UN environment programme

Chemicals of Concern in Electronics

Review of Legislative and Regulatory Approaches

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Geneva, 23/12/2020

Acknowledgements

This report was prepared by the United Nations Environment Programme, Economy Division, Chemicals and Health Branch with the following support:

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Further valuable input within UNEP was provided by Wenjia Fan, Kostyantyn Pivnenko, Feng Wang and Ran Xie.

Further comments were received from: Keima Gardiner, Agustín Harte, Madalina Laxton and Kei Ohno Woodall.

This document has been developed within the framework of the Global Environment Facility (GEF) project ID: 9771 on Global Best Practices on Emerging Chemical Policy Issues of Concern under the Strategic Approach to International Chemicals Management (SAICM).

Feedback and contact The United Nations Environment Programme encourages interested readers of this report to engage and share their views about the report.

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1 Background, aims and scope

Chemicals in products and hazardous substances within the life cycle of electrical and electronic products have been longstanding emerging policy issues under the Strategic Approach to International Chemicals Management (SAICM). To further advance these issues, a GEF-funded project on "Global best practices on emerging chemical policy issues of concern under SAICM" has been launched in 2019, running through 2022. Amongst others, the activities under the project aim at increasing the ambition of different stakeholders to track and control chemicals along the value chains of electrical and electronic products.

To provide a strategic overview of the capacity and models that exist for sustainable management of electronics, the project includes the development of a review of legislative and regulatory approaches for prohibiting the use of Chemicals of Concern (CoC) in electronics including the transposition of the EU Directive on Restriction of Hazardous Substances (RoHS). This report provides this overview.

The regulatory landscape relevant for the use of CoC in electronics is complex and multidimensional (Figure 1). On an international level, several chemicals and chemical groups with documented uses in electrical and electronic equipment have been designated for global elimination by Multilateral Environmental Agreements (MEAs). Examples for this are the listing of polybrominated diphenyl ethers or short-chain chlorinated paraffins in Annex A of the Stockholm Convention or the global agreement on the elimination of mercury for a variety of uses under the Minamata Convention. On a national level, several different types of laws or regulations may be relevant for the use of CoC in electronics. The most apparent are laws and regulations that stipulate explicit chemicals-related provisions that are specific for electrical and electronic products, such as the EU directive on the restriction of certain hazardous substances in electrical and electronic products (RoHS). This type of regulation also includes mandatory standards that are specific for electronic products. In addition to these specific laws and regulations, overarching framework laws on chemicals or products can contain provisions that are not specific, but nevertheless relevant for the use of CoC in electronics. In the EU for example, the REACH regulation sets obligations for suppliers to provide consumers with sufficient information, if their products contain Substances Of Very High Concern (SVHC). These obligations apply to suppliers of all products, including suppliers of electronics. Similarly, the US Consumer Product Safety Improvement Act sets limit values for lead in all products designed or intended primarily for children age 12 or younger, which also includes electronic products. Lastly, specific regulations that address the use of individual chemicals or groups of chemicals independent of their use, may also be relevant for the issue of CoC in electronics. For example, the Argentinian Resolution 451/2019 from the Ministry of Environment prohibits chemicals listed under the Stockholm convention including their use in domestically manufactured and imported products including electronics.

All of these types of laws or regulations can exist alone or in parallel, and the nature of the regulatory landscape relevant for the use of CoC in electronics is highly specific on national contexts. Due to this complexity and the time constraints under the project, the scope of this analysis only covers **regional and national laws and regulations stipulating explicit chemicals-related provisions that are specific for electrical and electronic products**. Any other regulatory approaches that may not be specific, but nevertheless relevant to the use of CoC in electronics are not considered. Regulatory approaches explicitly only addressing batteries were also not considered.

