MARQUIS
CARBON INJECTION

October 2, 2025

Ms. Felicia Chase
Underground Injection Control Program
USEPA Region 5
77 West Jackson Boulevard, Mail Code WP-16J
Chicago, Illinois. 60604

Re: Comments on Draft UIC Class VI Injection Well Permit
Putnam County, Illinois (Permit No: IL-155-6A-0001)
Docket No. EPA-R05-OW-2025-1612

Dear Ms. Chase:

Marquis Carbon Injection LLC (Marquis) has reviewed the public notice and Draft Underground Injection Control (UIC) Class VI permit for the carbon dioxide (CO_2) injection well. Marquis is providing the following comments based on our review of the Draft Permit.

Purity of CO_2

As stated in Table 1-3 of Section 1.0, Section 6.5.2, Table 6-4 of Section 6.0, and Table 7-2 of Section 7.0 of the permit application, Marquis requests the Operating Parameter for Carbon Dioxide Purity listed in Table 1 and the System Monitoring Details Section in Attachment C of the Draft Permit be revised to 99% CO_2 Purity.

Marquis will be sequestering biogenic CO_2, an inherent by-product from the fermentation of corn. The fermentation gases are primarily CO_2 and ethanol, but there could be some variability in the percentage of impurities in the CO_2 stream. The inclusion of a 99.86% pure CO_2 operating parameter allows no opportunity for minor fluctuations. Marquis takes its compliance obligations seriously and cannot accept a permit condition that it does not know with a high degree of certainty can be consistently complied with, nor does it expect EPA to include one, as it has proposed to do here.

While minor fluctuation of impurities is expected, concentrations above 1% are not expected. An operating parameter of 99% purity provides the variability needed to ensure consistent compliance. Marquis' permit application relied on a 99% purity for purposes of the corrosion modeling for the injection well design. As detailed in the modeling report, an injection stream with 99% CO_2 concentration would not promote corrosion for the following reasons:

1) Viking Engineering conducted a thermohydraulic analysis and corrosion assessment to evaluate the fitness for service of the 13Chrome (13Cr) metallurgy based on the material properties, the in-situ conditions, and laboratory analytical test data for the water from the MCI MW-1 well (Marquis stratigraphic test well). Viking considered normal injection conditions as well as worst-case upset injection conditions where the injected CO_2 mixed with Mt. Simon brine water flowed back into the well. The purity of the CO_2 used in this assessment was 99%. Viking also considered the potential for sulfide stress cracking. Based

on the CO_2 corrosion risk analysis conducted, the corrosion modeling estimated the corrosion rate to be in the order of 0.006 millimeter/year (0.05% per year based upon the thickness of the casing) and that the service life for the materials (13Cr) under those conditions exceeds the duration of the project. The Viking Report demonstrated that the site-specific characteristics of the CO_2 (99% purity) and the brine within the injection zone present a very low corrosivity risk with very low potential thickness loss based on the industry corrosion standards (Section 7.4 of Permit Application).

2) More importantly, the grade of metallurgy used in the modeling was an older technology with less advanced functionality within the injection zone. Marquis will be utilizing Super Chrome 25 in the casing and tubing material within the Mt. Simon in the injection well and the two deep monitoring wells. By utilizing the Super Chrome material grade, which is a Super Duplex Stainless Steel, these well designs have increased pitting and corrosion resistance to formation fluids combined with CO_2 beyond what was demonstrated in the modeling.

An assessment of the CO_2 impurity level of 99% has been made, and the approval of this change will pose no risk to the integrity of the well components or the Mt. Simon injection zone.

Analysis CO_2 Stream to Injection Well

The draft permit differs from Marquis' permit application regarding the constituents and frequency and method of analysis of certain constituents in the CO_2 stream. Marquis is not aware of any basis or purpose for the differences, and as further described below, requests that the draft permit be revised to conform with the application. Further, the draft permit results in internal inconsistencies where the CO_2 stream analysis requirements are not consistent with the Quality Assurance and Surveillance Plan ("QASP" - Attachment K to the draft permit), Marquis' requested revisions would result in a consistent permit.

1) **Constituents Analyzed**
Per Table 7-2 of Section 7.0 of the permit application, Marquis requests that carbon monoxide (CO) and nitrogen oxides (NOx) be removed from Table 1 of Attachment C. Biogenic fermentation will not result in the release of CO or NOx.

CO and NOx are constituents associated with combustion. CO and NOx would not be present in Marquis' CO_2 stream which is biogenic and would not be introduced by the compression and dehydration of the CO_2 gas. Marquis is not utilizing a natural gas compression system to compress the CO_2 gas. Each of Marquis' three integrally geared centrifugal compressors will be driven by a steam turbine so the presence of CO and NOx due to combustion will not occur. Therefore, Marquis requests CO and NOx be removed from Table 1 of Attachment C.

