



Orphan Well Oil Spill, Warren County, Pennsylvania
The "Confluence Well"

WELL PLUGGING REPORT

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HISTORY: In late 2016 an oil well adjacent to the Tionesta Creek began to leak oil. Several barrels of oil were on the ground and oil had reached the Tionesta. The well had not been operated in many decades, and given the lack of an owner of record the Pennsylvania Grade Crude Coalition (PGCC) volunteered to install plugs and valves on the well to stem the flow of additional oil.



November 28, 2016: oil reached the Tionesta

PGCC also suggested that a biopod be constructed at the site to treat the spilled oil via bioremediation. Bioremediation is a natural attenuation mechanism; microbes found naturally in the soil use the paraffin based oil as a food source, and the digestion process breaks down the oil. Although employed in other states, bioremediation is not regularly used in DEP monitored oil cleanup.

Mr. Scott Perry, DEP Deputy Secretary, was personally involved in the decision to allow bioremediation. To provide information about bioremediation PGCC sponsored two seminars, the first by Dr. Kerry Sublette, Professor of Chemical Engineering at the University of Tulsa, OK, and the second by Vincent Zenone, OSC, U.S. Environmental Protection Agency. Both seminars were well attended by DEP staff and the seminars successfully brought about a greater understanding of the function and potential of bioremediation.

Cameron Energy Company, a PGCC member, volunteered to build and maintain the biopod. An area near the well site was selected and the several barrels of spilled oil, plus the contaminated soil, were moved there. Vegetative matter was added and the mixture was tilled into the ground. Upon the advent of warm weather (when microbes become active) Cameron tilled the biopod regularly to provide oxygen and to better expose the oil to the microbe activity.



Crude oil collected from the abandoned well spill is poured on the ground and cultivated into the soil to create the biopod where microbes digest the oil.

Meanwhile, at the abandoned well, the plugs and valves were not sufficient to stem the flow of oil and the need to plug the well became evident. The DEP's plugging funds were not sufficient to plug the well; DEP planned to contact the EPA to request the EPA plug the well.

PGCC president, David Clark, has called his trade group members to action by suggesting they be "caught doing something good." Plugging abandoned wells meets that call since conventional oil and gas operators are uniquely poised with the equipment and expertise to address abandoned wells. In that spirit PGCC member Cameron volunteered to plug the well.

USE OF THE GOOD SAMARITAN ACT: The Good Samaritan Act encourages the voluntary reclamation of lands by limiting the liability of a volunteer. The Act has not been commonly used in the context of oil and gas well plugging. However, DEP Geologist Manager Seth Pelepko, District Manager Craig Lobins and other DEP staff worked with Cameron to facilitate the application and to provide the other permitting (stream crossing and well plugging) necessary to advance the project. To create a plan of operations numerous on-site meetings were held in May, July and August 2017.

The Good Samaritan Act has numerous requirements including notification of neighbors, publication in the PA Bulletin, and the obtaining of permission to proceed from the surface owner, in this case the United States Forest Service. The Good Samaritan requirements and biopod application were new circumstances for the Forest Service and additional meetings, with the Forest Service, were held at the well site in July and August.

To address the Forest Service questions PGCC held a bioremediation seminar in Warren that was attended by EPA, the Forest Service, DEP and conventional oil and gas operators. The seminar concluded with an impromptu visit to the well site with Allegheny National Forest Supervisor Sherry Tune. Forest Service concerns were addressed with changes to the operating plan; local Forest Service staff assisted by expediting tree-marking and resource delineation.



From left to right: Forest Supervisor Sherry Tune, Cameron president Arthur Stewart, and DEP Deputy Secretary Scott Perry at the well site.

Plugging the Well: Plugging operations began September 6, 2017 and concluded two weeks later. Cameron mobilized its tracked equipment (service rig, dump truck, etc.) thus minimizing the need to stone and otherwise improve the 1/3 mile access road to the site. This reduced both cost, earth disturbance, and energy consumption. E & S controls were installed along the access road.



Access Road E &S measures.

Access to the site required a stream crossing. With the cooperation of the Forest Service Cameron cut small poles at the site which it used to armor the stream banks. DEP approved a late change to the operating plan to allow additional mechanical transport across the stream. The tracked dump truck proved an effective tool, its wide tracks creating minimal disturbance.



The wide tracks dispersed vehicle weight resulting in minimal impact.

