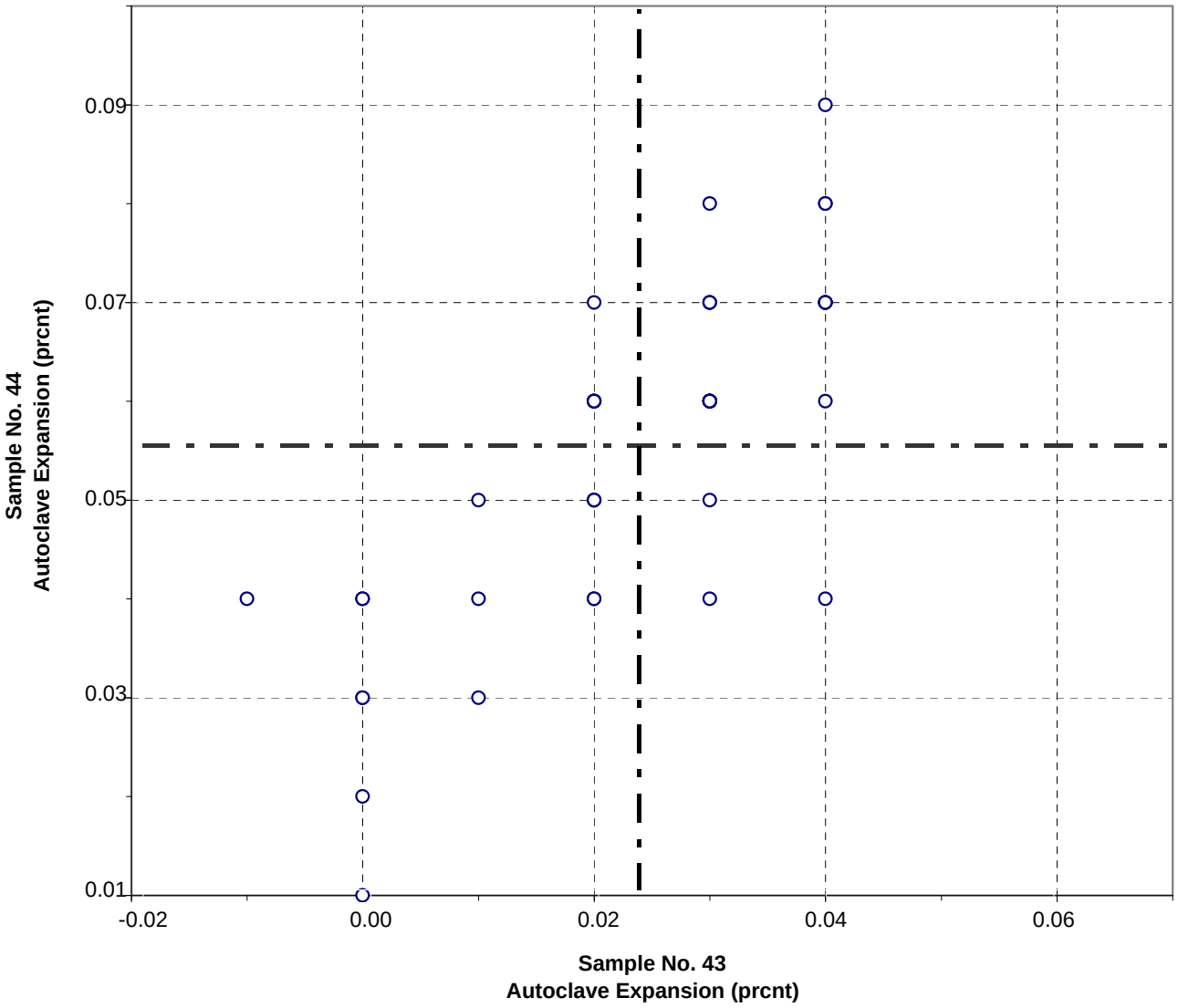


Test No. 340 Drying Shrinkage 16 Points

Sample No. 43	Ave -0.004	S.D. 0.0069	C.V. -187.55
Sample No. 44	Ave -0.002	S.D. 0.0053	C.V. -264.58

Labs eliminated: 207

CCRL Proficiency Sample Program
Autoclave Expansion
POZZOLAN Samples No. 43 and No. 44