2) **Frequency of Analysis –** Marquis requests the Draft Permit be revised to clarify the monitoring frequency for three of the analytical parameters listed in Table 1 of Attachment C. Table 2 of Attachment A requires continuous CO_2 stream characterization and refers to Attachment C. Attachment C lists nine CO_2 Stream Analytical Parameters. As stated above, Marquis requests removal of CO and NOx. Marquis also requests clarification that continuous monitoring of oxygen, nitrogen, carbon dioxide purity, and moisture will be

conducted on the CO_2 stream. Additionally, the liquid CO_2 stream will be sampled and analyzed in a lab on a quarterly basis. The samples will be collected from a sampling manifold connected to the CO_2 piping after the compression system and upstream from the injection point to monitor the different impurities that may be present in the CO_2 stream. Because Marquis' CO_2 is from biogenic fermentation and originates from organic materials, it does not require the purification associated with CO_2 from flue gas recovery. The CO_2 from biogenic fermentation of corn is a high-purityCO_2, and it does not contain the significant impurities in CO_2 captured from a fossil fuel combustion exhaust stream in other industries. 40 CFR 60.146.90(a) requires analysis of the CO_2 stream with sufficient frequency to yield data representative of its chemical and physical characteristics. Marquis believes limiting the analytical parameters that are subject to continuous monitoring, and requiring quarterly monitoring of total hydrocarbons, methane, and hydrogen sulfide is a monitoring approach with sufficient frequency to yield representative data.

Marquis requests the following revisions:

1. Additional language in Attachment A, Table 2 that minimum recording frequency column for CO_2 stream characterization is "continuous or quarterly".
2. Revisions to the Analytical Parameters Section of Attachment C to include the clarification in the text of the continuous and quarterly analysis change.
3. Revisions to the Analytical Method(s) Column of Table 1 to Attachment C that "lab analysis" in place of mass spectrometer for quarterly analysis of total hydrocarbons, methane, and hydrogen sulfide.

Pressure and Temperature Monitoring

Injection Well Monitoring at Injection Interval – Marquis requests clarification be included in Section N.3 of the Draft Permit concerning the location of the continuous recording devices used to monitor downhole temperature and pressure. The condition states that temperature and pressure monitors will be placed to obtain data at the surface and "at the injection interval". Marquis requests that clarification be provided that the monitors will be placed immediately above the packer as identified in Figure 7-4(a) of Section 7.0 of the Permit Application.

Marquis has discussed EPA's proposed placement of the pressure and temperature monitors with multiple expert consultants with experience in well design for oil-field and carbon sequestration projects. They have consistently agreed that Marquis' original proposed location (in the tubing, proximate to the packer) is a better design, as it provides equivalent or better readings, and is more practical as it allows for replacement of malfunctioning devices. Monitoring pressure and temperature with the gauges located at the packer provides equivalent quality data to gauges placed at the formation. When the well is undergoing pre-injection testing, the accuracy of the pressure monitor will be verified. If a significant difference between the monitored pressure and injection interval pressure is identified, calculations to determine injection interval pressure are straightforward and can generate the pressures at the perforations accurately in real-time. Consultants have also expressed concerns regarding the accuracy of monitors proximate to perforated intervals due to the turbulent flow. There are also significant reliability advantages to the proposed gauge placement. The tubing deployed gauges allow for replacement should equipment malfunction and ensure effective monitoring for the life of the well. Consultants have shared that other carbon sequestration projects have utilized the same gauge configuration as proposed by Marquis.

Plume Monitoring - Continuous Pulse Neutron (PNC) Logging in ACZ-1 and MW-2

Marquis requests that the Pulse Neutron Capture logging in Attachment C, Table 7 be revised to an annual requirement because continuous PNC logging cannot practically be done. PNC logging requires shutdown of the well and the deployment of logging tool that is lowered into the well to monitor the reservoir through a sequence of neutron pulses and gamma ray detection. The purpose of the PNC test is to monitor the distribution and saturation of long-term CO_2 migration over a period of time. The PNC data is then compared to the computational dynamic modeling predictions. Continuous data is not necessary to achieve this purpose, and annual PNC data will suffice. For these reasons, Marquis requests this requirement reflect an annual PNC test.

Groundwater Monitoring

1. **Continuous Isotope Analysis within Upper Mt. Simon in MW2 –** Marquis requests that the isotope analysis requirement in Attachment C, Table 7 be revised to reflect annual isotope analysis. Per discussions with Marquis' third-party contractor, continuous isotope monitoring involves using specialized downhole instruments and sampling systems that could present a pathway for CO_2 migration. In a continuous system, the groundwater is routed continuously up the well to an onsite laboratory for analysis. Long-term system reliability also becomes a challenge. Marquis requests annual isotope monitoring be conducted through the collection of groundwater samples for comprehensive isotopic analysis within an offsite certified laboratory. Additionally, annual isotope monitoring is sufficient frequency to evaluate the overall geochemistry of the aquifers and CO_2 movement as fluid monitoring is one of several monitoring approaches that would provide an indication of fluid or CO_2 migration (i.e., temperature or pressure well monitoring, annulus pressure and fluid monitoring, and distributed fiber optic sensing).

