Mercury Hygiene in Dental Offices, Clinics and Schools

Prepared By Amanda Just, MS, IAOMT Program Director, and
Jack Kall, DMD, MIAOMT, Chairman of the IAOMT Board of Directors
Written September 14, 2016; Updated July 31, 2017

Brief Overview of Occupational Hazards and Dental Mercury

While amalgams are currently used for 45% of all direct dental restorations worldwide,[1] articles published in the *Journal of the American Dental Association* have established that these mercury fillings are still being used on over 50% of Americans.[2] What this means is that while some American dentists have stopped using amalgam, others are still using it on a routine basis.

The highly significant amount of mercury still being used by dentists in the U.S. has been established by other statistics. According to the United States Geological Survey, in 2010, dental amalgam was the leading end-use sector of mercury in the U.S.[3] Other sources demonstrate that the use of mercury for dental amalgam in the U.S. has been estimated at 35.2 tons per year[4] and that there are currently over 1,000 tons of mercury in the mouths[5] of approximately 120 million Americans,[6] which is more than half of all the mercury being used in the U.S. today.

In 2013, the United Nations Environment Programme (UNEP)'s Intercessional Negotiating Committee formalized a global, legally-binding mercury treaty, which has now been ratified by more than 70 countries, including the U.S. Part of UNEP's "Minamata Convention on Mercury" text includes initiatives to *phase-down* the use of dental mercury.[7] This treaty will enter into force on August 16, 2017. As part of this effort, a new EU mercury regulation plans to prohibit the use of dental mercury amalgam for vulnerable populations (pregnant or breastfeeding women, children under 15 years old), require amalgam separators in dental offices, and provide for discussion about ending dental mercury use in the European Union by 2030.[8] Yet, even if dental mercury was no longer placed as a filling material, there would still be a need for American dentists to remove millions of the existing amalgam fillings due to device failure, tooth decay, consumer preference, and other circumstances.

Meanwhile, scientific research demonstrates that dental mercury amalgam exposes patients, dental professionals, dental staff, and fetuses to releases of mercury vapor, mercury-containing particulate, and/or other forms of mercury contamination.[9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 3435 36 37 38 39 40 41 42 43 44 45 46] Furthermore, mercury vapor is known to be released from dental mercury amalgam fillings at higher rates during brushing, cleaning, clenching of teeth, chewing, etc.,[47 48 49 50 51 52 53 54 55 56 57 58 59 60] and mercury is also known to be released during the placement, replacement, and removal of dental mercury amalgam fillings.[61 62 63 64 65 66 67 68 69]

Because of daily exposures to dental mercury in their breathing zone during the placement, cleaning, polishing, removal, and other practices involving amalgam fillings, dentists, dental staff, and dental students are exposed to mercury at a greater rate than their patients. Severe exposures from past practices include hand-squeezing of fresh amalgam, where drops of liquid mercury could run over the dentist's hands and contaminate the entire office.[70] Dangerous levels of mercury are still generated in the dental workplace, and research has clearly identified that exposure to these mercury levels can cause ill-health to dental workers,[71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102] and dental students.[103 104 105] Another area that has received much attention is the possibility of reproductive hazards to female dental personnel, including menstrual cycle disorders, fertility issues, and pregnancy risks.[106 107 108 109 110 111]

Clearly, dental workers require protection from mercury exposures when working with dental mercury amalgam, and a variety of studies have specifically called for protective measures to be taken in the dental office as a means of limiting mercury releases.[112] [113] [114] [115] [116] [117] [118] [119] [120] [121] [122] [123] There are levels of increasing protection for limiting exposure during mercury-related dental procedures. Depending on the level of protection, health risks will vary. The challenge is raising awareness of both the current OSHA standards[124] [125] and the EPA standards,[126] as well as educating and training U.S. dentists to properly comply with them. In particular, dentists need easily accessible, hands-on information about adequately utilizing effective engineering controls, safe work practice controls, administrative controls, and personal protective equipment as they work with dental amalgam mercury.

In summary, chronic (low dose, long-term) exposure to mercury for dentists, dental staff, dental students, and dental patients exists for all those still placing dental amalgam mercury fillings. There is also a high risk of acute (high dose, short-term) mercury exposure to dentists, dental staff, dental students, and dental patients when previously existing dental mercury amalgam fillings are drilled out.

This acute exposure to mercury vapor and particulate for dentists, dental staff, dental students, and dental patients has been scientifically documented,[127] [128] [129] [130] [131] [132] [133] [134] and it can especially endanger pregnant women, lactating women, women of childbearing age, fetuses, children, and other sensitive populations. In fact, a series of studies have shown that the removal of amalgam fillings can generate mercury levels that exceed OSHA's PEL.[135]

Other than primary exposures during dental mercury amalgam removal, secondary exposures in less obvious areas of the dental office are emerging as additional sources of chronic mercury exposures. Some of these peripheral exposures include the following:

- mercury exposure to staff, patients, and visitors in other parts of the office not directly involved in the removal process
- environmental mercury exposure caused by the waste from removal and storage of amalgam, especially because the ADA's "Best Management Practices for Amalgam Waste"[136] is voluntary
- storage and disposal of workplace protective clothing and instruments used during procedures involving dental mercury amalgam
- mercury vapor exposure from sterilization of instruments used on dental mercury amalgam fillings
- mercury vapor and particulate on the clothing, and under/around the dentist, staff, dental students, and patients in the immediate removal area
- mercury particulate that is carried home in hair, on shoes, and other clothing from the dental office

To assist in mitigating the potential negative outcomes of both primary and secondary mercury exposure during amalgam removal, the IAOMT continually updates its rigorous safety recommendations for removal of existing dental mercury amalgam fillings to protect dental professionals, students, staff members, patients, and others from mercury exposure.[137]

U.S. Regulations—Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA):

Amalgam separators can successfully reduce the amount of mercury discharge in wastewater from dental offices. [138] [139] In fact, a 2014 article about the issue written by mercury recyclers qualified: "Capture efficiency rates for mercury by amalgam separators range between 95-99%."[140]

For this reason, the U.S. EPA utilized measures in the Clean Water Act to develop standards for dental clinics to reduce mercury releases by requiring that dental offices install amalgam separators. This EPA requirement went into effect on July 14, 2017, and the EPA has estimated that it could reduce the discharge of mercury by 5.1 tons annually.[141]

Enforced standards that require amalgam separators are essential in stopping mercury from entering the environment, especially because voluntary initiatives have often been successful.[142] However, even when standards are required, it would be helpful to likewise enforce maintenance requirements for amalgam separators, as the Royal College of Dental Surgeons has done in Ontario, Canada.[143] It should also be remembered that amalgam separators only contribute to solving the problem of dental mercury in wastewater and not the additional burdens placed by amalgam fillings on the environment and human health.

