Environmental Assessment for 47-039-02026, Raymond City #6, Kanawha County, West Virginia

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Description of site
The well site is on a ridge between Harmon's Creek and Kelly's Creek Roads with its access road off Harmon's Creek Road.

The site is sparsely vegetated with a fringe of pine trees showing where the former cleared extent was. The well was drilled in the mid-1960s and according to state records never had a workover.

Significant clusters of deer tracks were used to identify possible locations of soil contamination from brine. Sparse vegetation on the site was an additional possible indicator.

In January 2008 the tank was allowed to overflow and crude petroleum and brine flowed down the hillside using an existing ditch. The tank in September 2008 had the required secondary containment constructed and the area was seeded. Several weeks later the road was graded, including part of the pad.

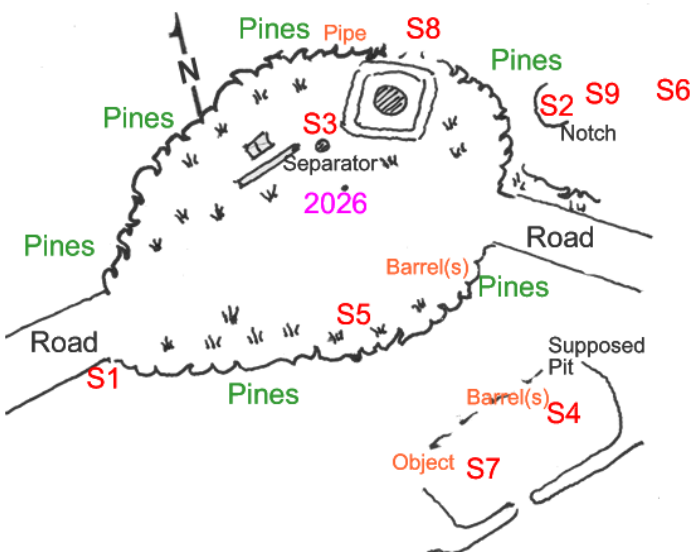
We began our examination of this site in September 2008.[1] Originally, we focused on equipment and maintenance of the site but beginning in 2009 we expanded our evaluation using this site as a way to develop our techniques for environmental assessment.[2]

The map shows approximate locations for soil sampling, features (such as supposed pit and "notch"), and scrap pipe and other metal from the operation of the well.

Soil testing
Soil samples were collected and testing was done by mixing an equal amount of soil sample with distilled water, shaking the mixture for 30

[1] Monk and Schaffnit, 2009, *Gas Well Study, 2008*.
[2] Monk and Schaffnit, "Environmental Assessment" web page.

seconds and letting settle. A Quantab chloride titrator test strip was used determine concentration of chlorides.[3]



Soil test locations

Soil testing occurred on two dates, 27 April 2009 and 20 May 2009. The first set of tests were locations called S1 through S4.[4] The second set of tests enhanced our understanding of the site and were S5 through S9.

Test locations were determined in order to see if we could evaluate the following issues we found in our evaluation. There were two locations (S2 and S3) that showed an unusually high number of deer tracks that we wanted to test to see if they had elevated chlorides.

Another location (S4 and S7) appeared to be an unfilled drilling waste pit. We wanted to see if soil there showed elevated chlorides.

The final set of tests examined the ditch behind the tank that was contaminated by brine and crude petroleum in January 2008 (S8); the hillside below the notch (S6 and S9), one of the heavily deer tracked spots we tested; and finally a test of the soil on the pad itself to see if a situation of elevated chlorides was a reason for lack of vegetation (S5).

High chloride locations

High chloride concentrations were found in the soil in three locations: the notch (136 mg/l), by the separator (136 mg/l) and the ditch contaminated

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[3] Otton and Zielinski, 2000, *Simple techniques for assessing impacts of oil and gas operations on Federal Lands: a field evaluation at Big South Fork National River and Recreation Area, Scott County, Tennessee (online edition)*.

