

Occupational and Environmental Levels of Metals and Poly Brominated Diphenyl Ethers in the Formal Electronics Recycling Industry Worldwide

Background

Electronics recycling (e-recycling) can be a source of exposure to a variety of toxic chemicals, including:

- Metals
- Polybrominated diphenyl ethers (PBDEs)



A recent review of published literature on chemical hazards in the formal e-recycling industry (Ceballos and Dong, *Env. Int.*, 2016) suggests that:

- Metal levels in workplace air and dust are often high enough to adversely affect the health of workers
- PBDEs were also commonly found in the workplace and transported outside of the facilities into the environment

Objectives and Methods

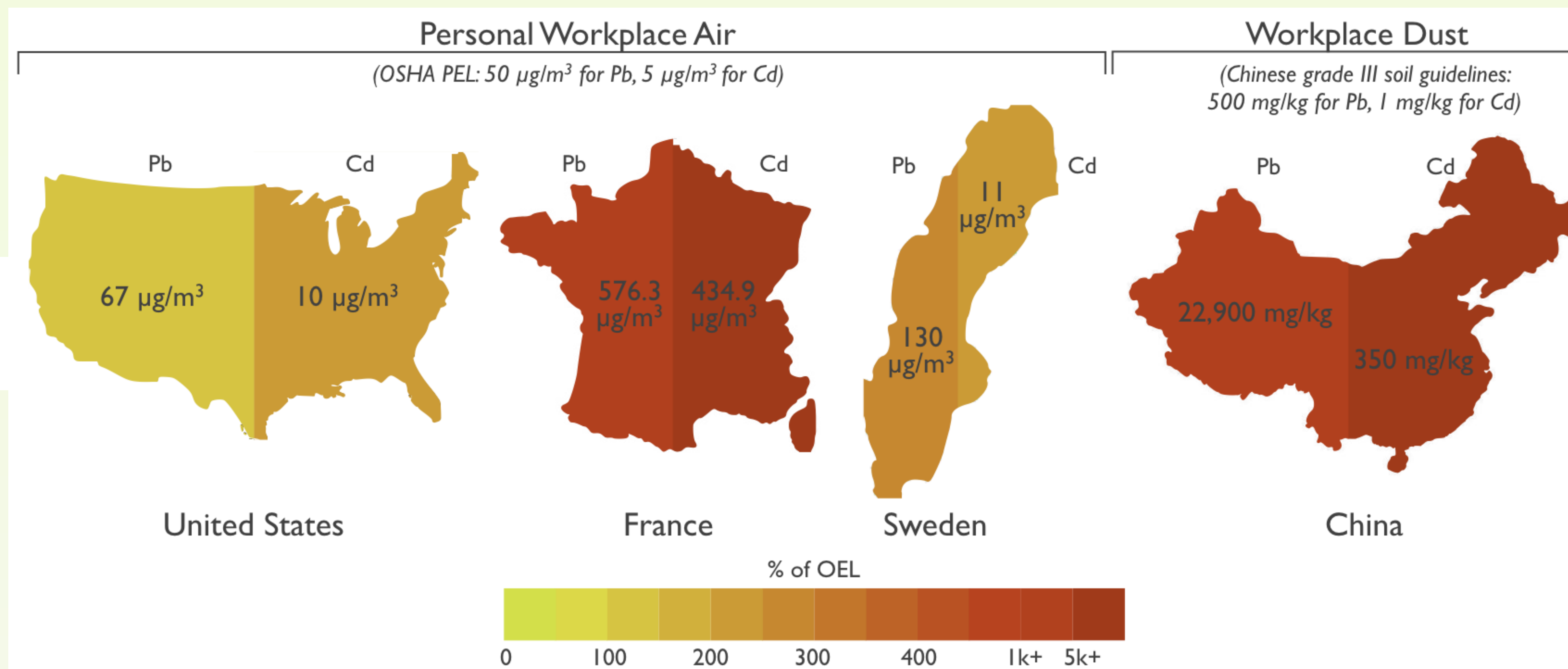
To graphically summarize published levels found in the air and dust at formal e-recycling facilities using Microsoft Excel and Tableau Data Analysis Software

