Environmental Assessment for 47-079-00731 and 47-079-01492, Putnam County, West Virginia

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Description of the Site

This site has two wells close together situated just above the Pocatalico River, south of South Pocatalico River Road (also called South Poca River Road) in Putnam County. The site is 2.6 miles east of the Doc Bailey Road (from Cross Lanes, West Virginia) turnoff onto South Pocatalico River Road. 731 was drilled in the 1960s, 1492 is a new well completed in 2008 whose site has yet to be reclaimed.

There are a number of serious problems with the overall site including noncompliance with federal SPCC regulations (40 CFR 112) and state regulations and legislated code. This report will deal with contamination from the closed pit for 1492 reaching the Pocatalico River hundreds of feet to the north.

We began an examination of this site in November 2008 when the drill rig for 1492 was still on the pad. Our website has photographs and descriptions of site visits and problems we observed.[1] In June 2009 we returned to the site on three different occasions and tested water and soil samples for chloride. This report will discuss the findings from these tests.[2]

The complex site is illustrated here with three maps. Map 1 is an elevation map. Letter zones, shown to the left of both the drainage and sample locations maps, refer to the elevation map. Map 2 is a drainage map

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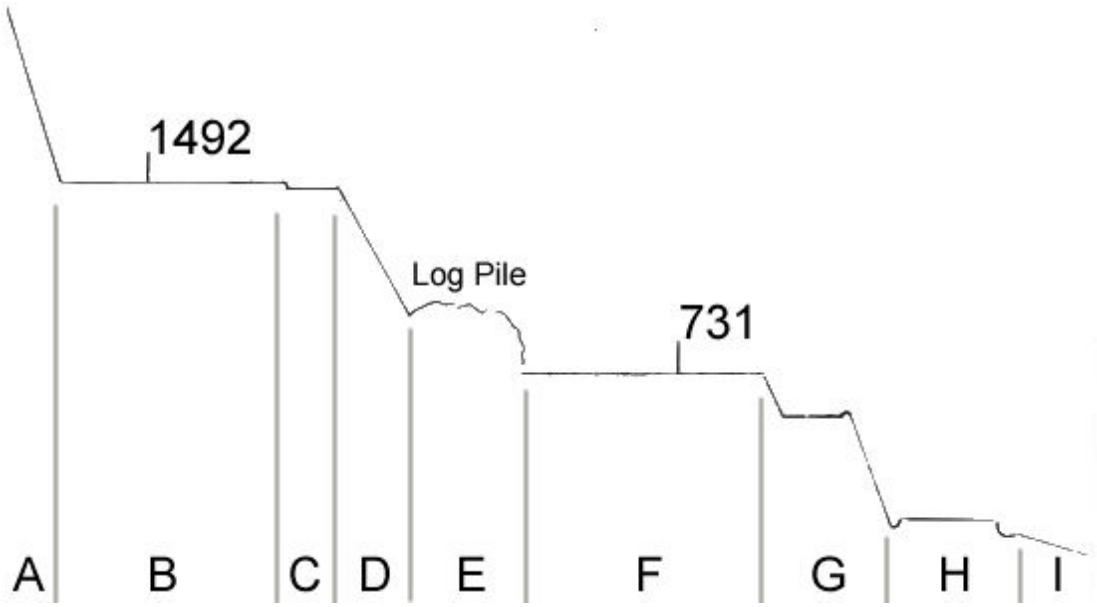
[1] Monk and Schaffnit, *Wells Operated by Various Companies, 47-079-0149* web page. We've made a total of seven visits to the site: 27 November 2008, 12 January 2009, 26 February 2009, 10 April 2009, 1 June 2009, 5 June 2009 and 13 June 2009.

