DRAFT EXECUTIVE SUMMARY

Desert Mountain Energy – McCauley Field Helium Well Stimulation
Inventory Number P-515038
Place ID 252040, LTF No. 110501

I. Introduction:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the Determination of No Migration of Pollutants (Determination of No Migration) for the McCauley Field Helium Well Stimulation activities. Based on the information submitted with the Determination of No Migration application received on September 8, 2025, no Aquifer Protection Permit (APP) will be required.

The Arizona Department of Environmental Quality (ADEQ) proposes to exempt the subject facility from an APP based on a Determination of No Migration of pollutants per A.R.S. 49-241(B). The director has determined that the facility will be designed, constructed and operated so that there will be no migration of pollutants directly to the aquifer or to the vadose zone. The no migration of pollutants determination may apply to multiple wells within a discrete project area of a single stratigraphic zone that is no more than 10 square miles contiguous in area. The no migration of pollutants determination may apply for future planned wells. ADEQ maintains the authority to amend or revoke a determination if any changes to the proposed project occur or if the information submitted for the purposes of this exemption review are found to be inaccurate. A Determination of No Migration of pollutants is not intended to waive any other federal, state or local requirements.

II. Facility Owner and Location:

Desert Mountain Energy (DME) is proposing to stimulate five helium gas wells to be completed within the Redwall Limestone (Redwall) formation in the Holbrook Basin, Navajo County, Arizona. The McCauley Field is located approximately 20 miles southeast of Winslow, Arizona in S19 T17N R17E, S35 T17N R16E, S2 T16N R16E, S8 T16N R17E, & S26 T16N R16E.

III. Well Stimulation Description:

Desert Mountain Energy (DME) proposes conducting well stimulation, as necessary, on five helium gas wells targeting the Redwall formation. The goal is to enhance the producing reservoir's permeability by fracturing the rock and injecting a sand proppant carried by a nitrogen-enriched fluid.

Crucially, DME's stimulation is strictly confined to the deep Redwall Formation and will not be applied to the overlying Coconino C-Aquifer (Coconino Sandstone Formation). Multiple safeguards are in place to ensure aquifer protection: two strings of casing cemented to the surface, a known aquitard (Supai Group) overlying the production zone, thousands of feet of vertical separation from the Coconino C aquifer, and a scaled-down stimulation design.

The project focuses on helium reservoirs within a 10-square-mile area, encompassing four existing wells (McCauley 1-1, McCauley 10-1, McCauley 3-1, Chevelon Minerals 11-1) and one planned future well. Exploration drilling and logs have confirmed the presence of gas in this region.

Stimulation Procedure and Scale

In contrast to industrial oil fracking, which can involve days or weeks of continuous high-pressure pumping, helium well stimulation in the McCauley Field is a significantly shorter event, typically taking about 45 to 60 minutes per well.

The process begins with an injection of approximately 1,000 gallons of a weak water-hydrochloric acid mixture (15%) to clean the borehole and remove any iron oxide residue at the perforation intervals.

The subsequent hydraulic fracture treatment will occur at approximate perforation depths ranging from 3,250 ft bgs to 3,435 ft bgs. Each stimulation will use about 100,000 lbs of sand proppant mixed with a total nitrogen-enriched fluid volume of 79,000 gallons. Key additives of the fluid will be a guar gelling agent and friction reducer, chosen to increase viscosity and temperature stability at these depths, ensuring effective proppant transport and placement.

The pressure applied during stimulation, between 1,300 and 1,800 psi, is substantially less than the 10,000+ psi typically used in deep oil/gas wells. Fracture modeling, based on rock geomechanics, estimates that the stimulation fluids will disperse about 650 feet laterally and 410 feet vertically from the target zone.

Post-Stimulation Handling

Following stimulation, each well will be fitted with a gas/water separator to separate the produced helium gas from the extracted liquids. These liquids consist of natural formation fluids (if present) and any remaining stimulation fluids. The separated liquids will be temporarily stored in onsite tanks before being transported offsite for final disposal.

The recovered natural nitrogen and helium gas stream will be processed at the McCauley Processing Facility. All recovered fluids produced from the process (produced water) will be transported to an approved injection well disposal facility in New Mexico.

IV. Hydrogeology of the Holbrook Basin:

The Holbrook Basin in east-central Arizona presents a unique hydrogeological environment where ancient groundwater flow, evaporite dissolution, and deep crustal degassing converge. The hydrogeology of the Holbrook Basin is defined by a massive Permian salt body and the highly productive Coconino Sandstone or C-aquifer. The basin is notable for its active evaporite karst processes, where groundwater dissolution of underlying salt leads to widespread surface landforms such as sinkholes and fissures.

