INCIDENT INVESTIGATION REPORT

INCIDENT NAME: Alpine CD1 Gas Release

May 3, 2022

TIME AND PLACE OF INCIDENT & INVESTIGATION:

Time & Date of Incident: Approximately 03:30 hrs, March 4, 2022

Time & Date Investigation Started: 11:00 hrs, March 28, 2022

Time & Date of Report: 12:00 hrs, May 3, 2022

DESCRIPTION OF INCIDENT: (The Incident and Events) – Insert Visual aids after the description if applicable.

The Alpine Field was discovered in 1994, and is located approximately 34 miles west of Kuparuk. It is one of the largest conventional onshore oil fields developed in North America in the past 25 years. The Colville Delta drillsite 1 (CD1) is one of several drillsites in the Alpine Field and has a total of 49 drilled wells – only 11 of which are considered active (*i.e.*, 1 disposal, 7 injector, and 3 producer). Of the remaining 38 wells, 22 are inactive; 15 are considered long-term shut-in wells; and 1 is plugged and abandoned.

The purpose of WD-03 was to provide additional disposal capacity for Alpine Field waste injection streams. On September 16, 2020, the U.S. Environmental Protection Agency (EPA) modified Underground Injection Control (UIC) Class 1 Permit AK-1I003-C (originally issued March 14, 2019), authorizing construction of WD-03 as a new injection well, in compliance with the Safe Drinking Water Act, as amended (42 U.S.C. §§ 300f-300j-9). On January 4, 2022, the Alaska Oil and Gas Conservation Commission (AOGCC) approved ConocoPhillips' Application for Permit to Drill WD-03, No. 221-103, in compliance with 20 AAC 25.005.

In late January 2022, drilling operations commenced on WD-03, using the Doyon 142 drilling rig. The WD-03 well used slot number 50 on the CD1. The CD1 gravel pad and associated production and injection wells are located in close proximity to the Alpine Central Facility (ACF), through which produced fluids and gas are processed for multiple drillsites. On January 25, the WD-03 well was spudded at approximately 18:30 hrs.

The first hole section was drilled, and 13 3/8" surface casing was set and cemented at 2434 ft on February 2. The Blowout Preventer Equipment (BOPE) test was witnessed by AOGCC on February 3. On February 5, the surface casing was pressure tested to 3532 psi and witnessed by EPA via Microsoft Teams. Also on February 5, a Formation Integrity Test (FIT)/Leak-Off Test (LOT) was performed, resulting in a 14.9 ppg Equivalent Mud Weight (EMW) at the surface casing shoe, which met the AOGCC minimum LOT of 14.5 ppg necessary to drill the intermediate hole section. The surface casing pressure test and LOT results were sent to AOGCC and EPA on February 6.

The second hole section was drilled, and 7 5/8" intermediate casing was set at 9268 ft and cemented via a two-stage cement job on February 24-25. The first stage cement job was originally designed to isolate the Alpine C formation. The job was subsequently modified to also isolate the Nanuq-Nanuq formation, after it was encountered in the well path of WD-03; an interpretation of Logging While Drilling (LWD) information and other geologic considerations made during drilling operations determined that this formation was also a "significant hydrocarbon zone" for purposes of AOGCC casing and cement regulations at 20 AAC 25.030. The second stage cement job was designed to isolate the Qannik and K3/Narwhal formations, which were originally expected to be "significant hydrocarbon zones" in the WD-03 well path. LWD information obtained during drilling operations corroborated this expectation. The C10/Halo interval was not determined to be a "significant hydrocarbon zone" in the WD-03 well path during pre-drill planning, after evaluating LWD information during drilling operations, and upon post-incident review.

On February 27, following the second stage cement job, an Annular Leak-Off Test and Freeze Protect was performed on the 7 5/8" x 13 3/8" Annulus (Outer Annulus or OA). The freeze protection procedure is designed to prevent damage to the casing within the permafrost interval, as required by AOGCC regulations at 20 AAC 25.030. During

the first Annular LOT performed pursuant to this procedure, the maximum test pressure limit of 14.9 ppg EMW set forth in the Section Plan 03 for WD-03 was exceeded at the surface casing shoe. By comparison, the actual WD-03 Annular LOT results were 17.2 ppg LOT, with the pressure breaking over at 18.2 ppg as injectivity was established. Approximately 300 bbls of water were then pumped into the OA to displace the drilling mud. During the second Annular LOT performed 12 hours later pursuant to Section Plan 03, approximately 45 bbls of water were pumped into the OA, and a LOT of 11.6 ppg was observed. Following the second Annular LOT, approximately 170 bbls of diesel were pumped into the OA to complete the freeze protection operations, consistent with the Permit to Drill, No. 221-103.

