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WORKPLANS

DATE:

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Mr. Ed Hansen
New Mexico Energy, Minerals, & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

Environmental

Subject:

**Response to NMOCD Request
Jcts. K-27North and K-27-1, BD SWD SYSTEM
Unit K, SEC. 27, T21S, R37E
NMOCD CASE #s 1R0426-02 and 1R0426-03**

Date:
July 18, 2008

Contact:
Sharon E. Hall

Phone:
432 687-5400

Email:
shall@arcadis-us.com

Our ref:
MT000834.0001

Dear Mr. Hansen:

On behalf of Rice Operating Company (ROC), ARCADIS G&M, Inc. (ARCADIS) respectfully submits this response to your email date June 30, 2008, regarding the Closure Report dated March 10, 2008 for the above-referenced site.

Your email states that NMOCD cannot approve the Closure Report at this time and requests that ROC provide an estimation of the chloride mass that has contaminated the groundwater at the former junction box locations and a plan for the removal of that chloride mass. Our chloride mass estimation and plan for removal of that chloride mass follows:

Calculations used to estimate the chloride mass in groundwater that may have resulted from releases from the former junction boxes are detailed in the table below. The size of the impacted area is conservatively assumed to be the combined width and length of each of the two excavations multiplied by a factor of 10 (the estimated horizontal dispersivity factor). This total area is then multiplied by the thickness of the aquifer (15 feet) and the estimated porosity (25%) resulting in a total saturated pore space volume.

The increase in chloride concentrations in groundwater is calculated by subtracting the lowest chloride concentration at the site (MW-5, 260 milligrams per Liter {mg/L}) from the highest measured chloride concentration identified at the site (MW-2, 600 mg/L). This net difference in chloride concentrations conservatively

Part of a bigger picture

reflects the net impact to groundwater at the site resulting from releases from the junction boxes. It does not take into account other sources or regional groundwater conditions. Impacted groundwater conditions are documented in this area since the 1950's. (Ground-Water Report 6; Geology and Ground-Water Conditions in Southern Lea County, New Mexico; Alexander Nicholson, Jr. and Alfred Clebsch, Jr., U.S. Geological Survey in cooperation with the State Bureau of Mines and Mineral Resources Division of the New Mexico Institute of Mining and Technology and with the State engineer.)

The net difference in the concentration of chlorides is multiplied by the total saturated pore space volume resulting in the estimated chloride mass as shown in the following table.

Estimate of Chloride Mass

Parameter	Value	Description of equations used
Release Area	1650 ft ²	Physical measurement of junction box excavation
Longitudinal Dispersivity	10	Professional estimate for factoring the plume length
Aquifer Thickness	15 ft	Based on regional groundwater data*
Porosity	25%	Professional estimate of pore volume
Volume of impacted groundwater below former junction boxes	61875 ft ³	Multiplication of parameters listed above
Volume of impacted groundwater below former junction boxes	1,752104.9 L	Unit conversion of above value to liters
Averaged increase in on-site chloride concentrations	340 mg/L	Difference between concentrations in MW-2 and MW-5
Total Chloride Mass	595.71 kg	Multiplication of two parameters above

* Ground-Water Report 6; Geology and Ground-Water Conditions in Southern Lea County, New Mexico; Nicholson and Clebsch

ROC proposes the installation of a groundwater recovery system at the former K-27-1 junction box location. A solar-driven pump will be placed in existing well MW-1, an existing 4-inch monitor well. The pump will operate 8-10 hours per day and the groundwater recovered from the well will be pumped into a tank. The groundwater will be treated on-site to a chloride concentration of 250 mg/L. The treated water will be used to irrigate the site to promote revegetation.

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ARCADIS

Mr. Ed Hansen
18 July 2008

At a pumping rate of 1 gallon per minute the groundwater recovery system could extract 0.864 kg per day. At that rate it will take approximately 684 days to remove the 591.71 kg of chloride mass.

Installation of the groundwater recovery system is contingent on approval of the New Mexico Office of the State Engineer and landowner approval in accordance with NMSA 1978 Article 72-12-3(B) (Article 1 1-17). The volume of recovery and duration to completion of recovery is based on the wells yield that can be sustained during pumping. If the recovery volumes are not sufficient to complete the chloride mass recovery in 684 days NMOCD will be notified and informed of the anticipated duration of recovery operations. Additionally, a second pump may be placed in another well.

ROC is the service provider (agent) for the BD Salt Water Disposal System and has no ownership of any portion of pipeline, well or facility. The BD SWD System is owned by a consortium of oil producers, System Partners, who provide all operating capital on a percentage ownership/usage basis.

Thank you for your consideration concerning this proposed treatment and disposal of groundwater at this site. If you have any questions, do not hesitate to contact me.

Sincerely,
ARCADIS G&M, Inc.

Sharon E. Hall

Sharon E. Hall
Associate Vice President

Copies:
Hack Conder, ROC
Marvin Burrows, ROC

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