

Additional **Figures:**

Materializing Exposure: Developing an Indexical Method to Visualize Health Hazards Related to Fossil Fuel Extraction

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Figure 1: John Baker and the meat goats he raises with his wife Patricia on a ranch between Deaver and Frannie, Wyoming.



Figure 2: Current regulations merely require posting signs warning of the H₂S hazard on the wells' fencelines. These signs themselves are corroding.



Figure 3a: Jerome Meter (Arizona Instruments, LLC 2015): Jerome Meter made by s Instrument. This handheld device measures Hydrogen Sulfide digitally over the course of a few seconds (Arizona Instruments, LLC 2015: 2, 12).

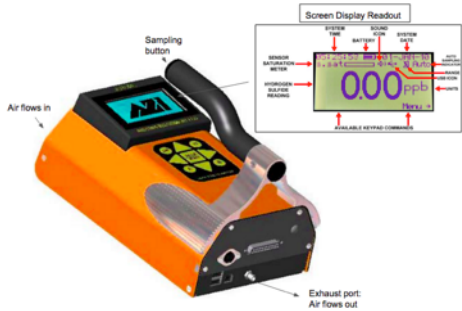


Figure 3b: The inside of a Jerome Meter and accompanying diagram of how it operates (Arizona Instruments, LLC 2017). The sample of air passes through sensing technology contained within the black-boxed body of the instrument. The gold film sensor is encased and sealed shut within the instrument.

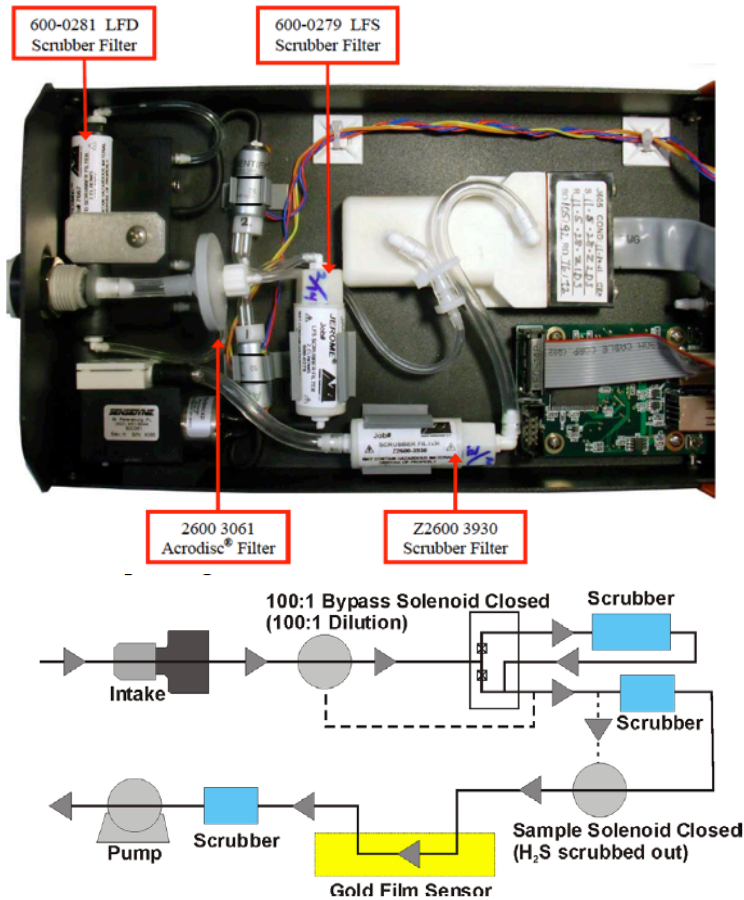


Figure 4: H₂S Photopaper Sensing Tool Components (<http://publiclab.org/wiki/hydrogen-sulfide-sensor>) Photo canisters, package of photopaper, scissors, and glycerol solution components used to make the H₂S sensing tool. H₂S reacts with the silver halide on the photo paper.



Figure 5: Horwell's results around Lake Rotorua. H₂S Distribution Map from Horwell et al. 2005. The map shows how volcanically produced H₂S travels through the city of Rotorua in New Zealand. The tarnished photopaper strips overlay a map with the locations in which they were placed over the course of 1 week. Darker squares indicate greater degrees of tarnish and higher levels of H₂S (Horwell et al. 2005: 264).

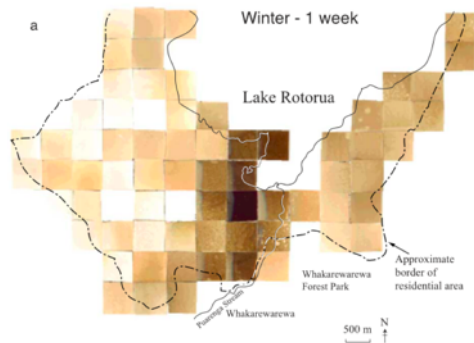


Figure 6: A data rich map combining the Bakers' exposure experiences with photographic paper results developed by Megan McLaughlin for the 1st Whitehouse Maker Faire (https://publiclab.org/notes/Sara/06-19-2014/report-on-1st-white-house-maker-faire-june-18th-2014).

