American Association of State Highway and Transportation Officials (AASHTO)

National Transportation Product Evaluation Program (NTPEP)

Project Work Plan for Evaluation of HDPE (High Density Polyethylene) Thermoplastic Pipe

Revised, June, 2009

Introduction and Purpose:

The purpose of AASHTO's NTPEP for Thermoplastic Pipe is to establish a list of manufacturing plants and pipe products that conform to the quality control and product testing requirements of this work plan. AASHTO member departments can then use this information in their quality assurance program for thermoplastic pipe and the resins from which it is manufactured. This may include utilizing this information to establish a qualified supplier list and/or a qualified products list. By participating in this program, the manufacturer agrees to produce thermoplastic pipe that meets or exceeds the requirements in AASHTO M294 or M252 and follow the minimum quality control provisions of the program. NTPEP validates this agreement through testing the manufacturer's product(s) to verify compliance with the applicable standard and auditing the manufacturer's in-plant quality control facilities and procedures. 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 work plan and the applicable AASHTO Specifications. If compliance is demonstrated, the NTPEP will list the product(s) and plant(s) in the NTPEP listing of products and facilities conforming to this work plan.

Definitions:

AMRL NTPEP Auditor – A third party retained by NTPEP to review submittals, coordinate auditing and testing, and report audit findings and resin and pipe split sample test results.

Annual NTPEP Audits – Audits of a manufacturer's plant and associated test facilities by a NTPEP AMRL auditor and any AASHTO member department co-auditor that wishes to participate.

AMRL Supervisor- The individual responsible for administering and managing the program.

Blowout – A void or hole in the finished pipe.

Bonding – How the inner liner and outer liner stick together. Lack of bonding would cause delaminating.

HDPEP Administrative Group – The HDPEP Administrative Group includes members from each AASHTO Region. The HDPEP Technical Committee Chairman is a Co-Chairman of this Administrative Group and the full HDPEP Technical Committee elects the other members. The majority of the members of the Administrative Group must be in agreement to reach a decision.

Independent Laboratory Acceptable to NTPEP – a laboratory that is qualified to perform the specific tests as outlined in the work plan and has on site qualified technicians and equipment necessary to perform the tests per ASTM and AASHTO standards.

Initial Audit- The first audit conducted at a manufacturing plant, which has not had an audit conducted by another independent agency.

Periodic Testing- Additional testing completed on specimens collected aside from what is tested during the annual on-site audit.

Manufacturer- the total amount of producing plants and testing laboratories a manufacturer owns and operates.

NTPEP Manager- The individual responsible for overseeing all areas of the program are being run according to what is noted in this Work Plan as well as resolving any conflicts which may arise.

NTPEP Split Sample Testing – a specimen selected from the manufacturing line or stockyard to be tested more than one entity which is accepted as an independent Laboratory.

QMS Desk Top Audit – a complete review of a manufacturer's Quality Management System (QMS) and the corresponding documentation by NTPEP or its designee.

Pipe Lot – The amount of pipe produced per type per diameter per machine per production run.

Plant- An individual pipe manufacturing facility.

Quality Management System (QMS) – the producing plant shall maintain documentation of their quality system by use of a Quality Manual (QM) and corresponding documentation.

Resin Lot – A lot of resin for a pipe manufacturing facility is a railcar or truckload, hopper truckload, or truckload of boxes.

Recycled Plastic – Post Consumer (detergent bottles, etc) Recycled HDPE used to produce pipe for non DOT jobs

Resin Blend – A resin blend is a blend of two or more virgin resins. A resin blend may include carbon black pellets and reworked material in accordance with the provisions of AASHTO M252 and M294.

Reworked Material – A plastic from a processor's own production that has been reground, pelletized, or solvated after having been previously processed by molding, extrusion, etc. (ASTM D 883)

Single-Stream Resin – A single stream resin a feed of one virgin resin. A single stream resin may include carbon black pellets and reworked material in accordance with the provisions of AASHTO M252 and M294.

