



Mercury

A Guide to Mercury Free Dentistry and Health Care Services in Nepal

Briefing Paper

Mercury is a natural element whose chemical symbol is **Hg**. It is notorious heavy metals of global concern and known to be a potent poison of the human nervous system. Atomic number of Hg is 80 and atomic mass $200.592 \text{ g}\cdot\text{mol}^{-1}$, in its pure form; mercury is a shiny silver white metal that is liquid at room temperature. It is naturally occurring heavy, odorless, lustrous liquid metal found mainly in four forms: metallic (liquid), inorganic, organic and gaseous. Organic form of mercury is highly toxic forms in comparison to other inorganic and elemental forms. Mercury has been used in various products and processes.



Mercury is highly toxic. It may be fatal if inhaled and harmful if absorbed through the skin. Around 80% of the inhaled mercury vapour is absorbed in the blood through the lungs. It may cause harmful effects to the nervous, digestive, respiratory, immune systems and to the kidneys, besides causing lung damage. Adverse health effects from mercury exposure can be: tremors, impaired vision and hearing, paralysis, insomnia, emotional instability, developmental deficits during fetal development, and attention deficit and developmental delays during childhood. Acute exposure to elemental mercury and

vapour can result in Acrodynia or "Pink Diseases" which is characterized by bright pink peeling palms, fingers, and soles of the feet, excessive perspiration, itchiness, rashes, joint pains and weakness, elevated blood pressures and heart palpitations.

Mercury Poisoning and Contamination Cases in Nepal

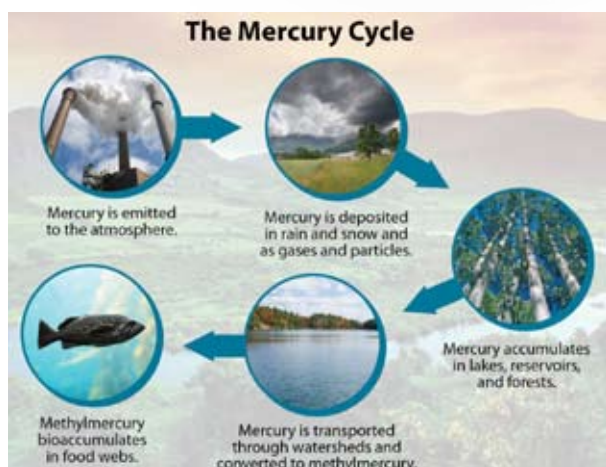
- A Bio Monitoring of **Mercury from Phewa Lake, Pokhara and Kalimati Market**, Kathmandu in 19 fishes sample shows contamination ranges from 0.003 to 0.242 ppm (CEPHED/IPEN/BRI 2012)
- A Bio Monitoring of **Mercury in Fisher Folks from Phewa lake side Pokhara** found ranges from 0.345 to 1.715 ppm with 53% (8 of 15) higher than reference doses of 1 ppm (CEPHED/IPEN/BRI 2012)
- A Bio Monitoring of **Mercury across Nepal among 50+ dental doctor and nurses** found ranges from 0.097 to 0.547 ppm (CEPHED/NDA/IPEN/BRI 2013)
- A Bio Monitoring of **Mercury in fish eating 20 female of child bearing ages** ranges from 0.11 to 1 ppm (CEPHED/ZMWG 2013)
- A Bio Monitoring of **Mercury in Fisher Folks from Begnas Lake, Pokhara** found ranges from 0.18 to 1.18 ppm with 9 % (3 of 33) higher than reference dose of 1 ppm. (CEPHED/IPEN/BRI 2016)
- A Bio Monitoring of **Mercury in Women Working in Gold Plating in Metal Idol** at Kathmandu found ranges from 0.35 to 28.46 ppm with 75 % (15 of 20) higher than reference doses 1 ppm. (CEPHED/IPEN/BRI 2017)



Why Mercury Free Dentistry is Needed?