Employee exposure to mercury is regulated in the United States by the 1970 Occupational Safety and Health Act[144] and Workers' Rights Handbooks[145] from the United States Department of Labor's Occupational Safety and Health Administration (OSHA), which establish that all employees have the right to know about the chemicals in their work environment. OSHA's Hazard Communication Standard (HCS) states: "All employers with hazardous chemicals in their workplaces must have labels and safety data sheets [SDS] for their exposed workers, and train them to handle the chemicals appropriately. The training for employees must also include information on the hazards of the chemicals in their work area and the measures to be used to protect themselves."[146] Employers must also evaluate workplaces for allowable airborne concentrations,[147] and they are supposed to keep a 30-year record of employee exposures and medical records.[148] Employees have the right to access this information, and more on workers' rights in regards to chemical exposures can be learned at https://www.osha.gov/Publications/pub3110text.html.[149]

The purpose of the safety data sheets (SDS, formerly known as material safety data sheets, or MSDS) required by OSHA is to protect workers by supplying them with the most crucial facts about the hazardous materials at their jobsite, such as the physical properties of the material, proper storage and handling techniques, known health risks and essential emergency procedures.

Thus, manufacturers of amalgam fillings must create these information sheets, and excerpts from just a few of the SDSs for dental amalgam includes compelling evidence about the known dangers of using mercury in fillings:

- SDI; Permite; Lojic +; GS-80, GS-80 Spherical; F400; Ultracaps +; Ultracaps S; SDI Admix; SDI Spherical and New Ultrafine.- Capsules; Australia, Brazil, Ireland, and the USA; 2015:[150]
    - Hazard Identification/California Prop 65 Warning: "This product contains mercury, a chemical known to the State of California to cause birth defects or other reproductive harm."
    - First Aid Measures: "May cause respiratory disorders including inflammation and fluid retention. Inhalation of mercury vapours at high concentration can cause dyspnea, coughing, fever, severe nausea, vomiting, excess salivation, kidney damage with renal shutdown."
    - Toxicological Information/Chronic Health Effects: "Inhalation of mercury vapours, dusts or organic vapours, or skin absorption or mercury over long periods can cause mercurialism. Symptoms include tremors, inflammation of mouth and gums, excessive salivation, stomatitis, blue lines on gums, pain and numbness in extremities, weight loss, mental depression, and nervousness. Exposure may aggravate kidney disorders, chronic respiratory disease and nervous system disorders. May cause damage to blood, kidneys, liver, brain, peripheral nervous system, central nervous system."

- Kerr Corporation; Tytin FC ™; USA; 2014:[151]
    - First Aid Measures/Inhalation: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations, salivation, metallic taste, eye irritation, respiratory tract irritation, coughing, pulmonary edema, wheezing and breathing difficulties, headache, fever, nausea or vomiting, diarrhea, abdominal cramps and pain, muscle weakness / pain, mental confusion or disorientation."
    - First Aid Measures/Skin Contact: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations."
    - First Aid Measures/Ingestion: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations."
- Henry Schein; SDS acc. to OSHA HCS; Stratosphere, Ionosphere, Troposphere; USA; 2014:[152]
    - Hazard Identification/Classification: "Very toxic, Very toxic by inhalation, Toxic, May cause harm to the unborn child, Toxic: danger of serious damage to health by prolonged exposure through inhalation."
    - Disposal Consideration: "Must not be disposed of together with household garbage. Do not allow product to reach sewage system."
    - Toxicological Information: "Avoid exposure of mercury to pregnant person."

---

[1] Heintze SD, Rousson V. Clinical effectiveness of direct Class II restorations—a meta-analysis. *J Adhes Dent.* 2012; 14(5):407-431.

[2] Makhija SK, Gordan VV, Gilbert GH, Litaker MS, Rindal DB, Pihlstrom DJ, Gvist V. Dental practice-based research network restorative material: Findings from the characteristics associated with type of practitioner, patient and carious lesion. *J Am Dent Assoc.* 2011; 142: 622-632.

[3] Wilburn DR. Changing patterns in the use, recycling, and material substitution of mercury in the United States: U.S. Geological Survey Scientific Investigations Report 2013–5137. 2013. 32 p. Available from: http://pubs.usgs.gov/sir/2013/5137/. Accessed January 22, 2016.

[4] Vandeven JA, McGinnis SL. An assessment of mercury in the form of amalgam in dental wastewater in the United States. *Water, Air, and Soil Pollution.* 2005; 164(1-4):349.

[5] United States Environmental Protection Agency. *International Mercury Market Study and the Role and Impact of US Environmental Policy.* 2004.

[6] Richardson GM, Wilson R, Allard D, Purtill C, Douma S, Gravière, J. Mercury exposure and risks from dental amalgam in the US population, post-2000. *Science of the Total Environment.* 2011; 409(20): 4257-4268.

[7] United Nations Environment Programme. *Minamata Convention on Mercury: Text and Annexes*. 2013: 48. Available from UNEP's Minamata Convention on Mercury Web site: http://www.mercuryconvention.org/Portals/11/documents/Booklets/Minamata%20Convention%20on%20Mercury_booklet_English.pdf. Accessed December 15, 2015.

[8] European Commission Press Release Database. Questions and answers: EU mercury policy and the ratification of the Minamata Convention. MEMO/17/134. http://europa.eu/rapid/press-release_MEMO-17-1344_lv.htm. Accessed July 28, 2017.

[9] Al-Saleh I, Al-Sedairi A. Mercury (Hg) burden in children: The impact of dental amalgam. *Sci Total Environ.* 2011; 409(16):3003-3015. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0048969711004359. Accessed December 22, 2015.

[10] Ask K, Akesson A, Berglund M, Vahter M. Inorganic mercury and methylmercury in placentas of Swedish women. *Environ Health Perspect.* 2002; 110(5):523-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240842/pdf/ehp0110-000523.pdf. Accessed December 22, 2015.

[11] Barregård L. Biological monitoring of exposure to mercury vapor. *Scandinavian Journal of Work, Environment & Health*. 1993:45-9. Available from: http://www.sjweh.fi/download.php?abstract_id=1532&%3Bfile_nro=1&origin=publication_detail. Accessed December 18, 2015.

[12] de Oliveira MT, Pereira JR, Ghizoni JS, Bittencourt ST, Molina GO. Effects from exposure to dental amalgam on systemic mercury levels in patients and dental school students. *Photomed Laser Surg.* 2010; 28(S2): S-111. Abstract available from: https://www.researchgate.net/profile/Jefferson_Pereira/publication/47369541_Effects_from_exposure_to_dental_amalgam_on_systemic_mercury_levels_in_patients_and_dental_school_students/links/02bfe50f9f8bf8946e000000.pdf. Accessed December 22, 2015.

[13] Fredin B. Mercury release from dental amalgam fillings. *Int J Risk Saf Med.* 1994; 4(3): 197-208.

