PUBLIC DOCUMENT –
NOT PUBLIC DATA HAS BEEN EXCISED

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

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

SURREBUTTAL TESTIMONY OF RICHARD A. POLICH

ON BEHALF OF

THE MINNESOTA DEPARTMENT OF COMMERCE
DIVISION OF ENERGY RESOURCES

February 11, 2022

PUBLIC DOCUMENT

PUBLIC SURREBUTTAL TESTIMONY OF RICHARD A. POLICH
IN THE MATTER OF THE PETITIONS FOR RECOVERY OF CERTAIN GAS COSTS

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

TABLE OF CONTENTS

Section **Page**

Schedules:

Schedule	**Designation**	**Description**
Schedule 1 (RAP-S-1)	Not Public	DOC No. 62(g) (Wescott Facility LNG Pumps)
Schedule 2 (RAP-S-2)	Not Public	DOC No. 63(a) (Post-Release Event LNG Pump Modifications).
Schedule 3 (RAP-S-3)	Public	DOC No. 64 – Attach. B (Butterfly Valve Purchase Order).
Schedule 4 (RAP-S-4)	Not Public	DOC No. 64(i) – Attach. C (Vaporizer Annual Calibration Records).
Schedule 5 (RAP-S-5)	Not Public	DOC No. 61 – Attach. A (Wescott Facility Operating Manual, Section 4.4).

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. Are you the same Richard A. Polich that previously submitted direct testimony in this proceeding?

A. Yes.

Q. Has your role in this proceeding change since your direct testimony was filed?

A. No. I am still testifying on behalf of the Minnesota Department of Commerce (DOC) regarding 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 2021 winter storm event (2021 winter storm).

Q. What is the purpose of your surrebuttal testimony?

A. My surrebuttal testimony will address issues raised in the rebuttal testimony of Xcel Energy witnesses Steven C. Yehle and Stephen G. Martz regarding the unplanned outages at Xcel's Wescott Liquified Natural Gas Plant (WLNG), Sibley Liquid Propane Plant (SLPG) and Maplewood Liquid Propane Plant (MLPG). My testimony will also

address Xcel's witness responses to the questions I raised in Section VII of my direct testimony.

II. WESCOTT LNG FACILITY VAPORIZER – ROOT CAUSE ANALYSIS

Q. Were the December 31, 2020 and January 4, 2021 natural gas release events at WLNG caused by the same set of circumstances?

A. Yes. My review of the information provided in this proceeding finds the WLNG operating conditions, plant operator actions, and equipment function during the December 31, 2020 natural gas release event at WLNG, were virtually identical to the cause of the natural gas release on January 4, 2021.[1] The remainder of my testimony will focus on the January 4, 2021 natural gas release event at WLNG because the Xcel's analysis and root cause analysis (RCA) work was focused on that event. Any reference to the January 4, 2021 release event should be assumed to equally apply to the December 31, 2020 event unless otherwise stated.

Q. What is a root cause?

A. A root cause is an initiating event of either a condition or a causal chain that leads to an outcome or effect of interest.

[1] Xcel appears to agree with this assessment. *See* DOC Ex. ___, RAP-D-10 at 2 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report) ("The previous event was not investigated separately a no injury or damage occurred and no investigation was requested at that time. It is believed that the cause is similar to the January 4th event since no changes were made to the system, processes or procedures.").

Q. How is root cause analysis performed?

A. Proper root cause analysis requires questioning each event in sequence to see if something else caused the event to happen. For example, imagine a car's brakes fail to prevent a car from stopping even though the driver put their foot on the brake. If the investigation finds the brakes did not operate properly, the next question is to ask why. If this inquiry then concludes that the brake fluid did not push on the brake pistons, the next question is to again ask why. This causal investigation should continue until the initiating event is reached. In this brake hypothetical, for example, the root cause might be a failure to check the brake fluid reservoir and fill it with brake fluid – as opposed to some other event further down the causal chain – such as a brake piston failure.

Q. Can you briefly describe the natural gas release on January 4, 2021?

A. First, the sequence of events that led to the January 4, 2021 natural gas release were virtually identical to the events of December 31, 2020, including WLNG operator actions. The sequence of events was discussed in several documents that are attached to my direct testimony.[2] The main components of the WLNG vaporization process are shown in Figure 1 below.

[2] DOC Ex. ___, RAP-D-6 (Polich Direct) (DOC No. 18(b) – Attach. B) (First Root Cause Analysis Report); DOC Ex. ___, RAP-D-9 at 1 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report); DOC Ex. ___, RAP-D-10 at 2 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

[NOT PUBLIC DATA BEGINS . . .