On February 28, an Ultrasonic Imaging Tool (USIT) was run in the intermediate casing to evaluate the two-stage cement job, pursuant to UIC Class 1 Permit AK-1I003-C; the results were approved by EPA on March 1. On March 1, the 7 5/8" intermediate casing was pressure tested to 4210 psi, which was remotely witnessed by EPA. On March 2, a FIT/LOT was performed, resulting in a 13.5 ppg EMW at the intermediate casing shoe, which met the AOGCC minimum to drill ahead (*i.e.*, 10.2 ppg EMW as set forth in Permit to Drill, No. 221-103).

On March 4, the third hole section was drilled to final Total Depth at 10,636 ft at approximately 1:00 hrs. At approximately 3:30 hrs, ConocoPhillips Operations personnel observed intermittent, low pressure natural gas releases at CD1-05, which is approximately 450 feet away from WD-03. In response, ConocoPhillips reported the release to AOGCC, and an Incident Management Team was activated. The Doyon 142 rig also suspended liner running operations at WD-03, the rig was secured, and rig personnel were safely relocated. After assessing the situation and inspecting the rig with gas detectors, the decision was made to re-start operations at WD-03 at approximately 23:00 hrs on the same day. After the rig equipment was warmed back up, operations at WD-03 resumed, while efforts to investigate the release first observed at CD1-05 proceeded.

On March 7, the 5 1/2" production liner (36 joints) was being run in hole when the decision was made to halt rig operations a second time following observations of surface cracks in the CD1 gravel pad and additional intermittent releases of natural gas along the well row. The rig was secured, and rig personnel were safely relocated again shortly thereafter at approximately 12:00 hrs. Out of an abundance of caution, production and injection activities at CD1 were shut-in, pending further review.

On March 8, at approximately 19:00 hrs, flowback operations began on the WD-03 OA that provided a controlled pathway for C10/Halo gas migrating up the wellbore. These operations successfully mitigated gas releases from the CD1 gravel pad and wellhouses. Well diagnostics and plug and abandonment operations of WD-03 commenced thereafter in accordance with AOGCC regulations and were completed on May 2.

No other CD1 wells had indications of surface casing leaks; ground penetrating radar surveys confirmed the integrity of the CD1 pad; and no gas was detected beyond the CD1 pad. No damage to the tundra was observed; and no wildlife impacts were reported.

FINDINGS: (The Conditions and Identified Causal Factors – those conditions that, had they not existed, would have lessened the severity of or eliminated the incident).

CAUSAL FACTOR NO. 1: Pressure limits were exceeded while performing Annular Leak-Off Test and Freeze Protect operations on the 13 3/8" x 7 5/8" annulus.

AOGCC regulations at 20 ACC 25.030(b)(3) require freeze protect operations, providing: "within permafrost intervals, fluids that have a freezing point above the minimum permafrost temperature may not be left in casing-by-casing annuli or inside casing upon completion, suspension, or shutdown of well operations, without commission approval of an alternate method that the commission determines will prevent damage to the casing;"

The Section Plan 03 Annular LOT and Freeze Protect procedure stated on Page 10, section 1.b. "Max. test pressure of 14.9 ppg EMW which was LOT at surface casing shoe." The actual WD-03 Annular LOT results were 17.2 ppg, with the pressure breaking over at 18.2 ppg as injectivity was established. See Figure 1 below.

Exceeding the surface casing shoe LOT of 14.9 ppg EMW by up to 3.3 ppg during the Annular Leak-Off Test and Freeze Protect operations on February 27 most likely broke down the casing shoe and provided an initial pathway for gas migration around the outside of the WD-03 surface casing. Subsequent injection of approximately 300 bbls of water to displace the mud in the OA as part of the freeze protection procedure likely expanded this pathway.

