

TOXIC CHEMICALS MAY CONTAMINATE OIL FIELD WASTEWATER USED TO GROW CALIFORNIA CROPS

EWG

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In the last three years, farmers in parts of California's Central Valley have irrigated 95,000 acres of food crops with billions of gallons of oil field wastewater possibly tainted with toxic chemicals, including chemicals that can cause cancer and reproductive harm, according to an EWG analysis of state data.

Oil companies reported more than 20 million pounds and 2 million gallons of dozens of toxic chemicals in recycled wastewater sold to Kern County irrigation districts since 2014, including 16 chemicals the state classifies as cancer-causing or reproductive toxicants. Levels of the chemicals were not measured.

Kern County farmers have irrigated crops with oil field wastewater for four decades or longer, but these recently released reports provide the first detailed look at the makeup of the toxic cocktail that could be lurking in the water. However, a full assessment is impossible because companies withheld the identity of almost 40 percent of the chemicals as so-called trade secrets.¹

No one should stop eating produce from California. Although there is evidence that pollutants in water and soil can build up in crops—especially root crops such as carrots and potatoes,² which are grown in Kern County with oil field wastewater—scientists don't have enough information in this case or know if it poses a health risk for people who eat the food. Consultants hired by one Kern County irrigation district tested nine samples of citrus and two samples each of grapes, almonds and pistachios and declared them safe, but those were poorly designed extremely short-term studies.

A healthy diet high in fruits and vegetables outweighs uncertainties about chemicals in produce. Still, the question of whether food should be grown with oil field wastewater should concern all Americans, since California grows two-thirds of the nation's fruits and nuts, and a third of its vegetables. The Central Valley Regional Water Quality Control Board has appointed an expert food safety panel to study this question, and its findings are expected next year. Meanwhile, the water board refuses to halt the practice until this fundamental question is answered, and it is even allowing the expansion of the irrigation method.

EWG analyzed oil companies' reports to the water board regarding chemicals used in oilfields from which wastewater was sold to four Kern County irrigation districts from January 2014 to May 2016. EWG's analysis of the reports closely matches a preliminary assessment by consultants who are scientists at the University of California at Berkeley, Lawrence Berkeley National Laboratory and University of the Pacific.³ The disclosures show:

Between January 2014 and May 2016, San Francisco-based oil giant Chevron and six smaller drilling companies sold more than 27 billion gallons⁴ of wastewater to four irrigation districts in Kern County, and three private landowners in Kern and adjacent Tulare County.

The oil companies reported that an estimated 21.8 million pounds and 2.1 million gallons of chemicals were used in the wastewater, including both chemicals used in drilling and those added to treat the water before it was sold for irrigation.

Sixteen chemicals reported as ingredients are on California's Proposition 65 list of chemicals known to cause cancer or reproductive harm (see Table 1 below).

Eleven chemicals are listed under the Clean Air Act as hazardous air pollutants, a concern not only for air quality but also because airborne pollutants can accumulate in crops.^{5,6}

Thirty-nine chemicals are classified by an international identification system as acutely toxic to aquatic life and capable, or potentially capable, of building up in the bodies of living things.⁷

The wastewater was from conventional oil drilling, not fracking, the high-pressure injection of water and chemicals into wells to free up oil deposits. The state water board says because of concerns about the safety of fracking chemicals, it has “never authorized the use of water from fracked wells for irrigation of food crops.”⁸ Yet almost 40 percent of the chemicals reported by the oil companies are also used in fracking, raising the question of why the water board has a double standard to allow irrigation with water contaminated by the same chemicals if they are used in conventional drilling instead of fracking.