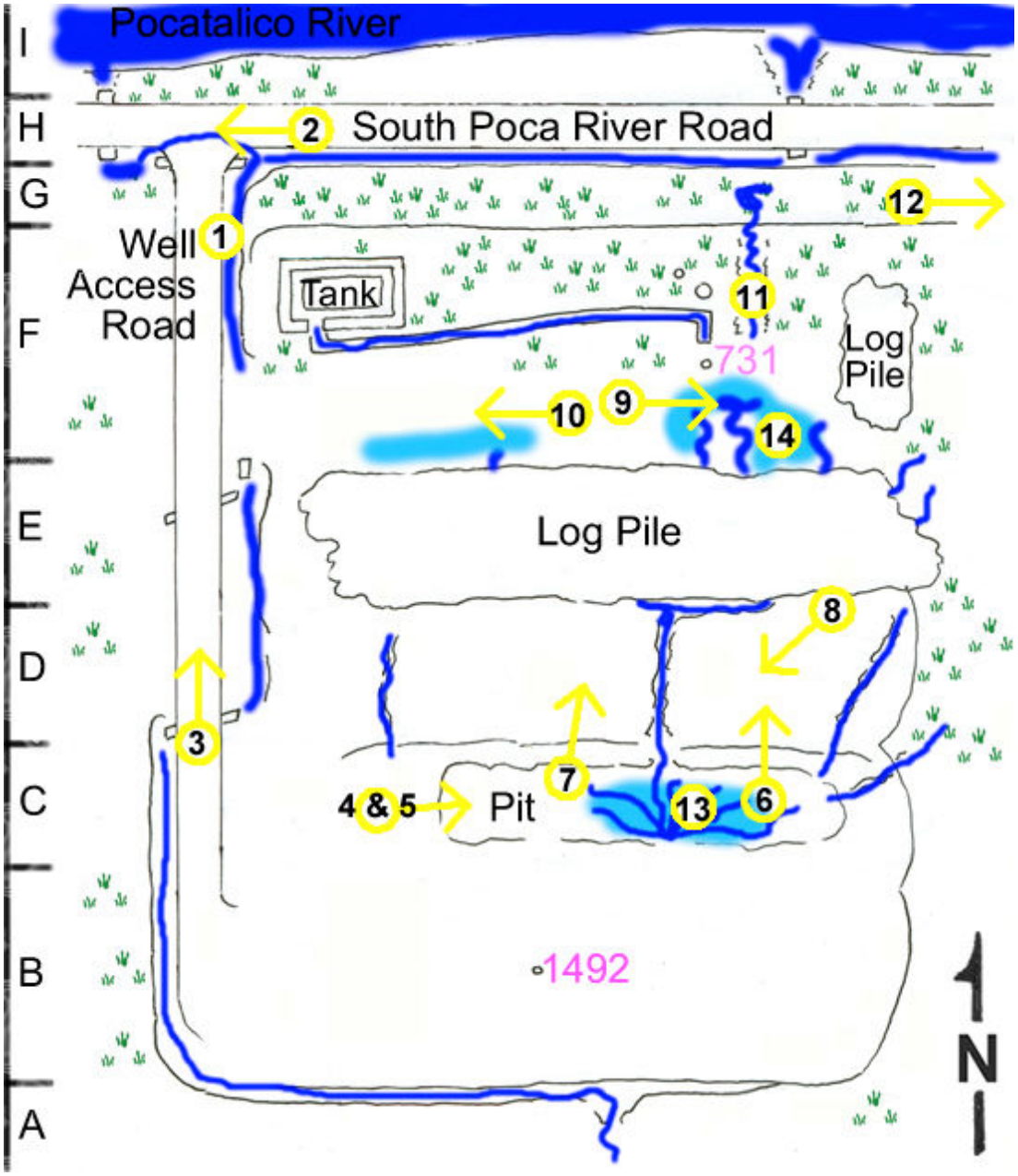
[2] An Interim Environmental Assessment for this site presents some of this material in a condensed form. George Monk and Molly Schaffnit, 2009, *Interim Environmental Assessment for 47-079-00731 and 47-079-01492, Putnam County, West Virginia*.

which shows major features of the site and associated drainage. A narrative description of the complicated drainage for this site appears later in this report. Photographs illustrating this assessment are keyed to the drainage map. Map 3 shows locations where soil and water samples were taken.

