RENEWCO-MEADOW BRANCH, LLC

DIRECT TESTIMONY OF ALLEN SPIVEY

BEFORE THE TENNESSEE REGULATORY AUTHORITY

DOCKET NO. 10-00195
OCTOBER 14, 2010

Q. State your full name, title and business address.

A. My name is Allen J. Spivey. I am the Director of the Office of Corporate Engineering at AGL Resources, Inc. (AGL). My business address is 10 Peachtree Place NE, Atlanta, Georgia 30309.

Q. Please describe your educational background and professional experience.

A. I received a Bachelor of Science in Civil Engineering from the University of Kansas in 1981 and a Master of Arts degree in Business from Webster University in 1991. I have 29 years in the natural gas industry and have held responsible positions in transmission, distribution, and research companies over my career span. I have written more than 30 papers on industry topics and presented on gas products and processes internationally. I have two patents, both in the area of trenchless technology (methods of installing, repairing, and replacing buried pipe with minimal or no excavation) and have worked collaboratively with leading utilities to develop, deploy, commercialize, and adopt the use of new gas products. Currently, I direct activities of a diverse group of seasoned engineers who provide technical support for development of large and unique capital assets, including, but not limited, to transmission pipelines, CNG, LNG, compression, landfill methane recovery and storage plants.

Q. What is AGL's interest in Renewco's landfill development project in Tennessee?

A. Renewco-Meadow Branch, LLC (Renewco) is a wholly-owned subsidiary of AGL Resources Inc. that develops existing landfills for natural gas production. AGL will design and construct the proposed pipeline and tap station for Renewco. Furthermore, AGL will

ensure staff are trained and qualified to operate and maintain the proposed pipeline and will assist with the development of related construction, operating and emergency manuals.

Q. Did you assist in the preparation of the Special Permit Request?

A. I assisted in the preparation and I am familiar with the contents of the request and its exhibits.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide justification for the regulatory approval of Renewco's Application for a Special Permit to Install Glass Reinforced Epoxy (GRE) Thermoset Pipe as proposed to transport processed Hi-BTU landfill gas.

Q. What due diligence has AGL performed to ensure Fiberspar (GRE) pipe is fit-for-purpose?

A. AGL has a dedicated staff experienced in evaluating, testing, deployment, and adoption of quality materials that will improve our efforts to provide safe, reliable and cost-effective gas supplies to our millions of gas customers in 6 states. AGL conducted the following tasks to assess the feasibility of using Fiberspar pipe in this landfill gas application:

- Conducted product data review to ensure pipe could meet performance specifications; size, pressure, and compatibility with natural gas medium. Product information disclosed historical uses and users, prior testing, as well as construction and maintenance procedures.
- Conducted Plant inspection to better understand the manufacturing process, to check the quality assurance and quality control procedures and practices, to investigate safety performance and to interview plant operators, technical

engineering, and field construction support staff. We witnessed random extraction and testing of the pipe and retrieved samples for subsequent inspection.

- Conducted a peer review, soliciting feedback from key stakeholders (Field Operations, Construction, Engineering, Supply Chain, Regulatory, and Safety) at AGL regarding the feasibility of using Fiberspar. Received approval to proceed with waiver request.
- Solicited input from an approved pipeline contractor with experience in not only gas but also in water and sewer pipe construction, since composite pipes are often used in water and sewer applications. After familiarizing the contractor with the product and installation procedures and equipment, the contractor walked the preferred route and submitted a quote to construct either a steel or a Fiberspar pipeline. The contractor commented on the basis of his pricing, noting what he felt were considerable advantages in using Fiberspar.
- Interviewed the pipeline company first to secure a waiver to use Fiberspar in a DOT application to discuss experiences during installation, operations, and in conjunction with mandate testing at various time intervals established to assess the extent of deterioration in pipe strength over time. Recently, the 5-year test was performed and the pipe was found to be "like new" with no notable degradation in pipe strength.

Q. Have you provided a description of the proposed pipeline application, its preferred route, pressure, class location, and relative placement in public or private right of way?