[14] Gay DD, Cox RD, Reinhardt JW: Chewing releases mercury from fillings. *Lancet.* 1979; 1(8123):985-6.
[15] Goldschmidt PR, Cogan RB, Taubman SB. Effects of amalgam corrosion products on human cells. *J Period Res*. 1976; 11(2):108-15. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0765.1976.tb00058.x/abstract. Accessed December 22, 2015.
[16] Hahn LJ, Kloiber R, Vimy MJ, Takahashi Y, Lorscheider FL. Dental" silver" tooth fillings: a source of mercury exposure revealed by whole-body image scan and tissue analysis. *The FASEB Journal.* 1989; 3(14):2641-6. Available from: http://www.fasebj.org/content/3/14/2641.full.pdf. Accessed December 18, 2015.
[17] Haley BE. Mercury toxicity: genetic susceptibility and synergistic effects. *Medical Veritas.* 2005; 2(2): 535-542.
[18] Hanson M, Pleva J. The dental amalgam issue. A review. *Experientia*. 1991; 47(1):9-22. Available from: https://www.researchgate.net/profile/Jaro_Pleva/publication/21157262_The_dental_amalgam_issue._A_review/links/00b7d513fabdda29fa000000.pdf. Accessed December 18, 2015.
[19] Herber RF, de Gee AJ, Wibowo AA. Exposure of dentists and assistants to mercury: mercury levels in urine and hair related to conditions of practice. *Community Dent Oral Epidemiol.* 1988; 16(3): 153-158. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0528.1988.tb00564.x/abstract;jsessionid=0129EC1737083382DF5BA2DE8995F4FD.f03t04. Accessed December 22, 2015.
[20] Karahalil B, Rahravi H, Ertas N. Examination of urinary mercury levels in dentists in Turkey. *Hum Exp Toxicol.* 2005; 24(8): 383-388. Abstract available from: http://het.sagepub.com/content/24/8/383.short. Accessed December 22, 2015.
[21] Krausß P, Deyhle M, Maier KH, Roller E, Weiß HD, Clédon P. Field study on the mercury content of saliva. *Toxicological & Environmental Chemistry*. 1997; 63(1-4):29-46. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/02772249709358515. Accessed December 22, 2015.
[22] Leistevuo J, Leistevuo T, Helenius H, Pyy L, Osterblad M, Huovinen P, Tenovuo J. Dental amalgam fillings and the amount of organic mercury in human saliva. *Caries Res.* 2001; 35(3):163-6. Abstract available from: http://www.karger.com/Article/Abstract/47450. Accessed December 22, 2015.
[23] Lönnroth EC, Shahnavaz H. Amalgam in dentistry. A survey of methods used at dental clinics in Norrbotten to decrease exposure to mercury vapour. *Swed Dent J.* 1995; 19(1-2): 55. Abstract available from: http://europepmc.org/abstract/med/7597632. Accessed December 22, 2015.
[24] Mahler DB, Adey JD, Fleming MA. Hg emission from dental amalgam as related to the amount of Sn in the Ag-Hg Phase. *J Dent Res*. 1994; 73(10):1663-8. Abstract available from: http://jdr.sagepub.com/content/73/10/1663.short. Accessed December 22, 2105.
[25] Martin MD, Naleway C, Chou HN. Factors contributing to mercury exposure in dentists. *J Am Dent Assoc.* 1995; 126(11): 1502-1511. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817715607851. Accessed December 22, 2015.
[26] Molin M, Bergman B, Marklund SL, Schutz A, Skerfving S. Mercury, selenium, and glutathione peroxidase before and after amalgam removal in man. *Acta Odontol Scand*. 1990; 48(3): 189-202. Abstract available from: http://www.tandfonline.com/doi/abs/10.3109/00016359009005875?journalCode=iode20. Accessed December 22, 2015.
[27] Mortada WL, Sobh MA, El-Defrawi, MM, Farahat SE. Mercury in dental restoration: is there a risk of nephrotoxity? *J Nephrol*. 2002; 15(2): 171-176. Abstract available from: http://europepmc.org/abstract/med/12018634. Accessed December 22, 2015.
[28] Mutter J. Is dental amalgam safe for humans? The opinion of the scientific committee of the European Commission. *Journal of Occupational Medicine and Toxicology*. 2011; 6:2.
[29] Nimmo A, Werley MS, Martin JS, Tansy MF. Particulate inhalation during the removal of amalgam restorations. *J Prosth Dent*. 1990; 63(2):228-33. Abstract available from: http://www.sciencedirect.com/science/article/pii/002239139090110X. Accessed December 22, 2015.
[30] Nourouzi E, Bahramifar N, Ghasempouri SM. Effect of teeth amalgam on mercury levels in the colostrums human milk in Lenjan. *Environ Monit Assess.* 2012: 184(1): 375-380. Available from: https://www.researchgate.net/profile/Seyed_Mahmoud_Ghasempouri/publication/51052927_Effect_of_teeth_amalgam_on_mercury_levels_in_the_colostrums_human_milk_in_Lenjan/links/00463522eee955d586000000.pdf. Accessed December 22, 2015.
[31] Nylander M, Friberg L, Lind B. Mercury concentrations in the human brain and kidneys in relation to exposure from dental amalgam fillings. *Swed Dent J*. 1987; 11(5): 179-187. Abstract available from: http://europepmc.org/abstract/med/3481133. Accessed December 22, 2015.
[32] Parsell DE, Karns L, Buchanan WT, Johnson RB. Mercury release during autoclave sterilization of amalgam. *J Dent Educ*. 1996; 60(5): 453-458. Abstract available from: http://www.jdentaled.org/content/60/5/453.short. Accessed December 22, 2015.

