

Oil and Water Don't Mix with California Agriculture

Jeremy Miller, High Country News, 12-7-10

KERN COUNTY, California -- From the "Petroleum Highway" -- a rutted, dusty stretch of California State Route 33 -- you can see the jostling armies of two giant industries. To the east, relentless rows of almonds and pistachios march to the horizon. To the west, an armada of oil wells sweeps to the foothills of the Temblor Range.

Fred Starrh, who farms along this industrial front, has seen firsthand what can happen when agriculture collides with oil. On an overcast February day, he drives his mother-of-pearl Lincoln Town Car down a dirt road through his orchards. Starrh Farms has 6,000 acres of pistachios, cotton, almonds and alfalfa. Starrh proudly points out almond trees planted 155 to the acre with the aid of lasers and GPS. At the edge of his land, he pulls up beside 20-foot-high earthen berms, the ramparts of large "percolation" ponds that belong to a neighbor, Aera Energy.

From the mid-1970s to the early 2000s, Aera dumped more than 2.4 billion barrels (or just over 100 billion gallons) of wastewater -- known in the industry as "produced water" -- from its North Belridge oilfield into those unlined ponds, Starrh says. The impact became apparent beginning in 1999, when Starrh dug several wells to augment the irrigation water he gets from the California Aqueduct. He mixed the groundwater with aqueduct water, applied it to a cotton field beside the berms -- and the plants wilted. Eventually, the well water killed almond trees, Starrh says; he points out a few that look like gray skeletons.

Starrh suspected that Aera's ponds were leaking pollutants. So he tested his well water and found high concentrations of chloride and boron along with detectable radiation -- common constituents of the oil industry's produced water. He took Aera -- a joint venture of Shell and ExxonMobil -- to court, and in the nine years of legal wrangling that followed, Aera was forced to disclose its practices. The state's regional water-quality control board ordered the company to stop dumping into the ponds, and Aera launched a cleanup of the site. Last January, a Kern County jury awarded Starrh \$8.5 million in damages and by October, the ponds had been demolished. But Starrh has appealed that court decision, saying he'll need as much as \$2 billion to rehabilitate his land and construct terraced ponds to "flush" his soil and groundwater of toxins.

The oil company should be "punished," says Starrh. "If you just hit them with a small fine, it becomes just a small expense of doing business."

Many local farmers face the same risk, Starrh believes. Kern County belies the old adage: Out here, oil and water do mix -- and they do so in staggering volumes. Moreover, Kern County's oilfields are a preview of the future of oil worldwide. The industry is moving further into the realm of "unconventional" fuels -- including tar sands, shale oil and "heavy oil," like the oil found here. But heavy oil requires the use and disposal of huge amounts of water. And the consequences are strewn across the local landscape.

Kern County's oilfields, which began producing in the mid-1800s, helped build the Standard Oil empire that eventually evolved into the likes of Chevron and ExxonMobil. The local Lakeview Gusher of 1910 remains California's greatest single strike and one of the largest oil spills in U.S. history; an estimated 9 million barrels spewed uncontrollably from it, creating a lake of oil.

The local oil is "heavy" due to its geology (shallow deposits and tectonic movement) and biochemistry (petroleum-consuming bacteria living near the surface have made the crude the consistency of molasses). In the

early days, companies skimmed off the lighter portions of the oil. Over the years, they developed methods to extract the heavier stuff, overcoming the oil's resistance to flow by injecting water and superheated steam underground. These extraction techniques, known as "waterflooding" and "steamflooding," loosen up the oil and push the tar toward closely spaced well bores, from which it is siphoned to the surface by pumps.

Despite their age, Kern County's oilfields still produce about 8 percent of the nation's domestic supply. Tens of thousands of pump jacks stand shoulder to shoulder amid a rusting circulatory system of pipelines. The hillsides glow with flares of natural gas venting from oil wells. And dozens of gas-fired steam generators and cogeneration power plants represent the oil industry's up-front water consumption. They supply steam to the oilfields through ubiquitous silver pipes.

Since the 1960s, when steamflooding was pioneered in Kern County, California oil companies have pumped more than 2.8 trillion gallons of freshwater into the ground -- an annual average large enough to supply a city of one million people. Some of that water is the industry's own recycled wastewater and some is bought from irrigation districts. A large portion of that water use occurs here, and the complicated plumbing is not easily untangled.

Oil companies must report the overall amount of water they inject into the ground to the agency overseeing oil production -- the California Division of Oil, Gas and Geothermal Resources. Though they don't say much about it, they get a great deal of this water from California's overburdened irrigation system -- in this case, the State and Central Valley water projects, which use dams and long-distance canals to divert river water to farms and other customers. According to J.D. Bramlet, superintendent of the West Kern Water District, which distributes water from the State Water Project to the west side of the San Joaquin Valley, oil companies and steam-producing cogeneration plants (most of which are owned by the oil companies) received 83 percent of the district's 31,500 acre-foot allocation in 2009. That means that last year, oil companies doing business with this single water district took roughly 8.4 billion gallons of water, the bulk of which they use to push heavy oil to the surface.