Metals Results

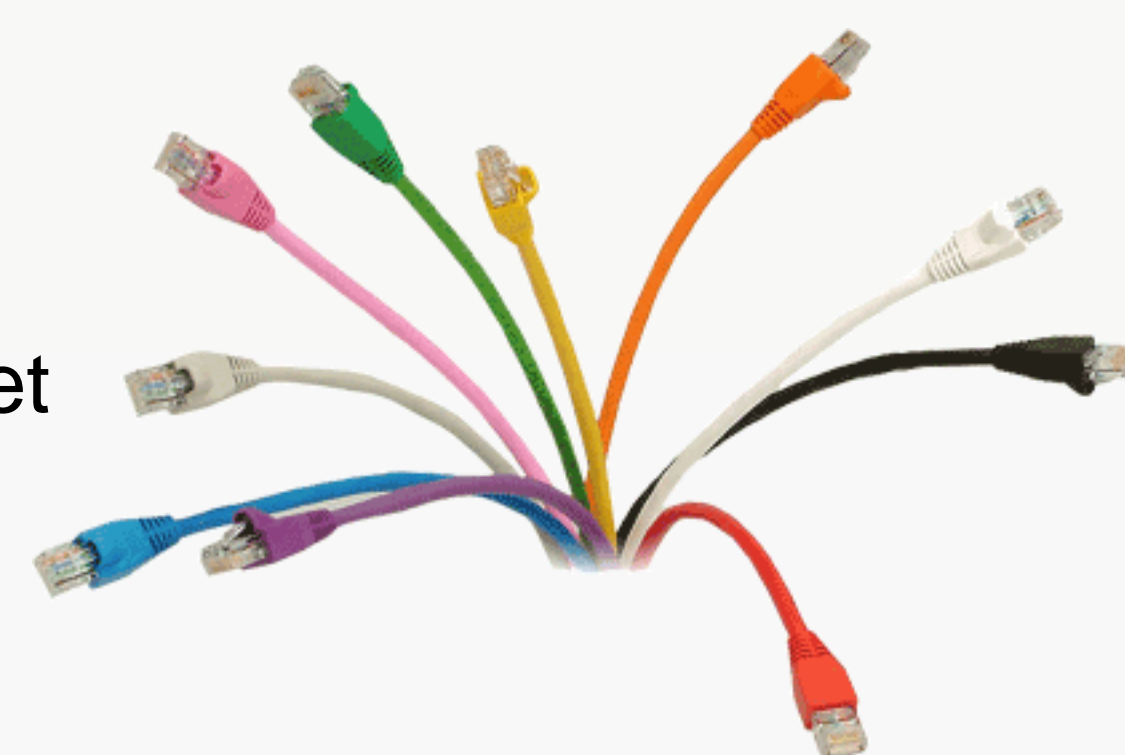
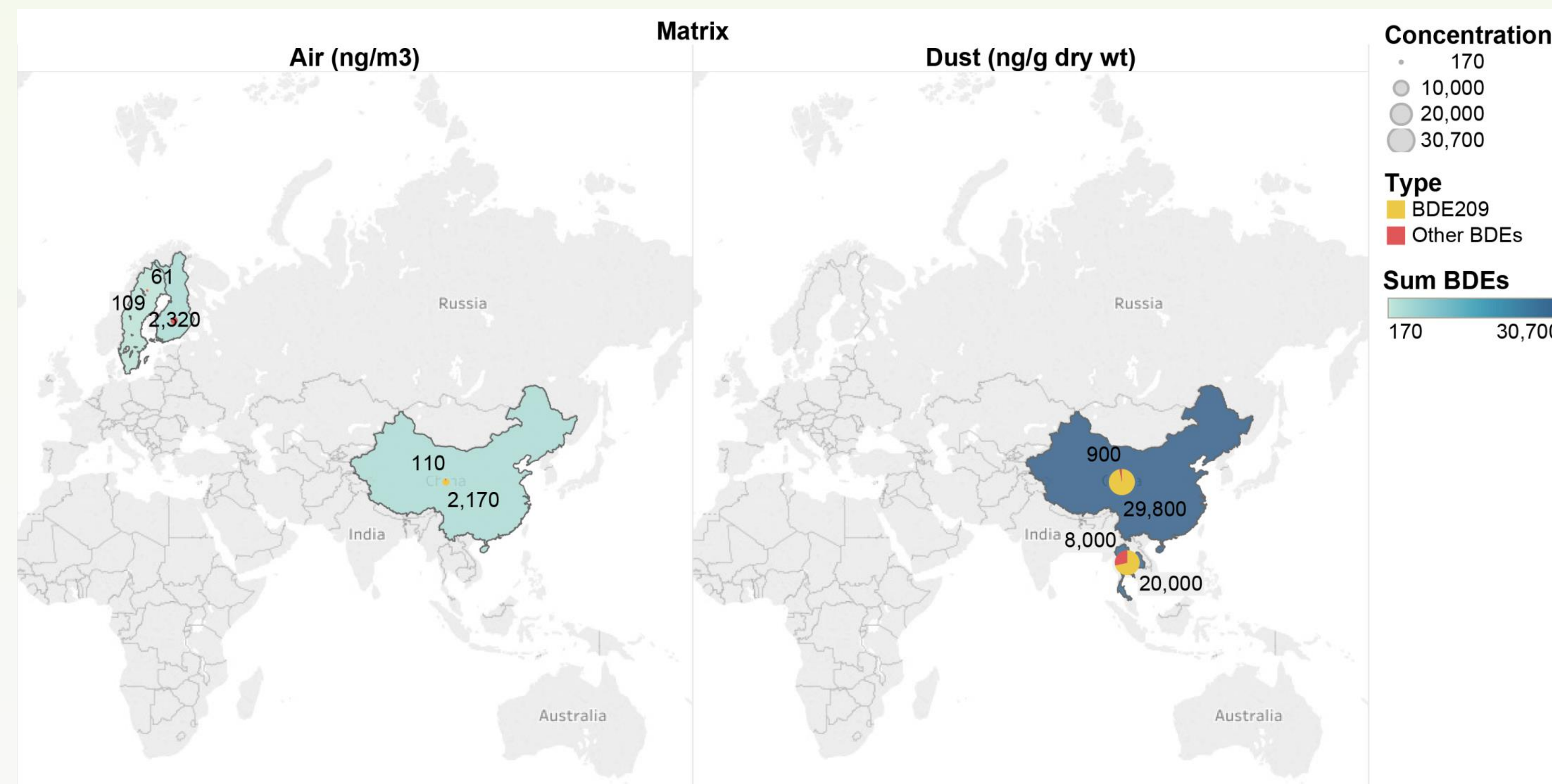
Most concerning levels of metals found were for lead and cadmium