Table 1. Total chemical use reported in oil fields and wastewater sold to irrigation districts, 2014-2016

Company	Total Water (Oil Barrels)	Total Chemicals	
		Gallons	Pounds
Chevron	419,607,475	1,078,878	10,192,903
California Resources Corporation	144,021,138	1,043,945	11,619,599
Bellaire	18,487,563	14,256	0
Valley Water Management*	—	6,615	2,375
Modus**	39,765,221	166	0
Hathaway LLC	26,046,640	1,184	0
Daybreak Oil & Gas Inc.	4,234,830	4,656	0
SOC Resources/ Shaefer Ranch	No Data	No Data	No Data
Total (All Companies)	652,162,867	2,149,700	21,814,877

One barrel is 42 U.S. gallons.

* Produced water reported under Bellaire and CRC, but managed by Valley Water Management.

** Reported 6,827,158 actually used for irrigation in 2014 and 0 for subsequent years.

Source: EWG, from oil company reports to **Central Valley Water Quality Control Board**

Water brought to the surface by oil and gas drilling is called produced water. In California, most produced water is disposed of by injection into deep underground wells, piped to percolation ponds to evaporate or to replenish groundwater, or recycled on site for use in additional oil extraction. But some is lightly treated, which can add more chemicals to the water, and sold to irrigation districts. Oil field wastewater, mixed with surface water and groundwater, irrigates about 13.5 percent of the approximately 700,000 acres of Kern County crop land, watering almonds, pistachios, citrus trees, grapes, carrots and potatoes.⁹ Some is also used as drinking water for livestock and for fish farming.^{10,11}

OIL FIELD WASTEWATER USED FOR IRRIGATION FOR DECADES

Permits for the use of oil field wastewater in irrigation projects date back as far as 1987,¹² but until recently, regulators only required limited testing for naturally occurring contaminants, employing outmoded standards that didn't monitor for the hundreds of chemicals now used in oil production.¹³ In the spring of 2015, news reports brought the practice to light, raising concerns from scientists and environmental groups.

The water board responded to the outcry by ordering limited testing. In June 2015, a consulting firm hired by Chevron collected five water samples over two days from the company's wastewater ponds near the Kern River Oil Field.¹⁴ Its analysis found acetone, benzene and xylene, all at levels Chevron said were below regulatory limits

for drinking water. Analysis of earlier samples collected by the water board showed two samples exceeding drinking water standards for benzene and arsenic.¹⁵

The water board also convened a **Food Safety Expert Panel**, including representatives from the state Departments of Food and Agriculture, Fish and Wildlife, and Public Health; scientists from the Lawrence Berkeley Laboratory and PSE Healthy Energy; the agricultural industry and a consultant paid by one of the water districts purchasing the water. A representative from California's Office Environmental of Health Hazard Assessment was recently asked to join the panel.

The panel is charged with evaluating data and studies needed to understand the potential risks of using produced water to irrigate food crops. But even before the panel first met, the water board approved a new permit for the California Resources Corporation, a spinoff of Occidental Petroleum, to sell 6.9 million gallons of wastewater a year to the North Kern Water Storage District.¹⁶ In April, the panel identified the lack of information about chemicals in the wastewater as a critical gap preventing it from doing its job.

California regulatory agencies do not require the disclosure of chemicals used by the oil and gas industry, other than those used for fracking (with the exception of the South Coast Air Quality Management District). To get the information, the Central Valley water board issued disclosure orders to the oil companies with permits to sell wastewater for irrigation. Currently, the water board allows seven companies to sell wastewater for irrigation.

'TRADE SECRETS' AND INCOMPLETE DISCLOSURES

Oil companies submitted records for 198 commercial chemical additives to the water board. From that list, EWG identified 114 unique chemical ingredients. Although the water board ordered disclosure of all chemicals, four of the companies only provided information on those used to treat the water before irrigation. And about 40 percent of the total ingredients were either hidden as trade secrets or could not be precisely identified because of incomplete Chemicals Abstract Service numbers, a system used worldwide to identify chemicals.

These shortcomings seriously undermine the legitimacy of the data. Allowing trade secrecy claims and incomplete submissions not only hampers the work of the expert food safety panel, but of government agencies in California and other states, and academic researchers and citizens trying to evaluate the risk of the chemicals and whether any risk is transferred to crops grown with the irrigation water.