2. **Field Measurement of Temperature in Shallow and Deep Monitoring Wells –** Marquis requests a revision to the temperature field analytical method for groundwater monitoring. Attachment C, Table 5 requires the use of the Distributed Temperature Sensing (DTS) Fiber Optic line for taking field temperature measurements of the shallow groundwater. The DTS system is used to monitor the external mechanical integrity of the deep monitoring wells, and it is located outside of the long string casing. The DTS is not the appropriate analytical method for conducting field temperatures of the groundwater samples in deep wells. The analytical method should be revised to utilizing a thermocouple. Additionally, EPA Method 170.1 will be used for field measurement. The method allows the use of a thermometer, thermistor, thermocouple or other instrument to obtain a direct readout of temperature.

3D Seismic Survey

Marquis requests that the 3D seismic surveys and microseismic surface monitoring network in the Sections of the Draft Permit listed below be limited to the 2022 pre-injection baseline survey area as detailed in Figure 7-6 of Section 7.0 of the permit application and the current microseismic surface network on the project site as detailed in Figure 10-5 of Attachment F, respectively. As drafted, the permit condition requires future 3D seismic surveys and microseismic surface network be expanded to the AOR. The AOR has a 14.5-mile radius and extends into portions of Putnam, Bureau, LaSalle and Marshall counties. Conducting a seismic survey would involve the acquisition of the land, right-of-way

agreements, extensive survey studies (e.g., threatened and endangered species and cultural resources) due to the placement of the survey equipment, agreements with counties being crossed, power and communication connections, resource crossings, agricultural mitigation agreements, and potential cessation of truck traffic and/or operations at other commercial/industrial facilities due to noise interference.

Marquis is in a seismically stable region. Marquis conducted 3D seismic program in early 2022 that confirmed the absence of large-scale faulting in the vicinity of the project site. Future 3D seismic surveys will be acquired and compared to the baseline survey which allows Marquis to monitor the subsurface over time and track fluid movement and geological structural integrity. Additionally, Marquis installed a microseismic surface monitoring network around the project site in January of 2024, and the microseismic stations have been collecting baseline data since installation.

Marquis believes the reliance on the established 3D seismic survey baseline area, network of surface seismological stations around the project site, and as required in Section 10.4.6 of Attachment F (Emergency and Remedial Response Plan), the subscription to the USGS Earthquake Notification Service to receive notification of seismic events (both natural and induced) within 100 kilometers (62.14 miles) from the well provides the seismic data necessary to monitor potential seismic activity within the AOR that may indicate failure of the confining zone and possible containment loss. Marquis requests revisions to the following Sections of the Draft Permit:

Attachment C – Tables 7 and 9
Attachment E – Tables 4 and 6
Attachment K - Table 7A-15

Location of Above Confining Zone and Deep Monitoring Wells

There is a typographical error in the Carbon Dioxide Plume and Pressure Front Tracking Section of Attachment C (p. 16). The text states that MW2 is west of MCI CCS3, and ACZ1 is east of MCI CCS3. The locations were reversed. The text should be revised to state MW2 is east of MCI CCS3 and ACZ1 is west of MCI CCS3.

Testing and Monitoring Schedules

Marquis requests a change to the monitoring schedule set forth in Attachment C of the Draft Permit. The testing and monitoring schedule for quarterly sampling requires sampling 5 days before March 31st, June 30th, September 30th, and December 31st. The semi-annual sampling requires sampling to take place 5 days before June 30th and December 31st. These same quarterly and semi-annual sampling schedules are included in the post-injection monitoring plan (draft Attachment E, p. 1). 40 CFR 146.68, that contains the monitoring requirements for Class I hazardous waste UIC wells, does not have schedule limitations such as those contained in the Draft Permit, and no other underground injection control program within 40 CFR Part 146 includes such limitations. Marquis requests the monitoring schedules be revised in both Attachments C and E to allow 30 days prior to the dates listed for both quarterly and semi-annual sampling to accommodate holidays as well as the third-party contractor's availability.

For the above-listed reasons, Marquis requests the Draft UIC Class VI Permit incorporate the proposed revisions. If you have any questions regarding these comments, please contact me at bethsteinhour@marquisinc.com or 815-925-7300.

Sincerely,
Marquis Carbon Injection LLC

Elizabeth Steinhour
Director of Regulatory Affairs