A. Yes. In brief, it is the intent of Renewco, upon approval of Renewco's CPCN Application by the TRA, to construct and operate a single purpose, point-to-point pipeline to transport

processed renewable landfill methane gas at a pressure between 500 psig but not more than 700 psig, from the Meadow Branch landfill located at 233 County Road 166, Athens, McMinn County, Tennessee 37303 to an inter-connect on the East Tennessee Natural Gas (ETNG) transmission line at a point about 1 mile north of the City of Athens Utility Board's Riceboro gate station, the total pipeline length of approximately 9.5 miles. The pipeline will be designed, constructed, operated and maintained in accordance with DOT Part 192 Pipeline Safety Regulations and applicable state codes and regulations by experienced and qualified contractors and staff following a competitive bid among companies familiar to AGL Resources for their experience and expertise in pipeline construction. If Fiberspar is approved, construction will be overseen by both experienced construction project coordinators from AGL Services Company and field construction personnel from Fiberspar. For more details, please see a description of the pipeline configuration and design parameters in the filed Special Permit.

Q. Given the comprehensive due diligence, what was the conclusion of the feasibility study?

A. Based on the findings in our feasibility study, GRE in general, and Fiberspar more specifically, is a viable alternative to steel pipe in this, and certain other, high pressure gas applications. Fiberspar is technically fit-for-purpose and offers several benefits over conventional steel pipe in this application.

Q. Can you describe the primary benefits that Fiberspar offers over using conventional steel pipe?

A. Fiberspar offers 4 primary benefits over conventional steel in this particular application:

- Reduced reliance on and need for corrosion control, so no groundbeds or rectifiers required.

- Reduced number of joints because Fiberspar can be spooled in lengths over 4500 feet long for 4 ½ inch diameter pipe. This eliminates potential weak points and leak points.
- Smaller construction footprint required to install Fiberspar compared to what's needed to construct a steel pipeline (no full-time welder, helper, and rig, no x-ray or jeeping for coating defects, and fewer pipe handling equipment rigs because of Fiberspar's considerably lighter weight than steel pipe).
- Faster construction which can improve safety because there is limited exposure to traffic and open excavations and can reduce costs because there are fewer of the more expensive skilled labor (welding) needed and in any case, such labor would be needed for a shorter time since the job can be planned for the installation of a single 4500 foot segment.

Q. What is your justification for requesting a waiver of the requirement to comply with certain parts of 49 CFR 192 to allow installation and operation of Fiberspar (GRE) thermoset pipe at an operating pressure based on the pipe's actual Hydrostatic Design Basis (HDB) as established through testing in accordance with ASTM D 2517 -06.

A. Among the most commonly used specifications for small diameter thermoset pipe in North America are API 15HR-01 – *"Specification for High Pressure Fiberglass Line Pipe"*, CSA Z662- 03 *"Oil and Gas Pipeline Systems"*, ASTM D2517-00 *"Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings"*, and CFR Title 49, Part 192 *"Transportation of Natural and Other Gas by Pipeline- 192.121, design of plastic pipe"*. These specifications provide guidelines for the design, manufacture, and testing of thermoset pipe. Each of these specifications describes field

use and safety factors in their own individual way, but with the exception of CFR Title 49, Part 192, all share a common philosophy for the calculation of the pipe design pressures:

Current

§192.121 Design of plastic pipe.

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

$$P = 2S\frac{t}{(D-t)}0.32$$

$$P = \frac{2S}{(SDR-1)}0.32$$

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

S = For thermoplastic pipe, the HDB determined in accordance with the listed specification at a temperature equal to 73 °F (23°C), 100°F (38°C), 120°F (49°C), or 140°F (60°C). In the absence 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-3/2004, HDB/PDB/SDB/MRS Policies", (incorporated by reference, *see* §192.7). For reinforced thermosetting plastic pipe, 11,000 psig (75,842 kPa).

t = Specified wall thickness, mm (in.)

D = Specified outside diameter, mm (in.)

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.

Appendix B

ASTM D 2517-00 – Standard Specification for Reinforced Epoxy Resin for Gas Pressure Pipe and Fittings

1. The Long Term Hydrostatic Strength (LTHS) of the manufacturers' material is determined by regression testing per ASTM D 2992. This is a technique that determines the long-term strength of the thermoset pipe by testing at maximum operating temperature and under various elevated stress levels on a large range of samples.
2. The LTHS data are then interpreted using statistical methods to arrive at a Hydrostatic Design Basis (HDB).
3. Each standard will normally provide formulas for calculating the final pipe design pressure using the HDB and will include safety factors for different operating fluids.
4. The particular statistical methodology and safety factors can vary slightly between industry standards but all yield similar results.

