

CECW-EG  Engineer Regulation 1110-1-2002	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	ER 1110-1-2002  30 September 1998
	Engineering and Design  CEMENT, SLAG, AND POZZOLAN ACCEPTANCE TESTING	
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CECW-EG

Regulation  
No. 1110-1-2002

30 September 1998

**Engineering and Design  
CEMENT, SLAG, AND POZZOLAN  
ACCEPTANCE TESTING**

**1. Purpose**

This regulation sets forth policy and responsibilities for acceptance testing of cementitious materials including portland cement, blended cement, pozzolan, and ground granulated blast-furnace slag (hereinafter referred to as slag).

**2. Applicability**

This regulation applies to all USACE Commands having military programs and/or civil works engineering and design responsibilities.

**3. References**

American Society for Testing and Materials (ASTM).

*a.* ASTM C 91. "Specification for Masonry Cement."

*b.* ASTM C 150. "Specification for Portland Cement."

*c.* ASTM C 183. "Practice for Sampling and the Amount of Testing of Hydraulic Cement."

*d.* ASTM C 311. "Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete."

*e.* ASTM C 595. "Specification for Blended Hydraulic Cements."

*f.* ASTM C 618. "Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."

*g.* ASTM C 845. "Specification for Expansive Hydraulic Cement."

*h.* ASTM C 989. "Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."

*i.* ASTM C 1157. "Performance Specification for Blended Hydraulic Cement."

*j.* ASTM C 1328. "Specification for Plastic (Stucco) Cement."

*k.* ASTM C 1329. "Specification for Mortar Cement."

*l.* ASTM C 1240. "Specification for Silica Fume for Use in Hydraulic-Cement Concrete and Mortar."

Copies of ASTM Standards are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

**4. Distribution Statement**

Approved for public release; distribution is unlimited.

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This regulation supersedes ER 1110-1-2002, dated 31 January 1993.

## 5. Policy

This regulation shall be followed in all cases where Corps project specifications require that cementitious materials (cement, slag, or pozzolan) be tested by and at the expense of the Government and in cases where another Federal or other governmental agency requests that such acceptance testing be performed by the U.S. Army Corps of Engineers. This regulation is not applicable where Corps project specifications require that cementitious materials be tested by and at the expense of the Contractor. Cement, slag, and pozzolan acceptance testing by the Government will be performed only by the U.S. Army Engineer Waterways Experiment Station (WES), except that Transatlantic Programs Center and Pacific Ocean Divisions are authorized to arrange for such acceptance testing as may be appropriate.

## 6. Types of Acceptance Testing

*a. Cement/pozzolan quality management system (CQMS/PQMS).* The CQMS/PQMS is designed to provide a means by which cement and/or pozzolan can be purchased from a qualified producer's regular production with a reasonable assurance that it will meet specification requirements. Use of slag is covered under the CQMS. Establishing a qualified source involves a combination of review of a producer's quality control data and testing at WES to verify between-laboratory agreement on critical test results. Following this initial evaluation, grab samples are taken from the project and tested at WES to verify compliance with specification requirements, but every lot of cement is not necessarily tested prior to use, as in sealed-bin testing (paragraph 6b). Complete descriptions of the procedures governing the CQMS and PQMS are found in Appendices A and B, respectively.

*b. Sealed-bin testing.* Sealed-bin testing offers an acceptance-testing program that provides assurance that material meets specification requirements. Samples of the material are tested prior to use, and the bin is sealed by a Government inspector exclusively for Government use. Loading of material into tankers is witnessed by the inspector, and the

tanker is sealed prior to departure for the job site. Seals are removed and seal numbers logged in at the job site prior to unloading. Details of procedures required for this type of testing are found in Appendix C.

*c. Single-sample testing.* With this type of testing, samples are analyzed and compared with specification requirements, but there is no interpretation of the results representing anything other than the properties of that sample.

