



# Palermo Plastics Pipe (P<sup>3</sup>) Consulting

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## I. Consultant Services Offered

### A. Manufacturers

Palermo Plastics Pipe (P<sup>3</sup>) Consulting will aid plastic pipe manufacturers (resin companies and pipe companies) to achieve HDB (Hydrostatic Design Basis) and MRS (Minimum Required Strength) pressure ratings through the Hydrostatic Stress Board (HSB), assist with HSB special cases, develop or revise industry standards (ASTM, CSA, AASHTO, ISO, AWWA), write petitions to the DOT, and/or aid in marketing plastic pipe products to the end user.

### B. End users

Palermo Plastics Pipe (P<sup>3</sup>) Consulting will aid end users, primarily gas and water utilities, to evaluate or qualify plastic pipe products (PE, PEX, PVC, PA), revise industry standards, and/or conduct failure analysis of plastic pipe products. P<sup>3</sup> Consulting will also present technical seminars at gas and water company locations to provide background on polyethylene pipe, polyamide pipe or new plastic piping materials for the gas and water industries.

### C. Laboratories

Palermo Plastics Pipe (P<sup>3</sup>) Consulting will work with laboratories or research organizations to keep abreast of domestic and international standard test methods and standard specifications, and/or write proposals for and then guide research projects for plastic pipe.

## **D. Litigation Cases**

Palermo Plastics Pipe (P<sup>3</sup>) Consulting is available for litigation cases involving plastic pipe products (PE, PVC, PEX, PA), particularly plastic pipe used for natural gas distribution and water distribution.

## **II. Dr Gene Palermo**

Dr. Gene Palermo received a Bachelor of Science in Chemistry from St. Thomas College in St. Paul, MN in 1969 and a Ph.D. in Analytical Chemistry from Michigan State University in 1973.

Dr. Palermo has been in the plastic piping industry for over 40 years. He worked for the Dupont Company from 1976 to 1991, and then the Uponor Aldyl Company from 1991 to 1995, in the Aldyl "A" polyethylene (PE) pipe business for natural gas distribution. Dr. Palermo developed the initial use of polyamide (PA) for high-pressure gas distribution, up to 300 psig, to replace metal pipe while with Elf AtoChem during 1995 and 1996.

Dr. Palermo was the Technical Director for the Plastics Pipe Institute (PPI) from 1996 until 2003. As Technical Director, Dr. Palermo was chairman of the Hydrostatic Stress Board (HSB) on which he served for 20 years to develop pressure rating methods for plastic pipe; and chairman of the Technical Advisory Group for ISO/TC 138 for international plastic piping systems. Dr. Palermo has developed standards for plastic pipe and fittings in several standards bodies; ASTM, CSA, AASHTO, ISO/TC 138, and AWWA.

Most of Dr. Palermo's expertise has been in the natural gas distribution industry. He has been a member of the AGA Plastic Materials Committee for 35 years, the Gas Pipe Technology Committee for 20 years, and was an original member of the Plastic Pipe Database Committee. Dr. Palermo also developed a one day Technical Seminar for the gas distribution industry.

Dr. Palermo currently serves as a member of PPI, AGA, GPTC (Chairman of Manufacturers Division), AWWA, ASTM F 17 (Director of Division I), ASTM D 20, CSA B137, CSA Z662 (Chairman of Clause 12 Gas Distribution), and ISO/TC 138.

## **III. Awards Received**

Dr. Gene Palermo received the **AGA (American Gas Association) Platinum Award of Merit** from the American Gas Association. This is the highest award given by AGA to its members. Dr. Gene Palermo had previously received the AGA Award of Merit in 1995 in recognition of several presentations made at plastic gas pipe industry meetings, and also serving as moderator at AGA Operations Conferences and Plastic Pipe Symposiums. Dr. Palermo also received the AGA

Silver Award of Merit in 2002 for having faithfully and constructively served the American gas industry, and for making continuous and extensive contributions to further the interests and promote the welfare of the gas industry and of the public.

