

# “DIOXINS” IN YOUR PLATE



Toxics Link  
for a toxics-free world

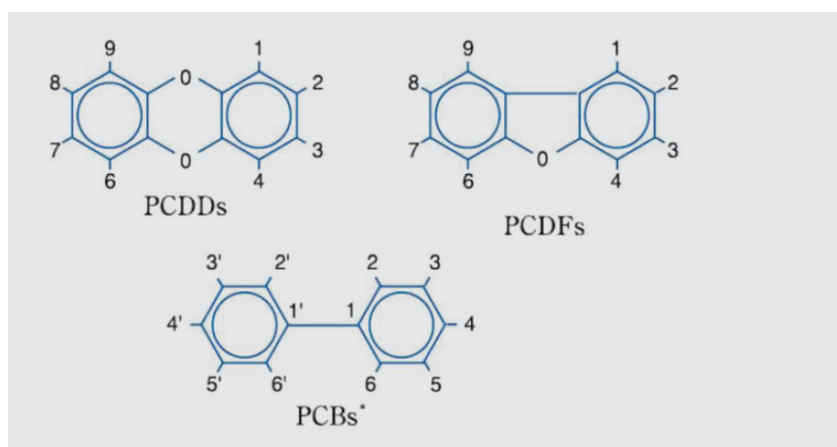
Dioxins and related compounds are Halogenated Aromatic chemicals with similar chemical & physical properties and structures commonly known as polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs). Around 419 types dioxins have been identified of which approximately 30 are considered to have significantly high toxicity. Out of these 2, 3, 7, 8-tetrachlorodibenzo-para-dioxin (TCDD) is the most toxic.

Dioxins are released unintentionally in various industrial processes such as waste incinerations, ferrous and nonferrous metal production, heat and power generation, production of mineral products, transportation etc. Uncontrolled combustion like forest fire/open burning of waste /accidental fire etc. also contributes to the dioxins release.

Dioxins are trans-boundary in nature and can travel a long distance from the source of emission and bio accumulates in the food chain. Through the food chain, they enter the human body and deposit in the fatty tissues for the long periods and cause serious health hazard. The dioxins are generally associated with various health ailments including skin lesions, reproductive disorders, endocrine disruptors, and cancer.

Dioxins are designated as Persistent Organic Pollutant (PoPs) in the Stockholm Convention and have been included in Annexure- C (unintentional release) of the Convention.