## 7. Responsibilities of Using Agencies

*a. General.* Personnel at the district, area, or residency level or other Federal or governmental agency (hereafter referred to as the using agency) shall be responsible for requesting cement, slag, or pozzolan acceptance testing (when it is a requirement of the project specifications), determining the type of acceptance testing, and providing the required funding document to WES. When cement or pozzolan is being supplied from a qualified source, the using agency shall request WES to develop the required history and shall be responsible for sampling material at the project, as described in Appendices A and B. Using-agency personnel shall be responsible for ensuring that the cement, slag, and pozzolan reaching the project site have not been contaminated in transit and are properly handled and stored at the project site. If project personnel suspect that pretested cement or pozzolan is deviating from the project requirements, additional samples of this material shall be taken for testing.

*b. Requesting cement, slag, and pozzolan acceptance testing.*

(1) Requests for acceptance testing by the using agency shall be addressed to:

**Structures Laboratory  
U.S. Army Engineer Waterways Experiment  
Station  
ATTN: CEWES-SC-E  
3909 Halls Ferry Road  
Vicksburg, Mississippi 39180-6199  
601-634-3261, FAX 601-634-3262**

(2) The request shall include the following information:

(a) Name and location of cement mill and/or pozzolan or slag source.

(b) Specification under which tests are to be made. (Indicate special tests desired under specification exceptions and options and whether retesting of cement, slag, or pozzolan will be required due to storage time in excess of 6 months.)

(c) Appropriate funding documents.

(d) Distribution for test reports.

(e) Type of acceptance testing.

(3) The following information is helpful but not mandatory:

(a) Contract number.

(b) Name of Contractor (and subcontractor, if applicable).

(c) Contractor's (or subcontractor's) purchase order number.

(d) Name, location, and mailing address of project.

(e) Types of concrete construction (e.g., conventional concrete or roller-compacted concrete (RCC)).

(f) Quantity of cement, slag, or pozzolan (if bulk, number of tons; if bagged, number of bags and quantity (mass) per bag).

(g) Storage conditions required by the project specifications.

(h) Estimated date of first shipment and shipping schedule, if known.

(i) Distribution of test reports, mailing addresses, and number of copies to each address.

(j) Complete information or requirements, including appropriate parts of project specifications.

(k) Information on whether shipment of "excess" quantities of cement, slag, or pozzolan is anticipated (paragraph 9d).

(4) The using agency shall urge its contractors to place orders well in advance of needs and shall submit requests for sampling, inspection, and testing promptly.

*c. Additional responsibility of the using agency.*

(1) Inspection at ready-mixed concrete plants. The using agency shall be responsible for monitoring use of tested cement, slag, or pozzolan from qualified sources at ready-mixed concrete plants.

(2) Project samples. When cement, slag, or pozzolan is being furnished under the CQMS or PQMS from a qualified source, the using agency shall be responsible for periodic and supplementary sampling of the product delivered to the job site as described in paragraphs A-4 and B-4 of Appendices A and B, respectively.

(3) Cement, slag, or pozzolan that fails tests and retests. Cement, slag, or pozzolan that has failed to meet specification requirements on the basis of tests and retests of the original samples may be resampled and retested. The using agency may initiate such a request upon notification from WES that the cement, slag, or pozzolan tested failed to meet specification requirements. Such materials shall be resampled and retested at no cost to the Government. The using agency is responsible for recovering and funding the resampling and retesting costs incurred by WES.

(4) Inspection at transfer facilities. Inspection at transfer facilities may be performed by the using agency or through arrangements made by the using agency with other users, in the event several users of tested cement, slag, or pozzolan are drawing from the same bin at the transfer facility. The using

agency may make arrangements with WES for such inspection, with the additional costs for inspection being chargeable by WES to the using agency.

## 8. Responsibilities of WES

*a. Sampling, testing, and inspection.* WES will be responsible for the sampling, testing, and inspection of cement, slag, and pozzolan at mill or source locations within the CONUS. Sampling of cementitious materials will be performed in accordance with ASTM C 183, ASTM C 311, or ASTM C 989. WES will maintain the capability for testing in accordance with ASTM C 91, ASTM C 150, ASTM C 595, ASTM C 618, ASTM C 845, and ASTM C 989.

