

CHLORINATED HERBICIDE LEACHING FROM UTILITY POLES AND POTENTIAL IMPACT ON PRIVATE WATER WELLS: FIRST DOCUMENTED CASE FROM INDIANA

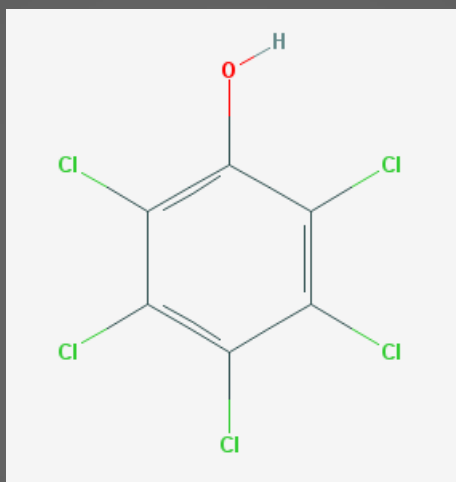
Indiana Academy of Science
Annual Meeting
March 24, 2018

Rachel Walker, PhD, L.P.G.
John A. Mundell, P.E., L.P.G.



What is Pentachlorophenol (PCP) and how is it used?

- PCP is a white organic solid with a phenolic odor.



- Was widely used as a herbicide and insecticide, but banned in 1987 for most uses including sales to the public.
- Currently a restricted use preservative for treating wood utility poles, railroad lumber and wharf pilings.



Pentachlorophenol (PCP) wood treatment



Wood is pressure treated in a retort with a solution of PCP suspended in a petroleum carrier oil.

After pressure treatment, wood is subjected to a vacuum to remove excess liquid.

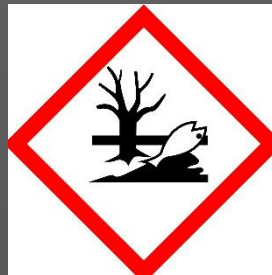
Wood poles are then removed from the retort and stored on a drip pad until dripping has ceased.

Poles are then stored in open yards until used.



Health Impacts of Pentachlorophenol

- Considered a probable human carcinogen.
- Contact can irritate the skin, throat and nose and burn eyes.
- Exposure can cause headaches, sweating, trouble breathing, high fever, pain in the chest and abdomen.
- Long-term contact can cause liver and kidney damage.
- Current residential tap water screening level is **1 ppb**.