Surveillance Audit- An audit conducted at a plant when major deficiencies are noted during a previous on-site audit. A local DOT may go into a plant, which is not the annual inspection by NTPEP and find major problems. Then a follow up audit would be needed.

Overview of the NTPEP Thermoplastic Pipe Program:

The NTPEP Thermoplastic Pipe Program assesses the conformance of both manufacturing plants and products. The program includes the following:

1. Desk Top Audit of the Plant's Quality Management System
2. Initial and Annual NTPEP AMRL Audits
3. Annual Split Sample Testing of Pipe and Resin
4. A NTPEP website with the following information:
   a) A listing of pipe products, by diameter and manufacturer, tested and found to conform to the requirements of the AASHTO M252 or M294 Material Specifications.
   b) A listing of plants with a quality management system found to conform to this work plan.
   c) A document library containing this work plan and a secure area where AASHTO member departments can view manufacturers' QMS documents and split sample test results for M 294 and M 252 pipe and materials.

Tests/Practices to be Included:

AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials
ASTM D 1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics
ASTM D 4218	Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique (Note 1)

Note 1*- Both D1603 or D4218 are permitted, but D4218 will be considered the definitive test in case of a conflict or dispute.*

ASTM D 1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D 2122	Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D 2412	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2444	Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by Means of a TUP (Falling Weight)
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F 2136	Standard Test Method for Notched, Constant Ligament-Stress (NCLS) Test to Determine Slow-Crack-Growth Resistance of HDPE Resins or HDPE Corrugated Pipe

Note 2 *- All ASTM test methods referenced herein are copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959.*

Participation:

Any manufacturer of thermoplastic pipe as defined in AASHTO M252 and/or M294 may participate in the program. All costs for participation in the program, including sample shipping and testing and other NTPEP auditing and administrative fees are to be borne by the manufacturers, except for those costs associated with member department co-auditors.

1.) The pipe manufacturer must make a formal request through the NTPEP website to participate in the program. The request must list the plants, testing facilities, and products to be evaluated and describe the manufacturer's Quality Management System (QMS).
2.) Once the QMS is found to conform, the plant and all associated testing facilities the manufacturer desires to qualify will be audited. Pipe and samples of the resin it was made from will also be taken for testing in accordance with the appropriate AASHTO specification.
3.) An on-site audit will be scheduled approximately 4 weeks in advance. The plant will receive an Announcement Letter from AMRL.
4.) Each unique corrugated or profile wall thermoplastic pipe product requested for inclusion into the program will be separately tested.
5.) Audit reports are released to the NTPEP website and are able to be viewed be all AASHTO Member Departments and the personnel from the plant the audit was conducted at. A hard copy of the summary is also left with the plant personnel at the completion of the on-site audit.
6.) Each plant is also listed on the NTPEP website, showing if they are compliant with the program.

Note: If major deficiencies are noted during an on-site audit, a surveillance audit will be required to be completed.

Annual Plant Audits:

Once initial plant QMS and product conformance is established as described in the Participation Section above, annual NTPEP auditing and testing will be required for a manufacturer's plant to remain on the NTPEP list of compliant plants. Annual plant audits will include the following;

1. **Documentation Review** - The auditor(s) will check the availability of the most current AASHTO and ASTM standards, review training and competency records, and evaluate the most current Quality Manual documentation and equipment records to verify implementation of the plant's QMS.
2. **Production Line Inspection** - During the production line inspection, the auditor(s) will walk through the manufacturing process to observe the conditions of the lines. During this process, the auditor will identify samples of resin and pipe to be collected for split-sample testing purposes.
3. **Sampling and Testing** - Audits will include the sampling of resin and pipe from current production to be submitted to the NTPEP designated independent laboratory for evaluation and current pipe production will be measured/evaluated on-site for compliance with AASHTO specifications. If current production pipe is not available, samples will be randomly selected from inventory, with the resin sampled from current production.

