Statement of Basis
Deer Creek SWD #1 UIC Class I Permit
EPA UIC Permit CO12264-09864

Background

In carrying out the mandate of the Safe Drinking Water Act, no injection shall be authorized if it results in the movement of fluid containing any contaminant into underground sources of drinking water. (40 CFR 144.1(g)

In January 2013, EPA received a UIC Class I Permit application from TC Operating, LLC (TC) to dispose of waste fluids produced in conjunction with oil and gas production. This application for a commercial UIC Class I non-hazardous waste injection well permit has further significance because it comes to EPA after TC's original UIC Class II disposal injection well permit application was denied by the Colorado Oil and gas Conservation Commission (COGCC). Chief among the COGCC's concerns was the determination by COGCC that use of this well as a commercial oil and gas waste disposal well could result in significant adverse impacts to the environment or public health, safety and welfare. Subsequent to initial UIC Program review and evaluation by Dan Jackson, the review team was expanded to include Mike Wireman, hydrologist and Andrew Schmidt, hydrogeologist. These regional experts conducted further review of the permit application and information related to the proposed injection operation, focusing especially on hydrologic aspects. (Attachment 1)

Proposed Operations

The Deer Creek commercial disposal facility is to be the source for the waste oilfield fluids to be injected, consisting of fluids produced from various area oil and gas wells, flow back water, and other industrial sources of non-hazardous waste as permitted and allowed under the facility's State of Colorado monitored and approved operating plan.

TC proposes to inject water into the Wingate Formation for a period of six months, then run temperature surveys to confirm there is no near wellbore movement of fluid into other formations and run pressure falloff tests to confirm that no faults or fractures that could allow movement of injected water are within the affected area of the injection well. TC estimates that after six months of injection these tests would confirm the lack of faults, fractures, and failures within a radius of at least 1,500 feet distance from the wellbore. TC estimates that no injected water would move more than 150 feet (1.3 acres) radially from the wellbore. Finally, assuming no negative results, TC would resume injection into the Wingate for another six months repeat the testing and analysis.

The hydraulic tests proposed by TC Operating will only include the Wingate Sandstone. However, TC has indicated that they plan to expand the disposal injection zone beyond only the Wingate to include the entire (high porosity) sandstone package from the top of the Bilk Creek Sandstone Member of the Wanekah Formation to the base of the Wingate Sandstone. Therefore, the data from the limited hydraulic testing of the Wingate would not necessarily characterize the entire expanded injection interval. Because there is hydraulic connection over along this entire vertical interval, coupled with the fact that there is a short distance between the top of the proposed injection zone (top of Bilk Creek SS) and the bottom of the Dakota Formation, a known USDW, suggests that there is a significant likelihood for fluid migration into a USDW as a result of the proposed injection operation.

Proposed Decision

EPA is proposing to deny a UIC permit to TC Operating, LLC for commercial injection of oilfield and other non hazardous waste fluids into a UIC Class I injection well. As discussed below, the proposed injection activity is understood to present a significant risk of endangerment to underground sources of drinking water (USDWs) in the vicinity of the Deer Creek SWD #1 well. The geologic and hydrologic characteristics of the area make it an unsuitable site for the proposed disposal injection operation. There is significant uncertainty regarding the ability of the geologic strata to confine injected fluids to the injection zone due to hydrologic properties of the rock strata, and concerns for potential unrecognized local faults and fractures acting as conduits for undetected fluid migration into groundwater and overlying USDWs. The agency is concerned that contamination of ground water and surface water due to the injection ultimately may occur and the contamination would not be apparent until it has become widespread and irreversible.

Summary of Findings and Concerns

- The proposed plan, to initiate operations with six months of oilfield waste water injection followed by testing to help determine whether or not conditions such as faults, fractures, and failures that could cause movement of fluid into other formations exist within the area, presents a risk scenario for contamination of overlying USDWs and local groundwater. The proposed tests would be run only after substantial volumes of oilfield waste injection had occurred, and therefore would not alleviate but instead exacerbate a risk of potential contamination of overlying USDWs.