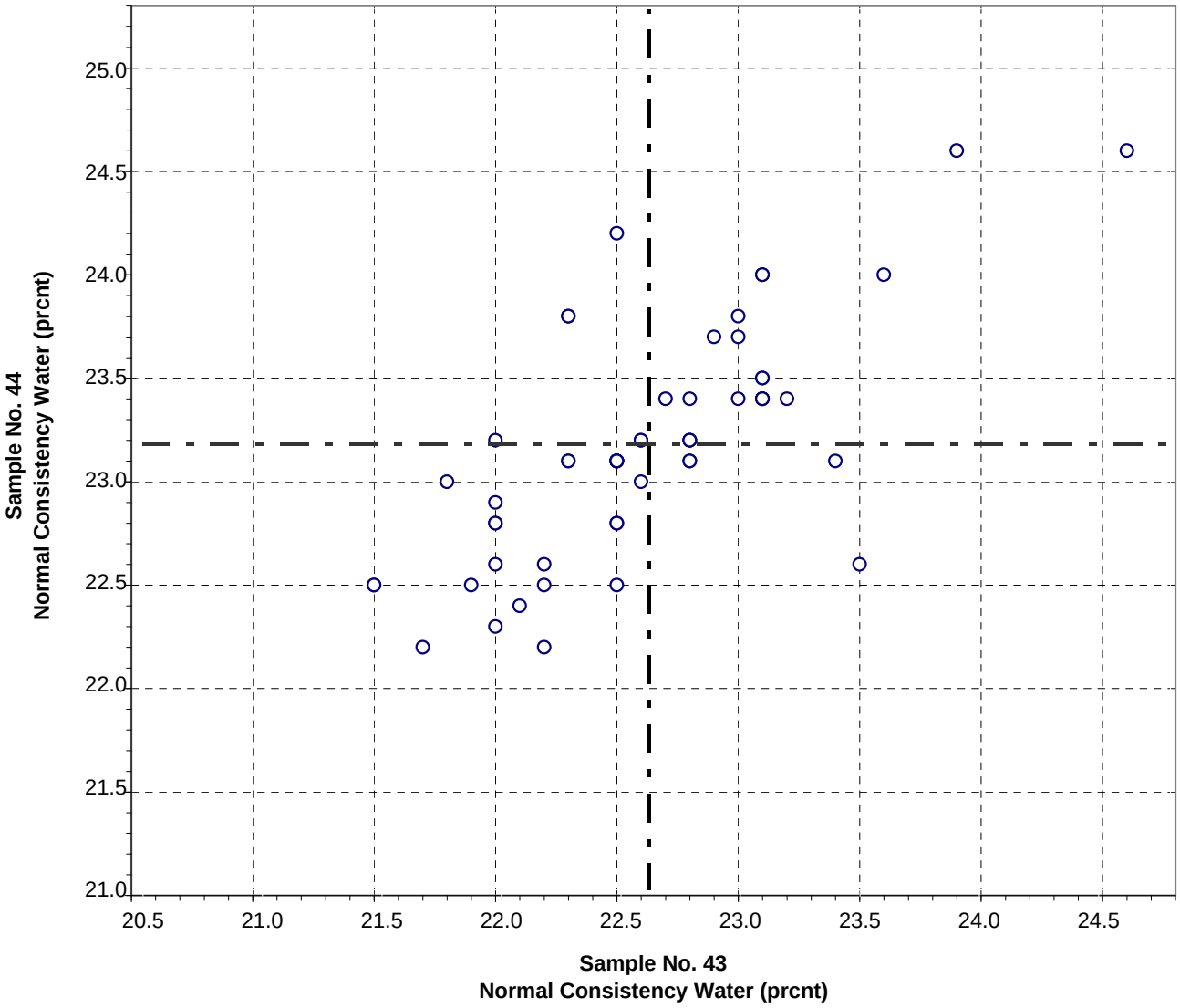


Test No. 160 Autoclave Expansion 48 Points

Sample No. 43 Ave 0.02 S.D. 0.013 C.V. 57.1
Sample No. 44 Ave 0.06 S.D. 0.016 C.V. 29.5