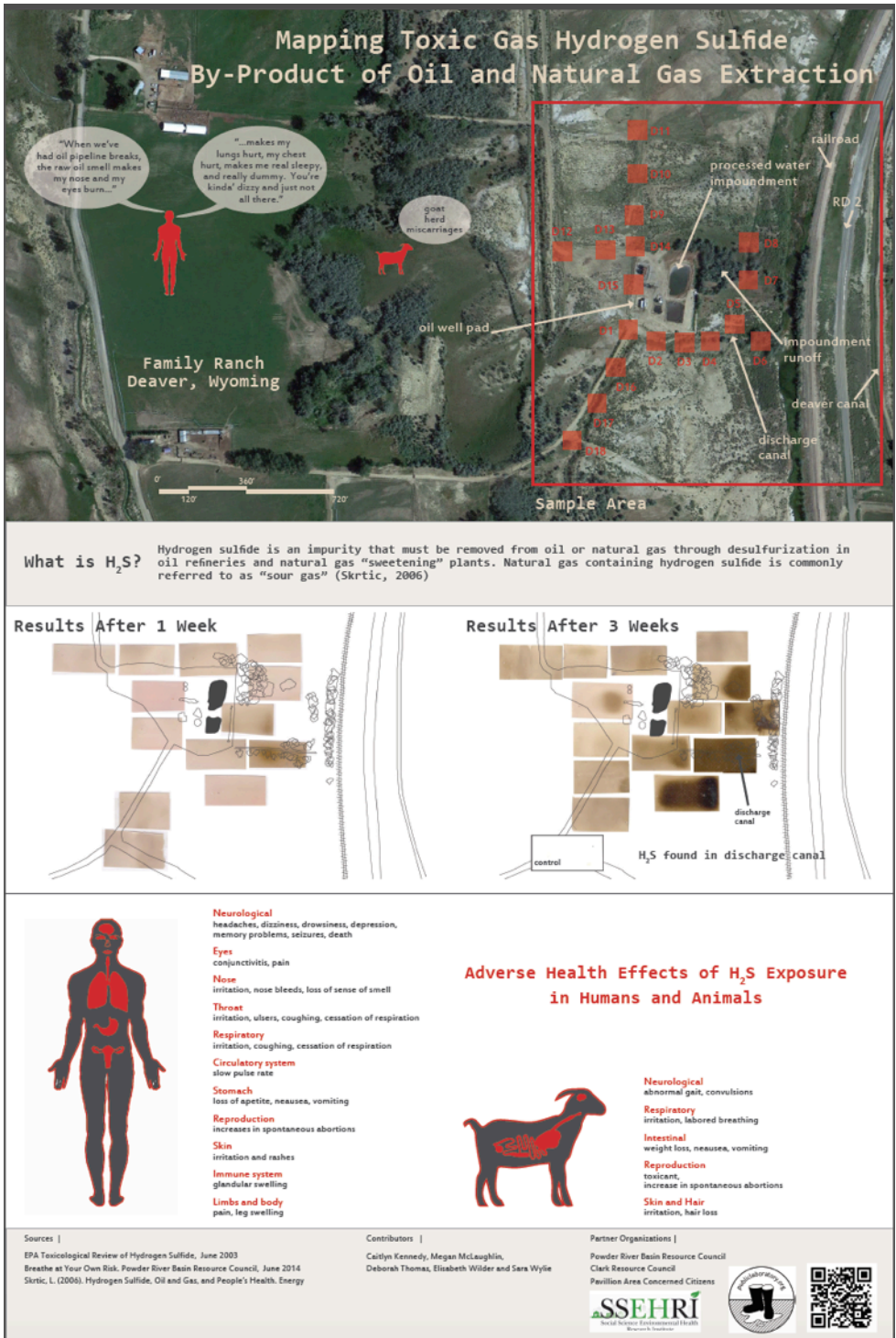


Figure 7: The Bakers' home is a third of a mile away from oil wells and the produced water pits that discharge into the irrigation system on their ranch