And year by year, it takes more freshwater to extract the oil that remains. At the peak of California production in 1985, Kern County producers needed roughly four-and-a-half barrels of water to produce a single barrel of oil. Today, that ratio has jumped to almost eight barrels of water per barrel of oil.

This use has been sanctioned despite the three-year drought that has ravaged the valley, causing reductions in the water delivered by the State and Central Valley projects' canals. Not only are farmers generally short of water, dozens of small poor agricultural hamlets -- including Alpaugh, Seville, East Orosi and Kettleman City -- have been forced to tap groundwater. And that groundwater is often contaminated with agricultural pollutants, including arsenic and nitrates.

Even as the local oil industry uses a lot of irrigation water, it generates an even larger outflow of contaminated "produced water" -- the stuff that poisoned Fred Starrh's crops. This includes some water that returns to the surface after it's been injected into the ground, but much of the outflow is simply a consequence of producing oil from an aging oilfield. Groundwater migrates into the pore spaces of oil-bearing formations as the oil is sucked away, and over time, the companies must pump up more and more water to get the remaining oil.

Much of the "produced water" in the west-side oilfields of Kern County contains naturally occurring heavy metals and other inorganic compounds associated with the oil. Until the 1980s and 1990s, the area's "produced water" was managed very loosely. Jan Gillespie, a geology professor at California State University-Bakersfield, recalls that when she worked for a local oil company in the late '80s, the produced water was merely shunted into ephemeral creeks. Any oily fluid that wasn't absorbed into the creek beds would eventually arrive at a pond.

"Every so often, a big tar mat would build up on the bottom (of a pond) and the water wouldn't seep in anymore. So someone would toss a stick of dynamite and blow up the mat, and things would start to percolate again."

Oil companies insist that produced water is mostly harmless -- and federal law appears to agree. In 1988, during the Reagan administration, the Environmental Protection Agency classified crude oil and produced water as "special wastes" rather than "hazardous substances," exempting them from the stringent requirements of the main law for tracking toxic substances, the Resource Conservation and Recovery Act. Several EPA whistleblowers later came forward, pointing out that crude oil and its produced waters are often laden with individual substances considered "hazardous" under the federal law. "This was the first time in the history of environmental regulation of hazardous wastes that the EPA has exempted a powerful industry for solely political reasons, despite a scientific determination of the hazardousness of the wastes," Hugh Kaufman, a former EPA ombudsman, told the Associated Press in 1988.

Kern County's fields now cough up roughly nine barrels of produced water for every barrel of tarry oil. Year by year, the ratio becomes more skewed toward produced water. In 2007, Kern County oilfields generated 1.3 billion barrels of produced water for 166 million barrels of oil. In 2008, the produced water increased by 100 million barrels, while oil production fell by 3 million barrels.

Produced water is usually disposed of by being piped to surface evaporation ponds or to injection wells. The California Regional Water Quality Control Board oversees all discharges to the surface, including evaporation ponds. Produced water injected into disposal wells is monitored jointly by the EPA and the California Division of Oil, Gas and Geothermal Resources. These layers of oversight also have a spotty record.

Some of the tainted water is cleaned and sent to the cogeneration plants, where it is converted to steam. The "purest" of the water is only lightly treated and may be applied directly to crops. One place this happens is at Chevron's Kern River oilfield near Bakersfield, which the company often cites as evidence of the compatibility of oil production and agriculture. The produced water at Kern River is said to be quite "fresh" -- reportedly the result of infiltration of runoff from the Sierra mountain range -- with low concentrations of hydrocarbons, boron, salt and heavy metals. Since 1994, the company has lightly treated the water and sold it to farmers, garnering much attention in the engineering world and an award from the California Water Resources Control Board.

On the other hand, at Chevron's Lost Hills oilfield, 30 miles northwest of Kern River, the company pumped millions of barrels of produced water laced with heavy doses of boron into unlined evaporation pits each year. The pits were adjacent to croplands and, according to Chevron records, 3,500 feet from the California Aqueduct. That practice ceased in 2008, under pressure from the regional water board.

Tupper Hull, a spokesman for the Western States Petroleum Association, says that oil companies recycle a significant portion of their wastewater, and adds that it's in their financial interest to do so. Chevron spokesman Jim Waldron says the company recycles up to 90 percent, although Chevron refuses to explain how it achieves that rate. Hull says companies tend to consider the details "proprietary -- oil companies are competing with one another. It's not in their best interest to disclose their methods."

But there is strong financial incentive for companies merely to dispose of produced water. According to Matt Trask, a California energy analyst, cleaning the produced water can cost up to three to five times as much as buying water on the open market -- and sometimes 10 times as much. Thus, in Kern County in 2008, according to state statistics, oil companies pumped 425 million barrels of produced water into underground disposal wells and discarded 200 million barrels into surface evaporation ponds. That amounts to nearly half of the local produced water.