*b. Point of contact, WES.* The Director, WES, will select an individual directly responsible for the cement, slag, and pozzolan testing function with whom representatives of the using agencies may deal directly. The using agencies shall be informed in writing of the name of the responsible individual, and all requests for sampling, inspection, and testing shall be marked to the attention of that individual.

*c. Technical surveillance.* The Director, WES, is assigned responsibility for the technical surveillance of the cement, slag, and pozzolan acceptance-testing function. This responsibility includes performing laboratory investigations into improving specification, sampling procedures, test methods, and equipment. These activities shall be coordinated with the applicable committees and subcommittees of ASTM and, when necessary, with using or other agencies.

*d. Procurement of items required for sampling and sample shipping.* WES shall be responsible for procurement of items required by mill or plant inspectors in the performance of sampling and sample shipping. WES will supply shipping materials and supplementary instructions for properly obtaining representative project samples.

*e. Maintenance of CQMS and PQMS.* WES shall maintain files of the current statistical test data furnished by participating producers on their quality

control procedures to determine qualification or continuance as an acceptable source under the CQMS or PQMS. CQMS and PQMS status will only be established and maintained for those sources that have been requested by a using agency.

*f. Administrative.* Administrative support for procurement, fiscal, and contractual matters in connection with the cement, slag, and pozzolan acceptance-testing service shall be provided by appropriate elements at WES.

*g. Resampling and retesting.* Resampling and retesting of previously failed material shall be performed only when authorized by the using agency.

*h. Inspection of WES testing facilities.* Cement testing facilities shall be inspected by the Cement and Concrete Reference Laboratory (CCRL), National Institute of Standards and Technology, Washington, DC 20324. Copies of all reports which result from the inspection will be forwarded to CDR USACE CECW-EG, WASHINGTON, DC 20314-1000. WES will participate in the CCRL proficiency-sample program for portland cement, blended cement, and pozzolan. Performance will be monitored as part of the WES quality assurance practice.

### *i. Reporting.*

(1) Notification. Upon completion of testing, WES shall notify the using agency, supplier, and mill or plant inspector whether or not the cement, slag, or pozzolan met the requirements. Results of 7-day tests will be available no later than 14 days after receipt of the sample (more rapid results are possible if prior arrangements are made). Results of 28-day tests will be available no later than 35 days after receipt of the sample. The using agency will receive a completed test report, for tests through 7 days, within 21 days of receipt of the sample. If there are 28-day tests, a preliminary test report will be issued after 7-day results are completed. Results can be transmitted by telephone or by FAX upon request.

(2) Noncompliance. Test results that indicate noncompliance with a specification requirement

shall be communicated to the using agency as soon as noted. Noncompliance will be verified by duplicate testing for the property or component in question. If the duplicate test result agrees with the original test result within the limit expected from the precision of the method, then a mean will be calculated and considered to be the definitive test result. If the duplicate test result does not agree within the limit of the precision of the method, additional testing will be performed until two results that do agree within these limits are obtained. The mean of these two results will be reported as the definitive test result. Results of such duplicate testing will be transmitted to the using agency as soon as available.

(3) Status. For cement, slag, or pozzolan furnished under the CQMS or PQMS, WES shall not alter the status of a qualified producer without prior notice to agencies currently being supplied by that producer and without arranging for an alternate sampling and testing system for materials to satisfy contract specification requirements.

(4) Test results. Test results of project samples submitted in accordance with paragraphs A-4 and B-4 of Appendices A and B, respectively, shall be furnished to the using agency.

## 9. Charges for Acceptance Testing

*a. Charges for testing.* Charges for testing will be based on a per-sample rate, regardless of the type

of acceptance testing requested. An additional one-time fee will be charged to establish a source as a qualified source under CQMS or PQMS or to set up a seal-bin inspection program. The rate will depend on the work involved and will be negotiated between WES and the using agency.


*b. Retesting of cement, slag, and pozzolan at contractor's request.* The costs of resampling and retesting shall be identified and billed to the using agency. In the event the bin or silo in question involves more than one using agency and more than one using agency requests resampling and retesting, the costs shall be prorated among the using agencies requesting resampling and retesting.