. . . NOT PUBLIC DATA ENDS]

The January 4, 2021 sequence of events are as follows with differences from the December 31, 2021 events noted:

1. Xcel started the WLNG vaporizer system with all preliminary activities completed to properly cool down components in accordance with WLNG operating procedures.
2. The valve alignment was set for vaporizer system start. Hot glycol then began to flow to the vaporizer, resulting in vaporizer temperatures between 116-119°F.

[3] Xcel Ex. ___ at 8 (Martz Rebuttal).

3. At 12:14:35 p.m., Pump **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**, controlling the flow of LNG into the vaporizer, was manually started.
4. At some point after LNG began flowing into the vaporizer, natural gas exit temperatures and the vaporizer's temperature start to fall.
5. At 12:31:41 p.m., the natural gas exit temperature from the vaporizer falls to 0°F, causing the valve **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** to close and LNG Pump **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** to trip, which caused the pump to stop operating.
6. At 12:32:33 p.m., less than one minute after the LNG pump tripped, Xcel employees decided to manually restart the LNG Pump **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**.[4]
7. Once again, vaporizer and natural gas exit temperatures began falling as LNG was pumped into the vaporizer.[5] Xcel then attempted to reduce LNG flow to the vaporizer to ensure an adequate balance of heat and LNG.
8. The temperature control valve **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** nevertheless closed again due to low natural gas exit temperatures from vaporizer.

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

9. This time, however, the LNG Pump **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** did not promptly trip when the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve closed, causing a pressure spike in the LNG piping to the vaporizer and causing the pressure relief valves to open.
10. At 12:39:05 p.m., the LNG Pump **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** tripped.[6]

As stated earlier, this was the same sequence of events as the December 31, 2021 event. Since there were no changes in the plant control system or equipment, I question why Xcel would follow the same sequence of events and attempt the second restart of the LNG pumps.

Q. Please explain the function of the temperature control valve [NOT PUBLIC DATA BEGINS . . . [redacted] **. . . NOT PUBLIC DATA ENDS].**

A. The label assigned to a particular valve is defined by the owner of the facility and does not always reflect the function of the valve. This is the case for the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve, whose actual function is to control the amount of hot glycol flow into the vaporizer to ensure the natural gas temperature exiting the vaporizer is within certain temperature requirements. This valve is controlled by a temperature instrument in the glycol discharge line from the vaporizer. If the glycol exit temperature from the vaporizer is too high, the valve will

[6] DOC Ex. ___, RAP-D-10 at 2-3 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

decrease its opening. If the glycol exit temperature from the vaporizer is too low, the valve will increase its opening. Because the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve is controlled by a temperature instrument and effectively is used to control the glycol temperature in the vaporizer, it has been called a temperature control valve. In reality, all valves control flow and the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve controls temperature by regulating the amount of hot glycol flow to the vaporizer.

Q. Please explain why the LNG Pump [NOT PUBLIC DATA BEGINS . . . [redacted] **. . . NOT PUBLIC DATA ENDS] tripped properly when the [NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS] valve closed the first time and did not do so the second time.**

A. The plant control system logic is programmed to trip the LNG Pump **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** if the temperature control valve on the exit of the vaporizer is signaled to close. This control logic includes a time delay between pump trips which disables the control logic link between the LNG pump and closure of temperature control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** if the LNG pump is restarted within **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** after the initial pump trip.[7] Xcel performed the second start of the LNG pump **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** within this time limit on both December 31, 2020 and January 4, 2021.

[7] DOC Ex. ___, RAP-D-9 at 2-3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report).

Thus, the control logic that tripped the LNG pump **[NOT PUBLIC DATA BEGINS . . . . [redacted] . . . NOT PUBLIC DATA ENDS]** the first time the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve closed was disabled after the LNG pump was restarted and a signal to trip the LNG pump never occurred following the restart. Xcel should have been aware of this logic after the December release event.

Q. Do you agree with Mr. Martz's testimony that the LNG pump was the "root cause" of the natural gas release on January 4, 2021?

A. No. Mr. Martz states "the root cause of the unplanned releases was that the LNG pump continued to operate after LNG flow to the vaporizer had stopped." This continued pumping created excess pressure in the LNG pipe and caused the pressure relief valves to open.[8] Mr. Martz states that the problem was the LNG pump was oversized which caused the over pressurization of the piping, and the pressure relief valves to release natural gas.[9] The first question in the root cause analysis should have been why did this happen after operating the WLNG facility for over twenty years with the same pumps? The second question should have been what were the sequence of events that led the LNG pump to deadhead; meaning, continue trying to pump LNG into a piping system that was already full of LNG. Based on my review of provided documents and experience, it is my view that the LNG pump over pressurization of the piping is not the

[8] Xcel Ex. ___ at 16 (Martz Rebuttal).
[9] *Id.* at 25-26.

root cause, but the end result of a sequence of events which starts with the testing of the vaporizer components prior to vaporizer startup.