Dental restoration is a common technique to treat dental caries. Dental amalgam is widely employed restorative materials which contain approximately 50% of mercury. Now, mercury in dentistry is growing concern when considering this heavy metal. **UNEP global mercury assessment 2013 revealed that mercury in dentistry use was 270-341 metric tons globally in 2010.** Accounting for at least 10% of global mercury consumption, amalgam is among the largest consumer uses of mercury in the world. This mercury eventually ends up in our environment by one pathway or another. Dental mercury from amalgam pollutes:

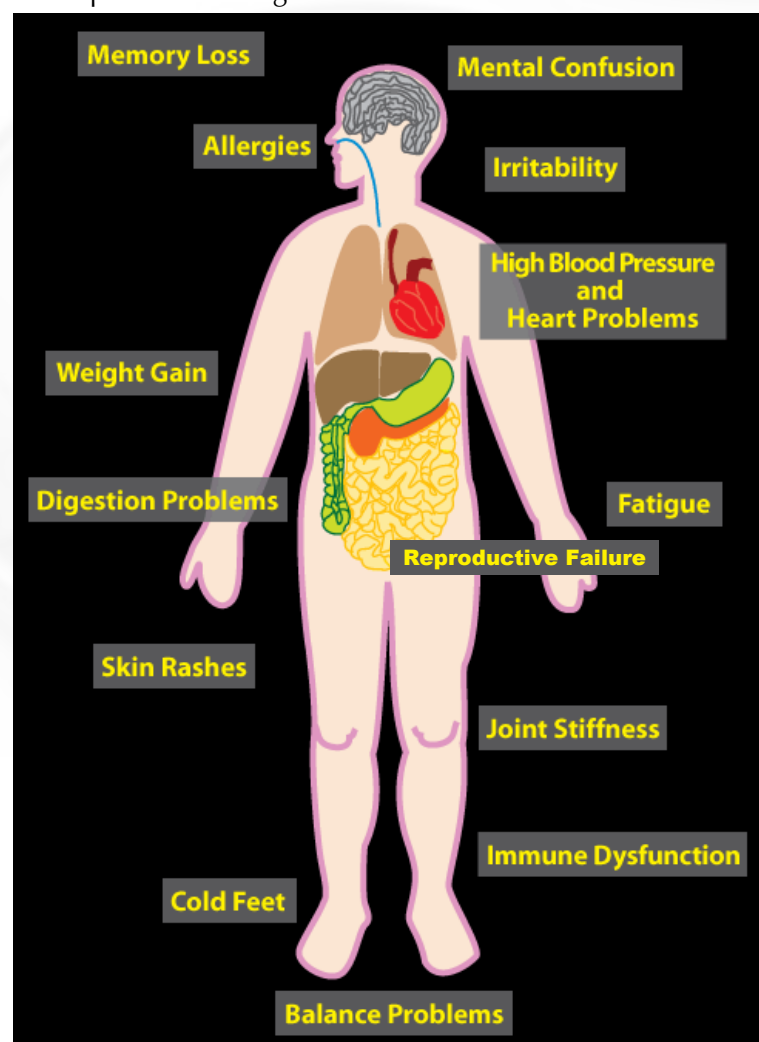
- **WATER** via not only dental clinic releases, but also human waste.
- **AIR** via cremation, dental clinic emissions, sludge incineration and respiration and
- **LAND** via landfills, burials and fertilizer



Dental mercury endangers our health. Children, the pregnant women, hypersensitive individual and people with kidney impairments are known to be particularly susceptible to the effect of dental mercury. Dental mercury from amalgam causes reproductive harm i.e. even crosses the placenta and accumulates in unborn babies. Due to mercury exposure, dental workers—including dentist, dental hygienist and dental assistants are at particular risk for suffering reproductive harm. Different studies have shown that, in Nepal, Chronic headache from dental amalgam, mercury poisoning from breakage of thermometer, death in case of mercury use to abort etc.

Some evidence of Dental Amalgam and Chronic Illness from Global Studies.

- New Science Challenges old notion that mercury dental amalgam is safe (Biometal, 2014 Feb.27).
- Evidences supporting a link between dental amalgam and chronic illness, fatigue, depression, anxiety and suicide –and these are among main symptoms associates with chronic fatigue syndrome(CFS), fibromyalgia (FM). Several studies have shown that the removal of amalgam Is associated with improvement in these symptoms (Pub Med. 2014).
- A dose-dependent relation between mercury exposure from dental amalgam and urinary mercury level: a further assessment of the Casa Pia Childrens Dental Amalgam Trial. It was observed that urinary mercury levels increased by 18 % to 53 % among 8 to 18 years old individual respectively with an average exposure to amalgam (Pub Med. 2012 January 31) in comparison with no exposure to amalgam.