*c. Inspection at transfer facilities.* The cost of transfer facility inspection requested by the using agency shall be identified and billed directly to the using agency.

*d. Inspection and testing of cement, slag, and pozzolan in quantities exceeding project requirements.* In a sealed-bin testing program, tested cement or pozzolan will sometimes be used by the Contractor for purposes other than those described in the contract with the using agency. It is the responsibility of the using agency to recover the cost of testing this material.

FOR THE COMMANDER:

3 Appendices  
APP A - Cement Quality  
Management System  
APP B - Pozzolan Quality  
Management System  
APP C - Sealed-Bin Testing

  
ALBERT J. GENETTI, JR.  
Major General, USA  
Chief of Staff

## APPENDIX A CEMENT QUALITY MANAGEMENT SYSTEM

### A-1. Introduction

*a.* The Cement Quality Management System (CQMS) is intended to provide the U.S. Army Corps of Engineers, and other Federal or governmental agencies that wish to participate, with a quality assurance program for hydraulic cements (portland cement, blended cement, expansive cement, and ground granulated blast-furnace slag) by establishing qualified sources of cements. The procedures by which qualified sources are established and maintained are intended to give the using agency reasonable assurance that a lot of cement purchased without prior testing of that lot, other than the manufacturer's quality-control testing, will comply with specification requirements. The system is based on an evaluation of the manufacturer's quality-control data, along with some testing of samples obtained from the manufacturer by the U.S. Army Engineer Waterways Experiment Station (WES). The evaluation procedure seeks to screen those manufacturers whose product appears likely to exceed specification requirements, because some properties vary excessively. The system is based fundamentally on faith that the quality-control data supplied by the manufacturer are an unbiased reflection of the product. It is intended that the product be verified by sampling at the project and by testing at WES.

*b.* The responsibility for monitoring this system is assigned to the Director, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

### A-2. Procedures for the Establishment of a Qualified Source of Cement

*a.* The using agency shall request that the producing plant be designated by WES as a qualified source. WES will then contact the producer, soliciting a formal request from the producer to be designated a qualified source. The formal request is to be made to the Director, WES, at the address shown in paragraph 7*b*(1), in a letter certifying that

the plant maintains a quality-control program and that each cement, by type and option for which a qualified source under this system is requested, will meet the current American Society for Testing and Materials (ASTM) specification requirements. The designation of a plant as a qualified source will be made separately for each type of cement. Qualification may be discontinued for one type without changing the supplier's status for other types. The letter requesting qualification as a source shall be signed by a representative of the producer having legal authority to bind the company. The letter will give the name, position, address, and telephone number of an individual at each production location who may be contacted for data and shipping information and to whom reports of tests shall be directed.

*b.* The cost for establishing qualified-source status will be negotiated between WES and the using agency. The cost will be based on the amount of work necessary to develop the required quality history.

*c.* The producer requesting status as a qualified source shall provide WES with the following:

(1) A brief outline of the procedures used to control the quality of the finished product; sampling and testing frequency, test sample preparation employed, and chemical analysis methods used, such as X-ray diffraction, atomic absorption spectroscopy, or wet chemistry.

(2) Evidence that the laboratory that produced the mill test data is inspected on each inspection tour of the Cement and Concrete Reference Laboratory (CCRL) by submission of a copy of the inspection report or reports.

(3) Results of all applicable chemical and physical tests generated as a result of quality-control testing required by the relevant ASTM specification for the last 40 samples tested. For cements

purporting to comply with the heat-of-hydration requirement of Table 4 in ASTM C 150 (70 cal/g max for Type II; or 60 or 70 cal/g max for Type IV), 40 analyses of the producer's regular-production Type II or IV cement and a minimum of 10 analyses of the heat-of-hydration cement, including heat-of-hydration data generated by the producer's quality-control laboratory, will be acceptable. Critical limits must be calculated as described in ASTM C 183. If the producer is not equipped to determine heat-of-hydration, then an alternative procedure for monitoring this property must be developed and verified. WES will assist in the process as part of the work necessary to establish qualified-source status referenced in paragraph A-2*b*.

