NTPEP Committee Work Plan for

Evaluation of Profile Wall Polyvinyl Chloride Drainage Pipe Manufacturers

NTPEP Designation: PVC-17-01
NTPEP Committee Work Plan for

Evaluation of Profile Wall Polyvinyl Chloride Drainage Pipe Manufacturers

NTPEP Designation: PVC-17-01

1. SCOPE

1.1 The National Transportation Product Evaluation Program (NTPEP) serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).

1.2 This NTPEP Committee Work Plan (hereafter referred to as the “work plan”) covers the requirements, auditing and testing criteria for the NTPEP evaluation of profile wall polyvinyl chloride (PVC) drainage pipe Manufacturers. This work plan is intended to be utilized with NTPEP document SP01, Qualification of Highway Product Manufacturers Through the Use of NTPEP Audits, to provide a comprehensive audit program for PVC pipe.

1.3 The purpose of the program is to provide audit information from manufacturing plants that comply with the quality control and product testing requirements of this program. AASHTO member departments can then use this information in their quality assurance program for Manufacturer/product acceptance. This may include utilizing this information to establish a qualified Manufacturer list, a qualified products list, or both. By participating in this program, the Manufacturer agrees to produce product that meets or exceeds the requirements in the applicable AASHTO/ASTM Designation Standard(s) and follow the minimum quality control provisions of their quality program.

1.4 Testing of the Manufacturer’s product(s) against the applicable standard(s) and auditing the Manufacturer’s in-plant quality control facilities and procedures are included in this program. The Manufacturer agrees that NTPEP may use the test results and audit reports along with other relevant information for review and verification of compliance with this NTPEP program and the applicable AASHTO/ASTM Designation Standard(s).

1.5 This work plan may involve hazardous materials, operations, and equipment. It does not purport to address all safety problems associated with its use. It is the responsibility of the user of this work plan to establish the appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:
- AASHTO M 304, Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter

2.2 ASTM Standards:
- ASTM D618, Standard Practice for Conditioning Plastics for Testing
- ASTM D883, Standard Terminology Relating to Plastics
- ASTM D1600, Standard Terminology for Abbreviated Terms Relating to Plastics
- ASTM D2152, Standard Test Method for the Degree of Fusion for Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- ASTM D2444, Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by Means of a TUP (Falling Weight)
- ASTM F412, Standard Terminology Relating to Plastic Piping Systems
- ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- ASTM F1057 Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique

2.3 NTPEP Documents:
- SP01, Qualification of Highway Product Manufacturers Through the Use of NTPEP Audits

3. **TERMINOLOGY**


3.2 **Auditor** – A NTPEP representative to review submittals, coordinate auditing and testing, and report audit findings.

3.3 **Audits** – Documented reviews of a Manufacturer’s plant and associated test facilities by a NTPEP Auditor and any AASHTO member department co-auditor that wishes to participate.

3.4 **Cell Classification** – The nomenclature used to define characteristics of PVC plastics. Pipe, internal sleeves, and fittings made of PVC plastic having a minimum cell classification of 12454 or 12364 as defined in ASTM D1784. Homopolymer PVC compounds will meet or exceed the requirements of the above listed

3.5 **Comparison Testing of Products** – Sample(s) of pipe selected from the manufacturing line or stockyard and corresponding resin/compound to be tested by the Manufacturer and the NTPEP designated laboratory. The results of both testing locations are reported for comparison.

3.6 **Compound** – The combination of raw materials from which PVC pipe covered by this Standard Practice is made. Compounds may include one or more resins, fillers, UV inhibitors and other components which are blended together in order to prepare plaques from which test specimen are made to qualify the compound and verify that it meets the cell classification required by AASHTO M 304 prior to pipe being manufactured.

3.7 **Gaskets** – Elastomeric material used in pipe connections. Gaskets will comply with low head-application requirements described in ASTM F477.

3.8 **Independent Laboratory** – An outside laboratory that performs raw material or finished product tests for the Manufacturer. NTPEP reserves the right to audit the independent laboratory for the tests that are being performed for the Manufacturer.