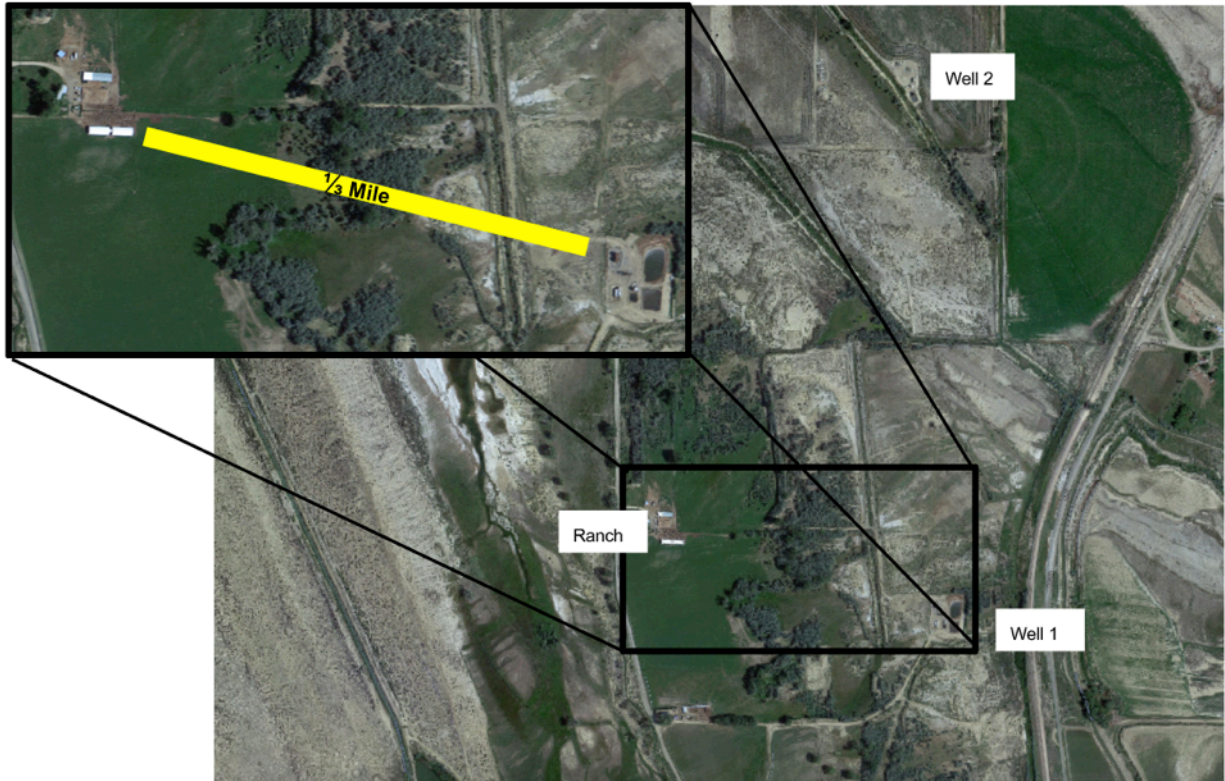


Figure 8: Series of impoundment/drainage/irrigation photos. In theory, the “impoundments” clean the wastewater by allowing heavy hydrocarbons, such as oil, to sink to the bottom of the pits and separate from the wastewater produced during extraction



Point 1: pump jack



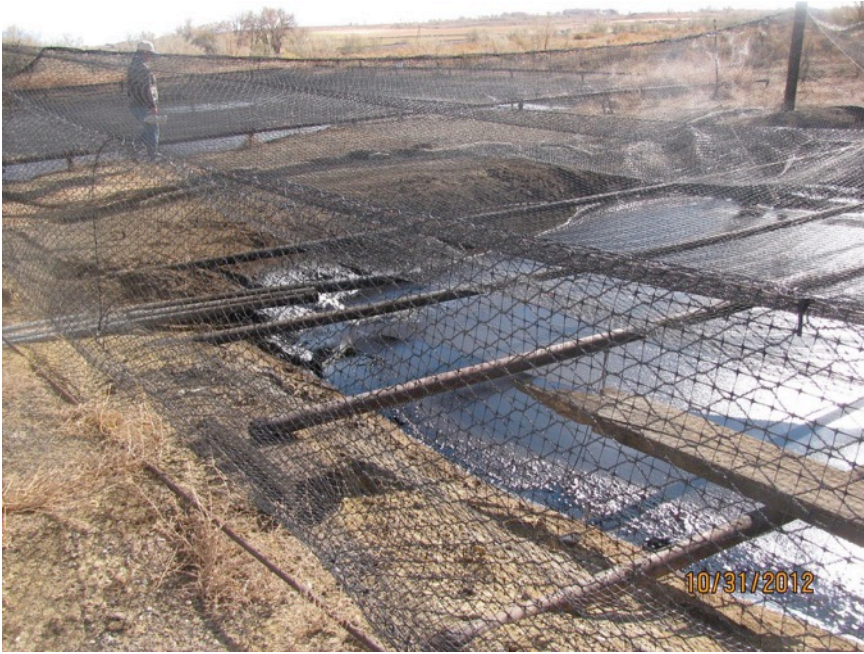
Point 2:



Point 3:



Point 4:



Point 5:



Point 6:



Point 7: After separation, the remaining water should meet the state's standard of clean up-- allowing it to be discharged into the irrigation system drains



Figure 9: For instance, we had to postpone testing on their property in the Spring of 2013 because they lost much of their goat herd when they kidded out (gave birth) too early in the year for the baby goats to survive



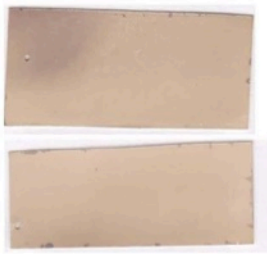
Figure 10: The Bakers', Deb, and her two interns conducted four rounds of testing for HS on their property- three trials of the photopaper and four Tedlar bag grab samples of air.



Figure 11: demonstrates that the duplicates all showed the same degree of discoloration, confirming the tests' consistency.

Deaver Round A

7/15-7/31 2013



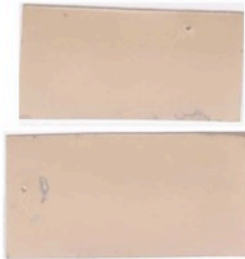
1



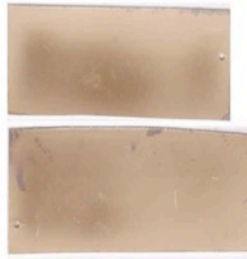
2



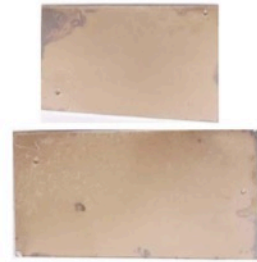
3



4



5



6

Figure 12: Photographic canisters testing locations on the Baker Ranch in Wyoming. Canisters were labeled and placed at set distances along roads surrounding a well. Image Courtesy of Caitlin Kennedy, 2013.



Figure 13 shows a canister in location



Figure 14: Some canisters were lost as they soon discovered how difficult it was to find the small canisters in the brush, other canisters were compromised by either the strips falling from the canisters or the canisters becoming dislodged. We also experimented with different approaches to presenting the data, here is test of how the strips looked over a black and white satellite image.

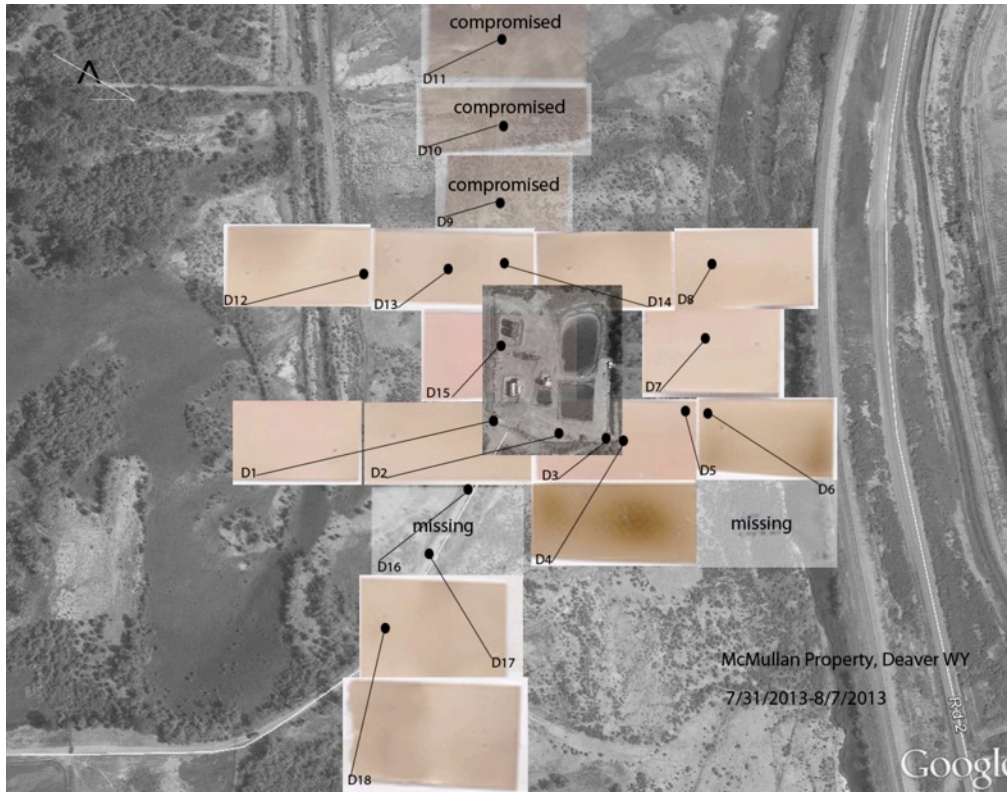
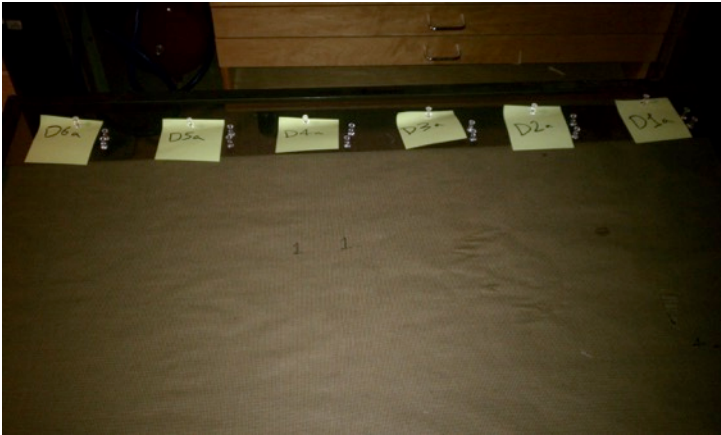