Labs eliminated: 958, 36, 1435, 2295

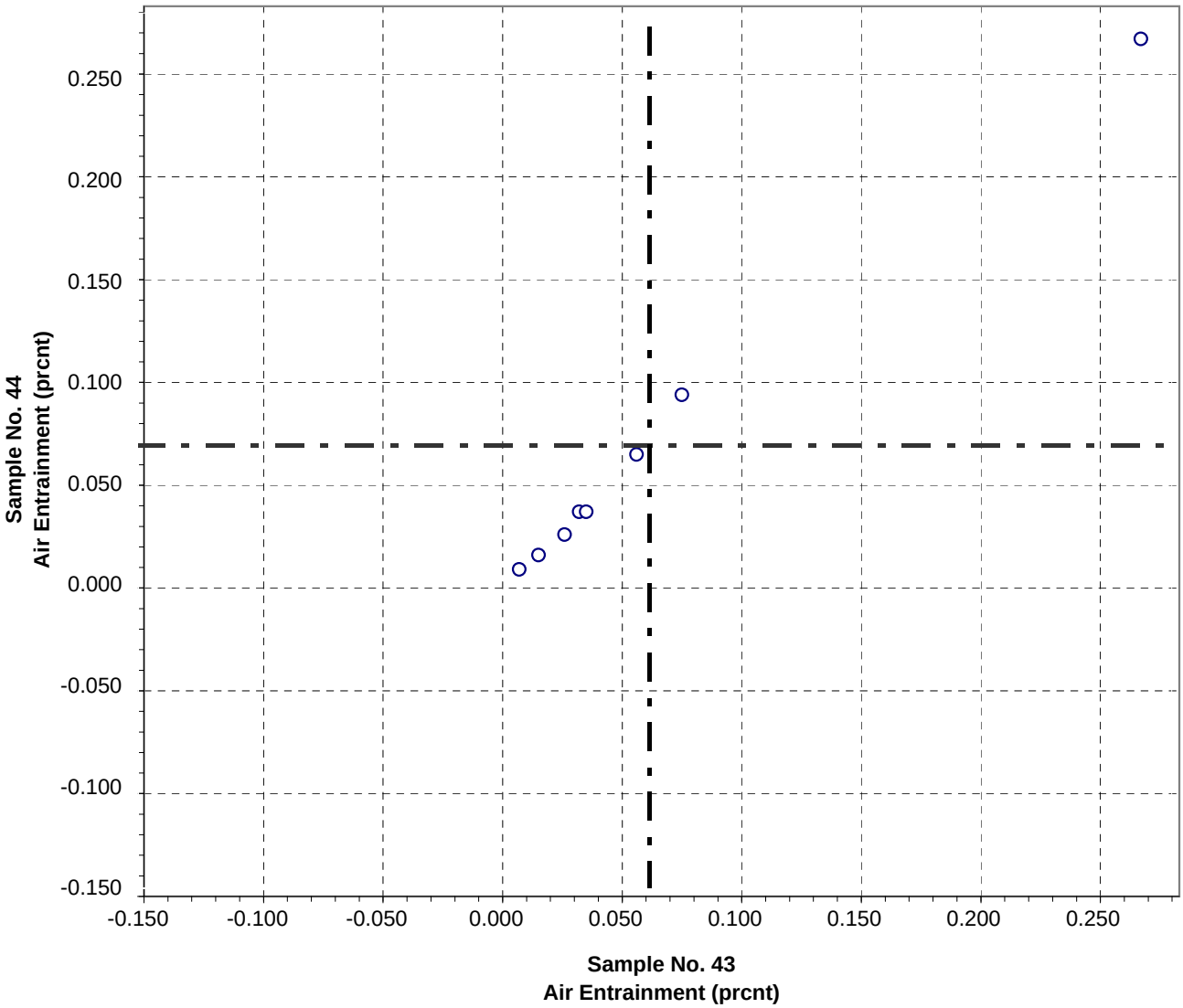
CCRL Proficiency Sample Program
Normal Consistency Water
POZZOLAN Samples No. 43 and No. 44



Test No. 110 Normal Consistency Water 55 Points

Sample No. 43	Ave	22.6	S.D.	0.59	C.V.	2.61
Sample No. 44	Ave	23.2	S.D.	0.56	C.V.	2.40

