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San Francisco Bay seals, part 2



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Even a few hundred parts per billion in a marine mammal can cause immune suppression, Kannan said.

Atlantic [bottlenose dolphins](#) from South Carolina and Florida that carried high concentrations of PFOS showed evidence of altered immune response. And [loggerhead turtles](#) along the southeast U.S. coast contaminated with PFOS contained markers in their blood indicative of liver damage and impaired immunity, researchers found.



NOAA
The bay's harbor seals are a living legacy offering insights into long-lived contaminants.

“It’s hard to measure altered immune responses in wildlife. We only have correlations and not evidence of causation,” Peden-Adams said.

So, Peden-Adams and others backed up the loggerhead turtle field work with lab study of a surrogate animal, in this case the western fence lizard. They saw the same thing: PFOS suppressed immunity.

However, “the seal’s immune system might respond differently than the dolphin’s. And marine mammals have more complex systems than reptiles,” she said.

In an odd twist, studies of people may offer clues to other, hormone-related health effects in animals. It’s usually the other way around. An investigation of about 47,000 people with drinking water contaminated by a DuPont plant in West Virginia linked PFOS to changes in [liver function](#), [pregnancy](#), [hypertension](#), [hormonal effects in women](#) and [high cholesterol](#). Other [studies](#) have linked it to [thyroid disease](#), preterm births and lower birth weight.

Routes to the bay

There are many ways perfluorinated compounds enter the bay. Clues compiled from the seals and birds – and research elsewhere – point to local sources from [sewage](#), [military bases](#) and [airports](#), Sedlak said.

Thirty-nine sewage treatment [plants](#) discharge effluent into the bay that likely contains perfluorinated compounds, which leach out of old consumer products or newer products imported from developing countries.

“Because the compound coats fabrics, when clothing gets washed, the chemicals enter the sewage treatment plant,” Field said. “We still have treated articles in our

homes, schools and automobiles. I suspect the rinse-off from treated articles is going to last as long as the articles last. They can be in our homes for 20 years and then go to landfills.”

Scientists looking for clues to PFOS sources found high concentrations of [PFHxS](#), an ingredient in carpet treatment, in the bay’s harbor seals and cormorant eggs.

“Just because you stop manufacturing doesn’t mean the perfluorinated compounds immediately disappear. If companies had stockpiles, they just used them,” Field said.

In addition, some fluorinated compounds widely used in industry may be transformed in the environment to PFOS.

The compounds also are caught in sewage sludge. PFOS is so persistent that in one case 30 years after sludge was spread on [cropland](#), it could still be detected. [Tests](#) have found it in every sludge sample and nearly every sediment sample from San Francisco Bay.

Christopher Higgins, an assistant professor at the Colorado School of Mines, suspects ongoing industrial sources in the Bay Area are still contaminating the bay. He found higher PFOS levels near the sewage treatment plants serving high-technology industries.

The lower south bay where the contaminated seals live receives runoff from San Francisco International Airport and effluent from three sewage treatment plants serving Silicon Valley. Three former military installations are there, too.



Wikimedia
PFOS has been found in every sludge sample from San Francisco Bay.

But pinning down the sources is difficult.

Regulators don’t require businesses to monitor and report perfluorinated compounds, and sewage plants aren’t required to measure them in effluent, according to Thomas Mumley, assistant executive officer of the San Francisco Bay Regional Water Quality Control Board.

“We’re scratching our heads trying to figure out where the perfluorinated compounds are coming from and how to stop them,” said Karin North, manager of environmental controls for Palo Alto.

“It’s a great lesson for people who manufacture a chemical. Years after it’s been phased out, it’s still causing a problem.”

Confirmed elsewhere are discharges from airports, military installations and refineries that have used PFOS-rich [firefighting foam](#) during fires and routine practice.

The U.S. Department of Defense is now purchasing formulations of foam that don’t contain PFOS, said Mark Wright, a DOD spokesman at the Pentagon. But the DOD is stuck with nearly 600 contaminated sites nationwide where PFOS-tainted foam was used in fire pits for training exercises, according to a federal database.

In addition, an array of products from overseas also may still contain PFOS. Although banned in the United States, Canada and the European Union, PFOS production began in China in 2003, the year after 3M stopped. PFOS was in widespread use in China in dozens of manufacturing sectors, according to a document submitted to the Secretariat of the Stockholm Convention.

“Perfluorinated compounds are unique in that they combine some of the negative aspects of chemicals such as TCE with the negative aspects of chemicals such as PCBs,” Higgins said. “They don’t just fit into the ‘mobile’ and ‘toxic’ category of TCE, or the ‘bioaccumulative’ and ‘persistent’ category of PCBs. They fit into both.”

Living legacies

Answers to why San Francisco Bay’s seals remain highly contaminated with this banned chemical, and how it may be affecting them, remain locked in their bulky bodies.

Perhaps these urban creatures are destined to serve as living repositories that sound alarms about toxic legacies.

A dozen years ago, studies of this same colony revealed that polybrominated flame retardants had increased 100-fold in 10 years. Based on that information, as well as skyrocketing levels in human breast milk, California in 2003 banned two flame retardants. The levels in these seals, and in wildlife around the world, have now plummeted.