- In workplace air, the breathing zone of workers had the highest levels of lead and cadmium at French facilities that processed cathode ray tubes (Lecler et al. 2015)
- In workplace dust, highest levels of lead were at a Chinese facility recycling printed circuit boards (Deng et al. 2104)

Highest Levels for Metals at Formal E-Recycling Facilities

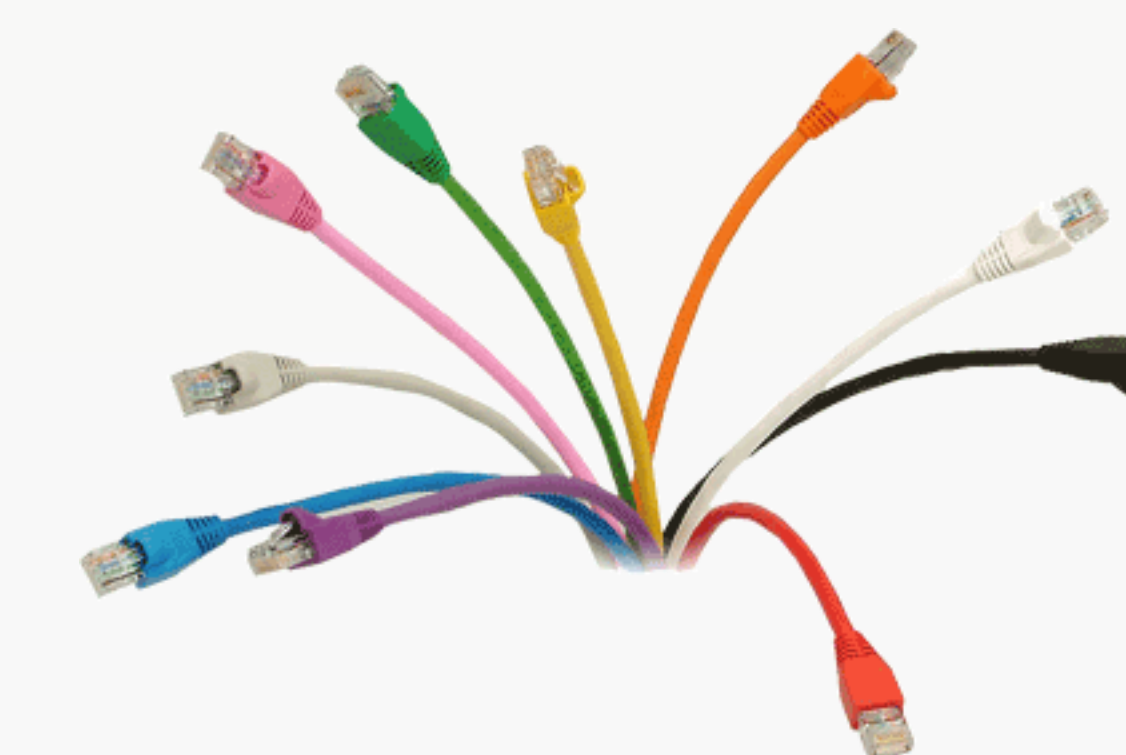


Highest Levels for PBDEs at Formal E-Recycling Facilities



E-waste Facts (UN University 2014, EPA 2011, ISRI 2016)

