MLGW MEMPHIS LIGHT, GAS AND WATER DIVISION

April 30, 2010

VIA FedEx

Sharla Dillon, Dockets and Records Manager
460 James Robertson Parkway
Nashville, Tennessee 37243

Re: Petition for Memphis Light, Gas and Water for
A Wavier to Permit the Continued Use of Plastic
Piping, Which is in Service and Had a Storage Period
In Excess of Two Years Prior to Installation
Docket No. 08-00124

Dear Ms. Dillon:

Please find enclosed an original and four (4) copies of the following:

1. Pre-Filed Testimony of Brent E. Haywood, and

2. Pre-Filed Testimony of Dr. Gene Palermo, PhD.

We ask that these be filed in the above action.

If you have any questions, please feel free to contact me at (901) 528-4343.

Sincerely,

Fred E Jones, Jr.
Staff Attorney

FEJ/fj

Attachments

BEFORE THE TENNESSEE REGULATORY AUTHORITY
NASHVILLE, TENNESSEE

IN RE:

PETITION OF MEMPHIS LIGHT,	)	
GAS AND WATER FOR A WAIVER	)	
TO PERMIT THE CONTINUED USE	)	
OF PLASTIC PIPING WHICH IS IN	)	
SERVICE AND HAD A STORAGE	)	
PERIOD IN EXCESS OF TWO	)	
YEARS PRIOR TO INSTALLATION	)	**DOCKET NO. 08-00124**

PRE-FILED TESTIMONY OF BRENT E. HAYWOOD

Q: Please state your name and business address.

A: My name is Brent E. Haywood and my business address is 220 S. Main Street, Memphis, Tennessee 38101.

Q: What is your relationship to the petitioner, Memphis Light, Gas and Water?

A: I am Manager of Gas Engineering and Operations, and I am responsible for managing and coordinating all engineering functions for the distribution of natural gas to the company's customers.

Q: Please describe your educational background and professional experience.

A: I received a Bachelor of Science in Civil Engineering from the University of Tennessee in Knoxville in 1997 and a Master of Science in Environmental Engineering from the University of Tennessee at Knoxville in 1999. I am also licensed as a Professional Engineer by the State of Tennessee

Q: What is the purpose of your testimony?

A: It is to support Memphis Light, Gas and Water's petition for a waiver to permit

the continued use of plastic pipe that is in service and had been stored outdoors in excess of two years prior to instillation

Q: For what purpose is the Company requesting a waiver?

A: For a waiver from the application of both sections 49 CFR § 192.7, Appendix B, and ASTM D 2513 to allow for continued operation the continued use of plastic pipe used in the Memphis Light, Gas and Water natural gas distribution system, which has an outdoor storage period in excess of 2 years prior to installation.

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to describe the type and extent of pipe in use by Memphis Light, Gas and Water, the methods utilized by the company to determine leaks throughout the system, the methods of instillation utilized by the company and the proposed methods to monitor any pipe subject to the proposed waiver after its instillation.

Q: Please describe the location of all installations of polyethylene pipe receiving in excess of two years exposure.

A: MLGW has 29,094 feet of pipe with more that two years of outdoor exposure installed. The footages are summarized in Table 1 and the map locations and the details (pipe size, footage, operating pressure, installation date, years of UV exposure) of the pipe are shown on the map "2009 PE Pipe Outdoor Exposure Assessment Map" attached hereto. All PE pipe used at MLGW is PE 3408, high density. All PE pipe identified with more than two years of outdoor exposure is manufactured by Performance Pipe. All PE pipe in inventory at

Memphis Light, Gas and Water is now protected from UV and outdoor exposure and is covered with tarps temporarily until a storage building can be constructed.

Table 1
Summary
Installed PE Pipe with Outdoor Storage Period in Excess of 2 years Footage

5/8"	1"	1-1/4"	2"	4"	6"	8"	12"
4,630'	545'	786'	3,625'	8,539'	5,204'	5,483'	282'

Q: Please describe the data from the three most recent leak surveys for installations located in business areas and two most recent leak surveys for installations located outside business areas.

A: A leak survey of the 108 locations of the identified PE pipe with more than two years of outdoor exposure was completed February 17, 2009 with no leaks found. Leak survey data was researched from 1998 – 2008. To better identify if there were leaks on the identified PE pipe the identified locations and the surrounding areas actual leak data was evaluated:

1) All MSS leak data was gathered from 2003-2008, which included all origins of leak reports (i.e. leak survey, customer reports, third party damage reports, etc.). The time frame encompassed the installation of all identified pipe.

2) The leak data was filtered to exclude any above ground leak reports that were resolved by gas fitters or customer service.

3) The leaks were exported to Microsoft Excel. The below ground leak data resulted in 14,437 leaks.

4) Leaks in the vicinity of the identified pipe were identified by manual

search of the excel spread sheet. MLGW CableCAD, Document Image WebExtender, and MSS were used to determine what the leak was and if the leak occurred before or after installation of the subject pipe.

