BEFORE THE MINNESOTA OFFICE OF ADMINISTRATIVE HEARINGS
600 North Robert Street
St. Paul, MN 55101

FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION
121 7th Place East, Suite 350
St Paul MN 55101-2147

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| In the Matter of the Petitions for Recovery of Certain Gas Costs | OAH Docket No. 71-2500-37763 |
| In the Matter of the Petition of N. States Power Co. d/b/a Xcel Energy to Recover Feb. 2021 Nat. Gas Costs | MPUC Docket No. G-002/CI-21-610 |

**DIRECT TESTIMONY OF RICHARD A. POLICH**

**ON BEHALF OF**

**THE MINNESOTA DEPARTMENT OF COMMERCE**
**DIVISION OF ENERGY RESOURCES**

**December 22, 2021**

# PUBLIC DOCUMENT

TRADE SECRET DIRECT TESTIMONY OF RICHARD A. POLICH
IN THE MATTER OF THE REVIEW OF THE JULY 2018 TO DECEMBER 2019 ANNUAL AUTOMATIC ADJUSTMENT REPORTS

MPUC DOCKET NO. G-002/CI-21-610
OAH DOCKET NO. 71-2500-37763

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## I. INTRODUCTION

**Q. Would you state your name, occupation, and business address?**

A. My name is Richard A. Polich, P.E. I am a Managing Director with GDS Associates, Inc. (GDS). My business address is 1850 Parkway Place, Suite 800, Marietta, Georgia, 30067.

**Q. For what party are you presenting testimony in this proceeding?**

A. I am presenting testimony on behalf of the Minnesota Department of Commerce, Division of Energy Resources (Department).

**Q. What is your assignment in this proceeding?**

A. My assignment is to assist Department of Commerce personnel in conducting an independent investigation of the unplanned outages at Xcel Energy's (Xcel) Wescott Liquified Natural Gas Plant (WLNG), Sibley Liquid Propane Plant (SLPG) and Maplewood Liquid Propane Plant (MLPG) which prevented the operation of these facilities during the February Event.

**Q. What is your educational and professional background?**

A. I received a Bachelor of Science Mechanical Engineering in 1979, a Bachelor of Science Nuclear Engineering in 1979, and a Master of Business Administration in 1990, all from the University of Michigan in Ann Arbor, Michigan. I am a registered Professional Engineer in the State of Michigan. I have over 40 years of experience in the utility industry and energy sector, performing duties and services for myriad companies and

organizations, and representing the interests of private and public constituencies throughout the world.

In May 1978, I joined Gilbert-Commonwealth Associates, Inc., located in Jackson, Michigan, as a Graduate Engineer and worked on several plant modification projects, new nuclear plant construction projects and in the information technology department. In May 1979, I joined Consumers Power Inc., (now called Consumers Energy), located in Jackson, Michigan, as an Associate Engineer in the Plant Engineering Services Department. While in this department, I provided plant engineering design, project oversight and engineering trouble shooting on the company's existing and new construction power generation fleet. In April 1980, I transferred to the Midland Nuclear Project and progressed through various job classifications to Senior Engineer. I also participated in the initial design evaluation of the Midland Cogeneration Plant. Between 1987 and 1998, I worked in Consumers Marketing and Rates Department, progressing to Manager of Rates.

I joined Nordic Energy, an independent power producer and retail/wholesale power marketer, in 1998 as Vice President. In 2003, I began my consulting career when forming Energy Options & Solutions, based in Ann Arbor, Michigan, as a consulting firm focused on providing engineering services and regulatory support. During my consulting career, I have provided a variety of testimony on rates, cost of service, and engineering problems in various state regulatory commissions and the Federal Energy Regulatory Commission. I also have provided project development expertise on wind, solar and various fossil generation projects. In 2015, I joined GDS Associates, Inc. (GDS).

**Q. What portion of your engineering project experience relates directly to evaluation of the cause of outages at the WLNG, SLPG and MLPG facilities that occurred earlier this year?**

A. Throughout my career, I have participated and performed failure analysis of multiple types of equipment and systems. The approach to failure analysis and root cause analysis for any piece of equipment is the same. While working on power plant failure analysis or root cause analysis, I have performed evaluations of control system logic failures associated with equipment sequencing, metallurgical damage and failure, impact of thermodynamics on systems causing failures and other types of events leading to equipment failures. A copy of my resume is contained in Schedule 1 of my direct testimony.[1]

**Q. In what proceedings have you previously testified before utility regulatory commissions?**

A. A list of utility regulatory proceedings in which I have filed testimony is set forth in Schedule 2.[2] Regulatory proceedings in which I provided testimony specifically on equipment failures and owner maintenance and operating practices include:

- Indiana Utility Regulatory Commission, Case No. 38707 FAC111-S1;
- Florida Public Service Commission, Docket No. 2019001-EI; and
- Minnesota Public Utility Commission, Docket No. E999/AA-20-171.