California's Proposition 65 list is the state's official registry of chemicals known to cause cancer, birth defects or reproductive harm. Chemicals reported by the oil companies contained 16 substances listed under Proposition 65, and some of them were among the chemicals most often used in the oilfields. Proposition 65-listed chemicals named most frequently in the oil company disclosures include the carcinogens crystalline silica, ethylbenzene and cumene, and the reproductive toxicants ethylene glycol, methanol and toluene (see Table 2 to the right).

Table 2. Proposition 65-listed chemicals used in oil fields from which wastewater is sold for irrigation

Silica, crystalline, cristobalite
Silica, crystalline, quartz
Silica, crystalline, tridymite
Ethylene glycol
Methanol
Ethylbenzene
Cumene
Naphthalene
Toluene
Antimony trioxide
Lithium carbonate
Sulfuric acid
Nickel sulfate
Radioactive Krypton 85 tracer (radionuclide)
Radioactive Sodium iodide tracer (radionuclide)
Radioactive Xenon gas tracer (radionuclide)

Source: EWG, from oil company reports to **Central Valley Water Quality Control Board**

After California enacted the nation's most comprehensive rules on disclosure of fracking chemicals in 2014, the California Council on Science and Technology recommended the prohibition of wastewater from fracked wells for irrigation unless studies show they are not hazardous.¹⁷ The Central Valley water board says it shares those concerns and that no wastewater from fracked wells has even been used for irrigation.

But of the chemicals the oil companies reported in wastewater for irrigation, EWG's analysis shows that 40 percent are also used in fracking. Since some chemicals were kept secret or not fully identified, the actual percentage of chemicals in irrigation water that are also fracking chemicals may be higher.

The oil company reports list both chemicals used during production and those added to treat the wastewater before irrigation by separating out petroleum-based hydrocarbons. In 2014, Chevron used nearly 100,000 gallons of additives containing Proposition 65-listed ingredients during water treatment to produce 187 million barrels of irrigation water.

Chevron's disclosure included statements downplaying the amounts of chemicals in the wastewater as insignificant. But that claim ignores the fact that some of the chemicals are hazardous in very small amounts, such as benzene, for which the state's legal limit in drinking water is just one part per billion—about a drop of water in an Olympic-size swimming pool. Only a few of the more than 100 other chemicals listed have drinking water standards. Recent research has shown that low levels of some of the chemicals listed most frequently in the disclosures can disrupt the hormone system.¹⁸

QUESTIONS STILL LOOM

Again, no one should stop eating produce from California. But it is troubling that crops have been irrigated with oil field wastewater for four decades without the public's knowledge and with so little known about the possible health risks.

Although the water board has appointed an expert panel to study the issue, the panel's work is hindered by letting oil companies hide the names of chemicals behind claims of trade secrecy. No firm conclusion can be reached about the safety of food grown with oil field wastewater without a complete review of the hazards of all the chemicals used; long-term analyses of water, soil and food samples; and evaluation of impacts on groundwater and farmworkers.

Those evaluations must also be free of conflicts of interest, unlike the limited wastewater tests conducted by consultants hired by Chevron or crop tests by consultants hired by irrigation districts. Until independent scientific studies can say whether it is safe to irrigate food crops with wastewater from oil fields, the state should suspend existing permits and declare a moratorium on new projects.

The State Water Resources Control Board should also exercise more oversight over the regional water board's decisions. The Central Valley water board has approved irrigation with wastewater for four decades and board members praise the practice as a win-win for farmers and the oil companies, especially in times of drought. An independent review body should take a closer look at more rigorous data to assure the public that the food produced with the wastewater is safe—for the short and long term.