Q. Were Xcel personnel aware that the [NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] valve was improperly operating at the time of January 4, 2021 release event?

A. Yes. Xcel personnel were already investigating the operation of valve **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** after the December 31, 2021 event as is evident in the Excel Engineering Service Report attached as Schedule 9 to my direct testimony. This report states the following which indicates valve **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** was not operating properly:

> With the system in steady state, [Xcel staff] did walk out to **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**. From the control room using the engineering laptop I gave inputs to the PLC to manually actuate that valve to multiple positions and waited for field verification that the valve was at the commanded position. It was noted by [Xcel staff] that **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** was not opening in a linear fashion as commanded by the PLC. [An Xcel staff member] performed a calibration of the valve and it was retested. The retest went well, the valve now actuated smoother and in a linear fashion.[10]

This report also identifies an Excel Engineering conversation with WLNG personnel on December 31, 2021, that discusses operation of valve **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]**.[11] Xcel personnel were aware that the **[NOT**

[10] DOC Ex. ___, RAP-D-9 at 3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report).
[11] *Id.* at 2.

PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] valve was improperly operating and likely causing the vaporizer temperature to fall.

Q. Is it common for pumps in utility systems, such as the WLNG LNG pump, to be designed for a larger capacity than their normal operating requirements?

A. Yes. Most utility systems I have designed and worked with have pumps that are designed with larger than normal operating capacity. For example, a power plant with two feedwater pumps will be designed so each pump can provide 75% of the feedwater needs of the plant because it provides a more reliable operating system. In this example, each pumps' normal operation provides 50% of the feedwater but if one pump fails the other pump can provide 75% of the needed feedwater. In this example, each pump is designed to provide 50% more capacity than it would normally need to provide when both pumps are running. The LNG pumps at WLNG are only designed to provide 20% higher capacity than needed on a normal operating basis. In my experience, this is not an over design condition.

Q. Did Xcel replace the LNG pumps in its refurbishment of WLNG to resolve the conditions that led to the January 4, 2021 natural gas release event?

A. No. Instead, Xcel installed a device called a variable frequency drive (VFD) that controls the motor power output and speed to match horsepower requirements and the LNG

flow requirements of the evaporation system.[12] Xcel had actually already designed the modification to the LNG pumps at WLNG prior to January 2021.[13] The VFD drive will allow the LNG pump to operate more efficiently by controlling the amount of electricity the pump uses and matching the LNG pump operating conditions. If designed properly, the VFD will allow the pump to operate at design maximum flow rates and the motor to produce the required horsepower needed to reach maximum design flow at design pressure.

Q. Will VFD prevent the LNG pumps from causing a pressure spike that could result in the LNG piping pressure relief valves releasing gas?

A. No. The LNG pumps at WLNG are still capable of operating in the same manner as they did when the over pressure event occurred on January 4, 2021. If an LNG pump is operating at maximum design flow, the LNG pump operating conditions will be the same as those that existed on January 4, 2021. If a valve closes off the flow of LNG downstream of the pump, the pressure in the pipe will rise very quickly, likely causing the pressure relief valves to open. This type of event is commonly referred to as a "water hammer" because of the noise the pressure wave can cause in the pipe.

[12] Xcel Ex. ___ at 29-30 (Martz Rebuttal); DOC Ex. ___, RAP-S-1 (Polich Surrebuttal) (DOC No. 62(g)) (Wescott Facility LNG Pumps).
[13] DOC Ex. ___, RAP-S-2 (Polich Surrebuttal) (DOC No. 63(a)) (Post-Release Event LNG Pump Modifications).

Q. What are the consequences of a "water hammer" event?

A. Sometimes water hammer events can cause considerable damage to equipment if the valve closure is extremely fast and the volume of fluid is very high. The design of piping systems include modeling of the water hammer effects so that the pipe does not break or tear itself away from pipe supports. The ASME Pressure Vessel Code has design requirements for this type of event that includes pressure relief valves which allow the pressure wave to be released prior to the pipe rupturing. The pressure relief valves are required to limit pressure in a piping system so the piping does not rupture and to prevent over pressurization that can be caused by pumps.

Q. Did WLNG experience a "water hammer" event during the January 4, 2021 release event?

A. Yes. Fortunately, during the events of January 4, 2021, the piping system, LNG pump, and pressure relief valves performed as designed, preventing a pipe rupture which would have resulted in a much more catastrophic event. The post January 4, 2021 modifications of adding VFDs to the existing LNG pumps at WLNG, however, did not eliminate the potential for the LNG pumps to suddenly deadhead into the LNG piping system and cause a pressure spike which results in the pressure relief valves opening.