Many existing thermoset standards were originally written not anticipating spooled thermoset pipe technology. Over the past few years, these standards have been amended to include this technology as it has gained industry acceptance and built a proven track record in the field. As a consequence, Fiberspar spooled thermoset pipe now meets or exceeds all of the industry standards listed above. Fiberspar was tested in accordance with ASTM D2992 by a Technical Review Board established to determine the LTHS values of Fiberspar Spoolable Linepipe. See attached Final Report which shows a 20 –year LTHS value of 34, 584 psi (@140 degrees F) and

157 a HDB of 31,500 psi, considerably greater than the 11,000 psi HDB limitation currently reflected
158 in Part 192.121.
159 Proposed
160 §192.121 Design of plastic pipe.
161 Subject to the limitations of §192.123, the design pressure for plastic pipe is determined
162 in accordance with either of the following formulas:

163
$$P = 2S\frac{t}{(D-t)}0.32$$
$$P = \frac{2S}{(SDR-1)}0.32$$

164 ***P*** = Design pressure, gage, kPa (psig).
165 ***S*** = For thermoplastic pipe, the HDB determined in accordance with the listed
166 specification at a temperature equal to 73 °F (23°C), 100°F (38°C), 120°F (49°C),
167 or 140°F (60°C). In the absence an HDB established at the specified temperature,
168 the HDB of a higher temperature may be used in determining a design pressure
169 rating at the specified temperature by arithmetic interpolation using the procedure
170 in Part D.2 of PPI TR-3/2004, HDB/PDB/SDB/MRS Policies", (incorporated by
171 reference, *see* §192.7). For reinforced thermosetting plastic pipe, 11,000 psig
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176 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.

Appendix B

ASTM D 2517-00 – Standard Specification for Reinforced Epoxy Resin for Gas Pressure Pipe and Fittings

Q. Can you describe the Fiberspar GRE pipe product and how it has been used?

A. Yes.

Fiberspar is a spoolable (coilable) thermoset pipe consisting of a complete pipeline system, manufactured in a continuous, automated process with sophisticated processing and quality control. A continuous thermoplastic layer (generally HDPE) is manufactured in the first process step. In a second process step, a reinforcing structural layer (generally thermoset) is applied to the thermoplastic inner layer. For some applications, a third layer (generally HDPE) is added as a protective jacket (not shown here). All pipe is then tested to 150% of the manufacturer's pressure rating. See Figs 1 & 2.

Fig 1: Spoolable Thermoset Pipe

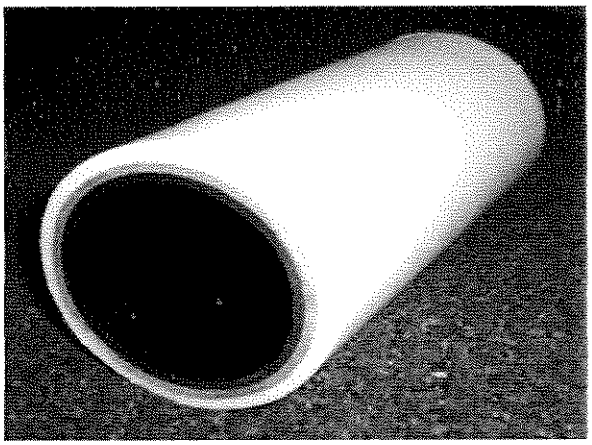

Fig 2: Jacketed Spoolable Thermoset Pipe

The thermoset pipe is delivered to the field on large reels in a spooling frame, and unspooled, like cable, into the pre-prepared trench. Mechanical connections are used to join lengths of pipe at location or to provide connection to the field headers or terminations. See Figs 3, 4 & 5.

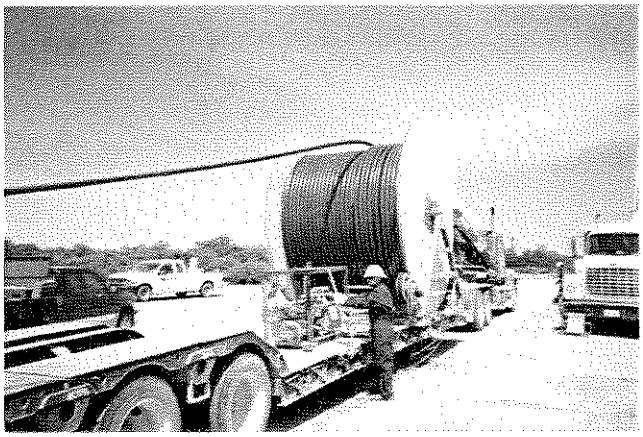

Figure 3: 3-in., 1,500 psig spoolable pipe loaded on truck in hydraulic spooling frame, ready for deployment.

