

Dental Amalgam Mercury and the Environment Online Learning Activity Script
International Academy of Oral Medicine and Toxicology (IAOMT); www.iaomt.org
Last updated June 2020

PREFACE TO IAOMT’S DENTAL AMALGAM MERCURY AND THE ENVIRONMENT ONLINE LEARNING VIDEO ACTIVITY

Text on screen:

Welcome to IAOMT’s Dental Amalgam and the Environment Online Learning Video Activity. The “Materials” tab above this video, as well as the text box below this video, contain links to references and resources cited in this activity, scientific literature related to the topics presented, and a script for this entire video. The successful completion of a quiz at the end of this activity is required for individuals participating in an IAOMT course.

In offering this activity, the IAOMT’s intention is to present as much scientific information as possible on different dental materials, treatments, patient and dental staff safety, and other aspects of dentistry.

The objective of the Dental Amalgam and the Environment Online Learning Video is that at the conclusion of this activity, participants will be able to recognize the impact of mercury pollution from dental amalgam and other sources and measures being taken to reduce mercury releases to the environment.

The IAOMT emphasizes that health care practitioners must make their own professional judgments for the benefit of themselves and their patients and staffs. You are responsible for exercising your own judgment concerning the specific treatment options to utilize in your practice; for complying with applicable laws and regulations including local dental practice acts and informed consent requirements; and for abiding by insurance requirements including written declarations of coverage.

Only proceed if you understand and agree with these statements.

If you are ready to proceed, the activity will begin with Lillian Lasaten-Ebuen, DDS AIAOMT, providing you with the coursework for this Dental Amalgam and the Environment Online Learning Video Activity.

MERCURY AS A GLOBAL POLLUTANT

The governing bodies of the world have come to recognize mercury pollution as a serious environmental and health issue. In October 2013, a worldwide treaty to eliminate trading mercury and mercury added products, negotiated at the United Nations Environmental Program, was signed by 100 countries in Minamata, Japan. I am proud to have been at those negotiations as a representative of the IAOMT as we successfully argued to have dental amalgam included as one of the products that should be regulated. It is not on the list of

products to be eliminated though, but rather to be phased down. To quote the text of the treaty, “mercury is a chemical of global concern owing to its long-range atmospheric transport, its persistence in the environment once introduced by human activity, its ability to bioaccumulate in ecosystems, and its significant negative effects on human health and the environment.” Minamata in the 1950’s was the site of the most shocking incident of mass mercury poisoning the world has ever seen, so it's fitting that the treaty is called the Minamata Convention, and that the signing ceremony took place there.

THE MINAMATA CONVENTION ON MERCURY

Insert Video IAOMT UNEP PARTICIPATION in the Minamata Convention on Mercury:
<https://youtu.be/tbTvRPniX7A>

The following is the script from the video:

In the 1950s, Chisso Fertilizer Company had begun to dump its toxic wastewater containing methylmercury, a byproduct of fertilizer manufacturing process, into Minamata Bay. This deluge of methylmercury from Chisso contaminated the local fisheries which residents of Minamata relied upon for jobs and sustenance. The results of contaminating the local food supply led to many people exhibiting strange symptoms, including difficulty with speech, numbness in the limbs, and seizures, just to name a few. The impact of this metal mercury exposure to children and the unborn was devastating, leading to many deaths and disabilities. In October of 2013 the government of the world united in their efforts to reduce the amount of mercury released into the environment by signing on to the Minamata Treaty on Mercury. This groundbreaking treaty will require governments to implement a number of measures to drastically reduce the amount of mercury entering the environment, ending its use in a number of various sectors by the year 2020. While scientific evidence has proven beyond a shadow of a doubt that exposure to mercury that is released from amalgam fillings harms human health, the legislation and political policies necessary to safeguard the health rights of patients lags further behind. That’s why the IAOMT has been active at the international level, spreading awareness of the harm from dental mercury fillings and outlining currently available solutions. During the years that the Minamata Treaty was being negotiated, the IAOMT was actively involved by informing delegates about the large amounts of mercury that the dental profession releases into the environment each year and its potential to harm human health. These efforts paid off as the final treaty includes language to phase down the use of mercury amalgam fillings, and shortly after the Convention, the United States government was the first to ratify this monumental mercury treaty.