[33] Redhe O, Pleva J. Recovery of amyotrophic lateral sclerosis and from allergy after removal of dental amalgam fillings. *Int J Risk & Safety in Med.* 1994; 4(3): 229-236. Available from: https://www.researchgate.net/profile/Jaro_Pleva/publication/235899060_Recovery_from_amyotrophic_lateral_sclerosis_and_from_allergy_after_removal_of_dental_amalgam_fillings/links/0fcfd513f4c3e10807000000.pdf. Accessed December 22, 2015.
[34] Reinhardt JW. Side-effects: Mercury contribution to body burden from dental amalgam. *Adv Dent Res*. 1992; 6(1):110-3. Abstract available from: http://adr.sagepub.com/content/6/1/110.short. Accessed December 22, 2015.
[35] Richardson GM, Brecher RW, Scobie H, Hamblen J, Samuelian J, Smith C. Mercury vapour (Hg(0)): Continuing toxicological uncertainties, and establishing a Canadian reference exposure level. *Regul Toxicol Pharmicol*. 2009; 53(1):32-38. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0273230008002304. Accessed December 17, 2015.
[36] Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. *Human and Ecological Risk Assessment.* 2003; 9(6): 1519-1531. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/10807030390251010. Accessed December 22, 2015.
[37] Snapp KR, Svare CW, Peterson LD. Contribution of dental amalgams to blood mercury levels. *J Dent Res.* 1981; 65(5):311, Abstract #1276, Special issue.
[38] Stock A. [Zeitschrift fuer angewandte Chemie, 29. Jahrgang, 15. April 1926, Nr. 15, S. 461-466, *Die Gefaehrlichkeit des Quecksilberdampfes*, von Alfred Stock (1926).] The Dangerousness of Mercury Vapor. Translated by Birgit Calhoun. Available from: http://www.stanford.edu/~bcalhoun/AStock.htm. Accessed December 22, 2015.
[39] Vahter M, Akesson A, Lind B, Bjors U, Schutz A, Berglund M. Longitudinal study of methylmercury and inorganic mercury in blood and urine of pregnant and lactating women, as well as in umbilical cord blood. *Environ Res*. 2000; 84(2):186-94. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0013935100940982. Accessed December 22, 2015.
[40] Vimy MJ, Lorscheider FL. Intra-oral air mercury released from dental amalgam. *J Den Res.* 1985; 64(8):1069-71.
[41] Vimy MJ, Lorscheider FL: Serial measurements of intra-oral air mercury; Estimation of daily dose from dental amalgam. *J Dent Res.* 1985; 64(8):1072-5. Abstract available from: http://jdr.sagepub.com/content/64/8/1072.short. Accessed December 22, 2015.
[42] Vimy MJ, Luft AJ, Lorscheider FL. Estimation of mercury body burden from dental amalgam computer simulation of a metabolic compartment model. *J. Dent. Res.* 1986; 65(12):1415-1419. Abstract available from: http://jdr.sagepub.com/content/65/12/1415.short. Accessed December 22, 2015.
[43] Votaw AL, Zey J. Vacuuming a mercury-contaminated dental office may be hazardous to your health. *Dent Assist.* 1991; 60(1): 27. Abstract available from: http://europepmc.org/abstract/med/1860523. Accessed December 22, 2015.
[44] Warwick R, O Connor A, Lamey B. Sample size = 25 for each mercury vapor exposure during dental student training in amalgam removal. *J Occup Med Toxicol.* 2013; 8(1):27.
[45] Weiner JA, Nylander M, Berglund F. Does mercury from amalgam restorations constitute a health hazard? *Sci Total Environ*. 1990; 99(1-2):1-22. Abstract available from: http://www.sciencedirect.com/science/article/pii/004896979090206A. Accessed December 22, 2015.
[46] Zahir F, Rizwi SJ, Haq SK, Khan RH. Low dose mercury toxicity and human health. *Environ Toxicol Pharmacol*. 2005; 20(2): 351-360. Available from: https://www.researchgate.net/profile/Soghra_Haq/publication/51515936_Low_dose_mercury_toxicity_and_human_health/links/00b7d51bd5115b6ba9000000.pdf. Accessed December 22, 2015.
[47] State of Connecticut Department of Environmental Protection. Fillings: The Choices You Have. Hartford, CT; Revised May 2011. Available from: http://www.ct.gov/deep/lib/deep/mercury/gen_info/fillings_brochure.pdf. Accessed December 22, 2015.
[48] Maine Bureau of Health. Filling Materials Brochure. 2002. Available from: http://www.vce.org/mercury/Maine_AmalBrochFinal2.pdf. Accessed December 22, 2015.
[49] Advisory Committee on Mercury Pollution. *Dental Amalgam Fillings: Environmental and Health Facts for Dental Patients*. Waterbury, VT, October 27, 2010; 1. Abstract available from: http://www.mercvt.org/PDF/DentalAmalgamFactSheet.pdf. Accessed December 22, 2015.
[50] Abraham JE, Svare CW, Frank CW. The effect of dental amalgam restorations on blood mercury levels. *J Dent Res.* 1984; 63(1):71-3. Abstract available from: http://jdr.sagepub.com/content/63/1/71.short. Accessed December 22, 2015.
[51] Björkman L, Lind B. Factors influencing mercury evaporation rate from dental amalgam fillings. *Scand J Dent Res.* 1992; 100(6):354–60. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0722.1992.tb01086.x/abstract. Accessed December 22, 2015.
[52] Dunn JE, Trachtenberg FL, Barregard L, Bellinger D, McKinlay S. Scalp hair and urine mercury content of children in the Northeast United States: the New England Children's Amalgam Trial. *Environmental Research*. 2008; 107(1):79-88. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2464356/. Accessed December 17, 2015.