[1] DOC Ex. ___, RAP-D-1 (Polich Direct) (Professional Resume).
[2] DOC Ex. ___, RAP-D-2 (Polich Direct) (List of Prior Testimony)

## II. WLNG, SLPG AND MLPG FACILITIES BRIEF DESCRIPTION

**Q. Please provide a brief description of the Wescott Liquified Natural Gas Facility.**

A. The Wescott LNG plant, located in Inver Grove Heights, Minnesota, was built in the 1970s. The peaking plant has two storage vessels capable of storing approximately 2,145,000 Dth of liquid natural gas (LNG) (Dth or Dekatherm refers to the energy contained in natural gas, is equal to one million Btu (1.0 mmBtu) or approximately 1 Mcf of natural gas) for injection into the gas distribution system. WLNG has two separate processes: First, the plant can liquefy natural gas by refrigerating it down to -260 °F for storage in the tanks. Second, the plant can vaporize LNG by heating it to around 60 °F for injection into the natural gas pipeline distribution system.[3]

**Q. When did Xcel last use WLNG for natural gas injection into the gas distribution piping system?**

A. WLNG was last dispatched in March 2019. The following table shows WLNG operation during over the last five years.

[3] Xcel Ex. ___ at 4–6 (Yehle Direct).

**Table 1: Wescott LNG Annual Operation[4]**

| Year | Days of Operation | Dth Injection | First Day of Operation |
|---|---|---|---|
| **2016** | 21 | 53,585 | 1/7/2016 |
| **2017** | 12 | 24,436 | 1/5/2017 |
| **2018** | 19 | 275,789 | 1/1/2018 |
| **2019** | 11 | 143,404 | 2/7/2019 |
| **2020** | Not used for peaking. | | |

As can be seen in Table 1, WLNG was used within the first week of January in three of the last five years. Based on this typical WLNG evaporator use, testing should be performed in early November to ensure any problems found during testing, could be repaired prior to potential need during the winter heating season.

**Q. How does the WLNG vaporizer system work?**

A. The vaporizer is a relatively simple system in which a heated glycol mixture transfers heat to the LNG in a heat exchanger (vaporizer), raising the LNG from – 260 °F to vapor temperature of about 60 °F before it is injected into the natural gas distribution piping system. An LNG pump transfers the LNG from the storage tank to the vaporizer where it is heated to about 60 °F prior to injection into the natural gas piping system. The WLNG vaporizer system has two trains of heat exchangers (vaporizers) in which the LNG flows through the tubes that are surrounded by the hot glycol mixture. Schedule 3 is a piping and instrument diagram (P&ID) of a portion of the vaporizer

[4] DOC Ex. ___, RAP-D-3 (Polich Direct) (DOC No. 10(b) – Corrected Attach. A) (Plant Operating Data).

system, showing the LNG and glycol mixture flow through heat exchanger **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS].**[5] This P&ID was contained in the Hazard and Operability Analysis (HAZOP) study and a Layer of Protection Analysis (LOPA) of the existing design of the vaporizers process at the WLNG.[6] To understand some of the discussion on the WLNG natural gas release events, the following identifies a few of the key components shown on P&ID NSP9604-PID2, Revision A:

1. **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**: One of two heat exchangers in which the hot glycol mixture heats the LNG from -260 °F to around 60 °F, vaporizing the natural gas. As mentioned before, the LNG flows through the heat exchanger tubes and the hot glycol flows around the tubes in the section of the heat exchanger called the shell.
2. **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**: This is a flow control valve in the hot glycol supply line to the heat exchanger **[NOT PUBLIC DATA BEGINS . . . [redacted] . . NOT PUBLIC DATA ENDS]**. This valve, located in pipe **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**, controls the hot glycol flow to ensure the temperature in **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** is hot enough to vaporize the LNG. A signal from a temperature probe in the glycol mixture outlet pipe **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** tells valve

[5] DOC Ex. ___, RAP-D-4 (Polich Direct) (DOC No. 18(e) – Attach. 45) (Piping & Instrument Diagram, LNG Vaporizer, HX-201).
[6] DOC Ex. ___, RAP-D-5 at 40 (Polich Direct) DOC 18(e) – Attach. 45 (Wescott LNG Plant HAZOP & LOPA Study Report).

