

## WATER POLLUTION Educator Guide

A resource for using QUEST video, audio, blogs and maps in the classroom

### QUEST SUBJECTS

**Life Science**  
Biology  
Health  
Environment

**Earth Science**  
Geology  
Weather  
Astronomy

**Physical Science**  
Physics  
Chemistry  
Engineering

### CA SCIENCE STANDARDS

#### Grade 5

*Earth Sciences*

3. (e) the origin of water used by local communities

#### Grade 6

*Ecology*

5. (b) Matter transfers between organisms in food webs and between organisms and their environment.

*Resources*

6. (b) renewable and nonrenewable resources

#### Grades 9-12

*Ecology*

6. (b) analyzing changes in an ecosystem

*California Geology*

9. (c) the importance of water to society, the origins of California's fresh water and the relationship between supply and need

### QUEST MEDIA FOR TEACHING ABOUT WATER POLLUTION

Read and comment on the blogs for these stories by clicking on the story link and clicking on the blog post link below the video/audio.

#### Watch **Mercury in the Bay, Part 1**

<http://www.kqed.org/quest/television/view/855>

- Did you know that mercury extracts gold out of rock? Mercury mined during the gold rush has left a toxic legacy in California, particularly in the San Francisco Bay, where the metal is still found in its mud and fish.

#### Listen to **Mercury in the Bay, Part 2**

<http://www.kqed.org/quest/radio/mercury-in-the-bay--part-2>

- **QUEST** discusses the problem of mercury in San Francisco Bay with local fisherman at the Berkeley Marina, a leading doctor who diagnoses "fish fog" mercury poisoning in her patients and a Bay ecologist who studies the ways mercury affects human life.

#### Listen to **Sea of Plastic**

<http://www.kqed.org/quest/radio/sea-of-plastic>

- Where do our used plastic cups, packaging and other plastic products go? Quite possibly into the "Great Pacific Garbage Patch" in the Pacific Ocean! **QUEST** reporter David Gorn finds out why some California cities and counties are looking to limit the amount of plastic waste produced in their area.

#### Listen to **Drugs in Our Drinking Water**

<http://www.kqed.org/quest/radio/drugs-in-our-drinking-water>

- Trace amounts of many different kinds of pharmaceuticals have been found in much of America's drinking water. But what risks do these small amounts of toxins pose to humans and animals?

### TOPIC BACKGROUND

Water pollution is the contamination of water resources by harmful wastes or toxins. This type of pollution can be dangerous to animals and plant populations in and around lakes,



rivers, polluted groundwater areas or oceans, and can pose major problems for humans as well. Although natural phenomena, such as volcanoes and algae blooms, can create drastic changes in water quality, water is typically deemed polluted only when impaired by human contaminants.

There are many possible causes of water pollution, but the primary ones are generally lumped into two categories: point source and non-point source pollutants. Point source pollution is caused by pollutants that enter the waterway through a specific source, like the major fuel spill caused when a freighter hit a Bay Bridge pillar in the San Francisco Bay in November 2007. Non-point source pollution is defined as a cumulative effect of small amounts of contaminants coming into a water source from a large area, like urban runoff from storm drains or traces of mercury filtering into rivers and streams from old mining areas.

#### Additional background resources:

Bay Trash Hot Spots Map <http://savesfbaygallery.org/hotspots08/index.html>

NRDC: Issues: Water <http://www.nrdc.org/water/default.asp>

USGS: Water Quality of San Francisco Bay <http://sfbay.wr.usgs.gov/access/wqdata/>

## VOCABULARY

### Property

a quality or trait

### Toxin

a poisonous substance

### Sediment

material deposited by water, wind or glaciers

### Indicator

a gauge by which standards are measured

### Contamination

the act of soiling, staining, corrupting or infecting by contact or association

### Sample

a representative part or single item from a larger whole or group

### Recycle

to reuse or process for reuse

### Detect

to discover or determine the existence or presence of

### Hormone

a product of living cells that circulates in body fluids or sap and produces a specific effect on the activity of cells usually away from its point of origin

### Pharmaceutical

a medicinal drug

## INTRO QUESTIONS

- What kinds of toxins are found in our water supply?
- Where do our plastic waste products go?
- What are some causes of water pollution?
- Should we be concerned about trace amounts of pharmaceuticals in our drinking water? Why or why not?