- A recent article featured on MSNBC.com entitled Mercury fillings may be affecting dentists (Copyright 2002 Reuters) in which “a study of 180 dentists by researchers at the Glasgow Royal Infirmary in Scotland found the dentists had up to four times the normal level of mercury in their urine and nails and had more kidney disorders and memory lapses than the general public.”
- In a study involving 45 women dentists and 31 dental nurses, a positive association was found between elevated mercury levels and incidence of malformations and aborted pregnancies.
- “The Health Status of Dentists Exposed to Mercury from Silver Amalgam Tooth Restorations” article based on employed pharmacy utilization data to evaluate the health status of a representative sample of 600 dentists, matched to control subjects, for gender, age, geographical area, and insurance plan structure. Dentists demonstrated significantly more prescription utilization of specific illness medications than did Controls, for the following disease categories: Neuropsychological, Neurological, Respiratory, and Cardiovascular. The greater majority of pediatric and general practice dentists still use mercury amalgam restorations. This places them at greater risk than the general population for those disorders (International Journal of Statistics in Medical Research, 2012, 1, 1-15)
- A study of mercury contamination in air at 34 dental sites by Sustainable Development Policy Institute (SDPI) Pakistan 2014 has indicated alarmingly very high level of mercury vapors in air which are threat to public health, specially heavy occupational exposure to medical, paramedical staff and children. More than 88% Dental Teaching Institutions, 71% General Hospitals and 100 % Dental clinics were found to have dangerous level of mercury over 300 ng/m³ of ATSDR (Agency for Toxic Substances and Disease Registry, USA) 2012 standard level. The maximum level of mercury found in Dental teaching insensitivities were 44067 ng/m³ (more than 147 times than prescribed standard), in General Hospitals maximum was 17172 ng/m³ (more than 57 times than standard) and among dental clinics maximum was 1800 ng/m³ (6 times more than standard value) respectively.

- A recent study (Gul, 2015) carried in Pakistan on biological samples (RBCs, plasma, urine, hair & nails) of individuals with mercury dental amalgam (n=30) and controlled samples (n=30) have shown mercury concentration 6 – 8 times higher than the controlled samples (individuals without dental mercury amalgam).

Environmental Health Risks

After amalgam enters the environment, certain microorganisms can change its elemental mercury into methylmercury, a highly toxic form of mercury that builds up in fish, shellfish, and people that eat fish. Methylmercury can damage children’s developing brains and nervous systems even before they are born.

Environmental Costs

After environmental costs are taken into account, amalgam is significantly more expensive than the mercury-free alternatives. According to the 2012 report [HYPERLINK “https://mercuryfreedentistry.files.wordpress.com/2016/02/the-real-cost-of-dental-mercury.pdf”](https://mercuryfreedentistry.files.wordpress.com/2016/02/the-real-cost-of-dental-mercury.pdf) “The Real Cost of Dental Mercury” The Real Cost of Dental Mercury, an amalgam filling can cost up to \$87 (USD) more than an equivalent mercury-free composite filling once the full lifecycle costs of each filling is considered.

Global Movement to Address Mercury Issues: Minamata Convention on Mercury

Minamata Convention on Mercury

is a global treaty which was adopted and opened for signature on 10th October 2013. The main objective is “To protect the human health and the environment from anthropogenic release of mercury and mercury compounds”. Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing

The environmental impacts of dental amalgam can be sustainably avoided by phasing down the use of dental amalgam as a restorative material and switching to quality mercury-free alternatives.



ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal

once it becomes waste, sites contaminated by mercury as well as health issues. The first meeting of the Conference of the Parties to the Minamata Convention on Mercury were held from September 24 to 29, 2017, Geneva, Switzerland. Convention became internationally legally binding treaty since 16th August 2017.

