Portland Cement Samples 233 & 234

Please Note:

- Both Portland Cement Samples No. 233 and No. 234 are ASTM C150 cements meeting Type I specifications. Both Portland Cement Samples No. 233 and No. 234 contain limestone additions, but no inorganic processing additions.
    - Adjust phase calculations for additions.
        - See next page for composition of additions.
    - An Excel spreadsheet is available to assist in making phase calculations.
- Perform fineness tests on cement taken from the physical sample.
- Please allow until February 7th for receipt of samples.

How to Submit Test Results:

- On the CCRL Home Page, enter your lab number and PIN and click on "SIGN IN".
- Click on "Portland Cement Physical" or "Portland Cement Chemical" from the menu on the left.
- Click on "Enter Data"
- Make sure the information at the top of the screen is accurate.
- Carefully enter your data. Round data properly. **Data that is not rounded correctly cannot be submitted until correction is made. You will receive an error saying you have bad data, and the data will not be entered into the website.**
- DO NOT enter "N/A" or zeros for data that you are not reporting, leave this data area blank. Zeros will be interpreted as data.
- Once all data has been entered click on the "Submit" button.
- You should see a confirmation screen. Print the confirmation screen for your records.
- If you have trouble entering or do not receive confirmation visit "Data Entry Trouble Shooting" or contact CCRL via ccrl@astm.org or by calling 240-436-4800, prior to the closing date.
- **Sign out of the website and login again to check that your data was submitted properly.** You may add data or make corrections up to the closing date.
- CCRL cannot make accommodations for data received after the closing date.
- **Closing date for entering test results is March 21, 2025.**

CCRL Portland 233		
Oxides	**Limestone**	**Inorganic processing addition**
SiO_2	13.8	0.0
Al_2O_3	5.2	0.0
Fe_2O_3	2.0	0.0
CaO	45.4	0.0
SO_3	1.0	0.0
CO_2	35.6	0.0

Ingredient	**% by mass**
Inorganic processing addition	0.0

CCRL Portland 234		
Oxides	**Limestone**	**Inorganic processing addition**
SiO_2	3.7	0.0
Al_2O_3	1.2	0.0
Fe_2O_3	0.6	0.0
CaO	51.5	0.0
SO_3	0.6	0.0
CO_2	41.3	0.0

Ingredient	**% by mass**
Inorganic processing addition	0.0

January 14, 2025

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

SUBJECT: Portland Cement Proficiency Samples No. 233 and No. 234

The current pair of samples in the Portland Cement Proficiency Sample Program has been sent to your laboratory. The samples for the physical tests are packaged in plastic bags. Both samples weigh approximately 8,100 grams. The samples for chemical analysis are in glass vials and weigh approximately 50 grams each. **Both Portland Cement Samples No. 233 and No. 234 are ASTM C150 cements meeting Type I specifications. Both Portland Cement Samples No. 233 and No. 234 contain limestone additions, but no inorganic processing additions.**

Please allow until February 7, 2025 for receipt of these samples (non-receipt date). Please weigh these bags prior to the non-receipt date to ensure that you have received the proper amount of each material. If the samples have not been received on this date or if the samples you received were damaged, you need to notify us in writing, so please email us at ccrl@astm.org. Replacement samples will be sent. Failure to notify us by this date may result in you not receiving replacement samples in time to perform the necessary testing. Additional shipping charges will be incurred if contact is not made by the non-receipt date.

Instructions covering the proposed tests and the necessary data sheets for reporting the test results are on the following pages. Read these carefully before testing.

The phase calculations for these samples must be adjusted for the limestone additions and inorganic processing additions. An Excel spreadsheet is available to assist in the cement phase calculations. Compositions of the limestone additions and inorganic processing additions are included in the instructions.

Each sample should be tested separately. The tests should be made as soon as possible, and the results should be promptly submitted upon completion. Enter test results at our website: www.ccrl.us.