## FOCUS QUESTIONS

- How does mercury in the watershed affect us?
- Where does mercury in the San Francisco Bay come from?
- Do you think there should be a statewide ban on polystyrene and other plastic items? Why or why not?
- How do pharmaceuticals get into our water supply?
- What are some things we can do in our daily lives to help prevent water pollution?

*For all media see:*

- Segment Summary Student Sheet  
[http://www.kqed.org/quest/downloads/QUEST\\_SegSum\\_StudentSheet.pdf](http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf)
- Personal Response Student Sheet  
[http://www.kqed.org/quest/downloads/QUEST\\_PersResp\\_StudentSheet.pdf](http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf)

## LESSON PLANS and RESOURCES from PBS, TEACHERS' DOMAIN and NPR

NOTE: Resources from the Teachers' Domain collection require a fast and free registration.

### Human Impact on Water Quality Teachers' Domain

[http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.lp\\_waterquality/](http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.lp_waterquality/)

How do human activities affect our water supplies? In this lesson, students will examine the causes of water pollution in their watershed and consider ways to avoid further pollution.

### Water Treatment Plant Teachers' Domain

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.h2otreatment/>

Where does our drinking water come from? Watch this video segment adapted from **Zoom** to see how a water treatment facility in Cambridge, Massachusetts, purifies its local water.

### Study Finds Drugs Seeping Into Drinking Water NPR

<http://www.npr.org/templates/story/story.php?storyId=88062858>

Listen to a discussion about water safety and pharmaceutical levels in drinking water from the March 10, 2008, episode of **Talk of the Nation**.

### Science Report: Water Recycling Online NewsHour

[http://www.pbs.org/newshour/indepth\\_coverage/science/water\\_recycling/index.html](http://www.pbs.org/newshour/indepth_coverage/science/water_recycling/index.html)

This investigative report discusses the debate over "toilet to tap" wastewater reuse. Features include a slideshow of the process wastewater undergoes in a treatment plant in Orange County, a discussion forum with water recycling experts and a link to a lesson plan, "Understanding Your Water."

### Boat Made of Plastic Bottles to Sail the Pacific NPR

<http://www.npr.org/templates/story/story.php?storyId=91066185>

Hear the story of Joel Paschal and Marcus Erikson, two scientists who attempted to raise awareness about the amount of plastics polluting the Pacific Ocean by sailing in a boat made of 15,000 plastic bottles.

## VISIT OUR PARTNERS

The Bay Institute  
[www.bay.org](http://www.bay.org)

California Academy of Sciences  
[www.calacademy.org](http://www.calacademy.org)

Chabot Space and Science Center  
[www.chabotspace.org](http://www.chabotspace.org)

East Bay Regional Park District  
[www.ebparks.org](http://www.ebparks.org)

Exploratorium  
[www.exploratorium.edu](http://www.exploratorium.edu)

Girl Scouts of Northern California  
[www.girlscoutsbayarea.org](http://www.girlscoutsbayarea.org)

Golden Gate National Parks Conservancy  
[www.parksconservancy.org](http://www.parksconservancy.org)

The J. David Gladstone Institutes  
[www.gladstone.ucsf.edu](http://www.gladstone.ucsf.edu)

Lawrence Berkeley National Laboratory  
[www.lbl.gov](http://www.lbl.gov)

Lawrence Hall of Science  
[www.lawrencehallofscience.org](http://www.lawrencehallofscience.org)

Monterey Bay Aquarium  
[www.mbayaq.org](http://www.mbayaq.org)

Monterey Bay Aquarium Research Institute  
[www.mbari.org](http://www.mbari.org)

Oakland Zoo  
[www.oaklandzoo.org](http://www.oaklandzoo.org)

The Tech Museum of Innovation  
[www.thetech.org](http://www.thetech.org)

UC Berkeley Natural History Museums  
<http://bnhm.berkeley.edu/>

U.S. Geological Survey  
[www.usgs.gov](http://www.usgs.gov)

## MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

### Why Use Media in Science Education?

[www.kqed.org/quest/downloads/QUEST\\_Why\\_Media\\_08-09.pdf](http://www.kqed.org/quest/downloads/QUEST_Why_Media_08-09.pdf)

- “As science educators, we know how important critical thinking and new technology skills are in the scientific community...” (read more).