- The Uncompahgre Uplift occurs nearby. Recent fault movement (Quaternary) and two recent earthquakes in 1990 and 1995 with epicenters less than three miles from the proposed well site are thought to be associated with this structurally active geologic feature. There is fairly extensive faulting and folding associated with the Uplift that affected the Wingate and many overlying formations. The suspected presence of unmapped faults that extend into and beyond the injection zone is of concern. It is possible that unmapped faults would act as conduits through which formation water and injected brine could discharge into the overlying USDWs. Such concerns contribute to finding this setting unsuitable for the proposed long term commercial Class I waste disposal injection.

- The volume of waste fluid anticipated to be injected at this commercial oilfield waste disposal well over its lifetime raise concerns regarding potential for endangerment of USDWs. Though limited, existing data indicate that the potentiometric surface elevation for the Dakota is presently higher than the potentiometric surface elevation for the proposed injection zone so that the vertical direction of flow between the Dakota and the injection zone is downward. However, high volume long term injection under pressure (13.7 million barrels over 15 years) could significantly alter current potentiometric surface elevations and ground water flow characteristics, resulting in unintended fluid discharge into overlying aquifers. The Dakota sandstone is used as a source of domestic water in this area, with the closest well approximately 1.5 miles southwest of the Deer Creek location.

- The fairly extensive faulting and folding associated with the nearby Uncompahgre uplift that affected the Wingate and overlying formations presents a moderate to high potential for the occurrence of secondary flow paths (faults and fractures) that would connect the Entrada-

Wingate injection zone with the overlying Morrison sandstones and Dakota aquifer in the vicinity of the proposed well. There is a potential for hydraulic connection between the Morrison, Entrada and Wingate Formations and the Gunnison River that, enhanced by injection of large volumes of oilfield waste under pressure, could cause fluid discharge into the Gunnison River (segments of which may be protected under the Wild and Scenic Rivers Act[1]) approximately 4.5 miles to the southwest. The Wingate and Entrada Formations both outcrop in the valley of a tributary to the Gunnison River, leading to the concern that formation water and/or injected fluid would discharge along this outcrop and/or into the Gunnison River. The COGCC also raised this concern despite the contrary hydrogeologic modeling information provided by the applicant.

- The MHA Petroleum Consultants LLC hydrogeologic model result presented by the applicant indicated no discharge to the Gunnison River. The model, however, includes assumptions that are not valid. The model was not calibrated and does not use data from anywhere other than the Deer Creek well. The Colorado State Engineers Office (SEO) ran its own Glover analysis numerical model to look at potential migration of injected waste fluids and /or high salinity groundwater into the Gunnison River. The SEO modeling indicated a discharge of 0.13 to 51 acre-feet (AF) after one year of injection and 50 -70 AF in year 15 of injection.

- The US Department of Energy (DOE) Office of Legacy Management (LM) is responsible for ensuring that the selected groundwater compliance strategy at the Grand Junction processing site continues to be protective of human health and the environment. The DOE expressed concerns in a letter to the COGCC that the proposed injection operation could cause potentially disruptive effects on its existing groundwater contamination control measures at the Grand Junction disposal site[2] (Cheney disposal cell) located approximately three to four miles northwest of the proposed well.

These findings are consistent with those of the COGCC and other State of Colorado scientists, and in agreement with the decision reached by the Commissioner when it denied TC's Class II UIC disposal well permit application.

[1] http://www.blm.gov/co/st/en/nca/denca/denca_rmp/DENCA_Wild___Scenic_River_Eligibility.html
[2] http://www.lm.doe.gov/Grand_Junction_DP/Disposal/Documents.aspx

ATTACHMENT 1

MEMORANDUM

TO: Dan Jackson, EPA Region 8 UIC Program

FROM: Mike Wireman, National Groundwater Expert
Andrew Schmidt, SUPERFUND Hydrogeologist

SUBJECT: Review of documents related to TC Operating LLC's proposed injection well
Deer Creek SWD # 1 – NENE Section 2 T14S, R98W, Mesa County, Colorado

We have reviewed the documents provided by Dan Jackson (EPA Region 8 UIC program) related to the application by TC Operating LLC for a Class I UIC permit to inject waste fluids generated from oil and gas development into the Wingate Formation. It is our understanding that TC Operating LLC applied to the COGCC for a Class II UIC permit (utilizing the Deer Creek SWD # 1) and that their application was denied based on the results of a hydrogeologic assessment completed by the COGCC, with input from the Colorado SEO-DWR and the CGS. There is no information in the files as to whether or not the waste fluids proposed for injection would meet the criteria for classification as Class I waste.