5) The final list identified 34 leaks of interest. No identified PE pipe leaks were found. The following table lists the 34 leaks of interest and the leak cause:

Cause	Type	WR Number	Street Address	Date	Leak Cause
300	231	W8Y08299	904 PHILADELPHIA ST	6/16/2004	riser replaced
301	227	W8G50956	908 PHILADELPHIA ST	6/21/2004	service tap leak
300	231	W8Y08325	2184 NELSON AV	6/23/2004	riser replaced
300	231	W8Y08761	1196 WHITTEN RD	9/22/2004	replace trap coupling
300	231	W8Y08772	1196 WHITTEN RD	9/23/2004	cut service 3rd party damage
300	231	W8Y23295	ELLENDALE RD	5/4/2005	3rd party damage
300	231	W8Y30439	APPLING RD	7/13/2005	repair leak on valve
300	231	W8Y31023	6327 BRAM BL	10/17/2005	repair cut main 3rd party damage
300	231	W8Y31193	NUNN CV	11/7/2005	replace 2" valve
300	231	W8Y32043	165 GREENBRIAR DR	3/7/2006	replaced crimped PE
300	231	W8Y32258	2011 ELZEY AV	4/10/2006	replace PE pipe 3rd party damage
300	231	W8Y26504	5074 BRIAN RIDGE RD	5/31/2006	cut line 3rd party damage
300	231	W8Y32601	5098 BRIAN RIDGE RD	5/31/2006	repair cut service 3rd party damage
300	231	W8Y30067	7981 PARKMONT AV	7/28/2006	repair cut service 3rd party damage
300	231	W8Y33078	GERLAND CREEK PW	8/16/2006	replace cut PE 3rd party damage
300	231	W8Y29296	7459 CASH CV	9/26/2006	replace wing cock

300	231	W8Y33218	BILLY MAHER RD	11/9/2006	replaced tee
300	231	W8Y26898	1362 E ISLAND PL	12/6/2006	replaced PE 3rd party damage
300	231	W8Y26937	1354 E ISLAND PL	12/8/2006	bar holed no leak found
300	231	W8Y34229	ELLENDALE RD	1/10/2007	valve leak
300	231	W8Y27407	7504 DELMONICO CV	1/23/2007	replace PE pipe 3rd party damage
300	231	W8Y34361	WALNUT GROVE RD	1/24/2007	repair cut service tap 3rd party damage
300	231	W8Y35208	194 GREENLAW AV	4/4/2007	cut service 3rd party damage
300	231	W8Y35266	LATTING RD	4/11/2007	wing cock leak
300	231	W8Y28643	1775 SHOAL CREEK LN	6/6/2007	no leak found
300	231	W8Y36008	11949 WALNUT GROVE	7/9/2007	repair cut service at tap 3rd party damage
300	231	W8Y36141	APPLING RD	7/31/2007	repair damaged 6" 3rd party damage
300	231	W8Y36724	5239 CEDRICK CV	10/19/2007	Cut by electric 3rd party damage
302	227	W8J41293	BILLY MAHER RD	10/29/2007	tighten 2" tee cap
300	231	W8Y37823	7600 NESHOBA RD	2/27/2008	Cut gas line 3rd party damage
300	231	W8Y37903	2898 OVERTON CROSSING	3/6/2008	Repair 2" crimped main 3rd party damage
300	231	W8Y41170	WALNUT GROVE RD	4/16/2008	Cut line 3rd party damage
302	227	W8J78003	OVERTON CROSSING	4/24/2008	Leak on main valve
300	231	W8Y47769	305 AUCTION AV	10/30/2008	Service valve leak

Q: Describe the construction details used in the installation of subject pipe relative to pipe bedding and envelope.

A: MLGW construction practices include the removal of sharp objects, rocks, bricks, stones boards and other construction materials from trenches, excavations and

backfill materials before installing PE or steel gas pipe. MLGW crews physically inspect PE pipe for cuts, scrapes, dents, gouges or other damage before installing or pulling PE pipe in during the directional drilling process. MLGW crews will not install PE pipe with damage that meets or exceeds 10% of the nominal wall thickness. MLGW crews also pressure test all PE pipe with a minimum of 150 psig for twenty minutes and overnight whenever possible.

Q: Was the installation of subject pipe accomplished in accordance with operator qualifications and was each section of the subject pipe installed using consistently good construction practices?

A: All installations of the subject pipe were accomplished following OQ qualifications using consistently good construction practices in accordance with the manufacturer's recommended procedures. All crew members that install PE pipe were OQ qualified to do so through:

1) Maintenance and Repair of PE Pipe,

2) PE Pipe Squeeze Off,

3) Purging of Gas Mains & Services,

4) Tapping PE Pipelines Under Pressure,

5) Locating & Marking Gas Facilities, or

6) Abandonment of Facilities.

Q: What joining procedures were used for the installed pipe?

