

Does Your Farmed Salmon Contain This Chemical?

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

STORY AT-A-GLANCE

- › Fish farms are the water-based equivalents of land-based concentrated animal feeding operations, and as such they create the same, if not worse, environmental concerns
- › Since the salmon pens are placed along wild salmon runs, they pose a severe threat to wild salmon that pass by, exposing wild fish to diseases such as piscine reovirus, which now threatens wild salmon with extinction
- › Toxicology testing reveals farmed salmon is one of the most toxic foods in the world – more than five times more toxic than any other food tested, with eight times higher PCB levels than wild salmon
- › One of the reasons farmed salmon contain higher levels of toxins than wild is because their feed can be highly contaminated. Another is because they contain far higher levels of fat, which binds to and accumulates toxins
- › A chemical of particular concern found in farmed salmon (but not in wild) is ethoxyquin – a rubber stabilizer, pesticide, preservative and antioxidant all in one, and a suspected carcinogen that damages DNA

This article was previously published April 24, 2018, and has been updated with new information.

Do you buy farmed salmon in the belief that it's the environmentally responsible thing to do? Think again. Fish farms are the water-based equivalents of land-based concentrated

animal feeding operations (CAFOs), and as such they create the same, if not worse, environmental concerns.

Since the salmon pens are placed along wild salmon runs, they pose a severe threat to wild salmon stocks that pass by, exposing wild fish to diseases such as sea lice, pancreas disease,¹ infectious salmon anemia virus and piscine reovirus.

For a quick review, see "Racing a Virus"² above — a video created by Alexandra Morton, a Canadian marine biologist who has spent decades studying the impact of salmon farming on wild salmon. Piscine reovirus is a highly contagious blood virus that causes heart disease in the affected fish.

The virus was first discovered in Norwegian salmon farms and has proven to be nearly impossible to eradicate. And, with the spread of this disease into wild populations, wild salmon may soon go extinct.

Toxins Abound in Farmed Salmon

Importantly, farmed salmon also poses health risks to those who eat them. In fact, toxicology testing reveals farmed salmon is one of the most toxic foods in the world — more than five times more toxic than any other food tested.³ A global assessment of farmed salmon published in the January 2004 issue of *Science*⁴ found no less than 13 persistent organic pollutants in the fish, including PCBs and dioxins.

Other investigations⁵ reveal PCB concentrations in farmed salmon are, on average, eight times higher than in wild salmon. According to the authors, "Risk analysis indicates that consumption of farmed Atlantic salmon may pose health risks that detract from the beneficial effects of fish consumption."

Another group of scientists concluded that⁶ "Consumption of farmed salmon at relatively low frequencies results in elevated exposure to dioxins and dioxin-like compounds with commensurate elevation in estimates of health risk."

Persistent organic pollutants (POPs) are also a concern because, according to Cleveland Clinic,⁷ "levels of PCB (polychlorinated biphenyl, which is one type of POP) are **16 times higher** in farmed fish than in wild fish." Other contaminants, such as antibiotics, are at such high levels that the clinic advises children, women of child-bearing age and women who are pregnant not to eat farmed salmon at all.

Farmed Salmon Contain Harmful Fats

One of the reasons why farmed salmon contains much higher levels of toxins than wild is because the feed they're given is highly contaminated. In 2017 Responsible Seafood wrote:⁸

"Research shows farmed fish fed diets heavy on vegetable oils have higher amounts of omega-6 and lower amounts of omega-3 compared to fish fed diets heavy on fish oil. While seafood remains the primary source of beneficial omega-3s – the prevalence of omega-6 threatens seafood's healthy halo, particularly for farmed species with low levels of omega-3 fatty acids.

'The data shows those [vegetable] oils have affected the fatty acid profile in farmed fish, not just in omega-3 overall, but in increased omega-6 as well,' said Jillian Fry, project director of public health and sustainable aquaculture at the Johns Hopkins Center for a Livable Future."