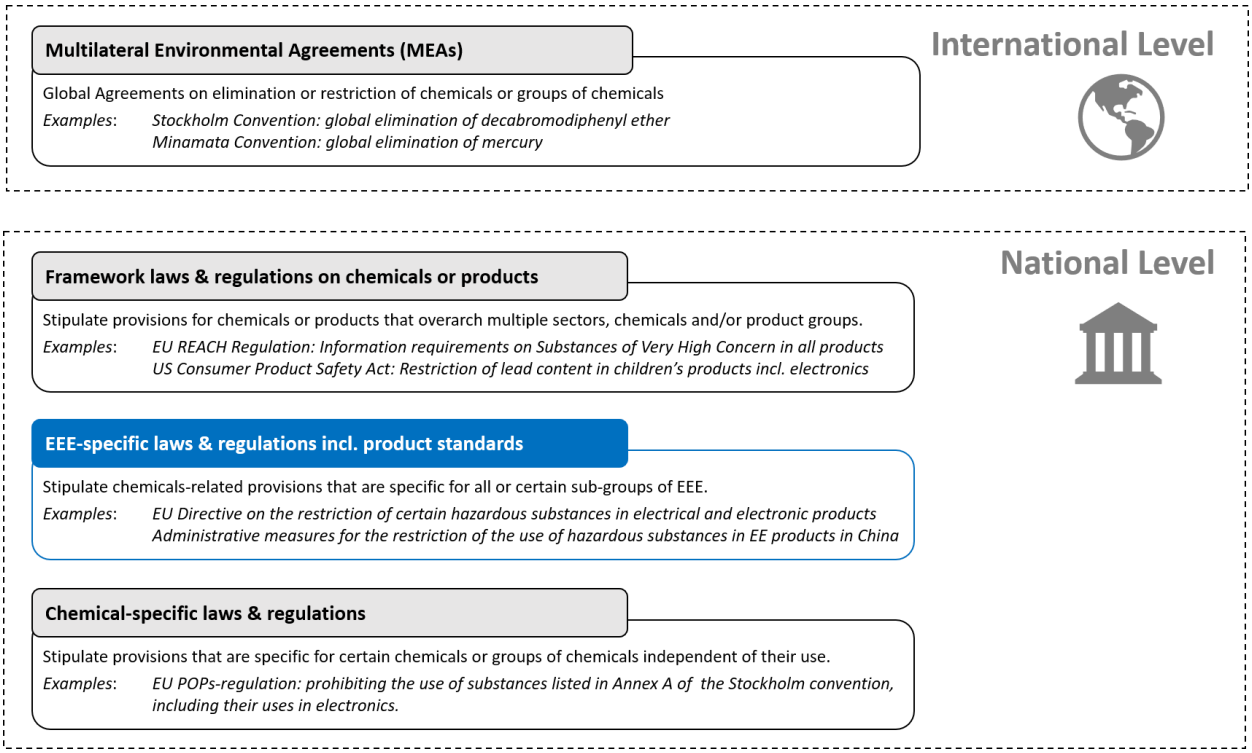

Figure 1: Regulatory landscape relevant for the use of chemicals of concern in electronic products.

As the EU RoHS directive has, to some extent, served as reference for some of the relevant laws and regulations across the globe, the second chapter of the report provides a brief summary of this approach. The third chapter provides an extensive overview of various regulatory approaches for the use of CoC in electrical and electronic products across the globe.

The compilation of this overview is based on publicly available documents and reports identified through online research. Wherever possible, regulatory texts were used as primary sources, but secondary sources, such as news articles, press releases or publicly available industry information were also considered. The research was conducted mainly in English and French. Documents only available in other languages were accessed with the aid of machine-based translation tools where possible. Although extensive efforts were undertaken to find relevant regulations, the research approach is limited to the public and online availability of documents in the respective search languages and it is possible that relevant regulatory approaches were not captured in the analysis. The report therefore provides a comprehensive but not necessarily exhaustive overview of the various regulatory approaches for CoC in EEE. Further inputs from the international community are welcomed to complement the research, especially with regards to relevant regulations that are not yet captured in the report.

2 The EU RoHS Directive

2.1 Directive 2002/95/EC – RoHS 1

The "directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment" (Directive 2002/95/EC) [1] was adopted in February 2003 by the European Union. Sometimes referred to as "RoHS 1", this directive was closely linked to the directive 2002/96/EC on waste electrical

and electronic equipment (WEEE directive) and restricted the use of six hazardous substances in the following categories of electrical and electronic equipment

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control instruments
10. Automatic dispensers

Table 1 summarizes the regulatory provisions for the substances addressed under the original RoHS directive.

Table 1:Summary of regulatory provisions of Directive 2002/95/EC ("RoHS 1").

Substance	**Maximum allowable concentration in homogenous* materials**
Lead	0.1 % by weight
Mercury	0.1 % by weight
Hexavalent chromium	0.1 % by weight
Cadmium	0.01 % by weight
Polybrominated biphenyls (PBB)	0.1 % by weight
Polybrominated diphenyl ethers (PBDE)	0.1 % by weight
*a homogenous material is defined as "a material of uniform composition throughout or a material consitsting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions […]"	

In its latest version, the directive contained 79 specific exemptions from the restrictions.

2.2 Directive 2011/65/EU – RoHS 2

In 2011, the RoHS Directive was recast in order to reduce the administrative burden and ensure coherency with newer EU policies and legislation, such as the Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACh) or the new legislative framework for the marketing of products in the EU. The recast RoHS directive (Directive 2011/65/EU) [2], also referred to as "RoHS 2", was published on 1 July 2011 and fully replaced RoHS 1. Most notably, RoHS 2 decoupled its scope from the WEEE directive, introduced a methodology for the assessment of new hazardous substances in EEE and stipulated clearer and more transparent rules for exemptions [3]. It also streamlined specific product markings by integrating RoHS compliance into the requirements for CE-marking of products.