Within ASTM F 17, Dr. Palermo has received two Awards of Appreciation in recognition of his many years of outstanding service and active participation in the plastic piping standards work of ASTM F 17, and a Special Service Award for his many technical contributions and development of plastic piping standards. Dr. Palermo received the Paul Finn Memorial Award in 1995 for his distinguished and continuous service to ASTM F 17 (plastic pipe standards), and particularly for steadfast contributions to the development of sound engineering standards, particularly for plastic gas pipe standards. Dr. Palermo received the Rinehart Kuhlmann Award in 2002 in acknowledgment of faithful and significant contributions in furthering the cause of sound and effective plastics piping standardization. In 2005 Dr. Palermo received the ASTM Award of Merit, which is the highest award given within ASTM. Most recently, Dr. Palermo received another Special Service Award in 2010 for his dedicated service to ASTM.

Dr. Palermo was also recognized by the US Department of Transportation (Transportation Safety Institute) for outstanding performance as an associate staff in the Pipeline Safety Division in teaching DOT inspectors about plastic gas pipe standards in ASTM and ISO, plastic pipe pressure ratings methods from ASTM and ISO, plastic pipe failure analysis and new plastic pipe materials for the natural gas industry.

#### **IV. Gas Pipe Industry Experience**

For the past 40 years Dr. Gene Palermo has been primarily involved in plastic piping systems for the natural gas distribution industry. Most of those years were with the Dupont Company where he worked with Aldyl "A" polyethylene gas pipe. He presented several industry papers on the use of the Rate Process Method (RPM) to forecast the life expectancy of polyethylene gas pipe and butt fusion (BF) fittings. At Plastics Pipe XII in Milan (April 2004) Dr. Palermo presented a paper correlating RPM projections with actual field performance for polyethylene gas pipe materials. While with DuPont, Dr. Palermo also conducted several failure analyses of Aldyl "A" polyethylene pipe components and wrote several failure analysis reports for gas companies. Dr. Palermo has also authored several butt fusion (BF) reports using the tensile test, tensile impact test, and 80°C stress rupture test to evaluate the integrity of butt fusion joints.

Dr. Palermo was hired by Elf AtoChem in 1995 to develop an all plastic piping system made from polyamide (PA) to be used for high-pressure gas distribution systems as a replacement for metal pipe. He wrote several ASTM and CSA standards for the polyamide piping system. He worked with PPI member companies to develop polyamide pipe, butt fusion fittings, mechanical fittings,

meter risers, transition fittings, and valves. Dr. Palermo also developed a butt fusion (BF) procedure for joining polyamide pipe and fittings using the same BF equipment that gas companies use for polyethylene pipe and fittings.

He has been actively involved in the AGA Plastic Materials Committee (PMC) since 1981. He presented several papers at various AGA PMC Winter Workshops. He has provided PMC members with liaison reports for PPI and ISO activities and served as the chairman of the Code, Standards and Regulatory task group for AGA PMC. Dr. Palermo has also been an active member of the AGA Gas Pipe Technology Committee (GPTC) since 1995. He has chaired several projects in the Plastics task group and the Design task group. He is currently a voting member on the Main Body Committee of GPTC.

Dr. Palermo was an original member of the Plastic Pipe Database Committee, which is a joint government/industry committee to develop a database of plastic pipe and fitting failures that occurred in the gas industry. This database will confirm that industry standards for plastic pipe systems used in the gas industry result in outstanding performance for the end user.

More recently, Dr. Palermo has developed a one-day technical seminar for plastic pipe materials used in the gas industry. This seminar is intended to provide a background on plastic pipe materials, primarily polyethylene, to update gas engineers on recent developments in ASTM and ISO standards for the gas industry, and to provide information on new plastic pipe materials for the gas industry. These include polyamide for high pressure gas applications to replace metal pipe, crosslinked polyethylene for niche applications that require increased slow crack growth resistance, PE 100 materials that are considered the next new generation of polyethylene materials and multiplayer pipe for higher pressure gas applications.