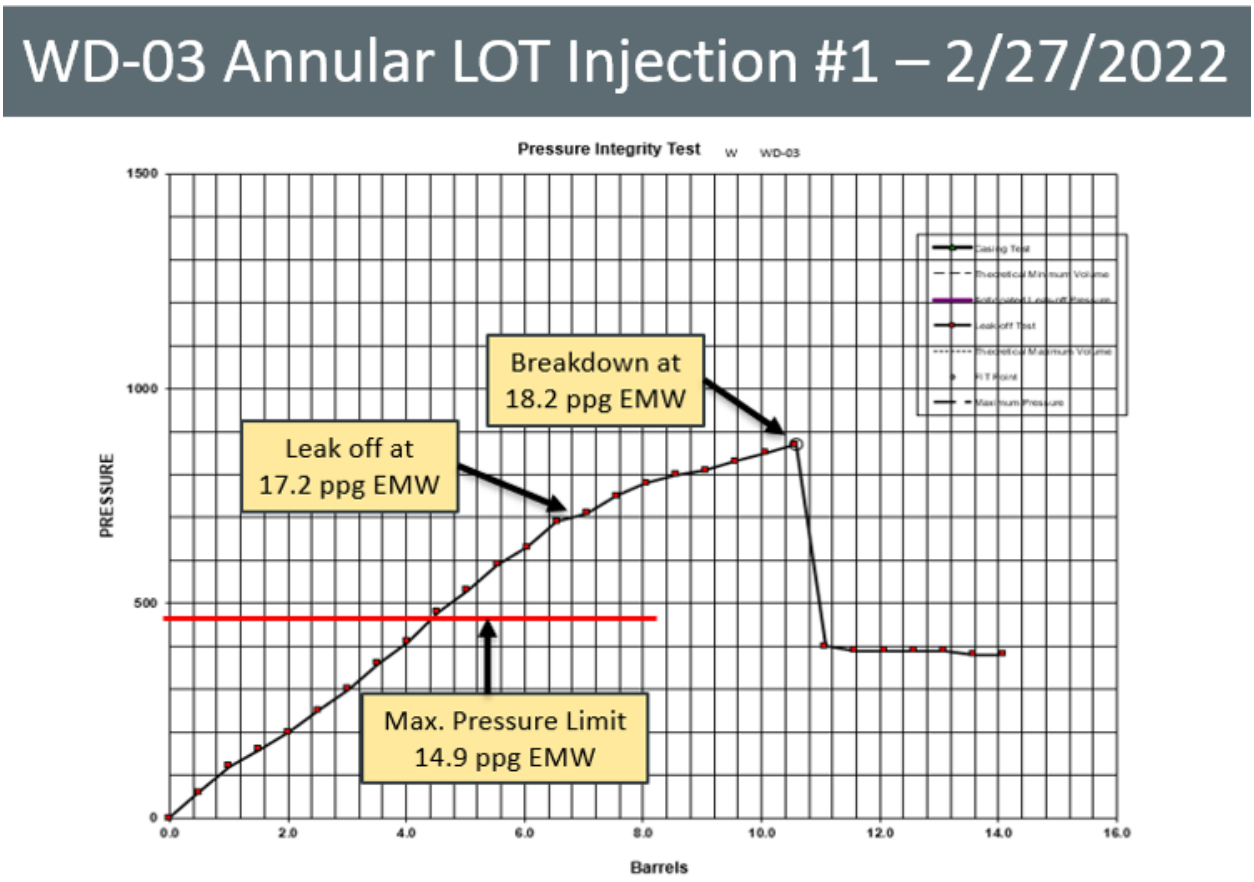

Figure 1.

CAUSAL FACTOR NO. 2: Pressure increases in the WD-03 OA during post-Annular LOT and Freeze Protect operations were not recognized and/or addressed.

The pressure increases in WD-03's OA from March 1 to March 3 were not recognized and/or addressed and, accordingly, did not lead to investigation or remedial action during that period. The volume of gas released from the C10/Halo in WD-03 could have been reduced if actions to address the elevated OA pressures had been taken earlier. See Figure 2 below.