**Note: ENG Form 5034, Report of Cement Quality History, on which test data may be tabulated is available upon request from WES.**

(4) A 2-kg sample of each type of cement for which qualified status is requested, along with a mill certificate that represents the properties of that sample.

(5) A list of the distribution terminals and marketing points served by each producing plant.

### **A-3. Acceptance of a Producer as Qualified Source**

*a.* Quality-history data in accordance with paragraph A-2*c*(3) will be evaluated for acceptance according to the following criteria:

(1) The frequency with which test results for any single property exceed the applicable specification requirements for that property shall be less than or equal to 5 percent of test results submitted for that property. Further, the amount by which these exceed the specification limit shall be no more than 5 percent of the limit.

(2) The frequency with which test results for any single property exceed the critical limit for that property shall not exceed 30 percent of test results submitted for that property.

(3) These criteria (paragraphs A-3*a*(1) and (2)) may be waived if convincing evidence is presented to indicate that materials that exceed specification or critical limit requirements can be detected and isolated and, hence, not shipped. This evidence, in addition to written explanations, may also include charts or graphs and must specifically address the properties in question. It is the responsibility of the producer to review these data prior to submittal to WES and to provide explanatory data or information if the requirements of paragraph A-3*a*(1) or (2) are not met.

*b.* The producer shall be advised in writing of acceptance.

### **A-4. Project Samples**

*a.* Cement from a qualified producer delivered to the project site or concrete producing plant shall be sampled by a representative of the using agency and forwarded to WES for testing (paragraph A-4*d*). The recommended frequency for testing of project samples is: one sample per 1,000 Mg (1,000 tons) for conventional concrete construction and one sample per 2,000 Mg (2,000 tons) for roller-compacted concrete construction, but a minimum of one sample per project per year, or when, in the opinion of the using agency, the field performance of the cement indicates the need for a checktest.

*b.* Samples shall be sent to WES, Structures Laboratory (ATTN: CEWES-SC-E), 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, and identified on ENG Form 5035, Project Sample Identification, as follows: (1) project name, location, and contract number, (2) source of cement (manufacturer), (3) silo or lot number, (4) type and specification, (5) date shipped to project, (6) carrier identification (rail car number, truck name and number), and (7) description of the field performance problem, if any, for checktest samples. Necessary forms and sampling supplies are available upon request from WES.

*c.* Project samples will be tested for compliance with project specifications as noted on sample



identification, and results will be reported to the using agency.

*d.* The procedures for taking project samples will be in accordance with ASTM C 183 and supplementary instructions provided by WES to ensure that the material submitted to WES represents material shipped from the qualified source.

#### **A-5. Retention of a Producer as Qualified Source**

*a.* Quality-history data in accordance with paragraph A-2c(3) must be submitted every 6 months for evaluation in accordance with paragraph A-3a.

*b.* A 2-kg sample along with a mill certificate must be sent to WES with the 6-month quality history.

*c.* CCRL inspection reports on file at WES must be updated after each biannual CCRL inspection.

*d.* The producer shall be advised in writing of retention. An updated list of producers shall be maintained by WES.

#### **A-6. Removal of a Producer from the Qualified Source List**

*a.* Qualified-source status will be discontinued when the project, for which the using agency made the request, is completed.

*b.* Qualified-source status may be removed prior to the completion of the project if:

(1) Results of tests of any 3 of a series of 10 consecutive project samples of that type exceed the critical limit for any applicable specification property.

(2) An individual project sample fails to meet specification requirement by more than 5 percent of the value of the specification requirement.

(3) More than 1 in 10 project samples exceed any specification requirement by any amount.

*c.* A producing plant may also be removed for failure to submit data every 6 months as described in paragraph A-5.

*d.* Prior to removing a plant from the list of qualified sources, WES shall take appropriate measures to confirm the validity of the sampling procedures and the representativeness of the sample or samples that yielded the results prompting removal. In addition, WES shall confer with all relevant using agencies and the producer.

*e.* The producer and using agency shall be advised immediately by telephone followed by written notice of removal action. Test data, field performance data, or both will be provided to indicate the cause for such action.