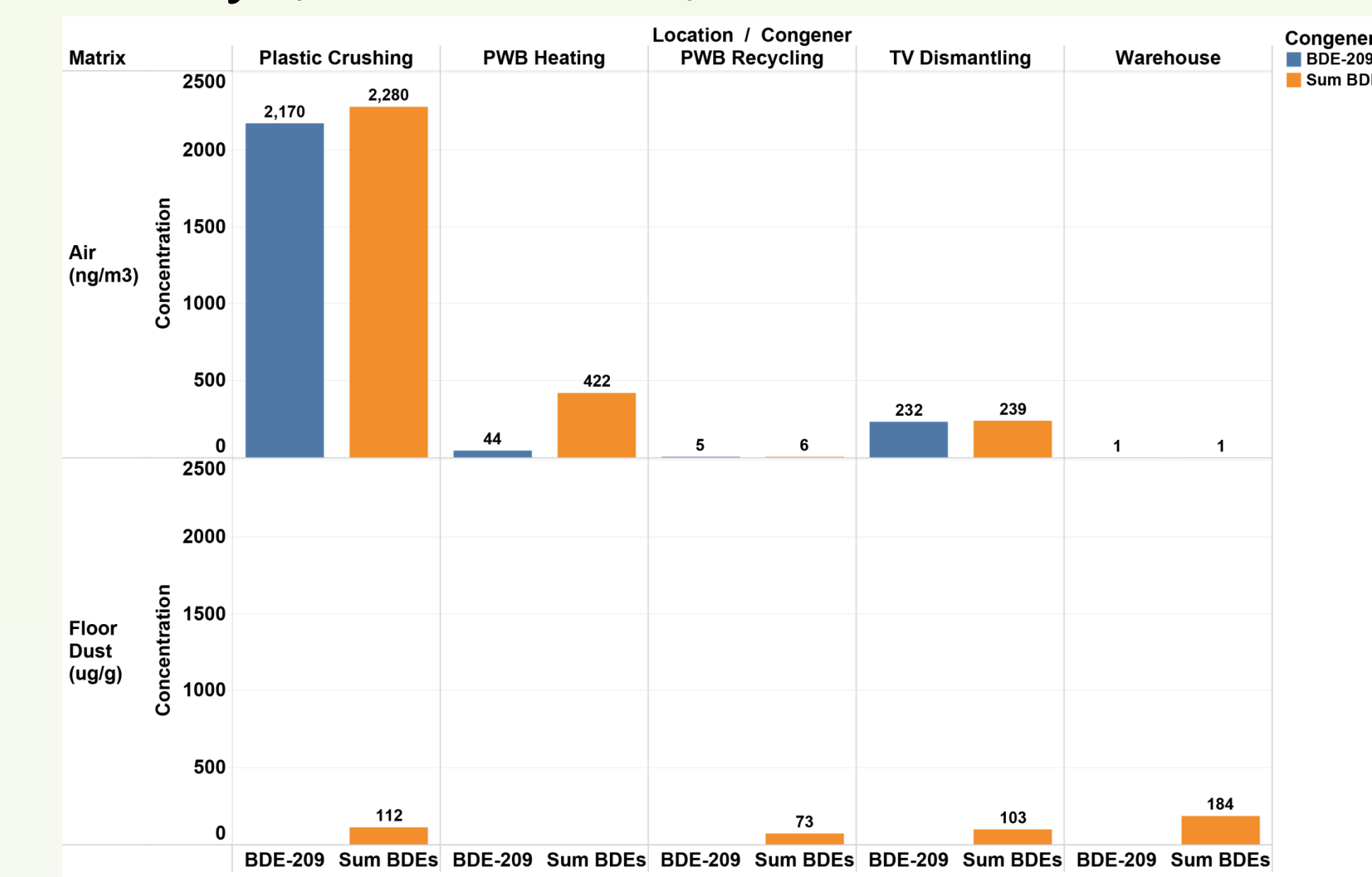
- 41.8 M tons of e-waste generated worldwide
- US is top world e-waste producer (7M tons)
- ~25% of electronics collected in US



PBDEs Results

The highest levels of PBDEs found in the publications were for BDE-209

- In workplace air, the highest levels of PBDEs were at a Finland facility (Rosenberg et al. 2011)
- In workplace dust, levels of PBDEs were highest at a Chinese facility recycling printed circuit boards and plastic casings (Guo et al. 2015) and at a Thailand electronic waste storage facility
- PBDEs were highest at or near the facility than in reference locations suggesting migration of contaminants outside of the facility (Ma et al. 2009)



PBDE Levers in Air and Floor Dust
 (Chinese e-recycling facility, Deng et al. 2014, Guo et al. 2015)

Recommendations