The primary regional aquifer consists of the Coconino Sandstone. It is unconfined in the southern part of the basin and becomes confined by the Moenkopi Formation north of Holbrook. Regional flow is generally toward the north and northeast toward the Little Colorado River, with a hydraulic gradient of approximately 6 meters per km. The C-aquifer serves the City of Holbrook, Winslow, the Navajo Nation, and several regional power plants.

Geological Units and Hydrogeologic Role

The basin is characterized by a "stacked" sequence of reservoirs and seals. The following table outlines the key units from the surface to the basement.

Geologic Unit	Age	Hydrogeologic Role and Characteristics
Moenkopi Formation	Triassic	Red siltstone; acts as an upper confining layer.
Shinarump Conglomerate	Triassic	Secondary Helium Reservoir. Fluvial channels; targeted for "dry" helium extraction.
Kaibab Limestone	Permian	Minor Aquifer. Often unsaturated in the central basin due to deep water tables.
Coconino Sandstone (C Aquifer)	Permian	**Principal Aquifer / Principal Helium Reservoir** Eolian sandstone; high porosity (20%+); main helium host.
Supai Group	Permian	**Primary Regional Seal** Includes halite (salt) and anhydrite; prevents upward leakage.
Naco Formation	Penn.	Deep Reservoir Potential. Marine limestone and shale; secondary gas shows.
Redwall Limestone	Miss.	**Helium Target Zone.** Karstic limestone; regional conduit for basement fluids. Variably saturated in McCauley Field
Basement Crystalline Complex	Precambrian	**Helium Source Rock.** Crystalline granite; source of radiogenic helium (U/Th decay).

Occurrence of Helium

The basin's hydrogeology is the primary driver of its world-class helium concentrations (up to 10%), primarily trapped in the Coconino Sandstone and Shinarump formations. Groundwater serves as both a carrier for helium and a structural influence on gas-water contacts. Helium migrates vertically from the Precambrian basement and then horizontally with groundwater in the main reservoir.

The Holbrook Basin is unique because its helium is primarily trapped with nitrogen rather than hydrocarbons (natural gas). This makes it "primary" helium, which is easier to refine and more environmentally friendly to produce than helium harvested as a byproduct of fossil fuel extraction.

Redwall Limestone: Helium Target Zone

While the Coconino Sandstone and Shinarump formations are the primary focus for helium in the Holbrook Basin, the Redwall (Mississippian age) acts as the basin's "basement" formation and a

potential long-term helium source. Its hydrogeology is defined by extreme depth, structural complexity, and its role as a regional conduit for high-salinity fluids.

Groundwater in the Redwall (helium zone of interest) generally flows northward toward the Little Colorado River and the Grand Canyon, where it eventually discharges at major features like Blue Spring. The Redwall Limestone is significantly deeper than the primary helium-producing zones. In the central Holbrook Basin, the Redwall sits approximately 3,200 to 4,000 feet (1,200 meters) below the surface. It is relatively thin compared to its Grand Canyon outcrops, typically ranging from 30 to 200 feet thick in the Holbrook area, thinning progressively toward the southeast. It lies unconformably above the Precambrian basement rocks and beneath the thick Supai Group (which acts as a major regional seal).

The Redwall is a massive, crystalline limestone. Groundwater generally occurs in secondary permeability features such as fractures, cracks and dissolved voids rather than through the rock grains. It's notable that the occurrence of groundwater within the McCauley Field is intermittent as no measurable quantities of return flow were encountered during well drilling.

Water quality in the Redwall within the Holbrook Basin is generally poor. Because the water has been in contact with ancient basement rocks for millions of years, it is highly mineralized with calcium, magnesium, and sulfate. In areas near the Supai salt deposits, they can reach brine-level concentrations.

The Redwall is crucial to the "helium system" of the basin for two reasons:

- The Redwall serves as the regional "collector" for helium leaking out of the Precambrian basement rocks. The gas dissolves into the high-pressure, saline water of the Redwall where it migrates upward to structural highs (like the McCauley Anticline).
- While most current production is shallow (Coconino Sandstone and Shinarump formation), the Redwall is considered an alternative target. The karst networks within the Redwall may hold significant "deep helium" reserves.

V. Best Available Demonstrated Control Technology (BADCT):

The BADCT for well stimulation includes the design and construction of the wells, the site-specific geology of the development area, pre-operational requirements for evaluating the well construction, and operational requirements for conducting the well stimulations. There are specific BADCT requirements for the wells and requirements for documenting, monitoring and reporting the well construction and stimulation activities prior to stimulation and post-stimulation.

