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Memorandum

Date: November 4, 2014

To: Mickey Horn, Paladin Energy Corporation

cc: Bob Allen, SESI

From: David G. Boyer, P.G.

RE: Update Information, South Vacuum SWD (Buckeye) Release

As you know we have been monitoring water quality constituents released in a pipeline leak reported in February 2008. Five monitor wells were installed and we perform quarterly monitoring and provide you with the results. Below I will provide you with the update results and briefly discuss our interpretation. A map showing well locations is also included.

Sampling Results:

The most recent sampling was performed September 15 and upon receiving the results I updated and have attached our data tabulation and water quality graphs of chloride and total dissolved solids (TDS). In addition to inorganic chloride and TDS, we monitor for several organic constituents most commonly found in produced water, notably benzene, toluene, ethylbenzene, and total xylenes (BTEX). The latter constituents, which were never highly elevated, have not been detected since December 2011 and are not discussed further.

Results from all monitor wells show chloride and TDS levels are either decreasing or are stable. In particular, background wells MW-2 and MW-3 have shown very little change since 2008. For these two wells chloride averages 56 mg/L and TDS 432 mg/L, both well within the NM groundwater standards of 250 mg/L and 1,000 mg/L, respectively. (Elevated TDS in both wells in September 2013 are outliers likely due to a laboratory issue; chloride concentrations for that sampling date are not similarly elevated.)

The graph for MW-1 shows initial chloride and TDS concentrations of 460 and 1,700 mg/L when first sampled in July 2008 and most recent results of 510 and 1,460 mg/L. However, in the interim both constituents were greatly elevated with maximum concentrations occurring in the 2010-2011 time period. Concentrations began declining in 2012 and have continued downward through spring of 2014. The two most recent results show little change with concentrations flattening such that they may be approaching an asymptotic condition.

In contrast, graphs for MW-4 and MW-5 show very high initial chloride and TDS concentrations in the first sample with chloride values in MW-5 at 2,600 mg/L and TDS at 5,400 mg/L. Though constituent values in both wells are declining, they remain well above NM groundwater standards.

Discussion and Summary:

Attached are two figures showing the location of the monitor wells and groundwater flow direction calculated in August of 2008. There likely is little or no change in flow direction as the general flow direction in this area is southeasterly and there are no large pumping water wells nearby that could otherwise cause a change in flow. The monitor wells are located downgradient of the leak area and positioned to reflect changes in water quality due to downgradient movement of the plume.

Water quality in monitor wells MW-2 and MW-3 is considered representative of background water quality in the area. As noted above there has been little change in water quality in these two wells since monitoring began in 2008. MW-1 was impacted by the release but water quality has now improved such that concentrations are approximately the same as first measured in July 2008. However, because initial concentrations measured in MW-1 are higher than background, it is unknown whether the July 2008 results represent impacts from the first release or whether there may have been an undetected slow release prior to the leak reported in February 2008.

Monitor wells MW-4 and MW-5 both show chloride and TDS much in excess of values measured in MW-1 at the beginning of monitoring and currently. Both of the graphs show a much higher initial concentration and a slower reduction in the two constituents during the time period measured. This indicates that there is a downgradient source of contamination unrelated to the February 2008 SWD line release.

An examination of the Google Earth photo shows an area of disturbance immediately east and adjacent to both MW-4 and MW-5 that may represent now closed salt water drilling or disposal pits. Without additional research including location and examination of older aerial photographs, the source of high salt contamination in the two wells can not be ascertained. However, the continued high elevation and slow decline of salt constituent concentrations in the two wells indicate a source unrelated to the February 2008 pipeline release.

It is recommended that an additional year of quarterly monitoring be performed and the results evaluated. If levels in MW-1 reach or approach background values the NMOCD should be provided with a request to discontinue monitoring due to the presence of an unrelated plume of salt contamination downgradient of the February 2008 release site.

DGB/DGB