**FIGURE 1 - Chemical Structure of Dioxins, Furans & PCB**



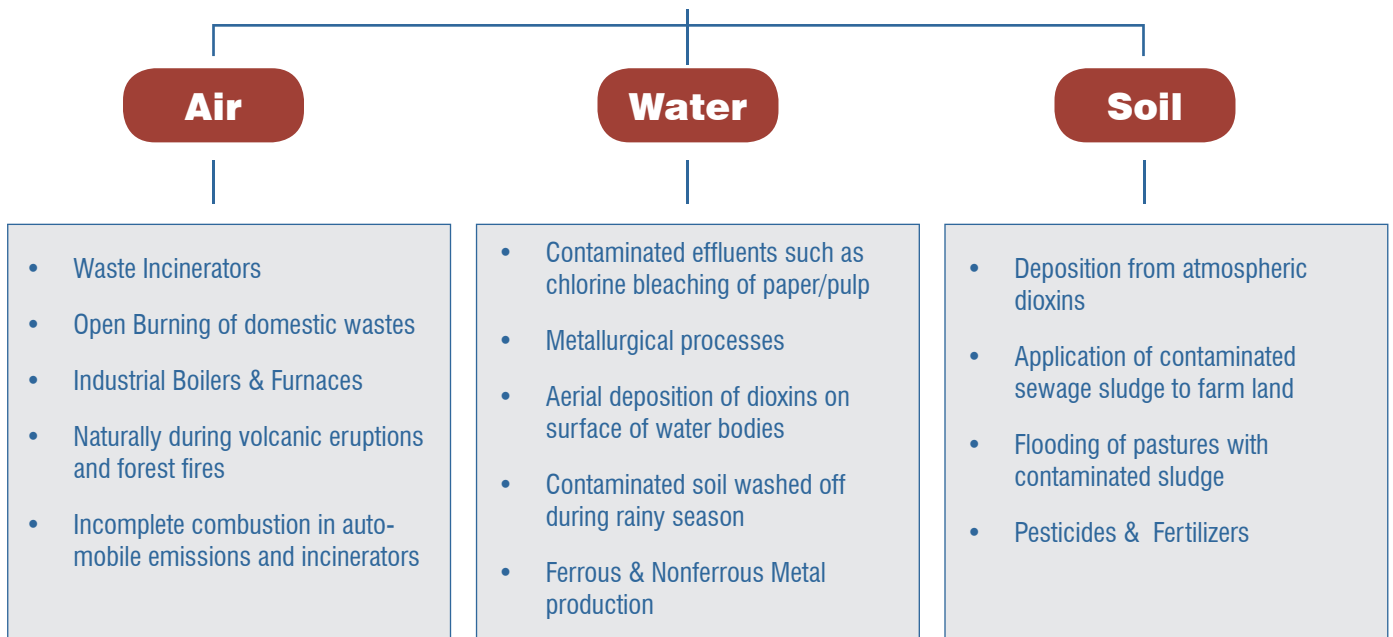
## DIOXINS & HUMAN HEALTH

- Short-term exposure: - skin lesions, such as chloracne and patchy darkening of the skin, and altered liver, thymus & spleen function.
- Long-term exposure: - impairment of the immune system<sup>[14]</sup>, the developing nervous system<sup>[15]</sup>, the endocrine system and reproductive functions.
- Chronic exposure (in animals): several types of cancer, chromosome break.
- Pregnant women, new born and developing fetus are sensitive to dioxins exposure.

### Other effects in human may include:

- Developmental abnormalities in the enamel of children's teeth
- Thyroid disorders<sup>[16]</sup>
- Endometriosis<sup>[17]</sup>
- Diabetes<sup>[18]</sup>