Sincerely,

Kent Niedzielski
Program Manager
Proficiency Sample Programs
Cement and Concrete Reference Laboratory

INSTRUCTIONS FOR TESTING

The two samples for the physical tests are packaged in plastic bags, **both contain approximately 8,100 grams of cement**. The two samples for chemical analyses (two additional samples are included for laboratories receiving "secondary" chemical samples) are sealed in glass vials, each of which contains approximately 50 grams of cement. The physical and chemical samples for the odd numbered sample represent one cement, and the physical and chemical samples for the even numbered sample represent another cement. The odd and even numbered samples should not be combined. **Both Portland Cement Samples No. 233 and No. 234 are ASTM C150 cements meeting Type I specifications and contains limestone additions.** To eliminate unnecessary variations in test results, one operator should perform a test method on both samples on the same day.

PHYSICAL TESTS

Prior to testing, pass the cement for the physical tests through a No. 20 sieve in accordance with ASTM Specification C183.

Perform fineness tests on cement taken from the physical sample.

If your laboratory is capable, perform the following physical tests on each sample in accordance with the current ASTM methods designated below.

Normal Consistency	ASTM C187-23
Time of Setting, Vicat	ASTM C191-21
Time of Setting, Gillmore	ASTM C266-21
Soundness, Autoclave	ASTM C151-23
Air Content	ASTM C185-20
Compressive Strength (nine cube batch; 3, 7, and 28 day)	ASTM C109-23
*Fineness, Air Permeability	ASTM C204-24
Fineness, by the 45 µm (No. 325) Sieve	ASTM C430-24
False Set Test (Paste Method)	ASTM C451-21
Expansion of Portland Cement Mortar Bars in Water	ASTM C1038-24
Heat of Hydration by Isothermal Conduction Calorimetry	ASTM C1702-24
Density of Hydraulic Cement	ASTM C188-17

* For the Air Permeability Fineness test (C204), use the standard density value given in C204 when determining the mass of the sample.

It is preferred that the one operator make the physical tests on both samples, on the same day.

CHEMICAL TESTS

Perform the following chemical tests in accordance with ASTM C114-24 and ASTM C150-24 on each sample. **The calculations of the cement phases for Samples No. 233 and 234 need to be adjusted for limestone additions**. An Excel spreadsheet with these values are available to assist in these calculations.

There are two chemical analysis programs. The "Primary Chemical Analysis" program is the laboratory "best effort" and should be the method used to qualify cement, or test cement for acceptance or rejection. A "Secondary Chemical Analysis" program is also available for laboratories that want to submit a second set of results. For more information about the two chemical analysis programs please read "Information on CCRL Chemical Analysis Program" included with the following pages.

Silicon dioxide,	SiO_2	Sodium oxide,	Na_2O
Aluminum oxide,	Al_2O_3	Strontium oxide,	SrO
Ferric oxide,	Fe_2O_3	Manganic oxide,	Mn_2O_3
Calcium oxide,	CaO	Zinc oxide,	ZnO
Free calcium oxide (free lime)		Chloride,	Cl
Magnesium oxide,	MgO	Chromium oxide,	Cr_2O_3
Sulfur trioxide,	SO_3	Carbon dioxide,	CO_2
Loss on ignition		Limestone content of portland cement[1]	
Insoluble residue		Tricalcium silicate [2],	C_3S
Potassium oxide,	K_2O	Dicalcium silicate [2],	C_2S
Phosphorus pentoxide,	P_2O_5	Tricalcium aluminate [2],	C_3A
Titanium dioxide,	TiO_2	Tetracalcium aluminoferrite [2],	C_4AF

[1] value calculated as shown in annex A2 of ASTM C150-24
[2] values calculated as shown in annex A1 of ASTM C150-24

It is preferred that one chemist make the chemical tests on both samples, on the same day. The results of a single determination should be reported rather that the average result of duplicate determinations. **IMPORTANT NOTE: You are asked to indicate if the XRF instrument was energy dispersive or wavelength dispersive, and what type of XRF sample preparation, glass disk or pressed powder, was used.**

INSTRUCTIONS FOR REPORTING

For the sake of uniformity, report the values for the various tests to the nearest significant number indicated on the reporting forms. Be sure to indicate what chemical analysis procedure was used.

Test results should be entered at our website: www.ccrl.us

CEMENT AND CONCRETE REFERENCE LABORATORY
PORTLAND CEMENT PROFICIENCY SAMPLE PROGRAM

INFORMATION ON CHEMICAL ANALYSIS PROGRAM

The chemical program consist of a “Primary” analysis program and a supplementary ”Secondary” analysis program. The “Primary” is the main chemical analysis report. Test results reported as primary analysis must be results a laboratory used to qualify cement, or test cement for acceptance or rejection. Any method of analysis (wet, x-ray, AA, etc.) is acceptable. This analysis represents a laboratory’s best effort and will be used to judge the laboratory’s testing proficiency.