#### **A-7. Procedures for Reinstatement to Qualified List**

Once a plant is removed from the qualified list as a source of a type of cement, reinstatement may be gained in the following manner:

*a.* Submit a written request for reinstatement to the Director, WES. This request shall present reasons why it is anticipated that the circumstances that led to removal will not be expected to recur.

*b.* Provide WES with samples of current production for test and evaluation, if requested.

*c.* If the data provided in paragraphs A-7a and b indicate that the reasons that led to removal are not expected to recur, WES shall reinstate the plant to the list of qualified sources of that type of cement.

#### **A-8. Inspection of Producer Facilities**

The plant and terminal facilities of a producer participating in this program may be visited periodically by a representative of WES to review procedures employed and project requirements and to provide guidance in the functional procedures of

the program. These visits should be conducted in a manner to promote better understanding and good working relationships between the laboratory and the producer company officials and to afford the laboratory an opportunity to maintain current knowledge of production and storage facilities of the cement mills and terminals.

## APPENDIX B POZZOLAN QUALITY MANAGEMENT SYSTEM

### B-1. Introduction

*a.* The Pozzolan Quality Management System (PQMS) is intended to provide the U.S. Army Corps of Engineers, and other Federal or governmental agencies that wish to participate, with a quality assurance program for pozzolans by establishing qualified sources of these materials. The procedures by which qualified sources are established are intended to give the using agency reasonable assurance that a lot of pozzolan purchased without prior testing of that lot, other than the supplier's quality control testing, will comply with specification requirements. The system is based on an evaluation of the supplier's quality-control data, along with some testing of samples obtained from the supplier by the U.S. Army Engineer Waterways Experiment (WES). The evaluation procedure seeks to screen those suppliers whose product appears likely to exceed specification requirements, because some properties vary excessively. The system is based fundamentally on faith that the quality-control data supplied by the supplier are an unbiased reflection of the product. It is intended that the product be verified by sampling at the project and by testing at WES.

*b.* The responsibility for monitoring this system is assigned to the Director, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

### B-2. Procedures for the Establishment of a Qualified Source of Pozzolan

*a.* The using agency shall request that a producing plant be designated by WES as a qualified source. The WES will then contact the producer soliciting a formal request from the producer to be designated a qualified source. The formal request is to be made to the Director, WES, at the address shown in paragraph 7*b*(1),

in a letter certifying that the plant maintains a quality-control program and that all class pozzolans for which a qualified source under this system is requested will meet the current applicable American Society for Testing and Materials (ASTM) specification requirements. The letter requesting qualification as a source shall be signed by a representative of the producer having legal authority to bind the company. The letter will give the name, position, address, and telephone number of an individual who may be contacted for data and shipping information and to whom reports of tests shall be directed.

*b.* The cost for establishing qualified-source status will be negotiated between WES and the using agency. The cost will be based on the amount of work necessary to develop the required quality history.

*c.* The producer requesting status as a qualified source shall provide WES with the following:

(1) A brief outline of the procedures used to evaluate the finished product; sampling and testing frequency, test sample preparation employed, and chemical analysis methods used, such as X-ray diffraction, atomic absorption spectroscopy, or wet chemistry.

(2) Evidence that the laboratory or laboratories that produced the test data (except for fineness, loss-on-ignition, and density) is inspected on each concrete inspection tour of the Cement and Concrete Reference Laboratory (CCRL) by submission of a copy of the inspection report.

(3) Certification that facilities equipped with the required apparatus and staff capable of performing the test for fineness, loss-on-ignition, and specific gravity, as outlined in ASTM C 311, are located at the pozzolan production site.

(4) Quality-control data and the calculated critical limit (ASTM C 183) as follows:

(a) Chemical and physical analyses as required by ASTM C 618, Tables 1 and 2, for the last 12 quality-control samples that received full testing as indicated by the sampling and testing frequency information required in paragraph B-2c(1). If the supplementary optional chemical or physical requirements of ASTM C 618, Tables 1A and 2A, are requested, these data must also be submitted.