**[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to open or close a certain amount based on the temperature of the glycol leaving **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**.

3. **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**: This valve is controlled by the temperature of natural gas leaving the evaporator and is designed to prevent LNG from entering pipe **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . NOT PUBLIC DATA ENDS]** which could cause pipe failure. If the temperature in the pipe falls below a certain setpoint the valve closes, stopping flow of LNG into the evaporator. Based on the P&ID, this valve is either open or closed and does not modulate.
4. **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**: This valve, located in pipe **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**, also is a flow control valve, used to control the flow of LNG to heat exchanger **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**. The flow of LNG is controlled to an WLNG plant operator-controlled level of LNG flow.
5. **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**: This is one of several pressure relief valves on the LNG pipe **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** which ensure that pressure in the pipe does not exceed piping design pressure of **[NOT PUBLIC DATA BEGINS . . .** [redacted] psig **. . . NOT PUBLIC DATA ENDS]**.

6. LNG Pumps: Shown on another P&ID, NSP9604-PID1. These pumps pump the LNG to heat exchanger **[NOT PUBLIC DATA BEGINS . . . [redacted] . . NOT PUBLIC DATA ENDS]** through LNG pipe **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**.[7]

7. Glycol Mixture Heater & Pumps: Shown on P&ID, NSP9604-PID8. This heater heats the glycol mixture and pumps it through pipe **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** into heat exchanger **[NOT PUBLIC DATA BEGINS . . . [redacted] . . NOT PUBLIC DATA ENDS]**.[8]

**Q. Please provide a brief description of the Sibley and Maplewood Liquified Propane Gas Facilities.**

A. The Sibley Liquified Propane Gas plant is located in Mendota, Minnesota, and the Maplewood Liquified Propane Gas plant is located in Maplewood, Minnesota. Sibley can store approximately 114,000 Dth equivalent of propane and Maplewood can store approximately 124,000 Dth equivalent of propane (a combined 2.6 million gallons of propane). Propane needs to be vaporized and mixed with air prior to injection into the natural gas pipeline distribution system.[9] The SLPG and MLPG vaporizer systems use a steam heated heat exchanger (vaporizer) to convert the liquid propane to gas which is then mixed with air to obtain similar burn characteristics to natural gas, prior to

[7] *Id.* at 39.
[8] *Id.* at 46.
[9] Xcel Ex. ___ at 6–7 (Yehle Direct).

injection into the natural gas piping distribution system. The shell side of the evaporator contains LPG and the steam flows through tubes. The gasified propane enters a second heat exchanger where its temperature is raised prior to mixing with air.

**Q. What is the relevant standard for your investigation of these facilities?**

A. The Minnesota Public Utilities Commission directed parties to evaluate whether Xcel prudently operated and maintained the WLNG, SLPG, and MLPG plants.[10] Department witness Mr. Matthew J. King explains that prudence requires that utilities act reasonably based on available knowledge or knowledge that could have been reasonably obtained. Mr. King also testifies that this understanding of the prudence standard is consistent the definition offered by the gas utilities.[11]

## III. DESCRIPTION OF WESCOTT LIQUIFIED NATURAL GAS FACILITY GAS RELEASES ON DECEMBER 31, 2020, AND JANUARY 4, 2021

**Q. What are Xcel's procedures for testing WLNG's vaporization equipment in preparation for winter operations?**

A. According to Xcel witness Mr. Steven C. Yehle, the WLNG's vaporizer system is tested each year in preparation for winter operations.[12] Vaporizer system testing is usually

[10] ORDER GRANTING VARIANCES & AUTHORIZING MODIFIED COST RECOVERY SUBJECT TO PRUDENCE REVIEW, & NOTICE OF & ORDER FOR HEARING ¶¶ 1, 23(d)(v), 27 (Aug. 30, 2021) (eDocket No. 20218-177548-05).
[11] DOC Ex. ___ at 28 (King Direct).
[12] Xcel Ex. ___ at 15–16 (Yehle Direct).

performed after Xcel completes use of the liquefaction system to store LNG storage because the switchover from liquefaction to vaporization is not a simple process. According to Xcel Energy's first Root Cause Investigation Report (RCA1),[13] the Wescott LNG Plant began "the process of vaporization preparation to convert liquid natural gas into vapor natural gas" on November 10, 2020. During this process, however, frost in the expansion tank loop caused pressure buildup in the LNG storage tank **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** , requiring operators to relieve the pressure by venting natural gas to the atmosphere.[14]