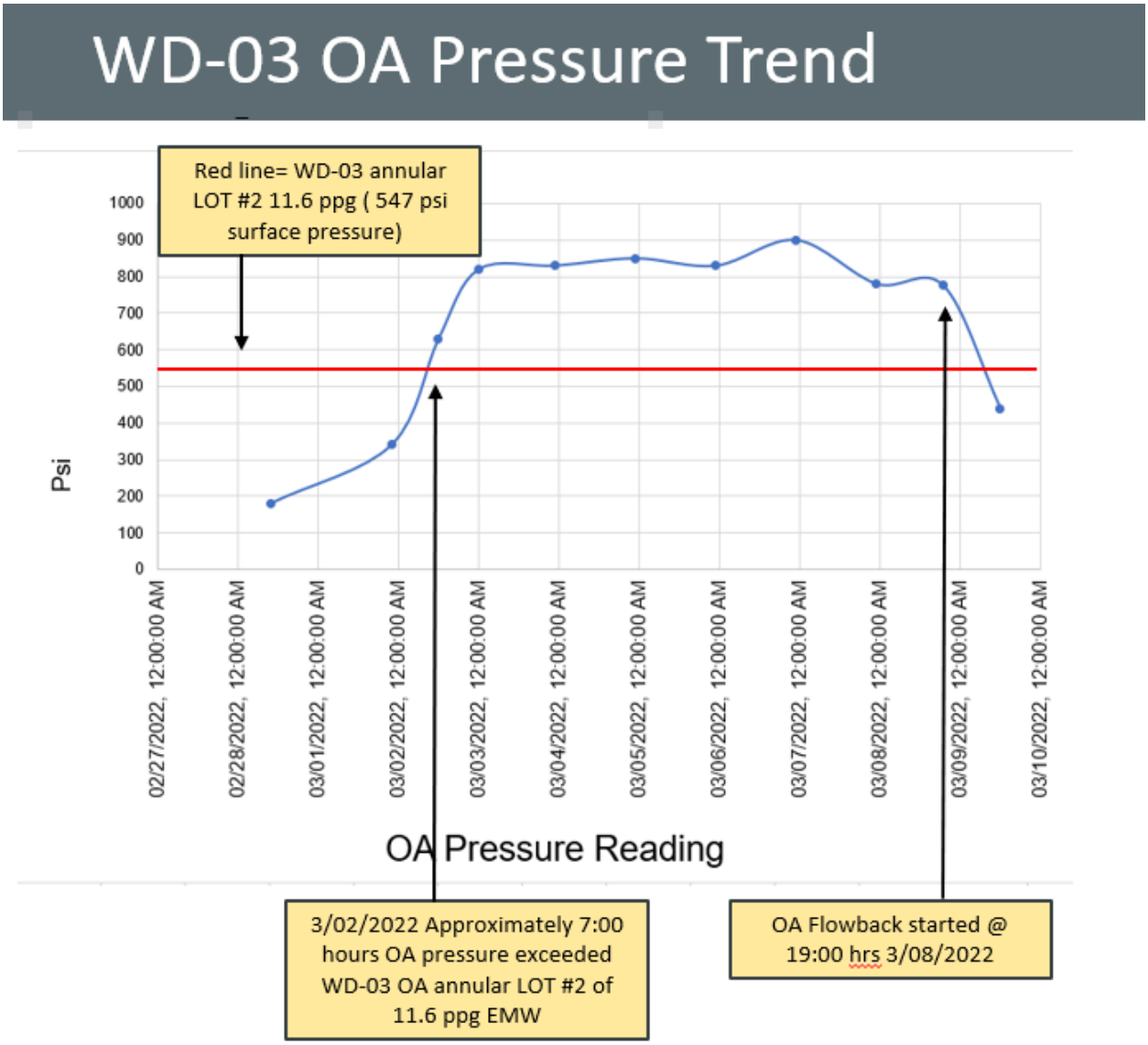

Figure 2.

POTENTIAL MISSED INDICATOR: A well in proximity to WD-03's well path potentially had indications of gas from shallower zones than the Qannik. Further review into the source of this gas may have informed WD-03 well planning.

During WD-03 pre-drill preparations (Anti-Collision Review), CD1-48 was identified as a well proximity risk to the planned WD-03 well path. Although the Qannik was cemented off in CD1-48, efforts to bleed off pressure within the CD1-48 OA were unsuccessful, indicating a potential source of gas shallower than the Qannik formation. Further review of the source of this gas might have informed WD-03 well planning.