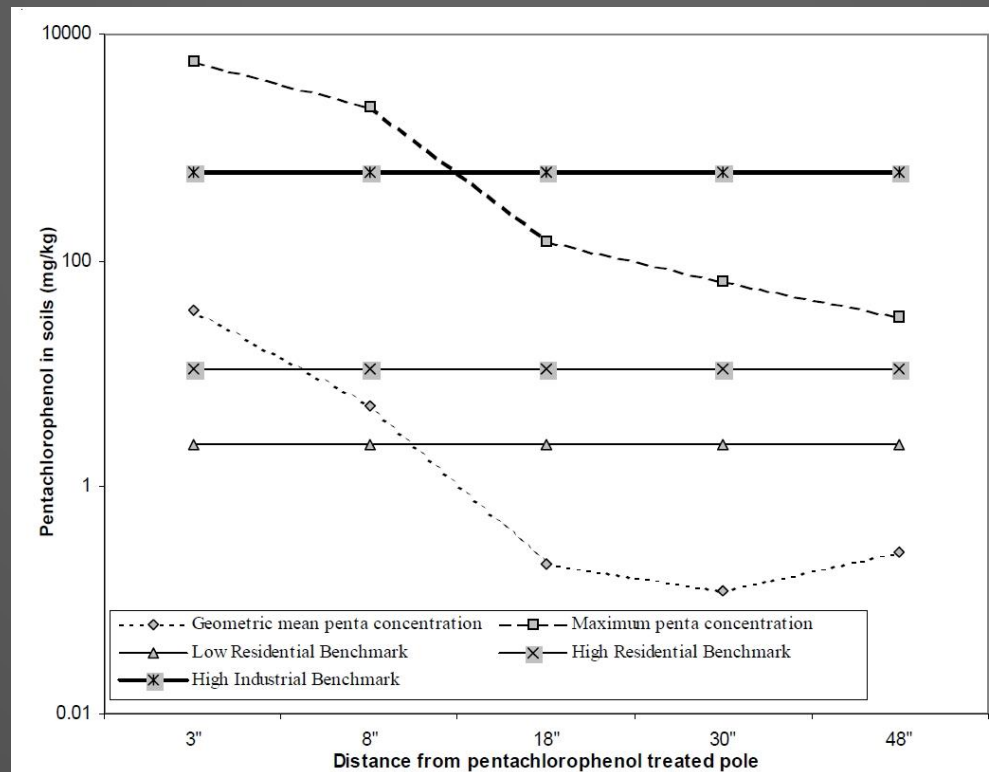
PCP and the environment

- Wood preservatives such as PCP have been shown to migrate from utility poles into the environment.
- PCP has low mobility in clay soils and moderate mobility in silty and sandy soils.
- PCP is less mobile at lower pH and more mobile at higher pH.
- In alkaline soils, PCP reacts to form calcium or sodium pentachlorophenate which are highly mobile.



PCP and the environment

- Industry studies of PCP in soil around poles noted that most of the PCP was in surface soils within 3 feet of the pole.
- One study noted that at sites where the pole base was near the water table, maximum PCP concentrations occurred in soils below the water table – but they didn't test groundwater!



PCP and the environment

- The average 45 foot long pole, 12 inches in diameter, contains between 13 and 35 pounds of PCP.
- Overall, industry studies anticipated that a limited extent of soil and groundwater would be impacted as a result of PCP leaching from individual utility poles.
- **PCP leaching behavior in subsurface soils and groundwater is not well understood.**



Private water well contamination cases: Vermont

- 2009 - PCP contaminated a shallow bucket well from a wood pole 40 feet away. Testing revealed the well had a PCP concentration of 2,006 ppb.
- 2009 - PCP contamination in a private spring. Three new PCP treated wood poles had been installed upgradient of the spring. Water tests revealed a PCB concentration of 7 ppb.
- 2014 - PCP contamination in private spring. Treated wood utility structure 45 feet upgradient from the spring. PCB levels in spring water exceeded 1 ppb.



Private water well PCP contamination cases: Vermont

A Vermont workgroup recommended in 2015 that:

“To help to protect human health and the environment, Vermont utilities, and their contracted entities, should implement the BMPs developed by this group to minimize environmental releases of pentachlorophenol.”