Q. Was the LNG pump the initiating event of the causal chain that led WLNG to be unavailable during February Event weekend?

A. No. Even if the LNG pump had stopped operating when the temperature control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** closed, WLNG would have been unavailable during the February Event because of the RCA process employed by Xcel. As discussed below, the overpressure event was consequence of insufficient hot glycol flow to the vaporizer to heat the incoming LNG and vaporize it to natural gas. The insufficient flow of hot glycol into the vaporizer was caused by the hot glycol flow control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** operating improperly, which prevented WLNG from operating normally. As noted in the Excel Engineering Service Report, temperature control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** was not opening in a linear fashion. In other words, the valve was sticking when the actuator was given a signal by the plant control system to open.[14]

Q. If the LNG pump was not the root cause of the natural gas release event of January 4, 2021, what was?

A. As discussed above, the fundamentals of root cause analysis require finding the source that started the sequence of events leading to the unexpected occurrence. Because the temperature control valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** controlled the flow of hot glycol into the vaporizer that heated up and

[14] DOC Ex. ___, RAP-D-9 at 3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report).

vaporized the LNG, its proper operation was a critical to the vaporizer operation. Its malfunction prevented sufficient heat from entering the vaporizer, allowing the temperature of the gas exiting the vaporizer to fall below a temperature setpoint, sending a signal to close the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve to protect the natural gas piping downstream of the vaporizer from thermal shock. The **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve's closure stopped flow of LNG downstream of the LNG pump, resulting in the pressure excursion in the pipe that caused the relief valves to open. If the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve had operated properly, the vaporizer would have heated the natural gas to the proper temperature, the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve would not have closed, and the natural gas release events of December 31, 2020 and January 4, 2021 would not have occurred. Because the valve **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**'s failure initiated this sequence of events, it constitutes the root cause.

Q. Based on your review of Xcel's efforts to diagnose the cause of WLNG natural gas release of January 4, 2021, did Xcel perform the RCA in a prudent manner?

A. No. Relative to the system's complexity, Xcel's RCA process took an exceedingly long period. The initial Xcel RCA was not completed until March. This should have been a two-week process. In the past, I performed an RCA analysis for a problem that caused the complete shutdown of a plant. In that instance, we had an initial identification of

the cause of the event within a few days and a preliminary report within a week. With Xcel coming into the winter heating season, it would have been prudent to expedite the RCA process, so WLNG was available for the winter heating season, if at all possible. Since Xcel also decided to cease operations at SLPG and MLPG it was even more prudent to expedite the RCA process to see if these plants could operate. This means all hands-on deck to figure things out.

Q. Should the initial assessment of the cause of the January 4, 2021 natural gas release at WLNG have been difficult to diagnose?

A. No. Xcel had data from the plant operating system, Citect, that would allow its team investigating the event to develop a clear picture of the sequence of events.[15] Since this event had not happened in the twenty-year period after installation of the existing LNG pumps, Xcel also had data on previous vaporizer startups with which to compare the December 31, 2020 and January 4, 2021 vaporizer startup data. This comparison would have easily revealed the problems with the vaporizer heating the LNG up to vaporization pressure. Comparing LNG flow to the vaporizer would have found the LNG pump to be functioning and providing comparable flow to other vaporizer startups. The only remaining potential cause would have been the supply of heat to the vaporizer to gasify the LNG. Since the glycol mixture in the vaporizer was at the proper temperature during startup and consistent with other vaporizer startups, the only other potential cause of the drop in temperature of the natural gas leaving the vaporizer was the volume of the

[15] Xcel Ex. ___ at 21 (Martz Rebuttal).

glycol mixture flow to the vaporizer. This could have been verified by reviewing the data on the glycol mixture exit temperature from the vaporizer. The vaporizer heat requirements during startup did not change so the problem had to be the lack of heated glycol mixture *flowing* to the vaporizer. There are only two components which could have reduced the volume of heated glycol flowing to the vaporizer, the glycol pumps and the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve. In my experience, the first cause of insufficient flow is the valve used to control flow.