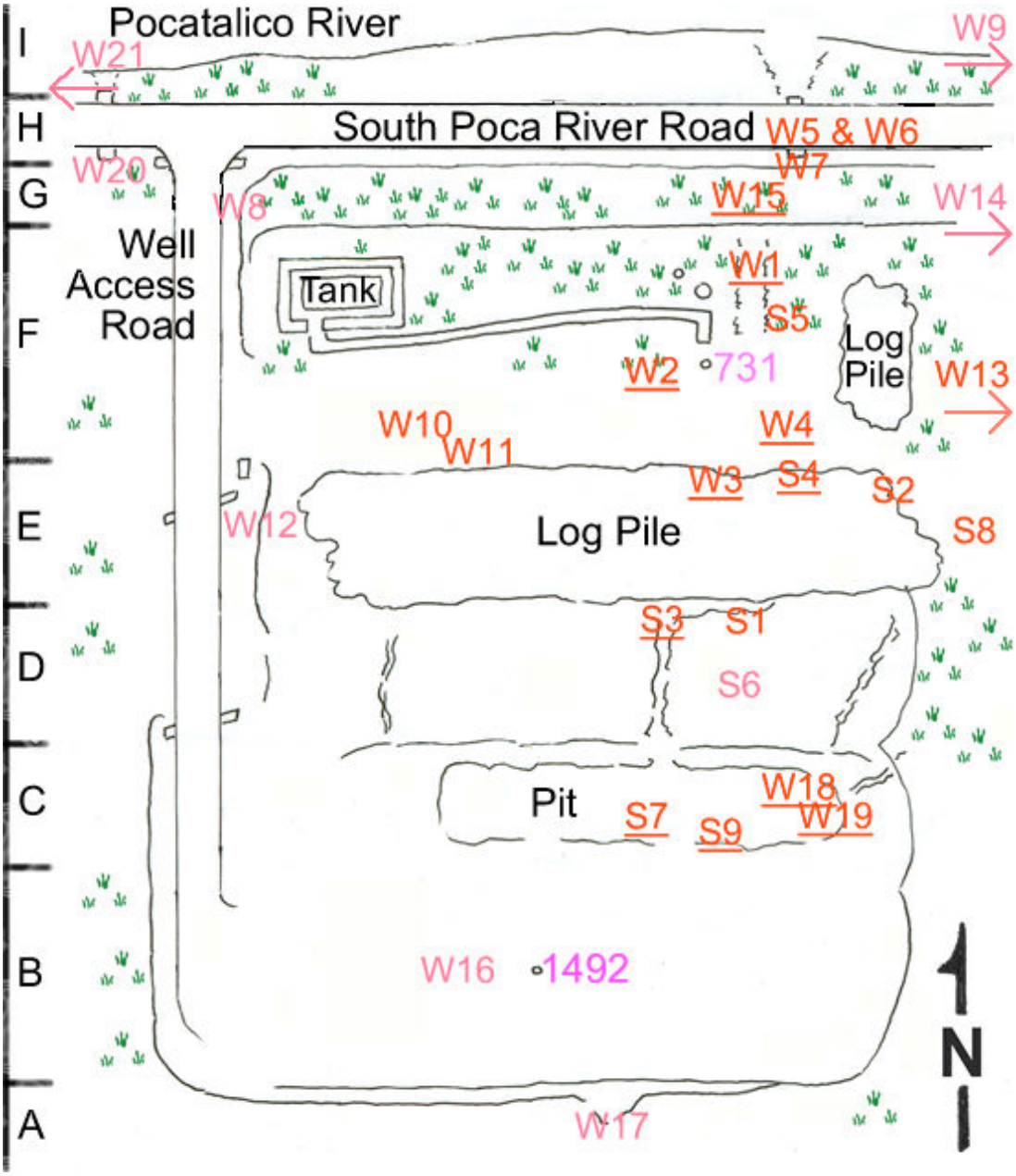
All the maps are sketch maps, not measured and should not be considered accurate. The operator's plat for this site shows that wells 1492 and 731 are 229 feet apart. Our soil sample S9 was taken at a distance of 79.5 feet from 1492's wellhead, about 20 feet from the edge of that part of the pad. We estimate that the two wells are at least 300 feet apart.



Map 1. Elevation diagram of the site. From left to right, south to north, the site is described in this report as Zones. Zone A is the cut slope above the well pad for 1492. Zone B is the pad for 1492. Zone C is the portion of the pad, including part of the pit, that slipped and is lower than the pad itself in Zone B. Zone D is the fill slope below 1492. Zone E is the log and branch sediment barrier between 1492 and 731. Zone F is the flat where 731 and the large condensate storage tank are located. Zone G is the bench below 731 and the slope from the bench to South Poca River Road. Zone H is South Poca River Road (including the ditch and culverts) and Zone I is the narrow strip between the paved road and the river.