3.9 **Initial Audit** – The first audit conducted at a Manufacturer, which has not had an audit conducted by another independent agency.
3.10 Manufacturer- An individual producer of profile wall PVC drainage pipe. The corporate name (actual location) will be included in the NTPEP program.

3.11 NTPEP Designated Laboratory – A laboratory qualified by NTPEP to perform the specific tests as outlined in the Standard Practice and has on site qualified technicians and equipment necessary to perform the tests per the applicable AASHTO/ASTM Designation Standard(s).

3.12 NTPEP PVC Pipe Technical Committee – The NTPEP Technical Committee that includes member departments of the AASHTO and members of Industry. The members are volunteers who are interested in the advancement of the product. The Technical Committee appoints a Chairman and a Co-Chairman.

3.13 Pipe Lot – The amount of pipe produced per type per diameter as defined in the Manufacturer’s Quality Control Plan/Quality Management System.

3.14 Profile Wall Pipe- A pipe product consisting of a smooth wall waterway braced with annular or helical projections or ribs on the outside of the pipe, or with annular or helical bracing between smooth outer and inner walls.

3.15 Quality Management System (QMS) – The documented process used by the Manufacturer for quality control/quality assurance.

3.16 Recycled Material- Material from a source other than the Manufacturer’s production line, which may not meet the requirements for minimum cell classification or has unknown properties.

3.17 Regrind- Reworked material that is processed for introduction into the feed stream.

3.18 Soiltight Joints- Connections that do not allow soil migration through the joint into the pipe in accordance with AASHTO M304 Section 7.6

Additional terminology can be found in applicable AASHTO/ASTM Designation Standard(s) as well as the NTPEP Standard Practice SP01.

4. ADDITIONAL QUALITY MANAGEMENT SYSTEM (QMS) REQUIREMENTS

4.1 Handling Raw Materials and Finished Product for DOT Products - The QMS will include a written procedure for handling compounds and finished product.

4.1.1 Compounds -. The pipe Manufacturer will test the compound, or have it tested at an independent laboratory acceptable to NTPEP, as specified in Table 1. For every compound formulation, the Manufacturer will maintain, for a minimum period of 5 years, verification test reports and the formulation’s cell classification, certificate of analysis (C of A), and supporting test reports. The Manufacturer will establish a lot number for each lot of compound and carry it through to the finished product. The QMS will include the location and method for sampling compounds.

Note 1 – When component materials are controlled in lieu of compound verification tests, the manufacturer may request approval from the PVC Pipe Technical Committee (TC) to deviate from the work plan. The request must state what components will be tested, for which properties and at what frequency. The TC will grant a waiver based on the proposed quality control meeting the intent of the requirements stated herein and does not absolve the manufacturer from meeting the compound requirements in AASHTO M 304.

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Test Designation</th>
<th>Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>Designation 1</td>
<td>Frequency 1</td>
</tr>
<tr>
<td>Test 2</td>
<td>Designation 2</td>
<td>Frequency 2</td>
</tr>
</tbody>
</table>
Pipe shall be made of virgin PVC compounds meeting cell classification 12454 or 12364 in accordance with ASTM D1784.

In lieu of virgin PVC, clean reworked material (regrind) may be used, provided that it meets the cell class requirements as described in Section 4.1.1.1.

Additional Compound Requirements for M 304 Products:

- When pipe is produced from a single stream compound there will be a C of A indicating the virgin compound meets the requirements of AASHTO M 304.
- The full cell classification testing of a compound will be performed with the initial use of any formulation and then annually with the continued use of that formulation. When the compound testing frequency varies from Table 1 it shall be noted in the QSM with the stated frequency documented by the auditor.
- Each compound formulation will be provided to the NTPEP auditor so that it can be verified it is an approved formulation being used to produce the AASHTO M 304 product.

M304 Fittings and Coupling Requirements:

- The QMS will document where fittings and couplings are manufactured, the source of the components, and the fabrication process used.
- All fittings will include indelible markings with the designation number of the specification, AASHTO M 304, and with the Manufacturer’s identification symbol. This procedure will also be included in the QMS.
- The QMS will also document the process used to assure that all compounds used to manufacture fittings and couplings meet the material requirements of AASHTO M 304, including those components purchased from another party.
- The QMS will require that the plant maintain records establishing traceability from the fitting or coupling back to the compound lot used to manufacture the fitting or coupling. Documentation establishing traceability will be maintained along with the inventory.