# Sources of Dioxins In Environment

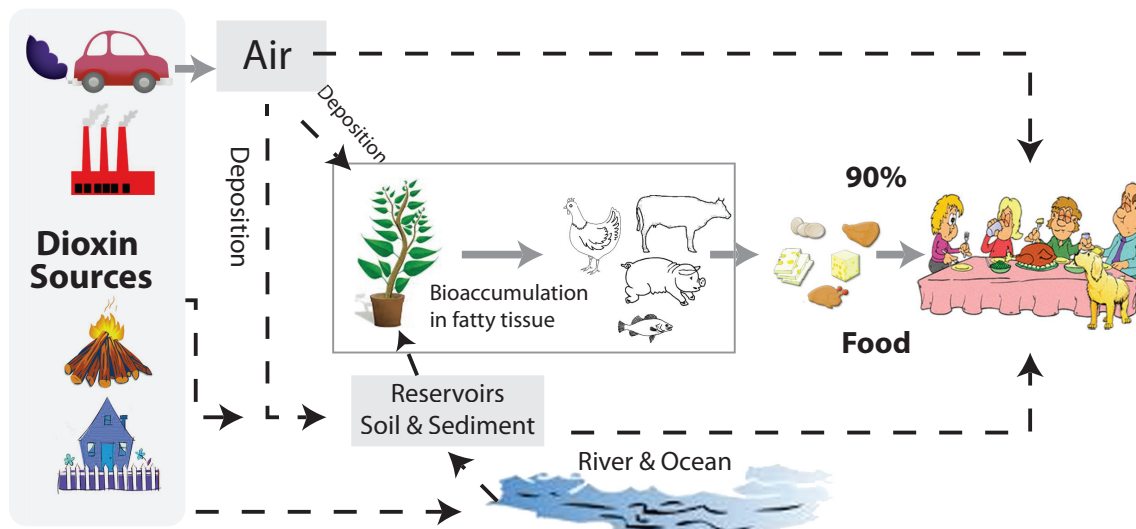


## DIOXINS IN FOODS: CONTAMINATION PATHWAY

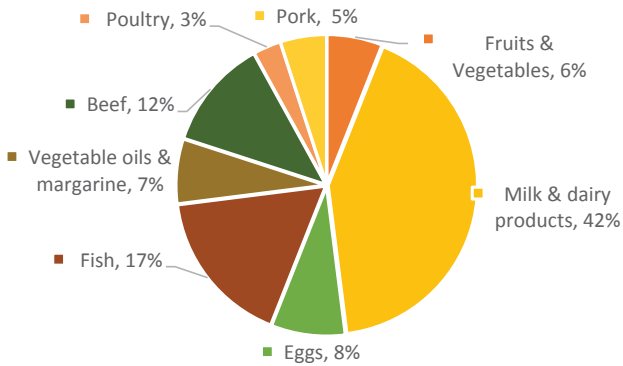
The half life period of the dioxins are about 7-12 years, thus after release from various sources, they stay in the environment for a very long time. Dioxins gradually enter the food chain and deposit in the fatty cells of food articles. The fat containing foods like Meat, Milk, Dairy products, Fish and Shell Fish are prone to the contamination of dioxins.

The plants are also getting contaminated from dioxins. Dioxins usually enter the leafy vegetables and pastures from atmospheric deposition and contaminated water then enter the food chain and become a part of the human food cycle. According to WHO, 90% of human exposure to dioxins is through dietary intake, mainly meat and dairy products, fish and shell fish.

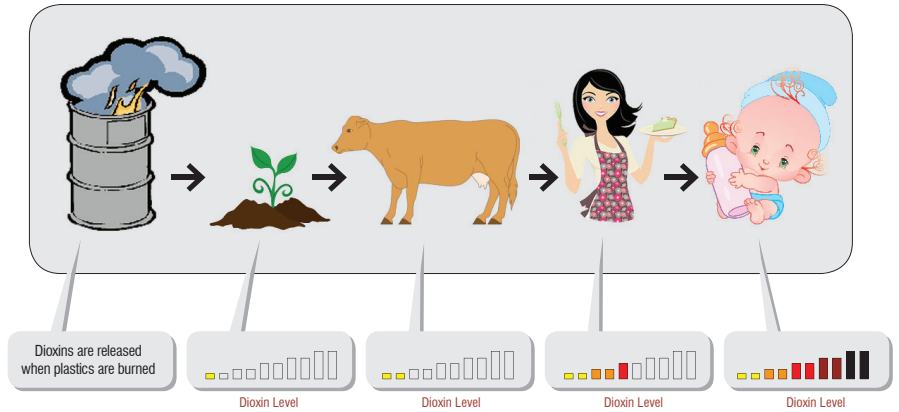
**FIGURE 2 - Sources of Dioxins in Food**



**FIGURE 3 - Contribution of different types of food to average daily intake of Dioxins**



**FIGURE 4 - Biomagnifications and Bioaccumulation of Dioxins**



## INCIDENCES OF DIOXINS CONTAMINATION IN FOODS

- In July 2013, Chile recalled 188,000 pounds of chicken imported to USA for potential dioxin contamination though FSIS had determined that exposure to dioxin in the product is low and does not pose a health threat.
- In late 2008, Ireland recalled many tons of pork meat and pork products when up to 200 times more dioxins than the safe limit were detected in samples of pork. The contamination was traced back to contaminated feed. The finding led to one of the largest food recalls related to chemical contamination. Risk assessments performed by Ireland indicated no public health concern.
- In July 2007, the European Commission issued a health warning to its Member States after high levels of dioxins were detected in a food additive - guar gum - used as a thickener in small quantities in meat, dairy, dessert or delicatessen products. The source was traced to guar gum from India, which was contaminated with pentachlorophenol (PCP), a pesticide no longer in use. PCP contains dioxins as a contaminant.
- In 1999, high levels of dioxins were found in poultry and eggs from Belgium. Subsequently, dioxin-contaminated animal-based food (poultry, eggs, pork), were detected in several other countries. The cause was traced to animal feed contaminated with illegally disposed PCB-based waste industrial oil.
- In March 1998, high levels of dioxins in milk sold in Germany were traced to citrus pulp pellets used as animal feed exported from Brazil. The investigation resulted in a ban on all citrus pulp imports to the EU from Brazil.