A supplementary “Secondary” analysis is also available for laboratories that want to report a second set of test results. This secondary analysis could be performed by a second technician or analyzed by a different method. Each laboratory’s “Secondary” analysis would be compared to statistical values from the “primary” analysis to assign their laboratory ratings. A laboratory must participate in the “Primary” analysis to be eligible to participate in the “Secondary” analysis.

If your laboratory is not currently receiving a “Secondary” chemical analysis sample and would like to participate in this program, please contact us at the following:

Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Fax: 610-834-7066
email: ccrl@astm.org

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
PRIMARY CHEMICAL ANALYSIS REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

PRIMARY CHEMICAL ANALYSIS

NOTE: Test results reported on this form should be the laboratory's "best effort". The method used should be the method used to qualify cement, or test cement for acceptance or rejection. More information about this program and the Secondary Analysis program is available on the page titled "Information on CCRL Chemical Analysis Program".

	Sample No. 233	Sample No. 234	Test ID		X-ray ✳	ASTM Alternate Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.01%					Check the method used				
Silicon dioxide, SiO_2			10		☐	☐	☐	☐	☐
Aluminum oxide, $A1_2O_3$			21		☐	☐	☐	☐	☐
Ferric oxide, Fe_2O_3			30		☐	☐	☐	☐	☐
Calcium oxide, CaO			40		☐	☐	☐	☐	☐
Free Calcium oxide			41		☐	☐	☐	☐	☐
Magnesium oxide, MgO			50		☐	☐	☐	☐	☐
Sulfur trioxide, SO_3			60		☐	☐	☐	☐	☐
Loss on ignition			70		☐	☐	☐	☐	☐
Briefly describe LOI procedure:									
Insoluble residue			80		☐	☐	☐	☐	☐
Potassium oxide, K_2O			100		☐	☐	☐	☐	☐
Titanium dioxide, TiO_2			103		☐	☐	☐	☐	☐

✳**Please provide the following information the XRF equipment used for these results.**

XRF instrument: ☐ energy dispersive ☐ wavelength dispersive
Sample preparation: ☐ pressed powder ☐ fused glass disk

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ FAX _____ CCRL laboratory number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
PRIMARY CHEMICAL ANALYSIS REPORT FORM

Enter test results at our website: www.ccrl.us

FROM: _____

_____

_____

e-mail: _____

	Sample No. 233	Sample No. 234	Test ID		X-ray ✳	ASTM Reference Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.001%					Check the method used				
Sodium oxide, Na_2O			90		☐	☐	☐	☐	☐
Strontium oxide, SrO			92		☐	☐	☐	☐	☐
Phosphorus pentoxide, P_2O_5			102		☐	☐	☐	☐	☐
Zinc oxide, ZnO			99		☐	☐	☐	☐	☐
Manganic oxide, Mn_2O_3			101		☐	☐	☐	☐	☐
Chloride, Cl			104		☐	☐	☐	☐	☐
Chromium oxide, Cr_2O_3			105		☐	☐	☐	☐	☐

✳**Please provide the following information the XRF equipment used for these results.**

XRF instrument: ☐ energy dispersive ☐ wavelength dispersive

Sample preparation: ☐ pressed powder ☐ fused glass disk

Carbon dioxide, CO_2			97		Report vale to nearest 0.01%
Method used to determine CO_2 (as described in Appendix X2 of C114) - ☐ Split loss on ignition ☐ Thermogravimetric analysis (TGA) ☐ ASTM Test method C 25, section 22 ☐ XRF ☐ Combustion by induction furnace/IR ☐ ASTM Test method E 350 ☐ Other					
Limestone content in portland cement			98		Report values to nearest 0.1%
CO_2 content in limestone	35.6%	41.3%	These values used in calculation of limestone content		

Potential Cement Phase Composition - Bogue calculations (as described in Annex A1 of ASTM C150-24)
Note: Phase composition calculations for Sample No. 233 & No. 234 must be adjusted for limestone additions.

