

Technical and environmental standards for the treatment of WEEE

Comparison of WEEE-Standards from Switzerland, Europe and the US



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SRI builds capacity for sustainable recycling in developing countries. The programme is funded by the Swiss State Secretariat of Economic Affairs (SECO) and is implemented by the Institute for Materials Science & Technology (Empa), the World Resources Forum (WRF) and ecoinvent. It builds on the success of implementing e-waste recycling systems together with various developing countries since more than ten years.

1 Introduction

In recent years, the fast technological development, the strong increase in sales and the continuous digitalization of society have caused an accelerated rise of waste electrical and electronic equipment (WEEE). Due to the increasing economic and social development, these tendencies have been particularly pronounced in Latin America. While the industry in many developed countries is already paying a great deal of attention to the recycling and disposal of WEEE, this topic has just barely started to become important in many Latin American countries.

The participation of the informal sector in the handling of WEEE is typical in Latin America, even though there are also formal companies with several years of experience that have undergone a continuous learning process. Many more are starting or are interested in starting operations. Due to the low availability or complete absence of specific norms and legal requirements for the appropriate handling of WEEE in several Latin American countries, there are companies that strive for an inexpensive recycling without considering the negative impacts that their practices may have on the health of their employees and the environment. Even though WEEE are regarded as an important source of secondary resources that should be taken advantage of, it should not be overlooked that some of its components and materials exhibit hazardous properties, and, therefore, have to be handled with the appropriate knowledge. The companies that are handling WEEE are currently facing the challenge of finding more adequate methods for the processing and recovery of materials in a world where new types of equipment and technology are continuously appearing in the market. Therefore, there is a strong need for the establishment of guidelines and requirements concerning the appropriate handling of WEEE.

This document provides a comparison between five current technical and environmental standards for the treatment of WEEE: A Swiss (Swico/SENS), two European (WEEELabex and Cenelec) as well as two North American (R2 and e-Stewards). Through this comparison, the document seeks to establish a solid foundation for the development and implementation of a corresponding standard in Colombia. The comparison covers all types of WEEE and its components and considers all steps from the collection and transportation to dismantling, processing and final disposal.

While the focus of the comparison lies on the actual treatment, the detailed requirements for specific categories of equipment (that can commonly be found in the appendices of the standards, or additional technical guidelines) are not compared. Due to the distinct structures and foci of the different standards, such a comparison would have been overly complex and obfuscated. Nonetheless, an overview of the categories covered in the detailed requirements will be presented for each standard.

2 Compared standards

Zone	Standard	Original name	Most recent version	Analyzed version	Languages
Switzerland	SENS/Swico	Technische Vorschriften zur Entsorgung von Elektro- und Elektronikaltgeräten	1.1	1.1	German, French
Europe	WEEELabex	WEEELabex	10.0	9.0	English, German, French, Spanish, Portuguese, Italian, Polish
	CENELEC	Treatment of Waste Electrical and Electronic Equipment (WEEE) - General	There is no final version yet	Version 29 th of May 2013	English (further translations in progress)
United States	R2	The responsible recycling ("R2") standard for electronics recyclers	2013	2013	English
	e-Stewards	The e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment	2.0	1.0	English

2.1 Switzerland

The **Swico/SENS** standard is the official standard of Switzerland, and came into force the 8th of December 2009. The standard was declared state of the art by the Swiss Federal Office for the Environment, implying that compliance is mandatory for WEEE recycling companies in Switzerland. The standard complements and refines the existing legal framework, and consists of two parts: The general technical directives, and detailed, specific directives for six types of equipment.

2.2 Europe

WEEELabex (**WEEE Label of Excellence**) is a European standard that was created in the course of a project co-financed by LIFE+ (the environmental program of the European Union) between 2009 and 2012. In its first version, the standard was based on the Swiss Swico/SENS document, and the most recent approved version is still very similar to the Swiss standard. The standard is available in 7 languages, and consists of three documents: Collection, Logistics and Treatment. The standard about the treatment of WEEE includes several extensive annexes.

The **CENELEC** standard (French: Comité Européen de Normalisation Électrotechnique; English: European Committee for Electrotechnical Standardization) is based entirely on WEEELabex. Therefore, these two standards are very similar, although there is some dissimilarity worth mentioning. While compliance with WEEELabex is voluntary, the CENELEC standard will become an official European Standard, and, therefore, it is expected to become binding in the next revision of the European WEEE Directive.