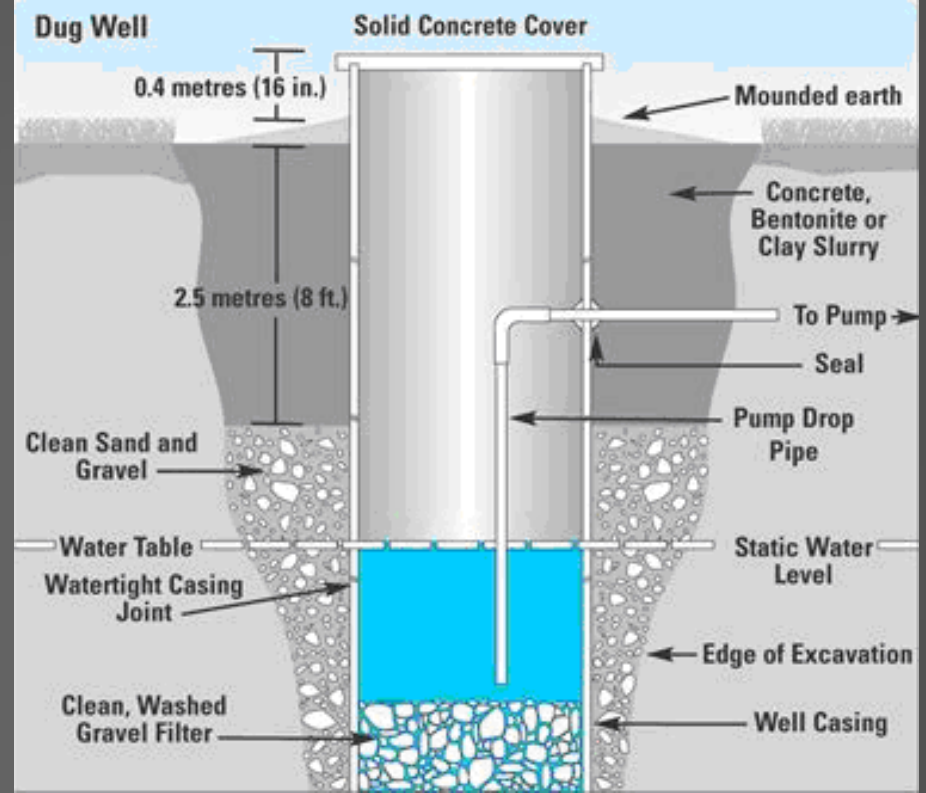


Southern Indiana Case

- County utility installed PCP treated wood poles in June 2015 - all houses had private water wells.
- Resident of one house complained of water smelling like 'kerosene' in July.
- Water tests revealed PCP concentration of 2,280 ppb.
- Wood poles removed and replaced with steel poles in August 2015.
- All wells in area were large diameter shallow bucket wells.



Bucket Wells



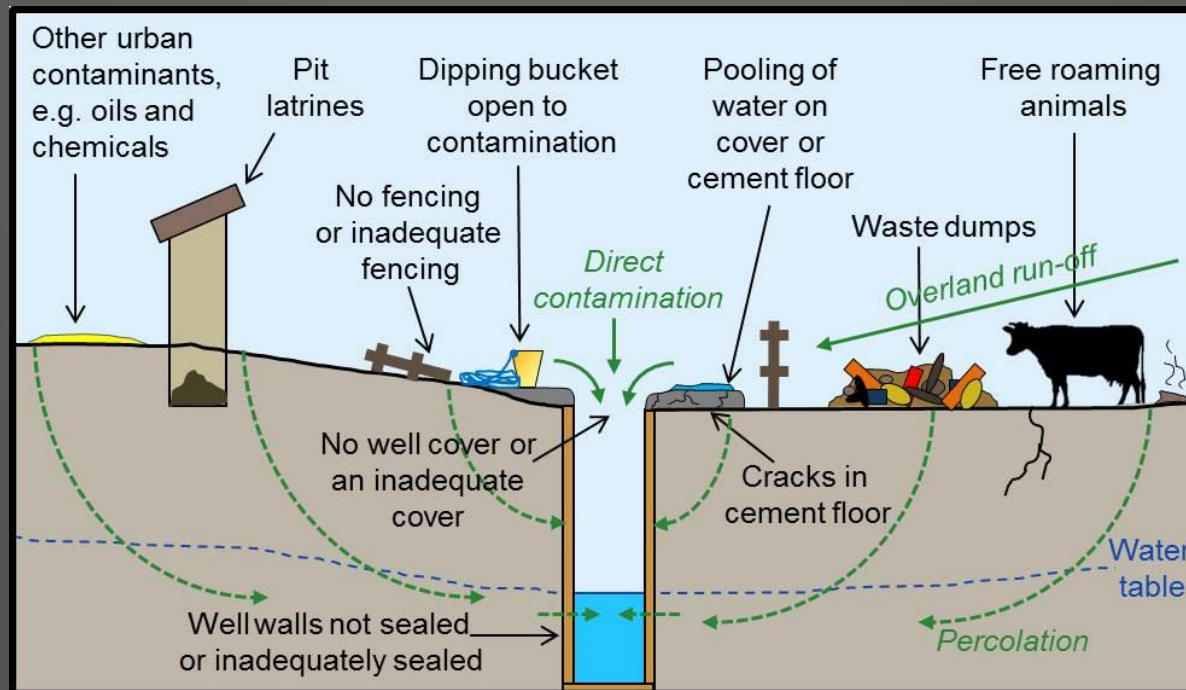
Typically used in low yield areas as they act as a storage tank that can buffer usage.

Area bucket wells produce from thin seams of coarse-grained material, ~35-50 feet deep with 36 inch diameter concrete casing.



Problems with Bucket Wells

- Prone to surface water influx if not properly sealed around the top.
- Many bucket wells may even rely on surface water as part of supply to the well.
- Although the joints between concrete sections should be sealed, they often allow sediment to ooze into the well.



Southern Indiana Case

- A second well with 2.1 ppb PCP dropped to non-detect after one quarter of monitoring. This well has been non-detect for eight consecutive quarters – monitoring no longer required.



- The well with 2,280 ppb PCP continued to have detections above the 1 ppb screening level - why?