Another reason for the higher toxin content is because farmed salmon contains far higher levels of fat, which binds to and accumulates these toxins. According to Cleveland Clinic:⁹

"A 3-ounce fillet of wild salmon has fewer calories and half the fat content of the same amount of farmed salmon. And although farmed salmon may have more omega-3 fatty acids, it also has more than double the saturated fat content – and that's not fat you want."

The exaggerated fat content in farmed salmon is a direct result of the processed high-fat feed that farmed salmon are given, which includes species-inappropriate ingredients

such as poultry meal, fish meal, poultry fat, fish oil, whole wheat, soybean meal, corn gluten meal, feather meal and rapeseed oil. In essence, the salmon are being fed a processed junk food diet high in toxic contaminants and drugs, and their nutritional composition reflects this.

Their diet also results in radically skewed ratios of omega-3 to omega-6 fats. Interestingly, industry leaders are beginning to see the light and they know this is not sustainable for good health. According to Responsible Seafood:¹⁰

"Out of necessity fish feed companies have turned to a variety of vegetable oils made from rapeseed (canola), soybeans, corn, nuts and wheat. Some are high in omega-6s. Douglas Tocher, professor at University of Stirling in the Institute of Aquaculture, over 15 years has researched how to use plant oils instead of fish oils while keeping the final fillets rich in omega-3s.

*There is no way around the fact that shifting to vegetable oils **has led to a loss of EPA and DHA**," he said. "Farmed salmon is still the best source of EPA and DHA you can get. But we're at the point where we can't continue that forever. We can't continue to just replace fish oil and fishmeal [with plant oils] because then we'll compromise seafood's health benefits ... Retaining the long-chain omega-3s in the fish tissue is the top priority."*

What's concerning is that the main oil they use — soybean — has an omega-6 to omega-3 ratio as high as 8-to-1! When Purdue University scientists looked at the fatty acid profiles of 76 different fish, they found that the omega-6 fatty acid content "ranged from 11 mg/100 grams in Alaska pollock to 2,530 mg/100 grams in Atlantic salmon."

This lopsided ratio can have negative health ramifications since most people are deficient in omega-3 while already getting far more omega-6 than they need thanks to processed foods, which tend to be high in damaged omega-6 fats. The imbalance also triggers inflammation in your body, according to researchers at Deakin University in Burwood, Australia, who said:

"When we have such an imbalance it means the body is constantly producing eicosanoids from omega-6 than omega-3. Basically, we put our body in a constant inflammation mode and that can facilitate a lot of diseases.' Those include cardiovascular disease, diabetes, and some forms of cancer."

The bottom line is, rather than being a wonderful source of healthy omega-3s, farmed salmon contains far more omega-6 than omega-3.

Chemical Added to Salmon Feed Has Questionable Safety Profile

A chemical of particular concern found in farmed salmon (but not in wild) is ethoxyquin,¹¹ developed by Monsanto in the 1950s. This chemical is a rubber stabilizer (used in the production of tires), pesticide, preservative and antioxidant all in one.

While it doesn't have the health benefits normally associated with dietary antioxidants, it does prevent oxidation of fats, which is why it's used in different types of animal feed, including fish feed and pet food.¹² As explained by Nutraceutical Business Review:¹³

"Globally, ethoxyquin is not approved for use as a direct food additive in foods for human consumption; therefore, ethoxyquin should not be detectable in the food supply. Specific to the omega-3 industry, some krill meals and crude fish oils for animal feed are preserved using ethoxyquin ...

The European Union (EU) upper limit in feed (including fish feed, but excluding dog food) is 150ppm ethoxyquin alone or together as the sum of BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene) and ethoxyquin.