Map 2. Drainage map showing main drainage features of the site. Dark blue shows flowing water and paler blue shows large areas of standing water. Zones are indicated in the left margin. Photographs appearing at the end of this report are located on this map as numbers in yellow circles. Arrows attached to the circle indicate the direction the camera was pointed.



Map 3. Sample locations for water (W samples) and soil (S samples). Light red sample locations were less than 30 mg/l chloride concentration. Underlined dark red sample locations were above 300 mg/l chloride concentration. Zones are indicated in the left margin.

Drainage

The site and its associated drainage covers a large area and is complicated for a number of reasons. Complications include deteriorating and overwhelmed drainage structures; the large amount of water draining into the site from off the site; and the wetland area to the east of the site (not shown on the map).

The site's construction did not take in consideration the amount of surface water entering and passing through the site. The pad for 1492 is cut into a steep hillside where a steam's drainage was evident. The stream goes down the cut slope in Zone A, south of 1492, and enters a ditch at the base of the cut slope to be directed away from the pad. Sometime between our visits in November 2008 and January 2009, the cut slope slipped filling that ditch so that the stream's flow crossed the pad.

In January 2009 we noticed that the pit, located above the fill slope, had begun to slip, cutting that portion of the pad into what are now zones B (the pad) and C (part of the pit). In June 2009 we were able to verify that water was entering the pit in Zone C and then draining down the fill slope. At this time a new ditch had been cut at the base of the slipped slope for the stream in Zone A and water from the stream's flow was not observed crossing the pad in Zone B.

We believe the operator sited the pit on a spring or stream. In June 2009 we estimated the continuous flow leaving Zone C at its primary drainage point was half an inch in diameter or greater. Water also drained from the pit area at other points to the east. To repeat, we did not observe water crossing the pad to enter Zone C.

In early 2009 the operator refurbished part of the drainage structures and added new sedimentation controls in parts. The ditch at the base of the slipped slope was created then. The ditch running along the paved road was not repaired at that time nor was the sediment trap cleaned out for the culvert under the well access road in Zone H.

Water draining from the pad and fill slope of 1492 carried so much sediment that by June 2009 sediment had reached an approximate height at the southern side of the log barrier (Zone E) of about 8 feet above the former surface.

The pad and access road for 731 (Zone F) had ponding water along the northern edge of the log pile, where water from above was entering at several points. Drainage was interrupted by the trench cut through the containment dike for the large (200 barrel) condensate storage tank, then east toward 731. Every time we visited the site in 2009 this trench was filled with water.

To the east of 731 there was a wide shallow ditch dug for drainage. Water here flowed to a narrow bench below (Zone G) and then down a bank to a ditch along the paved road (Zone H) where it drained into a culvert to the east.

The trench through the dike for the large tank would serve as a conduit for condensate if the tank ever leaked. Condensate would then leave the site, just as surface water does, through the short wide ditch, onto the bench and

then into the roadside ditch. A culvert leading to the river is 30 paces to the east from this point.

The narrow bench (Zone G) widens to the east of the site where it is a wetland with cattails. South of here, still off the site, is another area that, when we visited in June 2009, had several inches of standing water. Earlier in 2009, further east, we found the monument for a plugged well, 47-079-00595 which was standing in a large depression with several inches of ponding water.

Some parts of this wetland seem, from our limited observation, to have continuous standing water. Other areas experience intermittent standing water. We estimate that the wetland is at least an acre in size.

Water enters the culvert to the river, noted above, from the eastern portion of the site and from areas to the east of the site. We observed a fast flow of at least 4 inches in diameter entering the culvert from mixed sources on 5 June 2009.

The ditch along the road (Zone H) drains partially into the culvert to the east and partially to the west to another culvert to the river, located just outside the western property boundary of the site.

A much smaller culvert is under the site's access road connecting the ditches to the western culvert. This road culvert had been entirely blocked with sediment since January 2009 forcing water onto the road where it flowed toward the western culvert or across the road to the river.