On November 18, Xcel again attempted the vaporization preparation procedure. Once again, the operator noticed frost on the north expansion loop that "increased [the] level of liquid natural gas in the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** tank and the boil-off line. The plant manager observed the safety relief valve on the top of Tank 2 activate, reviewed available options, and decided to release liquid natural gas into the containment area."[15]

The RCA1 states that the WLNG vaporization system was tested successfully on December 3,[16] but review of the WLNG plant operation data provide by Xcel does not show any evidence of evaporator system testing.[17] In addition, the RCA1 states that plant staff were asked what was changed or what was done differently between

[13] DOC Ex. ___, RAP-D-6 (Polich Direct) (DOC No. 18(b) – Attach. B) (First Root Cause Analysis Report).
[14] *Id.* at 2.
[15] *Id.*at 2–3.
[16] *Id.*at 3.
[17] DOC Ex. ___, RAP-D-7 (Polich Direct) (DOC No. 18(j) Supplement – Attach. 2) (Wescott LNG Plant Operating Data).

November 18 and December 3. "The response was that no changes were made to the system and nothing was done differently."[18]

In preparation for winter 2021 operations, Xcel states, "In November and December, the Company had begun testing certain components of the vaporization equipment in preparation of winter operations."[19] WLNG's vaporizer was not tested again until December 31, 2020.[20]

**Q. Has Xcel explained the discrepancy between the WLNG plant operating data from December 3, 2020 and the RCA1?**

A. No. I ask that Xcel explain in rebuttal testimony why WLNG plant operating data does not show any evidence of evaporator system testing despite the RCA1's statement that the vaporization process successfully occurred on December 3.

**Q. Did Xcel perform any WLNG maintenance work before the December 31, 2020 vaporizer testing?**

A. Yes, according to Excel Engineering, Inc., Xcel Energy installed a "new solenoid and block for the **[NOT PUBLIC DATA BEGINS . . .** [redacted] . **. . . NOT PUBLIC DATA ENDS]** Xcel also installed a new

[18] DOC Ex. ___, RAP-D-6 at 3 (Polich Direct) (DOC No. 18(b) – Attach. B) (First Root Cause Analysis Report).
[19] DOC Ex. ___, RAP-D-8 at 2 (Polich Direct) (DOC No. 8(a) – Wescott Modifications) (Docket No. 21-135).
[20] Xcel Ex. ___ at 15–16 (Yehle Direct).

programmable logic controller (PLC) card[21] **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** This PLC card is used to operate the solenoid that **[NOT PUBLIC DATA BEGINS . . .** [redacted]**. . . NOT PUBLIC DATA ENDS]**

**Q. Describe the natural gas release that occurred during WLNG evaporator testing on December 31, 2020.**

A. The documentation of the December 31, 2020, natural gas release consists of Excel Engineering's service report[24] and Xcel Energy's second Root Cause Investigative Analysis (RCA2), investigation starting January 6, 2021.[25] Neither of these reports provide details of the December 31, 2020 natural gas release event.

While the Excel Engineering service report does not contain detail on the events leading to December 31, 2020 natural gas release, it does indicate that Excel Engineering discussed setpoints with Xcel Energy personnel in attempt to troubleshoot

[21] DOC Ex. ___, RAP-D-10 at 2 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).
[22] DOC Ex. ___, RAP-D-9 at 1 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report).
[23] *Id.* at 2.
[24] *Id.*
[25] DOC Ex. ___, RAP-D-10 at 2 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

control valves **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** operation. A later entry in the report noted that during the December 31, 2020 evaporator testing, glycol mixture flow control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** appeared to not open sufficiently, preventing sufficient flow of hot glycol mixture to the evaporator **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** , causing temperature drop in the evaporator due to LNG flow.[26] If the valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** does not fully opening, the vaporizer will not have sufficient heat to vaporize the LNG. Xcel Energy's RCA2 primarily discusses the January 4, 2021 natural gas release event, only noting that: "A similar event took place on December 31, 2020."[27]

**Q. Describe the natural gas release that occurred during WLNG evaporator testing on January 4, 2021.**

Excel Engineering personnel spent several hours investigating the control logic for glycol mixture flow control valves **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** . After discussion with Xcel Energy's WLNG operations, plant engineering and management staff, it was decided the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . . NOT**

[26] *Id.* at 2–3.
[27] *Id.* at 2.

