# STATEMENT OF BASIS

## AMERICAN SHALE OIL, LLC
## AMSO T-1P
## RIO BLANCO COUNTY, CO

## EPA PERMIT NO. CO52154-08524

This STATEMENT OF BASIS gives the derivation of site-specific UIC Permit conditions and reasons for them. EPA UIC permits regulate the injection of fluids into underground injection wells so that the injection does not endanger underground sources of drinking water. EPA UIC permit conditions are based upon the authorities set forth in regulatory provisions at 40 CFR Parts 144 and 146, and address potential impacts to underground sources of drinking water. Under 40 CFR 144.35, issuance of this permit does not convey any property rights of any sort or any exclusive privilege, nor authorize injury to persons or property of invasion of other private rights, or any infringement of other Federal, State or local laws or regulations. Under 40 CFR 144 Subpart D, certain conditions apply to all UIC Permits and may be incorporated either expressly or by reference. General Permit conditions for which the content is mandatory and not subject to site-specific differences (40 CFR Parts 144, 146 and 147) are not discussed in this document.

Upon the Effective Date, the Permit Modification authorizes the operation of the injection well so that the injection does not endanger underground sources of drinking water, governed by the conditions specified in the Permit Modification.

**Project Description**

The American Shale Oil, LLC (AMSO) has been issued a Class V Experimental Technology permit on January 4, 2011. Under the Research, Development, and Demonstration lease from the Bureau of Land and Management, AMSO intends to demonstrate technologies capable of developing oil shale resources. The goals of the project are to test the viability of their technology, experiment with different monitoring technologies, and to investigate materials and conditions that would provide the best insulation to protect the formation from the high operating temperatures.

**Permit Modification**

During installation of the aerogel insulation, compaction of the insulation occurred at the shallower portion of the well resulting in a section of the well that may not provide the needed insulation to prevent heating of the formation near the well bore to meet the maximum allowable temperature requirements in the final permit. The purpose of the temperature monitoring along the wellbore is to ensure that the high temperatures do not cause kerogen pyrolysis within the oil shale and therefore potential contamination of underground sources of drinking waters (USDWs). AMSO is requesting to modify the temperature monitoring requirements for the shallower intervals, from a depth greater than 350 feet below ground surface (bgs) to surface, where oil shale may not be present at all or exists at much lower concentrations

than used to develop the permit temperature limits.

Based on the testing and sampling of the outcrop approximately 1 mile away from the permitted well, onsite field observations and literature review, AMSO has concluded the following:

| Formation Name | Depth (feet bgs) | Geology |
|---|---|---|
| Uinta Formation 6 | 0-240 | sandstone, siltstone, and minor marlstone (lacks oil shale) |
| Black Sulphur Tongue | 240-265 | gray to very light brown marlstone |
| Uinta Formation 5 | 265-350 | sandstone, siltstone, and minor marlstone (lacks oil shale) |

Based on the field observations at the outcrop dated January 23, 2012, provided by Western Water & Land, Inc. (WWL), consultants to AMSO, the Uinta Formation 6 and 5 do not contain oil shale. Core samples from surface to approximately 500 feet bgs had not taken and evaluated. For future projects, core samples should be retrieved and analyzed for confirmation, particularly for projects whose project life well exceeds the planned one year duration for this pilot project.

WWL also sampled the outcrop of the Black Sulphur Tongue and the chemical analysis showed that the oil content varies between 0.63 and 2.50 gallons/ton (gpt), with an average of 1.4 gpt. The concentration used to derive the permit temperature requirements was 30 gpt, or approximately twenty times less. By adjusting the reaction constant by a factor of twenty, the equivalent temperature for shale oil to be produced is an increase in 50 degrees Fahrenheit (deg F) in temperature.

The proposed new temperature requirements are as follows from surface to 350 feet:

| Formation Name | Depth* (feet) | Temperature Monitoring |
|---|---|---|
| Uinta Formation 6 | 0-230 | no requirements |
| Black Sulphur Tongue | 230-270 | Table 1 |
| Uinta Formation 5 | 270-350 | no requirements |
| Below Uinta Formation 5 | > 350 | Table 2 |

*note: The Black Sulphur Tongue depth has been approximated to 240 to 265 feet. However, for the purpose of temperature monitoring, AMSO has proposed to increase the top and bottom depths, by 10 and 5 feet, respectively, to account for the uncertainty.

**Table 1**

| Temperature (deg F) | Number of Days |
|---|---|
| 400 – 450 | 633 |
| 451 – 460 | 341 |
| 461 – 470 | 186 |
| 471 – 480 | 103 |
| 481 – 490 | 58 |
| 491 – 500 | 33 |

**Table 2**

| Temperature (deg F) | Number of Days |
|---|---|
| 350 – 400 | 633 |
| 401 – 410 | 341 |
| 411 – 420 | 186 |
| 421 – 430 | 103 |
| 431 – 440 | 58 |
| 441 – 450 | 33 |

An automatic alarm will sound when 450 deg F is reached for the region monitored below 350 feet bgs. A second automatic alarm will sound in the event that the temperature within the Black Sulphur Tongue interval (230-270 feet) reaches 500 deg F.

The EPA has reviewed the requested modification and agrees that the suggested approach is reasonable, given the much lower concentrations or the lack of oil shale that exists in that portion of the well bore.