CONDITION NO. 1: The C10/Halo formation interval at the WD-03 well path was determined not to be a "significant hydrocarbon zone" or "abnormally geo-pressured strata" requiring cement isolation.

Based on historical evaluation methods used to successfully drill 49 other CD1 wells, the C10/Halo at the WD-03 well path was determined not to be a "significant hydrocarbon zone" or "abnormally geo-pressured strata" during pre-drill

planning and/or during drilling operations. Therefore, no cement isolation was deemed necessary to be in compliance with AOGCC regulations. See 20 AAC 25.030, 25.990.

Note #1: The CD1-15 well produces gas intermittently from the C10/Halo as necessary to restart the Alpine facility following shutdowns. Thus, in contrast to the C10/Halo formation interval at the WD-03 well path, the C10/Halo formation interval at the CD1-15 well path was determined to be a "significant hydrocarbon zone" and was accordingly isolated with cement as per AOGCC regulations. The CD1-15 C10/Halo interval is located in a seismic bright spot/amplitude approximately 4922 ft NE of the WD-03 C10/Halo location. See Figures 3 and 4 below.

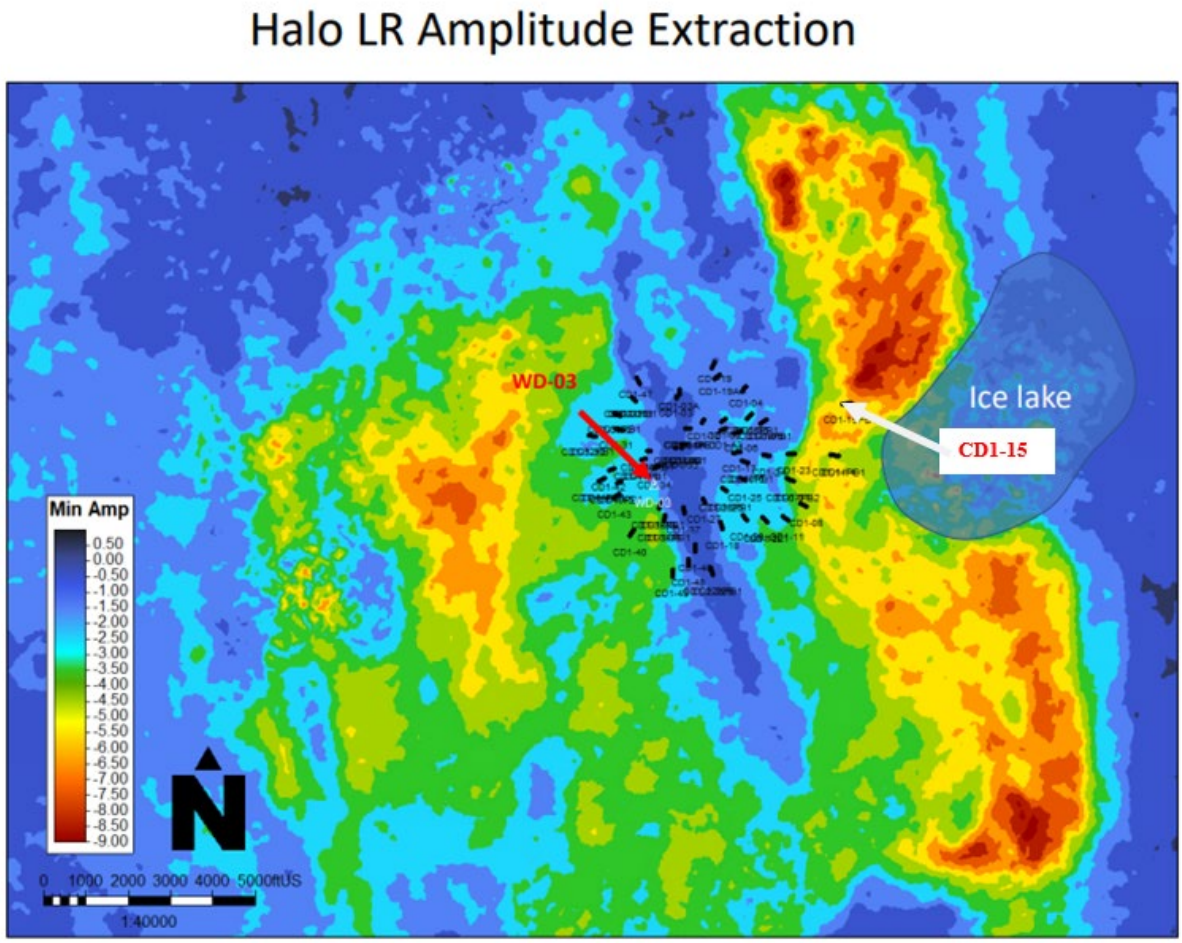

Figure 3. WD-03, CD1-15, and offset CD1 well locations at the C10/Halo interval

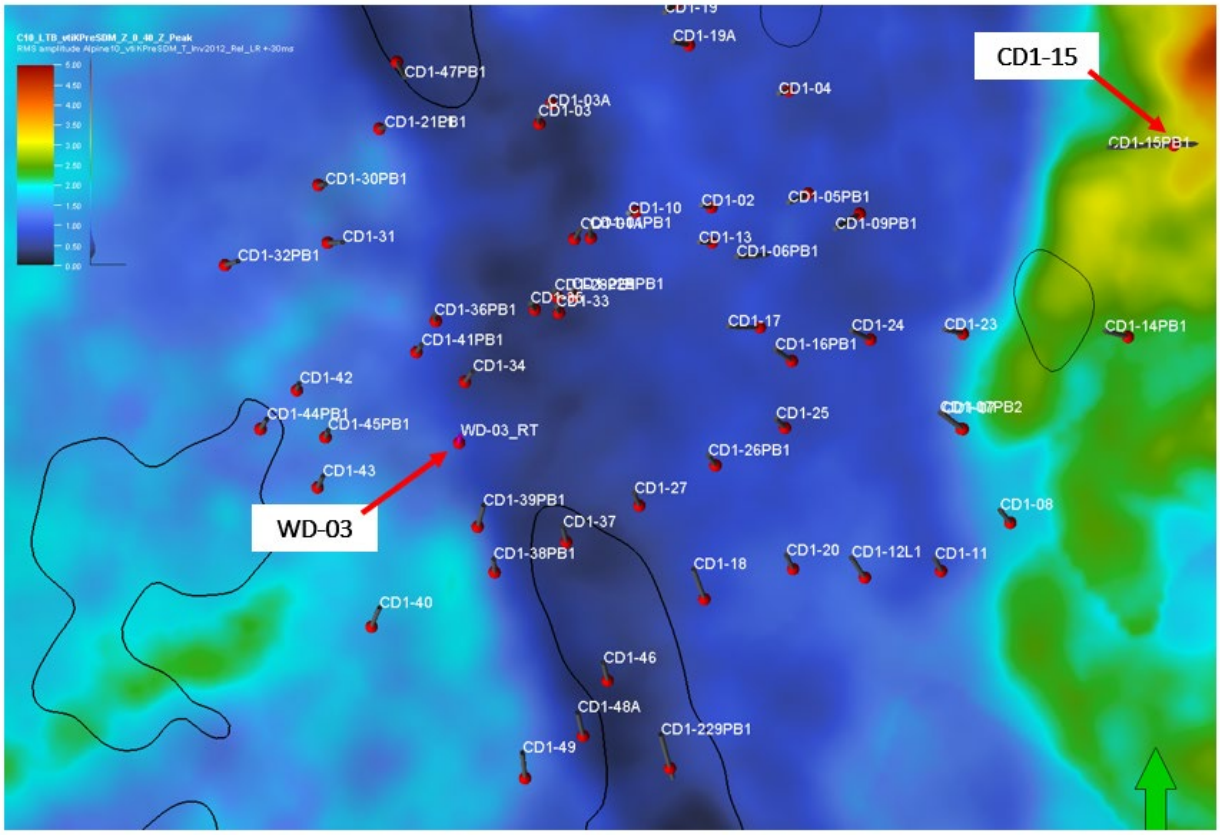

Figure 4. Zoomed in view showing WD-03, CD1-15, and offset CD1 well locations at the C10/Halo interval

CONDITION NO. 2: Although the USIT interpretation of surface casing cement confirmed that the cement job met the overall objective of providing isolation, it also indicated poor cement bonding and probable microannulus from the surface casing shoe at 2434 ft Measured Depth (MD) to 1935 ft MD. After the casing shoe was compromised during the Annular LOT and Freeze Protect operations, the poor cement bonding and existence of a microannulus on the lower section of the surface casing may have contributed to the creation of a potential pathway for gas migration to the base of the permafrost at 1582 ft MD.