4. **Yard Inspection** - The auditor(s) will inspect the condition of AASHTO M 252 and M294 pipe fittings, and coupling in the plant's yard. Additionally, the auditor(s) will select various sizes of AASHTO M 252 and M294 pipe and verify that resin samples, resin lot test results, and a test report associated with each lot representing the pipe selected are available for the samples of pipe selected.
5. **Quality Control Testing Evaluation** - Each manufacturer will be asked to demonstrate the quality control tests they perform on a regular basis. While performing each test, the most current AASHTO or ASTM test methods may be referenced if needed. The equipment used for each test will be examined and applicable records will be reviewed.
6. **The NTPEP Audit Team** - The NTPEP audit team will consist of an AMRL NTPEP Auditor and an AASHTO member department co-auditor(s) from any state that wishes to participate. The AMRL NTPEP Auditor will produce a single audit report, which will include findings from both the AMRL NTPEP Auditor and AASHTO Member Department co-auditor(s), if present.
7. **Surveillance Visits and Testing** - AASHTO member departments using the NTPEP listing have the right to conduct surveillance visits and audit any manufacturer's plant and associated laboratory included in the program to determine compliance with the program requirements. These visits may not necessarily be announced. They may also randomly select samples of product and the resin or resin blend being used in production for confirmation testing by NTPEP. Any testing above and beyond the basic NTPEP program requirements shall be at the state's expense, unless the tested product(s) does not meet the specification requirements, in which case the manufacturer shall bear the cost of testing and any subsequent re-testing required. A product's failure to comply will result in removal from the NTPEP listing pending the evaluation of the issue.

Note 3 *- These visits may result in the need for an AMRL NTPEP surveillance audit.*

Quality Management System (QMS) Requirements:

AMRL Audits will be based on a manufacturer following a quality control program at the plant that provides the following information: assurance that the products produced meet the requirements of the AASHTO Materials Specifications and that these products conform to this NTPEP work plan. The Manufacturer will implement a documented Quality Management System (QMS). Each manufacturer shall include elements that it considers necessary to assure that products meet M252 or M294 requirements, but as a minimum the QMS shall include or address the following:

1. Organization and Organizational Policies
2. A Quality Mission Statement
3. Quality Control of Raw Materials
4. Quality Control Inspection and Testing
5. Quality Control Personnel Training and Competency Evaluation
6. Statistical Analysis of Test Results
7. Resolution of Non-Conforming Product or Test Results
8. Retention of Test Results and Product Traceability
9. Records Retention
10. Quality Control Testing Facilities
11. Marking, Storage, Shipping, and Handling of Finished Pipe
12. Internal Quality Audits of Each Plant Producing Product
13. A List of Plants and Quality Control Testing Facilities
14. Written Copies of all Company Developed Test Procedures.

The following sections provide more information about each of these elements:

1) **Organization -** The QMS shall indicate the line of authority from the QC testing technicians to the QC manager, ensure that QC testing technicians have the authority to require corrective action, and ensure that the QC manager is independent of production management and of equal status.

2) **Quality Mission Statement** - The quality mission statement shall be endorsed by the company's Chief Executive Officer and also be made available to all employees.

3) **Quality Control of Raw Materials (General)** - The QMS shall include requirements for quality control testing of polyethylene resins as specified in AASHTO M 252 and M 294. The pipe manufacturer shall test the resin, or have it tested at an independent laboratory acceptable to NTPEP, as specified in Table 1. For every lot of resin, the pipe manufacturer shall maintain, for a minimum period of 5 years, resin test reports and the resin manufacturer's lot specific density and melt index data, certificate of analysis (C of A), and supporting test reports. The pipe manufacturer shall establish a lot number for each lot of resin and carry it through to the finished product. The QMS shall include the location and method for sampling resin.