Tricalcium silicate, C_3S			106	Report values to nearest 0.1%
Dicalcium silicate, C_2S			107	
Tricalcium aluminate, C_3A			108	
Tetracalcium aluminoferrite, C_4AF			109	

Tests performed by _____ Date _____

Tests reported by _____ Title _____

Phone _____ FAX _____ CCRL laboratory number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
PHYSICAL TESTS REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

TEST RESULTS

Report as Indicated in ( )

	Sample No. 233	Sample No. 234	
NORMAL CONSISTENCY:			
Water *(nearest 0.1 percent by weight of cement)*			[110]
VICAT TIME OF SETTING:			
Initial Set, Report in **minutes** *(nearest 1 minute)*			[120]
Final Set, Report in **minutes** *(nearest 5 minutes)*			[121]
Is automated Vicat Instrument used? ☐ yes ☐ no			
Manufacturer of automated Vicat: _____			
GILLMORE TIME OF SETTING:			
Initial Set, Report in **minutes** *(nearest 5 minutes)*			[130]
Final Set, Report in **minutes** *(nearest 5 minutes)*			[140]
FALSE SET (PASTE METHOD):			
Final Penetration / Initial Penetration *(nearest percent)*			[150]

AUTOCLAVE EXPANSION:	No. 233	No. 234	
Final Reading			
Initial Reading			
Difference			
Percent Expansion *(nearest 0.01 percent)*			[160]

AIR ENTRAINMENT:			
Percent Air *(nearest 0.1 percent)*			[170]
Mixing water *(nearest 0.1 percent by weight of cement)*			[180]
Flow Obtained *(nearest percent)*			[190]

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ Fax _____ CCRL Laboratory Number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
PHYSICAL TESTS REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

TEST RESULTS

Report as Indicated in ( )

		Sample No. 233	Sample No. 234	
COMPRESSIVE STRENGTH:		No. 233	No.234	
3-day, total load, lbs.	1)			
	2)			
	3)			
Average 3-day strength *(nearest 10 psi)*				[200]
7-day, total load, lbs.	1)			
	2)			
	3)			
Average 7-day strength *(nearest 10 psi)*				[210]
28-day, total load, lbs.	1)			
	2)			
	3)			
Average 28-day strength *(nearest 10 psi)*				[211]
Flow Obtained for compressive strength mortar - constant water *(nearest percent)*				[230]

Information on cube molds and sealants (used for informational purposes only):

Type of cube mold: ☐ cube mold NOT clamped to base plate ☐ cube mold clamped to base plate

Type of sealant used between cube mold and base plate:
☐ wax ☐ grease ☐ other - please specify _____

FINENESS:			
Air Permeability -			
Air Permeability, *(nearest 1 m^2/kg)*			[270]
45 µm (No. 325) Sieve –	No. 233	No. 234	
Correction Factor for 45 µm sieve *(nearest 0.1 percent)*			
SRM used for for 45 sieve calibration *(114q, 46h, etc.)*			
45 µm (No. 325) Sieve, Corrected percent passing *(nearest 0.01 percent)*			[281]
Density, (*nearest 0.01 g/cm^3)*			[310]

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ Fax _____ CCRL Laboratory Number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
C1038 REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Program
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

C1038 EXPANSION OF PORTLAND CEMENT MORTAR BARS STORED IN WATER

	Sample No. 233 Bar				Sample No. 234 Bar			
	#1	#2	#3	#4	#1	#2	#3	#4
Final reading								
Initial reading								
Difference (final - initial)								
Expansion *(Nearest 0.001%)*								
Average expansion **[400]** *(Nearest 0.001%)*								

A fixed water/cement ratio of 0.485 is specified for C1038 mortar using portland cement

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ Fax _____ CCRL Laboratory Number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
HEAT OF HYDRATION REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

C1702 HEAT OF HYDRATION BY ISOTHERMAL CONDUCTION CALORIMETRY

	Sample No. 233	Sample No. 234	
3-day, J/g *(nearest 1 J/g)*	_____	_____	[500]
7-day, J/g *(nearest 1 J/g)*	_____	_____	[510]

Method Used:

☐ Method A - sample and water are both temperature equilibrated and mixed inside the calorimeter.
☐ Method B - sample is mixed outside of the calorimeter then put into the calorimeter.