The maximum content of ethoxyquin allowed in dog food is 100ppm and the mixture of ethoxyquin with BHA and BHT is allowed provided the total mixture doesn't exceed 150ppm. According to the European Food Safety Authority (EFSA), ethoxyquin is 'considered to be toxic to aquatic organisms based on the acute toxicity data provided for fish, daphnia and algae."

Ethoxyquin Health Effects

In human food production, ethoxyquin is used post-harvest to prevent scald (browning) in pears and apples, and as a color preservative for chili powder, paprika and ground chili powder.^{14,15} Side effects from direct exposure to this chemical include skin and eye irritation, allergic reactions, depression, reproductive effects, liver and kidney damage, and thyroid problems, and it's known to be "harmful if swallowed."¹⁶

Studies have also shown it adversely affects cell metabolism, especially the metabolic pathways of renal and hepatic cells in rats, and the mitochondria in bovine hearts and kidneys. As noted in one review, "The authors suggested that [ethoxyquin] interacted with site I of the mitochondrial respiratory chain, and it resulted in inhibition of oxygen consumption in the mitochondria of kidney and liver cells when glucose was a respiratory substrate. The effect was dose dependent."¹⁷

According to Chemical News, "While ethoxyquin has not been tested for its carcinogenic potential, a closely related chemical, 1,2-dihydro-2,2,4-trimethylquinoline, showed some evidence of carcinogenic activity in rats. The only suggestion of a potential carcinogenic effect for ethoxyquin came from a Manson et al. (1987) study."¹⁸

What Chemical News fails to mention is that the one and only study ever done to assess ethoxyquin's effects on human health also found carcinogenic effects.

This human health study was part of a thesis by Victoria Bohne, a former researcher with the Norwegian National Institute of Nutrition and Seafood Research (NIFES) in Norway, who made a number of disturbing discoveries, including the fact that ethoxyquin can cross the blood brain barrier. She was ultimately pressured to resign from NIFES after attempts were made to falsify and downplay her findings.

EFSA has also pointed out that while there's not enough data to make a conclusion about ethoxyquin's safety, one of its metabolites, ethoxyquin quinone imine, is "possibly genotoxic," and the impurity p-phenetidine, produced during the manufacturing process, is suspected of being mutagenic, meaning it may damage your DNA.¹⁹ As noted in a 2013 review:²⁰

"Possible carcinogenicity of [ethoxyquin] is probably connected with its prooxidant activity and induction of reactive oxygen radicals which cause DNA damage. DNA damage is usually repaired by cellular repair system, but if it is severe or there are too many lesions, this leads to programmed cell death (apoptosis).

Sometimes, however, the programmed cell death pathway is damaged so when the defense mechanisms fail there is no way to stop a cell from becoming a cancer cell. Some in vitro studies showed both cytotoxic effects of [ethoxyquin] leading to cell apoptosis or necrosis and damage of genetic material at DNA or chromosome levels."

Farmed Salmon Is a Significant Source of Ethoxyquin

Due to its potential toxicity, the EU has strict limits for ethoxyquin levels in fruits, nuts, vegetables and meat. However, since it was never intended for use in fish, and fish feed manufacturers never informed health authorities that they were using it, there are no limits on how much of the chemical is allowed in seafood.

One 2010 study²¹ found that eating 300 grams of farmed salmon would contribute "at most" 15% of the acceptable daily intake (ADI) of ethoxyquin for an individual weighing 60 kilos (132 pounds), and 75% of the ADI for BHT – another toxic chemical antioxidant. However, other testing has revealed farmed fish can contain levels of ethoxyquin that are up to 20 times higher than the level allowed in fruits, vegetables and meats, so it can hardly be brushed off as insignificant.

There are also lingering questions about just how much of the chemical people are getting from fish when you add in the metabolites of ethoxyquin, as researchers have found the chemical transforms once inside the animal's body. As one would expect, NIFES insists the levels of ethoxyquin found in fish feed are safe for humans.²² However, considering the lack of research, what guarantees do we have that such claims are accurate?