(b) Daily records of loss-on-ignition, fineness, and density for the 30 most recent daily quality-control samples.

**Note: ENG Form 5033, Report of Pozzolan Quality History, on which test data may be tabulated, is available upon request from WES.**

(5) A 1-kg sample of pozzolan for which qualified status is requested, along with a mill certificate that represents the properties of that sample.

(6) A list of the distribution terminals and marketing points served by each producing plant.

### **B-3. Acceptance of a Producer as Qualified Source**

a. Quality-history data, in accordance with paragraph B-2c(4), will be evaluated for acceptance according to the following criteria:

(1) The frequency with which test results for any single property exceed the applicable specification requirements for that property shall be less than or equal to 5 percent of test results submitted for that property. Further, the amount by which these exceed the specification limit shall be no more than 5 percent of the limit.

(2) The frequency with which test results for any single property exceed the critical limit

for that property shall not exceed 30 percent of test results submitted for that property.

(3) These criteria (paragraphs B-3a(1) and (2)) may be waived if convincing evidence is presented to indicate that materials that exceed specification or critical limit requirements can be detected and isolated and, hence, not shipped. This evidence, in addition to written explanations, may also include charts or graphs and must specifically address the properties in question. It is the responsibility of the producer to review these data prior to submittal to WES and to provide explanatory data or information if the requirements of paragraph B-3a(1) or (2) are not met.

b. The producer shall be advised in writing of acceptance.

### **B-4. Project Samples**

a. Pozzolan from a qualified producer delivered to the project site or concrete producing plant shall be sampled by a representative of the using agency and forwarded to WES for testing (paragraph B-4d). The recommended frequency for testing of project samples is: one sample per 400 Mg (400 tons) for conventional concrete construction and one sample per 800 Mg (800 tons) for roller-compacted concrete construction, but a minimum of one sample per project per year, or when, in the opinion of the using agency, field performance of the pozzolan indicates the need for a checktest.

b. Samples shall be sent to WES, Structures Laboratory (ATTN: CEWES-SC-EM), 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, and identified on ENG Form 5035, Project Sample Identification, as follows: (1) project name, location, and contract number, (2) source of pozzolan (manufacturer), (3) silo or lot number, (4) class and specification, (5) date shipped to project, (6) carrier identification (rail car number, truck name and number), and (7) description of the field performance problem, if any, for checktest samples. Necessary forms

and sampling supplies are available upon request from WES.

*c.* Project samples will be tested for compliance with project specifications as noted on sample identification, and results will be reported to the using agency.

*d.* The procedures for taking project samples will be in accordance with ASTM C 311 and supplementary instructions provided by WES to ensure that the material submitted to WES fairly represents material shipped from the qualified source.

### **B-5. Retention of a Producer as Qualified Source**

*a.* Quality-history data in accordance with paragraph B-2c(4) must be submitted every 6 months for evaluation in accordance with paragraph B-3a.

*b.* A 1-kg sample along with a mill certificate must be sent to WES with the 6-month quality history.

*c.* CCRL inspection reports on file at WES must be updated after each biannual CCRL inspection.

*d.* The producer shall be advised in writing of retention. An updated list of producers shall be maintained by WES.

### **B-6. Removal of a Producer from the Qualified Source List**

*a.* Qualified-source status will be discontinued when the project, for which the using agency made the request, is completed.

*b.* Qualified-source status may be removed prior to the completion of the project if:

(1) Results of tests of any 3 of a series of 10 consecutive project samples exceed the

critical limit for any applicable specification requirement.

(2) An individual project sample fails to meet a requirement of the applicable specification by more than 5 percent of the value of the specification requirement.

(3) More than 1 in 10 project samples exceed any specification requirement by any amount.

*c.* A producing plant may also be removed for failure to submit data every 6 months as described in paragraph B-5.

*d.* Prior to removing a plant from the list of qualified sources, WES shall take appropriate measures to confirm the validity of the sampling procedures and the representativeness of the sample or samples prompting removal. In addition, WES shall confer with all relevant using agencies and the producer.

