



20 November 2013

Mr. Jeffrey D. Wiese  
Associate Administrator for Pipeline Safety  
Pipeline and Hazardous Materials Safety Administration  
1200 New Jersey Avenue, SE  
Washington D.C. 20590

Re: Petitions to Amend Title 49 Code of Federal Regulations  
Sections 192.7, 192.121 and 192.123

Dear Mr. Wiese:

Arkema Inc. is pleased to submit this petition to the Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA). The petition proposes to reference current editions of all relevant polyamide-11 (PA-11) American Society of Testing Materials (ASTM), American Society of Mechanical Engineers (ASME) and American National Standards Institute (ANSI) standards, as shown in the body of the petition. The petition further proposes that PA-11 piping systems in compliance with these standards be permitted to be operated at pressures in accordance with 49 CFR §§192.121 and 192.123 revised, as shown in the body of this petition.

Arkema had previously submitted two similar petitions in 2008 which resulted in a Final Rule, Amendment 192-108, issued in the Federal Register on December 24, 2008 (Volume 73, Number 248) to 49 CFR Part 192, [Docket no. PHMSA-2005-21305] RIN 2137-AE26 entitled Pipeline Safety: Polyamide (PA-11) Plastic Design Pressures. As noted in this Final Rule, the design factor and design pressure limits were amended for natural gas pipelines made from new polyamide-11 (PA-11) thermoplastic pipe. Together, these two changes in the regulations allowed pipeline operators to operate certain pipelines constructed of new PA-11 pipe at higher operating pressures compared to other plastic pipe materials.

This Final Rule resulted in revisions to §§192.121 and 192.123 increasing the maximum design pressure for PA-11 piping, produced after January 23, 2009, from 100 psig to 200 psig and limiting the PA-11 piping size to a maximum of NPS4 with a maximum DR of 11.

This petition seeks to revise the size, SDR and pressure limitations for the operation of PA-11 gas piping systems prescribed under the above discussed December 24, 2008 Final Rule. This petition proposes these changes to §§192.121 and 192.123, as shown in the body of this petition, based on the successful use of PA-11 at operating



pressures >100 psig since 1999 on projects under special permit or on non-DOT jurisdictional pipelines and on successful installations of PA-11 up to and including 200 psig since the 2008 Final Rule (as detailed in Attachment 1).

Furthermore, by removal of the §192.121 note stating “Arithmetic interpolation is not allowed for PA-11 pipe”, this Arkema petition requests that mathematical interpolation be permitted for PA-11 piping systems. This note precluding interpolation for PA-11, was added to the regulations by the above mentioned Amendment 192-108 2008 Final Rule because Arkema simply did not request interpolation for PA-11 in the petition at the that time. Additionally, the section of Part 192 referenced the Plastic Pipe Institute (PPI) Technical Report (TR) TR3 Interpolation Policy which applies to all PPI TR4 listed thermoplastic piping materials, including PA-11 which has been PPI TR4 listed since the mid 1990’s.

A further justification for this petition is the fact that there is continuing confusion regarding ASTM D2513 in the industry because the current §192.7 referenced standard for PA-11 piping (D2513-99) had its title and scope changed in 2009 (ASTM 2513-09a) making it a polyethylene only gas piping specification. Thus, if one now purchases the current D2513-12 standard they find that PA-11 is nowhere to be found in the document. To remedy this confusing situation, a standalone PA-11 gas piping standard was developed, approved and published as ASTM F2945 *Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing and Fittings*, which is one of the ASTM standard specifications this petition proposes to be added to §192.7.

Together, if adopted, these proposed revisions will allow gas companies to install PA-11 pipe, as an alternative to steel piping, for use at pressures up to 250 psig and pipe sizes up to NPS6. The PA-11 pipe would continue to be designed according to the design equation in §192.121, utilizing a design factor of 0.4 and the hydrostatic design basis (HDB) of 3150 psi as listed in PPI TR4.

Over the past several years Arkema Inc., the Gas Technology Institute (GTI), and PPI have presented the results of comprehensive testing and evaluation, in both laboratory and field environments, at various industry conferences and symposiums. In addition, we have continuously informed the Department of Transportation Office of Pipeline Safety (DOT-OPS) and the National Association of Pipeline Safety Representatives (NAPSR) regarding the results of these evaluations through various meetings and discussions. We believe that we have addressed all technical issues as reflected in the ASTM standards cited in the body of this petition. The proposal is clearly within the performance capabilities of PA-11. This is demonstrated by its long-term properties using industry established test methods that have been validated through successful installations under waiver, special permit, and under current regulations over the past 14 years.