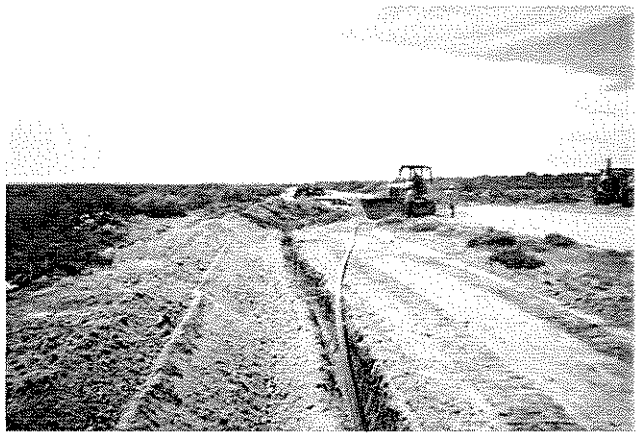

Figure 4: spoolable pipe being pulled down right-of-way by bulldozer

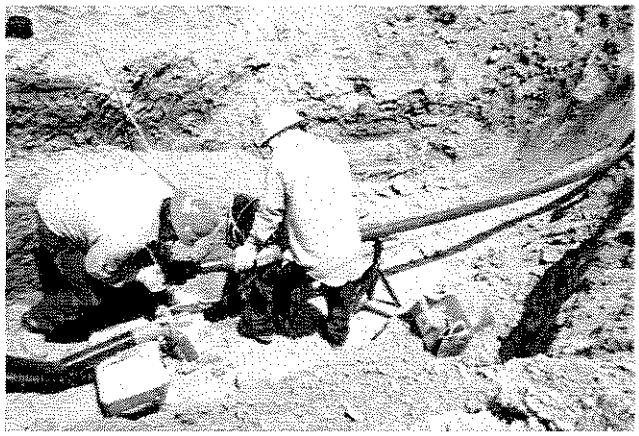

Figure 5: 4-in., 1,500 psig service-end fitting with integral ANSI Flange

Spoolable thermoset pipe is available in sizes up to 6 1/2-inch nominal diameter, and operating pressures up to 2,500 psig. It is used for liquid, gas, and multi-phase applications and is compatible with most common oilfield fluids.

Below is a History of Spoolable Pipe. From 1993 to 1995, Fiberspar and Conoco, Inc. worked together to develop a basic spoolable pipe technology for applications in the oil industry by leveraging Conoco's industry knowledge with Fiberspar's core technologies in design and

manufacturing. This joint development effort was primarily focused on downhole, coiled-tubing, well-intervention applications, but many of the underlying design, manufacturing, connector, and qualification methods used in Fiberspar's thermoset pipe flowline products were developed as a direct result of the development collaboration between Conoco and Fiberspar.

In 1996, Fiberspar acquired from Conoco all background intellectual property in this technology. By 2000, Fiberspar had successfully demonstrated that its patented spoolable fiber reinforced pipe technologies could be fully developed and commercially marketed to meet the rigorous product requirements of the oil and gas industry.

The first commercial installation for a major operator consisted of over 40,000 ft of 2-½ inch nominal thermoset pipe, tying in over 250 wells. This installation has been in trouble free operation for more than 5 years, at operating pressures of 2,200psig.

Fiberspar moved its manufacturing operations to Houston, Texas in 2002, and acceptance of the technology is now widespread among all operators. Fiberspar thermoset pipe is rapidly becoming the technology of choice for oil and gas gathering, injection and disposal operations. Many major operators now use thermoset pipe technology exclusively, and the customer list is growing rapidly. AGL contacted two users of the pipe for gas applications. Both were very satisfied with the pipe's performance. According to Fiberspar™, more than 6 million feet of spoolable thermoset pipe were installed in North America in 2006, and the total installed since 2000 is in excess of 15 million feet.

Q. What steps will you take to mitigate risks associated with the first-time use of this pipe if the request is approved?

A. AGL will take the following steps to mitigate risks from manufacturing and through operations:

- Perform plant inspection and sample testing during the manufacturing process.
- Contract Fiberspar to plan installation and to manage construction contractor (material handling, joining, and testing).
- Work collaboratively with Fiberspar to complete training of staff and to complete operating procedures manuals.
- Perform additional leak surveys (beyond the mandatory requirement).
- Design the pipeline with additional check valves (in addition to required mainline valves) strategically installed to reduce the blow-down volume and length of pipe evacuated in the case of 3rd-part damage or other leak situation. Install pressure monitoring and alarm capability for a prompt response to an upset condition.