Table 1: Resin Test Requirements

Test Property	Test Performed On	Test Designation	Test Frequency
Density	virgin resins and blends	ASTM D1505 or ASTM D792	one test per lot of resin
Melt Index	virgin resins and blends	ASTM D1238	one test per lot of resin
Notched Constant Ligament-Stress (NCLS)	M294 product, resin blends only	AASHTO M 294 & ASTM F 2136	once on initial use of a resin blend and then quarterly with continued use of the blend

a. Single-Stream Resin - If reworked material is added a single-stream resin, it must have been produced from products meeting or exceeding the resin cell class requirements of the new product being produced. **Recycled plastic is not allowed.**

b. Resin Blend- If reworked material is added to a resin blend, must have been produced from products meeting or exceeding the resin cell class requirements of the new product being produced. **Recycled plastic is not allowed.**

c. Additional Resin Requirements for M252 Products
   - If produced from a single stream resin there must be a C of A indicating the virgin resin meets the melt index and density requirements of M252. The resin may be used before testing, but the pipe manufacturer must verify the melt index and density for each lot by subsequent testing.
   - If produced from a resin blend the pipe manufacturer must test the melt index and density of each component resins and it must be found to conform to the C of A results. The pipe manufacturer's test results must be used to determine the blend ratios. Each blend of resin components establishes a lot, and a new lot is established each time a component resin or a component ratio changes more than allowed by the blend tolerances (±1.5%).

d. Additional Resin Requirements for M294 Products

- Resin blends used to produce M294 products shall meet the requirements of M294, either through the PPI listing or recognized third party testing, with component variations limited to ± 1.5% of the certified blend components.
- Follow-up testing for melt index and density must be done for each lot to verify the certification and the pipe manufacturer. Testing can be completed through in-house testing capability or testing at an independent laboratory acceptable to the NTPEP.
- The full cell classification testing including the NCLS test shall be performed with the initial use of any lot and then quarterly with continued use.
- Each resin component for a PPI or third party approved blend must be provided to the AMRL NTPEP auditor so that it can be verified it is an approved blend being used to produce the M294 product.

e. M252 and M294 Fittings and Coupling Requirements

- The QMS shall document where fittings and couplings are manufactured, the source of the components, and the fabrication process used.
- All (blow-molded and fabricated) fittings shall include indelible markings with the designation number of the specification, M 294 or M 252, and with the manufacturer's identification symbol. This procedure shall also be included in the QMS.
- The QMS shall also document the process used to assure that all resins used to manufacture fittings and couplings meet the material requirements of M252 and M294, including those components purchased from another party.
- The QMS shall require that the plant maintain records establishing traceability from the fitting or coupling back to the resin lot used to manufacture the fitting or coupling. Documentation establishing traceability shall be maintained along with the inventory.

4) **Quality Control Inspection, Measurement and Testing**

a. The QMS shall describe the pipe manufacturer's pipe inspection procedures. As a minimum the procedure shall require the pipe manufacturer to conduct visual inspections of the exterior and interior walls for bonding, blowouts, and workmanship items as described in AASHTO M252 and M294, during production. The procedure shall 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:

Inspection	Frequency
• Workmanship (per AASHTO M252 and M294)	continuous, recorded at least once per shift
• Marking (per AASHTO M252 and M294)	one per shift

b. The QMS shall define the quality control tests, the method for random sampling, the size of the sample, and the lot size for production facility quality control sampling and testing. The QMS shall also include an example of a quality control test report form. A pipe lot shall be no larger than the amount of pipe produced per type per diameter per machine per day. The QMS shall reference the AASHTO, ASTM, or In house procedures and calibrations. The QMS shall describe any company procedure used.

Note 4 *- Company procedures are subject to approval. The company test procedures which pertain to the tests providing useful information to evaluate the product are included in this requirement.*

c. The QMS shall 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:

Measurements and Tests	Frequency
• Unit Weight	two per work shift
• Wall Thickness (See Appendix 4)	two per work shift
• Carbon Black Content (AASHTO M252 or M294 and ASTM D3350)	one per day
• Inside Diameter	one per work shift
• Pipe Length	one per work shift
• Perforation Locations and Dimensions (Type "CP" and "SP")	one per work shift
• Water Inlet Area (Type "CP" and "SP")	one per work shift
• Pipe Stiffness	two per week
• Pipe Flattening	two per week
• Elongation (M252 Only)	one per year
• Low Temperature Flexibility (M252 Only)	one per year
• Brittleness	two per week
• Joint Integrity	welded bell/spigot, one per week integral bell/spigot, quarterly
• Environmental Stress Cracking	one per year

d. The QMS shall ensure that:
   - each sample selected for quality control inspection and testing is designated with a sample control number for record keeping and traceability
   - the test report for each sample identifies the plant, date, shift of manufacture, production line, and lot designation for the polyethylene resin, and that
   - quality control test reports (not samples) are maintained and available for review for 5 years.