RELEVANT INFORMATION

Proposed Injection zone

- June 13, 2011 letter from COGCC to TC Operating indicates that injection zone is 1553 -1766

Geology - June 13, 2011 letter from COGCC to TC operating

- Base of Dakota Dakota ss @842
- Morrison Salt Wash @ 1220 -1292
- Entrada @ 1426 – 1520
- Wingate occurs from 1533 – 1766

Hydrogeology

- The Entrada and Wingate Formations are both predominantly sandstones and function as a single aquifer unit which is used as a source of drinking water.
- There is less than 700 feet of vertical separation between the top of the proposed injection zone (1533 ft) and the bottom of the Dakota Formation–a known USDW.
- The Wingate and Entrada Formations both outcrop in the valley of a tributary to the Gunnison River –approximately 3.5 miles from DCSDW #1. This provides for a possible hydraulic connection between the Wingate –Entrada aquifer system and the Gunnison River.
- The Uncompahgre Uplift is nearby. – Recent fault movement (Quaternary) and 2 recent (1990, 1995) earthquakes w/ epicenter less than 3 miles from DC SDW #1 are thought to be associated with this structurally active feature.
- Limited existing data indicate that the vertical direction of flow between the Entrada –Wingate aquifer and the overlying Dakota aquifer is downward, i.e. – the elevation of the potentiometric surface for the Dakota is higher than the elevation of the potentiometric surface for the underlying Entrada-Wingate.

- TDS values for Wingate –three are reported -quite variable- only one sample from Deer Creek # 1
  - Moore Wingate domestic well – fresh (USDW) – about 9 miles NW of DC SDW #1
  - Wortman Domestic well TDS - 962 mg/l -2 miles NW of DC SDW #1
  - MK Ferguson UMTRA – 5000 mg/l (USDW) – approx. 2.5 miles NW of DC SDW #1
  - Deer Creek # 1 – 63,000 mg/l - only one sample

The Wingate, the Morrison and the Dakota are all considered to be USDWS in the vicinity of the Deer Creek SDW #1.

QUESTIONS

1. What is the source of the info in Table 2.1, 2.4 in Statement of Basis?
2. What is the AOR? If ¼ mile –why? Why is it not a calculated zone of endangering influence?
3. Has TC Operating provided EPA Region 8 with any data /information that the COGCC did not receive?

CONCLUSIONS /RECOMMENDATIONS

After reviewing the files in some detail I concur with the COGCC decision to disapprove the Class II injection permit. My opinion is based on the following:

- The shallow proposed injection depth (1553-1766)
- The presence of significant sandstones above the top of the injection zone and known overlying / adjacent USDWs,
- The fairly extensive faulting and folding associated with the Uncompahgre uplift (that affected the Wingate and overlying formations).This indicates a moderate to high potential that there are secondary flow paths that could connect the Entrada-Wingate aquifer with the overlying Morrison sandstones and /or the Dakota aquifer.
- The potential for hydraulic connection between the sandstone formations (Morrison, Entrada and Wingate) and the Gunnison River; which could be enhanced by injection of waste fluids under pressure into the Wingate. If a large volume of waste fluid is injected into the Wingate –there is a potential for reversing the vertical gradient direction as a result of increasing hydrostatic pressure in the Entrada -Wingate due to injection. This could result in an upward gradient between the Dakota and the underlying Wingate – Entrada.
- The modeling done to support the injection permit application includes assumptions that are clearly not valid. The model has not been calibrated and does not use data from anywhere other than the Deer Creek well. The SEO also ran a numerical model (Glover analysis) to look at the potential migration of injected waste fluids and /or the migration of high TDS groundwater to the Gunnison River. The SEO modeling indicated a discharge of 0.13 to 51 AF after one year of injection and 50 -70 AF in year 15 of injection. This is contrary to the MHA model result, presented by the applicant –which indicated no discharge to the Gunnison River.

In my opinion, a review of all available information indicates a hydrogeologic setting which is not suitable for injection of large volumes of waste fluids.