A: Select individuals are OQ qualified to perform the fusion covered tasks. There are three approved joining methods for PE pipe at MLGW:

1) heat fusion

2) electro fusion

3) mechanical (trap) for sizes 5/8"-2"

The following pages detail the fusion procedures:

SMALL DIAMETER FUSION QUALIFICATION
PE 3408 PIPE
Memphis Light Gas & Water Division
OBSERVERS COPY

Name:_____ Employee #_____

NAME OF OBSERVER_____ Date: _____

PASS / FAIL (Circle One) Company: _____

Directions
Participant must make a 2" and a 4" butt fuse using a 14 LC and or a 2 LC machine and a 2"x 1" saddle fuse using a Sidewinder Fusion machine. Observer must watch each step as participant sets up equipment, makes fusion joints, and demonstrates knowledge of fusion equipment and pipe manufactures procedures. Participant must verbally explain each step while making an acceptable fusion joint.
MUST BE SUCCESSFUL ON ALL STEPS IN SMALL DIAMETER FUSION QUALIFICATION

BUTT FUSION	**2"**	**4"**
1. Check equipment for damage or excessive wear.		
2. Check to match pipe size to clamping insert size.		
3. Inspect pipe for damage.		
4. Clean ends of pipe inside and out with clean cotton cloth before clamping.		
5. Place pipe in fusion machine, tighten clamps while aligning pipe.		
6. Attach facer and lock onto guide rods. Face off pipe ends to machine stops. CHECK HIGH LOW. If adjustment is necessary, tighten high side, FACE OFF after any adjustment, recheck high-low, if no adjustment is necessary remove any PE trimmings, clean pipe ends with alcohol/cotton cloth.		
7. Check heater plate with infrared or surface pyrometer for 500 degrees (plus or minus 10 degrees). Clean surface with dry cotton cloth.		
8. Insert heater plate between pipe ends. Engage locking cam, bring pipe ends against heater firmly, reduce pressure to only maintain contact with heater plates. DO NOT APPLY PRESSURE		
9. Follow pipe manufactures procedures for correct melt bead width, 2" pipe - 1/16" – 4" pipe - 1/8"		
10. Remove heater after achieving correct melt bead width, quickly inspect heated ends for a uniform melt pattern.		
11. Bring melted pipe ends together quickly. DO NOT SLAM. Apply fusion pressure to roll melt beads back to the pipe. Hold fusion pressure for 90 seconds on 2" pipe and 120 seconds on 4" pipe, be sure locking cam is holding properly, joint **must** be allowed to cure under pressure until cooled to below 110 degrees. Wipe heater plates clean with dry cotton cloth.		
12. Pipe must be completely cool (below 100^0 F) before air testing or any rough handling or backfilling.		

PROCEDURE FOR MAKING A SADDLE FUSION JOINT - *TAPPING TEE 2" X 1"*	
When fusing on a pressurized main, the risk of blow-out can be reduced by using equipment that is in proper working order, following the manufacture's operating instructions, using recommended fusion procedures and by using relieved-center heater faces when fusing High Volume Tapping Tees.	
1. Assemble application unit according to manufacturer's instructions and position on the pipe.	
2. Remove surface skin from the melt areas of the clean, dry pipe and saddle fitting by roughening with utility cloth (50 to 60 grit). Brush away residue with dry rag after roughening.	
HEATING	
3. With the heating surfaces of the tool at 500^0 +/- 10^0F place the tool in position on pipe. Place fitting against heater faces and apply **PRESSURE** during **heating** and **fusing**.	
Standard Tapping Tees, Heating 60-80 lbs Fusion & Cooling 60-80 lbs on all sizes.	
High Volume Tapping Tees, Heating 120-140 lbs Fusion & Cooling 2" 120-140 lbs 4"-8" 120-140 lbs	
Keep handle from dropping as this will enlarge the melt pattern on the pipe.	
4. After proper melt is achieved on the top of the main, remove fitting from heater and heater from the main, being careful not to damage either fusion area.	
Check melt pattern on pipe and fitting – heating surfaces on fitting and pipe should be 100% melted with no cold spots.	
FUSION AND COOLING	
5. If melt patterns are satisfactory, press the fitting on the pipe very quickly (within 3 seconds after removing the heater) with firm pressure until a melt bead appears around the entire base of the fitting. For a 2" tee the bead thickness should be 1/8".	
Maintain constant fusion pressure for 70 seconds.	
Allow the 2" fusion joint to cool to 110^0 F before releasing pressure.	
If melt pattern on fitting or pipe is unsatisfactory after heating, apply fitting to pipe and let cool. Remove cutter from the tapping tee and cut off fitting top to avoid misuse later.	
6. After letting joint cool, remove application unit from pipe.	
Visually check fitting for fusion melt bead around entire fitting base. If fusion joint quality is Unacceptable or doubtful, cut off fitting top and apply a new fitting to a new section of pipe.	
7. For standard tapping tees, let fusion cool an additional 10 minutes prior to pressure testing and tapping the main. Allow an additional 30 minutes before pressure testing or tapping a HVTT. FUSION AREA MUST BE COMPLETELY COOL BEFORE AIR TESTING OR TAPPING.	
8. Clean heater faces carefully after each fusion with wood or 100% cotton rag.	

TESTING

	Visual Inspection	Ultrasonic Inspection	Destructive Testing
2"			
4"			
2"x1" Tee			

ABNORMAL OPERATING CONDITIONS	
• Burn through in fusing process	
• Failure To Follow Procedures	

As Observer, I certify Participant has demonstrated the proper and correct Saddle Fusion and Butt Fusion procedure in a timely manor using the manufacture's recommended procedures.