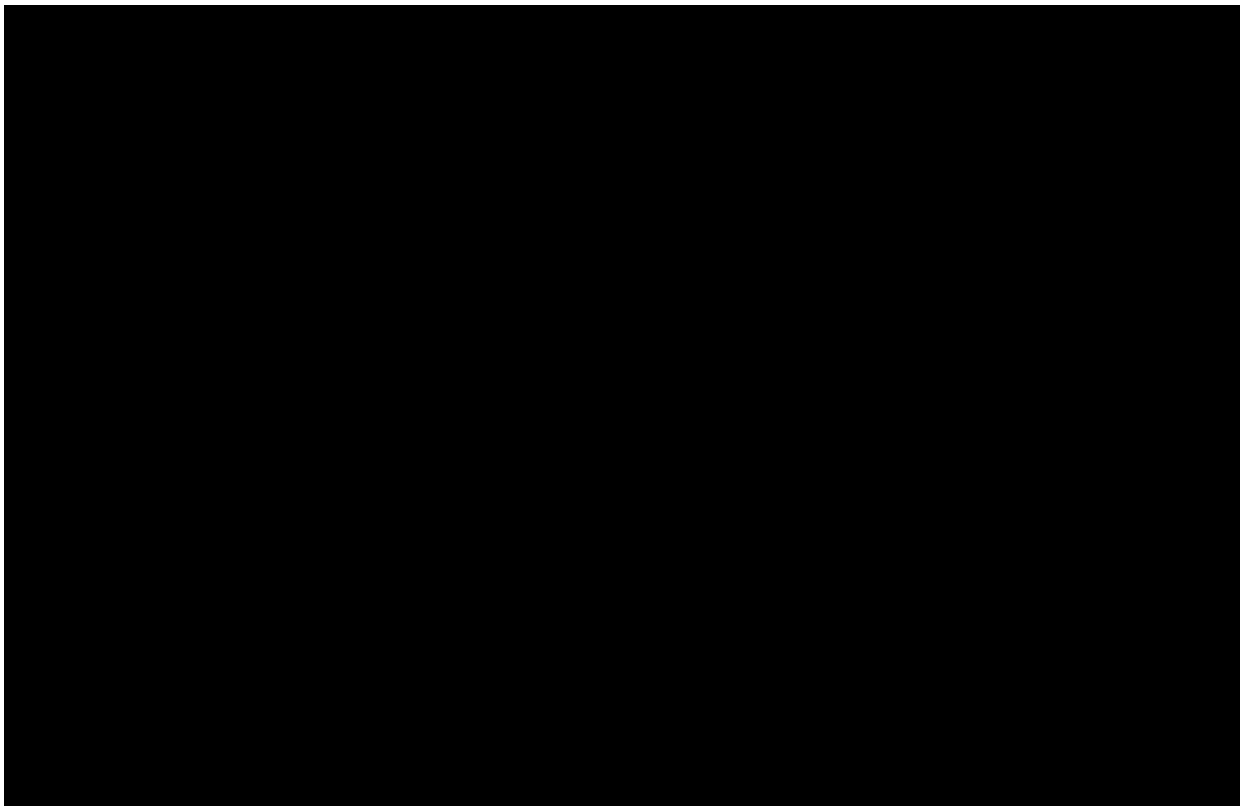
Q. Do you agree with Mr. Martz's testimony that the problem with the [NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] valve could only be diagnosed through destructive testing?

A. No. Mr. Martz suggests that destructive testing was the only way to identify the problems with the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve.[16] This is not the case because on December 31, 2021, Excel Engineering personnel noted that the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve was not operating properly, as previously discussed.[17] If Xcel had performed proper valve testing of the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve in preparation for vaporizer startup, it would have found the valve was not functioning properly. The **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve is a 12" diameter butterfly valve (shown in Figure 2 with

[16] Xcel Ex. ___ at 29 (Martz Rebuttal).
[17] DOC Ex. ___, RAP-D-9 at 2 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report).

valve in a fully open position).[18] A butterfly valve only needs to turn 90° to go from fully closed to fully open. There are several methods of testing the valve for proper operation without removal from the piping system. All of which would have diagnosed the valve problem.

[NOT PUBLIC DATA BEGINS . . .



. . . NOT PUBLIC DATA ENDS]

[18] Xcel Ex. ___, SGM-R-1 at 9 (Martz Rebuttal) (Element Testing & Analysis Report).

Q. Can operation of the valve be verified using the plant operating control system, Citect?

A. The plant operation control system can be used to verify proper operation of the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve only if used in combination with visual observation of the valve operation. Although Mr. Martz's testimony implies a digital position indicator is needed to verify that a valve responds properly to Citect controls,[19] plant personnel could have visually observed and verified that the valve operated properly. First, the valve was equipped with a visual position indicator.[20] Second, Excel Engineering personnel were able to visually identify the improper operation of the valve on January 4, 2021.[21]

Q. Could the valve's operation have been quickly assessed once the RCA team determined it was a key contributor to the January 4, 2021 natural gas release event?