The river (Zone I) is a short distance to the north of the paved road. The eastern culvert discharges into a narrow marshy area between the river and road; the western culvert discharges directly into the river.

An important drainage feature is the well access road for 1492 and 731 which climbs straight up the hillside (27% grade) from the paved road. Only a short portion, at the entrance, had gravel. The operator, because of a complaint by a neighboring homeowner, put in a water bar about halfway up the access road before our visit on 12 January 2009. In June 2009 the water bar had been cut by tires and equipment treads so that it was no longer working effectively.

It was obvious during all our visits that sediment was washing down this road onto and across the paved road. A silt fence between the river and the paved road should have been employed. A better drainage feature than a water bar for the well access road would have been a graveled broad based dip.

Water and Soil Samples

Samples and testing indicate that the pit area is the primary source of pollution. Twenty-one water samples and nine soil samples were tested for chloride for this assessment. Water samples taken from above the pad, on the pad away from the pit, or in the drainage at the westernmost edges of the site or off the site showed non-elevated chloride contamination. On Map 3, light red sample locations indicate results of chloride concentrations less than 30 mg/l. Dark red sample locations indicate results greater than 30 mg/l, and those locations which are underlined indicate results greater than 300 mg/l.

The closed pit area (Zone C), the drainage from the pit on the fill slope (Zone D), in the log pile below this drainage, and the area surrounding 731 all showed high or elevated water and soil chloride concentrations. We were able to measure effects of pit contamination in the wetland to the east of the site and at the eastern culvert's entrance leading to the river.

Soil and water samples to the west of the area of primary pit drainage showed elevated chloride concentration but not nearly so high as the eastern side of the site.

The appearance of the closed pit's surface in Zone C seems to indicate extremely shallow burial. We've seen a site operated by another company where part of the pit's contents were under only an inch or two soil cover. The piece of bent steel seen above the surface of 1492's closed pit may have been a rod used to hold the corners of the pit liner closed by piercing and pinning them.

Samples were collected on three different occasions -- 1 June 2009, 5 June 2009 and 13 June 2009. 1 June's samples were W1-W5 and S1-S7. 5 June's samples were W6-W8. 13 June's samples were W9-W21 and S8 and S9.

We used Hach Quantab chloride test strips which have an effective range of 30 mg/l to 650 mg/l. All tests showed at least a trace of chloride (Quantab 0.2 or 0.4), measurable concentrations between 30 mg/l and 650 mg/l or more than 650 mg/l. Samples were taken on site from static or flowing water, from grab samples of flowing water, or from soil.[3]

Sample locations are organized according to zone and locations are arranged from south to north and west to east.

Zone A -- Hillside and cut slope above pad.		
W17	Water grab sample from flowing stream cutting through cut slope, taken from above ditch.	trace

[3] A description of how we use the Quantab test strips is available on our website, George Monk and Molly Schaffnit, *Environmental Assessment -- Chloride Testing*, Sootypaws website.

Zone B -- Pad for 1492.		
W16	Water sample from puddle on pad west of 1492.	trace

Zone C -- Slipped portion of pad and part of closed pit area.		
S9	Soil sample from closed pit area in wet spot north of 1492.	477 mg/l
S7	Soil sample from closed pit area in wet spot north of 1492.	>650 mg/l
W19	Water sample from easternmost area of pit, by drainage from pit.	383 mg/l
W18	Water sample from eastern area of pit, by drainage from pit.	>650 mg/l

Zone D -- Fill slope below closed pit.		
S6	Soil sample from fill slope above log pile. Sample was from dry soil higher on fill slope than S3 and S1 and above S1.	<30 mg/l
S3	Soil sample from fill slope close to log pile. Sample was from drainage from pit.	513 mg/l
S1	Soil sample from fill slope close to log pile. Sample was from drainage from pit.	285 mg/l

Zone E -- Log pile.		
S8	Soil sample from east of log pile, just above pipeline.	149 mg/l
W12	Water sample from flowing drainage west of log pile.	trace
S2	Soil sample from high in log pile above S4.	285 mg/l
W3	Water sample in log pile above W2.	>650 mg/l
S4	Soil sample in log pile above W4.	356 mg/l