## **V. Water Pipe Industry Experience**

Dr. Palermo has written or revised several water pipe standards to incorporate new plastic piping products or new rating methods for plastic piping materials. Some of the water related industry standards that Dr. Palermo has experience with are AWWA, ASTM, CSA and ISO.

Dr. Palermo has given several presentations to water companies about the benefits of the new HDPE materials, primarily PE 4710 and PE 100. In some of these cases, Dr. Palermo has explained how the ISO pressure rating methodology using the MRS or CRS can lead to higher operating pressures or thinner wall pipe for water applications.

Dr. Palermo has also written several papers and given numerous industry presentations on failures that have occurred in PVC water pipe that is joined by the

butt fusion method. These failures are primarily long running cracks (over 3000 feet) known as rapid crack propagation, and butt fusion failures.

There have been over 20 known rapid crack propagation (RCP) field failures in butt fused PVC water pipe. Dr. Palermo has explained that the industry accepted test method to assess the resistance of plastic pipe to RCP failures is determination of the critical pressure. Laboratory testing has shown that the critical pressure for PVC pipe is well below the pipe pressure rating, indicating that PVC pipe is susceptible to RCP failure. Dr. Palermo has demonstrated that these laboratory data correlate very well with the known RCP field failure experience for butt fused PVC water pipe. He has proposed adding a critical pressure requirement to AWWA C605 to prevent further RCP failures in butt fused PVC water pipe.

There have been over 50 known butt fusion field failures in butt fused PVC water pipe. Dr. Palermo has explained that the industry accepted test methods to assess the integrity of butt fusion joints are tensile testing and tensile impact testing. Laboratory testing has shown that the tensile elongation for PVC butt fusion joints is very low (only 3% of control pipe) and the tensile impact energy-to-break values are also very low (only 5% to 10% of control pipe). Dr. Palermo has demonstrated that these laboratory data correlate very well with the known field experience. He has proposed adding tensile and tensile impact requirements to AWWA C605 to prevent further butt fusion failures of PVC butt fusion joints.

## **VI. Plastic Pipe Standards Activities**

### **A. ASTM**

1. Dr. Gene Palermo has been a member of ASTM F 17 since 1982, and D 20 since 1999. He has been primarily involved in the following F 17 plastic pipe standards subcommittees:

F17.10	Fittings
F17.20	Joining
F17.26	Olefins
F17.38	ISO
F17.40	Test Methods
F17.60	Gas
F17.61	Water
F17.90	Executive
F17.94	Terminology

Dr. Palermo has served as chairman of F17.94 on Terminology and F17.38 on ISO. He is also a member of the F17.90 Executive Committee for F17. Dr. Palermo is currently the Chairman of ASTM F17 Division I.

2. New plastic piping standards that Dr. Palermo developed or existing plastic piping standards that Dr. Palermo revised include:

- Added 80°C sustained pressure requirements to water pipe standards to assure slow crack growth resistance.
- Revised D 2513 quick burst requirement to be a ductile failure mode for polyethylene gas pipe instead of a minimum pressure because it is more meaningful.
- Developed a new annex in D 2513 for polyamide pipe and fittings
- Wrote a new standard for polyamide butt fusion fittings (F 1733)
- Added 50-year substantiation for polyethylene materials to D 2513 for gas pipe
- Included pressure design basis protocol in ASTM D 2837
- Added polyethylene validation requirement to D 2837
- Included a crosslinked polyethylene pipe material designation code in F 876
- Wrote a new ASTM standard test method for rapid crack propagation based on the ISO standard (F 1583)
- Wrote a new ASTM standard test method for an 80°C notch pipe test based on the ISO method (F 1474)
- Introduced 80°C requirements for polyethylene heat fusion socket fittings (D 2683) and polyethylene butt fittings (D 3261) consistent with ISO TC 138 requirements
- Wrote a new ASTM test method to measure slow crack growth resistance of polyethylene materials used in corrugated pipe (F 2136)
- Wrote a new standard for metric ABS pressure pipe
- Wrote a new standard for metric PEX pressure pipe
- Wrote a new annex for peelable PE pipe in ASTM D2513
- Wrote a new standard for corrugated HDPE pipe used in sanitary sewer applications
- Chaired an ASTM project to add RCP requirements to two PVC standards – project was tabled upon addition of RCP requirements in the AWWA manual for PVC pipe.