A. Yes. Troubleshooting the valve problem is straightforward once it is determined that the valve does not respond properly to Citect control signals. First, the valve actuator is removed and checked to see if it responds to control signals and applies the proper torque to rotate the butterfly valve. If the valve operator is found to function correctly, manual testing of the butterfly valve is the next step. The manual testing involves measuring the amount of torque required to open the valve and move it into the proper

[19] Xcel Ex. ___ at 2 (Martz Rebuttal).
[20] DOC Ex. ___, RAP-S-3 at 2 (Polich Surrebuttal) (DOC No. 64 – Attach. B) (Butterfly Valve Purchase Order).
[21] DOC Ex. ___, RAP-D-9 at 3 (Polich Direct) (DOC No. 18(e) – Attach. 44) (Excel Engineering Service Report) ("With the system in steady state. [staff] did walk out to **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** . . . [to] field verif[y] that the valve was at the commanded position.")

position. It should be noted that Xcel Ex. ___, SGM-R-1 at 8 (Martz Rebuttal) (Element Testing & Analysis Report), shows the assembled **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]**. Valves and valve actuators are designed to operate based on the specific force or torque needed to rotate the valve. Butterfly valves typically require very little torque to open. If manual operation finds the torque exceeds design specifications, then there is likely a binding in the valve and disassembly is required to repair. None of this testing required destructive testing of the valve and could have been done within 48 hours after the January 4, 2021 event.

Q. When should have Xcel initially tested the [NOT PUBLIC DATA BEGINS . . . [redacted] **. . . NOT PUBLIC DATA ENDS] valve's operation?**

A. Xcel should have tested valve operation in the initial preparation of the WLNG vaporization system for operation back in October 2020.

Q. Should the failure of the [NOT PUBLIC DATA BEGINS . . . [redacted] **. . . NOT PUBLIC DATA ENDS] valve have prevented Xcel from operating WLNG during the winter 2021 heating season?**

A. No. Xcel had multiple options for solving the problem with the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve. First, Xcel could have purchased a replacement valve either in October 2020 if it had properly tested the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve at that time or

soon after the discovery of the valve improperly operating on December 31, 2020. Second, Xcel could have removed the valve and attempted to correct the cause of the high torque valve operation problem. The corrective action could be as simple as cleaning scale or rust off the rotating components of the valve or griding away part of the valve seat to free up valve movement. The griding may result in the valve not being able to fully shutoff glycol flow to the vaporizer, but this is not critical since the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve is normally open when the vaporizer is in service. If done properly, the griding will have minimal effect on valve performance. Third, the plant operating team could have manually operated the valve. Although this would have been inconvenient it is a workable solution. Based on the control logic for the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve, a plant operator could be dispatched to the valve location and operate the valve manually during vaporizer startup. The control room could radio information to the plant operator at the valve and the plant operator would then position the valve accordingly. Once the plant is in steady state operation, the valve can then be locked into position.

IV. XCEL'S FAILURE TO PROPERLY MAINTAIN AND OPERATE WLNG

Q. Did Xcel's maintenance of WLNG components lead to the release of natural gas on January 4, 2021?

A. Yes. The failure type of the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve could have been diagnosed during testing of the WLNG vaporization

system that Xcel began in October 2020. Mr. Martz states that calibration and testing of the valve was performed on October 24, 2020.[22] Xcel's 2020 Vaporizer Record, however, shows that the company did not verify the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve actually opened to the position commanded by control signals sent to the valve.[23] All Xcel checked was that the intended amperage was flowing to the valve. The company should have also confirmed that valve physically opened to the commanded position after receiving the signal from the controller, **[NOT PUBLIC DATA BEGINS . . .** [redacted]

[redacted]

. . . NOT PUBLIC DATA ENDS]

Q. Can you provide an example to explain what you're talking about?

A. Yes. For example, if the valve were to receive a control signal to open 25%, Xcel should have verified the valve physically opened 25%. Xcel should have then recorded in its calibration record that the valve actually opened that amount.

[22] Xcel Ex. ___ at 29 (Martz Direct).
[23] DOC Ex. ___, RAP-S-4 (Polich Surrebuttal) (DOC No. 64(i) – Attach. C) (Vaporizer Annual Calibration Records).

Q. Is it possible to verify the [NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] valve's position as part of testing procedures?

A. Yes. According to the purchase records for the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve, the valve was equipped with a position indicator that WLNG staff could have observed and recorded as part of the annual calibration of the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve.[24] Xcel failed to require its plant personnel to verify actual function of the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve and for its opening position to be correct based upon electrical input signal to the valve actuator.

Q. Has Xcel ever verified that the [NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS] valve was actually opening as commanded?

A. Not according to records provided by Xcel. The **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve was purchased and installed in 1997, making the valve over 20 years old. In response to DOC Information Request No. 64(i), Xcel did not produce documentation of any maintenance on the **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** valve since it was placed into service.[25] In my professional experience, no maintenance and no testing to verify that a twenty-year-old valve is operating properly when given control signals is not prudent.