NIFES also claims ethoxyquin is "required to be added to fish meal in order to prevent it from exploding during sea transport and storage," and inaccurately states that "Everything is toxic if it is consumed in sufficiently large amounts, which is to say that the amount of a given substance ... determines whether or not it can damage our health."

This is not an accurate statement of fact, as researchers have shown that even minute amounts of certain toxins can be dangerous. In some cases there's no safe level above zero.

Studies²³ have also demonstrated that even tiny amounts of chemicals, when combined with others, can have significant effects. Even nontoxic chemicals can become carcinogenic at low doses when combined with other chemicals.

As noted in one 2015 study,²⁴ "Our analysis suggests that the cumulative effects of individual (noncarcinogenic) chemicals acting on different pathways, and a variety of related systems, organs, tissues and cells could plausibly conspire to produce carcinogenic synergies."

Norwegian Fishery Minister Has Financial Ties to Industry

According to Kurt Oddekalv, a Norwegian environmental activist who has brought a lot of attention to the harmful impacts of fish farming, one of the reasons research into the health effects of ethoxyquine is so hard to come by is because it was purposely stifled by the former Norwegian minister of fisheries and coastal affairs, Lisbeth Berg-Hansen,²⁵ a major shareholder in a commercial salmon farm and deputy chair of the board of the Norwegian Institute of Marine Research.

In 2009, the Norwegian environmental group Green Warriors of Norway filed charges against Berg-Hansen, claiming her financial conflicts of interest had led her to violate regulations she was supposed to enforce. A 2013 French documentary claimed she was single-handedly responsible for lowering the legal limits of toxins allowed in Norwegian fish. In the documentary, "Poisonous Fish: The Big Health Lie," Oddekalv also told the filmmakers:²⁶

"... [T]he research budget in the area of ethoxyquin was severely reduced ... through pressure from the former Norwegian fishery minister [Berg-Hansen] ... The minister herself created the current regulations for fishery. She had full control over the public health authority and everything that had to do with fish farming.

She exploited her power. She wanted fish to be sold at all costs, regardless of whether [it's] sick or not, so that the farmers don't lose any money. This never happened before in Norway. She's the pivotal point of this whole matter."

Ethoxyquin May Pose Greater Risks Than Imagined

A recent article in the Norwegian newspaper Morgenbladet,²⁷ also addresses the conflicts of interest that has kept ethoxyquin in the salmon industry and highlights Bohne's and others' findings:

"[Bohne] contacted a Polish researcher, Alina Blaszczyk of the University of Lodz, who had studied the effect of ethoxyquin on human cells. Attempt that the substance caused chromosomal aberrations, holes and fractures in chromosomes.

Blaszczyk believed the substance damaged the DNA in our lymphocytes – a subset of white blood cells. Today, she explains: 'We found that ethoxyquin was chemically toxic, destroyed chromosomes and DNA ...'

... Professor Edmund Maser at the Department of Toxicology and Pharmacology at the University of Kiel ... [commented on] the metabolite quinone imine [saying] ... 'Quinone imine structures can bind to DNA and can create mutations. They can be carcinogenic.

There is no safe lower level. One molecule may be enough to start a tumor' ... Blaszczyk ... agrees: 'If a molecule reacts with DNA, it can cause mutations and lead to the development of cancer.'

Blaszczyk has studied how ethoxyquin affects cells and their genetic material. In a summary study, she and colleagues say that research suggests that ethoxyquin is 'guilty of a wide range of health-related problems in dogs as well as in humans.' Dog tests show symptoms in the liver, kidneys, and thyroid gland, dysfunctionality of reproductive capacity, maternal injuries, allergic reactions, skin and hair abnormalities.

Blaszczyk also refers to studies indicating that the metabolite ethoxyquin dimer (EQDM) in the salmon is chemophilic and recombinant in human lymphocytes. The implication of this is that ethoxyquin must be labeled well, consumers must take care not to get too much and that the drug needs to be regulated better than today.