[4] Monk and Schaffnit, "47-039-02026" web page.

in January 2008 (42 mg/l). The notch (S2) and the separator (S3) locations showed evidence of unusual deer activity. High soil chlorides here seems to indicate that where we see high level deer tracking at other sites we can expect also to find elevated chlorides.

Photo 1. Oil sheen on mud in ditch behind tank. Location of sample S8.

The contaminated ditch showed a lower concentration of chlorides (S8). When the soil sample was taken the petroleum contamination of the soil was still evident in the form of an oily sheen on the mud. This sample, after mixing with distilled water, had a strong condensate odor when the lid of the container was removed. The condensate odor never went away.

Trace and no chloride locations

Three locations showed no evidence of chlorides -- the control sample (S1) taken at the edge of the pad from undisturbed area; a sample from the pad itself (S5); and a sample down the hillside from the notch (S6).

Three samples showed trace chlorides (less than 30 mg/l, the lower limit of the test we used). Two of those samples were from the supposed pit (S4 and S7). The third sample was a short distance downhill from the notch. This sample was taken where a piece of black plastic from the notch rested (S9).

Testing didn't show one way or the other if the supposed pit was a drill waste pit or not. Chlorides would be expected but not necessarily high chlorides. At the same time, soil chlorides possibly would diminish over time in response to weathering.

The two tests down the hillside from the notch seem to indicate that there is no serious migration of chlorides from the site.

Conclusions

Our evaluation allows some conclusions but in other instances opens the door for more questions. Our testing seems to show that unusual deer tracking is a sign of brine contamination of soil. The contamination by the separator wasn't entirely unexpected because of the purpose of that piece of equipment.

Photo 2. Photograph of notch taken in February 2009 showing extensive deer tracking.

What has happened to cause the soil at the notch to be contaminated is one of the questions we'll try to resolve in the future. Fragments of black plastic (pit liner?) seem to indicate that it might be a workover pit but we've been told by the Office of Oil and Gas that no permitted workover has taken place at this site. Soil here always shows signs of moisture, unlike most areas of the pad, and that raises other questions. Does soil contaminated with chlorides hold moisture better? Is there something happening at this spot so that fluids (either water or brine) from below the surface are appearing here?

Poor vegetation on the pad probably isn't caused by chloride contamination, though chlorides do inhibit the germination and development of some varieties of Tall Fescue, the operator's seed of choice.[5] Vegetation problems are most likely due to the continual grading the road and pad receive -- at least once every year or two. The pad was seeded after construction in September 2008, but shows poor growth and no germination at all by the separator. The operator needs to change practices at this site so grass can grow properly.

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[5] Munn and Stewart, 1989, "Effect of Oil Well Brine on Germination and Seedling Growth of Several Crops."

Nothing was done by the operator to mitigate the effects of contamination of the soil by the crude petroleum and brine spill of January 2008. While eventually petroleum hydrocarbons will be broken down by soil bacteria, it appears that this will take years to happen. A question here is whether the high chloride content of the soil inhibits these bacteria.

Soil sample locations

ID	Description	Chlorides
S1	Control, edge of pad	none
S2	Notch	136 mg/l
S3	By separator	136 mg/l
S4	Supposed pit, 6 inches below surface	trace
S5	Pad, between well and supposed pit	none
S6	Below notch, further than S9	none
S7	Supposed pit, 17 inches below surface	trace
S8	Ditch, below tank	42 mg/l
S9	Below notch, between S2 and S6	trace
Note: Samples taken from surface except where noted. Locations shown on map.		

Sources

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Photo 3. Pipe for oil and brine running from separator to tank (not shown). Great numbers of deer tracks along here to right up against separator.

Photo 4. The notch with extensive deer tracking at time soil sample (S2) is being taken. GPS device is in center of photograph.

Photo 5. Ditch behind and below tank.
The ditch goes a short way down hillside.

Photo 6. This photo was taken in the supposed pit,
showing high bank. The bank appears
to be artificial.

Comments or questions? Email gmonk@citynet.net.