

December 1, 2023

Stephen H. Lee, Director
Louisiana Department of Natural Resources
Injection and Mining Division
617 N. 3rd Street
Baton Rouge, Louisiana 70802

**Re: Second Response to 3rd Supplement to Compliance Order No. IMD 2022-027
Westlake US 2, LLC – Well 6X (SN 57788) & Well 7B (SN 67270)**

Dear Mr. Lee,

This response letter is submitted on behalf of Westlake US 2, LLC (“Westlake”) who received the 3rd Supplement to Compliance Order No. IMD 2022-027 on October 25, 2023. The order listed certain findings of fact, and orders requiring responses at various due dates.

- The First Response was submitted on November 27, 2023.
- This is the Second Response to satisfy a certain Order as presented below.
- Additional Responses will be submitted at later dates.

Orders & Responses:

3. Westlake must as soon as possible, but in no event later than thirty (30) days after receipt of this Supplement, submit all of the following to IMD:
 - a. An identification of the potential path(s) of migration for liquids from within Cavern 6 and 7 to the outside of the salt stock.

Westlake Response:

Cavern 7

Cavern 7 is located near the western edge of Sulphur dome and has a ceiling ~1,040 feet below the top of salt. The cavern has three penetrations, one active well (PPG No. 007B [SN 67270]) and two plugged and abandoned wells (PPG No. 007A [SN 67269] and PPG No 007C [SN 971288]). There has been no observed surface expression of brine adjacent to these well bores. A nitrogen/brine interface mechanical integrity test was conducted on PPG No. 007B in April 2022, which indicated no nitrogen integrity concerns with the cemented production casing. This test was performed after the initial pressure loss event and prior to the need for brine injection pressure maintenance of Cavern 7. Temperature/Noise survey logging was performed on PPB No. 7B on January 13, 2023 which found no indication of fluid movement behind the cemented casings. This logging was performed after continuous brine injection pressure maintenance operations had started on Cavern 7. PPG No. 7A and 7C were plugged and abandoned in 2018 with mechanical plugs set near the bottom of the cemented production casing and cement plugs placed to surface within the production casing. It would be unlikely that these plugged wellbores are acting as a conduit due to the apparent brine leak

rate (currently ~320 GPM) from Cavern 7 and relatively low drive/injection pressure (currently ~70 psig at surface). If fluid were to be flowing from Cavern 7 through a wellbore full of cement plugs (a heavily restricted flow path), then it would be reasonable to expect the drive/injection pressure required to move the fluid at ~320 GPM needing to be notably higher.

There is no evidence of anomalous pressure in nearby caverns within the dome that are being pressure monitored. With the information available to Westlake, this indicates that brine most likely is following a path to exit the interpreted salt dome structure and enter a receiving formation.

The exact location of brine loss from Cavern 7 is unknown, however, possibilities for most likely orientation and a possible pathway(s) may be presented:

- *The path orientation through the salt dome structure is more likely to the west of Cavern 7 since the minimum distance between Cavern 7 and the exterior of the salt dome is in this direction. However, it is possible that liquid migration to the exterior of the salt dome may occur in other directions. In theory, the depth of the brine loss from Cavern 7 could be occurring from any depth of the cavern geometry.*
- *The depth of brine migration from Cavern 7 most likely is bounded by the cavern height interval, from ~2,500 feet to ~3,260 feet (based upon available historical sonar survey records).*
- *Once the fluid migrates from Cavern 7 to the edge of the salt dome structure it is most likely that the fluid will move downward due to the Cavern 7 brine being of a higher density to that of the native fluids within receiving formation(s). The potential receiving formation(s) would most likely encourage flow away from the salt dome (interpreted as the predominant down dip direction of those formations).*
- *The fluid flow exterior to the salt dome would favor the path of least resistance (i.e. geologic formations or features exhibiting the highest permeability and porosity).*

Although we do not currently know the physical characteristics of the pathway of the liquid migration, the brine must make its way from Cavern 7 and ultimately to the salt dome edge, and then presumably into a receiving sedimentary formation. Possible physical characteristics of that pathway could be:

- *Cavern 7 to interpreted salt dome structure edge:*
 - *Anomalous salt possessing sufficient permeability to allow flow.*
 - *An anomalous or boundary shear zone – passage may be along a sedimentary bedding plane or at a boundary shear zone that penetrates within the salt dome structure.*

- *The flow pathway may originate at any depth common to the Cavern 7 geometry.*
- *The flow pathway from Cavern 7 to the edge of dome may be indirect.*
- *The flow pathway could consist of a combination of the above.*
- *Interpreted salt dome structure edge to receiving formation:*
 - *The exact location is unknown as there are multiple sand and shale sequences that terminate at or near the exterior of the salt dome structure.*
 - *The flow path may exit the dome structure and travel laterally and/or vertically to a receiving formation(s).*
 - *The flow path may exit the dome structure and travel vertically downwards along the edge of the dome prior to entering a receiving formation(s).*
 - *The flow path may exit the dome structure and traverse faulting within the dome-adjacent sedimentary formations prior to entering a receiving formation(s).*

Cavern 6

Cavern 6, located northeast of Cavern 7, is at a greater distance from the edge of the salt dome as compared to Cavern 7. The Cavern ceiling is ~1,180 feet below the top of the salt. The cavern has three penetrations, one active well (PPG No. 006X [SN 57788]) and two plugged and abandoned wells (PPG No. 006Y [SN 58711] and PPG No. 006Z [SN 971287]). There has been no observed surface expression of brine adjacent to these well bores. Pressure data supports Cavern 6 and Cavern 7 being hydraulically connected. A nitrogen/brine interface mechanical integrity test was conducted on PPG No. 006X in April 2022, and which indicated no nitrogen integrity concerns with the cemented production casing. This test was performed after the initial pressure loss event and prior to the need for brine injection pressure maintenance of Cavern 7. There is no evidence that brine from Cavern 6 is migrating to the outside of the salt stock. It is most likely that the brine leaving Cavern 6 is migrating solely into Cavern 7. The more likely path of connection between the two caverns is at their point of closest approach. The minimum distance occurs at a depth between ~3,100 feet and ~3,200 feet, near the base of Cavern 7 on its northeast side and 150 feet above the bottom of Cavern 6, on its southwest side.

12/1/2023

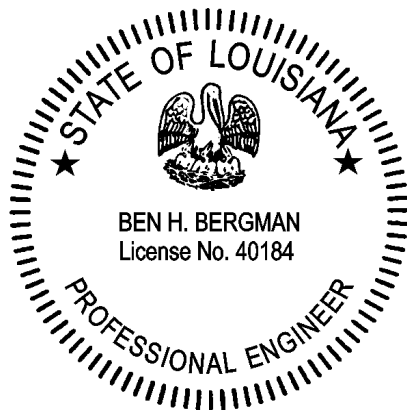
Page | 4

If there are any questions, please contact Josh Bradley (Westlake US 2, LLC), Coleman Hale (Lonquist & Co., LLC), Ben Bergman P.E. (Lonquist & Co., LLC) and Troy Charpentier (Kean Miller LLP).

Sincerely,



R. Coleman Hale
Vice President
Lonquist Field Service, LLC



Certified By:
Lonquist Field Service, LLC
Louisiana Registration No. EF-5853



Ben H. Bergman, P.E.
Senior Engineer
Louisiana License No. 40184

Date Signed: December 1st, 2023
Houston, Texas