Includes footage from: Minamata: The Victims and their World. Directed by Noriaki Tshuchimoto, Higashi Productions, 1971. Zakk Films,
<https://www.zakkafilms.com/product/minamata-the-victims-and-their-world/>

INDUSTRIAL RELEASES OF MERCURY

Using ice and sediment cores, scientists have been able to track the increasing global mercury that is due to human activity. They've concluded that we have roughly tripled the amount of mercury that circulates in the air, land, and water over pre-industrial levels.

A recent accounting of total mercury use estimates that industrial activity has taken 720,000 tons of mercury out of the ground and put it into global circulation since 1850. That's twice as much as had previously been measured. Click on the link to see a diagram of world-wide mercury circulation; showing current and pre-industrial levels.

Screen to the right:

- Human activity has “tripled the mercury content of surface waters compared to pre-anthropogenic conditions.”

Lamborg CH, Hammerschmidt CR, Bowman KL, Swarr GJ, Munson KM, Ohnemus DC, Lam PJ, Heimbürger LE, Rijkenberg MJ, Saito MA. A global ocean inventory of anthropogenic mercury based on water column measurements. *Nature*. 2014 Aug;512(7512):65-8.

- Industry has used twice as much mercury since 1850 as had been known before.

Horowitz HM, Jacob DJ, Amos HM, Streets DG, Sunderland EM. Historical mercury releases from commercial products: Global environmental implications. *Environmental Science & Technology*. 2014 Sep 2;48(17):10242-50.

GOLD MINING AND MERCURY RELEASES

We know perfectly well where industrial mercury pollution is coming from: burning of coal, mining activity, smelting of non-ferrous metals, and of course, some comes from dental amalgam waste. One of the most problematic areas of mining activity that impacts developing areas of the world, including my own country, the Philippines, is small scale or artisanal gold mining. Poor people excavate mostly low-grade ore deposits and extract the gold by amalgamating it with mercury. Then they burn off the mercury to get verified gold to sell, without any regard to the toxic effects of mercury on themselves or their immediate environment. Unfortunately, a proportion of mercury imported to areas where this small scale gold mining goes on is actually labeled for use in dental amalgam.

EPA MERCURY CAPTURE SYSTEM FOR GOLD MINING

Insert video:

EPA Mercury Capture System for Gold Mining: <https://youtu.be/-rg4utXDuf8>

MERCURY'S IMPACT ON WILDLIFE

Why do we care about mercury in the environment? We care because mercury pollution has a toxic impact on ecosystems, on wildlife, and on human health.

Impact on wildlife has been documented for many decades in surveys and references, almost too numerous to mention. There have been overt poisoning episodes, but also many more subtle effects, such as decreased reproductive success in fish and birds and altered development of vocalization in songbirds.

Text on screen:

- Birdsong differs between mercury polluted and reference sites.

Hallinger KK, Zabransky DJ, Kazmer KA, Cristol DA. Birdsong differs between mercury-polluted and reference sites. *The Auk*. 2010 Jan 1;127(1):156-61.

- Mercury induces reproductive impairment in fish.

Crump KL, Trudeau VL. Mercury-induced reproductive impairment in fish. *Environmental Toxicology and Chemistry: An International Journal*. 2009 May;28(5):895-907.

- Concerning levels of mercury have been documented in sea lions, whales, and seals.

Correa L, Rea LD, Bentzen R, O'Hara TM. Assessment of mercury and selenium tissular concentrations and total mercury body burden in 6 Steller sea lion pups from the Aleutian Islands. *Marine Pollution Bulletin*. 2014 May 15;82(1-2):175-82.

Frouin H, Loseto LL, Stern GA, Haulena M, Ross PS. Mercury toxicity in beluga whale lymphocytes: limited effects of selenium protection. *Aquatic Toxicology*. 2012 Mar 1;109:185-93.

Peterson SH, Ackerman JT, Costa DP. Marine foraging ecology influences mercury bioaccumulation in deep-diving northern elephant seals. *Proceedings of the Royal Society B: Biological Sciences*. 2015 Jul 7;282(1810):20150710.

- Mercury concentrations in the world's oceans are expected to rise even if anthropogenic mercury emissions are stopped due to a lag time that varies from decades to centuries.