REFERENCES

1. Seth Shonkoff et al., Preliminary Hazard Assessment of Chemical Additives Used in Oil and Gas Fields that Reuse Their Produced Water for Agricultural Irrigation in The San Joaquin Valley of California. September 2016. Available at www.psehealthyenergy.org/data/Preliminary_Results_13267_Disclosures_FINAL.pdf
2. Sardar Khan and Qing Cao, Human Health Risk Due to Consumption of Vegetables Contaminated with Carcinogenic Polycyclic Aromatic Hydrocarbons. February 2011. Available at www.researchgate.net/publication/257679749_Human_health_risk_due_to_consumption_of_vegetables_contaminated_with_carcinogenic_polycyclic_aromatic_hydrocarbons
3. Seth Shonkoff et al., Preliminary Hazard Assessment of Chemical Additives Used in Oil and Gas Fields that Reuse Their Produced Water for Agricultural Irrigation in The San Joaquin Valley of California. September 2016. Available at www.psehealthyenergy.org/data/Preliminary_Results_13267_Disclosures_FINAL.pdf
4. About 652 million barrels. In the oil industry, one barrel is 42 U.S. gallons.
5. A. M. Kipopoulou et al., Bioconcentration of Polycyclic Aromatic Hydrocarbons in Vegetables Grown in an Industrial Area. April 1999. Available at www.researchgate.net/publication/8610692_Bioconcentration_of_polycyclic_aromatic_hydrocarbons_in_vegetables_grown_in_an_industrial_area
6. Chris Collins et al., Benzene Accumulation in Horticultural Crops. February 2000. Available at www.researchgate.net/publication/12650781_Benzene_accumulation_in_horticultural_crops
7. Seth Shonkoff et al., Preliminary Hazard Assessment of Chemical Additives Used in Oil and Gas Fields that Reuse Their Produced Water for Agricultural Irrigation in The San Joaquin Valley of California. September 2016. Available at www.psehealthyenergy.org/data/Preliminary_Results_13267_Disclosures_FINAL.pdf
8. State Water Resources Control Board, Fact Sheet: Food Safety Expert Panel on Recycled Oilfield Water for Crop Irrigation. April 2016. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/fact_sheet/of_foodsafety_fact_sheet.pdf
9. ERM-West Inc., Development of Risk-Based Comparison Levels for Chemicals in Agricultural Irrigation Water. April 2016. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/studies/erm_riskassrpts.pdf
10. State Water Resources Control Board, Fact Sheet: Food Safety Expert Panel on Recycled Oilfield Water for Crop Irrigation. April 2016. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/fact_sheet/of_foodsafety_fact_sheet.pdf
11. Schaefer Oil Company, Application for NPDES Permit. Technical Report. October 1991. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/schaefer/schaefer_tr_oct_1991.pdf
12. The oldest permits, that were made publicly available, data back to 1987.
13. Julie Cart. Central Valley's Growing Concern: Crops Raised with Oil Field Water. May 2015. Available at www.latimes.com/local/california/la-me-drought-oil-water-20150503-story.html
14. Amec Foster Wheeler Environment & Infrastructure Inc., Technical Report: Reclaimed Water Impoundments Sampling. June 2015. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/information/disposal_ponds/chevron/2015_0615_com_chevron_cawello.pdf
15. State Water Resources Control Board, Fact Sheet: Food Safety Expert Panel on Recycled Oilfield Water for Crop Irrigation. April 2016. Available at www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/fact_sheet/of_foodsafety_fact_sheet.pdf
16. Andrew Grinberg, California Green Lighted More Irrigation with Oil Wastewater. December 2015. Available at www.cleanwateraction.org/2015/12/18/california-green-lighted-more-irrigation-oil-wastewater
17. California Council on Science & Technology, An Independent Scientific Assessment of Well Stimulation in California. July 2015. Available at ccst.us/projects/hydraulic_fracturing_public/SB4.php
18. Christopher Kassotis, Endocrine-Disrupting Activity of Hydraulic Fracturing Chemicals and Adverse Outcomes After Prenatal Exposure in Male Mice. October 2015. Available at www.ncbi.nlm.nih.gov/pubmed/26465197