LOCATION_____

EMPLOYEE SIGNATURE_____

LARGE DIAMETER FUSION QUALIFICATION
PE PIPE 3408
FIELD EVALUATION
Memphis Light Gas & Water Division
OBSERVERS COPY

Name: _____ Employee# _____

NAME OF OBSERVER _____

PASS / FAIL (CIRCLE ONE) Area #: _____ Date _____

Directions Participant must setup machine to fuse correct size pipe with no help from Observer. Observer must watch each step as the Participant sets up machine, makes fusion joints and demonstrates knowledge of fusion equipment and pipe manufactures procedures. Participant must verbally explain each step while making an acceptable joint.

INSPECT FUSION EQUIPMENT	
1. Check equipment for damage or excessive wear. Check oil level. Connect to electrical power source. Check generator engine oil level, and fill fuel tank. Check electrical cords for damage.	
SET HYDRAULIC PRESSURE	
2. Turn on pump, note pressure at the relief valve. Set pressure to 900 psi for machines with hydraulic facer, machines with electric facer set to 800 psi.	
3. Set up McElroy # 28 or # 28 DIPS fusion machine by selecting and installing appropriate clamping inserts. Adjust fusion pressure to pipe manufacture's specifications, set facing pressure to not more than 90 psi, if facer stalls reduce pressure. Set heating pressure to "0", (30 psi drag pressure may show on some gauges).	
4. Inspect pipe for damage.	
5. Clean ends of pipe inside and out with clean cotton cloth before clamping. Load pipe in machine. Tighten outside clamps first to hold pipe, tighten inside clamps to adjust high / low alignment. Always tighten high side.	
FACING THE PIPE	
6. Apply fusion pressure to make sure pipe will not slip. Move selector up to Facing pressure. Face off pipe ends to machine stops. Check high / low, if adjustment is necessary tighten high side. Face-Off after any adjustment, recheck high-low, if no adjustment is necessary remove all PE trimming, clean ends with **99% ISOPROPYL** alcohol and cotton cloth.	
HEATING THE PIPE	
7. Check heater plate with infrared or surface pyrometer, 500 +/- 10 degrees, adjust if necessary. Clean heating surface with cotton cloth.	
8. Insert heater between pipe ends. **A.** With SELECTOR VALVE in the FUSING position, move carriage to the LEFT, bringing the pipe ends into contact with the heater plate. **B.** Move the SELECTOR VALVE into HEATING position **C.** Allow the pressure to stabilize at zero and return carriage control to NEUTRAL.	

PROPER MELT BEAD ACCORDING TO MANUFACTURER'S RECOMMENDATION: 6" PE Pipe 3408 SDR 11 — 3/16" melt bead 8" PE Pipe 3408 SDR 11 — 3/16" to ¼" melt bead *12" PE Pipe 3408 SDR 17 — ¼" to 5/16" melt bead 6" Phillips 8000 Pipe SDR 11 — 3/16" – ¼" melt bead 8" Phillips 8000 Pipe SDR 11 — 3/16" – ¼" melt bead	
9. Shift the selector valve down to FUSION POSITION. Move carriage to the right just enough to remove the heater. QUICKLY REMOVE HEATER AND BRING PIPE ENDS TOGETHER under FUSION PRESSURE. Pipe Manufacture's recommended pressure: 6" PE Pipe 3408 SDR 11 @ **224 psi** 8" PE Pipe 3408 SDR 11 @ **358 psi** *12" PE Pipe 3408 SDR 17 @ **383 psi** 6" Phillips 8000 Pipe SDR 11 @ **393 psi** 8" Phillips 8000 Pipe SDR 11 @ **645 psi**	
10. Allow joint to cool to below 110 degrees under FUSION PRESSURE. Before air testing, backfilling or rough handling, joint must be allowed to cool completely. Clean heater surface with clean cotton cloth.	
VISUAL INSPECTION	
ULTRASONIC INSPECTION	
DESTRUCTIVE TESTING	
ABNORMAL OPERATING CONDITIONS	
• FAILURE TO FOLLOW PROCEDURES	

* Using the McElroy # 412 high velocity fusion machine and/or the McElroy # 618 high velocity fusion machine.

As Observer, I certify Participant has demonstrated the proper Butt Fusion Procedures using the McElroy # 28 machine in a timely manor using the manufacture's recommended procedures.

LOCATION_____

EMPLOYEE SIGNATURE_____

ELECTROFUSION, FIELD EVALUATION

BUTT AND SIDEWALL PROCEDURES FOR PE 3408 PIPE

Memphis Light, Gas and Water Division

OBSERVERS COPY

Print Name _____ **Employee#** _____

NAME OF OBSERVER_____

PASS / FAIL (circle) **Area #** _____ **Date** _____

INSTRUCTIONS Observer may hand a check list copy to Participant. Observer shall check each item as Participant completes each check and/or demonstrates skill requirements. Participant must complete test without any help from Observer. Participant must orally explain to the Observer what and how checks are performed while performing checks. During each explanation, for example pipe to fitting alignment, Participant may use pencil and paper and illustrate requirements as Participant is verbally explaining to Observer. Participant must conduct electrofusion procedure in correct sequence. Observer must attentively watch Participant set up for butt and sidewall fusion and destructive testing.