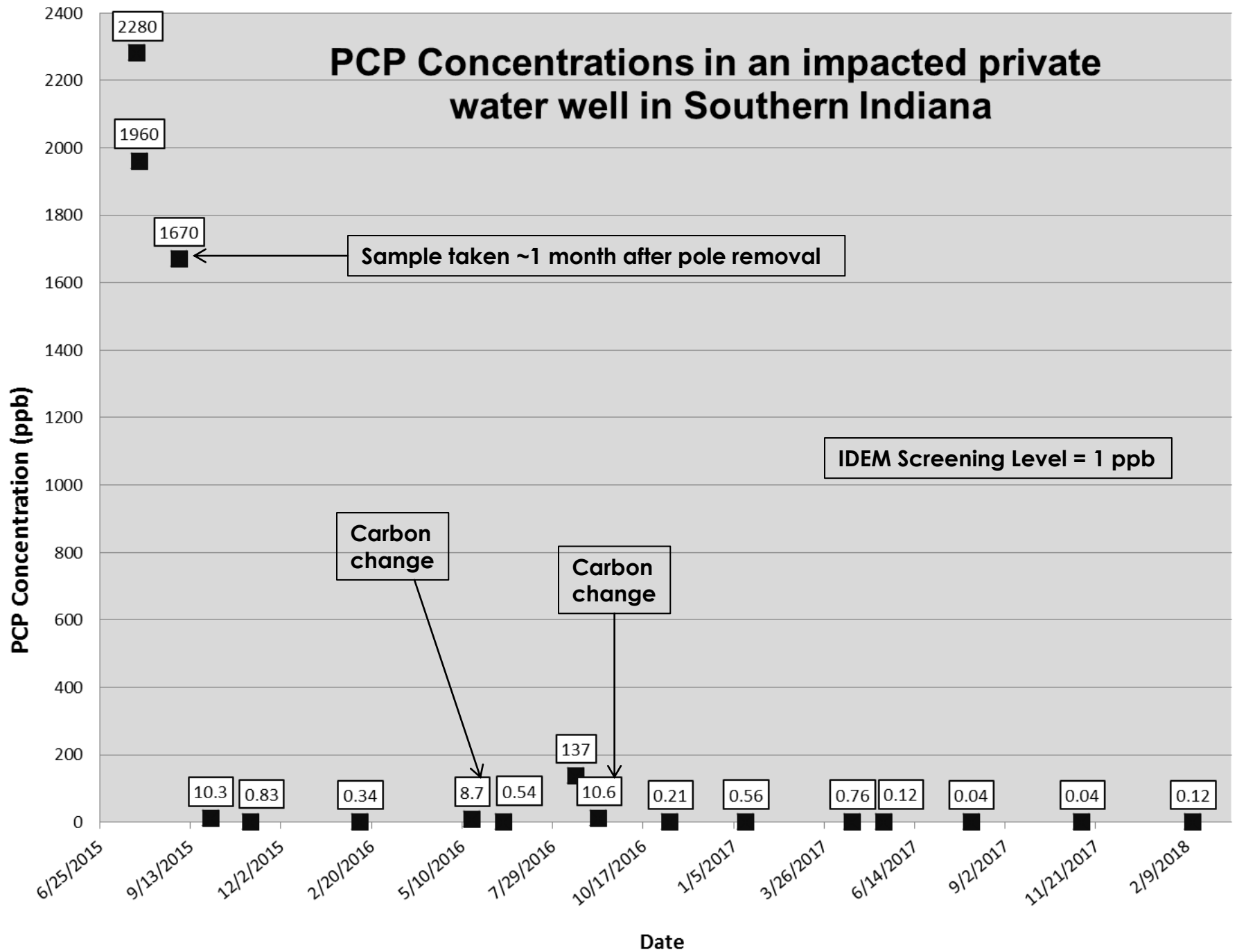


Southern Indiana Case – Recalcitrant Well

- Well is located 54 feet from the poles, lines up exactly downgradient for groundwater flow.
- Site is flat and water pools across yard in heavy rain.
- The continued presence of PCP after pole removal indicated that PCP had leached from the pole into site soils.



