UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

# *Fact Sheet and Statement of Basis*

*Major Modification of Class III Solution Mining Underground Injection Control (UIC) Permit – UTU-27AP-718D759*
*Magnum Solution Mining, LLC (Magnum)*
*September 2017*

## *I. Purpose of the Fact Sheet*

Pursuant to section §124.8 of the Underground Injection Control (UIC) regulations in Title 40 of the Code of Federal Regulations (CFR) which is incorporated by reference in the Utah UIC Administrative Rules (R317-7), the purpose of this fact sheet is to briefly describe the principal facts and considerations that went into preparing the modifications of this permit by the Division of Water Quality (DWQ), the UIC permitting authority. To meet these objectives, this fact sheet contains a description of the permitted facility, a description of the injectate, information on the permitting process, a statement of basis for setting permit conditions, and the reasons for specific permit modifications.

## *II. Brief Description of the Facility*

Magnum plans to create underground salt caverns for storage of natural gas, refined or crude petroleum products, compressed air energy, and other liquids or gases. The caverns will be created using conventional solution mining technology. A single well will be drilled for each cavern and engineered casing will be installed and cemented to surface to protect Underground Sources of Drinking Water (USDWs), provide stability to the cavern well, and to protect the inner production casing from corrosion. The caverns will be created in a tectonically thickened salt body located approximately 9 miles north of Delta, Utah in Millard County and at depths greater than 3,000 feet below the surface.

Location:

Northeastern Millard County (see map below)

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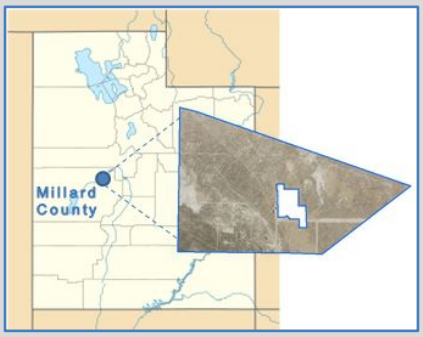


***Location of the Magnum Storage Project in Millard County, Utah***

### *III. Description of Injectate*

The storage caverns will be created by solution mining with fresh water that will be injected through one suspended tubing string under sufficient pressure to lift the produced brines back to the surface through a second, concentric tubing string. The produced brines will be piped to lined ponds for solar evaporation.

### *IV. Information on the Permitting Process*

The last modification of this permit, which became effective on September 26, 2014, was for 4 natural gas storage caverns. This modification addresses Magnum's intent to create caverns for natural gas, refined or crude petroleum products, compressed air energy and other liquids or gases and the substantial expansion of the permit area. In preparing this modification of the permit to incorporate these revisions as described in the permit modification application, DWQ has imposed several additional requirements including more stringent injection zone monitoring during the drilling of the pilot borehole for each cavern.

Referring to 40 CFR 144.39 which is incorporated by reference in R317-7 and included in the permit at Part II (D) (6) (a), DWQ has determined that these modifications represent material and substantial alterations and additions to the last modification of the permit and are therefore subject to the procedures for decision-making under 40 CFR 124. Furthermore, 40 CFR 124.5 (c) (2), also incorporated by reference in R317-7, states that for permit modifications only those conditions being modified shall be reopened when preparing a new draft permit.

### *V. Statement of Basis for Establishing Permit Conditions*

The original basis for issuing the UIC Class III Solution Mining area permit was, and still is, to ensure compliance with the Utah UIC administrative rules for Class III injection well activities, R317-7. Additionally, the underground hydrocarbon storage industry has standards for the construction of wells and caverns which were used to inform the development of the permit conditions where they apply to the storage of hydrocarbons in brine-compensated caverns and natural gas caverns.

The following references apply to the underground storage of hydrocarbons in solution-mined caverns, in general. While these references do not address the creation of compressed air energy storage (CAES) caverns, they were used to inform the development of permit conditions concerning cavern integrity and stability.

- Common Practices – Gas Cavern Site Characterization, Design, Construction, Maintenance, and Operation, SMRI Research Report RR2012-03
- Recommended Practice for the Design of Solution-Mined Underground Storage Facilities – API Recommended Practice 1114, API, July 2013
- Recommended Practice on the Operation of Solution-Mined Underground Storage Facilities – API Recommended Practice 1115 (R2012), API, October 2012
- Design and Operation of Solution-mined Salt Caverns Used for Natural Gas Storage - API Recommended Practice 1170, API, July 2015
- Canadian Standard Association, CWA Z341 Series 14 – Storage of hydrocarbons in underground formations, April 2014

Since Utah does not have specific statutes and regulations for the construction and operation of underground hydrocarbon storage caverns, we have combined the authorities under the UIC Program in DWQ and those available in the Division of Oil, Gas and Mining (DOGM) to cover the oversight of these facilities. DWQ and DOGM share regulatory oversight of the construction of each underground

hydrocarbon storage cavern well. DWQ assumes primary oversight during the solution mining of the caverns. At the end of a solution mining phase, DOGM assumes primary authority under a special board order during storage of hydrocarbon product. This cycle continues until the cavern has reached its permitted volume under the UIC permit at which time each cavern well system will be released from the Class III UIC permit and regulatory oversight transferred to DOGM for maintenance and operation of the storage facility.

Regulation of the compressed air energy storage (CAES) wells and cavern will be the sole responsibility of DWQ under a Class V UIC permit.