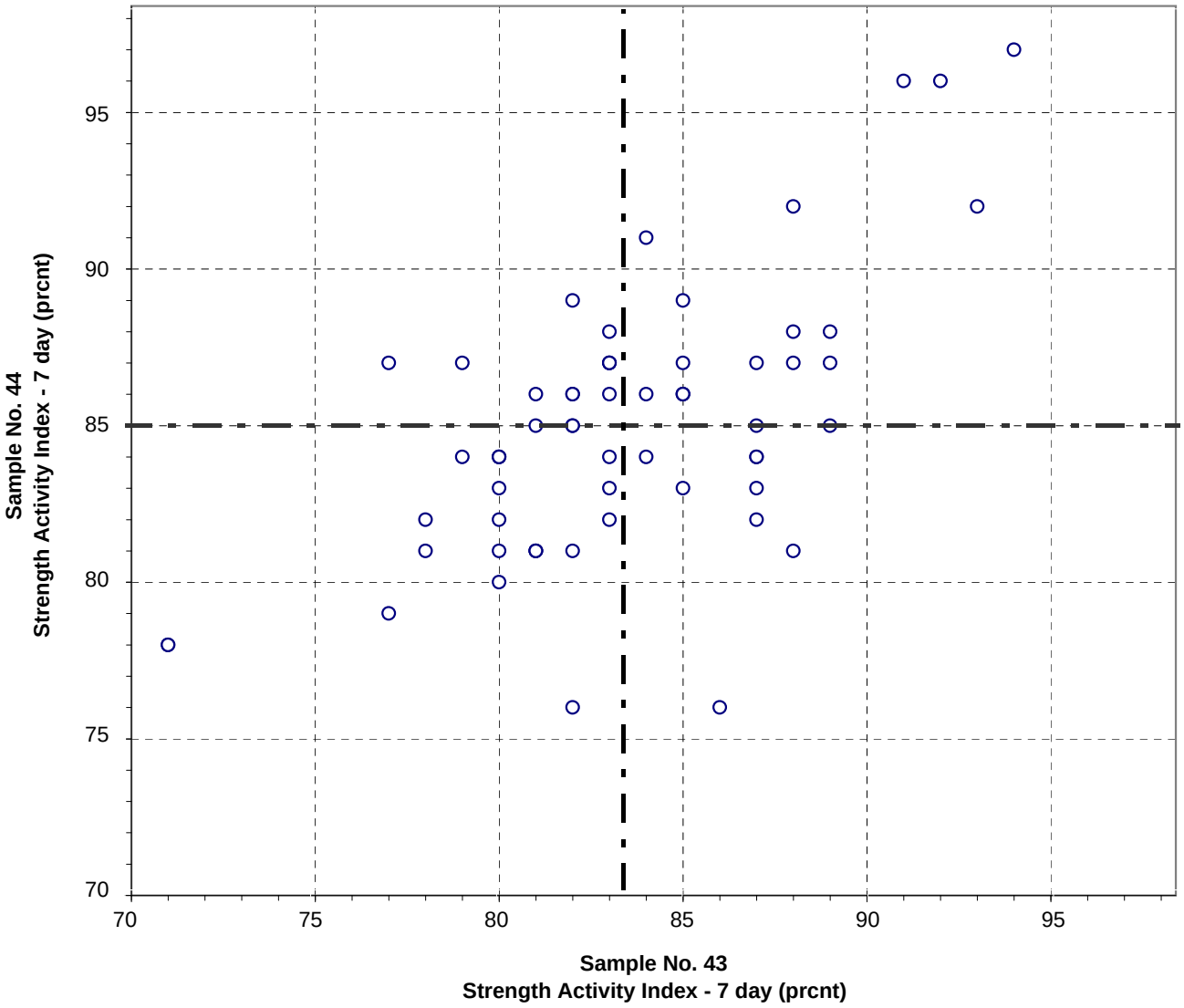
CCRL Proficiency Sample Program
Air Entrainment
POZZOLAN Samples No. 43 and No. 44



Test No. 350 Air Entrainment 8 Points

Sample No. 43	Ave	0.064	S.D.	0.085	C.V. 132
Sample No. 44	Ave	0.069	S.D.	0.085	C.V. 123