### Science Multimedia Analysis

[www.kqed.org/quest/downloads/QUEST\\_Science\\_Multimedia\\_Analysis\\_08-09.pdf](http://www.kqed.org/quest/downloads/QUEST_Science_Multimedia_Analysis_08-09.pdf)

- “By increasing students’ awareness of the intersections between media and science, we give them the tools to think like scientists...” (read more).

### How to Use Science Media for Teaching and Learning

[http://www.kqed.org/quest/downloads/QUEST\\_Media\\_Tips\\_08-09.pdf](http://www.kqed.org/quest/downloads/QUEST_Media_Tips_08-09.pdf)

- If we consider all forms of media “texts” from which students gather information, we can use similar literacy strategies to engage them in video, audio, blogs and Explorations. Once students have obtained information from multiple media sources, how do they share what they have learned? Through their own media-creation projects, of course!

### Using Google Maps to Create Explorations

[http://www.kqed.org/quest/files/download/52/QUEST\\_ExplorationCreation.pdf](http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf)

- Do you like the science hike Explorations on the **QUEST** site? Use this place-based educational guide for educators and group leaders to create similar science-based maps with youth.

## OTHER WAYS TO PARTICIPATE IN QUEST



### LOG ON

[www.kqed.org/quest](http://www.kqed.org/quest)



### LISTEN

KQED 88.5 FM San Francisco &  
89.3 FM Sacramento  
Mondays at 6:30am and 8:30am



### WATCH

KQED Channel 9  
Tuesdays at 7:30pm



Whenever you order your double latte to go at the corner coffee shop, the empty cup and lid may end up in a giant pit of plastic ocean litter floating off the California coast. Some cities and counties are so concerned about the garbage in the so-called “North Pacific Gyre” that they've passed ordinances to try to limit the amount of plastic in our lives. David Gorn reports.

Hannah Rose Nevins is a researcher at Moss Landing Marine Laboratories. Today she's in Santa Cruz, working the necropsy lab.

She steps into a huge walk-in freezer to pluck a frozen seabird off the shelves, and then hefts the large carcass onto an examining table...

...and starts to tear away the rigid plastic wrapping.

NEVINS: “Last year we got about 200 samples. Those all came from Beach COMBERS' beach survey program.”

Nevins is checking the stomach contents of each of these birds, which are called fulmars, and look similar to sea gulls, to see if she finds any plastic inside them. So far, she says, she's found an average of about 15 pieces of plastic in the bellies of most of the birds she's investigated.

And in some of them, she says, she found as much as 120 bits of plastic ... jammed and pressed into a bird stomach the size of a walnut.

NEVINS: “So there's a piece of line, plastic, reds and pinks and blues....”

That much plastic may be dangerous for the birds, she says, but she's not investigating what plastic does to these birds.

NEVINS: “Our study is mainly focusing on not the population-level impacts but how we can use the birds as samplers of the marine environment.”

Nevins is using the fulmar stomachs as indicators of just how much plastic pollution is out in the ocean.

And there's a lot of it, says John Fentis. Most of the plastic in the northern Pacific, more than three million tons of it, he says, comes from land litter, much of it carried by stormwater runoff into the sea.

FENTIS: “The plastic will collect in this area called the North Pacific Gyre.”

Fentis is president of Algalita Marine Research Foundation, which first discovered the concentration of garbage about a thousand miles offshore in the Pacific Gyre, a swirling vortex of trash twice the size of Texas. Fentis is looking out across the relatively clean harbor in Long Beach, where Algalita has its headquarters. He says it's not just the size of the Gyre that's such a danger; it's more the *density* of the amount of plastic found in the water. He holds up a thick sample of what the water looks like out in the Gyre.