2.3 United States

R2 was designed by the EPA (Environmental Protection Agency) of the United States. It is a voluntary standard that is characterized by its global applicability and by the fact that since its first publication in 2008, 511 operators in 17 countries have already been certified – more than by any other standard (March 2014). Within Latin America, certifications have been awarded to operators in Mexico and Costa Rica.

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The **e-Stewards** standard was created by the NGO BAN (Basel Action Network). Its creation was initiated by NGOs that had been involved in the design process of the R2 standard, but had not been not happy with some directives (in particular, those about exports). As no satisfactory compromise could be made, these parties abandoned the R2 standard and initiated the e-Stewards project. Therefore, e-Stewards is more restrictive in general, especially in the areas of exports and the protection of human health. Currently, there are 68 operators certified in three countries (United States, Canada and England, March 2014).

3 Structure of the comparison

The comparison in text form (chapter 4) is based on the table in the last chapter (Annex A) and serves as a summary. The table itself lists a shortened version of the respective paragraph(s) in the standards for each specific point of comparison.

The comparison of the standards, both in text as well as in table form, is based on the structure depicted in Figure 1. This structure follows the usual sequence of processing of WEEE, from collection (4.4) to final disposal (4.13). Additionally, education (training and practice) as an input, as documentation as an output of these activities are included, as are the general underlying principles of management that influence all subordinate activities. Table 1 shows the relationships between these chapters (4.1 – 4.14) and the corresponding sections of all the recycling standards.