PARTICIPANT MUST KNOW AND/OR PERFORM ALL STEPS BOLDED = PASS
PARTICIPANT MUST KNOW ALL ABNORMAL OPERATING CONDITIONS

State How to Use the Electronic Device in a Gaseous Atmosphere **Eliminate any leaking gas**	
JOINING & REPAIR PROCEDURE	
Demonstrates How to Prepare Out-of-Round Pipe for Fusion Process Use butt fusion machine Fuse a straight piece of pipe on coiled pipe	
Cut Main Pipe Ends Square and Even	
Removed Burrs and Shavings From Main Pipe Ends	
Properly Measured Repair Replacement Pipe Section to Plus/Minus 1/16"	
Pipe Repair Section Cut Square and Even	
Properly Cleans Blades Area of Scraping Tool	
Properly Attaches Scraping Tool to Pipe	
Properly Prepares Pipe Ends by Using Scraping and Cleaning Procedures Use alcohol and 100% cotton rags when necessary	
Accurately Scrapes Pipe End Until Surface Material is Removed and New Material is Exposed	
Explains What is Meant by the Fitting's Stabbing Depth	
Demonstrates How to Measure the Fitting's Stab Depth Use ruler or use coupling to measure from the center of coupling	
Correctly Follows Procedure to Remove Internal Fitting Stops Use a board on striking end and bump fitting onto pipe to let pipe break off internal stops	

Properly Slides Coupling Over Pipe and Aligns with Measurement Marks	
Properly applies Clamping Tools to Secure the Pipe from Movement During Fusion Cycle	
Correctly Places Clamps as Close to the Fitting as Possible	
Explain the Use of Two Clamps on Each Side of Coupling for Coiled Pipe or Binding Installations For assisting in re-rounding coiled pipe	
The Sequence Processor is Connected to an Adequate AC Power Source	
If Generator is Being Used for Power Source, Is Generator Started Before Sequence Processor Function Generator has to have enough gasoline to complete any fusion cycle	
Correctly Reads the Diagnostic Check on the Operational Function Of the Sequence Presser	
Properly Attaches Sequence Processor Leads to Fitting Terminals	
State the Proper voltage Read Out for Proper ElectroFusion	
State the Recommended Clamped Cooling Time for Various Pipe Sizes After Fusion is Complete	
State the Additional Fusion Cooling Time for Various Pipe Sizes After Clamps are Removed	
Demonstrate Where to Find the Recommended Cooling Times for Various Pipe Size and Type of Fitting Used	
Document date and other necessary information on fitting Time Initials of person fusing ID # of fusion Fusion machine ID #	
SADDLE JOINING PROCEDURE	
Properly Cleaned and Scraped Pipe & Saddle Fitting Use alcohol and 100% cotton rags when necessary	
Properly Installed and Secured Clamp for Saddle	
Connected Sequence Processor to an Adequate AC Power Source	
If Generator is Being Used for Power Source, Is Generator Started Before Sequence Processor Function Generator has to have enough gasoline to complete any fusion cycle	
Correctly Reads the Diagnostic Check on the Operational Function Of the Sequence Processer	
Properly Attaches Sequence Processor Leads to Fitting Terminals	
State the Proper voltage Read Out for Proper ElectroFusion	
State the Additional Fusion Cooling Time for Various Pipe Sizes After Clamps are Removed	
Document date and other necessary information on fitting Time Initials of person fusing ID # of fusion Fusion machine ID #	

GENERAL		
Fusion specimen joined according to Company and manufacturer's approved procedure by Participant		
Visual examination of joint acceptable.	Butt	
Butt fusion joint (coupling)		
Sidewall Fusion joint	Sidewall	
Visual inspection of all 3 test specimens indicate no voids or discontinuities on the cut specimen surface area		
All test specimens are acceptable after destructively tested.	Butt	
Butt fusion joint		
Sidewall Fusion joint	Sidewall	
ABNORMAL OPERATING CONDITIONS		
• **Failure to follow procedures** • **Burn through in fusing process** • **Flammable atmosphere**		

AS OBSERVER , I CERTIFY PARTICIPANT HAS DEMONSTRATED THE PROPER AND CORRECT BUTT AND SIDEWALL ELECTROFUSION IN A TIMELY MANNER USING COMPANY AND MANUFACTURER'S PROCEDURES.

LOCATION_____

EMPLOYEE SIGNATURE_____

Q: What long term monitoring and reporting does Memphis Light, Gas and Water intend to perform on the installed pipe outside of the current requirements in the Minimum Federal Safety Standard?

A: MLGW currently performs various activities that provide long term monitoring of all pipe installed in the MLGW system. MLGW performs long term monitoring on all installed pipe by patrolling and leak surveying, in accordance with 49 C.F.R. §§ 192.511, 192.513, 192.721 and 192.723, respectively and no incidence of pipe fatigue or failure has been recorded. MLGW participates each month in the AGA Plastic Pipe Data Collection Project. No material failures or leaks have been found on the identified PE pipe either before or after filing MLGW's Petition for a Waiver. All high density PE pipe purchased is manufactured with a minimum of 2% finely dispersed carbon black to provide the highest degree of protection possible from UV exposure. All Street Main Records reporting repairs and replacements are reviewed each month. MLGW data on failures and testing does not indicate a need for any different long term monitoring or reporting on the installed suspect pipe. MLGW current practices go above and beyond the "Minimum Federal Safety Standard". If at any time data is received on the suspect pipe that would indicate a change, MLGW monitoring and reporting procedures would be reevaluated.