The UIC Class 1 Permit AK-1I003-C requires the company to run Cement Bond/Ultrasonic Imaging (USIT) or other logs and pressure tests (leak off test and/or formation integrity test) for both surface and injection casings to confirm zonal isolation and verify casing integrity.

ConocoPhillips' analysis of the surface casing USIT log, which was reviewed and approved by EPA via email on February 15, concluded the surface casing cement job met the overall objective of providing isolation with non-continuous channels to surface. That noted, the USIT log also reflected poor cement bonding and probable microannulus from the surface casing shoe at 2434 to 1935 ft MD.

After the casing shoe was compromised by the high Annular LOT pressures, approximately 300 bbls of water were injected to displace drilling mud from the OA. Because of the compromised casing shoe, the path of least resistance for some of this fluid was likely behind the surface casing (i.e., between the outside of the casing and the cement and/or between the cement and the formation). Fluid flow across these interfaces may have further degraded the cement bonding and enlarged or extended the existing microannulus on the lower section of the surface casing, thus contributing to the creation of a potential pathway for gas migration to the permafrost at 1582 ft MD.

While cement bond/USIT logs are not typically run to evaluate surface casing cement in production and injection wells, the USIT log run in WD-03 provided some relevant data related to identifying a potential gas migration pathway.

CONDITION NO. 3: Displacing water with diesel in WD-03's OA for freeze protection purposes reduced the hydrostatic pressure in the OA, causing it to become hydrostatically underbalanced relative to the C10/Halo pore pressure.

AOGCC regulations at 20 ACC 25.030(b)(3) require freeze protect operations, providing: "within permafrost intervals, fluids that have a freezing point above the minimum permafrost temperature may not be left in casing-by-casing annuli or inside casing upon completion, suspension, or shutdown of well operations, without commission approval of an alternate method that the commission determines will prevent damage to the casing;"

Displacing water with diesel in WD-03's OA for freeze protection purposes was necessary to prevent casing damage from the forces that would be exerted by the expansion of fluids (e.g., water or water-based fluids) that would freeze across the permafrost interval. Displacing the water with diesel for freeze protection purposes also reduced the hydrostatic pressure in the WD-03 OA. This put the WD-03 OA into a hydrostatically underbalanced pressure condition relative to the C10/Halo pore pressure, thereby allowing gas to flow out of the C10/Halo and into the WD-03 OA. See Figure 5 below.