[24] DOC Ex. ___, RAP-S-3 at 2 (Polich Surrebuttal) (DOC No. 64 – Attach. B) (Butterfly Valve Purchase Order).
[25] DOC Ex. ___, RAP-S-4 (Polich Surrebuttal) (DOC No. 64(i) – Attach. C) (Vaporizer Annual Calibration Records).

Q. Was the operation of WLNG prudent during the vaporizer operation on December 31, 2020 and January 4, 2021?

A. No. In both instances, the vaporization process was restarted within **[NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** of an LNG pump trip. Prudent operation requires investigation into the cause of a major component trip, such as LNG pumps, prior to restarting operation of a system. Xcel's Wescott Facility Operating Manual, Section 4.4, provides instructions in the event of abnormal operation which requires the following: **[NOT PUBLIC DATA BEGINS . . .**

[redacted]

- [redacted]
- [redacted]
- [redacted][26]

. . . NOT PUBLIC DATA ENDS] The restart of the vaporization process within [**NOT PUBLIC DATA BEGINS . . . [redacted] . . . NOT PUBLIC DATA ENDS]** of the first LNG pump trip was insufficient time to perform any investigation into the cause of the LNG pump trip. Prudent utility operation of any type of operating facility, such as an LNG storage facility, should require a thorough investigation and assessment of the reason for an unusual event that leads to major components tripping offline. If Xcel had taken

[26] DOC Ex. ___, RAP-S-5 at 6 (Polich Surrebuttal) (DOC No. 61 – Attach. A) (Wescott Facility Operating Manual, Section 4.4).

the time to review the data from the plant operating system, they would have seen the temperature drop in the vaporizer and investigated the cause of the temperature drop. The LNG pump would not have been restarted prior to determining the reason for the vaporizer temperature drop.

V. PRUDENCY OF SUSPENDING SLPG AND MLPG OPERATIONS

Q. Was suspending SLPG and MLPG operations until completion of WNLG RCA appropriate?

A. The initial decision to suspend SPLG and MLPG operations was appropriate because of safety concerns. Xcel, however, failed to take additional prudent actions of aggressively determining if the SPLG and MLPG operating systems could result in similar events leading to the release of propane mixtures. The operation of the liquid propane vaporization system is completely different from the LNG vaporization system at WLNG. Mr. Martz states that a comprehensive investigation was needed to verify the operation of the LPG peaking facilities would not result in a flammable gas release.[27] If Xcel had approached operation of SPLG and MLPG in a cautious manner by performing thorough testing of the vaporizer components, reviewing operating conditions, and cautiously starting the vaporizer system, they likely would have discovered the plants would be available during the 2021 winter storm. Xcel likely would have found the operating conditions of the liquid propane at the SLPG and MLPG did not have the same low temperatures and potential thermal shocks to piping systems. They would have found

[27] Xcel Ex. ___ at 34-35 (Martz Rebuttal).

different control logic that would have avoided the high piping pressures that caused pressure relief valves to open at WLNG. Xcel likely would have found they could have prudently and safely operated the SPLG and MLPG facilities in 2021.

VI. CONCLUSIONS

Q. Has Xcel shown it acted prudently in the operation of the WLNG facility?

A. No. The information provided in Mr. Martz's rebuttal testimony on operation of the WLNG facility and maintenance of key equipment provides evidence the facility was not prudently maintained or operated. Contrary to Mr. Martz's testimony, the root cause of the natural gas release events on December 31, 2020 and January 4, 2022 was not the LNG pumps.[28] Xcel's own internal RCA report identifies the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve's failure to operate properly, which resulted in insufficient hot glycol mixture flow to the vaporizer, as the primary cause of the event.[29]

Q. What was the root cause of natural gas release events and WLNG's unavailability during the February Event?

A. My review of Xcel's WLNG maintenance and operating records found that the company had not performed prudent maintenance and testing of the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve prior to startup of the vaporization

[28] Xcel Ex. ___ at 16 (Martz Rebuttal).
[29] DOC Ex. ___, RAP-D-10 (Polich Direct) (DOC No. 18(b) – Attach. A) (Second Root Cause Analysis Report).

system. The **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve was originally installed in 1997 and was over twenty years old at the time of the December 31, 2020 natural gas release event. The **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve is a butterfly valve that could easily have been tested for proper operation during Xcel's initial efforts to prepare the WLNG vaporizer system for operation in October 2020. The testing Xcel did perform was not prudent because it failed to verify the valve operated properly with visual verification.