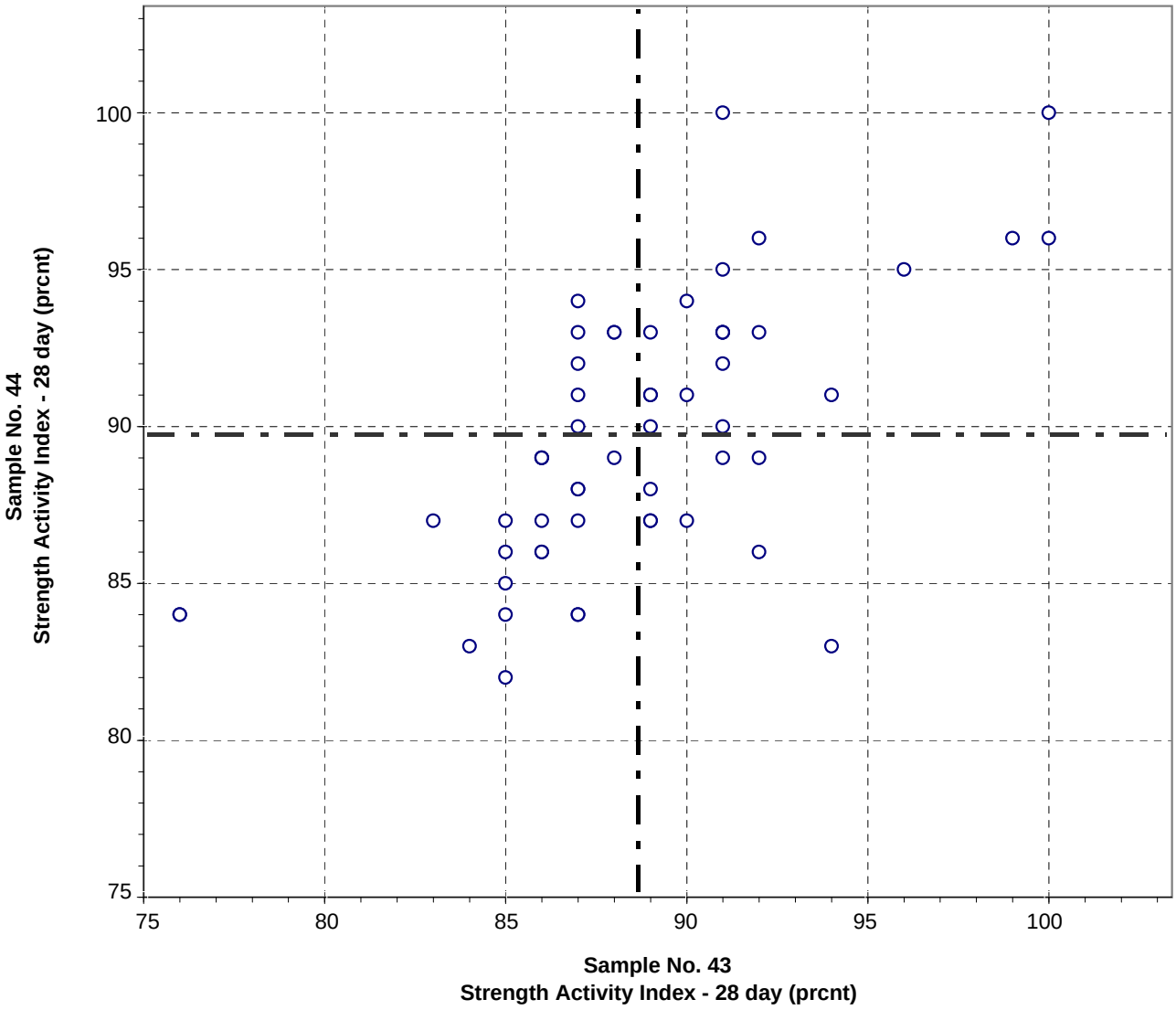
CCRL Proficiency Sample Program
Strength Activity Index - 7 day
POZZOLAN Samples No. 43 and No. 44