The clearing and improvement of the access road, installation of E & S controls, movement of materials across the stream, and site setup required five days. The tracked rig proved an important tool; setup of a non-tracked rig, while not impossible, would have required significant excavation and the installation of many loads of stone on both banks, many more crossings of the stream, and significant upgrades of the access road to accommodate the stone deliveries. Without tracked equipment the project would have required at least an additional week.

The well proved to have a significant quantity of oil remaining in the well bore. Before it was abandoned the well was fitted with a gas escape packer. At the time of plugging about 15 to 20 barrels of oil were under that packer, and when the gas escape tubing was removed (and the freshwater resting above the packer displaced below it) that oil flowed to the surface. The escaping oil was contained in a lined pit and was later removed to a small vacuum truck. Given the well's condition it is quite certain the well would have continued to spill oil upon the ground for many years to come.



A solid stream of oil flowed for more than two minutes.

The weather remained dry and stream conditions low during the entire two weeks consumed by the project. Cement was applied to the well without incident on September 14, 2017, and the next day the rig “tagged” the cement, showing the cement had settled at the proper depth. Thereafter significant restoration measures were undertaken. The oil soaked soil around the well site was collected and added to the biopod. (The plan called for up to five barrels of oil to be added to the biopod. However, the well flowed significantly more than that amount and the oil was removed from the site.) The well was monumented and all work areas were seeded and mulched.



Biopod delineated by silt fence and “confluence” area seeded and mulched.



Stream crossing restored, seeded and mulched.

Not counting hours devoted to the planning meetings, the administrative tasks involved in the application documents, or the hours devoted to care of the biopod, the man-hours for the plugging operation were slightly more than 400. Major items of equipment employed included tracked rig, tracked dump truck, excavator, bulldozer, vacuum truck, pipe trailer, cementer, two tanks and the trucks and trailers necessary to mobilize the equipment to the site. Adding the costs of equipment, E & S and plugging supplies, and labor, the cost of the plugging operation exceeded \$40,000.

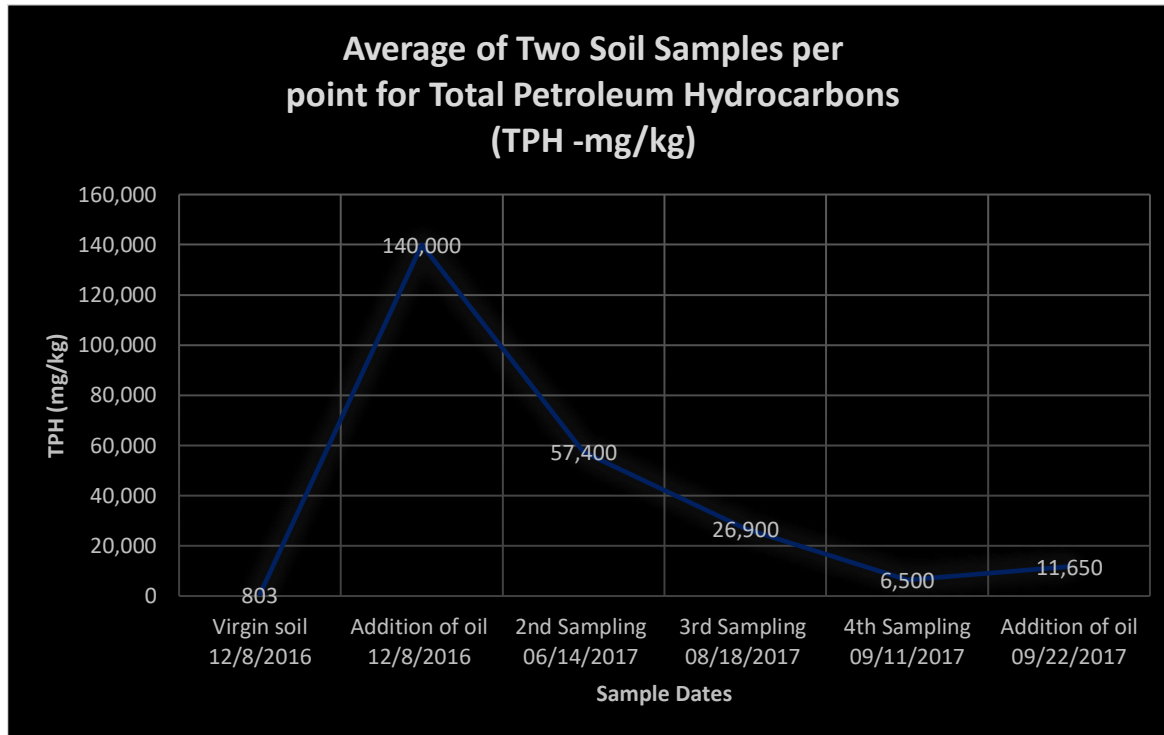
Naming of the Confluence Well: Due to the running water on each side of the well it was originally termed the island well. However, in reality the well is at the confluence of two streams. More important, the project required the coming together of private industry, the DEP and the Allegheny National Forest. In respect of the latter it was agreed to rename the well the “Confluence Well.”