“It’s essential we keep monitoring the population. That’s the only way we’ll see changes in seal health or survival,” Greig said. “Even if we don’t get the complete answer [about PFOS], we can start to understand what the risks are to the seals that live in the bay.”



Dezmann Penderflick
Thirty-nine sewage treatment plants discharge into the bay.

“It’s a great lesson for people who manufacture a chemical. Years after it’s been phased out, it’s still causing a problem.”
—Karin North, City of Palo Alto

There have been no die-offs, disease outbreaks or reproductive failures among the bay’s seals. But even without dramatic signs of damage, their health could be compromised by PFOS in a serious yet subtle way.

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10 March [Election 2014: Climate change versus the oil boom](#). Record-breaking domestic oil production is likely to swamp any effort to inject climate concerns into 2014 mid-term elections – and could even cost Democrats the Senate. [Daily Climate](#).

7 March [Armed with arm candy: Bracelets can detect people's chemical exposures](#). Wristbands are the accessory of choice for people promoting a cause. And the next wave of wrist wear might act as a fashionable archive of your chemical exposure. [Environmental Health News](#).

7 March [Energy industry to hog the rails, shutting out farmers – report](#). Western growers trying to get grain to market fear they'll be shut out as oil and coal companies increasingly turn to rail to transport energy. [Daily Climate](#).

6 March [Soot success: Clean air within reach nationwide – but not for long](#). Later this year, for the first time ever, people in Riverside, Calif. – and throughout the nation – will breathe air that meets an annual health standard for fine particles, a feat considered inconceivable just a decade ago. But the victory will be short-lived. The U.S. Environmental Protection Agency is about to begin enforcing a new standard for the pollutant known as PM2.5. [Environmental Health News](#).

3 March [Opinion: Thar she blows! The whale oil myth surfaces again](#). Petroleum didn't undercut the whale oil industry, and an unfettered free market didn't create the petroleum industry. To use imaginary history to degrade discussions about energy policy is about as historically irresponsible as it gets. [Daily Climate](#).

25 February [Canada's whale whisperer: Scientist will keep telling tales of his ocean](#). Environmental Health News chats with scientist Peter Ross who lost his job last year after Canada's Harper administration axed contaminants research at the Institute of Ocean Sciences. Last week the Vancouver Aquarium announced that Ross will be the founding director and chief scientist of the aquarium's new Ocean Pollution Science Program. [Environmental Health News](#).

20 February [Yellow pigments in clothing, paper contain long-banned PCB](#). Throwing on pajamas and curling up with a magazine could mean exposure to chemicals banned several decades ago. New, unpublished research has found that traces of polychlorinated biphenyls – banned in the United States 35 years ago – are leaching out of clothing and printed materials from around the world. [Environmental Health News](#).

18 February [Essay: Males' chemical vulnerabilities challenge a stereotype](#). Contrary to cultural assumptions that boys are stronger and sturdier, basic biological weaknesses are built into the male of our species. These frailties leave them more vulnerable than girls to life's hazards, including environmental pollutants such as insecticides, lead and plasticizers that target their brains or hormones. Several studies suggest that boys are harmed in some ways by these chemical exposures that girls are not. It's man's fate, so to speak. [Environmental Health News](#).

14 February [Warming sends no love to Olympic bidders](#). All five cities vying to host the 2022 winter games could face some of the warmest weather they've ever seen when the Olympics open, according to a Daily Climate analysis. With athletes at the Sochi games complaining about mush, a peek at what climate models are predicting might be prudent when picking host cities in the future. [Daily Climate](#).

13 February [New BPA experiment finds no low-dose effects, FDA says](#). A new experiment by scientists at the U.S. Food and Drug Administration has found that bisphenol A does not affect the health of rats fed low doses. Other scientists say the study is flawed. [Environmental Health News](#).

12 February [Polar plight: Flame retardant in Antarctic comparable to urban rivers](#). Antarctica is not untouched by contaminants. Penguins, fish, sea sponges and even worms there are contaminated with flame retardants. In some sediment at McMurdo Sound, one widely used chemical was found at levels similar to those found in urban rivers. Research stations are the apparent source. [Environmental Health News](#).

11 February [The Daily Climate is hiring a climate science reporter](#). We're hiring! The Daily Climate is looking for an experienced reporter to cover climate change and climate science. Interested? Contact publisher Peter Dykstra at pdykstra@ehn.org. [Daily Climate](#).

10 February [Opinion: Time to look beyond the UN climate negotiations](#). A top-down, consensus-driven process involving 195 negotiating parties isn't likely to slow greenhouse gas emissions. Society's success curbing nuclear weapons offers a better paradigm. [Daily Climate](#).

6 February [Opinion: Ham and Cheese on Nye](#). Debating arch-creationists and climate deniers is a bad thing for science, and maybe even for 'debate.' [Daily Climate](#).

5 February [Photo essay: North Dakota's energized landscape](#). What does oil independence look like? Those living and working in North Dakota's booming Bakken oil field are seeing first-hand both pros and cons. Photographer Gary Braasch returned from the region with a slice of that life. [Daily Climate](#).

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