Test No. 359 Strength Activity Index - 7 day 62 Points

Sample No. 43	Ave	83	S.D.	4.5	C.V. 5.38
Sample No. 44	Ave	85	S.D.	4.3	C.V. 5.03

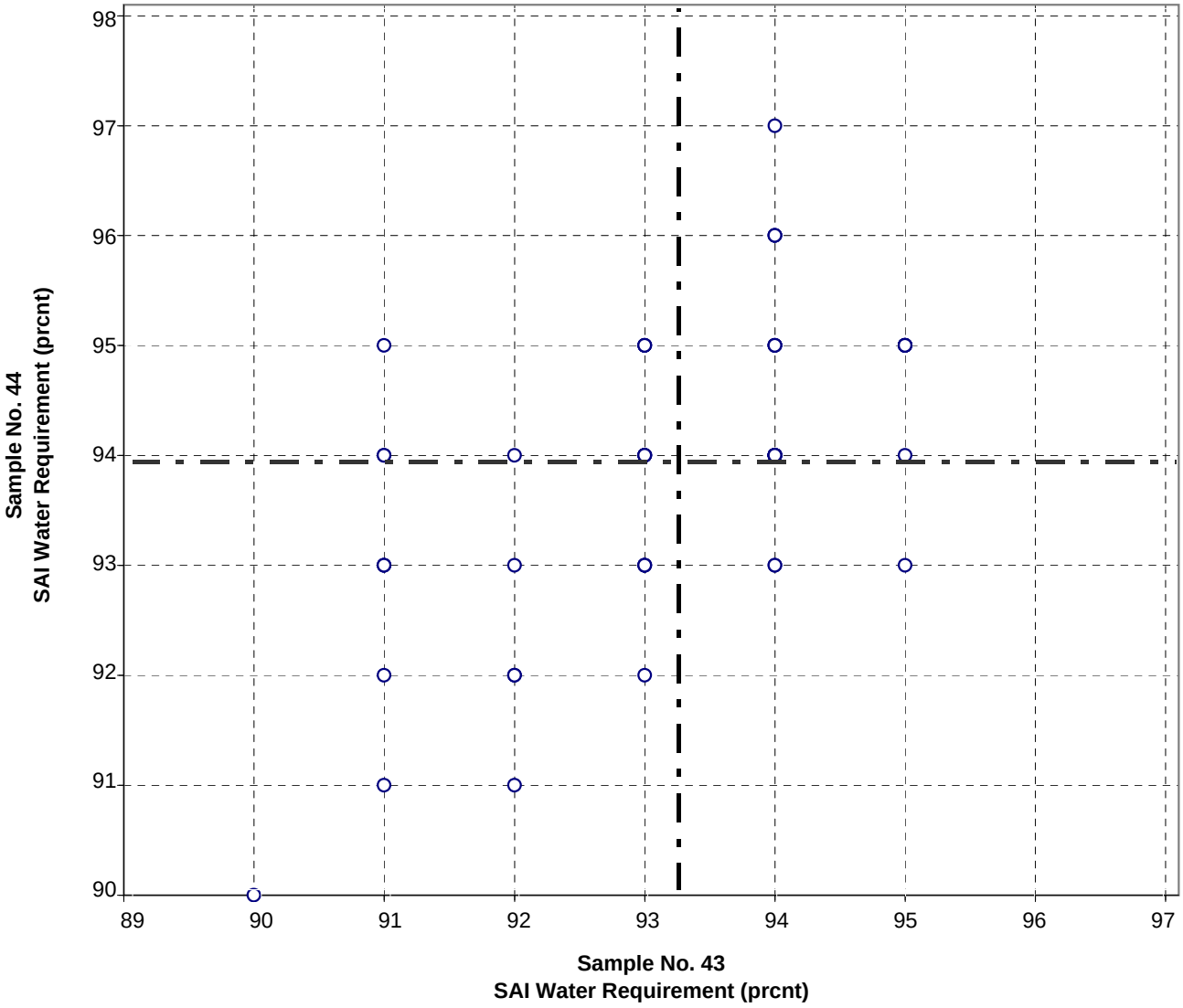
CCRL Proficiency Sample Program
Strength Activity Index - 28 day
POZZOLAN Samples No. 43 and No. 44



Test No. 360 Strength Activity Index - 28 day 56 Points

Sample No. 43	Ave 89	S.D. 4.4	C.V. 5.00
Sample No. 44	Ave 90	S.D. 4.2	C.V. 4.71

CCRL Proficiency Sample Program
SAI Water Requirement
POZZOLAN Samples No. 43 and No. 44