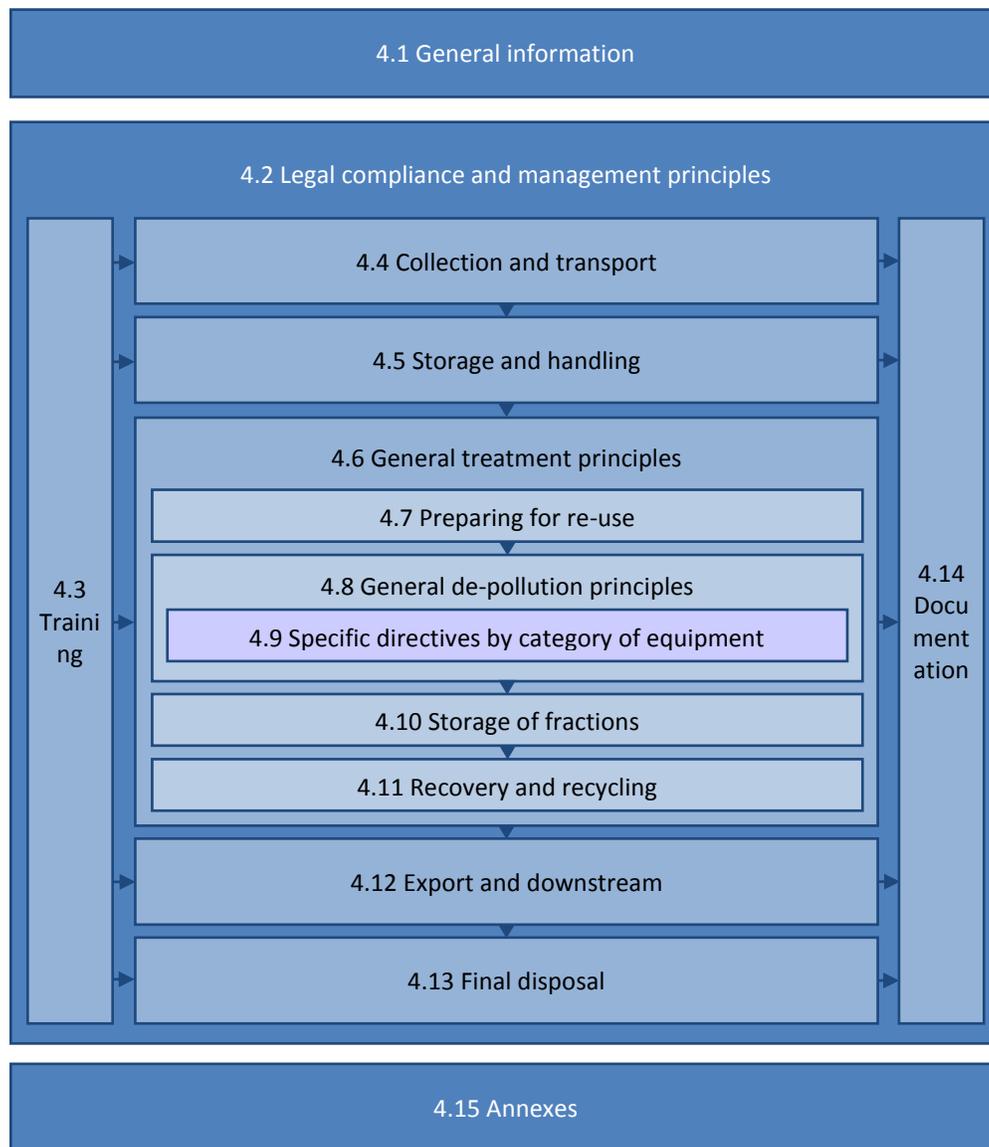


Figure 1 Structure of the comparison

Comparison of WEEE-Standards from Switzerland, Europe and the US**Table 1** Overview of the chapters of this document and the corresponding sections in the documents of the five recycling standards.

Section	Sens/SWICO	WEEELabex	Cenelec	R2	e-stewards
4.1 General information	<ul style="list-style-type: none"> ▪ A1: Goals ▪ A2: Scope ▪ A3: Terms ▪ (Information from the internet) 	<ul style="list-style-type: none"> ▪ 1: Scope ▪ 2: Normative references ▪ 3: Terms & definitions ▪ (Information from the internet) 	<ul style="list-style-type: none"> ▪ 1: Scope ▪ 2: Normative References ▪ 3: Terms & Definitions ▪ (Information from the internet) 	<ul style="list-style-type: none"> ▪ Introduction ▪ Definitions ▪ (Information from the internet) 	<ul style="list-style-type: none"> ▪ 1: Introduction ▪ 2: Scope ▪ 3: Glossary of Terms ▪ (Information from the internet)
4.2 Legal compliance and management principles	<ul style="list-style-type: none"> ▪ B1: Legal principles ▪ B2: Obligation to provide proofs – also in 4.14 	<ul style="list-style-type: none"> ▪ 4.1: Legal compliance ▪ 4.2: Management principles 	<ul style="list-style-type: none"> ▪ 4.1: Compliance ▪ 4.2: Management Principles 	<ul style="list-style-type: none"> ▪ 1: Environmental, Health and Safety Mgmt System ▪ 3: Legal Requirements ▪ 4: On-Site Environment, Health and Safety – also in 4.3, 5.6 y 5.14 ▪ 10: Insurance, Closure Plan, and Financial Responsibility 	<ul style="list-style-type: none"> ▪ 4.1: General requirements ▪ 4.2: Environmental Policy ▪ 4.3: Planning ▪ 4.4.1: Resources, Roles, Responsibility and Authority ▪ 4.4.3: Communication ▪ 4.6: Management Review ▪ 4.4.6.8: Site Closure Plans ▪ 4.4.7: Emergency Preparedness and response ▪ 4.4.8: Insurance Requirements ▪ 4.5: Checking – also in 4.14
4.3 Training	<ul style="list-style-type: none"> ▪ G1.2 – also in 4.14 	<ul style="list-style-type: none"> ▪ 4.4: Training 	<ul style="list-style-type: none"> ▪ 4.4: Training 	<ul style="list-style-type: none"> ▪ 4: On-Site Environment, Health and Safety – also in 4.2, 5.6 y 5.14 	<ul style="list-style-type: none"> ▪ 4.4.2: Competence, Training and Awareness ▪ See also Annex A (contains a lot of detail about training)
4.4 Collection and transport	<ul style="list-style-type: none"> ▪ - ▪ F3: Transport 	<ul style="list-style-type: none"> ▪ Standard "Collection" ▪ Standard "Logistics" 	<ul style="list-style-type: none"> ▪ (no requirements) 	<ul style="list-style-type: none"> ▪ 12: Transport 	<ul style="list-style-type: none"> ▪ (no requirements)
4.5 Storage and handling	<ul style="list-style-type: none"> ▪ F1: Storage ▪ F2: Handling 	<ul style="list-style-type: none"> ▪ 5.1: Handling ▪ 5.2: Storage 	<ul style="list-style-type: none"> ▪ 5.1: General ▪ 5.2: Receiving of WEEE at treatment facility – also in 4.14 ▪ 5.3: Handling of WEEE ▪ 5.4: Storage of WEEE prior to treatment 	<ul style="list-style-type: none"> ▪ 9: Storage ▪ 10: Security 	<ul style="list-style-type: none"> ▪ (no requirements)
4.6 General treatment principles	<ul style="list-style-type: none"> ▪ C1: Data carriers ▪ C2: Disassembly and mechanical treatment – also in 4.8 ▪ C3: Prohibition of mixing 	<ul style="list-style-type: none"> ▪ 4.3: Technical and infrastructural preconditions ▪ 5.3: De-pollution – also in 4.8 	<ul style="list-style-type: none"> ▪ 4.3: Technical and infrastructural preconditions ▪ 5.5: De-pollution – also in 4.8 ▪ Annexes A/F 	<ul style="list-style-type: none"> ▪ 2: "Reuse, Recover, ..." Hierarchy of Responsible Mgmt Strategies ▪ 4: On-Site Environment, Health and Safety – also in 4.2, 5.3, 5.14 ▪ 8: Data Destruction 	<ul style="list-style-type: none"> ▪ 4.4.6.1: Health and Safety in the Workplace ▪ 4.4.6.3: Data Security ▪ 4.4.6.4: Managing Hazardous e-Waste and Problematic Components and Materials – also in 4.8