Provision of Mercury Convention (Annex A, Part I: Products subject to Article 4, Paragraph 1)

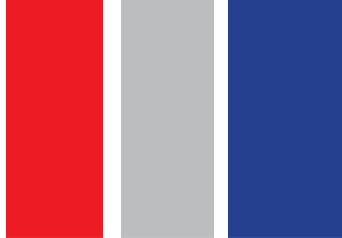
Mercury- added products	Phase-out date*
Batteries , except for button zinc silver oxide batteries with a mercury content < 2% and button zinc air batteries with a mercury content < 2%	2020
Switches and relays , except very high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments with a maximum mercury content of 20 mg per bridge, switch or relay	2020
Compact fluorescent lamps (CFLs) for general lighting purposes that are ≤ 30 watts with a mercury content exceeding 5 mg per lamp burner	2020
Linear fluorescent lamps (LFLs) for general lighting purposes: a) Triband phosphor < 60 watts with a mercury content exceeding 5 mg per lamp; b) Halophosphate phosphor ≤ 40 watts with a mercury content exceeding 10 mg per lamp	2020
High pressure mercury vapour lamps (HPMV) for general lighting purposes	2020
Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: a) short length (≤ 500 mm) with mercury content exceeding 3.5 mg per lamp b) medium length (> 500 mm and ≤ 1 500 mm) with mercury content exceeding 5 mg per lamp c) (c) long length (> 1 500 mm) with mercury content exceeding 13 mg per lamp	2020
Cosmetics (with mercury content above 1ppm), including skin lightening soaps and creams, and not including eye area cosmetics where mercury is used as a preservative and no effective and safe substitute preservatives are available	2020
Pesticides, biocides and topical antiseptics	2020
The following non-electronic measuring devices except non-electronic measuring devices installed in large-scale equipment or those used for high precision measurement, where no suitable mercury-free alternative is available: (a) Barometers; (b) Hygrometers; (c) Manometers; (d) Thermometers; (e) Sphygmomanometers.	2020

*Date after which the manufacture, import or export of the product shall not be allowed

Provision of Mercury Convention (Annex A, Part II: Products subject to Article 4, paragraph 3)

Mercury-added products	Provisions
Dental amalgam	Measures to be taken by a Party to phase down the use of dental amalgam shall take into account the Party's domestic circumstances and relevant international guidance and shall include two or more of the measures from the following list: - Setting national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration; - Setting national objectives aiming at minimizing its use; - Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration; - Promoting research and development of quality mercury-free materials for dental restoration; - Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices; - Discouraging insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration; - Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration; - Restricting the use of dental amalgam to its encapsulated form; - Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land.





Mercury-free Alternatives

Mercury-free dental fillings have been developed and studied for over fifty years. As a result, a wide variety of dental restorative materials to meet all needs are available today.

The most popular mercury-free fillings include:

- Composite
- Glass ionomer
- Compomer



Advantages of Mercury-free Fillings

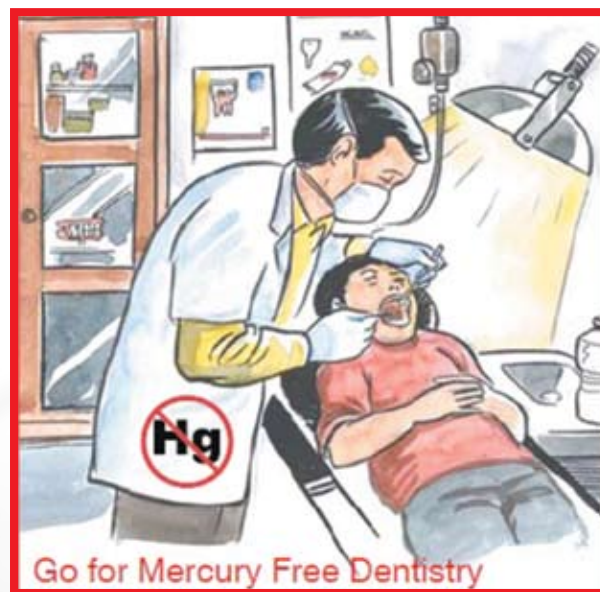
Mercury-free dental fillings offer many advantages:

Environment-friendly: Composites and glass ionomers are mercury-free with no evidence of environmental toxicity.

Preserve teeth: Adhesive resin materials allow for less tooth destruction and preserving tooth structure, composites can strengthen and enhance biomechanical properties of the restored tooth.

Prevent caries: Glass ionomers and Composite prevent tooth decay including sealing of adjacent pits and tooth fissures.