*e.* The producer and using agency shall be advised immediately by telephone followed by written notice of removal action. Test data, field performance data, or both will be provided to indicate the cause for such action.

### **B-7. Procedures for Reinstatement to Qualified List**

Once a plant is removed from the qualified list as a source of pozzolan, reinstatement may be gained in the following manner:

*a.* Submit a written request for reinstatement to the Director, WES. This request shall present reasons why it is anticipated that the circumstances that led to removal will not be expected to recur.

*b.* Provide WES with samples of current production for test and evaluation, if requested.

*c.* If the data provided in paragraphs B-7a and b indicate that the reasons that led to

removal are not expected to recur, WES shall reinstate the plant to the list of qualified sources of that class of pozzolan.

**B-8. Inspection of Producer Facilities**

The production plant, test facilities, and terminal locations of a producer participating in this program may be visited periodically by a representative of WES to review procedures employed and

project requirements and to provide guidance in the functional procedures of the program. These visits should be conducted in a manner to promote better understanding and good working relationships between the laboratory and the producer company officials and to afford the laboratory an opportunity to maintain current knowledge of production and storage facilities of the pozzolan producing plants and terminals.

## APPENDIX C SEALED-BIN TESTING

### C-1. Introduction

Sealed-bin testing is an acceptance-testing program that seeks to give maximum assurance that a material meets specification requirements when it is used in construction. The procedure is to sample material as it is being delivered into storage bins and to seal the storage bin until testing confirms compliance. Material is loaded into conveyances under the surveillance of an inspector and again sealed until delivery into the storage facilities at the construction site. Under this system, there is little or no opportunity for untested material to reach the project.

### C-2. Authority and Procedures for Initiating Sampling, Inspection, and Testing

*a.* Sampling, inspection, and testing of cement, slag, or pozzolan shall be undertaken only on direct or confirmatory request of the using agency. Upon receipt of a request from the using agency, the U.S. Army Engineer Waterways Experiment Station (WES) shall authorize the mill or source inspector to perform the required sampling and inspection. Receipt of this authorization by the inspector shall constitute authority to perform sampling and inspection when requested to do so by the producer. The inspector shall promptly notify the producer of receipt of such authority. The inspector shall perform no sampling without proper authorization from WES.

*b.* In the event a producer requests inspection and testing of cement, slag, or pozzolan for which WES has not received a request from a using agency, WES will immediately contact the using agency to confirm that inspection and testing are desired in connection with the order in question. Oral, followed by written, confirmation shall be a satisfactory basis for the

laboratory to authorize the necessary sampling and inspection.

### C-3. Inspector

*a. Contract.* Inspectors can be Government employees or contract employees, but they must not be employees of the producer. Development and maintenance of inspector contracts may be the responsibility of the using agency or of WES.

*b. Duties.* The inspector is responsible for sampling, witnessing the transfer of material, and maintenance of records as follows:

(1) Sampling. When authorized, by WES or by the using agency, to initiate inspection activities on a lot of material, the inspector will take samples of the material as it is transferred from process to storage. Exact location for taking samples will depend on the setup of the production facility and should be coordinated with production personnel. Instructions on sampling frequency will be issued from the using agency or from WES prior to the start of inspection.

(2) Witnessing and sealing. Once a storage bin is full, or no more material is to be placed into it, the inspector shall seal the bin so that no additional material can be added without the inspector's knowledge. During loading for transport to the project site, which must not occur until notification from WES that the material complies with specification requirements, the inspector shall note the storage bin from which material is taken, the tanker number, and the amount loaded into it and seal the discharge tube(s), noting the seal numbers.

(3) Records. The inspector shall maintain logs of seal numbers, their location, and dates of

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application and/or removal. The inspector shall also maintain logs of amounts of materials shipped from each sealed bin, dates of shipping, truck or rail line responsible for transport, and tanker numbers. Copies of records shall be sent to WES monthly.

#### **C-4. Testing and Reporting**

Samples taken during the filling of bins will be sent to WES for testing. Full or reduced testing will be applied as required by ASTM C 183. Test results will be transmitted to the using agency, the inspector, and the producer.