Finished Product – As a minimum the QMS will describe the Manufacturer’s inspection process to conduct visual inspections of: the exterior and interior walls for visible cracks, holes, foreign inclusions, or other defects as described in AASHTO M 304, during production. The procedure will require the Manufacturer to monitor the process and finished product and perform and record the results of the following inspections at the minimum frequency indicated:

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workmanship (per AASHTO M 304)</td>
<td>continuous, recorded at least once per shift</td>
</tr>
<tr>
<td>Markings (per AASHTO M 304)</td>
<td>one per shift</td>
</tr>
</tbody>
</table>

Quality Control Inspection - The QMS will include an example of a quality control test report form. The QMS will reference the AASHTO, ASTM, or in house procedures and calibrations.
The QMS will describe any company procedure used.

**Note 2** - Company procedures are subject to review. The company test procedures which pertain to the tests providing useful information to evaluate the product are included in this requirement.

4.2.1 The QMS will require that the Manufacturer perform and record the results of at least the following quality control measurements and tests, at the minimum frequency indicated on each lot of pipe:

<table>
<thead>
<tr>
<th>Measurements and Tests</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Thickness</td>
<td>one per shift per line ^</td>
</tr>
<tr>
<td>Inside Diameter</td>
<td>one per shift per line ^</td>
</tr>
<tr>
<td>Perforation Locations and Dimensions</td>
<td>one per shift per line ^</td>
</tr>
<tr>
<td>Pipe Stiffness</td>
<td>one per day per line</td>
</tr>
<tr>
<td>Pipe Flattening</td>
<td>one per day per line</td>
</tr>
<tr>
<td>Impact Resistance (Tup)</td>
<td>one per day per line</td>
</tr>
<tr>
<td>Acetone Immersion</td>
<td>one per line per year</td>
</tr>
<tr>
<td>Heat Reversion</td>
<td>one per line per year</td>
</tr>
<tr>
<td>Soiltightness*</td>
<td>one per year</td>
</tr>
<tr>
<td>Watertightness*</td>
<td>one per year</td>
</tr>
</tbody>
</table>

^ At least one set of measurements per shift per line will be from a cut section of pipe. A minimum of once per day, these tests shall be on conditioned pipe.

* The pipe will be identified in the QMS as either soiltight or watertight. Only the applicable test will be performed at the required frequency.

4.3 Labeling and Storage of Finished Product - The QMS will include a written procedure describing how finished product is labeled, packaged and stored to include:

- The Manufacturer’s method for permanently marking the pipe in accordance with the minimum requirements of AASHTO M 304;
- Detailed explanation of any coding used to mark the pipe; and
- The procedures used to ensure that product handling, storage, and shipping processes will not adversely affect the material composition, characteristics, or product quality.

5. NTPEP ON-SITE AUDITS

5.1 Quality Control Testing Evaluation - Each Manufacturer will be asked to demonstrate the quality control tests they perform as stated in their QMS. While performing each test, the most current AASHTO or ASTM test methods will be referenced. The equipment used for each test will be examined and applicable records will be reviewed. The auditor may also select three random weeks (within the previous 12 months) of test reports for compound and pipe produced in accordance with AASHTO M 304 to review.

5.2 Testing of Products – The auditor(s) will select samples of PVC thermoplastic pipe available at the time of the audit for testing in accordance with SP01, Section 8, “Annual Testing of Products”. The auditor(s) may select pipe from the production line or from the yard. All sampling and testing will be in accordance with the applicable AASHTO/ASTM Designation Standard(s). The samples will be for testing at the Manufacturer’s testing facility and the NTPEP Designated Laboratory.

**Note 3** - If major deficiencies are noted during an on-site audit, a follow-up audit will be required to be completed.
6. **ANNUAL PRODUCT TESTING**

6.1 The NTPEP Auditor will select two sets of test specimens for comparison testing during each annual Manufacturer audit (one set to be tested by the Manufacturer and one set to be tested by the NTPEP Designated Laboratory). All specimens will be from the same lot of material.