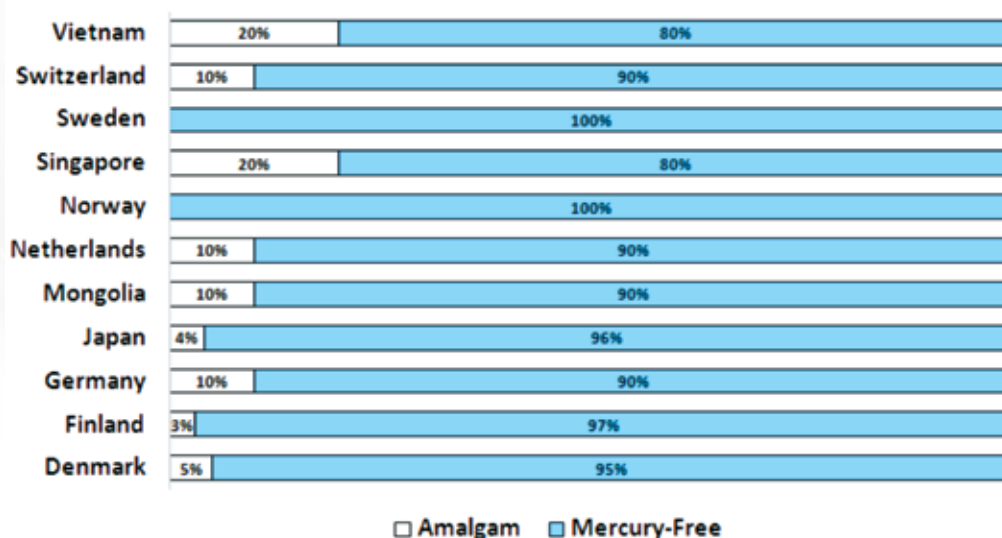
More accessible: Glass ionomers, used in ART, can be more accessible and less expensive than amalgam over long time.



User-friendly: Mercury-free restoration is quick and user friendly.

Increasing Use of Mercury-free Fillings

Because mercury-free dental restorations are increasingly effective, available, and affordable, a growing number of countries have already made significant progress in phasing down – and even phasing out – amalgam use. **The chart below shows the percentage of total fillings that are amalgam versus how many are mercury-free in several countries.** Therefore, Dental Health Care Services in Nepal should also move towards Mercury Free Dentistry.





Waste Management does not Address Amalgam's Full Lifecycle

Waste management is not a cost-effective way to prevent mercury pollution from amalgam due to several factors like high cost of separator installation, operation, maintenance, air pollution control devices with crematoria.

Separators are devices designed to capture mercury from dental clinic wastewater. But they do not address dental clinic air emissions, human waste, cremation, and burial – all of which can pollute the environment with dental mercury. Only by reducing amalgam use we can reduce mercury releases over its full lifecycle.

A Sustainable Solution

Rather than implement expensive waste management measures in perpetuity, it is far more cost-effective to simply use mercury-free fillings in the first place. Consistent with the Minamata Convention, the most cost-effective, health-protective, and environmentally-sound practice is to phase down – and ultimately phase out – amalgam use.

Dental colleges and universities should move towards curricula by replacing more and more mercury based theoretical and practical parts with safer alternative filling materials based theory and practice including discouraging the exam practical on dental amalgam restoration.

Dental doctors and hygienists should move mercury free restoration and take responsibility of environment sound management of waste they produce.

Mercury Free Health Care Service in Nepal

Health care facilities are one of the main sources of mercury release into the environment because of emissions from the incineration of medical waste. Health-care facilities are also responsible for mercury pollution taking place in water bodies from the release of untreated wastewater. Government of Nepal, Ministry of Health has decided to make mercury free health care services through imposing the blanket ban of Import, purchase and use of Mercury in health sector of Nepal in March 2013 and decision has made effective from July 16, 2013. Piloting of mercury free health care services in Nepal was conducted by CEPHED, Paropkar Maternity, Stupa Community Hospital, Alka Hospital Lalitpur, Blue Cross Hospital Kathmandu, Dhulikhel Community Hospital Dhulikhel, Nobel Hospital Biratnagar and BPKIHS Dharan etc. **During the third phase of UDPP GEF SGP Nepal supported program with CEPHED, it is going to develop and declare the Bharatpur Medical City as the first ever mercury free medical city of Nepal, in coordination and collaboration with Nepal Dental Association (NDA), Medical Colleges and Government Agencies including DHO, DPHO Chitwan, MoH and MoPE.**