The pipe manufacturer clearly supports that its black PE pipe can be stored outside for ten years and even supports use of their product for outdoor applications. The Plastic Pipe Institute has published documents stating that black PE pipe with 2% carbon black may be used for continuous outdoor service.

. Long-term testing has demonstrated the black PE pipe stored outdoors for eight years has a projected life of over twenty-seven years at three times the operating pressure of 99 psig. In fact, since the filing if this petition for a waiver, ASTM D 2513 has been revised to reflect that black PE pipe may be stored outdoors up to ten years with no effect on performance.

The company will also utilize the Heat Fusion Melt Pattern Test for Black HDPE Pipe Stored Outdoors for Over Two Years From Date of Manufacture as described in Dr. Palermo's testimony

Q: In conclusion please summarize what relief Memphis Light, Gas and Water is seeking in its petition.

A: MLGW requests that its petition include the continued use of plastic piping which is in service and had a outdoor storage period in excess of two (2) years prior to installation be extended to include pipe currently in inventory that has been exposed to UV for up to ten years as follows:

4" (40' lengths) - 2,960', three years outside exposure

6" (40' lengths) - 2,200', five years, four years, two years outside exposure

6" (coil) – 1,000', two years, five years outside exposure

8" (40' lengths) - 3,160', three years outside exposure

12" (52' lengths) - 1,161', 4 years, 10 years outside exposure

Total footage - 10,481'

BEFORE THE TENNESSEE REGULATORY AUTHORITY
NASHVILLE, TENNESSEE

IN RE:

PETITION OF MEMPHIS LIGHT,	)	
GAS AND WATER FOR A WAIVER	)	
TO PERMIT THE CONTINUED USE	)	
OF PLASTIC PIPING WHICH IS IN	)	
SERVICE AND HAD A STORAGE	)	
PERIOD IN EXCESS OF TWO	)	
YEARS PRIOR TO INSTALLATION	)	**DOCKET NO. 08-00124**

PRE-FILED TESTIMONY OF DR. GENE PALERMO, Ph.D.

Q: Please state your name and business address.

A: My name is Dr. Gene Palermo and my business address is 654 Watershaw Drive, Friendsville, Tennessee 37737.

Q: What is your relationship to the petitioner, Memphis Light, Gas and Water?

A: I have been retained by Memphis Light, Gas and Water as a consultant.

Q: Please describe your educational background and professional experience.

A: I 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. I have been in the plastic piping industry for over 30 years. I worked for the Dupont Company from 1976 to 1995 in the Aldyl "A" polyethylene (PE) pipe business for natural gas distribution. I developed the initial use of polyamide (PA) 11 for high-pressure gas distribution, up to 300 psig, to replace metal pipe while with Elf AtoChem during 1995 and 1996. I was the

Technical Director for the Plastics Pipe Institute (PPI) from 1996 until 2003. As Technical Director, I was chairman of the Hydrostatic Stress Board (HSB) on which I 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. I developed standards for plastic pipe and fittings in several standards bodies; ASTM F17, CSA, AASHTO, and ISO/TC 138.

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to support Memphis Light, Gas and Water's petition for a waiver to permit the continued use of plastic pipe that is in service and had been stored outdoors in excess of two years prior to installation or continued storage indoors.

Q: For what purpose is the Company requesting a waiver?

A: For a waiver from the application of both sections 49 CFR § 192.7, Appendix B, and ASTM D 2513 to allow for continued operation and indoor or covered storage of plastic pipe, used in the Memphis Light, Gas and Water natural gas distribution system, which has an outdoor storage period in excess of 2 years prior to installation or indoor or covered storage.

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to validate the intended use of this black PE pipe with 2% carbon black in inventory that has been stored outdoors for up to ten years.

Q: What is the basis of your opinion that such pipe can be utilized after a ten year

exposure to ultraviolet rays?

A: MLGW submitted three pipe samples to Performance Pipe for testing to confirm conformance to ASTM D 2513: 4" SDR 11 stored outside for nine years and not installed; 1-1/4" SDR 11 stored outside for five years and installed for three years; 6" SDR 11 stored outside for eight years and installed for four years. The following three tables are the actual test data:

Test Results Confirmation From MLGW Stock Pipe (Not Installed) Conformance to ASTM D2513 Specifications				
Pipe Size and Type	4" SDR 11, 3408, High Density PE			
Manufacturer	Performance Pipe Yellowstripe®			
Date of Manufacturing	January 9, 1999			
Years Outside Exposure	9			
Date of Testing	June 18, 2008			
Test	**Test Method**	**Test Value**	**Requirement**	**Result**
Melt Flow	ASTM D3350 and ASTM D1238 190/5.0	0.3663 g/10min	0.34 g/10min nominal	Pass (Within expected variation)
Carbon Black %	Microwave Furnace	2.11%	>2.0 %	Pass
Density	ASTM D3350 and ASTM D1505	0.954 g/cc black 0.945 g/cc (natural calculated)	0.946 g/cc (nominal natural)	Pass (Within expected variation)
Thermal Stability	ASTM D2513 and ASTM D3350	245 deg C	>220 deg C	Pass
ID Ductility	ASTM D2513 A.1.5.11.1	Pass	Pass	Pass
Ring Tensile Strength	ASTM D2513 and ASTM D2290	3794 psi	>2920 psi	Pass
Test Results Confirmation Installed Pipe Conformance to ASTM D2513 Specifications				