Q. Where there any secondary causes of the January 4, 2021 release event?

A. Yes. The secondary cause was Xcel's attempt to restart the vaporization process less than **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** after the first LNG pump trip. A natural gas release did not happen prior to the first LNG pump trip, it only happened after the operators attempted to restart the vaporizer process prior to determining the cause of the LNG pump trip. Based on various Xcel documents, Xcel did not investigate the cause of the first LNG pump trip prior to initiating a restart of the LNG pumps. Prudent operation practice and WLNG's own operating manual require the investigation of the cause of the LNG pump trips prior to restarting the vaporization process.[30] The restart of the vaporization process within **[NOT PUBLIC DATA BEGINS . . .** [redacted] . . . **NOT PUBLIC DATA ENDS]** of the first LNG pump trip was insufficient time to perform any investigation into the cause of the LNG pump trip. Prudent utility operation of any type

[30] DOC Ex. ___, RAP-S-5 at 6 (Polich Surrebuttal) (DOC No. 61 – Attach. A) (Wescott Facility Operating Manual, Section 4.4).

of operating facility, such as an LNG storage facility, should require a thorough investigation and assessment of the reason for an unusual event that leads to major components tripping offline.

Q. Could the unavailability of the WLNG facility during the February event been prevented?

A. Yes. The shutdown of WLNG facility in 2021 could have been prevented if Xcel had properly tested key components. It is clear that the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve was the primary problem with the WLNG vaporization system.[31] Based upon information provided in Xcel rebuttal testimony and various discovery responses, Xcel failed to inspect, test and/or properly maintain the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve since its installation in 1997. Testing and calibration records for the years 2016-2020 provided by Xcel do not contain any reference to an inspection or calibration that would verify proper operation of the **[NOT PUBLIC DATA BEGINS . . .** [redacted] **. . . NOT PUBLIC DATA ENDS]** valve.[32] If Xcel had prudently maintained and tested this valve during vaporizer preparation for operation in October 2020,[33] it is likely that the problems with the valve would have been discovered, the valve would have been repaired, refurbished or replaced, allowing the plant to be available for the winter 2021 heating season.

[31] Xcel Ex. ___, SGM-R-1 (Martz Rebuttal) (Element Testing & Analysis Report).
[32] DOC Ex. ___, RAP-S-4 (Polich Surrebuttal) (DOC No. 64(i) – Attach. C) (Vaporizer Annual Calibration Records).
[33] Xcel Ex.___ at 29 (Martz Rebuttal).

Q. Has Xcel shown it acted prudently in the decision to discontinue operation of the SLPG and MLPG facilities in 2021?

A. No. I agree it was appropriate to discontinue operation of SLPG and MLPG facilities on a short-term basis after the natural gas release event at WLNG for safety reasons and public protection. In this type of situation, however, the prudent action would have been to immediately verify design operating conditions and test SLPG and MLPG equipment to determine if the same event could occur at the propane storage plants. LNG and LPG have very different physical characteristics and do not physically respond in the same manner.

Q. How did Xcel's review of the release events at WLNG impact the availability of the SLPG and MLPG facilities in 2021?

A. Xcel's RCA analysis process for WLNG appears to have taken a significantly longer than it should have. Initial characteristics of the plant operating events that led to the natural gas release and the plant operating conditions during the event were readily available for analysis within minutes of the occurrence. Assuming that Xcel had assembled a team immediately to assess the WLNG events, the control system data would have quickly shown the key issue was the temperature drop in the LNG vaporizer, which can only be caused by three things:

1. Too high a flow of LNG to the vaporizer,
2. Too low a glycol temperature entering the vaporizer, or
3. Too low a flow of hot glycol into the vaporizer.

At the same time, detailed equipment and control testing at SLPG and MLPG should have been performed to verify that the equipment at these facilities do not have the same problem. If Xcel had prudently followed this path, it would have known whether SLPG and MLPG had the same problems and could have been safely operated. Xcel could have prudently added additional procedures to ensure thorough investigation of equipment trips or malfunctions, such as investigating the cause of an LPG pump trip prior to restart, thus avoiding the WLNG incident.

Contrary to Mr. Martz's statement that I "don't recognize how significant it is to have an event which results in the direct release of flammable gas to the environment,"[34] I do recognize the significance of a natural gas event because of my background of working for a gas utility, as a nuclear engineer, and as a private pilot. My experience in these areas as well as other experience in the utility industry dictates the prudent course is safety first, but also to attack the problem to develop solutions and complete testing of those contemplated solutions. Xcel should have performed startup testing of SLPG and MLPG to determine if those facilities had the same issues as WLNG and there is no evidence of such testing. Xcel failed to prudently evaluate the problem at WLNG, taking until March 2021 to complete the initial RCA. Xcel failed to expedite the return to service of SLPG and MLPG through testing and analysis of the operating characteristics of these facilities.

[34] Xcel Ex. ___ at 31 (Martz Rebuttal).

Q. Does this conclude your surrebuttal testimony?

A. Yes.