3. Dr. Palermo led an ASTM workshop to review differences and similarities between the ASTM plastic pipe pressure rating method – D 2837 and the ISO plastic pipe pressure rating method – ISO 9080.

4. Dr. Palermo gave a “spotlight presentation” on ASTM F17.38 ISO standards activities during an ASTM Committee Week.

## **B. ISO**

Dr. Palermo was chairman of the Technical Advisory Group (TAG) for ISO (International Standards Organization)/TC 138 for plastic pipe materials for over 10 years and has attended ISO meetings since 1983. As chairman, Dr. Palermo represented the US plastic pipe industry at all ISO/TC 138 meetings. Dr. Palermo

also formulated the US position on all standards ballots from ISO/TC 138. Within TC 138, Dr. Palermo was primarily active in SC 2 for water plastic pipe, SC 4 for gas plastic pipe and SC 5 for plastic pipe test methods. Dr. Palermo has provided ISO liaison reports at various ASTM F 17 subcommittee meetings, and also provided ASTM F 17 liaison reports at ISO/TC 138 meetings.

Dr. Palermo is an active member of several ISO ad hoc groups (AHG), including SC4/WG7 on polyamide materials for gas piping, SC5/WG5 on polyolefin materials, SC5/WG10 on standard extrapolation methods, SC5/SCG for slow crack growth test methods, and SC5/RCP for rapid crack propagation test methods. Dr. Palermo is an original member of the RCP AHG that developed the correlation between the full-scale test method and small scale steady state (S4) test method.

Recently, Dr. Palermo has authored new draft standards for plasticized polyamide (PA-P) pipe and fittings for natural gas distribution, and has chaired a project to lower the melt flow rate (MFR) for PE materials in ISO 4427 for water pipe to account for the new bimodal PE 100 material made on a single reactor.

Currently, Dr. Palermo is developing a new ISO standard for corrugated HDPE pipe used in non-pressure applications.

### **C. HSB and PPI**

Dr. Palermo became a member of the PPI Hydrostatic Stress Board (HSB) in 1985 and was chairman of the HSB for seven years. HSB is responsible for establishing the policy for pressure rating of plastic pipe materials in North America. While with PPI, Dr. Palermo continually updated both TR-2 and TR-4. TR-2 is a public listing of the various ingredients that are qualified for the PPI PVC generic formulation. TR-4 is a public listing of the pressure rating of plastic pipe materials obtained using ASTM D 2837. Dr. Palermo was also instrumental in listing the pressure rating of plastic piping materials obtained using the international pressure rating system (ISO 9080) in TR-4. These MRS (Minimum Required Strength) ratings were added to TR-4 in 1999. Under his leadership, the PDB (pressure design basis) for composite or multiplayer pipes, CRS (Categorized Required Strength), and the SDB (Strength Design Basis) for molding materials were also added to TR-4. Dr. Palermo has attended PPI meetings since 1990 and served as the PPI Technical Director from 1996 until 2003.

### **D. AASHTO**

Dr. Palermo has also assisted with revision of AASHTO standards for polyethylene corrugated plastic pipe used in highway applications. His key contribution was development of an ASTM test method to measure the slow crack growth resistance of the polyethylene material used in corrugated plastic pipe. Through a PPI task group, round robin testing was conducted to establish the precision of the test method known as NCLS (notched constant ligament stress). AASHTO now references this NCLS test as a requirement in their M 294 corrugated pipe

standard.