Mercury Based Chemicals and Equipments



Mercury Based Dental Amalgam Filling



Mercury Thermometer



Mercury Sphygmomanometer



Mercury Tubelight and CFLs



Mercury Based Batteries

Mercury Free Alternatives

(Safe, Reliable, Cost Effective, Durable & Environment and Public Health Friendly)



Go for composite filling and glass ionomers



Digital and Radiation Thermometer



Digital and Aneroid Sphygmomanometer



LED (Light Emitting Diode) Bulb



Go for Zero Mercury Batteries



Promote and Use of Mercury Free Alternatives for Mercury Free health Care Services

Mercury Base Equipments and Products	Mercury Free Safer and Reliable Alternatives
Thermometers	Digital or Radioation Theremometers
Sphygmomanometers	Aneroid or Digital Sphygmomanometer
Gastrointestinal tubes	Non Mercury based Gastrointestinal tubes
Dental amalgam	Composite, Glass Ionomer, Compomer, Zirconomer, Ceramics etc.
Pharmaceutical Supplies	Non Mercury Pharmaceutical Supplies
Electrical Equipment	Non Mercury based electrical equipments
Float control	Non Mercury based floating control/stoppers
Thermostats	Non Mercury based thermostat or Foams
Thermostat probes in electrical equipment	Digital Probe and indicators in electrical equipments
Lamp (Tube, CFL, Discharge, Sodium Vapor)	Light Emitting Diode (LED)
Batteries	Mercury with Zero Mercury or non mercury
Pressure gauges	Non Mercury based Pressure Gauges
Laboratory chemicals etc.	Non Mercury based laboratory reagents
Button Batteries	Mercury free button batteries
Quicksilver Maze Toys	Mercury Free Toys
Old Latex Paints	New Latex Paints
Switches	Mechanical or Pressure Switches
Contact lens solution containing Thimerosal	Mercury free solution
Nasal Spray (with Thimerosal / phenylmercuric acetate)	Mercury Free Spray
Flame Sensor	Hot surface Ignition System

Mercury Free Dentistry in Nepal

Center for Public Health and Environmental Development (CEPHED) with the technical support from The Asian Center and World

Alliance for Mercury Free Dentistry (WAMFD) and IPEN under the ongoing UNDP GEF SGP supported project on **“Reduction of POPs and Mercury from Health Sector of Nepal through awareness raising, helping CTF Setup and Policy Influence”** are campaigning for an end to the use of mercury dental amalgam in Nepal and especially in Bharatpur Chitwan. Our current program includes:

- Working with Professional Dental Associations and Societies to promote mercury free alternatives
- Developing mercury-free curriculum resources for dental colleges and universities
- Policy interventions
- Awareness campaigns
- Harm minimization campaign for dentists still using mercury dental amalgam

Conclusion

MERCURY FREE DENTISTRY AND MERCURY FREE HEALTH CARE SERVICES through dental amalgam phase down and/or Phase out as well as shifting to mercury free alternative equipments are possible in Nepal and other developing countries by:

- Set National objectives for minimizing amalgam use.
- Building capacities of dentists on oral health promotion and disease prevention.
- Creating awareness on the environmental risks and Public Health impacts of dental amalgam.
- Promoting alternatives for dental amalgam in dental restoration.
- Update dental school curriculum to promote mercury-free dentistry.
- Make adherent of insurance and government program to favor mercury-free dentistry.
- End amalgam use in children and pregnant women first and then move to all.
- Ensuring regulatory and legislative framework towards banning mercury amalgam and all mercury based equipments1s import, sale, distribution and uses are in place.
- Supporting best management practices and environmentally sound management of health care waste including mercury containing waste
- Encouraging waste collection, separation and use of facilities for hazardous waste storage and treatment etc.



Call to stop mercury use in dentistry

POST REPORT
KATHMANDU, JAN 13

Civil society representatives from Nepal, India, Bangladesh, Sri Lanka, Pakistan and Thailand have agreed to a declaration that calls to end the use of mercury in amalgam fillings in dental care in Asia.

More than 137 civil society organisations, individuals

environment. "The continuous use of mercury-filled dental amalgam in medical field is not justified when alternatives are now affordable, effective and available in the region," said a press statement issued by Center for Public Health and Environmental Development on Tuesday.