**PUBLIC DATA ENDS]** Xcel Energy then attempted to start WLNG evaporator, but the first test was stopped due to the LNG pump tripping. During a second attempt to start the WLNG evaporator, the glycol mixture control valve, **[NOT PUBLIC DATA BEGINS . . .** [redacted]**, . . . NOT PUBLIC DATA ENDS]** appeared to be functioning as directed by the control logic, but not enough hot glycol was flowing to the evaporator. After **[NOT PUBLIC DATA BEGINS . . .** [redacted]**. . . NOT PUBLIC DATA ENDS]**, the glycol mixture heater tripped. **[NOT PUBLIC DATA BEGINS . . .** [redacted] [redacted] **. . . NOT PUBLIC DATA ENDS]** but Xcel Energy's RCA2 states it was flow control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted]**. . . NOT PUBLIC DATA ENDS]**, which closed due to low natural gas temperature exiting the evaporator **[NOT PUBLIC DATA BEGINS . . .** [redacted]**. . . NOT PUBLIC DATA ENDS]**. The pressure in the LNG piping exceeded **[NOT PUBLIC DATA BEGINS . . .** [redacted]**. . . NOT PUBLIC DATA ENDS]** psi because the LNG pump continued to operate after LNG flow to the evaporator stopped, and the pressure relief valves opened, releasing natural gas to the atmosphere.[28] In summary, the release of natural gas was due to hot glycol mixture flow control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** not opening enough to provide the heat to evaporator **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to heat the amount of LNG flowing into the evaporator. The

[28] DOC Ex. ___, RAP-D-9 at 2-3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report); DOC Ex. ___, RAP-D-10 at 4 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

temperature of natural gas exiting the evaporator fell below the temperature setpoint, causing valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to close and the LNG pump pressurized the LNG pipe above the safety valve set points, causing the release of natural gas.

Overall, the evaporator failure events of December 31, 2020 and the January 4, 2021 respectively released 27.31 and 26.25 Dth of natural gas.[29]

## IV. DISCUSSION OF THE CAUSE OF THE WLNG GAS RELEASES

**Q. What information on the WLNG evaporator failure and natural gas release is available?**

A. The Excel Engineering service report and Xcel Energy's RCA2 are in general agreement on the events which caused the December 31, 2020 and January 4, 2021 natural gas release. The cause of the release was insufficient hot glycol flow to the evaporator to heat the amount of LNG flowing into the evaporator, resulting in natural gas outlet temperature from the evaporator to fall below the setpoint of temperature control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** and the valve closing. This "deadheaded" the LNG pump, raising the pressure in the LNG supply line above the safety valve setpoints and releasing natural gas to the atmosphere.[30]

[29] Xcel Ex. ___ at 16 (Yehle Direct).
[30] *Compare* DOC Ex. ___, RAP-D-9 at 3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report), *with* DOC Ex. ___, RAP-D-10 at 3 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

**Q. What explanation did Xcel provide for failure of the [NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] that resulted in insufficient hot glycol flow to the evaporator?**

A. Xcel states that their review of the December 31, 2020 and January 4, 2021 natural gas release events concluded the following cause:

> The investigation reviewed the operational history of the plant, including the condition of vaporization system on the dates of the unplanned gas releases, and determined the primary root cause of the safety issue was attributed to a modification made approximately twenty years ago to the LNG pumps.[31]

This statement lacks clarity regarding the cause and does not describe how the cause led to the gas release events. The description does not discuss why the WLNG evaporator had operated for over twenty years without the control system sequency and/or valve malfunctions leading to the 2020 and 2021 natural gas releases. Xcel also failed to provide any information on the modifications that it made to resolve the WLNG evaporator system problem that caused the 2020 and 2021 natural gas releases.

**Q. Did Xcel's discovery responses conflict with the RCA2 performed following the December 31, 2020 and January 4, 2021 release events?**

A. Yes, the RCA2 and Excel Engineering service report both indicate the true cause of the natural gas release was setting the LNG flow into the evaporator too high for the

[31] DOC Ex. ___, RAP-D-8 at 2 (Polich Direct) (DOC No. 8(a) – Wescott Modifications) (Docket No. 21-135).

amount of hot glycol mixture allowed to flow into the evaporator **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** through flow control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** during the first approximately **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** minutes of startup operation. With insufficient heat to vaporize the amount of LNG flowing into the vaporizer, the exiting natural gas fell below temperature limits and caused **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to close. This caused a sequence of events which led to the LNG pump over pressurizing the LNG header. The LNG flow into the evaporator appears to have been set too high for startup of the evaporator.[32] But Xcel described the problem as the result of a "modification made approximately twenty years ago" in a discovery response.[33]