Sunderland EM, Mason RP. Human impacts on open ocean mercury concentrations. *Global Biogeochemical Cycles*. 2007 Dec;21(4).

Peterson SH, Ackerman JT, Costa DP. Marine foraging ecology influences mercury bioaccumulation in deep-diving northern elephant seals. *Proceedings of the Royal Society B: Biological Sciences*. 2015 Jul 7;282(1810):20150710.

- Once in the environment, mercury pollution damages animals, plants, and the entire ecosystem, while creating “hotspots that last for centuries.”

Pirrone N, Mason R. *Mercury Fate and Transport in the Global Atmosphere: Emissions, Measurements, and Models*. New York, New York: Springer. 2009: 166.

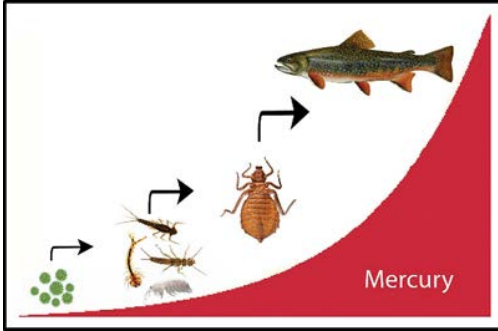
MERCURY IN SEAFOOD

As mercury concentrates in the global food web, it inevitably ends up in the human food supply, mostly as methyl mercury in seafood. The more mercury circulating in the environment, the more mercury gets into our food supply.

Text on screen:

This graphic from the National Park Service shows how mercury levels increase exponentially up the food web as larger species eat smaller ones and “bioaccumulate” the mercury.

Most fish advisories, which warn people to limit or avoid eating certain types of fish, are due to dangerous mercury levels.



Source: Mercury (Hg) Biomagnification Graphic; National Park Service; 2001:
<https://npgallery.nps.gov/AssetDetail/ba40f463-9f49-4a28-bcd9-a1e65a0d1dee>

Fish advisory from EPA and FDA from July 2019:

<https://www.fda.gov/food/consumers/advice-about-eating-fish>

Choices to Avoid HIGHEST MERCURY LEVELS		
King mackerel	Shark	Tilefish (Gulf of Mexico)
Marlin	Swordfish	Tuna, bigeye
Orange roughy		

www.FDA.gov/fishadvice
www.EPA.gov/fishadvice

 United States Environmental Protection Agency
  U.S. FOOD & DRUG ADMINISTRATION

Research on Mercury and Pregnancy

- “Thus, there seems to be no margin of safety for neurodevelopmental effects in fetus, for women with high fish consumption unless they decrease their intake of certain fish species.”

Björnberg KA, Vahter M, Grawé KP, Berglund M. Methyl mercury exposure in Swedish women with high fish consumption. *Science of the Total Environment*. 2005 Apr 1;341(1-3):45-52.

- “Both the Environmental Protection Agency and National Academy of Science state that between 8 and 10% of American women have mercury levels that would render any child they gave birth to at risk for neurological disorders.”

Haley BE. Mercury toxicity: genetic susceptibility and synergistic effects. *Medical Veritas*. 2005 Nov;2(2):535-42.

DENTAL MERCURY'S IMPACT ON THE ENVIRONMENT

Worldwide trade and use of mercury for dentistry is not a small player in the environment. The United Nations environmental program has documented that dental mercury accounts for as much as 10% of global, industrial mercury output.

Not only that, but restorative dentistry using amalgam is a sure way to disperse mercury into the environment. Excess amalgam scraped away from new fillings, used amalgam capsules with traces of mercury left inside, mercury that people with fillings breathe out and excrete through urine and feces, and the fillings of the buried and cremated, all add up to more mercury than we can ever account for with reclamation and recycling.

Following is a video that explains how our use of amalgam ends up polluting the environment.

EVIDENCE OF HARM EXCERPTS ON DENTAL MERCURY IN THE ENVIRONMENT

Insert video:

Evidence of Harm excerpt Dental Mercury's Toxic Journey into the Environment:
<https://youtu.be/nocbPC1W3Y>

AMALGAM WASTE AND MERCURY RELEASES FROM DENTAL OFFICES

The essence of biological dentistry is about the choices we make in dental practice to always choose the safest and least toxic methods to accomplish our goals of treatment. The most fundamental and far reaching choices we can make as a professional is to stop using amalgam fillings and to start treating amalgam waste in responsible ways.