5) **<u>Quality Control Personnel -Training and Competency Evaluation</u>**

a. The QMS shall ensure that:
   - the manufacturer's QC manager meets the requirements established by the manufacturer;
   - the QC manager qualifies technicians performing QC testing;
   - QC personnel are familiar with the tests they perform, and that
   - QC personnel have sufficient authority to assure that corrective actions are carried out when necessary.

b. The QMS shall describe the manufacturer's QC technician qualification program. As a minimum the program shall include:
   - training in the AASHTO, ASTM, or Company test procedures, operation of equipment, the procedures to be used, calculations required, and reporting;
   - demonstration of competency in each required test;
   - demonstration of ability to properly document test results;
   - annual auditing of each technician's ability to satisfactorily perform the required tests;
   - retraining when a test method is revised

c. Training and competency reviews shall be documented in such a way that compliance with the requirements for the initial and updated training and the initial and annual competency reviews can be demonstrated for each technician and for each test the technician performs. The documentation shall include the date of the training or competency review and contain the hand written signature or initials of the trainer/reviewer and the technician. This documentation shall be retained, for a minimum period of 5 years, at each facility where quality control testing occurs, and shall be made available to NTPEP for review upon request. **See Appendix 3** for examples of forms that can be used to meet these documentation requirements.

6) **Statistical Analysis of Test Results** - The QMS shall include a description of the manufacturer's statistical process control plan. The plan shall use methods such as statistical control charts to monitor production facility quality control test results for the purpose of identifying trends and being able to make production adjustments as necessary. The plan shall monitor each production plant separately and total manufacturer product quality trends.

7) **Resolution of Non-Conforming Product or Test Results** – The QMS shall include a procedure for resolving non-conforming product or test results. The procedure shall specify that:

a. test reports clearly identify the deficiencies;
b. all product produced subsequent to the previous testing be identified and quarantined pending investigation of the failure;
c. investigations include obtaining and testing check samples;
d. if the first check sample meets requirements, the manufacturer shall document the reasons for the original failure and may release the quarantined material and resume normal production and testing;
e. if the first check sample fails, the manufacturer shall take corrective action to bring the product into conformance, shall note the corrective action on the test report, and shall take a second check sample to verify the deficiency has been corrected;
f. if the second check sample also fails, the manufacturer shall repeat the process until the deficiency is corrected, and that,
g. all non-conforming material shall be segregated in the inventory and re-worked or scrapped.

8) **Retention of Test Results and Product Traceability** - The QMS shall describe in detail the process for storing and the location of stored quality control test reports. The QMS shall ensure that:

a. test reports are retained for at least 5 years and are available to the NTPEP upon request;
b. product and product test reports are identified in such a way that the test results for any pipe and resin used to manufacture the pipe can be located;
c. test reports indicate the action taken to resolve resin or product failures, and that
d. the manufacturer retains a copy of the NTPEP audit documentation for a facility and actions taken to resolve any noted deficiencies on file at the facility for a period of 5 years.

9) **Records Retention** - The QMS shall ensure that the following records are maintained for a minimum period of 5 years and made available to NTPEP for review upon request:

a. resin test reports and the resin manufacturer's lot specific density and melt index data, certificate of analysis (C of A), and supporting test reports for every lot of resin,
b. quality control test reports (not samples),
c. QC technician training or competency review documentation,
d. test reports,
e. NTPEP audit documentation for a facility and actions taken to resolve any noted deficiencies,

f. Records of maintenance activities,
g. Records of all calibration activities, including the person doing the work and the date the calibration activities were performed.