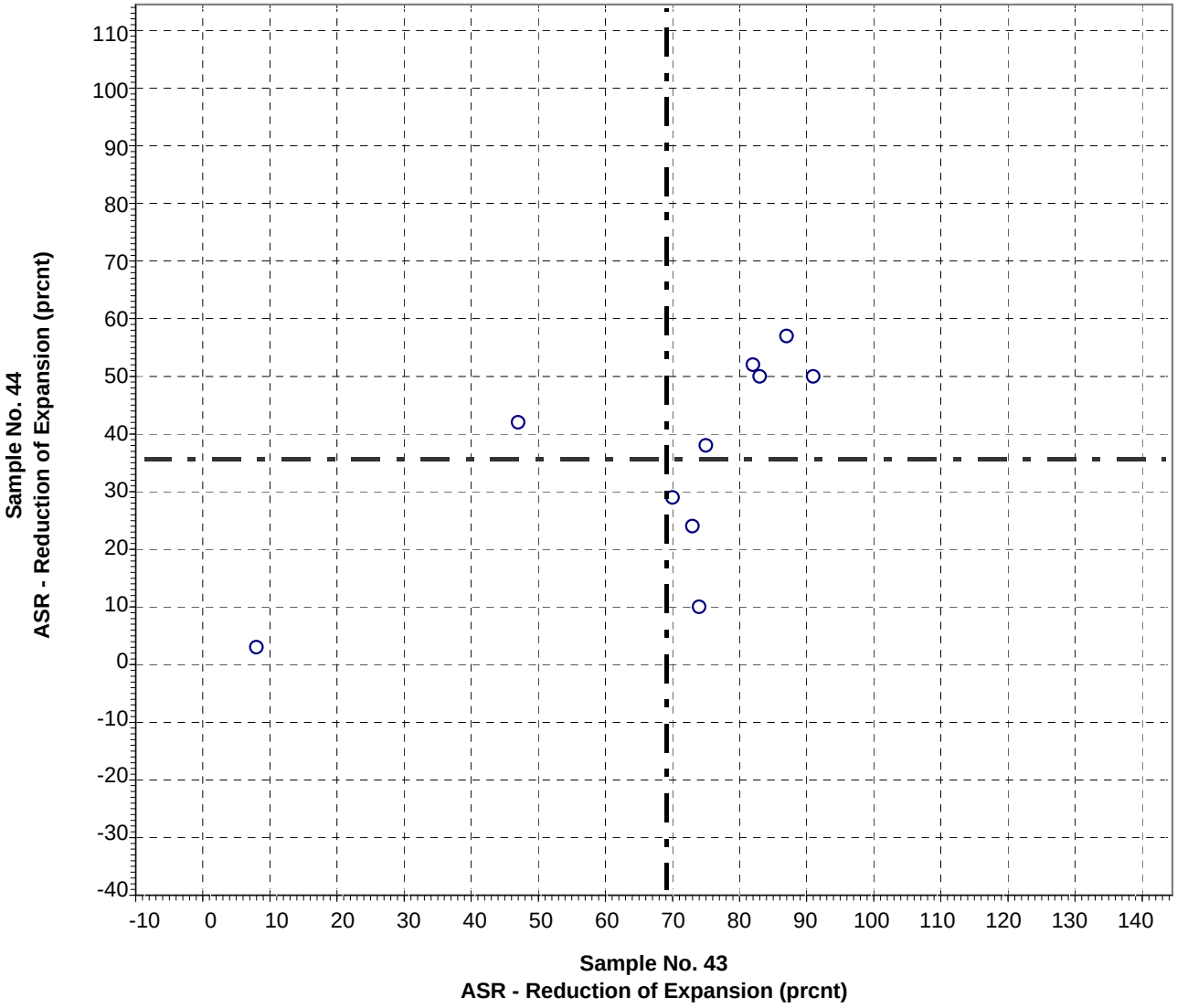


Test No. 370 SAI Water Requirement 58 Points

Sample No. 43	Ave	93	S.D.	1.3	C.V. 1.41
Sample No. 44	Ave	94	S.D.	1.3	C.V. 1.39

Labs eliminated: 870, 1379, 2295

CCRL Proficiency Sample Program
Alkali-Silica Reaction - Reduction of Expansion
POZZOLAN Samples No. 43 and No. 44



Test No. 390 ASR - Reduction of Expansion 10 Points

Sample No. 43	Ave.	69	S.D.	24.6	C.V. 35.7
Sample No. 44	Ave.	36	S.D.	18.5	C.V. 52.1