Zone F -- Flat where 731 and tank are located.		
W11	Water sample from large puddle between log pile and W10.	102 mg/l
W10	Water sample from large puddle with tadpoles and vegetation north of log pile.	113 mg/l
W4	Water sample between log pile and wide ditch.	>650 mg/l
W2	Water sample from west of 731.	>650 mg/l
S5	Soil sample from disturbed soil above wide ditch.	192 mg/l
W1	Water sample from wide ditch east of 731.	595 mg/l
W13	Water sample from east of 731 in wetland area about 100 feet beyond edge of site.	57 mg/l

Zone G -- Bench between flat for 731 and paved road and bank above paved road.		
W8	Water grab sample from flow in ditch along well access road between tank and paved road.	trace
W15	Water sample on bench below wide ditch from flat (Zone F).	595 mg/l
W14	Water sample from about 100 feet east of well site in standing water amongst cattails.	trace
W7	Water grab sample from flow down bank above culvert.	42 mg/l

Zone H -- Poca River Road and two culverts under road draining water from site and other water.		
W20	Water grab sample taken from flow into western culvert at culvert mouth.	trace
W5	Water grab sample taken from flow into eastern culvert at culvert mouth.	57 mg/l
W6	Water grab sample taken from flow into eastern culvert at culvert mouth after heavy rain.	49 mg/l
W21	Water grab sample from Pocatalico River west of site.	trace
W9	Water grab sample from Pocatalico River east of site.	trace

High Chloride Locations

Testing showed a clear line of pollution from the pit, down the fill slope, through the log pile, past well 731, and onto the bench below. At each point a sample tested for chloride above 500 mg/l, many samples found much higher concentration.

No significant chloride concentrations were found in Zone A (the cut slope above well 1492) or Zone B (the well pad for 1492). In Zone C, samples S7, S9, W18 and W19 found concentrations of chloride in various locations in the pit area ranging from 383 mg/l to >650 mg/l.

Drainage from the pit in Zone D on the fill slope again showed elevated chloride in samples S1 and S3 (285 and 513 mg/l respectively). A sample taken on the fill slope away from visible drainage from the pit (sample S6) showed <30 mg/l chloride.

High chloride concentrations in the log pile (Zone E) in samples S2, S4 and W3 (from 285 to >650 mg/l) and flat around well 731 (Zone F) in samples W1, W2, and W4 (from 595 to >650 mg/l) document the pollution's travel from the pit.

The bench below well 731 (Zone G) again had a sample with high chloride concentration (595 mg/l). The pollution's high chloride concentration becomes diluted when it mixes with water from other sources before entering the river.

Areas outside this main flow of pollution show no or relatively low contamination. A sample (W13 -- 57 mg/l) taken in the wetland to the east of the wells shows that the effects of the pollution have not been narrow. Similar samples to the west (W10 and W11, the former with 113 mg/l) show how broad the affected area is.

Conclusions

We believe that several factors contribute to the widespread pollution we found at this site. We believe the operator built the pit on a spring or in a stream's flow. We also believe that the pit was inadequately closed and had insufficient cover.

According to state regulations, the operator did nothing wrong. There is no requirement for a minimum distance between the bottom of a pit and ground water (or prohibition for locating a pit on or in a stream or pond). There are no specific closure requirements for a pit and no requirement for the amount of cover.[4]

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[4] West Virginia's regulations are found in 35CSR4. Compare with Commonwealth of Pennsylvania, *Pennsylvania Code, Chapter 78.62*, subsections (A)17 and (A)18. These require encapsulation of the pit's contents and a soil cover of at least 18 inches.

While the amount of measurable chloride leaving the site and entering the Pocatalico River was not a dangerous concentration at the time of our tests in June 2009, it is significant that we could track pollution from the pit crossing hundreds of feet to the river. Our tests were for chloride only and did not measure other possible pollutants, carried by chloride as compounds or mobilizing on their own. These possible pollutants would include heavy metals, organic compounds and radionuclides.