## REGULATIONS OF DIOXINS IN FOODS

In many countries, dioxin content in foods is well regulated. There are prescribed limits for the dioxin content in food items to evade its impact on human health. Dioxins are usually measured as Toxicity Equivalent Quantities (TEQs) or parts per trillion (ppt) of toxicity

equivalents. Toxic Equivalents (TEQs) report the toxicity-weighted masses of mixtures of PCDDs, and PCDFs.

Many countries have put maximum permissible limit (TEQ) for dioxin content in various food items to check dioxin contamination in foods.

### PERMISSIBLE “TEQ” LIMIT OF DIOXINS IN FOODS

Standards in TEQ or ppt	Fish & shell fish	Milk & milk products	Pork	Egg	Beef
US EPA	5	-	-	1	-
EU	4	3	1	3	3
Australia	-	3	2	5	6

Tolerable Daily Intake (TDI) is a value calculated as an index of the effects on health, when daily intake continues throughout life. The international agencies including, WHO-FAO, Codex Alimentarius Commission have issued TDI limit for dioxins intake of a human being. Many countries have put regulation in place on the permissible intake of dioxins through their food.

### Tolerable daily intake (TDI) of dioxins

Regulatory Body	TDI (pg/kg of body weight/ day)
WHO	1-4
FDA EPA	0.7
European Union	1-4
Japan	4
Canada	2.3
Australia	2.3
Joint FAO/WHO Expert Committee on Food Additives	2.3
India	Does not have any standards