**Q. What is your assessment of the WLNG evaporator failures on December 31, 2020 and January 4, 2021?**

A. My assessment finds the root cause of the natural gas leak was allowing too high of an initial LNG flow into the evaporator which could not be heated fast enough because the control logic on **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** was restricted to **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** open for the first approximately **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC**

[32] DOC Ex. ___, RAP-D-9 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report); DOC Ex. ___, RAP-D-10 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).
[33] DOC Ex. ___, RAP-D-8 at 2 (Polich Direct) (DOC No. 8(a) – Wescott Modifications) (Docket No. 21-135).

**DATA ENDS]** minutes of evaporator system operation. The high LNG flow cooled the evaporator **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . NOT PUBLIC DATA ENDS]**, resulting in outlet evaporated natural gas temperature to fall below the setpoint for injection into the natural gas pipeline system and causing **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to close. What is not clear is why LNG pump did not trip on low flow or why the LNG pump recirculation line was not open. Both conditions would have prevented the pressure in the LNG piping, downstream from the LNG pump, from exceeding design pressure and prevented the safety valves from releasing natural gas. In rebuttal testimony, Xcel should explain the underlying reasons that the control logic could not cause the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** to physically open to the commanded position as mentioned in the RCA2. The company also should explain in rebuttal why the LNG pump did not trip on low flow or why the LNG pump recirculation line was not open.

In addition, operating data appears to show that the evaporator plant functioned properly in years 2016-2019. Xcel should provide its assessment of the evaporator failure to show the problem was due to a "20-year old modification" in rebuttal testimony.

**Q. You stated earlier that Xcel also shuttered the SLPG and MLPG facilities after the WLNG release events. Do the SLPG and MLPG facilities operate in the same manner as the WLNG plant?**

A. No. The SLPG and MLPG vaporizers are heated with steam, the control system for heat to the evaporators is controlled differently, and the evaporators operate at a much lower pressure. It is a completely different evaporation process because propane liquifies under pressure at ambient temperature, thus it requires less heat to vaporize. The LPG vaporizers are a completely different design in which the LPG is vaporized on the shell side and the heating steam flows through tubes in the vaporizer. Based on my review, I do not see any similarities of WLNG's evaporation system to SLPG's and MLPG's evaporator system.

**Q. Has Xcel provided any evidence that the problem with the WLNG evaporator would also have affected the operation of SLPG and MLPG evaporators?**

A. No. Xcel has not provided sufficient details to demonstrate they were justified in discontinuing operation of the SLPG or MLPG. The operating condition for these evaporators is different than WLNG because of the temperature and pressure differences between liquid natural gas and liquid propane gas.

## V. ASSESSMENT REPORTS ON WLNG, SLPG, AND MLPG FACILITIES

**Q. Did Xcel perform any assessments of its policies and procedures for the WLNG, SLPG, and MLPG?**

A. Yes. Xcel retained EN Engineering to perform a "gap analysis" of its liquified natural gas and liquid propane gas facility policies and procedures. EN Engineering's gap analysis compared Xcel's WLNG, SLPG, and MLPG policies and procedures against applicable

federal and state regulations. EN Engineering observed 140 issues through documentation review and discussions with Xcel personnel.[34] EN Engineering, in part, found:

1. Xcel's LNG policies and plans do not contain all reporting requirements as defined in 49 CFR Part 191.
2. Xcel had not provided documentation on leak reports.
3. Xcel's LNG/LPG policies and procedures did not document design or construction requirements.
4. Xcel lacked an established internal corrosion control program at its LNG and LPG facilities.
5. Xcel was noncompliant with National Fire Code Association's NFPA 59 standard for redundant fail-safe product control, **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . . NOT PUBLIC DATA ENDS]** [35]

Xcel's failure to comply with federal reporting requirements was demonstrated by the company's delayed reporting of December 31, 2020 and January 2, 2021 natural gas releases. Xcel failed to report the December 31, 2020 release until February 23, 2021 and the January 4, 2021 natural gas release until January 26, 2021. However, 49 CFR Section 191.5 requires that a release of a hazardous liquid or gas from an LNG facility be