Approval of this petition will provide multiple industries with a broader scope of safe and economical hydrocarbon transportation systems. Approval of this will also provide technical and engineering teams with an expanded range of options for design and installation of thermoplastic piping systems. PA-11 offers all of the common benefits



associated with plastic piping systems while being cost competitive with steel in terms of total installed cost and lifetime maintenance costs. This will allow natural gas distribution companies to redirect some of their limited resources into other operational areas.

Should you or your staff need any additional information or have any questions concerning this petition, please do not hesitate to contact me.

Sincerely,

A handwritten signature in blue ink that reads "Brandon Babe". The signature is written in a cursive, flowing style.

Brandon Babe  
Business Development Engineer – Specialty Polyamides  
Phone: 610-205-7234  
Email: [brandon.babe@arkema.com](mailto:brandon.babe@arkema.com)

Arkema, Inc.  
900 First Avenue  
King of Prussia, PA 19406



# Petition of Arkema, Inc. to Revise the Pipeline Safety Regulations

## BACKGROUND

Arkema had previously submitted two petitions in 2008 which resulted in a Final Rule being issued in the Federal Register on December 24, 2008 (Volume 73, Number 248) to 49 CFR Part 192, [Docket no. PHMSA-2005-21305] RIN 2137-AE26 entitled Pipeline Safety: Polyamide (PA-11) Plastic Design Pressures. This Final Rule resulted in revisions to §§192.121 and 192.123 increasing the maximum design pressure for PA-11 piping, produced after January 23, 2009, from 100 psig to 200 psig and limiting the PA-11 piping size to a maximum of NPS4 with a maximum DR of 11. This past petition was based on technical data for Arkema's PA32312 PA-11 resin listed in PPI TR4 as having a hydrostatic design basis of 2500 psig at 73°F. The current petition is based on similar technical principles, considering that Arkema now has a PPI TR4 listing for its PA32316 PA-11 material with a hydrostatic design basis of 3150 psig at 73°F.

Furthermore, Arkema and its partners have developed a complete, commercialized PA-11 piping system, a comprehensive, in-depth installation handbook accompanied by a complete set of standards and procedures governing the requirements for, and use of, PA-11 piping, fittings, valves and appurtenances. It is Arkema's position that this petition is clearly within the performance capabilities of PA-11. This is demonstrated by its long-term properties using industry established test methods that have been validated through successful installations under waiver, special permit, and under current regulations over the past 14 years.

## PETITION

The following revisions/additions to §§192.7, 192.121 and 192.123, as detailed below, are being proposed under this petition. Please note, underlined and italicized items are requested additions to the Code and items that are ~~struck through~~ are requested to be deleted.

**Proposed revisions to §192.7**

Add reference to:

<u>Source and name of referenced material</u>	<u>49 CFR reference</u>
<u>ASTM/ANSI F2945-12a Standard Specification for Polyamide-11 (PA-11) Gas Pressure Pipe Tubing and Fittings</u>	<u>§§ 192.123(e)(2); 192.191(b); 192.281(b)(2); 192.283(a)(1)(i); Item I, Appendix B to Part 192.</u>
<u>ASTM/ANSI F2600-09 Standard Specification for Electrofusion Type Polyamide-11 Fittings for Outside Diameter Controlled Polyamide-11 Pipe and Tubing</u>	<u>§192.281(c)(3), 192.283(a)(1)(iii)</u>
<u>ASTM/ANSI F1973-13 Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA-11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems</u>	<u>§192.361</u>
<u>ASTM/ANSI F2145-13 Standard Specification for Polyamide 11 (PA 11) and Polyamide 12 (PA12) Mechanical Fittings for Use on Outside Diameter Controlled Polyamide 11 and Polyamide 12 Pipe and Tubing</u>	<u>§192.283(b), 192.281(e)</u>
<u>ASTM/ANSI F1948-12 Standard Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing</u>	<u>§192.283(b) , 192.281(e)</u>
<u>ASME/ANSI B16.40-08 Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems</u>	<u>§192.193</u>

**Proposed Revisions to §§192.121 and 192.123**

**§ 192.121 Design of plastic pipe.**

Subject to the limitations of § 192.123, the design pressure for plastic pipe is determined by either of the following formulas:

$$P = 2S \frac{t}{(D - t)} (DF)$$

$$P = \frac{2S}{(SDR - 1)} (DF)$$

Where:

P = Design pressure, gauge, psig (kPa).

S = For thermoplastic pipe, the HDB is determined in accordance with the listed specification at a temperature equal to 73 °F (23 °C), 100 °F (38 °C), 120 °F (49 °C), 140 °F (60 °C) or 180 °F (82 °C). In the absence of an HDB established at the specified temperature, the HDB of a higher temperature may be used in determining a design pressure rating at the specified temperature by arithmetic interpolation using the procedure in Part D.2 of PPI TR-3/2008, *HDB/PDB/SDB/MRS Policies* (incorporated by reference, see § 192.7). For reinforced thermosetting plastic pipe, 11,000 psig (75,842 kPa). ~~[Note: Arithmetic interpolation is not allowed for PA-11 piping.]~~

t = Specified wall thickness, inches (mm).