6.2 Manufacturer Samples:

6.2.1 Once initial product evaluation has been established, a NTPEP Auditor will sample pipe and compound during each annual plant audit. It is the intent to sample all pipe sizes produced by the Manufacturer. Subsequent annual pipe samples should not duplicate previously tested diameters or formulations (as practical) until all diameters and formulations produced at the plant have been tested.

6.2.2 If the pipe Manufacturer does not have capability to perform the cell class as specified in M 304, the compound samples may be tested at a laboratory acceptable to NTPEP, preferably not at the same laboratory testing the NTPEP portion of the sample.

6.3 NTPEP Designated Laboratory Samples:

6.3.1 The NTPEP Auditor will instruct the Manufacturer on the proper labeling of the NTPEP Designated Laboratory samples. These samples will be located adjacent to the previous (Manufacturer) samples and from the same lot(s) and in the same quantities. Compound testing, performed by the NTPEP designated laboratory, shall verify the most recent cell classification that was performed by the manufacturer.

6.3.2 Once the NTPEP Auditor sends the Manufacturer the results from the NTPEP Designated Laboratory testing, the Manufacturer can provide an explanation of any significant differences between the NTPEP Designated Laboratory and Manufacturer sample test results, including any corrective actions found necessary in the manufacturing process or testing procedures within 15 business days of receiving the test results.

6.4 Retest Samples:

6.4.1 All NTPEP sampled pipe and compounds will contain additional material obtained from the same lot as the Manufacturer samples. The additional material will be used by the NTPEP Designated Laboratory in the verification of any failing test results.

6.4.2 Testing for product conformance performed by an independent laboratory will be witnessed during the audit. All conformance testing will be in accordance with this Section.

6.4.3 If during the testing portion of the audit or during NTPEP Designated Laboratory, the sample fails to meet specification requirements or when the Manufacturer is found during an audit to have neglected one or more aspects of the governing QMS during manufacturing, the non-conformance will be addressed as outlined in Section 10 of SP01.

6.5 Shipment of Samples:

6.5.1 The Manufacturer is responsible for the shipment of the pipe and compound samples. Proper care (packaging, identification, tracking, etc.) to limit damage or loss of the sample shipment is the responsibility of the Manufacturer. Loss or damage of the samples will require re-sampling and testing at the Manufacturer’s expense.

6.6 Testing of Samples:

6.6.1 The Manufacturer will complete all in-house testing on the pipe and send test results to AASHTO and the NTPEP Designated Laboratory within 15 days of the completion of their audit.
7. **DELIVERABLES – EVALUATION RESULTS AND DATA**

7.1 Audit results (in the form of an Audit Report, a Comparison Report for the tested samples, and any Corrective Action Reports) will be located in the web-based database – DataMine, as follows:

7.1.1 Once the test data is reported to the Auditor by the NTPEP Designated Laboratory, the Auditor will review the data to ensure completeness. The Comparison Report will be posted to DataMine and will be available to the product manufacturer and the end state user participants for review.

7.1.2 All other audit documents (Audit Report, Manufacturer QMS, and Corrective Action Report – if applicable) will be uploaded by the Auditor, as competed, and made available for review.

7.1.3 Audit results will be made available to all participating states through the AASHTO/NTPEP DataMine website. No judgement as to a product’s acceptability to any state DOT requirement is made in DataMine. End state user participants are responsible for establishing their criteria for product acceptability.

7.2 The DataMine database can be accessed through the AASHTO/NTPEP website link at http://data.ntpep.org/.

---

8. **KEYWORDS**

8.1 NTPEP; PVC pipe; plastic pipe; profile wall PVC pipe; Manufacturer
APPENDIXES (NONMANDATORY INFORMATION)

X1. NTPEP QA PROGRAM FOR POLYVINYL CHLORIDE DRAINAGE PIPE - PARTICIPANT RESPONSIBILITIES

X1.1. **Background:** This section summarizes the responsibilities for the different parties, which can be found in more detail in the following sections titled, “Operating Procedures” and “Quality Control Polyvinyl Chloride (PVC) Drainage Pipe Manufacturers”.