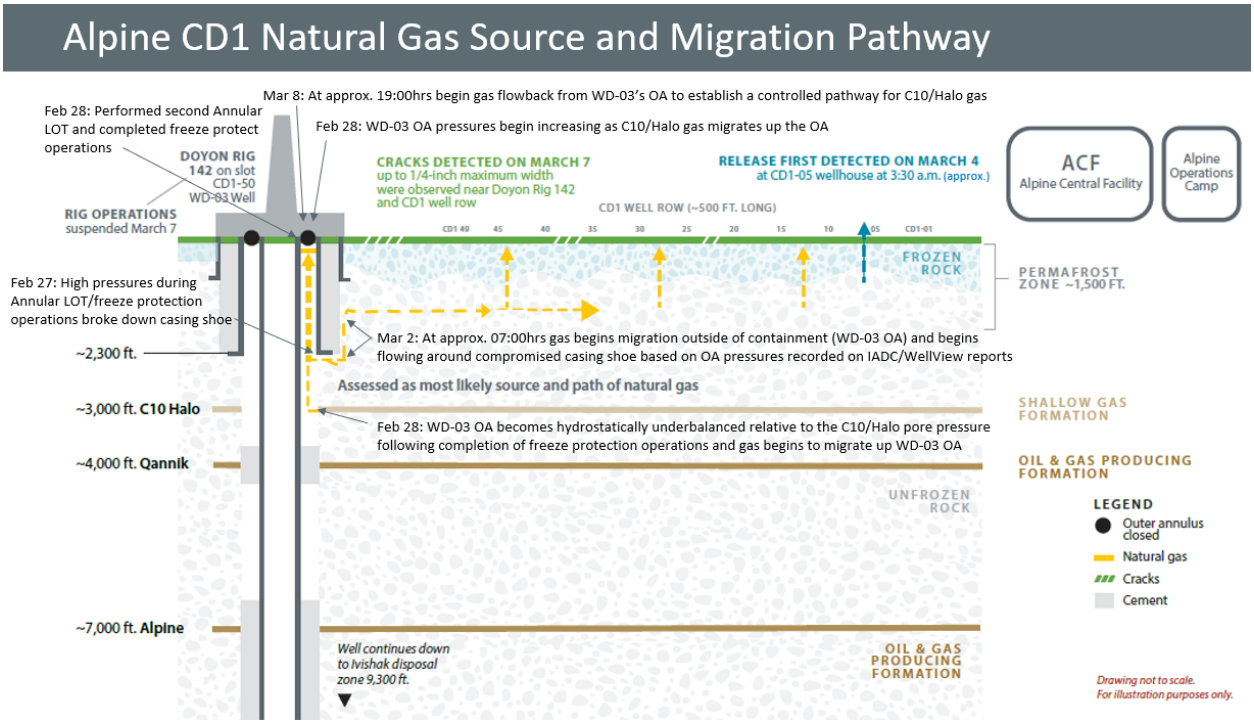

Figure 5.

CONDITION NO. 4: A permafrost thaw bulb exists under the CD1 pad that provides little to no resistance, both vertically and horizontally, for any gas that escaped from the WD-03 wellbore due to the compromised surface casing shoe and that also reached the base of the permafrost. The condition manifested as surface releases hundreds of feet from WD-03 along the well row and across the CD1 pad.

The permafrost below CD1 extends from the surface to approximately 1500 ft True Vertical Depth Subsea (TVDSS). The flow of warm fluids inside production and injection well tubing allows heat transfer from inside the well through to the surrounding formations. In the case of the permafrost, this heat transfer melts the frozen water bound in the pore space of the formations around the well. From just above the conductor shoe down to approximately 1000 ft TVDSS,

the thawed regions surrounding each well have coalesced into a single large zone referred to as the “thaw bulb.” Below the base of the thaw bulb, the permafrost surrounding each well remains thawed down to the base of the permafrost if fluids are flowing through the wellbore. Modeling indicates that permafrost will re-freeze around the wellbore after a well is shut-in. Continued freeze and thaw cycles at the surface can result in cracks/fractures in the soil directly below the CD1 pad, which would provide a pathway for gas to migrate to surface.

Listed below are the causal factors and root causes that the team identified for this incident:

Causal Factors	Root Cause(s)
CAUSAL FACTOR No 1: Pressure limits were exceeded while performing Annular Leak-Off Test and Freeze Protect operations on the 13 3/8" x 7 5/8" annulus	details need improvement (ROOT CAUSE) data / computations wrong or incomplete (ROOT CAUSE) pre-job briefing needs improvement (ROOT CAUSE) knowledge-based decision required (ROOT CAUSE) monitoring too many items (ROOT CAUSE)
CAUSAL FACTOR No. 2: Pressure increases in the WD-03 OA during post-Annular LOT and Freeze Protect operations were not recognized and/or addressed	knowledge-based decision required (ROOT CAUSE) no procedure (ROOT CAUSE)

WHAT CORRECTIVE MEASURES (HAVE BEEN/WILL BE) TAKEN?

Recommended Remedial Action	Responsible Party/Internet Address @conocophillips.com	Due Date
Develop a Freeze Protect SOP document for the North Slope with procedures, pressure limits, and contingent solutions when pumping operations reach limits.	[redacted]	July 1, 2022
Develop OA maximum pressure limits in the drilling program, communication protocols to the Wells Support Center, and consider drilling rig OA pressure sensors to allow for alarms/trending.	[redacted]	July 1, 2022
Recognizing that Section Plan execution can occur across multiple personnel shift patterns, critical section plan operations should be reviewed with the personnel performing the work prior to execution.	[redacted]	June 1, 2022
Conduct a review of the overburden and adjust the associated log models as necessary to improve identification of drilling risks, flowability assessments, and zones requiring cement isolation.	[redacted]	August 1, 2022
Integrate additional well intervention and well integrity information into well planning (both pre-spud and during operations).	[redacted]	July 1, 2022