Q. Is the Applicant prepared and capable of complying with all laws, rules, regulations, and orders of this Authority applicable to the construction and operation of the pipeline distribution system?

A. Yes.

Q. On behalf of the Applicant, are you asking the Authority to approve the Application for a Special Permit to Install and Operate Fiberspar Glass Reinforced Epoxy (GRE) Thermoset Pipe as proposed?

A. Yes, we are respectfully requesting the Authority to approve the Special Permit to Install and Operate Fiberspar Glass Reinforced Epoxy (GRE) Thermoset Pipe.

Q. Does this conclude your direct testimony?

A. Yes.

JANA LABORATORIES INC.

Final Report

Project 06-4046

Technical Review Board Evaluation of the LTHS Values of Fiberspar LinePipe Spoolable Composite Pipe

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Executive Summary

Columbia Gas Transmission Corporation requested formation of a Technical Review Board (TRB) to comply with the requirements of the DOT PHMSA Waiver [Docket No. RSPA–04–18757; Notice 2]. The TRB's goal was to review Fiberspar's stress rupture data and, using industry accepted methodologies, determine appropriate LTHS (Long-Term Hydrostatic Strength) values for Fiberspar LinePipe Spoolable Composite Pipe.

The purpose of this report is to summarize and document the process and actions of the TRB in evaluating the LTHS values for the Fiberspar pipe.

The review process consisted of the following:

- Formation of the Technical Review Board
- Agreement on the Technical Review Board's scope of work
- Review of the pertinent test and product standards
- Review of data
- Conclusions reached by the Board

The Board determined that the key objective of the Board was:

> To provide a recommendation on the LTHS values appropriate for the pipe, based on a review of the methodologies employed and the results obtained.

Based on a review of the standards and the final data provided by Fiberspar, as per ASTM D2992-06, the Technical Review Board agrees with the following:

1. The appropriate LTHS values at 11-, 20- and 50-years for the Fiberspar LinePipe Spoolable Composite Pipe are:

Time		140 °F LTHS	140 °F HDB
Hours	Years	(psi)	(psi)
100,000	11	35,154	31,500
175,200	20	34,584	31,500
438,000	50	33,672	31,500

2. The corresponding Hydrostatic Design Basis (HDB) category at 140 °F is 31,500 psi for all three time periods based on ASTM D2992-06

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Report No.: Project 06-4046 – Final Report

Client: Columbia Gas Transmission Corporation
40 Grosset Drive
Kirkwood, NY 13795
U.S.A.

Date of Issue: February 29, 2008

Purpose of Report:

Columbia Gas Transmission Corporation requested formation of a Technical Review Board (TRB) to comply with the requirements of the DOT PHMSA Waiver [Docket No. RSPA–04–18757; Notice 2]. The TRB's goal was to review Fiberspar's stress rupture data and, using industry accepted methodologies, determine appropriate LTHS (Long-Term Hydrostatic Strength) values for Fiberspar LinePipe Spoolable Composite Pipe (SCP, also known as glass reinforced epoxy pipe with a PE liner).

The purpose of this report is to summarize and document the process and actions of the Technical Review Board in evaluating the LTHS values for the Fiberspar pipe.

Background:

Columbia Gas Transmission Corporation was granted a waiver by DOT PHMSA [Docket No. RSPA–04–18757; Notice 2] for the installation of approximately 4,200 feet of a composite thermoset pipe manufactured by Fiberspar subject to fulfilling certain requirements. One of the requirements is to submit the data on the LTHS (Long-Term Hydrostatic Strength) to the Hydrostatic Stress Board (HSB) for approval and listing under PPI TR-4. The Hydrostatic Stress Board has declined to consider this pipe citing that it is outside their scope which is thermoplastic pipe.

After discussions with DOT PHMSA it was decided to pursue an alternative route – the formation of a Technical Review Board to review the data and issue an opinion as to the appropriateness of the methodologies used and of the LTHS value sought.

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Review Process:

The review process consisted of the following:

- Formation of the Technical Review Board
- Agreement on the Technical Review Board's scope of work
- Review of the pertinent test and product standards
- Review of data
- Conclusions reached by the Board

Details are provided below.

A Technical Review Board was formed and Board members were selected. The Board consisted of seven members. The credentials of the seven members are provided in Appendix A. Dr. Gene Palermo was selected as the TRB Chairman. All of the members signed a Confidential Disclosure Agreement with Fiberspar covering Fiberspar's proprietary information.