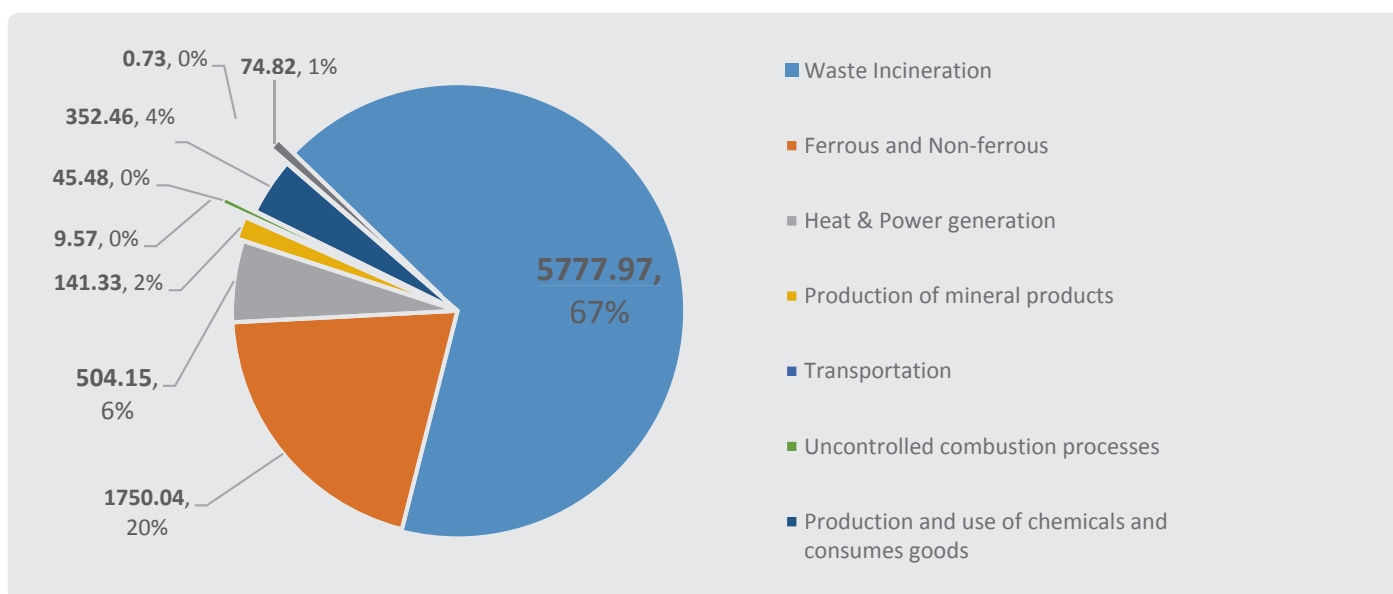
## INDIAN SCENARIO

In India annual release of dioxins and furans are estimated to be 8656.55 gTEQ. The waste incinerators contribute to 66.7% of total dioxins release in the country. Open burning of Municipal Solid Waste (MSW) and landfill fires emit 10,000 grams of dioxins/furans in Mumbai's lower atmosphere every year. Though there are reports of significant amount of dioxins release in the environment in India, at present there is no prescribed standard for dioxins content in food items.

### ISSUES FOR INDIA

- No standards on dioxins content in food items (NO TEQ Limit).
- No TDI limit for dioxins has been prescribed.
- Very little data on dioxins content in food items is available.
- Very few laboratories to deal with the issue.
- Low public awareness on the issue.

**FIGURE 5 - Annual emission of Dioxins & Furans: Main source category (gTEQ/a)**



## RESEARCH ON DIOXINS IN INDIAN FOOD

Institute of Environmental Science and Technology, Yokohama National University, Japan, 2001

- The levels of PCDD and PCDF in Indian fishes, meat and wildlife samples have been found in the following order:

Country chicken < Fat bodies of Goat / lamb < Fishes < River Dolphins < Predatory birds.



- Fishes contained the highest concentration of total PCDDs / PCDFs (130 pg/gm of fat weight).
- Concentrations of PCDDs and PCDFs in meat products were, on average, 2 – 5 times less than those found in fishes.
- The liver tissue of dolphins contained approximately three fold higher concentrations of PCDDs and PCDFs.

### International PoPs Elimination Network (IPEN), 2005

- Contaminant levels of dioxins exceeded the EU limit in eggs by more than 4-fold.
- Measured levels of PoPs in eggs (per gram of fat)



PCDD/Fs in WHO-TEQ (pg/g)	Measured level	EU limits
Kerala	13.91	3.0
Lucknow	19.80	3.0

- Measured levels of PoPs in eggs (per gram of egg fresh weight)

PCDD/Fs in WHO-TEQ (pg/g)	Measured level	EU limits
Kerala	1.82	1.0
Lucknow	2.48	1.0