[53] Fredin B. Mercury release from dental amalgam fillings. *Int J Risk Saf Med*. 1994; 4(3): 197-208. Abstract available from: http://europepmc.org/abstract/med/23511257. Accessed December 22, 2015.
[54] Gay DD, Cox RD, Reinhardt JW. Chewing releases mercury from fillings. *Lancet*. 1979; 313(8123):985-6.
[55] Isacsson G, Barregård L, Seldén A, Bodin L. Impact of nocturnal bruxism on mercury uptake from dental amalgams. *European Journal of Oral Sciences*. 1997; 105(3):251-7. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0722.1997.tb00208.x/abstract. Accessed December 17, 2015.
[56] Krausß P, Deyhle M, Maier KH, Roller E, Weiß HD, Clédon P. Field study on the mercury content of saliva. *Toxicological & Environmental Chemistry*. 1997; 63(1-4):29-46. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/02772249709358515#.VnnujPkrIgs. Accessed December 22, 2015.
[57] Sällsten G, Thoren J, Barregård L, Schütz A, Skarping G. Long-term use of nicotine chewing gum and mercury exposure from dental amalgam fillings. *Journal of Dental Research*. 1996; 75(1):594-8. Abstract available from: http://jdr.sagepub.com/content/75/1/594.short. Accessed December 17, 2015.
[58] Svare CW, Peterson LC, Reinhardt JW, Boyer DB, Frank CW, Gay DD, et al. The effect of dental amalgams on mercury levels in expired air. *J Dent Res*. 1981; 60:1668–71. Abstract available from: http://jdr.sagepub.com/content/60/9/1668.short. Accessed December 22, 2015.
[59] Vimy MJ, Lorscheider FL. Clinical Science Intra-oral Air Mercury Released from Dental Amalgam. *Journal of Dental Research*. 1985; 64(8):1069-71. Abstract available from: http://jdr.sagepub.com/content/64/8/1069.short. Accessed December 17, 2015.
[60] Vimy MJ, Lorscheider FL. Serial measurements of intra-oral air mercury: estimation of daily dose from dental amalgam. *Journal of Dental Research*. 1985; 64(8):1072-5. Abstract available from: http://jdr.sagepub.com/content/64/8/1072.short. Accessed December 17, 2015.
[61] Health Canada. *The Safety of Dental Amalgam*. 1996: 4. Available from Health Canada Web site: http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/md-im/dent_amalgam-eng.pdf. Accessed December 15, 2015.
[62] Karahalil B, Rahravi H, Ertas N. Examination of urinary mercury levels in dentists in Turkey. *Hum Exp Toxicol*. 2005; 24(8):383-388. Abstract available from: http://het.sagepub.com/content/24/8/383.short. Accessed December 16, 2015.
[63] Lönnroth EC, Shahnavaz H. Dental clinics--a burden to environment? *Swed Dent J*. 1996; 20(5):173. Abstract available from: http://europepmc.org/abstract/med/9000326. Accessed December 16, 2015.
[64] Martin MD, Naleway C, Chou HN. Factors contributing to mercury exposure in dentists. *J Am Dent Assoc*. 1995; 126(11):1502-1511. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817715607851. Accessed December 16, 2015.
[65] Nimmo A, Werley MS, Martin JS, Tansy MF. Particulate inhalation during the removal of amalgam restorations. *J Prosth Dent*. 1990; 63(2):228-33. Abstract available from: http://www.sciencedirect.com/science/article/pii/002239139090110X. Accessed December 16, 2015.
[66] Oliveira MT, Constantino HV, Molina GO, Milioli E, Ghizoni JS, Pereira JR. Evaluation of mercury contamination in patients and water during amalgam removal. *The Journal of Contemporary Dental Practice*. 2014; 15(2):165. Abstract available from: http://search.proquest.com/openview/c9e4c284ca7b3fd3779621692411875c/1?pq-origsite=gscholar. Accessed December 18, 2015.
[67] Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. *Human and Ecological Risk Assessment*. 2003; 9(6): 1519-1531.
[68] Sandborgh-Englund G, Elinder CG, Langworth S, Schutz A, Ekstrand J. Mercury in biological fluids after amalgam removal. *J Dent Res*. 1998; 77(4):615-24. Abstract available from: https://www.researchgate.net/profile/Gunilla_Sandborgh-Englund/publication/51331635_Mercury_in_biological_fluids_after_amalgam_removal/links/0fcfd50d1ea80e1d3a000000.pdf. Accessed December 22, 2015.
[69] Warwick R, O Connor A, Lamey B. Sample size = 25 for each mercury vapor exposure during dental student training in amalgam removal. *J Occup Med Toxicol*. 2013; 8(1):27. Available from: http://download.springer.com/static/pdf/203/art%253A10.1186%252F1745-6673-8-27.pdf?originUrl=http%3A%2F%2Foccup-med.biomedcentral.com%2Farticle%2F10.1186%2F1745-6673-8-27&token2=exp=1450380047~acl=%2Fstatic%2Fpdf%2F203%2Fart%25253A10.1186%25252F1745-6673-8-27.pdf*~hmac=6ae07046977e264c2d8d25ff12a5600a2b3d4b4f5090fbff92ce459bd389326d. Accessed December 16, 2015.
[70] Buchwald H. Exposure of dental workers to mercury. *American Industrial Hygiene Association Journal*. 1972; 33(7): 492-502. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/0002889728506692#.Vnolb_krIgs. Accessed December 22, 2015.
[71] Ahlbom A, Norell S, Rodvall Y, Nylander M. Dentists, dental nurses, and brain tumors. *Br. Med. J*. 1986; 292(6521):662. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1339649/pdf/bmjcred00224-0024.pdf. Accessed December 16, 2015.

[72] Akesson I, Schutz A, Attewell R, Skerfving S, Glantz PO. Status of mercury and selenium in dental personnel: impact of amalgam work and own fillings. *Archives of Environmental Health: An International Journal*. 1991; 46(2):102-9. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/00039896.1991.9937436. Accessed December 17, 2015.
[73] Anglen J, Gruninger SE, Chou HN, Weuve J, Turyk ME, Freels S, Stayner LT. Occupational mercury exposure in association with prevalence of multiple sclerosis and tremor among US dentists. *The Journal of the American Dental Association*. 2015; 146(9):659-68. Abstract available from: http://jada.ada.org/article/S0002-8177(15)00630-3/abstract. Accessed December 18, 2015.
[74] Buchwald H. Exposure of dental workers to mercury. *Am Ind Hyg Assoc J.* 1972; 33(7):492-502. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/0002889728506692. Accessed December 16, 2015.
[75] Cooper GS, Parks CG, Treadwell EL, St Clair EW, Gilkeson GS, Dooley MA. Occupational risk factors for the development of systemic lupus erythematosus. *J Rheumatol.* 2004; 31(10):1928-1933. Available from: http://www.jrheum.org/content/31/10/1928.short. Accessed December 16, 2015.
[76] Duplinsky TG, Cicchetti DV. The health status of dentists exposed to mercury from silver amalgam tooth restorations. *International Journal of Statistics in Medical Research.* 2012; 1(1):1-15. Available from: http://lifescienceglobal.bizmarksolutions.com/pms/index.php/ijsmr/article/download/433/pdf. Accessed December 16, 2015.
[77] Echeverria D, Aposhian HV, Woods JS, Heyer NJ, Aposhian MM, Bittner AC, Mahurin RK, Cianciola M. Neurobehavioral effects from exposure to dental amalgam Hgo: new distinctions between recent exposure and body burden. *FASEBJ.* 1998; 12(11):971-980. Available from: http://www.fasebj.org/content/12/11/971.long. Accessed December 16, 2015.
[78] Echeverria D, Heyer N, Martin MD, Naleway CA, Woods JS, Bittner AC. Behavioral effects of low-level exposure to Hg0 among dentists. *Neurotoxicol Teratol.* 1995; 17(2):161-8. Abstract available from: http://www.sciencedirect.com/science/article/pii/089203629400049J. Accessed December 16, 2015.
[79] Echeverria D, Woods JS, Heyer NJ, Rohlman D, Farin F, Li T, Garabedian CE. The association between a genetic polymorphism of coproporphyrinogen oxidase, dental mercury exposure and neurobehavioral response in humans. *Neurotoxicol Teratol.* 2006; 28(1):39-48. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0892036205001492. Accessed December 16, 2015.
[80] Echeverria D, Woods JS, Heyer NJ, Rohlman DS, Farin FM, Bittner AC, Li T, Garabedian C. Chronic low-level mercury exposure, BDNF polymorphism, and associations with cognitive and motor function. *Neurotoxicology and Teratology*. 2005; 27(6):781-796. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0892036205001285. Accessed December 16, 2015.
[81] Fabrizio E, Vanacore N, Valente M, Rubino A, Meco G. High prevalence of extrapyramidal signs and symptoms in a group of Italian dental technicians. *BMC Neurol*. 2007; 7(1):24. Available from: http://www.biomedcentral.com/1471-2377/7/24. Accessed December 16, 2015.
[82] Goodrich JM, Wang Y, Gillespie B, Werner R, Franzblau A, Basu N. Methylmercury and elemental mercury differentially associate with blood pressure among dental professionals. *Int J Hyg Environ Health.* 2013; 216(2):195-201. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3727420/. Accessed December 16, 2015.
[83] Hilt B, Svendsen K, Syversen T, Aas O, Qvenild T, Sletvold H, Melø I. Occurrence of cognitive symptoms in dental assistants with previous occupational exposure to metallic mercury. *Neurotoxicology.* 2009; 30(6):1202-1206. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0161813X09001119. Accessed December 16, 2015.
[84] Johnson KF. Mercury hygiene. *Dental Clinics of North America*. 1978; 22(3):477-89. Abstract available from: http://europepmc.org/abstract/med/277421. Accessed December 17, 2015.
[85] Kanerva L, Lahtinen A, Toikkanen J, Forss H, Estlander T, Susitaival P, Jolanki R. Increase in occupational skin diseases of dental personnel. *Contact Dermatitis.* 1999; 40(2):104-108. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0536.1999.tb06000.x/abstract. Accessed December 16, 2015.
[86] Karahalil B, Rahravi H, Ertas N. Examination of urinary mercury levels in dentists in Turkey. *Hum Exp Toxicol.* 2005; 24(8):383-388. Abstract available from: http://het.sagepub.com/content/24/8/383.short. Accessed December 16, 2015.
[87] Lee JY, Yoo JM, Cho BK, Kim HO. Contact dermatitis in Korean dental technicians. *Contact Dermatitis.* 2001; 45(1):13-16. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1034/j.1600-0536.2001.045001013.x/abstract?userIsAuthenticated=false&deniedAccessCustomisedMessage=. Accessed December 16, 2015.
[88] Lönnroth EC, Shahnavaz H. Amalgam in dentistry. A survey of methods used at dental clinics in Norrbotten to decrease exposure to mercury vapour. *Swed Dent J.* 1995; 19(1-2):55. Abstract available from: http://europepmc.org/abstract/med/7597632. Accessed December 16, 2015.
[89] Martin MD, Naleway C, Chou HN. Factors contributing to mercury exposure in dentists. *J Am Dent Assoc*. 1995; 126(11):1502-1511. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817715607851. Accessed December 16, 2015.