The Board reviewed the Waiver and determined that the key objective of the Board was:

> To provide a recommendation on the LTHS values appropriate for the pipe, based on a review of the methodologies employed and the results obtained.

The scope of work set by the Board was:

1. Review of the test methods used for the original calculations.
2. Review of the structure and composition of the pipe.
3. Review of the equipment used for testing and the data collection techniques.
4. Review of the data and calculations per ASTM D2992.
5. Recommendations for any additional data or analysis required to make a final determination.
6. A report detailing conclusions of the above evaluation together with a final statement as to the LTHS recommended by the Board.

In total, the Board held three conference calls and one meeting to complete the scope of work:

- May 11, 2007 – Conference Call
- June 21, 2007 – Conference Call
- August 15, 2007 – Conference Call
- September 6, 2007 – Meeting at Fiberspar facility in Houston, Texas

Mr. Richard Sanders, Training and Qualifications Director, DOT, was invited to attend the conference calls and the meeting as an observer. The meeting minutes provide a list of the attendees and a summary of the items discussed,

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reviewed and agreed upon. Meeting agendas and minutes are provided in Appendix B.

The Board reviewed the relevant test methods and the long-term hydrostatic strength data. A list of the standards reviewed is provided in Appendix F. The Board compared the industry specifications for SCP Pipe. This review is provided in Appendix C. A list of all of the documents reviewed is provided in Appendix E. Due to confidential and proprietary information, only the document names have been provided for selected documents. The documents are retained on file at Jana Laboratories, Inc.

In addition to the LTHS data, an overview of the product and its application was requested. This outline is provided in Appendix D. These points were addressed by Fiberspar with documents (in Appendix E) and during the final meeting of September 6, 2007.

At the September 6, 2007 meeting, after reviewing all of the information provided by Fiberspar, the Technical Review Board unanimously approved the motion to issue 11-, 20- and 50-year LTHS values at 140 °F in accordance with ASTM D2992 for the Fiberspar pipe based on the completion of four action items. The letter detailing the Board's motion is provided in Appendix B. These action items were completed when the following documents (listed in Appendix E) were submitted to Jana Laboratories, Inc.:

- Document 11: Fiberspar letter of December 6, 2007 (in response to the TRB letter on September 25, 2007)
- Document 12: Fiberspar LinePipe Qualification Report per ASTM D2992-06 – November 26, 2007
- Document 13: Fiberspar letter of November 26, 2007 (Certification letter)
- Document 14: Short-term Burst, Survival, and Sustained Pressure Test Data of Fiberspar LinePipe – November 26, 2007

Based on the data provided in Fiberspar's report (Document 12 in Appendix E), as shown in Table 1, the appropriate LTHS values at 11-, 20- and 50-years for the Fiberspar LinePipe SCP are:

Table 1: Summary of LTHS values

Time		140 °F LTHS	140 °F HDB
Hours	Years	(psi)	(psi)
100,000	11	35,154	31,500
175,200	20	34,584	31,500
438,000	50	33,672	31,500

The corresponding Hydrostatic Design Basis (HDB) category at 140 °F is 31,500 psi for all three time periods based on ASTM D2992-06. The HDB category value is based on the LTHS falling within a specified range per ASTM D2992.

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The calculations to determine the LTHS and HDS values shown in Table 1 were independently verified by Jana Laboratories, Inc.

Conclusions:

Based on a review of the standards and the final data provided by Fiberspar, as per ASTM D2992-06, the Technical Review Board agrees with the following:

1. The appropriate LTHS values at 11-, 20- and 50-years for the Fiberspar LinePipe Spoolable Composite Pipe are:

Time		140 °F LTHS	140 °F HDB
Hours	Years	(psi)	(psi)
100,000	11	35,154	31,500
175,200	20	34,584	31,500
438,000	50	33,672	31,500

2. The corresponding HDB category at 140 °F is 31,500 psi for all three time periods based on ASTM D2992-06

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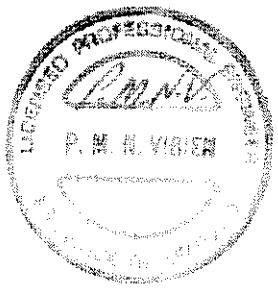
Issued by:

Sarah Chung, M.A.Sc., P.Eng.
Senior Project Leader



Reviewed by:

Patrick Vibien, M.Sc., P.Eng.
Technical Solutions Director

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