Bioremediation: To date the bioremediation effort has consumed more than 100 man hours. Those hours include the initial creation of the biopod, the cultivation of the biopod (on average at least two times per week throughout this summer’s growing season), and the periodic introduction of vegetative matter, lime and fertilizer.

The bioremediation was successful sooner than anticipated. Before biopod construction the total petroleum hydrocarbons (TPH) found naturally in the soil were slightly less than 1000 mg/kg. After construction of the biopod the TPH shot up to 140,000 mg/kg. Since then the TPH has steadily declined. By June it was cut in half to about 60,000 mg/kg. By August it was cut in half again to slightly under 30,000 mg/kg. By September 11th the TPH fell to 6500 mg/kg. The EPA considers 10,000 mg/kg to be a satisfactory outcome. The EPA hopes for those results over the course of two growing seasons—PGCC’s successful results were achieved in one season.

There were successes beyond the TPH content. The DEP acknowledged that in the plugging of orphan wells the focus is on well plugging rather than site restoration. The biopod at the confluence well

afforded a cost-effective cleanup of the spilled oil and contaminated soil to a condition better than required in an orphan well situation. That was a success for the surface owner (Forest Service) and the community. Also successful was the good attendance at the seminars; the attendance and statements by the DEP throughout the process demonstrated an openness to the application of bioremediation in other spill or plugging situations.



Bipod TPH results

Lessons:

- 1) Leadership from the Top: Mr. Perry routinely communicated the message that the project would succeed; that message motivated all involved. In approving the bioremediation experiment Mr. Lobins included a “thank-you” in his note. Those words of appreciation were a significant motivator. At the ANF Jim Seyler found a solution to the procedural problems that could have stymied the Good Samaritan application. Sherry Tune broke a logjam when she suggested an impromptu site visit immediately following the bioremediation seminar in Warren.
- 2) Solutions from the Trenches: The folks who are in the woods every day brought assistance in several ways. ANF field staff offered to help cut trees and had an eye for finding the most efficient access routes. The DEP field staff suggested E & S measures that were practical and, in the main, cost effective.
- 3) Benefits of bioremediation: Treating the oil and contaminated soil at the site, rather than removing it, yielded multiple benefits. For the operator it is cost effective. For the environment it is minimally intrusive, meaning there is minimal disturbance from the hauling. Additionally, treatment on site is a desirable environmental choice in that foreign soil is not substituted for that which is removed. The latter benefit was a major focus of the positive remarks by Forest Service Regional Minerals Program Manager, Theresa Bodus, who has over twenty years’ experience with bioremediation.

- 4) Bioremediation site: This project provided an accidental test as to the siting of a biopod. Due to the proximity of the flowing streams this was not the perfect bioremediation site. PGCC “backed into” this site because the project began merely as a volunteer effort to clean up the oil spill. Several months later, when the project escalated to a well-plugging, the question arose whether the biopod could be expanded to receive oil and soil from the plugging process. The biopod worked with remarkable speed, suggesting that excellent results can be achieved even at imperfect sites.
- 5) Equipment on tracks and skids: That the major equipment was brought on site either upon tracks or skids resulted in significantly less roadway preparation, reducing cost, earth disturbance and energy consumption.
- 6) Underhand or overhand: One of the DEP staff overseeing the project notes that basketball points count regardless of whether the ball goes through the hoop underhand or overhand. With the plugging of the well there were multiple ways to achieve each step, be it the location of the stream crossing, the specific E & S controls to be put in place, and the like. During the planning process there were many decision-makers on site, some committed to overhand style, and others to underhand. The project was served at several points by the reminder that the points count either way.



Scoring points: permission to cross the stream with the trailer allowed 3” water string to be installed in the well, thus better protecting the water aquifers during the plugging operation.