D = Specified outside diameter, inches (mm).

SDR = Standard dimension ratio, the ratio of the average specified outside diameter to the minimum specified wall thickness, corresponding to a value from a common numbering system that was derived from the American National Standards Institute preferred number series 10.

DF = 0.32 or

= 0.40 for PA-11 pipe ~~produced after January 23, 2000 with a nominal pipe size (IPS or CTS) 4-inch or less, and a SDR of 11 or greater (i.e. thicker pipe wall).~~

**§ 192.123 Design limitations for plastic pipe.**

(a) Except as provided in paragraph (e) and paragraph (f) of this section, the design pressure may not exceed a gauge pressure of 100 psig (689 kPa) for plastic pipe used in:

- (1) Distribution systems; or
- (2) Classes 3 and 4 locations.

(b) Plastic pipe may not be used where operating temperatures of the pipe will be:

(1) Below -20 °F (-20 °C), or -40 °F (-40 °C) if all pipe and pipeline components whose operating temperature will be below -29 °C (-20 °F) have a temperature rating by the manufacturer consistent with that operating temperature; or

(2) Above the following applicable temperatures:

(i) For thermoplastic pipe, the temperature at which the HDB used in the design formula under § 192.121 is determined.

(ii) For reinforced thermosetting plastic pipe, 150 °F (66 °C).

(c) The wall thickness for thermoplastic pipe may not be less than 0.062 inches (1.57 millimeters).

(d) The wall thickness for reinforced thermosetting plastic pipe may not be less than that listed in the following table:

Nominal size in inches (millimeters).	Minimum wall thickness inches (millimeters).
2 (51)	0.060 (1.52)
3 (76)	0.060 (1.52)
4 (102)	0.070 (1.78)
6 (152)	0.100 (2.54)

(e) The design pressure for thermoplastic polyethylene pipe produced after July 14, 2004 may exceed a gauge pressure of 100 psig (689 kPa) provided that:

(1) The design pressure does not exceed 125 psig (862 kPa);

(2) The material is a PE2406 or a PE3408 as specified within ASTM D2513-99 (incorporated by reference, see § 192.7);

(3) The pipe size is nominal pipe size (IPS) 12 or less; and

(4) The design pressure is determined in accordance with the design equation defined in § 192.121.

(f) The design pressure for polyamide 11 (PA-11) pipe produced after ~~January 23, 2009~~ [insert effective date] may exceed a gauge pressure of 100 psig (689 kPa) provided that:

(1) ~~The design pressure does not exceed 200 psig (1379 kPa); The design pressure is determined in accordance with the equation defined in § 192.121;~~

(2) ~~The pipe size is nominal pipe size (CTS or IPS) 4-inch or less; The design pressure does not exceed 250 psig (1728 kPa); and~~

(3) ~~The pipe has a standard dimension ratio of SDR-11 or greater (i.e., thicker pipe wall). The pipe size is a nominal pipe size 6-inch or less; and the wall thickness may not be less than that listed in the table below.~~

<u>Nominal Pipe or Tubing Size in inches</u>	<u>Minimum Wall Thickness in inches</u>	<u>Corresponding DR values</u>
<u>½ CTS</u>	<u>0.090</u>	<u>7.0</u>
<u>¾ CTS</u>	<u>0.090</u>	<u>9.7</u>
<u>½ IPS</u>	<u>0.090</u>	<u>9.3</u>
<u>¾ IPS</u>	<u>0.095</u>	<u>11.0</u>
<u>1 IPS</u>	<u>0.119</u>	<u>11.0</u>
<u>1-1/4 IPS</u>	<u>0.151</u>	<u>11.0</u>
<u>1-1/2 IPS</u>	<u>0.173</u>	<u>11.0</u>
<u>2 IPS</u>	<u>0.216</u>	<u>11.0</u>
<u>3 IPS</u>	<u>0.259</u>	<u>13.5</u>
<u>4 IPS</u>	<u>0.333</u>	<u>13.5</u>
<u>6 IPS</u>	<u>0.390</u>	<u>17.0</u>

## **DISCUSSION**

This section discusses each of the proposed changes to the Code as outlined above.