10) **Quality Control Testing Facilities**

> ***Note 5*** *– QC testing may be performed at a location separate from the pipe manufacturing facility.*

a. The QC testing facility shall:
   - maintain current versions of all AASHTO, ASTM, and Company test procedures for all tests performed and a current version of the Company's QMS documentation;
   - adequately house and allow proper operation of all required testing equipment; and
   - maintain records of all NTPEP reviews and actions taken to resolve any noted deficiencies.

b. The QMS shall describe in detail the requirements for the QC test facility(ies) and include, as a minimum, a description of how the following requirements are met:
   - The plant shall cover QC responsibilities at all times, including when the QC Manager is away from the plant for any reason. (Note 6)

> ***Note 6*** *- Audits may be unannounced and will proceed regardless of the availability of key QC staff.*

   - The manufacturer's QC manager shall be responsible for QC testing at all facilities and assure that all sampling and testing is done by technicians meeting the requirements of the manufacturer's technician qualification program.
   - QC testing equipment shall be calibrated/verified in accordance with the equipment manufacturer's recommendations at least once every 12 months by personnel customarily involved in such work. Records of calibration and verification activities shall be retained for a minimum of 5 years and made available to NTPEP for review upon request.
   - QC testing equipment shall be properly maintained. Records of maintenance activities shall be retained for a minimum of 5 years and made available to NTPEP for review upon request.

11) **Marking, Storage, Shipping, and Handling of Finished Pipe** - The QMS shall:
   a. describe the manufacturer's method for permanently marking the pipe in accordance with the minimum requirements of AASHTO M252 and/or M294;
   b. detail and explain any coding used to mark the pipe; and
   c. describe the procedures used to ensure that product handling, storage, and shipping processes will not adversely affect the material composition, characteristics, or product quality.

12) **Internal Quality Audits of Each Plant**
   a. The QMS shall include a description of the procedures used to conduct internal audits. The manufacturer, or an independent auditor hired by the manufacturer, shall perform these audits at least annually unless problems in the quality control program or with the quality of the product indicate more frequent audits are necessary. The internal audits shall include the following as a minimum:
      - Evaluation of plant inspection,
      - Inspection of testing equipment and calibrations,
      - Observation of resin sampling and lot control procedures,

- Observation of sampling and testing procedures,
- Review of product certification procedures,
- Review of inspection and testing report documentation, and
- Review of nonconforming product documentation and actions taken.

b. The QMS shall ensure that:
   - audit findings are discussed with plant management and testing technicians and documented in a report;
   - corrective actions are taken as necessary and documented in the report, and that
   - the most recent report is included in QMS documentation submissions.

13) **Lists of Plants, Quality Control Testing Facilities, and Technicians** - The QMS shall include the address and telephone numbers of all plants and QC testing facilities for which the manufacturer desires NTPEP qualification. The QMS shall also identify the QC contact for each facility with contact information and lines of responsibility.

14) **Company Test Procedures** - The QMS shall include all Company developed test procedures used in quality control testing and ensure that company developed tests are only used when an ASTM or AASHTO test method does not exist.

Product Conformance Testing (NTPEP Split Sample Testing)

The NTPEP Thermoplastic Pipe Program requires that pipe and resin samples be tested to determine conformance with the AASHTO Materials Specifications. There are two types of product evaluation required, as follows:

1. **Annual Product Conformance Testing**

a) For M252 Products - Once initial product evaluation has been established, an AMRL Auditor will sample pipe and resin during each annual plant audit. At a minimum, all pipe styles and sizes must be sampled and tested within a 5-year period with at least 1 pipe and resin sample being taken during each plant audit. The AMRL or DOT Auditor will select and label the samples to be tested.