[90] Ngim CH, Foo SC, Boey KW, Jeyaratnem J. Chronic neurobehavioural effects of elemental mercury in dentists. *Br J Ind Med.* 1992; 49(11):782-790. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1039326/pdf/brjindmed00023-0040.pdf. Accessed December 16, 2015.
[91] Nylander M, Friberg L, Eggleston D, Björkman L. Mercury accumulation in tissues from dental staff and controls in relation to exposure. *Swed Dent J*. 1989; 13(6):235-236. Abstract available from: http://europepmc.org/abstract/med/2603127. Accessed December 16, 2015.
[92] Oliveira MT, Constantino HV, Molina GO, Milioli E, Ghizoni JS, Pereira JR. Evaluation of mercury contamination in patients and water during amalgam removal. *The Journal of Contemporary Dental Practice*. 2014; 15(2):165. Abstract available from: http://search.proquest.com/openview/c9e4c284ca7b3fd3779621692411875c/1?pq-origsite=gscholar. Accessed December 18, 2015.
[93] Parsell DE, Karns L, Buchanan WT, Johnson RB. Mercury release during autoclave sterilization of amalgam. *J Dent Educ*. 1996; 60(5):453-458. Abstract available from: http://www.jdentaled.org/content/60/5/453.short. Accessed December 16, 2015.
[94] Pérez-Gómez B, Aragonés N, Gustavsson P, Plato N, López-Abente G, Pollán, M. Cutaneous melanoma in Swedish women: occupational risks by anatomic site. *Am J Ind Med.* 2005; 48(4):270-281. Available from: https://www.researchgate.net/profile/Beatriz_Perez-Gomez/publication/227715301_Cutaneous_melanoma_in_Swedish_women_Occupational_risks_by_anatomic_site/links/0deec519b27246a598000000.pdf. Accessed December 16, 2015.
[95] Richardson GM, Brecher RW, Scobie H, Hamblen J, Samuelian J, Smith C. Mercury vapour (Hg(0)): Continuing toxicological uncertainties, and establishing a Canadian reference exposure level. *Regul Toxicol Pharmicol*. 2009; 53(1):32-38. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0273230008002304. Accessed December 17, 2015.
[96] Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. *Human and Ecological Risk Assessment.* 2003; 9(6):1519-1531. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/10807030390251010. Accessed December 16, 2015.
[97] Rojas M, Seijas D, Agreda O, Rodríguez M. Biological monitoring of mercury exposure in individuals referred to a toxicological center in Venezuela. *Sci Total Environ*. 2006; 354(2):278-285. Available from: https://www.researchgate.net/profile/David_Seijas/publication/7372790_Biological_monitoring_of_mercury_exposure_in_individuals_referred_to_a_toxicological_center_in_Venezuela/links/0c9605253f5d25bbe9000000.pdf. Accessed December 16, 2015.
[98] Shapiro IM, Cornblath DR, Sumner AJ, Sptiz LK, Uzzell B, Ship II, Bloch P. Neurophysiological and neuropsychological function in mercury-exposed dentists. *Lancet.* 1982; 319(8282):1447-1150. Available from: http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(82)92226-7/abstract?cc=y=. Accessed December 16, 2015.
[99] Uzzell BP, Oler J. Chronic low-level mercury exposure and neuropsychological functioning. *J Clin Exp Neuropsychol*. 1986; 8(5):581-593. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/01688638608405177. Accessed December 16, 2015.
[100] Van Zyl I. Mercury amalgam safety: a review. *The Journal of the Michigan Dental Association.* 1999; 81(1):40-8.
[101] Votaw AL, Zey J. Vacuuming a mercury-contaminated dental office may be hazardous to your health. *The Dental Assistant*. 1990; 60(1):27-9. Abstract available from: http://europepmc.org/abstract/med/1860523. Accessed December 17, 2015.
[102] Zahir F, Rizwi SJ, Haq SK, Khan RH. Low dose mercury toxicity and human health. *Environ Toxicol Pharmacol.* 2005; 20(2):351-360. Available from: https://www.researchgate.net/profile/Soghra_Haq/publication/51515936_Low_dose_mercury_toxicity_and_human_health/links/00b7d51bd5115b6ba9000000.pdf. Accessed December 16, 2015.
[103] de Oliveira MT, Pereira JR, Ghizoni JS, Bittencourt ST, Molina GO. Effects from exposure to dental amalgam on systemic mercury levels in patients and dental school students. *Photomed Laser Surg.* 2010; 28(S2):S-111. Available from: https://www.researchgate.net/profile/Jefferson_Pereira/publication/47369541_Effects_from_exposure_to_dental_amalgam_on_systemic_mercury_levels_in_patients_and_dental_school_students/links/02bfe50f9f8bf8946e000000.pdf. Accessed December 16, 2015.
[104] Warwick R, O Connor A, Lamey B. Sample size = 25 for each mercury vapor exposure during dental student training in amalgam removal. *J Occup Med Toxicol.* 2013; 8(1):27. Available from: http://download.springer.com/static/pdf/203/art%253A10.1186%252F1745-6673-8-27.pdf?originUrl=http%3A%2F%2Foccup-med.biomedcentral.com%2Farticle%2F10.1186%2F1745-6673-8-27&token2=exp=1450380047~acl=%2Fstatic%2Fpdf%2F203%2Fart%25253A10.1186%25252F1745-6673-8-27.pdf*~hmac=6ae07046977e264c2d8d25ff12a5600a2b3d4b4f5090fbff92ce459bd389326d. Accessed December 16, 2015.
[105] White RR, Brandt RL. Development of mercury hypersensitivity among dental students. *JADA.* 1976; 92(6):1204-7. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817776260320. Accessed December 16, 2015.
[106] Gelbier S, Ingram J. Possible fetotoxic effects of mercury vapor: a case report. *Public Health.* 1989; 103(1):35-40. Available from: http://www.sciencedirect.com/science/article/pii/S0033350689801003. Accessed December 16, 2015.