Pipe Size and Type	1-1/4" SDR 11, 3408, High Density PE
Date of Manufacturing	February 21, 2000
Manufacturer	Performance Pipe Yellowstripe®
Date of Installation	August 17, 2005
Years Outside Exposure	5
Years Installed	3
Date of Testing	October 13, 2008

Test	Test Method	Test Value	Requirement	Result
Melt Flow	ASTM D3350 and ASTM D1238 190/5.0	3.3 g/10min	3.4 g/10min nominal	Pass (Within expected variation)
Carbon Black %	Microwave Furnace	2.09%	>2.0 %	Pass
Density	ASTM D3350 and ASTM D1505	0.955 g/cc black 0.946 g/cc (natural calculated)	0.946 g/cc (nominal natural)	Pass (Within expected variation)
Thermal Stability	ASTM D2513 and ASTM D3350	247 deg C	>220 deg C	Pass
ID Ductility	ASTM D2513 A.1.5.11.1	Pass	Pass	Pass
Quick Burst	ASTM D2513 and ASTM D1599	Ductile	Ductile	Pass

Test Results Confirmation Installed Pipe Conformance to ASTM D2513 Specifications	
Pipe Size and Type	6" SDR 11, 3408, High Density PE
Date of Manufacturing	August 7, 1996
Manufacturer	Performance Pipe Yellowstripe®
Date of Installation	November 12, 2004
Years Outside Exposure	8
Years Installed	4
Date of Testing	October 13, 2008

Test	Test Method	Test Value	Requirement	Result
Melt Flow	ASTM D3350 and ASTM D1238 190/5.0	3.3 g/10min	3.4 g/10min nominal	Pass (Within expected variation)
Carbon Black %	Microwave Furnace	2.17%	>2.0 %	Pass
Density	ASTM D3350 and ASTM D1505	0.955 g/cc black 0.946 g/cc (natural calculated)	0.946 g/cc (nominal natural)	Pass (Within expected variation)
Thermal Stability	ASTM D2513 and ASTM D3350	247 deg C	>220 deg C	Pass
ID Ductility	ASTM D2513 A.1.5.11.1	Pass	Pass	Pass
Ring Tensile Strength	ASTM D2513 and ASTM D2290	3660 psi Ductile	>2920 psi	Pass
80 deg C testing	ASTM D2513 A.3.2.1	670 psi	5 samples to exceed >170 hrs without failure	>200 hrs Pass

The most important consideration for outdoor stored pipe is if the UV radiation has affected the long term performance of the pipe. The key long term test to assure long-term performance is the elevated temperature sustained pressure test. Good pipe will fail on the ID of the pipe in its normal failure time. UV degraded pipe will fail on the OD of the pipe in a shorter failure time.

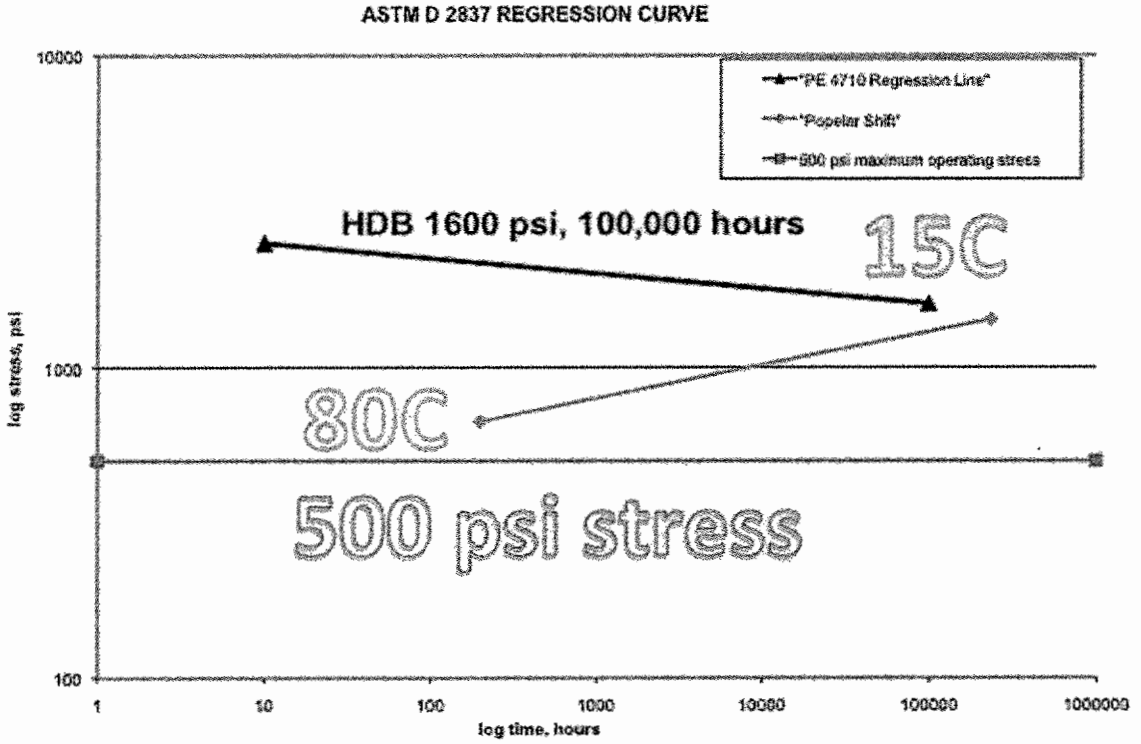
Q: Could you please summarize the test results.

