Toxicity of Chemicals Contained in Everyday Electronic Devices: A European Perspective

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I. Introduction

WHY toxicity in everyday electronics matters ? Most of our electronic devices contains chemicals. Some are inoffensive and other can be harmful. Harmful chemicals are widely used and sometimes for security concern. In Europe, we have a policy to regulate the amount of the toxic known chemicals. Despite this regulation, we are still exposed to these chemicals. This review will focus on the toxicity of chemicals contained in everyday electronic devices from a European perspective. The purpose of this work is to give an overview of the most common toxic chemicals in electronic devices and how they can affect humans.

II. Toxic Substances in Everyday Electronics

Electronic devices can be toxic in multiple ways and we use them everyday. This state of the art report will only treat about the toxicity of the chemicals contained in the devices. It is important to know that not only the electronic components themselves contain toxic compounds but also the metal or plastic casing, the wiring, the solder and other mechanical or electrical items that could be included in most of the electronic devices.

The most common and well-known toixc chemicals are listed in the table 1 in the annexes. Brominated Flame Retardants (BFR) are a big concern since they are used in most of electronic device for safety policies imposed by EU [4]. The BFRs are extremely present in our lives and are able to bioaccumulate. They are dangerous for most of the living beings as they are endocrine disruptors and carcinogenic [1], [2]. They are present in pcb and incorporated in polymers which are used for casing. This means we are almost constantly in contact with BFRs. The two most common BFRs are Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ethers (PBDE).

Another important heavy metal is Lead (Pb). It was widely used in old solders and is still present in some batteries and electronic components. Lead is extremely toxic for humans and can lead to neurological disorders, especially for children [5], reproductive system disorders [6], [7]. It is also restricted by the EU regulations [3].

Phtalastes are also widely used in electronic devices as plasticizers. They are used to increase the flexibility of plastics and cables. —¿ TO DEVELOP

Cadmium (Cd) is another heavy metal used in batteries (Ni-Cd), electroplating and coatings. —¿ TO DEVELOP

Mercury (Hg) is used in some switches, sensors and lamps. —¿ TO DEVELOP

Hexavalent chromium (Cr VI) is used for corrosion-resistant coatings and metal plating. —¿ TO DEVELOP

Other toxic chemicals can be found in electronic devices but are less common. —¿ TO DEVELOP

III. Exposure Pathways

How are we exposed to these toxic chemicals ? The main exposure pathways are inhalation, ingestion and dermal contact. —¿ TO DEVELOP

IV. EU Regulatory Framework

What does EU impose regarding these toxic chemicals ? Are the regulations sufficient to protect us from these toxic chemicals ? Are the regulations well enforced ? —¿ TO DEVELOP

Appendix A
Appendix title

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References

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TABLE I
COMMON TOXIC CHEMICALS IN EVERYDAY ELECTRONIC DEVICES — EU LIMITS AND POTENTIAL HAZARDS

Substance	**Max. concentration**	**Common uses**	**Toxicity**
Lead	0.1 %	Solders, cable sheathing, CRT-glass, other components.	
Mercury	0.1 %	Switches, sensors, some lamps or fluorescent elements, older electronic meters/gauges.	
Cadmium	0.01 %	Batteries (e.g. Ni–Cd), electro-plating, coatings, older CRT phosphors, stabilizers in plastics.	
Hexavalent chromium	0.1 %	Corrosion-resistant coatings, metal plating, protective finishes on metal housing or parts.	
PBB	0.1 %	Plastics, housings, insulation, printed circuit boards (PCBs), casings — to reduce flammability.	
PBDE	0.1 %	Plastics, PCBs, cable insulation, housings.	
2-ethylhexyl, DEHP	0.1 %	Plasticizers in cables, insulation, plastic parts, housings.	
BBP, DBP, DIBP	0.1 %	Similar uses: plastic parts, cable insulation, polymer components.	