### **E. CSA**

Dr. Palermo is a member of CSA (Canadian Standards Association) B137 Technical Committee for plastic piping systems and also a voting member of CSA Z662 Technical Committee for oil and gas pipelines. Recent projects that Dr. Palermo has chaired are the addition of the MRS (Minimum Required Strength) ISO pressure rating method for PE 100 materials to B137 and the addition of RCP (rapid crack propagation) requirements to the gas pipe standard B137.4.

Dr. Palermo has also added PE 100, MRS, CRS, RCP and PLUS Performance requirements to CSA Z662 Clause 12. Both the PE 100 and PLUS performance requirements include 2000 hours PENT and an RCP S4 requirement of 10 bar. Dr. Palermo is currently the Chairman of CSA Z662 Clause 12 for gas distribution.

### **F. Plastics Pipes Conferences**

Dr. Palermo has served on the Organizing Committee for Plastics Pipes XII held in Milan, Italy in 2004, Plastics Pipes XIII held in Washington DC in 2006, Plastics Pipes XIV held in Budapest, Hungary in 2008, Plastics Pipes XV held in Vancouver, BC in 2010, and Plastics Pipes XVI held in Barcelona, Spain in 2012, and most recently Plastics Pipes XVII held in 2014 in Chicago.

### **G. GPTC**

Dr. Palermo has been a member of the Gas Piping Technology Committee (GPTC) since 1995. GPTC provides guide material for the gas industry to comply with US Federal requirements for the gas distribution industry. Dr. Palermo has chaired several projects within GPTC. Dr. Palermo is currently the Chairman of the Manufacturers Division of GPTC.

### **H. TRB**

Dr. Palermo has been attending TRB meetings since 1999, and has made several presentations at various committee meetings. Dr. Palermo is currently a member of the Committee on Subsurface Soil-Structure Interaction, AFS40.

### **I. AWWA**

Dr. Palermo has attended AWWA annual meetings and also the Polyolefin Committee and PVC Committee meetings. Dr. Palermo has also attended and given presentations at several of the local state AWWA meetings, such as CA, FL, SC, MI, MN and IN. More recently, Dr. Palermo has authored a draft for a new AWWA standard for PEX pipe in both metric pipe sizes and imperial pipe sizes.

## **VII. Plastic Pipe Industry Publications**

1. E. F. Palermo and M. Cassaday, "Comparison of Water/Methane Stress Rupture Testing", AGA PMC Workshop (1982).



2. E. F. Palermo, "Aging of Plastic Pipe", AGA PMC Workshop (1983)
3. E. F. Palermo and I. K. DeBlieu, "Aging of Polyethylene Pipes in Gas Distribution Service", AGA Distribution Conference (1983).
4. E. F. Palermo and I. K. DeBlieu, "Compression Ring Environmental Stress Crack Resistance (Pipe) Precision and Accuracy Round Robin", ASTM Quality Assurance Symposium (1983).
5. E. F. Palermo, "Rate Process Method as a Practical Approach to a Quality Control Method for Polyethylene Pipe", Eighth Plastic Pipe Symposium (1983).
6. E. F. Palermo, "Plastic Piping Material", South Eastern Gas Association Meeting (1984).
7. E. F. Palermo and I. K. DeBlieu, "Rate Process Concepts Applied to Hydrostatically Rating PE Pipe", Ninth Plastic Pipe Symposium (1985).
8. E. F. Palermo, "Battelle Slow Crack Growth Test - DuPont Technical Position", AGA PMC Workshop (1986).
9. E. F. Palermo, "Impact Tests on Saddle Fittings to Determine Conformance to ASTM F905", AGA Distribution Conference (1986).
10. E. F. Palermo, "New ASTM D 2513 Outdoor Storage Requirements", AGA PMC Workshop (1987).
11. E. F. Palermo, "Polyethylene Pipe for Gas Distribution - That Was Then, This is Now", Irish Gas Association Centenary Conference (1987).
12. E. F. Palermo, "Plastic Pipe/Fitting Failure: Cause and Prevention", Pacific Coast Gas Association Workshop (1987).
13. E. F. Palermo, K. G. Toll, G. T. Appleton, "Using Laboratory Tests on PE Piping Systems to Solve Gas Distribution Engineering Problems", Tenth Plastic Pipe Symposium (1987).
14. E. F. Palermo, "Critical Evaluation of Rate Process Method 'Anomalies'", AGA PMC Workshop (1988).
15. E. F. Palermo, K. Gunther, and M. Kanninen, "Progress Toward Designing PE Gas Pipe Against RCP (Rapid Crack Propagation)", AGA PMC Workshop (1989).