In 2015 RoHS was amended to include provisions for the restriction of four ortho-phthalates [4] which entered into force in July 2019. This amendment is sometimes referred to as "RoHS 3"[1]. Table 2 summarizes the general provisions of RoHS currently in force in the EU [5].

Annexes III and IV of the EU RoHS Directive furthermore provide more than 100 specific exemptions for certain applications. Box 1 provides further information and illustrations of these exemptions.

Conformity assessment of products with the provisions of the directive is based on self-declaration. Companies are required to compile the relevant technical documentation for conformity assessment but must provide them to authorities only upon request.

Table 2: Summary of the general provisions of RoHS currently in force in the EU.

Scope	**Excluded from scope**	**Restricted substances & max. allowable content***
1. Large household appliances. 2. Small household appliances. 3. IT and telecommunications equipment. 4. Consumer equipment. 5. Lighting equipment. 6. Electrical and electronic tools. 7. Toys, leisure and sports equipment. 8. Medical devices. 9. Monitoring and control instruments including industrial monitoring and control instruments. 10. Automatic dispensers. 11. Other EEE not covered by any of the categories above.	• Military equipment • Space equipment • Large-scale industrial tools • Large-scale fixed installations • Vehicles • Mobile machinery • Active implantable medical devices • Photovoltaic panels • R & D equipment • Pipe organs	• Cadmium: 0.01% • Mercury: 0.1% • Lead: 0.1% • Hexavalent chromium: 0.1% • Polybrominated biphenyls (PBB): 0.1%; • Polybrominated diphenyl ethers (PBDE): 0.1% • Bis(2-Ethylhexyl) phthalate (DEHP): 0.1% (added in 2015); • Benzyl butyl phthalate (BBP): 0.1% (added in 2015); • Dibutyl phthalate (DBP): 0.1% (added in 2015); • Diisobutyl phthalate (DIBP): 0.1% (added in 2015).
* In homogenous materials, is defined as "a material of uniform composition throughout or a material consitsting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions […]"		

Box 1: Exemptions under the RoHS directive

For situations where

- the elimination or substitution of regulated substances is scientifically or technically impracticable; or
- the reliability of substitute is not ensured; or
- the substitution's total negative environmental, health and consumer safety impacts are likely to outweigh the total environmental, health and consumer safety benefits,

[1] With these extensions being an amendment instead of a recast of the directive, "RoHS 3" has not been used in the terminology of the European Commission and will therefore not be further used in this report.

exemptions from the RoHS provisions be granted by the European Commission for specific applications. These exemptions are included in the Annex III and Annex IV of the RoHS directive. The Full list contains more than 90 specific applications and an additional 43 exemptions for applications specific to medical devices and monitoring and control instruments. Many of these exemptions are time-limited with the possibility of renewal upon request by industry stakeholders. Existing exemptions for which a renewal request has been submitted remain valid until a decision on the request is taken by the European Commission [6]. The listed specific exemptions include, for example:

- *Lead in high melting temperature type solders (i.e. lead-based alloys containing 85%w or more lead) for the following scope and timeframe*
    - Products falling in the scope categories 1-7 and 10 until 21 July 2021
    - Products falling in the scope categories 8 and 9 other than in-vitro diagnostic medical device and industrial monitoring and control instruments until 21 July 2021
    - In vitro diagnostic medical devices until 21 July 2023
    - Industrial monitoring and control instruments and for all other EEE not captured by any of the scope categories 1-10 until 21 July 2024.

2.3 Implementation and enforcement of RoHS within the EU Member States and other European countries

With RoHS being an EU directive, it has no direct binding legal force, but it lays down certain results that must be achieved by the Member States. Its provisions and procedures for enforcement, therefore have been transposed into the respective national laws of the 27 Member States.

Beyond the EU, other countries in Europe and in the European Economic Area (EEA) have also transposed the EU RoHS Directive into their national law. These countries include Norway, Liechtenstein and Iceland (EEA Member States) as well as Switzerland (EFTA Member State).

3 Overview of regulatory approaches outside of Europe

Since its first introduction the term “RoHS” has increasingly been used to describe chemicals-specific regulations and restrictions in electric and electronic products and many other regions and countries have introduced similar laws or regulations. While the EU RoHS directive has served as reference for some of these laws or regulations they can sometimes significantly differ in their scope and provisions due to differences in regulatory environments. While certain regulations, for example, explicitly prohibit the sale of products that contain certain substances above a maximum level, others simply require manufacturers