## **CODEX GUIDELINES TO REDUCE DIOXINS EXPOSURE IN FOOD**

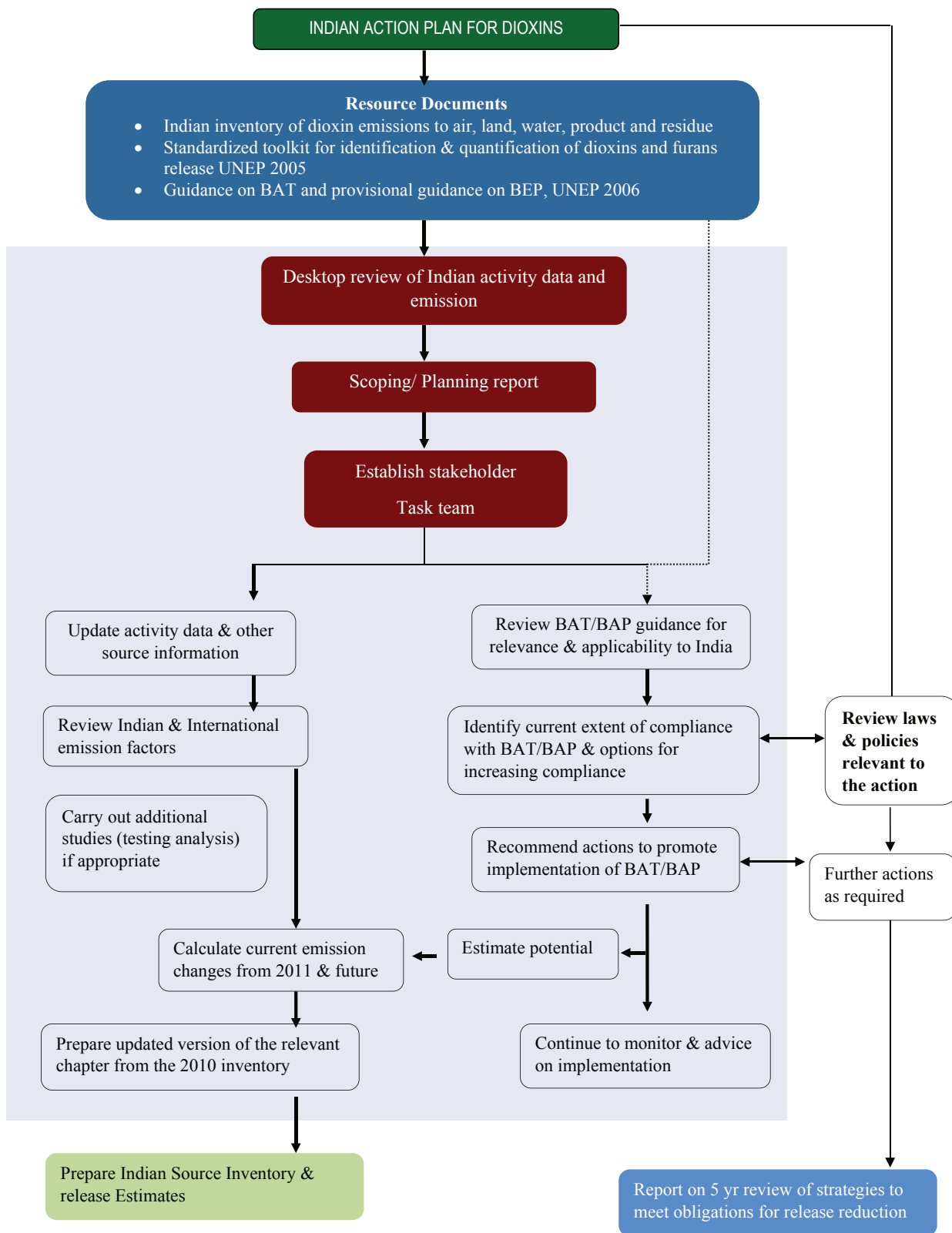
- Identification of agricultural areas with increased dioxin contamination due to local emission, accidents or illegal disposal of contaminated materials, and monitoring of feed and feed ingredients derived from these areas,
- Setting guidance values for soil and recommendation for special agricultural use (e.g., limitation of grazing or use of appropriate agricultural techniques),
- Identification of possibly contaminated feed and feed ingredients,
- Monitoring compliance with nationally-established guideline levels or maximum limits, if available, and minimizing or decontaminating (e.g., refining of fish oil) non-complying feed and feed ingredients, and
- Identification and control of critical feed manufacturing processes (e.g., artificial drying by direct heating).

## **PREVENTIVE MEASURES**

- Need for stringent standards and periodic monitoring to prevent release of dioxins from industrial sources.
- Adoption of best available technologies (BAT) for dioxins mitigation.
- Setting up standards for dioxins content in foods.
- Periodic monitoring of the food items in suitable laboratories.
- Systems in place to stop dioxins contaminated foods to enter the market.
- Sewage sludge used for agricultural purpose needs to be monitored.
- The livestock should be monitored to prevent contamination.
- Adequate steps need to be taken to prevent indiscriminate and uncontrolled burning of wastes.

## **PUBLIC ROLE IN PREVENTION**

A citizen can play an important role in reducing dioxins. There are many sources of dioxins release like open burning, waste burning and biomass burning where citizen's role is crucial to bring significant change. The general public also needs to be encouraged for source segregation and promote composting of household municipal wastes as far as possible, this will minimize waste burning. Schools can also play a crucial role in creating awareness.