Instrument Used:
Manufacturer: _____
Model: _____

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ Fax _____ CCRL Laboratory Number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
SECONDARY CHEMICAL ANALYSIS REPORT FORM

RETURN TO: Kent Niedzielski
Program Manager, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
4441 Buckeystown Pike, Suite C
Frederick, Maryland 21704
Enter test results at our website: www.ccrl.us

FROM: _____
_____
_____
_____
_____
e-mail: _____

SECONDARY CHEMICAL ANALYSIS

NOTE: A final report on these results will not be provided to your laboratory unless you subscribe to the Secondary Chemical Analysis program. More information about this program and how to enroll in the program is available on the page titled "Information on CCRL Portland Chemical Analysis Program".

	Sample No. 233	Sample No. 234	Test ID		X-ray ✳	ASTM Alternate Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.01%					Check the method used				
Silicon dioxide, SiO_2			910		☐	☐	☐	☐	☐
Aluminum oxide, $A1_2O_3$			921		☐	☐	☐	☐	☐
Ferric oxide, Fe_2O_3			930		☐	☐	☐	☐	☐
Calcium oxide, CaO			940		☐	☐	☐	☐	☐
Free Calcium oxide			941		☐	☐	☐	☐	☐
Magnesium oxide, MgO			950		☐	☐	☐	☐	☐
Sulfur trioxide, SO_3			960		☐	☐	☐	☐	☐
Loss on ignition			970		☐	☐	☐	☐	☐
Briefly describe LOI procedure:									
Insoluble residue			980		☐	☐	☐	☐	☐
Potassium oxide, K_2O			900		☐	☐	☐	☐	☐
Titanium dioxide, TiO_2			903		☐	☐	☐	☐	☐

✳**Please provide the following information about the XRF equipment used for these results.**

XRF instrument: ☐ energy dispersive ☐ wavelength dispersive

Sample preparation: ☐ pressed powder ☐ fused glass disk

Tests performed by _____ Date _____
Tests reported by _____ Title _____
Phone _____ FAX _____ CCRL laboratory number _____

CCRL PROFICIENCY SAMPLE PROGRAM
PORTLAND CEMENT SAMPLES NO. 233 AND NO. 234
SECONDARY CHEMICAL ANALYSIS REPORT FORM

Enter test results at our website: www.ccrl.us

FROM: _____

_____

_____

e-mail: _____

	Sample No. 233	Sample No. 234	Test ID		X-ray ✳	ASTM Reference Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.001%					Check the method used				
Sodium oxide, Na_2O			990		☐	☐	☐	☐	☐
Strontium oxide, SrO			992		☐	☐	☐	☐	☐
Phosphorus pentoxide, P_2O_5			902		☐	☐	☐	☐	☐
Zinc oxide, ZnO			999		☐	☐	☐	☐	☐
Manganic oxide, Mn_2O_3			901		☐	☐	☐	☐	☐
Chloride, Cl			904		☐	☐	☐	☐	☐
Chromium oxide, Cr_2O_3			905		☐	☐	☐	☐	☐

✳**Please provide the following information the XRF equipment used for these results.**

XRF instrument: ☐ energy dispersive ☐ wavelength dispersive

Sample preparation: ☐ pressed powder ☐ fused glass disk

Carbon dioxide, CO_2			997		Report vale to nearest 0.01%
Method used to determine CO_2 (as described in Appendix X2 of C114) - ☐ Split loss on ignition ☐ Thermogravimetric analysis (TGA) ☐ ASTM Test method C 25, section 22 ☐ XRF ☐ Combustion by induction furnace/IR ☐ ASTM Test method E 350 ☐ Other					
Limestone content in portland cement			998		Report values to nearest 0.1%
CO_2 content in limestone	35.6%	41.3%	These values used in calculation of limestone content		

Potential Cement Phase Composition - Bogue calculations (as described in Annex A1 of ASTM C150-24) Note: Phase composition calculations for Sample No. 233 & No. 234 must be adjusted for limestone additions.				
Tricalcium silicate, C_3S			906	Report values to nearest 0.1%
Dicalcium silicate, C_2S			907	
Tricalcium aluminate, C_3A			908	
Tetracalcium aluminoferrite, C_4AF			909	

Tests performed by _____ Date _____

Tests reported by _____ Title _____

Phone _____ FAX _____ CCRL laboratory number _____