FENTIS: “This is a jar, as you can see, filled with plastic pieces and a kind of a soupy mixture, part of which is plankton. This is more like a synthetic soup.”

The plastic breaks down into such small bits that researchers can't strain it out of the water, so it's almost impossible to clean up. Birds and fish mistake it for food and the plastic ends up in their stomachs. And that could end up in our stomachs, according to biomedical researcher Bruce Blumberg of the University of California at Irvine

Some chemicals in the plastic, he says, can make their way into the tissue of the fish we eat. The possible endocrine disruptors in plastic, he says, could be hazardous.

BLUMBERG: “Is ingesting plastic acutely toxic at the levels we see it and is it going to kill us? Probably not in the short term, but is it causing long-term damage? I would say the data are pretty strong that it is.”

The plastics industry maintains that plastics are safe and that the solution for all of that marine debris is a stronger recycling effort. But Dustin McDonald of the environmental group Surfrider Foundation says that not all plastic can be easily recycled, and much of it breaks into small pieces that can't be managed.

MCDONALD: “Trying to clean up polystyrene on a beach is like trying to filter the Sahara Desert. You just can't do it.”

McDonald sees the same thing over and over during his beach cleanups in the tourist town of Capitola, population 9,000, just south of Santa Cruz. Tiny bits of plastic, everywhere you look. So Capitola, he says, was one of the first in the state to pass a ban on polystyrene. Those are the to-go containers for leftovers from restaurants, Styrofoam cups and the hard plastic lids from coffeehouses.

MCDONALD: “Polystyrene is a big problem, because once it's being used in a food environment, it's food contaminated and there's no way to recycle it. And that's the real reason why food vendors themselves are the ones that have been targeted by this particular ban.”

The idea, McDonald says, is to stop the flow of plastic before it can get into the water and onto the beaches. A state panel recently agreed. The Ocean Protection Council is now recommending a statewide ban on plastic bags and containers and will hold public meetings on the subject next month.

For QUEST, I'm David Gorn, KQED Radio News.



What's in that water coming out of your tap? Increasingly sophisticated tests detect contaminants we couldn't have even measured 10 years ago. But just because something's there, does that mean it's harmful? Amy Standen reports on one contaminant we're learning more about -- pharmaceuticals like ibuprofen and birth control pills -- and what we might do about it.

It's surely a sign of the times that a laboratory used to test drinking water would be so high security we can't even tell you exactly where it is.

SCOTT: "This is our lobby area and it is a secure facility."

Jim Scott is the water quality lab manager for the Santa Clara Valley Water District, based in San Jose. He swipes a key card to let us into the district's new \$18 million testing lab, which opened this spring.

SCOTT: "It is secure [BEEP] because of the nature of the work that we do and the nature of chemicals we have here in the laboratory."

This lab will be a command center should terrorists ever strike California's drinking water supply. Ditto if any other water-borne contaminant starts making people sick. But the real bread-and-butter work done here is much more mundane than that. It's the daily testing for things like mercury, lead, *E. coli* -- contaminants all water agencies routinely test for. And that list is growing, says Scott, as he opens the door to a small, mostly empty laboratory.

SCOTT: "This was designed for the future needs of the water district, so that when we do get into the monitoring of pharmaceuticals and such, this is where the instrumentation will be."

In recent years, scientists at water agencies across the country have found tiny amounts of things like heart medicine, hormones and pain killers in their drinking water. Here in Santa Clara County, scientists detected eight different drugs, including ibuprofen and a cholesterol-control medication.

Keep in mind, the doses are so small they're almost undetectable -- in the parts per billion or per trillion. That's millions of times smaller than a medical dose. Put in perspective, one part per billion is one second in the span of 32 years. Tiny enough that it may well have no effect on us at all.

Still, the discoveries have raised questions. For starters, how did the drugs get there?

REPORTER/KREISBERG: "Can we dump this out somewhere?" "Dump it out over here. Sure."

Over in Berkeley, Joel Kreisberg rummages through an 18-gallon plastic canister filled with expired pills. Kreisberg runs the Teliosis Institute, which, among other things, runs a collection program for drugs people don't want anymore.