If all the gowns, drapes, gloves, rubber dams, etc. are disposable, this photo shows how much waste one dentist can produce in one day. It is all mercury contaminated. Where should it be disposed of?

Screen to the right:



A lot of that amalgam waste is generated when we drill out old fillings. It is in the form of fine particles that go up the suction lines, and traditionally, it was just sent down the sewer. But waste-water authorities in the developed countries noticed that their treatment plants were emitting water that still had too much mercury content. Investigations showed that result even when there were no industries dumping mercury and found that most of the mercury contamination was coming from dental offices.

Unless something is done to remove mercury from the waste steam before it enters the sewer system, each dental office that uses or removes amalgam fillings acts like a point source of pollution. It's much cheaper and easier to remove the mercury at the source than it is to try to get it out of sewage water downstream.

Screen to the right:



Fact Sheet: Effluent Limitations Guidelines and Standards for Dental Offices

More and more cities in developed countries have demonstrated success in reducing mercury and treated wastewater with amalgam separators in dental offices because amalgam separators can reduce the amount of mercury discharge in wastewater from dental offices.

Text on screen:

In fact, the U.S. EPA has utilized measures in the Clean Water Act to develop standards for dental clinics to reduce mercury releases by mandatory use of amalgam separators. These standards went into effect in July 2017, and the EPA expects it will reduce the discharge of metals to publicly owned treatment works by at least 10.2 tons per year, about half of which is mercury.

Even though standards are required, it would be helpful to enforce maintenance requirements for amalgam separators. It should also be remembered that amalgam separators only contribute to reducing dental mercury in wastewater and not the additional burdens on the environment and human health.

Which separator is right for you?

Consider the size of your practice, and how many chairs will be removing amalgam at a time.

Think about how often will it need to be changed, and what the exposure risk will be when it needs to be changed.

It is highly recommended that you research amalgam separators for their efficiency. When researching amalgam separators, remember that there are different ways of reporting efficiency.

A great resource is the State of New Jersey's Amalgam Separator Recycling Page at http://www.nj.gov/dep/dwq/amalgam_separators.htm.

Another great resource is the IAOMT Scientific Review for Best Management Practices for Mercury and Mercury Amalgam Separation from Dental Office Waste Water by Nestor Shapka, which is provided in the Resources and References section of this online learning activity.

MERCURY RECYCLING

Recycling is perhaps a misnomer when referring to mercury. The United Nations Environmental Program Minamata Convention on Mercury mandates that mercury removed from commerce should be securely stored, indefinitely, and not resold nor used again. Engineers are actively working on ways to store mercury, but whole systems will have to be built all over the world to implement the terms of the treaty and keep reclaimed mercury from becoming a pollutant all over again.

Several companies from Europe and North America are actively working to extend mercury recycling services to the rest of the world. There are many technical issues. How can dental practices in poor countries pay for mercury recycling services? Will governments subsidize them? What happens to mercury that is collected? Does every country have to develop a system to store and sequester the mercury forever, or can it be transported to permanent storage facilities in other countries?

Screen to the right:

UNEP's technical options for storage and disposal of mercury study results are provided in the Resources and References section of this online learning activity. Also provided in the Resources and References section is more information about finding out how to recycle items in your specific region.

CONCLUSION

The IAOMT is an accredited member organization of the United Nations Environment Programme. The environmental impact of dental materials and procedures is an important part of our mission.

We can do better, healthier, and more environmentally friendly dentistry if we were to leave mercury amalgam to its place in history, switched to the far less toxic alternatives materials for restorative dentistry, and commit ourselves to cleaning up the mercury mess that is our legacy.

POSTFACE TO IAOMT'S DENTAL AMALGAM AND THE ENVIRONMENT ONLINE LEARNING VIDEO ACTIVITY

Text on screen:

You have finished viewing the video component of this activity. If you are participating in this activity as part of an IAOMT course, you must successfully complete a quiz to obtain credit. Access to the quiz is provided in the "Activity Content" below this video, as well as on the menu to the left. Additionally, the "Materials" tab above this video contains links to references and resources cited in this activity, scientific literature related to the topics presented, and a script for this entire video. Thank you for learning with the IAOMT, as we work together to achieve safer dentistry and a healthier world.