[34] DOC Ex. ___, RAP-D-11 at 4–5 (Polich Direct) (DOC No. 18(e) – Attach. 55) (EN Engineering Report).
[35] *Id.*

reported as early as practicable, but no later than one hour after confirming the discovery. This failure to properly report the gas leaks of December 31, 2020 and January 4, 2021 and other Minnesota Department of Public Safety – Office of Pipeline Safety (MDPS) investigation findings resulted in a **[NOT PUBLIC DATA BEGINS . . .** [redacted][36] **. . . NOT PUBLIC DATA ENDS]**

**Q. Did Xcel obtain any other assessments applicable to the WLNG Plant?**

A. Yes. Xcel retained Quest Consultants and Campos EPC to perform a Hazard and Operability Analysis (HAZOP) study and a Layer of Protection Analysis (LOPA) of the existing design of the vaporizers process at the WLNG.[37]

**Q. What are HAZOP and LOPA studies?**

A. A HAZOP study is an analysis of a system or process in which various plant processes are reviewed to determine how unsafe or unexpected operating conditions can result from deviations from intended process operation and lead to public safety risk. A LOPA study assesses how layers of protection prevent the plant in the event of unintended conditions from unsafe operation. For example, the WLNG HAZOP study identified the potential for the LNG pumps to be deadheaded and cause over pressurization of the LNG piping. The LOPA reviewed the control system and other components of the WLNG

[36] DOC Ex. ___, RAP-D-12 at 1–2 (Polich Direct) (DOC No. 8, Supp. No. 4 – Attach. F) (MNDPS Hazardous Facility Order & Notice of Probable Violation).
[37] *See* DOC Ex. ___, RAP-D-5 (Polich Direct) (DOC 18(e) – Attach. 45) *(*Wescott LNG Plant HAZOP & LOPA Study Report).

evaporator system to determine the probability of a pipe rupture causing an uncontrolled release of natural gas. The combination of these two studies provides a probability of catastrophic failure and identifies options for preventing unexpected plant operations that violate plant safety requirements.

**Q. What did the Quest Consultants and Campos EPC review of the WLNG Plant find?**

A. The studies performed by Quest Consultants and Campos EPC occurred from February 15-17, 2021, over a month after the January 4, 2021 natural gas release. The studies recommended that Xcel make improvements to the WLNG to address forty different issues, thirty-eight of which were considered high-risk and several which would lead to catastrophic failure.[38] The report also identified twelve LOPA recommendations to avoid catastrophic failures.[39] Some the issues addressed in the HAZOP/LOPA study include:

1. Lack of control interface between LNG pumps and **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** can lead to over pressurization of the LNG pipe and cause the safety valves to release natural gas.
2. Closure of **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** causing stoppage of LNG flow to avoid over pressurization of LNG piping due to LNG pump continuing to operate.

[38] *Id.* at 24.
[39] *Id.* at 25.

**Q. Did Xcel obtain any assessments applicable to the SLPG or MLPG?**

A. Yes. Xcel similar retained Quest Consultants and Campos EPC to perform HAZOP and LOPA studies for the SLPG and MLPG facilities.[40] The SLPG study was performed June 21-23, 2021. It identified eighty-eight issues, three of which were identified as high-risk and could lead to catastrophic failure.[41] The MLPG study was performed June 28-30, 2021. It identified ninety-eight issues, four of which were identified as high-risk and one of which could lead to catastrophic failure.[42]

**Q. Were Xcel's operations at the WLNG, SLPG, and MLPG subject to any oversight by safety regulators?**

A. Yes. The operations of all three facilities are monitored and inspected by the MDPS. The operation of WLNG, SLPG, and MLPG can potentially threaten public safety. Since 2011, MDPS has issued five notices of violation for WLNG, and three violations for SLPG and MLPG. Many of these violations may have been prevented with proper training of plant personnel.[43]

[40] DOC Ex. ___, RAP-D-13 (Polich Direct) (DOC No. 19(d) – Attach. A) (Sibley HAZOP Report); DOC Ex. ____, RAP-D-14 (Polich Direct) (DOC No. 19(d) – Attach. A) (Maplewood HAZOP Report)
[41] DOC Ex. ___, RAP-D-13 at 14 (Polich Direct) (DOC No. 19(d) – Attach. A) (Sibley HAZOP Report).
[42] DOC Ex. ____, RAP-D-13 at 14 (Polich Direct) (DOC No. 20(d) – Attach. A) (Maplewood HAZOP Report)
[43] *See, e.g.*, DOC Ex. ___, RAP-D-12 (Polich Direct) (DOC No. 8, Supp. No. 4 – Attach. F) (MNOPS Order & Notice of Probable Violation).