b) For M294 Products - Once initial product evaluation has been established, an AMRL Auditor will sample pipe and resin during each plant audit. At a minimum, all pipe styles and sizes must be sampled and tested within a 5-year period with at least 1 pipe and 1 resin sample being taken during each audit. The AMRL or DOT Auditor will select and label the samples to be tested. Each sample will be a split sample, with the manufacturer retaining one set of samples for in-house testing. If the pipe manufacturer does not have capability to perform the cell class and NCLS testing as specified in M294, the resin split samples may be tested at a laboratory acceptable to NTPEP, preferably not at the same laboratory testing the NTPEP portion of the split sample. If requested, a DOT testing facility can be included in the split sampling process. The manufacturer split samples shall be taken from one of the originally sampled pipes or from another pipe made during the same shift. Within 14 days after the sample is taken, the manufacturer shall submit their split sample test results to the AMRL Supervisor. The submission shall also include an explanation of any significant differences between the NTPEP laboratory and split sample test results, including any corrective actions found necessary in the manufacturing process or testing procedures. The AMRL Supervisor will post the standard form comparing the split sample results in the secure area of the NTPEP website, available only to AASHTO member departments, and annually evaluate the split sample results and report on testing proficiency.

Resolution of Audit or Testing Failures and Disputes:

Inevitably, there are times when the sampled pipe or resin fails to meet one or more of the M252/294 specification requirements when tested by NTPEP or when the manufacturer is found, during an audit, to have neglected one or more aspects of the governing QMS during manufacturing. While the manufacturer may request a retest, if sufficient sample is available, the burden will be on the manufacturer to identify the cause, document the resolution, and revise his QC plan to assure future conformance. All results will be reported. Any retesting or re-auditing will be at the discretion of NTPEP and the associated costs will be borne by the manufacturer.

1. **Disagreements with NTPEP** - Disagreements with NTPEP regarding test results will be handled as follows:

    a) The manufacturer should verify that his/her manufacturing process is operating correctly, that test equipment is calibrated, and that test procedures are correct. If these conditions are met, then test another piece of pipe or sample of resin, as appropriate, from the same lot as the failing test if possible.
    b) If the manufacturer's test results on the second sample are satisfactory, send one sample of the same product to the North Carolina Department of Transportation and a second sample to NTPEP and request that the product be tested. NTPEP will consider the dispute resolved if the manufacturer's test result is in reasonable conformity with at least one of the other testing facility results. If this is not the case, the manufacturer should repeat the process of checking the manufacturing process, the equipment calibration and the test procedures until satisfactory agreement with inter-laboratory testing is accomplished.

2. **Disagreements with the NTPEP auditor or audit team** - Disagreements with the NTPEP auditor or audit team regarding procedural issues will be handled as follows:

    a) The manufacturer will notify the HDPEP Administrative Group Co-Chairman (currently Mr. David Meggers and Ed Lucas) in writing of the dispute, providing appropriate documentation for the committee to fully understand the controversy, and request a resolution.
    b) If the dispute is not resolved to the manufacturer's satisfaction, the dispute will be raised to the NTPEP Executive Committee Chairman (currently Mr. Thomas Baker) for resolution by the NTPEP Appeals Board. The decision by the Appeals Board shall be considered final.

Public Notice:

One of the primary reasons for a quality control program is to instill confidence in the end-user and the general public that the materials being used for infrastructure construction are of sufficient quality and to facilitate use of products that have proven to be of sufficient quality. To this end the program will provide for public notice of companies, plants, and M252/294 products found to conform with the provisions of this work plan via website postings, with official hard-copy reports issued to AASHTO member departments.

Modification of Qualified Products (Retest Requirements):

Product design may change over time as manufacturers improve their products and optimize their manufacturing processes. When a design change is made in a NTPEP listed product, the Manufacturer shall notify the NTPEP of the change and submit samples for re-consideration of

conformance with this work plan. Any changes in a manufacturing method, product weight, or pipe wall design shall be considered design changes.