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Section	Sens/SWICO	WEEELabex	Cenelec	R2	e-stewards
4.7 Preparing for re-use	<ul style="list-style-type: none"> ▪ (no hay) 	<ul style="list-style-type: none"> ▪ 4.6: Preparing for re-use 	<ul style="list-style-type: none"> ▪ (no requirements) 	<ul style="list-style-type: none"> ▪ 6: Reusable Equipment and Components 	<ul style="list-style-type: none"> ▪ 4.4.6.2: Reuse and Refurbishment of Electronic Equipment ▪ See also Annex A: Test Procedures for Different Device Categories
4.8 General de-pollution principles	<ul style="list-style-type: none"> ▪ C2: Disassembly and mechanical treatment – also in 4.6 ▪ See also directiva 3 	<ul style="list-style-type: none"> ▪ 5.3: De-pollution – also in 4.6 ▪ 5.4: De-pollution monitoring – also in 4.14 ▪ 5.5: Further treatment ▪ Also in 4.15 (Annexes A/B and Part II: Specific requirements) 	<ul style="list-style-type: none"> ▪ 5.5: De-pollution – also in 4.6 ▪ 5.7: Treatment of non de-polluted WEEE and fractions ▪ Also annexes A/F and technical specification (separate document) 	<ul style="list-style-type: none"> ▪ 5: Focus materials – also in 4.12, 5.13 	<ul style="list-style-type: none"> ▪ 4.4.6.4: Managing Hazardous e-Waste and Problematic Components and Materials – also in 4.6
4.9 Specific directives (for de-pollution) by category of equipment	<ul style="list-style-type: none"> ▪ D1-D6 ▪ Directives 2-6 	<ul style="list-style-type: none"> ▪ Annexes A1-A10 ▪ Part II: Specific requirements 	<ul style="list-style-type: none"> ▪ Annexes A1-A9 ▪ Technical specification (separate document) 	<ul style="list-style-type: none"> ▪ (no detailed requirements) 	<ul style="list-style-type: none"> ▪ 3.43 ▪ 4.4.6.4 ▪ 4.4.6.6
4.10 Storage of fractions	<ul style="list-style-type: none"> ▪ F1.5 - F1.6 	<ul style="list-style-type: none"> ▪ 5.6: Storage of fractions and components ▪ 5.7: Recycling and recovery 	<ul style="list-style-type: none"> ▪ 5.8: Storage of fractions 	<ul style="list-style-type: none"> ▪ (no requirements) 	<ul style="list-style-type: none"> ▪ (no requirements)
4.11 Recovery and recycling	<ul style="list-style-type: none"> ▪ E: Recovery ▪ Also in 4.15 	<ul style="list-style-type: none"> ▪ Also in 4.15 (Annex D) 	<ul style="list-style-type: none"> ▪ 5.9: Recycling and Recovery targets ▪ 5.6: De-pollution monitoring – also in 4.14 y 5.15 (Annex B) ▪ 5.10: Recovery and disposal of fractions – also in 4.13 ▪ Annexes C/D 	<ul style="list-style-type: none"> ▪ (no requirements) 	<ul style="list-style-type: none"> ▪ (no requirements)
4.12 Export and downstream	<ul style="list-style-type: none"> ▪ G4: Proofs of material flows – also in 4.14 ▪ A2.2 	<ul style="list-style-type: none"> ▪ 4.5: Downstream monitoring – also in 4.14 ▪ 4.7: Shipments 	<ul style="list-style-type: none"> ▪ 4.5: Monitoring – also in 4.14 ▪ 4.6: Shipments ▪ Annex G 	<ul style="list-style-type: none"> ▪ 5: Focus materials – also in 4.8, 5.13 	<ul style="list-style-type: none"> ▪ 4.4.6.5: Accountability for Downstream Recycling Chain ▪ 4.4.6.7: Exportation of Hazardous Electronic Wastes
4.13 Final disposal	<ul style="list-style-type: none"> ▪ C4: Disposal of non-recoverable fractions 	<ul style="list-style-type: none"> ▪ 5.8: Disposal of fractions 	<ul style="list-style-type: none"> ▪ 5.10: Recovery and disposal of fractions – also in 4.11 	<ul style="list-style-type: none"> ▪ 5: Focus materials – also in 4.8, 5.12 	<ul style="list-style-type: none"> ▪ 4.4.6.6: Materials Recovery and Final Disposition
4.14 Documentation	<ul style="list-style-type: none"> ▪ B2: Obligation to provide proofs– also in 4.2 ▪ G1-G5: Obligation to create and guard documentation – also in 4.12 (G4) and 5.3 (G1.2) 	<ul style="list-style-type: none"> ▪ 4.5: Downstream monitoring – also in 4.12 ▪ 5.4: De-pollution monitoring – also in 4.8 ▪ 5.9: Documentation ▪ Also in 4.15 (Annex B) 	<ul style="list-style-type: none"> ▪ 4.5: Monitoring – also in 4.12 ▪ 5.2: Receiving of WEEE at treatment facility – also in 4.5 ▪ 5.6: De-pollution monitoring – also in 4.11 y 5.15 (Annex B) ▪ 6: Documentation 	<ul style="list-style-type: none"> ▪ 4: In situ medio ambiente, salud y seguridad (On-Site Environment, Health and Safety) – also in 4.2, 5.3, 5.8 ▪ 7: Seguimiento de flujos de materiales (Tracking throughput) ▪ 13: Documentación y 	<ul style="list-style-type: none"> ▪ 4.4.4: Documentation ▪ 4.4.5: Control of Documents ▪ 4.5: Checking – also in 4.2