**PROPOSED CHANGE: Add reference to applicable ASTM/ASNI and ASME/ANSI Standards for PA-11 piping and fittings in §192.7.**

**RATIONALE:** There is a list of accepted Standards for PA-11 piping systems that can be Incorporated by Reference.

**PROPOSED CHANGE: Add “180°F (82 °C)” to the definition of “S” in §192.121.**

**RATIONALE:** PA-11 has a PPI TR4 HDB listing at this temperature.

**PROPOSED CHANGE: Remove “[Note: Arithmetic interpolation is not allowed for PA-11 pipe]” in §192.121**

**RATIONALE:** This note precluding interpolation for PA-11, was added to the regulations by the above mentioned Amendment 192-108 2008 Final Rule because Arkema simply did not request interpolation for PA-11 in the petition at the that time. Additionally, the section of Part 192 referenced the Plastic Pipe Institute (PPI) Technical Report (TR) Policy which applies to all PPI TR4 listed thermoplastic piping materials, including PA-11 which has been PPI TR4 listed since the mid 1990’s.

**PROPOSED CHANGE: Move PA-11 0.4 design factor limitations in §192.121 to §192.123**

**RATIONALE:** The 0.40 PA-11 design factor limitations are moved to §192.123 Design Limitations for Plastic since this is a design limitation for plastic piping systems.

**PROPOSED CHANGE: Correct §192.123(e) replacing “thermoplastic” with “polyethylene”**

**RATIONALE:** This corrects this paragraph since §192.123(e) only applies to PE, not all thermoplastics.



**PROPOSED CHANGE: Revise §192.123(f) as shown**

RATIONALE: This revision sets limitations on pipe sizing and minimum wall thickness for PA-11.

1. PA-11 has been an approved piping system in Annex A5 of ASTM D2513 since 1996.
2. Part 192, by referencing ASTM D2513-99 (which is the current reference today), has permitted the use of PA-11 gas piping in regulated gas piping systems for a period of over 13 years.
3. A Final Rule was issued in the 2008 Rulemaking permitting the use of PA-11 gas piping in regulated gas piping systems using a design factor of 0.4 at pressures up to and including 200 psig.
4. A total of 155,720 ft of PA-11 gas piping systems has been installed in regulated installations since the 2008 Rulemaking and these installations are still being safely operated.
5. This record of installations of PA-11 gas piping has demonstrated that it is a safe, cost effective alternative to steel piping eliminating the corrosion, coating and cathodic protection concerns related to steel gas piping.
6. PA-11 is available as a complete system with a comprehensive set of ASTM and ASME standards for pipe, fittings, valves and appurtenances as well as PPI Generic fusion procedures and model specifications.
7. PA-11 has a PPI TR4 listing of 3150 psi permitting PA-11 SDR 11 piping to be operated at 250 psig based on the design equation listed in §192.121 with a 0.4 design factor.
8. The proposed revision to the table containing allowable pipe sizes is consistent with other industry petitions (including a joint PA-12 petition and an industry group PE petition to increase the design factor).

## ATTACHMENT 1

### Successful PA 11 Installations since 2008 PA-11 Final Rule

Project	Location	Ft of pipe	IPS	Pipe ship date
Project 1	Frost, TX	6,000	4"	11/1/2009
Project 2	Coolidge, TX	55,440	4"	4/1/2010
Project 3	Grossbeck, TX	7,280	4"	9/1/2010
Project 4	Hubbard, TX	16,040	4"	4/1/2011
Project 5	Frost, TX	7,600	4"	5/1/2011
Project 6	Grossbeck, TX	14,000	4"	8/1/2011
Project 7	Priscilla, TX	24,000	4"	6/12/2012
Project 8	Ferris, TX	23,360	4"	9/30/2012
Project 9	Various (for risers, transitions, service tubing)	2,000	1"	Various

## ATTACHMENT 2

The section lists additional relevant published documentation for PA-11 piping systems.

### ***PPI TR-45/2008 – Butt Fusion Joining Procedure for Field Joining of Polyamide-11 Pipe***

This document outlines the recommended Fusion procedures for field joining PA-11 pipe.

### ***PPI MS-4/2007 – Model Specification for Polyamide-11 Plastic Pipe, Tubing and Fittings for use in Fuel Gas Distribution Systems***

This publication is designed to assist the utility companies in developing their own specifications for PA-11 piping systems in order to ensure the products purchased will perform satisfactorily in the intended end use.

### ***Georg Fischer Central Plastics Hyperplast® Piping System User Manual ©2010***

This 84 page publication is a comprehensive piping manual for PA-11 piping systems generated by a manufacturer of PA-11 piping that covers material properties of PA-11, design of the Hyperplast® piping system, underground installation methods, butt fusion and electrofusion joining procedures, squeeze off procedures, and applicable codes and standards that pertain to pipe design and regulated piping systems. This manual is intended to be a guide for operators of Hyperplast® PA-11 piping systems.