The organisations also urged the Asian countries to

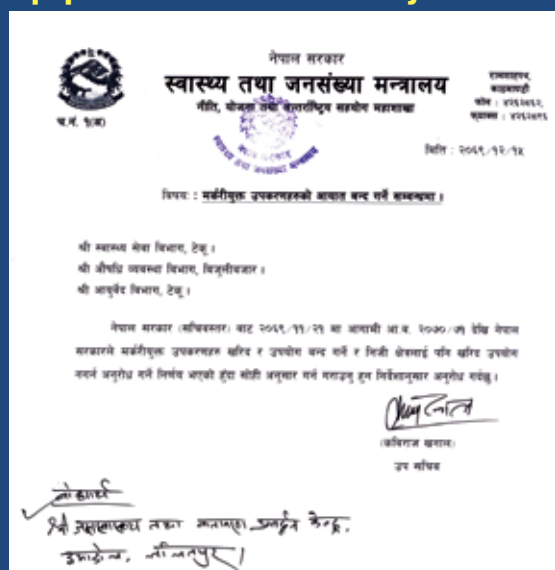
therefore be more significant.

"We are calling on Asia to end the use of mercury-based dentistry. Asia is the most densely populated continent on the planet and therefore risks incredible harm to human health and environment," the statement further reads.

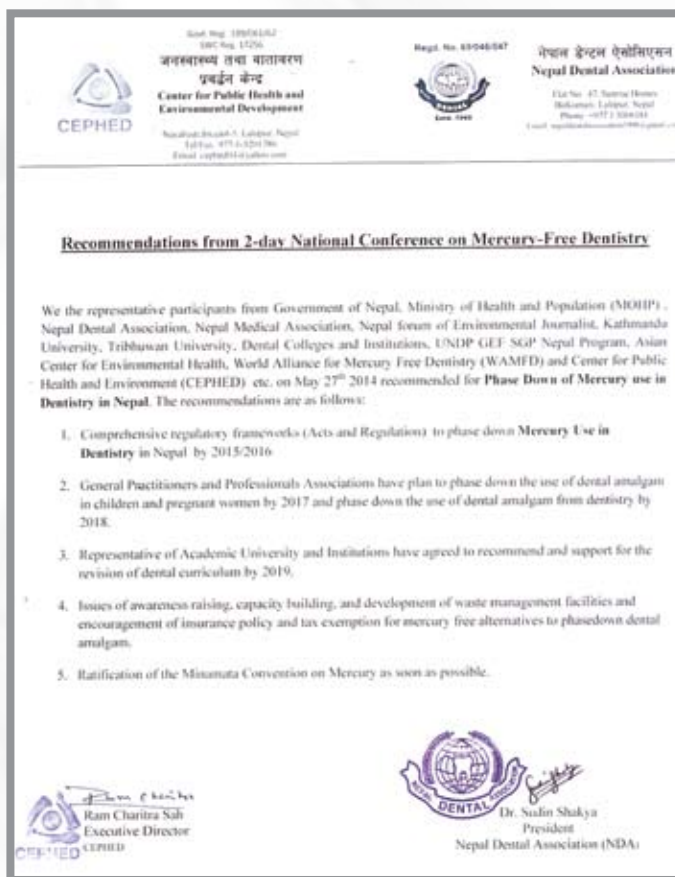
Mercury-free dentistry is

growing in Asia. Recent studies in India and Pakistan show that, already, over 50 percent of dentists are using alternatives to dental amalgam in India, while in Pakistan 42.86 percent of dental professionals strongly recommend to phase down the use of mercury/dental mercury amalgam.

Government of Nepal, Ministry of Health (MoH the then MoHP) banned the import, purchase and use of all mercury based equipments effective from July 16th 2013.



NOTE: Due to this Government decision, import of mercury based equipment's including dental amalgam has reduced substantially but not completed stopped. This calls for even stronger effective implementation through making this banning decision mandatory through gazette notification from MOH and/or MOPE as soonest possible



This briefing paper has been produced by CEPHED under UNDP GEF SGP (supported Reduction of POPs and Mercury from Health Sector of Nepal through awareness raising, helping CTF Setup and Policy Influence Project) in association with WAMFD, Asian Center for Environmental Health and IPEN.