STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Investigation pursuant to 30 V.S.A. §§ 30 and 209 regarding the alleged failure of Vermont Gas Systems, Inc. to comply with the certificate of public good in Docket 7970 by burying the pipeline at less than required depth in New Haven, Vermont	))))))	Case No. 17-3550-INV
Notice of Probable Violations of Vermont Gas Systems, Inc. for certain aspects of the construction of the Addison natural gas pipeline	)))	Case No. 18-0395-PET

PREFILED DIRECT REBUTTAL TESTIMONY OF KEVIN BODENHAMER ON BEHALF OF VERMONT ELECTRIC POWER COMPANY, INC. AND VERMONT TRANSCO LLC

November 1, 2021

Summary of Testimony

Mr. Bodenhamer of TRC Pipeline Services, LLC responds to the Prefiled Direct Testimony of Intervenors' witness Gregory Liebert filed on September 10, 2021 and "corrected" on October 4, 2021.

Q1. Please state your name and occupation.

A1. My name is Kevin Charles Bodenhamer. I am employed by TRC Pipeline Services, LLC ("TRC") as Vice President and Chief Engineer. I am also a Registered Professional Engineer in all 50 states and the District of Columbia.

Q2. Have you previously submitted testimony in this proceeding?

A2. Yes, I previously provided prefiled direct testimony on July 23, 2021 on behalf of VELCO in Case Nos. 17-3550-INV and 18-0395-PET.

Q3. Please explain the purpose of your testimony?

A3. My testimony responds to the prefiled testimony of Mr. Gregory Liebert filed on behalf of the Intervenors, submitted on September 10, 2021 and "corrected" on October 4, 2021, with respect to the appropriate procedures and formulas for determining load-bearing calculations in connection with the loading standard (HS15+20%) that applies to the Addison Natural Gas Pipeline ("ANGP").

Q4. What new documents did you review and/or consider in preparation of your rebuttal testimony that were not previously identified in your direct testimony or related discovery responses?

A4. I have reviewed, in whole or in part, the following documents:

1. Mr. Liebert's prefiled testimony dated September 10, 2021 (and related exhibits) and his "corrected" prefiled testimony dated October 4, 2021.
2. Prefiled testimony of John St. Hilaire and Carlos Chaves (and related exhibits), filed by VGS, dated September 10, 2021.
3. Intervenors' Responses to VGS R1 Discovery, dated October 8, 2021.

4. Transcripts of the deposition of Mr. Liebert, conducted on October 12 and 20, 2021.
5. Exhibits used during Mr. Liebert's deposition.

Q5. In Mr. Liebert's prefiled testimony, he concludes that the ANGP does not meet Class 3 standards for load-bearing. Specifically, he states that with respect to the ANGP, the ASME B31.8 14 – 2012, has a Design Factor of 0.5 for Class 3 locations and that "[a] Design Factor of 0.5 means that the pipeline must be constructed so that the load on the pipeline is no greater than 50% of the Specified Minimum Yield Strength (SMYS)." Liebert pf. at 2. Do you agree with this statement? Why or why not?

A5. No, I do not agree with Mr. Liebert's statement. The Design Factor (F) stated in ASME B31.841.1.1 and 49 CFR 192.111 is utilized to determine the "Design Pressure" of a pipeline, and is only applicable to the internal pressure of the pipe, not the maximum stress allowed at any location on the pipe. The Design Pressure is used along with the pressure to which the pipeline was tested to determine the Maximum Allowable Operating Pressure of the pipeline. The Design Factor (F) relates directly to the Class 3 determination of the pipeline and is not a limitation to the maximum stress allowed in section 833 of ASME B31.8. The maximum stress allowed takes into account many factors, such as the HS20+15% loading, and is not covered in 49 CFR 192 because 49 CFR 192 is not a design document, but a federal regulation that prescribes the minimum requirements for the design, construction, and operation of a gas pipeline. The standard utilized by gas pipeline companies for the design of gas pipelines (and by the PUC in this case) is America Society of Mechanical Engineers (ASME) B31.8. ASME B31.841.1(a) is the same formula as 49 CFR 192.105 which is used to determine the design pressure or minimum wall thickness of a pipeline.

ASME B31.8 also goes deeper into design requirements in section 833.4, which specifies a maximum allowable sum of combined stresses due to all loads (internal pressure, wheel loading, temperature, etc.) of 1.0 for occasional loads of short duration. The subject of wheel loading specifically is addressed in ASME B31.8.833.9(b) which allows a maximum allowable stress of 0.90. Wheel loading is a short duration load, including those from a vehicle crossing the ANGP; however, like Mott McDonald, I am assuming that the 0.90 factor applies.

These factors are established to provide a conservative factor of safety in the design of any structures that have potential safety risks associated with their operation, such as gas pipelines. The Design Factor (F) used to determine the maximum operating pressure of the pipeline of ANGP is 0.50, which is conservative. The calculation for the allowable combined stress in a pipeline is separate from the maximum operating pressure of a pipeline, but does include all stress applied to the pipeline. For ANGP, the maximum combined stress is 0.90.