Figure 15: They capped each canister they recovered and mailed the collection back to Northeastern where we developed them in a standard photographic darkroom.

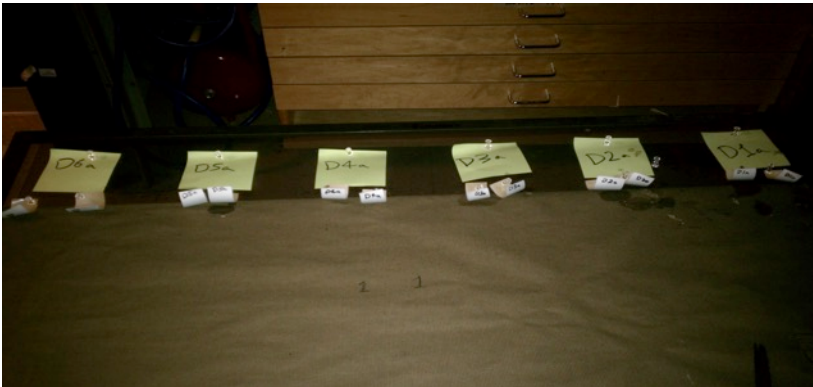
Round A: Drying Rack



Fix and Water Bath:



Round A: Strips Drying



Round B: Deaver





Round C Deaver:



Figure 16: Map of tarnished H₂S photo strips at a well site on Baker Ranch. Tarnished photo strips show areas with higher levels of H₂S. Points D9, D10 and D11 were compromised (knocked over or lost).