## *VI. Reasons for Specific Modifications of the Permit*

The major modifications of the permit are being made for the following reasons:

1. to increase the size of the permit area,
2. to address the addition of several different types of products that will be stored in different types of caverns (pressurized and brine-compensated),
3. to address ongoing regulatory oversight of CAES caverns during active operation after cavern development is complete,
4. to address the development of product-specific Construction and Cavern Development Plans and Monitoring, Recording, and Reporting Plans prior to receiving authorization to drill,
5. to include a requirement for submitting a CAES cavern closure plan and financial assurance for closure to the Director,
6. to change language referring to several included standards documents,
7. to include requirement for maintaining appropriate S:D and P:D ratios where S, P, and D refer to the distance between the centers of two caverns or between a cavern and the edge of the salt body, the minimum pillar thickness between adjacent caverns, and the average of the maximum diameter of the two caverns, respectively.

Following are the specific modifications made to the permit:

1. Throughout the Permit – revised language referring to the 'Magnum Gas Storage Project' to the 'Magnum Storage Project' because the permittee proposes to store products other than gases,
2. Part I – includes a modification expanding the type of products to be stored in the caverns from natural gas to natural gas, refined or crude petroleum products, compressed air energy, and other liquids and gases.
3. Part I – includes a modification replacing the legal description of the permit area with a new, substantially larger area,
4. Part III (A) – includes a modification stating that while regulatory authority during the operation of the underground hydrocarbon storage caverns will be transferred to DOGM; regulatory authority for the operation of the CAES caverns will remain with DWQ under a UIC Class V permit,
5. Part III (B) (1) – includes a modification stating that a product-specific Construction and Cavern Development Plan (CCDP) will be submitted to and approved by the Director prior to receiving authorization to drill,

6. Part III (B) (2) – includes a modification stating that a product-specific Monitoring, Recording and Reporting Plan (MRRP) will be submitted to and approved by the Director prior to receiving authorization to drill,
7. Part III (D) (1) – revises the language referring to the listed standards indicating they were used to inform the development of permit conditions,
8. Part III (D) (2) – revised to include a statement that prior to receiving authorization to commence drilling, Magnum shall submit a product-specific CCDP for review and approval by the Director, and that each approved CCDP shall become an enforceable attachment to the permit and that each product-specific CCDP shall include:
    a. a maximum design capacity (Open Cavern Volume) for the product-specific cavern;
    b. the Required Pillar Width based on geomechanical analysis.
9. Part III (D) (2) – revised to include a statement that if the design criteria for the hydrocarbon product-specific CCDPs are significantly different than the design assumptions used in preparing the original geomechanical analysis dated September 2010, a new geomechanical analysis must be performed that reflects the intended design. A new geomechanical analysis must be performed for caverns developed to store any gas other than natural gas, the gas for which the original geomechanical analysis was performed unless a statement is provided from an expert knowledgeable in the evaluation of geomechanical analyses of caverns and cavern fields stating that the original geomechanical analysis performed for the storage of natural gas is applicable to the newly proposed gas. The geomechanical analysis must support the product-specific CCDP,
10. Part III (D) (2) – revised to include a requirement that a cavern enlargement plan be included in each CCDP which addresses all modes of cavern enlargement,
11. Part III (D) (6) – revised to include an additional item (e) stating that Magnum shall include in the Formation Testing Program in each product-specific Construction and Cavern Development Plan in Attachment D a detailed description of the methodologies to be employed to characterize anomalous zones during the drilling of new cavern wells. The location of these anomalous zones may be interpolated / extrapolated from corresponding anomalous zones in adjacent cavern wells,
12. Part III (D) (10) – revised to include requirements for maintaining minimum S:D ratios between caverns to maintain the mechanical integrity of the salt web between caverns intended to store different products (the Required Pillar Width),
13. Part III (D) (10) – revised to include requirements for maintaining minimum P:D ratios between adjacent caverns (Required Pillar Width),
14. Part III (D) (10) – revised to delete the table of permitted cavern capacity for natural gas caverns to be replaced by the requirement that each product-specific CCDP shall include the maximum design capacities for each product-specific cavern,
15. Part III (D) (10) – revise to include a condition that if Magnum proposes to construct caverns near the flanks of the salt body, the product-specific CCDP shall include a plan for assessing and defining the edge of salt and determining an adequate standoff so as to maintain the mechanical integrity of the cavern and surrounding salt.

16. Part III (E) (1) - revises the language referring to the listed standards indicating they were used to inform the development of permit conditions,
17. Part III (E) (2) - revised to include a statement that prior to receiving authorization to commence drilling, Magnum shall submit a product-specific MRRP for review and approval by the Director and that each approved MRRP shall become an enforceable attachment to the permit,
18. Part III (E) (6) (a) - revised to add to the purpose for conducting sonar surveys, the maintenance of the Required Pillar Width,
19. Part III (F) (1) – revised to include an additional reporting requirement – the 4th quarterly report shall include a tabulation of the pillar thickness (P) between adjacent caverns and between caverns and the permit area boundaries at 200' depth intervals beginning at the depth of the last cemented casing,
20. Part III (K) – revised to refer to the Required Pillar Width,
21. Part III (K) – revised to include a list of conditions that would justify the Director requiring a geomechanical analysis and reassessment of the cavern, adjacent caverns, and adjacent salt web.

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