16. E. F. Palermo, "Large Diameter Plastic Pipe Damage Investigation", Midwest Gas Association Meeting (1989).
17. E. F. Palermo, K. Gunther, and D. VanDeventer, "Squeeze-Off of Large Diameter Polyethylene Pipe", AGA Distribution Conference (1990).
18. E. F. Palermo, "ASTM/ISO Rating Methods – bridging the gap across the waters", Plastics Pipes IX (1995)
19. E. F. Palermo, "High Pressure Gas Distribution Piping System", AGA Distribution Conference (1996).
20. E. F. Palermo, "Plastic Pipe Design Equation Update", AGA Distribution Conference (1997).
21. E. F. Palermo and D. B. Edwards, "An Alternate Method for Determining the Hydrostatic Design Basis for Plastic Pipe Material", Plastics Pipes X (1998)
22. E. F. Palermo, "Comparison of ASTM and ISO Gas Pipe Standards", AGA Distribution Conference (2001).
23. E. F. Palermo, "PPI Adopts International Pressure Rating Method for Plastic Piping Materials", Plastics Pipes XI (2001)
24. E. F. Palermo, "What's New with ASTM, DOT and ISO?", AGA Distribution Conference (2003).
25. E. F. Palermo and Jimmy Zhou, "Can ISO MRS and ASTM HDB Rated Materials be Harmonized", Plastics Pipes XII (2004)
26. E. F. Palermo, "Correlating Aldyl 'A' and Century PE Pipe RPM Projections With Actual Field Performance", Plastics Pipes XII (2004)
27. E. F. Palermo, "High Performance Bimodal PE 100 Materials For Gas Piping Applications", AGA Distribution Conference (2005)
28. E. F. Palermo and Steve Swanstrom, "Reinforced Thermoplastic Pipe (RTP) for High- Pressure (800 psig) Gas Piping Applications", AGA Distribution Conference (2006)
29. E. F. Palermo and E. Lever, "Innovative Methodology for Fitting Lifetime Prediction and Process Control by Correlating Rate Process Method Analysis of Molded Fittings with Notch Ring Test Data", Plastics Pipes XIII (2006)