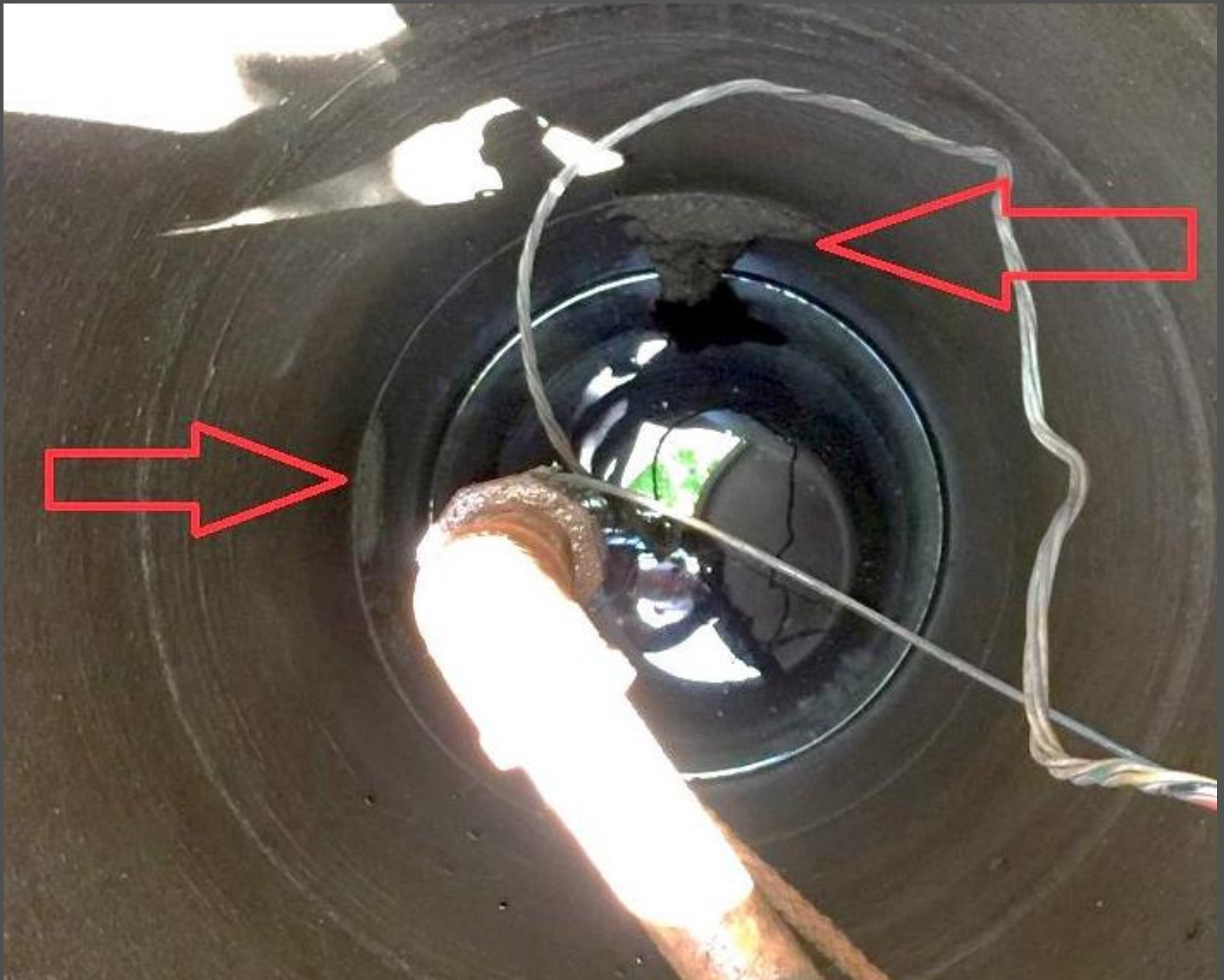
PCP Concentrations in an impacted private water well in Southern Indiana





Sediment Infiltration





Southern Indiana Case – Recalcitrant Well

- Sediment from inside well contained 0.034 mg/kg of PCP.
- Caulking interior of well may stop sediment influx but reduce water supply.
- Site borings indicated that moving well could result in loss of reliable water yield.
- Deep well not an option due to arsenic in bedrock water.
- Ultimately residents chose to stay with existing well and filtration system/monitoring regime.



Conclusions

- PCP leaching from wood utility poles can pose a contamination threat to shallow water wells.
- How far the PCP migrates from a pole is dependent on individual site conditions.
- Shallow bucket-style water wells are most at risk of contamination from PCP wood poles due to construction.
- Although the 'right' kind of site conditions for contamination to occur may be particular – there are ~36 million PCP treated wood poles are in service in the US.
- The potential for private shallow water well contamination is not insignificant.