To protect aquifer water quality, helium gas extraction wells must meet Arizona Oil and Gas Conservation Commission (AOGCC) design requirements in A.A.C. R12-7-110-111. The well design includes multiple steel casings, one placed inside another, cemented into place from the land surface to total depth, and pressure tested for integrity to assure that the well does not leak anywhere above the injection and production zone. The outer steel casing must extend deep enough to protect and isolate all known or reasonably estimated freshwater zones. This zone includes any water within the Coconino C aquifer or other shallow aquifers to a depth of approximately 600

feet or more. The inner steel casing extends to the depth where the helium gas will be extracted and must be cemented into place.

VI. Monitoring and Reporting Requirements:

Before stimulation, DME must document the proposed stimulation procedure, including the fluid composition, pressures, volumes, and geologic isolation of the wellbore from freshwater aquifers. DME is also required to perform sampling and analysis of the stimulation fluid and flowback water (if present) for pollutants with Aquifer Water Quality Standards (AWQS).

During and immediately after stimulation, real-time monitoring of injection pressure and flow rates is required. This data, along with integrity test results for the well casings and cement, must be maintained for regulatory review as required per A.A.C. R12-7-192.

Post-stimulation requirements include:

- **Fluid Sampling:** DME must collect samples of the stimulation fluid and, if applicable, flowback water. These samples are analyzed for pollutants with AWQS, particularly those related to the stimulation fluid composition. The results must be reported to ADEQ. This monitoring will allow comparison and evaluation of any changes to the quality of water immediately surrounding the well.
- **Waste Management:** All stimulation fluids and flowback water must be managed and disposed of in compliance with applicable waste regulations to prevent surface or subsurface contamination.
- **Mechanical Integrity Testing:** Periodic mechanical integrity testing of the well must be performed to confirm the continued isolation of the production zone from freshwater aquifers.

VII. No Migration of Pollutants:

The stimulation fluids are not expected to migrate outside the Redwall target zone during well stimulation activities. This determination is based on fracture modeling, geological isolation, and well construction design.

Fracture Modeling and Containment

Fracture modeling simulations provide a clear expectation for the containment of stimulation fluids:

- Stimulation fluids will be contained within the general vicinity of the well.
- Fractures and stimulation fluids are not expected to migrate more than 650 feet laterally from the well.
- Fractures and stimulation fluids are not expected to migrate more than 410 feet vertically from the target zone.
- The hydrochloric acid used in the stimulation activities that remain in the Redwall would be consumed by the limestone in the formation.

Geological and Well Isolation
The Redwall is hydrologically isolated from overlying formations, primarily the Coconino C-aquifer, by several natural and engineered barriers:

- The Redwall (where well stimulation occurs) is hydrologically "isolated" by the low-permeability geologic formations above it.
- The Redwall formation, the zone of interest, is approximately 3,400' deep.
- The Redwall formation is separated by 2,800' feet of strata from the Coconino-C aquifer.
- The Coconino C aquifer is isolated by two strings of casing.
- Salt and anhydrite layers within the Supai Group are identified as impermeable barriers to vertical water movement.
- The well construction and planned stimulation activities are designed to avoid communication with any water productive intervals such as the overlying Coconino-C aquifer.

Operational Factors Limiting Migration
Several operational and site-specific factors further reduce the risk of migration:

- **Stimulation Duration:** For helium production in the Holbrook Basin, the duration of hydraulic fracturing is significantly shorter and involves much lower volumes than traditional shale oil or gas fracking. The proposed stimulations are expected to last approximately 45 minutes to an hour.
- **Water Production:** The Redwall's ability to produce water is inconsistent, and typically low-yield when present. During drilling, the zone of interest was perforated and tested, with no water recovered, indicating the Redwall is assumed to be a dry formation in this area. No flowback was produced from the Redwall target zone in the 4 wells that were constructed.
- **Well Design:** The design of the helium extraction wells, which are solid pipes that are leak tested, which limits the risk of the discharge to underground sources of drinking water.
- **Fluid Recovery:** The stimulation process involves pumping and recovery of the stimulation materials. It is expected that most of the stimulation fluids will be quickly extracted back through the well, and the stimulation activities are not expected to cause an exceedance of Aquifer Water Quality Standards.
- **Low Exposure Risk:** It is highly unlikely that a drinking water well would be screened in the Redwall due to the depth below ground surface (>3,000 feet) and high salinity, which decreases the risk of potential exposure to the stimulation fluids.

VI. Financial Capability
Desert Mountain Energy has demonstrated the financial responsibility necessary to close, plug and abandon all five wells in accordance with A.A.C. R12-7-103. DME is expected to maintain financial capability throughout the life of the wells. The plugging and abandonment costs for the five wells have been estimated as $43,650. DME maintains bonds with the Arizona Oil and Gas Conservation Commission in the amount of $50,000 in accordance with A.A.C. A.A.C. R12-7-103.