[107] Lindbohm ML, Ylöstalo P, Sallmén M, Henriks-Eckerman ML, Nurminen T, Forss H, Taskinen H. Occupational exposure in dentistry and miscarriage. Occupational and environmental medicine. 2007; 64(2):127-33. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078431/. Accessed December 17, 2015.
[108] Olfert, SM. Reproductive outcomes among dental personnel: a review of selected exposures. Journal (Canadian Dental Association). 2006; 72(9), 821.
[109] Rowland AS, Baird DD, Weinberg CR, Shore DL, Shy CM, Wilcox AJ. The effect of occupational exposure to mercury vapour on the fertility of female dental assistants. *Occupat Environ Med*. 1994; 51:28-34. Available from: http://oem.bmj.com/content/51/1/28.full.pdf. Accessed December 16, 2015.
[110] Sikorski R, Juszkiewicz T, Paszkowski T, Szprengier-Juszkiewicz T. Women in dental surgeries: reproductive hazards in exposure to metallic mercury. *International Archives of Occupational and Environmental Health*. 1987; 59(6):551-557. Abstract available from: http://link.springer.com/article/10.1007/BF00377918. Accessed December 16, 2015.
[111] Wasylko L, Matsui D, Dykxhoorn SM, Rieder MJ, Weinberg S. A review of common dental treatments during pregnancy: implications for patients and dental personnel. *J Can Dent Assoc*. 1998; 64(6):434-9. Abstract available from: http://europepmc.org/abstract/med/9659813. Accessed December 16, 2015.
[112] Buchwald H. Exposure of dental workers to mercury. *Am Ind Hyg Assoc J*. 1972; 33(7):492-502. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/0002889728506692. Accessed December 16, 2015.
[113] Johnson KF. Mercury hygiene. *Dental Clinics of North America*. 1978; 22(3):477-89. Abstract available from: http://europepmc.org/abstract/med/277421. Accessed December 17, 2015.
[114] Kanerva L, Lahtinen A, Toikkanen J, Forss H, Estlander T, Susitaival P, Jolanki R. Increase in occupational skin diseases of dental personnel. Contact Dermatitis. 1999; 40(2):104-108. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0536.1999.tb06000.x/abstract. Accessed December 16, 2015.
[115] Lönnroth EC, Shahnavaz H. Amalgam in dentistry. A survey of methods used at dental clinics in Norrbotten to decrease exposure to mercury vapour. *Swed Dent J*. 1995; 19(1-2):55. Abstract available from: http://europepmc.org/abstract/med/7597632. Accessed December 16, 2015.
[116] Lönnroth EC, Shahnavaz H. Dental clinics--a burden to environment? *Swed Dent J*. 1996; 20(5):173. Abstract available from: http://europepmc.org/abstract/med/9000326. Accessed December 16, 2015.
[117] Martin MD, Naleway C, Chou HN. Factors contributing to mercury exposure in dentists. *J Am Dent Assoc*. 1995; 126(11):1502-1511. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817715607851. Accessed December 16, 2015.
[118] Nimmo A, Werley MS, Martin JS, Tansy MF. Particulate inhalation during the removal of amalgam restorations. *J Prosth Dent*. 1990; 63(2):228-33. Abstract available from: http://www.sciencedirect.com/science/article/pii/002239139090110X. Accessed December 16, 2015.
[119] Parsell DE, Karns L, Buchanan WT, Johnson RB. Mercury release during autoclave sterilization of amalgam. *J Dent Educ*. 1996; 60(5):453-458. Abstract available from: http://www.jdentaled.org/content/60/5/453.short. Accessed December 16, 2015.
[120] Stonehouse CA, Newman AP. Mercury vapour release from a dental aspirator. *Br Dent J*. 2001; 190(10):558-60. Abstract available from: http://www.nature.com/bdj/journal/v190/n10/full/4801034a.html. Accessed December 16, 2015.
[121] Perim SI, Goldberg AF. Mercury in hospital dentistry. *Special Care in Dentistry*. 1984; 4(2):54-5. Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1754-4505.1984.tb00146.x/abstract. Accessed December 17, 2015.
[122] Pleva J. Mercury from dental amalgams: exposure and effects. *The International Journal of Risk & Safety in Medicine*. 1992; 3(1):1-22. Abstract available from: http://europepmc.org/abstract/med/23510804. Accessed December 17, 2015.
[123] Votaw AL, Zey J. Vacuuming a mercury-contaminated dental office may be hazardous to your health. *The Dental Assistant*. 1990; 60(1):27-9. Abstract available from: http://europepmc.org/abstract/med/1860523. Accessed December 17, 2015.
[124] United States Department of Labor. OSHA Act of 1970. Occupational Safety and Health Administration. Available from OSHA Web site: http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=OSHACT. Accessed December 22, 2015.
[125] Occupational Safety and Health Administration. Workers' Rights. 2011. Available from OSHA Web site: http://www.osha.gov/Publications/osha3021.pdf. Accessed December 22, 2015.
[126] United States Environmental Protection Agency. *Health Services Industry Detailed Study Dental Amalgam*. EPA-821-R-08-014. Available from EPA Web site: http://www.epa.gov/sites/production/files/2015-06/documents/dental-amalgam-study-2008.pdf. Accessed December 22, 2015.
And United States Environmental Protection Agency. Dental effluent guidelines. Last Updated October 5, 2015. Available from EPA Web site: http://www.epa.gov/eg/dental-effluent-guidelines. Accessed December 22, 2015.
[127] Health Canada. *The Safety of Dental Amalgam*. 1996: 4. Available from Health Canada Web site: http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/md-im/dent_amalgam-eng.pdf. Accessed December 15, 2015.
[128] Karahalil B, Rahravi H, Ertas N. Examination of urinary mercury levels in dentists in Turkey. *Hum Exp Toxicol*. 2005; 24(8):383-388. Abstract available from: http://het.sagepub.com/content/24/8/383.short. Accessed December 16, 2015.