Source: CPCB

## REFERENCES

1. WHO (World Health Organization). 2010. Dioxins and their effects on human health (Fact Sheet No. 225). Available: <http://www.who.int/mediacentre/factsheets/fs225/en/>
2. Fries GF. 1995. A review of the significance of animal food products as potential pathways of human exposures to dioxins. *Journal of Animal Science*. 73(6), 1629–1650. <http://www.ncbi.nlm.nih.gov/pubmed/7673057>
3. Dioxin and dioxin-like PCB contamination in foods and feeds (CAC/RCP 62-2006)
4. Dioxins. 2012. Govt. of Japan.
5. USDA (U.S. Department of Agriculture). 2010. Dietary Guidelines for Americans. Available: <http://www.cnpp.usda.gov/dgas2010-policydocument.htm> [Accessed 19 June 2010].
6. National Dioxins Program – National Action Plan for addressing dioxins in Australia, 2005.
7. Dioxins in food. 2004. Food Standards Australia & New Zealand.
8. Dioxins in food. Centre for Food Safety, Hong Kong.
9. Dioxins in Foods and Feeds. 2013. Institute of Food and Science technology, U.K.
10. Dioxins. 2012. National Institutes of Health, U.S. Department of Health and Human Services.
11. Dioxins & Furans. 2005. Health Canada.
12. National Implementation Plan, India 2011.
13. Schecter A, Cramer P, Boggess K, et al. 1997. Levels of dioxins, dibenzofurans, PCB and DDE congeners in pooled food samples collected in 1995 at supermarkets across the United States. *Chemosphere*. 34(5), 1437–1447. <http://www.ingentaconnect.com/content/els/00456535/1997/00000034/00000005/art00440>
14. Baccarelli A, Mocarelli P, Patterson DG, et al. 2002. "Immunologic effects of dioxin: new results from Seveso and comparison with other studies". *Environ. Health Perspect*. 110 (12): 1169–73.
15. Pelclová D, Urban P, Preiss J, et al. 2006. "Adverse health effects in humans exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)". *Reviews on environmental health* 21 (2): 119–38. PMID 16898675.
16. Pavuk M, Schecter AJ, Akhtar FZ, Michalek JE. 2003. "Serum 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) levels and thyroid function in Air Force veterans of the Vietnam War". *Annals of epidemiology* 13 (5): 335–43.
17. Eskenazi B, Mocarelli P, Warner M, et al. 2002. "Serum dioxin concentrations and endometriosis: a cohort study in Seveso, Italy". *Environ. Health Perspect*. 110 (7): 629–34.
18. Arisawa K, Takeda H, Mikasa H. 2005. "Background exposure to PCDDs/PCDFs/PCBs and its potential health effects: a review of epidemiologic studies". *J. Med. Invest*. 52 (1–2): 10–21.
19. Kumar KS, Kannan K, Paramasivan ON, Sundaram VPS, Nakanishi J and Masunaga S. 2001. Polychlorinated Dibenzo-p-dioxin, Dibenzo-furan and Polychlorinated Biphenyls in Human tissues, Meat, Fish and Wildlife samples from India. *Environ. Sci. Technol*. 35(17):3448-3455.
20. National Environmental Engineering Research Institute, NEERI. Air Quality Assessment, Emissions Inventory and Source Apportionment Studies: Mumbai. New Delhi : Central Pollution Control Board (CPCB), 2010
21. Ranjith Kharvel Annepu 2012. Sustainable Solid Waste Management in India. Waste-to-Energy Research and Technology Council, Columbia University.

### Compiled and written by:

Piyush Mohapatra | Email: [piyush@toxicslink.org](mailto:piyush@toxicslink.org)

Alka Dubey | Email: [alka@toxicslink.org](mailto:alka@toxicslink.org)

---

### For more information, please contact:

#### Toxics Link

H2 (Ground Floor)

Jungpura Extension

New Delhi 110 014

T: +91-(0)11-24328006, 24320711

E: [info@toxicslink.org](mailto:info@toxicslink.org)