X1.2. **Manufacturers’ Responsibilities:** Participating Manufacturers will develop and implement a QMS (including a quality management manual) outlining their quality control testing program for production of PVC Drainage Pipe. In addition, the manual will address the following general program, testing facilities, personnel qualification, and record keeping requirements:

X1.2.1. **General Requirements:**

X1.2.1.1. Each Manufacturer will be prepared to accommodate Manufacturer and testing facility audits (scheduled and follow-up) by NTPEP representatives when submitting its initial QMS, or updated QMS in the case of the annual re-evaluation, to NTPEP.

X1.2.1.2. Each Manufacturer’s facility is responsible for ensuring continuous compliance with all NTPEP quality control requirements. Failure to do so may result in revocation of the listing and certificate on the NTPEP website.

X1.2.2. **Testing Facilities:**

X1.2.2.1. The Manufacturer’s quality control manager will be responsible for quality control testing at all facilities and will assure that all sampling and testing is done by qualified technicians.

X1.2.2.2. The testing facilities will maintain current versions of all AASHTO, ASTM, and Manufacturer’s test procedures for all tests performed and a current version of the Manufacturer’s QMS.

X1.2.2.3. The facilities will adequately house and allow proper operation of all required testing equipment.

X1.2.2.4. The testing equipment will be calibrated/verified/checked in accordance with the Manufacturer’s recommendations at least at the specified intervals (Ref.: SP01, Annex A.1) by personnel customarily involved in such work as documented in the QMS.

X1.2.2.5. The testing facilities will maintain records of all test results and all NTPEP reviews and actions taken to resolve any noted deficiencies.

X1.2.2.6. Records of equipment calibration and verification will be maintained and available to NTPEP and AASHTO member departments upon request.

X1.2.3. **Testing Personnel:**

X1.2.3.1. The Manufacturer’s quality control manager will meet the requirements established by the company for the position.

X1.2.3.2. Documentation will show that the technician has been trained in the test procedures to be performed.

X1.2.3.3. Documentation will show that the technician has satisfactorily demonstrated competency to perform the required testing and that this demonstration is repeated annually.

X1.2.3.4. Documentation will show that technician training has been updated when revisions in test methods occur.
X1.2.5. Review of reports will show the technician can properly perform test procedure calculations and properly record information.

X1.2.6. Technicians-in-training may perform sampling and testing at qualified facilities provided they are working under the direct supervision of a technician fully qualified under NTPEP requirements.

X1.2.7. If requested, technicians will perform sampling and testing for NTPEP observers.

X1.2.4. Testing Documentation

X1.2.4.1. All quality control test results for Polyvinyl Chloride Drainage Pipe will be documented in reports of the same format as the sample forms submitted in the QMS and will be kept for a minimum of three years.

X1.2.4.2. The reports will document the actions taken in the event of product test failures.

X1.2.4.3. The reports will show the manufacture location, date of manufacture, physical and chemical test results. Identification will be such that the test reports for any product can be located.
AUDIT AGENDA

X2. On-Site Plastic Pipe Audit

**Opening Meeting**
- Introductions
- Address Any Safety or Security Concerns
- Address Confidentiality
- Questions, Comments, or Concerns?

**Summary of Desktop Review**
- Resolved Findings
- Unresolved Findings

**Yard Walk Through**
- Inspect Pipe, Fittings, and Couplings
- Record Product Information for Traceability Purposes

**Manufacturing Line Walk Through**
- Process and Conditions
- Collect Pipe and Compound Samples for Comparison Sample Testing

**Review of Documentation**
- Review and Collect Certificates of Analysis
- AASHTO and ASTM Standards
- Training and Competency Evaluations
- Internal Audits
- Management Reviews
- Most Current Quality Manual
- Equipment Records

**Quality Control Testing**
- Demonstration of In-House Testing Methods
- Inspection of Equipment

**Audit Summary Close-Out Meeting**
- Review of Audit Findings
- Questions/Concerns?
- Closing Remarks