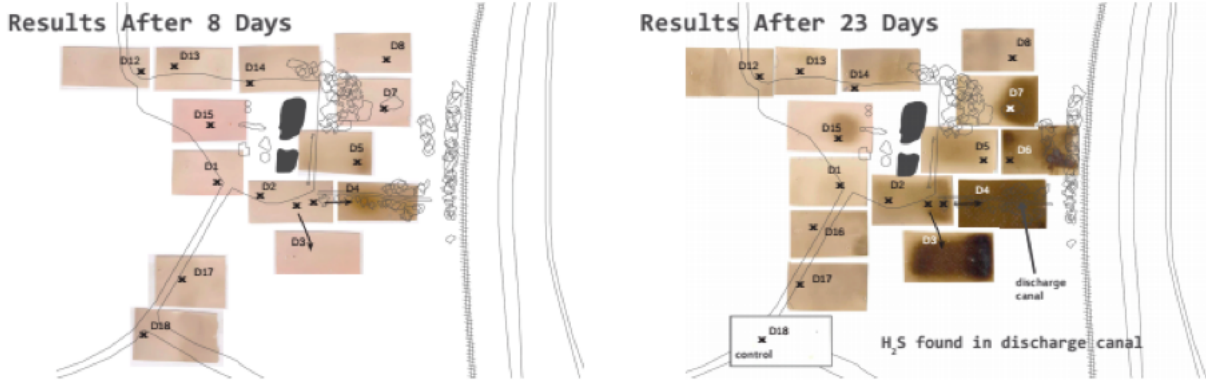
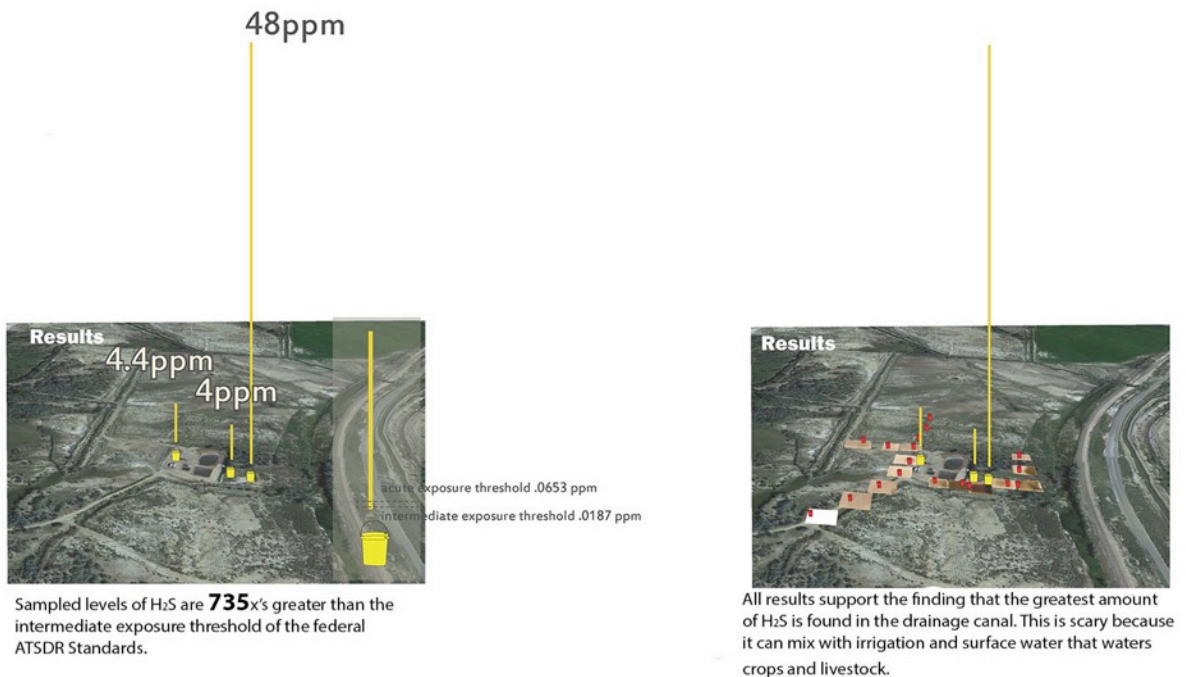


Figure 17: The locations and results of bucket samples. The first image shows the Tedlar Bag results from bucket testing on the Baker Ranch at 4 locations. Note that the grab sample of air taken at the point of discharge had 48 ppm of H₂S. This finding is supported by image 2 which shows both the bucket results and the photopaper results together. Both methods showed the highest degree of H₂S at the point of discharge (Image Credit: Meghan McLaughlin 2013).



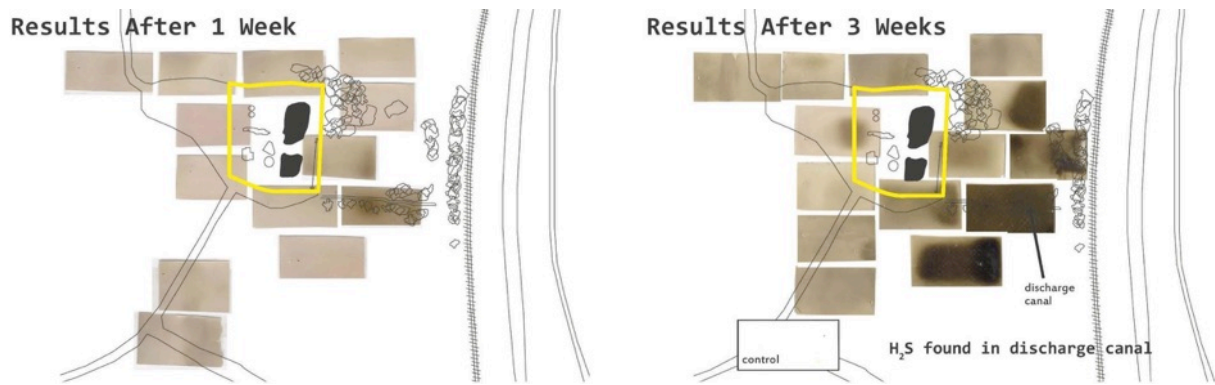


Figure 18: Boundaries of the leased well pad on the Baker Ranch, note that the H₂S travels beyond the boundary of the well site's property line (Image Credit: Meghan McLaughlin 2013).