KREISBERG: “The most common were acetaminophen, aspirin, Tylenol. But the first prescription drug is prednisone, which is a very strong prescription drug. My thinking is that’s one of the medications that people have a strong side effect to, and therefore it gets thrown out too much.”

Until recently, the recommended way to throw out a pill was to simply flush it down the toilet. And to get a sense of how many pills that works out to, consider how many prescriptions we Americans receive in the first place.

KREISBERG: “Actually, the latest statistic was, as of 2005, there’s over a billion prescriptions made by physicians in the United States, and if you’re over 75, you’ll get 12 prescriptions a year.”

Most of those drugs get swallowed, just as the doctor prescribes. But since our bodies don’t absorb everything we feed them, a small amount passes right through, ending up, once again, down the toilet.

When toilet water gets to the treatment plant, it’s heavily purified and cleaned and then released into rivers, bays and the ocean. But that doesn’t eliminate the pharmaceuticals, some of which will eventually make it back into the drinking water supply. So, should we worry?

SNYDER: “I think it’s certainly scary in terms of perception.”

That’s Shane Snyder. He’s a toxicologist with the Southern Nevada Water Authority and an expert on drugs in drinking water.

SNYDER: “In terms of scientific knowledge, it’s not very scary.”

Snyder says what’s changed here isn’t the existence of the drugs; it’s our ability to see them at such incredibly low levels.

SNYDER: “What’s amazing is if you begin to look at what we can see versus where the health effects occur, we’re being able to detect things at orders of magnitude lower than any appreciable health effect.”

Still, we don’t know how those tiny amounts of drugs might interact with each other. And it’s not just a concern for humans. Studies suggest that hormones like estrogen may be part of what’s causing reproductive problems in fish.

Everyone wants drinking water to be as clean as possible. But the question, says Snyder, is what can we do about it?

SNYDER: “That’s my favorite question. Actually, we have never found a treatment process that could treat every single pharmaceutical to lower than the detection limits than we’re using today.”

If we did reduce levels somewhat, it would require state-of-the-art technologies like ozone treatment. Those come with their own costs -- they’re hugely expensive and energy intensive. Snyder wonders if the costs are justified.



SNYDER: “I don’t believe we’ve come to the point where we can dismiss it and say this is a non-issue altogether. The question is how do you prioritize? Do you want to put pharmaceuticals ahead of pesticides or ahead of heavy metals?”

Those are precisely the kinds of questions that the EPA is grappling with right now, but with so little data out there about health effects, it’s a long process. It will take regulators about a decade to decide which drugs, if any, are harmful in our water and what to do about it.

For QUEST, I’m Amy Standen, KQED Radio News.



OLD TAPE: Almaden California. A western Community that is famous. Famous for the curious metal mined in the mountains.

Everyone knows about California's Gold Rush - Sutter's Mill, the 49ers, the birth of a new state. But what made it all possible was another, less well-known mining rush. It happened here, in the hills on San Jose's southern edges.

SANISLO: Our mines were bigger than the biggest gold mines.

Terri Sanislo is an interpreter at the New Almaden Mining Museum in San Jose.

SANISLO: And ultimately, we made more money selling mercury than the biggest gold mine did selling gold.

So everyone talks about it being a gold rush, but financially, at least...

SANISLO: It was a mercury rush. A mercury rush.

150 years ago there were nine saloons on this little street, serving miners from as far away as Mexico, China, and England. They dug 40 miles of mining tunnels through the hills above town, and pulled out thousands of pounds of cinnabar, a rock that contains mercury. But, there wouldn't have been a mercury rush without the gold rush.

OLD TAPE: During the gold rush days, miners used mercury to help them refine their gold.

Mercury has an almost magical property: it can extract gold out of rock. In its peak years between 1850 and 1890, the New Almaden mines sold mercury to gold miners in the Sierra foothills, who spread it over their gold ore. When that mixture of gold and mercury was heated in smelters, the mercury vaporized.

SANISLO: And when you open their cooker pots, left in the bottom was the powdery rock, and sitting on top of it was, you hoped, pure 24 carat sponge gold.