The operator is in violation of federal and state secondary containment requirements for the large condensate storage tank.[5] We believe the operator is also in violation for polluting the waters the state.[6]

Sources

Commonwealth of Pennsylvania. *Pennsylvania Code, Chapter 78*. Website accessed October 28, 2009. http://www.pacode.com/secure/data/025/chapter78/chap78toc.html#78.62

George Monk and Molly Schaffnit. *Environmental Assessment -- Chloride Testing*, Sootypaws website. http://members.citynet.net/sootypaws/Woods/gaswell/comments/otherwells/other/environmental2.html

George Monk and Molly Schaffnit. *Wells Operated by Various Companies*, Sootypaws website page for 47-079-01492. http://members.citynet.net/sootypaws/Woods/gaswell/comments/otherwells/other/1492.html

George Monk and Molly Schaffnit. 2009. *Interim Environmental Assessment for 47-079-00731 and 47-079-01492, Putnam County, West Virginia*. [link]

United States. *SPCC Regulations*. 40CFR112. http://www.access.gpo.gov/nara/cfr/waisidx_08/40cfr112_08.html

West Virginia. *West Virginia Code*, Title 22, section 6, subsection 7. http://www.legis.state.wv.us/WVCODE/ChapterEntire.cfm?chap=22&art=6&section=7#06

West Virginia. *Code of State Regulations.* 35CSR1. http://www.wvsos.com/csr/verify.asp?TitleSeries=35-01

[5] The federal regulation is 40CFR112 and the state's is 35CSR1.7.

[6] Title 22-6-7(b) which states that it is unlawful to "allow pollutants or the effluent therefrom, produced by or emanating from any point source, to flow into the water of this state."

Photograph 1. Sedimentation control at this site was either lacking or insufficient. Sedimentation control structures were renewed between 12 January 2009 and 26 February 2009. This straw bale was improperly placed at this time.

Photograph 2. The truck in the background is sitting on the well access road entrance. A culvert under the access road directs water to the western culvert. On 27 November 2008 the culvert was nearly plugged with sediment. When sediment structures were renewed in early 2009, three straw bales were placed in the sediment trap. When this photograph was taken, the sediment trap has been completely plugged and the tops of the straw bales are barely visible in the middle of the photograph. Water can be seen running in the road toward the western culvert.

Photograph 3. This photograph was taken looking north down the well access road. The blue truck is parked by South Poca River Road and the large blue condensate storage tank is to the right. The trench through the tank's secondary containment is visible. The water bar constructed on the access road is in the middle of the photo.

Photograph 4. This is the drilling waste pit as seen on 12 January 2009, looking east. The extent of the slip is apparent. The black material is pit liner and the orange is fallen fencing. There is almost no freeboard at the northeast corner of the pit.

Photograph 5. This is the closed pit, looking toward the northeast corner as in Photograph 4. Standing water is readily apparent. The main drainage point is to the left edge of this photograph. Secondary drainage points are to the east and northeast sides of the closed pit area.

Photograph 6. This was taken looking north from the closed pit. The main and the smaller side log piles are visible, as is the separator for well 731. The drainage ditch to the east of the separator drains the flat that 731 sits on. The Pocatalico River is visible through the trees.

Photograph 7. This was taken looking north down the fill slope below the closed pit. Drainage erosion is visible as well as liquid drainage closer to the log pile.

Photograph 8. This was taken looking up the fill slope. The main drainage for the closed pit is behind Molly. The red circle shows the location for sample S6, away from the drainage.

Photograph 9. This is the flat where 731 sits, looking east. The wellhead for 731 is visible to the left. The main log pile is to the right.

Photograph 10. This is same flat for 731, looking east. The access road angles upward toward 1492's pad. Large pools of standing water were between the log pile and the large condensate storage tank. We saw tadpoles here.

Photograph 11. This is the ditch to the east of 731, draining water from this flat area. A water test is being done (W1 595 mg/l chloride) using a Hach test strip clipped to a wood shim stuck in the mud. Deer tracks are evident in the foreground.

Photograph 12. To the east of the previous photograph's location is a wetland with a large stand of cattails.

Photograph 13. Visible signs of pollution in the area of the closed pit included unnaturally colorful drainage.

Photograph 14. This was taken of water ponding between 731 and the log pile. The iridescent sheen here is caused by iron-loving bacteria. Other sheen did not break up into blocks like this and was caused by oil.