A: After 6" SDR 11 black HDPE pipe was exposed to UV radiation for eight years, the pipe was tested by Performance Pipe at the ASTM D 2513 test conditions and it survived

over 200 hours at 80°C/670 psi. This pipe is used in the MLGW gas distribution system at 99 psig. This 6" pipe meets the ASTM D 2513 requirements for elevated sustained pressure testing.

Q: What is your long term projection for this pipe?

A: The MLGW average annual ground temperature is about 60 °F (15 °C). Using the Popelar Shift Factors, these testing results at 80 °C/760 psi/200 hours shift to over twenty-seven years (235,000 hours) at 1,425 psi hoop stress at 60 °F (15 °C). These Popelar Shift Factors are based on analyzing the stress rupture curves for over 40 different polyethylene materials. They are based on the principle that failure time (log t) is proportional to stress (log stress). As the stress decreases, the failure time correspondingly increases as shown in the plot below.



The black line is the standard ASTM D 2837 stress regression curve for a PE material. The value at 100,000 hours (11 years) is known as the LTHS (long-term hydrostatic strength) and the categorized value of the LTHS is the HDB (hydrostatic design basis). The gas company uses the HDB to determine the PE pipe pressure rating in accordance with DOT Part 192.123. The Popelar Shift Factors are also based on the Arrhenius principle that time (log t) is inversely proportional to temperature (T). At higher temperatures, the failure time decreases. In this case we are starting with a test temperature of 80 °C, a test stress of 725 psi and a failure time of greater than 200 hours. We are going to use the Popelar Shift Factors to shift the temperature from 80 °C to the MLGW average annual ground temperature of 15 °C (60 °F). This is the blue line on the plot. When we shift from 80 °C to 15 °C, there is a corresponding bi-directional shift in stress and time. The stress shifts from 725 psi to 1425 psi and the time shifts from 200 hours to 235,000 hours (27 years), as shown on the plot. In layman's terms this means that testing at 80 °C for 200 hours is equivalent to a lifetime of 27 years at 15 °C. The shifted stress of 1425 psi is about three times the maximum hoop stress of 500 psi that the pipe will see - this is the red line on the plot. This testing, therefore, indicates that this 6" pipe (exposed to eight years outdoor storage) will last at least twenty-seven years at a stress three times the operating stress.

Q: Please specify how the tests performed fulfill the requirements of ASTM D 2513 — 99.

A: Since the original waiver was submitted, 80 °C sustained pressure was completed on 6" installed pipe that had been stored outdoors for eight years and is currently operating at 99 psig. The elevated temperature sustained pressure test is the most meaningful long-term test that can be conducted to determine the effect of UV exposure on the outside surface of the pipe. The test results were equivalent to over twenty-seven years of service at three times the maximum operating stress at the MLGW operating temperatures. In my opinion, with these test results, no additional testing is required to confirm the adequacy of this black PE pipe for the distribution of natural gas in the MLGW system.

Q: Are you recommending that Memphis Light, Gas and Water conduct any tests on the pipe which is the subject of this waiver before it is installed?

A For this black PE pipe with 2% carbon black in inventory that has been stored outdoors for up to ten years, I have proposed that Memphis Light, Gas and Water conduct a heat fusion melt pattern test. This test determines if the outside surface of the PE pipe has been degraded by UV radiation. Based on previous experience, it is very unlikely that only ten years of outdoor exposure would have affected the pipe, but Memphis Light, Gas and Water will conduct this test until the ASTM D2513 Standard becomes official. The Heat Fusion Melt Pattern Test for Black HDPE Pipe Stored Outdoors for Over Two Years from Date of Manufacture is as follows:

a. Select pipe in inventory that has been stored outdoors for over two years from date of manufacture;

b. Remove a one foot sample;

c. Select appropriate saddle fusion heating iron for the size of pipe;

d. Using standard saddle fusion procedures, apply the heating iron to the pipe with the aid of a wooden block to achieve the desired force;

e. Remove heating iron after recommended time or after development of recommended bead size;

f. Immediately examine the appearance of the melt pattern and look for the presence of any wax;

g. Poke the melt pattern with a small wooden stick to determine the integrity of the melt, i.e., any signs of a waxy substance;

h. If no waxy substance is observed, the pipe is suitable for use;

i. Record the results.

Q: What are your final conclusions?

A: The proposed waiver set forth in Memphis Light, Gas and Water's petition will assure that current pipe stocks will be utilized to the fullest without sacrificing the safety or integrity of Memphis Light, Gas and Water's gas distribution system.