Blaszczyk's studies are broadly cited in EFSA's report, but she writes [via] e-mail: 'They did not mention the most important of these studies. It was that ethoxyquin caused disentric chromosomes, and relocated atypical chromosomes. These deviations were not extensive, but they were serious.'

When Boycotting Factory Farmed Food, Remember the Fish

Factory farming has not only become a source of tremendous pollution but it's also creating food that is unsafe for consumption in the long term. This includes fish farms, which are the CAFOs of the sea. So, when you shop for healthy food for your family, remember to look for wild-caught seafood and shun farmed varieties.

At present, more than half of all fish consumed in the U.S. is farmed, and it's only customer demand that allows this destructive industry to flourish – which it does at the expense of your health. As noted by Organic Consumers:²⁸

"The U.S. industrial agriculture and fishing industry is an out of control system based on cruel, filthy, disease-ridden and environmentally destructive animal prisons and fish pens; labor exploitation; false advertising; ... corporate

corruption of government; and the use of massive amounts of dangerous pesticides, chemical fertilizers, antibiotics, hormones and growth promoters ...

The production of factory-farmed meat, dairy, poultry and fish is the No. 1 cause of water pollution, soil degradation, greenhouse gas emissions, and chronic diseases such as cancer, heart disease, diabetes, reproductive defects, hormone disruption and obesity...

Factory-farmed salmon and fish not only threaten wild salmon and other marine species by spreading disease ... but also by contaminating coastal waters and the ocean with the toxic chemicals and feed used on fish farms.

As Sea Shepherd Conservation Society says, via their Operation Virus Hunter campaign, 'You are not saving wild salmon by eating farmed salmon' ... We are what we eat. This means, among other things, we need to be just as concerned about fish and seafood as we are about the other items on our plate.

So, ask your restaurant waiter if the vegetables are organic, and better yet local and organic, and put your money where your values lie. But don't forget to ask whether the meat, dairy or eggs are organic or grass-fed; or whether they are coming off the food service truck from factory farms.

And last but not least, don't forget to do the same thing for the items on the fish menu. The nation that destroys its soil, freshwater and oceans is the nation that will eventually destroy itself."

Sources and References

- ¹ [J Fish Dis. 2007 Sep;30\(9\):545-58](#)
- ² [Alexandra Morton, Racing a Virus](#)
- ³ [Nspirement. April 19, 2019](#)
- ^{4, 5} [Science 2004 Jan 9;303\(5655\):226-9](#)
- ⁶ [Environmental Health Perspectives 2005 May;113\(5\):552-6](#)
- ^{7, 9} [Cleveland Clinic. Fish Face-Off: Wild Salmon vs. Farmed Salmon February 17, 2022](#)
- ^{8, 10} [Responsible Seafood. January 30, 2017](#)
- ¹¹ [The Norwegian American December 31, 2020](#)

- ¹² Dog Food Advisor Ethoxyquin
- ¹³ Nutraceutical Business Review June 20, 2014
- ^{14, 16} Chemical News December 5, 2017
- ^{15, 17, 20} International Journal of Food Science 2013, Article ID 585931
- ¹⁸ Carcinogenesis 1987 May;8(5):723-8
- ¹⁹ Michael Kummer, Ethoxyquin
- ²¹ Food Addit Contam Part A Chem Anal Control Expo Risk Assess. 2010 Dec;27(12):1652-7
- ²² NIFES.hi.no March 26, 2011
- ²³ National Food Institute March 19, 2015
- ²⁴ Carcinogenesis 2015 Jun;36 Suppl 1:S254-96
- ²⁵ Seafood Source. Norway Names Fisheries Minister. October 20, 2009
- ²⁶ Project Avalon Forum March 28, 2015
- ²⁷ Morgenbladet April 5, 2018
- ²⁸ Organic Consumers March 28, 2018