Q6. You mention 49 CFR 192 and ASME B31.8. Can you briefly explain how those documents are used by engineers in designing a gas pipeline?

A6. 49 CFR 192 is a Federal Regulation that prescribes the minimum requirements for the engineering, design, construction, operation, and maintenance of natural gas pipelines. Those regulations are not, by themselves, a design document and were never intended to be used as one. Rather, they are used in conjunction with ASME B31.8, an ANSI recognized international code for the engineering, design, construction, operation, and maintenance of natural gas pipelines that pre-dates the adoption of 49 CFR 192. The Pipeline and Hazardous Materials Safety Administration (PHMSA) references a number of industryrecognized codes and standards, such as ASME B31.8, all of which are used in the detailed design of a natural gas pipeline system.

Q7. Are 49 CFR 192 and ASME B31.8 easy to read and comprehend documents?

A7. Both of these documents are complicated technical publication that are not easy to comprehend or interpret on the first or second reading. Both documents have been developed over the years by engineers and pipeline operators to be used on very complex and detailed assets. Both ASME and PHMSA regularly conduct training sessions to explain how to read, understand, and apply what is in these documents to natural gas pipeline assets. Based upon Mr. Liebert's discovery responses (both written and in his deposition), it appears that he has never served as a licensed professional engineer for the design of a natural gas pipeline project and that this case represents the first instance in which he has attempted to interpret these regulations and design standards. Likewise, from the discovery responses it appears that Mr. Liebert had not previously performed surface load calculations of this type prior to this case.

Q8. In your experience have you used Design Factor (F) to calculate load on a pipeline, or have you reviewed the calculation of other engineers who have done so?

A8. By way of background, I have been involved in the design, operation, and maintenance of natural gas and hazardous liquid pipelines for over 40 years in the United States, Canada, and Mexico. During my career I have designed or have been responsible for the design of hundreds of pipelines. In addition, for over 20 years I have served on the ASME B31 Standard Committee, the committee that creates, updates, revises, reviews, and approves all of the ASME B31 pressure piping codes, including ASME B31.8. Eight years ago, I was selected by my peers to be designated a "Fellow" in ASME. This designation is given to less than 1% of active ASME members for distinguished engineering or technical achievements.

Every pipeline that I have designed, or reviewed the design for, have utilized the proper Design Factor (F) based upon Class Location for the determination of the maximum internal pressure or minimum wall thickness. In addition, other formulas are utilized for the calculation of the maximum load or maximum combined stress on a pipeline. As stated in above, there are many factors that are taken into account when calculating the maximum allowable stress (or load) allowed on a pipeline. Longitudinal stress for example, includes stress from internal pressure, external loads, temperature changes, etc. The Design Factor (F) is utilized to determine the maximum pressure at which the pipeline can operate and is not representative of the maximum combined longitudinal stress allowed. Calculations such as API 1102 and CEPA take into account the combined stress of internal pressure and wheel loading. In the case of the ANGP, the wheel load calculations performed by Mott McDonald were correctly performed with the Design Factor of 0.5 and combined stress allowable of 0.90.

Q9. When, if ever, would Design Factor (F) be applicable to a gas pipeline like the ANGP?

A9. The Design Factor (F) is applicable to ANGP for determining the operating pressure, but not for determining the maximum allowable combined stress.

Q10. When reviewing Mr. Liebert's CPEA calculations, did the inputs correctly match those required for the ANGP?

A10. No, Mr. Liebert utilized incorrect values for maximum allowable stress and other input values, causing "fail" results when they were actually "pass."

Q11. When reviewing Mr. Liebert's GPTC calculations, did the inputs correctly match those required for the ANGP?

A11. No, Mr. Liebert utilized incorrect values for maximum allowable stress and other input values, causing "fail" results when they were actually "pass."

Q12. When reviewing Mr. Liebert's Wheel Loading calculations, did the inputs correctly match those required for the ANGP?

A12. No. Mr. Liebert utilized incorrect values for maximum allowable stress and other input values, causing "fail" results when they were actually "pass." In Mr. Liebert's "corrected" prefiled testimony, he discussed his Wheel Loading calculations. Mr. Liebert increased the width of the trench to 4 to 5 feet while using the unrealistic 50% of SMYS combined stress limitation. As discussed above, the combined stress limitation should be 0.90 (or 100%) of the SMYS. Even assuming that Mr. Liebert's trench width values are realistic (which may or may not be the case), the Wheel Loading calculation would be pass rather than fail.

Q13. Mr. Liebert states in his prefiled testimony, "API RP 1102 was developed based on data derived from bored installations rather than trench installations." Do you agree with this statement?

A13. No. API 1102 was written for both trenched and trenchless installations. While there is one section in API 1102 that focuses entirely on trenchless technology, API 1102 is applicable to conventional trench installation. Please keep in mind that API 1102 was developed and first issued in 1952, long before the established use of trenchless technology. Mr. Liebert's statement is incorrect.

Q14. Does that conclude your testimony at this time?

A14. Yes, it does.