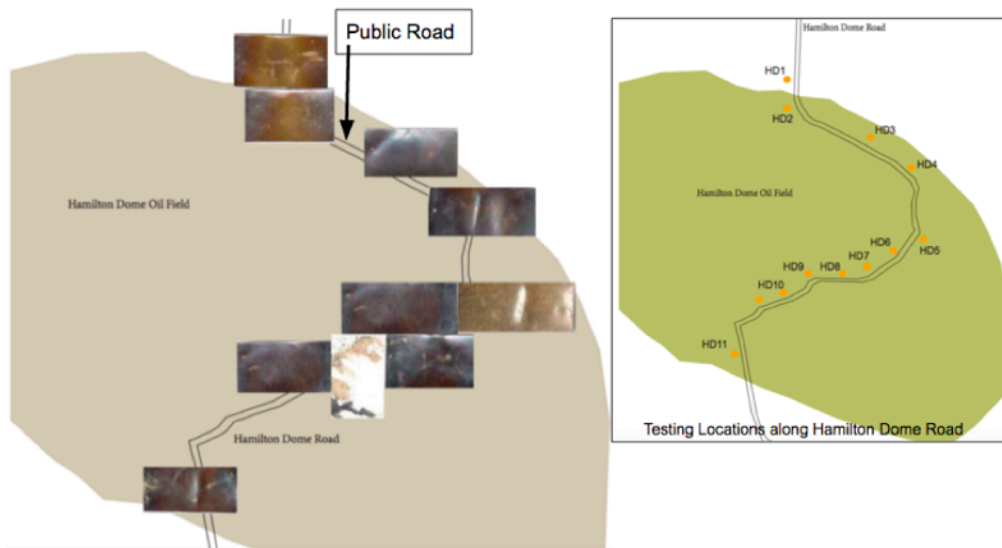


Figure 19: Shows results from testing along the well travelled public road in Hamilton Dome oil field. All recovered test strips showed tarnishing suggesting that H₂S from the field is contaminating public roads (Image Credit: Meghan McLaughlin 2013).

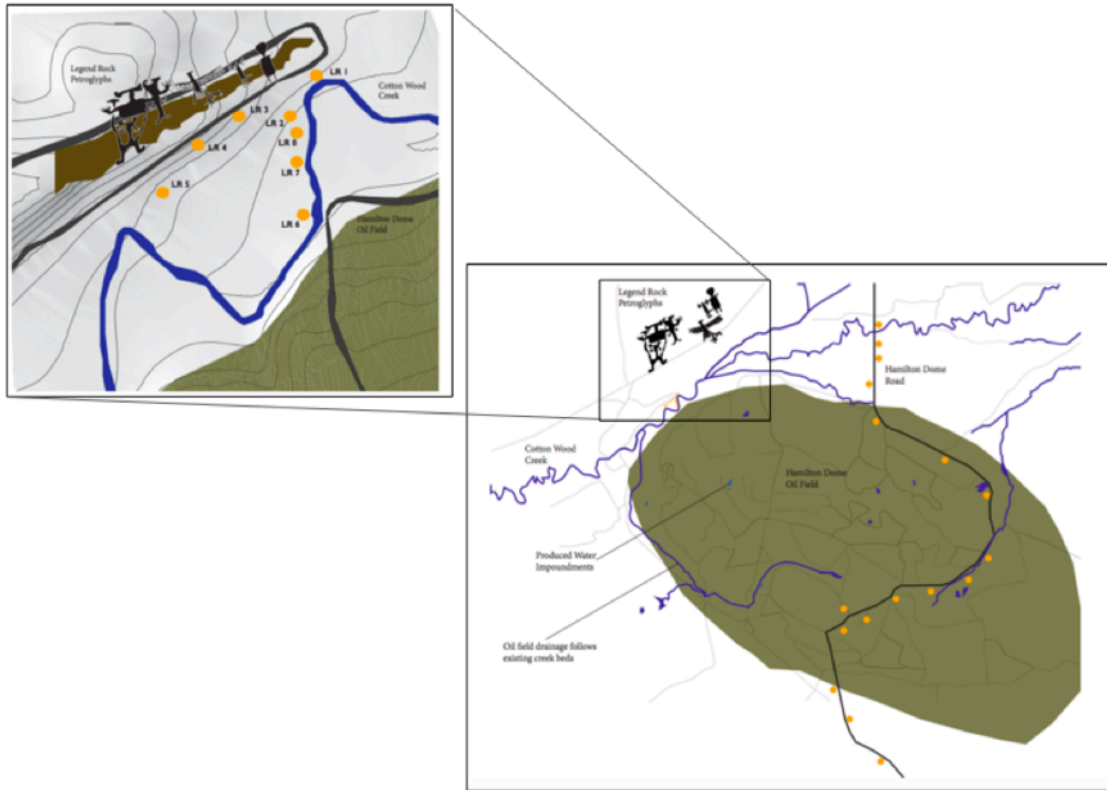


Figure 20: Shows the location of Legend Rock State Park in relation to Hamilton Dome oil field (Image Credit: Meghan McLaughlin 2013).