## VI. OBSERVATIONS FROM WLNG, SLPG AND MLPG REPORTS

**Q. Are you able to draw any general conclusions from your review of available documentation?**

A. Yes. The WLNG, SLPG and MLPG facilities were not available during the Presidents' Day weekend pricing event due to system failure at WLNG and Xcel's decision to remove SLPG and MLPG from service due to fear of similar problems at these two plants. Xcel's testing of WLNG evaporator system did not provide sufficient time to repair problems found in testing, prior to the Winter 2021 heating season. Xcel chose to not use SLPG and MLPG after the natural gas release at WLNG for fear of similar problems despite the SLPG's and MLPG's evaporator systems being very different from WLNG's evaporator system. The SLPG and MLPG HAZOP/LOPA studies did not find any similar findings to WLNG's HAZOP/LOPA Study. Xcel had not performed a HAZOP or LOPA study or WLNG, SLPG or MLPG prior to the gas release event at WLNG on December 31, 2020 and January 4, 2021, despite the critical need for these facilities and the considerable risk to public safety. Despite contrary requirements, Xcel failed to report the natural gas release immediately after the release to MDPS until February 2021. Xcel has also received several other previous notices of violations from MDPS.

**Q. What is your assessment of Xcel's operations and maintenance practices for WLNG, SLPG and MLPG?**

A. First, Xcel has not shown that its procedures for preparing the WLNG evaporator system in November and December 2020 for winter operations were prudent. Since WLNG was

not used in 2020, Xcel should only have needed to add a minimal amount of additional LNG in 2020 to ensure the tanks were full prior to the winter 2021 season. Xcel should have had plenty of time to switch from liquefaction mode to evaporation mode prior to November 2020 so that evaporator testing could be performed well before the winter 2021 heating season, providing time to perform repairs if needed.

Second, Xcel's decision to deem SLPG and MLPG unavailable for the winter 2021 heating season also appears to be imprudent. Xcel should have tested SLPG and MLPG to determine if the same operating conditions existed at these facilities and investigated if temporary design changes or software changes could provide the necessary protection from release of gases. None of the documentation provided by Xcel indicates Xcel took steps to find workable solutions to allow SLPG and MLPG to operate in the winter of 2021. If WLNG had been tested well in advance of the winter 2021 heating season, Xcel would have had time to assess the problems and install solutions that would enable SLPG and MLPG to operate during the winter 2021 heating season.

**Q. Were you able to draw any conclusions from your review of reports provided by Xcel on WLNG, SLPG and MLPG facilities?**

A. Prudence requires that utilities maintain and operate facilities, which have the potential to release liquids or substances that can be hazardous to public health and safety, in such a manner as to minimize risk. It was surprising that Xcel did not perform HAZOP or LOPA studies prior to the natural gas releases at WLNG. These reviews found that the company's procedures did not comply with federal reporting requirements, the

company had failed to properly review and update facility procedures. In addition to these deficiencies, the MDPS issued several Notices of Violation and Warning Letters for WLNG, SLPG and MLPG since 2012, **[NOT PUBLIC DATA BEGINS . . .** resulting in over [redacted] **. . . . NOT PUBLIC DATA ENDS]**

## VII. SUMMARY OF RECOMMENDATIONS

**Q. Please summarize your conclusions and recommendations.**

A. Based on my review of the information provided thus far, Xcel has not shown it prudently operated or maintained WLNG, SLPG, and MLPG. I request that Xcel address the following deficiencies that I have laid out in its rebuttal testimony:

1. Why WLNG plant operating data does not show any evidence of evaporator system testing despite the RCA1's statement that the vaporization process successfully occurred on December 3.
2. Why the control logic could not cause the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . . NOT PUBLIC DATA ENDS]**, to physically open to the commanded position as mentioned in the RCA2.
3. Why the LNG pump did not trip on low flow or why the LNG pump recirculation line was not open.
4. Why the evaporator failure was due to a "20-year old modification."
5. What modifications Xcel made to WLNG evaporator system to prevent the vents leading up to the December 31, 2020 and January 4, 2021 natural gas release.

6. Why did Xcel chose to discontinue use of SLPG and MLPG peaking units when the evaporation systems had no similarity to the WLNG evaporator system.

Upon review of Xcel's rebuttal testimony, I will make a final determinate on the prudency of Xcel's operations and maintenance of its peak shaving facilities in surrebuttal.

**Q. Does this conclude your direct testimony?**

A. Yes.