But mercury has other special properties as well, and while it was godsend for gold miners, it's left a toxic legacy here in the Bay Area -- one that scientists are still trying to understand.

We're inside a complex of labs and office buildings at the US Geological Survey in Menlo Park, meeting with scientist Mark Marvin DiPasquale. In one hand, he's holding a reddish rock, about the size of a golf ball. In the other, a small glass bottle containing a pea-sized drop of elemental mercury, like what you'd find in an old thermometer.

DIPASQUALE: Cinnabar. Mercury. It's not a lot of it, but we try to actually stay away from big balls of mercury around here. DiPasquale works with tiny amounts of mercury - not teaspoons or ounces, but picograms. That's a trillionth of a gram.



DIPASQUALE: A globule like this would really contaminate a laboratory for years.

Elemental mercury is not safe to handle. But what's even more dangerous is a form of the metal called methyl mercury. It's what happens to mercury when it gets eaten by bacteria in the dirt, and starts making its way up the food chain.

DIPASQUALE: And that's where it becomes problematic. As it moves from the sediments to the water column, it begins to accumulate in phytoplankton and consumed by very tiny organisms that we call zooplankton and then by smaller fish, larger fish and so on up the food chain.

Less than a teaspoon of methyl mercury can poison thousands of fish. When children or pregnant women eat that fish, the methyl mercury can cause brain damage and developmental delays. So the goal is to remove the mercury before it even hits the water.

That's what's happening here, just downstream of the former New Almaden Mercury mines, which are now a county park.

DRURY: This is a "before". I've been showing you "afters", here's a before. So if you could follow me.

Dave Drury is an engineer with the Santa Clara Valley Water District, in charge of cleaning up old mining waste. We're standing on a creek bank covered in what looks like concrete.

DRURY: You notice there's not much growing it? Remember that other spot? We had nice tall grass and there were trees and stuff. Nothing grows in this, it grows on the edges. This is a deposit of mine waste.

After miners extracted most of the mercury from the rocks, they dumped the waste rock into nearby streams. These rocks are harmless, you can't get mercury poisoning from handling them, or from walking around the old mines. But over time, they can slowly leech mercury, and eventually methyl mercury, into the water.

Scientists say about 200 pounds of mercury flow out of these streams every year and end up in San Francisco Bay. It's an enormous amount given the toxicity of the metal. This is just one of the sources of mercury in the Bay, but it's also one of the simplest to clean up.

DRURY: So, the way to reduce methyl mercury in fish is to prevent it from getting in the water in the first place because that's where your money is best spent, that's where you're going to make the most difference.

Meanwhile, the Bay is conducting its own clean up, as the tides slowly flush water, and mercury, out through the Golden Gate. At the current rate, it'll take a century or more



until the bay's mercury levels are safe. Unless, that is, state officials succeed in their plan to speed up the process. We'll hear about that next week.

For Quest, I'm Amy Standen, KQED Radio News.



From KQED Public Radio, I'm Andrea Kissack with Quest. Each week we explore Northern California's science and environment.

You wouldn't know it just by looking at the surface, but San Francisco Bay is still feeling the effects of the Gold Rush. Nineteenth-century mining left thousands of pounds of toxic mercury in the Bay's mud. And every year, local industry and city residents are adding even more mercury -- leaving many fish in the Bay unsafe to eat. But now, as Amy Standen reports, local officials are taking big steps toward cleaning up the mercury pollution in San Francisco Bay.

On a Sunday morning, in late April at the Berkeley Marina dozens of anglers are casting their fishing rods over the pier, hoping for a bite.

BERKELEY ANGLERS:

Well we're doing some halibut fishing...

Yeah halibut if they're biting...

that's what's in here now...

this is halibut season, so ...

We tried to get halibut! ...

That last voice belongs to Tu Van, who's here today with her husband Lam Chan. The two emigrated from Vietnam 33 years ago. Now that they're retired, they come out to fish in the Bay about once a week.

Do you ever hear about mercury in the fish?

TU VAN: Yeah, we hear but not too much in Bay. Not much mercury.

Halibut not a problem?