[129] Lönnroth EC, Shahnavaz H. Dental clinics--a burden to environment? *Swed Dent J*. 1996; 20(5):173. Abstract available from: http://europepmc.org/abstract/med/9000326. Accessed December 16, 2015.
[130] Martin MD, Naleway C, Chou HN. Factors contributing to mercury exposure in dentists. *J Am Dent Assoc*. 1995; 126(11):1502-1511. Abstract available from: http://www.sciencedirect.com/science/article/pii/S0002817715607851. Accessed December 16, 2015.
[131] Nimmo A, Werley MS, Martin JS, Tansy MF. Particulate inhalation during the removal of amalgam restorations. *J Prosth Dent.* 1990; 63(2):228-33. Abstract available from: http://www.sciencedirect.com/science/article/pii/002239139090110X. Accessed December 16, 2015.
[132] Oliveira MT, Constantino HV, Molina GO, Milioli E, Ghizoni JS, Pereira JR. Evaluation of mercury contamination in patients and water during amalgam removal. *The Journal of Contemporary Dental Practice*. 2014; 15(2):165. Abstract available from: http://search.proquest.com/openview/c9e4c284ca7b3fd3779621692411875c/1?pq-origsite=gscholar. Accessed December 18, 2015.
[133] Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. *Human and Ecological Risk Assessment.* 2003; 9(6): 1519-1531. Abstract available from: http://www.tandfonline.com/doi/abs/10.1080/10807030390251010#.VnNn0vkrIgs. Accessed December 17, 2015.
[134] Warwick R, O Connor A, Lamey B. Sample size = 25 for each mercury vapor exposure during dental student training in amalgam removal. *J Occup Med Toxicol.* 2013; 8(1):27. Available from: http://download.springer.com/static/pdf/203/art%253A10.1186%252F1745-6673-8-27.pdf?originUrl=http%3A%2F%2Foccup-med.biomedcentral.com%2Farticle%2F10.1186%2F1745-6673-8-27&token2=exp=1450380047~acl=%2Fstatic%2Fpdf%2F203%2Fart%25253A10.1186%25252F1745-6673-8-27.pdf*~hmac=6ae07046977e264c2d8d25ff12a5600a2b3d4b4f5090fbff92ce459bd389326d. Accessed December 16, 2015.
[135] For a list of studies with corresponding data of mercury levels during amalgam removal (that you can then apply to the OSHA PEL for comparison), see Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. *Human and Ecological Risk Assessment.* 2003; 9(6): 1519-1531.
[136] American Dental Association. Oral health topics: Amalgam waste best management. Available from: http://www.ada.org/en/member-center/oral-health-topics/amalgam-waste-best-management. Accessed December 23, 2015.
[137] IAOMT. Safe Removal of Amalgam Fillings. Available from: https://iaomt.org/safe-removal-amalgam-fillings/. Accessed December 17, 2015.
[138] Arenholt-Bindslev D, Larsen AH. Mercury levels and discharge in waste water from dental clinics. Water, Air, and Soil Pollution. 1996; 86(1-4):93-9. Abstract available from: http://link.springer.com/article/10.1007/BF00279147. Accessed December 17, 2015.
[139] Hylander LD, Lindvall A, Uhrberg R, Gahnberg L, Lindh U. Mercury recovery in situ of four different dental amalgam separators. Science of the total environment. 2006; 366(1):320-36. Available from: https://www.researchgate.net/profile/Lars_Hylander/publication/7582488_Mercury_recovery_in_situ_of_four_different_dental_amalgam_separators/links/54e727b50cf2cd2e0291297c.pdf. Accessed December 17, 2015.
[140] Cited as Vandeven J, McGinnis S. An assessment of mercury in the form of amalgam in dental wastewater in the United States. *Water, Air and Soil Pollution.* 2005; 164: 349-366. DCN 0469.
In Frost A, Madden R. *Reducing Mercury from the Environment: An Assessment of Dental Amalgam*. 2014. Page 11. Available from: https://www.phasa.org.za/wp-content/uploads/2014/10/DRI-Minamata-Paper.pdf. Accessed December 17, 2015.
[141] United States Environmental Protection Agency. Dental Effluent Guidelines. https://www.epa.gov/eg/dental-effluent-guidelines. Accessed July 28, 2017.
[142] Frost A, Madden R. *Reducing Mercury from the Environment: An Assessment of Dental Amalgam*. 2014. Page 13. Available from: https://www.phasa.org.za/wp-content/uploads/2014/10/DRI-Minamata-Paper.pdf. Accessed December 17, 2015.
[143] Royal College of Dental Surgeons in Ontario. Amalgam waste disposal. *Standard of Practice.* November 2003. Reported upon in Royal College of Dental Surgeons in Ontario. Maintaining an amalgam separator. *Dispatch.* May/June 2009; 23(2): 40-41. Available from: http://www.rcdso.org/save.aspx?id=bf43f9b3-6905-4f2a-844d-2c9b0c934a39. Accessed December 17, 2015.
[144] United States Department of Labor. OSHA Act of 1970. Occupational Safety and Health Administration. http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=OSHACT. Accessed December 22, 2015.
[145] Occupational Safety and Health Administration. Workers' Rights. 2011. Available from OSHA Web site: http://www.osha.gov/Publications/osha3021.pdf. Accessed December 22, 2015.
[146] United States Department of Labor Occupational Safety and Health Administration. Safety and health topics: chemical hazards and toxic substances. United States Department of Labor Occupational Safety and Health Administration Web site. https://www.osha.gov/SLTC/hazardoustoxicsubstances/. Accessed June 27, 2015.
[147] United States Department of Labor Occupational Safety and Health Administration. Safety and health topics: chemical hazards and toxic substances. United States Department of Labor Occupational Safety and Health Administration Web site. https://www.osha.gov/SLTC/hazardoustoxicsubstances/. Accessed June 27, 2015.

[148] United States Department of Labor Occupational Safety and Health Administration. Access to medical and exposure records, text extract of the OSHA 3169 Publication. 2001. United States Department of Labor Occupational Safety and Health Administration Web site. https://www.osha.gov/Publications/pub3110text.html. Accessed June 27, 2015.
[149] United States Department of Labor Occupational Safety and Health Administration. Access to medical and exposure records, text extract of the OSHA 3169 Publication. 2001. United States Department of Labor Occupational Safety and Health Administration Web site. https://www.osha.gov/Publications/pub3110text.html. Accessed June 27, 2015.
[150] SDI. Safety Data Sheet for Permite; Lojic +; GS-80, GS-80 Spherical; F400; Ultracaps +; Ultracaps S; SDI Admix; SDI Spherical and New Ultrafine Capsules; Australia, Brazil, Ireland, and the USA. Date/Revised: June 25, 2015. Available from: http://www.sdi.com.au/images/stories/MSDS/MSDS_EN/Amalgam_DS_EN.pdf. Accessed February 1, 2016.
[151] Kerr Corporation. Safety Data Sheet for Tytin FC ™; Orange, CA, USA; Date of Issue/Revision: November 6, 2014. Available from: https://www.dhpionline.com/msds/109-29996.pdf. Accessed February 1, 2016.
[152] Henry Schein; SDS acc. to OSHA HCS, Version Number 2; Stratosphere, Ionosphere, Troposphere; Melville, NY, USA; Printing Date/Reviewed: August 11, 2014. Available from: http://www.henryschein.ca/MSDS/1056614.pdf. Accessed February 1, 2016.