30. E. F. Palermo et al, "New Test Method to Determine the Effect of Recycled Materials on the Life of Corrugated HDPE Pipe as Projected by the Rate Process Method", *Plastics Pipes XIII* (2006)
31. E. F. Palermo, "Using the CRS Concept for Plastic Pipe Design Applications", *Plastics Pipes XIII* (2006)
32. E. F. Palermo and J. M. Kurdziel, "Stress Crack Resistance of Structural Members in Corrugated High Density Polyethylene Pipe", *Transportation Research Board* (2007)
33. E. F. Palermo et al, "Effect of Elevated Ground Temperature (from Electric Cables) on the Pressure Rating of PE Pipe in Gas Piping Applications", *AGA Distribution Conference* (2007)
34. E. F. Palermo and S. Chung, "Rate Process Method Applied to Service Life Forecast of PE Molded Fittings", *AGA Distribution Conference* (2008)
35. E. F. Palermo, "What's New With Plastic Pipes – An Overview", *Plastics in Underground Pipes 2008*.
36. E. F. Palermo and Dane Chang, "Increasing Importance of Rapid Crack Propagation (RCP) for Gas Piping Applications - Industry Status", *Plastics Pipes XIV* (2008).
37. E. F. Palermo, "What's New With Plastic Pipes – An Overview", *Plastics in Underground Pipes 2009*.
38. E. F. Palermo and Dane Chang, "Increasing Importance of Rapid Crack Propagation (RCP) for Gas Piping Applications - Industry Status", *AGA Distribution Conference* (2010).
39. E. F. Palermo and Jeremy Bowman, "Peelable Polyethylene Pipe for Gas Piping Applications", *AGA Distribution Conference* (2010).
40. E. F. Palermo and Tim Starodub, "Use of PE100 with a Minimum Required Strength (MRS) Rating in a Natural Gas Distribution System", *Plastics Pipes XV* (2010).
41. E. F. Palermo and Dane Chang, "Comparison Between PE 4710 (PE 4710 PLUS) and PE 100 (PE 100+, PE 100 RC)", *Plastics Pipes XV* (2010).
42. E. F. Palermo and Rob Fox, "CHANGES TO CSA Z662 "OIL AND GAS PIPELINE SYSTEMS" TO INCORPORATE HIGHER PERFORMANCE PLASTIC PIPE", *Plastics Pipes XV* (2010).

43. E. F. Palermo, "Rapid Crack Propagation (RCP) in Plastic Pipe for Water Applications", CA/NV AWWA Fall Conference (2010).
44. E. F. Palermo, "How to Design Against Long Running Cracks in Plastic Pipe for Water Applications", IN AWWA Conference (2011).
45. E.F. Palermo, "Characteristics of Thermoplastic Butt Fusion Joints", MRWA (2012).
46. E. F. Palermo, "Correlating Plastic Pipe RCP Field Failures with RCP Critical Pressure for Water Pipe Applications", MRWA (2012) and ASCE (2012).
47. E. F. Palermo, "Characteristics Of a High Quality Polyethylene Gas Pipe", AGA Operations Conference (2012).
48. E. F. Palermo, "Managing Aldyl "A" PE Pipe in Canadian Natural Gas Distribution Systems", Canadian Gas Association Conference (2013).
49. E. F. Palermo, "Methodology to Determine Design Life of Assemblies of PE Gas Distribution Pipe, Heat Fusion Fittings, and Heat Fusion Joints", AGA Operations Conference (2013).
50. E. F. Palermo and K. Busko, "Managing Aldyl "A" PE Pipe in the Avista Natural Gas Distribution System", AGA Operations Conference (2013).
51. E. F. Palermo and Steven Haine (CPUC), "Hazard Analysis & Mitigation Report on Aldyl "A" Polyethylene Gas Pipelines in California", June 2014.
52. E. F. Palermo, "Higher Pressure Oriented PE Pipe for Gas Distribution Applications", Midwest Energy Association, August 2014.
53. E. F. Palermo, Benefits of Bimodal PE 2708 Materials for Natural Gas Distribution Applications", Midwest Energy Association, August 2014.
54. E. F. Palermo et al, "Methodology to Determine Design Life of Assemblies of PE Pipe, Heat Fusion Fittings, and Heat Fusion Joints", Plastics Pipes XVII, Chicago, October, 2014.
55. E. F. Palermo and S. Haine, "Hazard Analysis & Mitigation Report On Aldyl A Polyethylene Gas Pipelines in California", AGA Operations Conference, 2015.
56. E. F. Palermo, "Chemical Design Factor – Effect of Liquid Hydrocarbons on PE Pipe Design Pressure", Midwest Energy Association, August 2016.
57. E. F. Palermo, "Plastic Pipe Rule", Midwest Energy Association, August 2016.

58. E. F. Palermo et al, "PVDF – The New High Pressure and High Temperature Plastic Gas Pipe", AGA Operations Conference, June 2018.

59. E. F. Palermo et al, "PVDF – The New High Pressure and High Temperature Plastic Gas Pipe", World Gas Conference, June 2018.