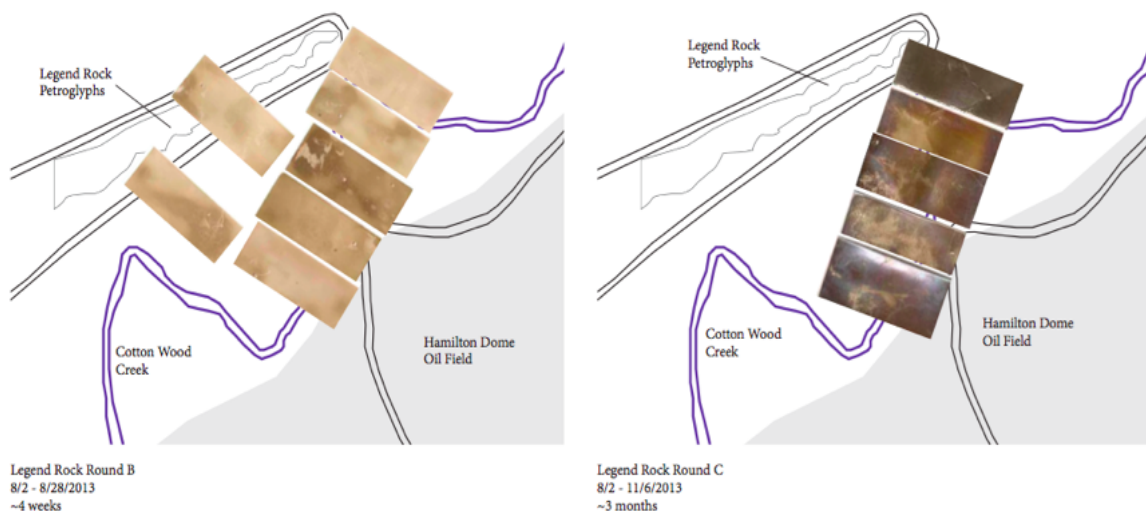


Figure 21: Map of tarnished H.S. photo strips at Legend Rock State Park over four weeks (upper left) and three months (upper right) Map of H.S. canister results from Elk Basin Oil Field in Wyoming (lower). Note that H.S. is found along the Public Road (Image Credit: Meghan McLaughlin 2013).

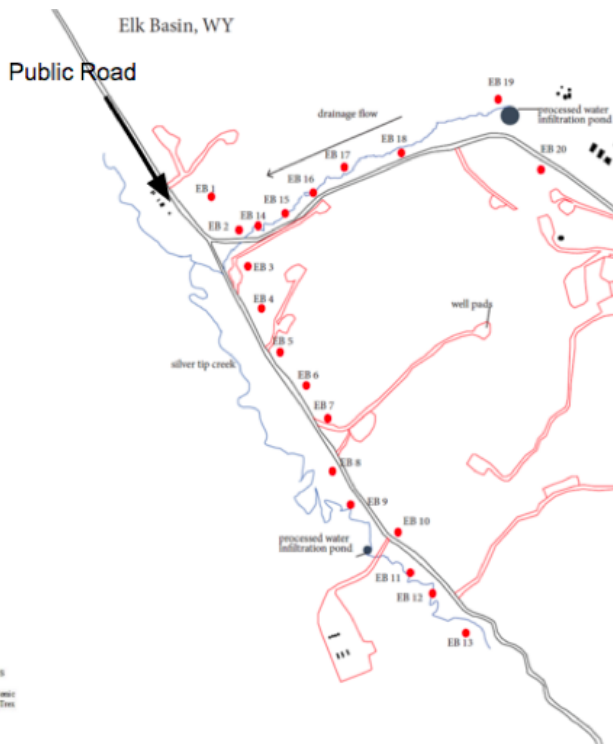
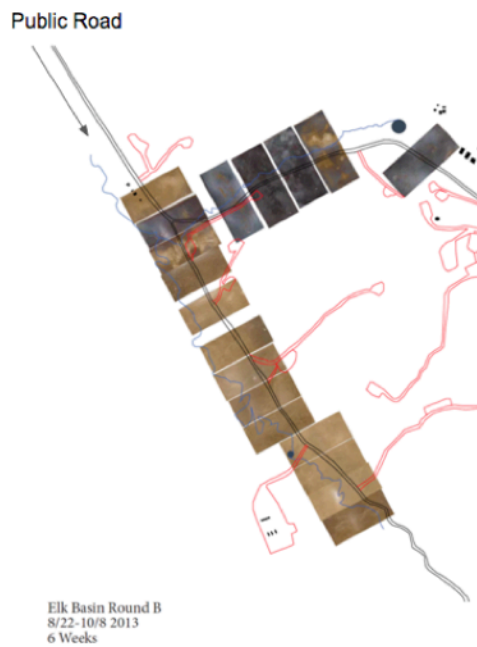


Figure 22: Map of H2S canister locations in Elk Basin Oil Field in Wyoming (Image Credit: Meghan McLaughlin 2013).