List of Appendices

Appendix 1 – Letter of Intent
Appendix 2- Approved Alternative Testing Procedure for Wall Thickness
Appendix 3 - Suggested Forms for Documenting Training and Competency Requirements
Appendix 4- Program Fees

Appendix 1: Letter of Intent

LETTER of INTENT FORM

Plant:
Name:
Physical Address:

Mailing Address:
(if different from above)

Ownership
Company Name:
Physical Address:

Primary Contact
Name:
Title:
Telephone: ( )
Email:
Fax: ( )

Management
QC Manager:
Plant Manager:

Product Scope
List the applicable product(s) that are produced at your facility:

2nd/ 3rd Party Testing
If applicable, list any other parties that perform testing for your facility:

NAME: **DATE**:
SIGNATURE:

Appendix 2

Approved Alternative Testing Procedure for Wall Thickness

The NTPEP Thermoplastic Pipe Program permits the use of ultrasonic thickness gauges for measuring wall (liner) thickness if the following equipment requirements are met and the procedure below is followed:

Equipment Requirements

1. Each gauge and transducer is identified and calibrated.
2. Records of all calibration activities, including the person doing the work and the date the calibration activities were performed shall be maintained for at least 5 years.
3. The AMRL NTPEP auditor is permitted to witness the calibration of an instrument used and sign the calibration verification form. A copy will be included with the NTPEP audit forms.
4. When a new transducer is placed in service, it is identified and calibrated with the ultrasonic gauge.
5. Gauge calibration blocks are maintained at the plants.

Procedure

1. Record two sets of liner thickness readings comprised of at least eight (8) readings per set per work shift.
2. Take one set of readings using a micrometer in accordance with ASTM D2122 and take the other set of readings using a calibrated ultrasonic gauge transducer.
3. Indicate which measuring device was used on the record form.

Appendix 3

Suggested Forms for Documenting Training and Competency Requirements

[Place Company Name On This Line]
Quality Control/Assurance Training Evaluation Form

Laboratory Location: _____

Tr'ee= Trainee, Tr'er= Trainer

Trainee Name	Weight			Line Thickness			Inside Diameter			Pipe Length			Brittleness			Workmanship			Carbon Content		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

Trainee Name	Marking			Perforations			Inlet Area			Pipe Stiffness/Flattening			Joint Integrity			Resin Density			Resin Melt Index			Resin NCLS		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

1.) To attest the training took place, the initials of both the trainee and the trainer are required.
2.) The initialing trainer attests the technician satisfactorily demonstrated the test.

3.) If the training is due to test method modification, indicate by an asterisk (*) next to the initials of the trainee.

[Place Company Name On This Line]
Quality Control/Assurance Competency Evaluation Form

Laboratory Location: _____

Tr'ee= Trainee, Tr'er= Trainer

Trainee Name	Weight			Line Thickness			Inside Diameter			Pipe Length			Brittleness			Workmanship			Carbon Content		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

Trainee Name	Marking			Perforations			Inlet Area			Pipe Stiffness/Flattening			Joint Integrity			Resin Density			Resin Melt Index			Resin NCLS		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

1.) To attest the competency evaluation took place, the initials of both the trainee and the trainer are required.
2.) The initialing trainer attests the technician satisfactorily demonstrated the test.

An electronic copy of this form is available from the NTPEP Manager.

Appendix 4- **Program Fees**

Quality System Document Review Fee (Cost per Company or Facility) $1,000.00

Website and Document Management Fee (Cost per Plant) $2,500.00

*Fee includes: website maintenance and updates, document uploads and updates, system enhancements and administrative costs associated with the NTPEP Audit Program.
*Fee includes: Review of plant documents (Quality Manual, Standard Specifications, Training and Competency Evaluation Records, Equipment Calibration Records, Certificates of Analysis, Physical Test Results, Raw Material Test Results, etc.) to ensure your plant is in compliance with the approved NTPEP work plan.
Note: This fee is assessed to a Manufacturer for each unique Quality System used per a specific facility's location.

Plant Audit Fee (Cost per Plant) $3,600.00

*Fee includes: yard inspection, manufacturing process evaluation, review of AASHTO/ASTM test methods, traceability of final product back to its required documentation, and collection of samples for testing verification. (HDPE Audit program requires third party testing).

Note: For the Pipe Audit Program Additional Fees do apply for third party testing (this fee is currently $3000 per diameter size)

Note: Please log onto the NTPEP website, http://data.ntpep.org/nap to review and download the following documents:

i. Letter of Intent
ii. Pre-Audit Application
iii. Audit Worksheets