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Section	Sens/SWICO	WEEELabex	Cenelec	R2	e-stewards
				contabilidad (Documentation and Recordkeeping)	
4.15 Annexes	<ul style="list-style-type: none"> ▪ Richtlinie 1: Recycling and recovery rates – related to 5.11 ▪ Richtlinien 2-6: Details de-pollution – related to 5.8 	<ul style="list-style-type: none"> ▪ Annex A: De-pollution guidelines ▪ Annex B: De-pollution monitoring ▪ Annex C: Requirements concerning batches ▪ Annex D: Determination of recycling and recovery rates ▪ Part II: Specific requirements 	<ul style="list-style-type: none"> ▪ Annex A: De-pollution ▪ Annex B: De-pollution monitoring ▪ Annex C: Determination of recycling and recovery rates ▪ Annex D: Requirements concerning processing of a batch ▪ Annex F: Materials and components of WEEE requiring selective treatment ▪ Annex G: Documentation for downstream monitoring and establishment of recycling and recovery rates ▪ Technical Specifications (separate document) 	<ul style="list-style-type: none"> ▪ (no annexes) 	<ul style="list-style-type: none"> ▪ Appendix A: Guidance Document ▪ Appendix B: Rules for e-Stewards Certification Bodies ▪ Appendix C: Tools for the e-Steward