TU VAN: Not a problem.

Fisherman Dave Hurwatt isn't too worried either.

HURWATT: I heard a long time ago that if you when you're cleaning the fish, if you trim the red meat off and just leave nice white meat don't eat the head, that's where it's all located. So I don't worry too much.

But halibut does contain mercury, and it's present throughout the fish. Levels aren't as high as they are in other Bay dwellers, like striped bass and sturgeon. Still, health officials advise against eating any fish caught in the Bay more than twice a month.

Herwatt and Tu Van highlight a basic problem of mercury poisoning. Despite warning signs posted near fishing piers, it's a difficult toxin to understand.

SWANSON: If you eat a fish that's contaminated with mercury you won't taste it, you won't see it.



Tina Swanson is an ecologist with the Bay Institute, an environmental group based in Novato.

SWANSON: You can't cook it out because much of the mercury accumulates in the muscles of the fish that we eat. Nor would you feel particularly sick after you'd consumed it or days later, it's just not that kind of a contaminant.

Instead, mercury contamination builds up over time, particularly in those who eat a lot of it. A 2001 study by the San Francisco Estuary Institute found that many Southeast Asian immigrants eat Bay fish almost daily.

Pregnant women are particularly at risk. Mercury can cause brain defects in a developing fetus. In children, high levels of mercury can cause learning disabilities. Among adults, the symptoms can be much more subtle.

Dr Jane Hightower runs her medical practice at California Pacific Medical Center in San Francisco - a long way from the fishing piers of Berkeley or Richmond.

HIGHTOWER: I have a Pacific Heights practice. They're not fishing in Martinez, they're fishing at Bryans and Whole Foods and the like.

Still, store-bought fish caught in the ocean can be just as high in mercury as fish caught in the San Francisco Bay, which is how Dr. Hightower came to be one of the first physicians to start diagnosing mercury poisoning in her patients.

HIGHTOWER: I'm getting a lot of people in my office in the last year or two that I really can't figure out what's wrong with them. And I thought of those folks first. And I started calling them up and asking what's for dinner. What are you eating for lunch?

Hightower's patients' symptoms were vague. She calls it fish fog.

HIGHTOWER: Fish fog is trouble thinking, fatigue, headache, muscle and joint pains, a little bit of stomach upset.

Initially, Hightower took hair samples to see how high her patients' mercury levels were. But eventually, her diagnostic methods became much simpler.

HIGHTOWER: Look, it's not rocket science. If you eat a poison and you don't feel well, stop eating poison and see if you feel better. And sure enough people started feeling better.

The good news, here in the Bay at least, is that we are finally doing something about mercury pollution. It's a multi-billion dollar clean-up project, begun last year, by the San Francisco Bay Regional Water Quality Control Board. Manager Will Bruhns says that cleaning up mercury the Bay is not as simple as the kinds of problems his agency once tackled.



BRUHNS: There's no bad actor. There's no factory in some city that's dumping out the tons of mercury and if we could just make them clean up their act, all the problems would be solved. There isn't any.

Mercury comes from many sources. Hundreds of pounds a year flow from old mercury and gold mines in the Sierra and San Jose. Hundreds more run off city streets from things like broken thermometers and other urban waste. Airborne mercury drifts over from coal-fired power plants in Asia. Meanwhile, the Bay Area's five oil refineries and a cement kiln pump over a thousand pounds of mercury into the air a year, some of which ends up in the Bay. So the clean up has to happen on many fronts, all at once.

BRUHNS: It's a different kind of problem, that's what new here. And it's hard to deal with.

Over the next 20 years, the clean up will include hauling away mining waste from creek beds that lead to the Bay. Cities will be required to clean up their streets. Refineries will have to account for their mercury waste. Meanwhile the Bay is slowly cleaning itself, flushing mercury out through the Golden Gate. Still, scientists believe it will be at least a century before all Bay fish are safe to eat.

For Quest, I'm Amy Standen. KQED Radio News

Find out whether or not Dr. Jane Hightower feeds HER kids tuna fish sandwiches - and check out an interactive mercury map on [www.kqed.org/quest](http://www.kqed.org/quest).