Evaporation ponds and sumps are being gradually eliminated. But Clay Rodgers, an officer with the California Regional Water Quality Control Board's Fresno division, estimates that there are still hundreds of pond "sites" - - containing more than 1,000 individual ponds and sumps -- across Kern County. And none of the ponds receiving oil wastes in Kern County are lined, Rodgers says. From a Google Earth-vantage, one can see these potentially hazardous manmade lakes, often arrayed in rows of four or five. Some ponds occupy a few hundred square feet; others are as large as several acres. Some are dry or hold just a small amount of residual water, but others are brimming with fluid.

The wastewater ponds not only threaten to pollute both surface and groundwater, they also might be dangerous to the health of wildlife and people. But little is known about the health risks. Matt Constantine, the director of the Kern County Environmental Health Services Department, says his agency focuses on produced water only when "there is a referral from the water board or a complaint from the public."

Constantine's agency did clamp down on one huge produced-water disposal site west of Bakersfield, operated by Hondo Chemical, after problems there -- including fires -- got out of control. To get an idea of the problem's scale, he flew a chartered helicopter over the site. In his office last October, he pulls out a thick binder filled with aerial photos, showing several large evaporation ponds, their surfaces various shades of green, blue and black from oil residues. "It is just an absolute mess," says Constantine as he flips through the pages.

The Hondo Chemical site is perched atop the Kern Water Bank, an underground reservoir that supplies water to municipal and agricultural users throughout the valley. "That presents a very significant concern," Constantine says. In 2007, his agency ordered Hondo to cease operations. The Kern County Board of Supervisors has since found Hondo to be in violation of environmental and health regulations and ordered the company to begin remediation. But Constantine says the cleanup is going slowly.

The serious interest in Kern County's heavy oil is emblematic of global changes. With worldwide stocks of the best raw oil -- "light sweet crude" -- dwindling, heavy oil and other "unconventional" fuels are now estimated to hold 80 percent of the remaining petroleum reserves. That's why major oil companies are going for Canada's Athabaskan tar sands and the heavy oil deposits of Venezuela's Orinoco and Mexico's Cantarell and Ku-Maloob-Zaap fields.

These once-maligned fuel precursors are the subject of giddy discussion in corporate boardrooms and R&D departments. Alberta's tar sands have recently become this country's leading foreign source of crude oil, surpassing imports from Saudi Arabia. "If the heavy oil and bitumen (or natural asphalt) deposits in the U.S. and Canada are brought to market," says a Houston-based consulting firm, Petroleum Equities Inc., "they would alone satisfy the current demand for oil in both countries for more than 150 years."

But this "unconventional" petroleum carries a host of heightened impacts. The production and refining of a barrel of oil from Alberta's tar sands generates two to three times the amount of carbon emissions as a barrel of conventional crude. Those tar sands operations also generate wastewater ponds similar to the ones in Kern County. Syncrude Canada, a leading producer of tar sands oil, was found guilty in a Canadian court earlier this year of causing the deaths of 1,600 ducks.

Many people don't realize the risks and costs of the oil industry's new direction. In Kern County, Chevron announced in 2008 that it plans to invest nearly \$1 billion in the production from its local heavy-oil fields. Meanwhile, produced water generated by various companies can even be found in reeking ponds adjacent to -- and within -- the city of Taft, a hardscrabble, historic oil town atop the Midway-Sunset oilfield. Town streets are named after General Petroleum and Chevron. Near a church, a trickle of oily outflow from one small pond sometimes reaches a dry streambed.

Such problems are seldom covered by local media, including the region's largest newspaper, the *Bakersfield Californian*, and the biweekly *Taft Midway Driller*. The *Driller's* editor, Doug Keeler, says, "If you're a business owner in Taft, you are beholden, either directly or indirectly, to the oil industry. ... We did (a story) three, four, maybe five years ago on a company that was putting water down a well that caused contamination. In newspaper time, that's a really long time (ago)."

Even the local Sierra Club chapter hesitates to delve too deeply into the affairs of the petroleum industry. Lorraine Unger, treasurer and spokeswoman for the group's Kern-Kaweah Chapter, lives in Bakersfield, in an area known as "The Bluff," which has a panoramic view of the Kern River oilfield. Many members of her Sierra Club chapter work for oil companies, and Chevron, she says, is "not so bad, as far as oil companies go."

Unger knows a fair amount about produced water. "They used to run it right through the agricultural ditches," she recalls. "I can see it all from my backyard." But she says her chapter is not terribly concerned about the practice. After all, there are plenty of other local issues to worry about -- air pollution, sprawl, and the poaching of black bears in the Sierra foothills.

"Besides, even if I was concerned about the water, oil is just too big and powerful around here to go after," Unger says. "It puts food on people's tables."