4 Comparison

4.1 General information

- The **number of certified operators** differs significantly between R2 and e-Stewards: There are nearly 8 times more operators certified under the R2 standard (511 versus 68), and these operators come from a much larger variety of countries (including two countries in Latin America). The Swico/SENS standard has 34 certified operators, among which there are 6 outside of Switzerland. WEEELabex is still emerging, and there are no figures about the total number of verified companies. No operators have been certified for compliance with the CENELEC standard so far.
- A notable difference between the two US standards is the **scope of application**: e-Stewards prohibits that brokers are certified, while this is permitted under R2. WEEELabex, CENELEC and Swico/SENS do not specifically exclude this option in their documents, although the recycling system operators may exclude this option in their tendering.
- It should be noted at this point that the analyzed version of the e-Stewards standard was 1.0. As a newer version (2.0) is available, some requirements may have changed by now. The same is true for WEEELabex, where version 9.0 instead of 10.0 was analyzed. In the latter case, only a single paragraph was changed, according to information obtained by the RAEE Forum.

4.2 Legal compliance and management principles

- All standards require the **identification of legal requirements** associated with the operations in question, although according to CENELEC, this identification is only *recommended*. Also, all standards require compliance with applicable law. At the same time, it should be noted that Swico/SENS and CENELEC form (or are going to form) part of the legal framework itself, whereas the other standards are voluntary, and thus just complementary to the legal requirements.
- There are considerable differences with respect to the **management system requirements**: e-Stewards demands (in fact, includes) the whole ISO:14001 management standard, and expands it with some additional points in order to account for the specific requirements of a standard that deals with the treatment of WEEE (in particular requirements for exports and the protection of human health). Therefore, e-Stewards contains the most extensive requirements regarding the management system in place. R2 requires the certification of the management system by an accredited standard (such as ISO, but no specific standard is specified), and includes several detailed guidelines associated with this requirement. The European standards are much less extensive in this area. They all do require an established management system (and a continuous improvement), but they do neither require a certification of the management system, nor present as detailed guidelines as the American standards.
- R2, e-Stewards and WEEELabex require a **closure plan and appropriate insurance**. CENELEC and Swico/SENS do not mention this aspect.

4.3 Training

- Whereas R2 hardly includes any directives related to this issue, WEEELabex and CENELEC include some general requirements. e-Stewards includes a short paragraph in its main document, but provides more detailed guidelines in its "guidance document" (section 4.6.1.1 h).

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- **e-Stewards is the only standard that prohibits prison labor.** While R2 allows it, this issue is not perceived as relevant in Europe, and therefore not part of the European standards.

4.4 Collection and transport

- Generally, it seems that not all standards fully included the topics of collection and transport into their scope; therefore, there are significant differences with respect to their coverage. WEEELabex provides the most detail, by actually including separate standards for collection and transport (logistics). The requirements in these documents are similar to the requirements for storage and handling in the main document (about treatment).

4.5 Storage and handling

- All European standards define a **maximum quantity of material that is allowed to be stored**, usually as a percentage of the annual amount processes. The specific values differ: 20% in Swico/SENS, 50% in WEEELabex (and less for non-covered storage areas), and 100% in CENELEC. e-Stewards, on the other hand, provides a maximum *duration* of storage of 12 months (for hazardous substances).
- All European standards contain quite some detail with respect to the **storage infrastructure and the protection** of the storage areas against weather conditions. The North American standards only provide quite general/vague requirements.
- The WEEELabex and CENELEC standards also contain directives about the **handling** (adequate care when handling materials, prohibition of handling that may adversely affect or inhibit subsequent treatment). The North American standards do not contain such directives.

4.6 General treatment principles

- The focus of the European and North American standards is different: The latter emphasize the compliance with the waste management hierarchy and the establishment of (further) internal policies for dealing with WEEE. The European standards, on the other hand, attach more importance to **the material flows**: They all require that extracted materials are kept separately from each other, require meeting the recovery rate targets, and prohibit the mixing of materials with the goal of lowering the concentration of contaminants.
- All standards require that **data is destroyed**, but the requirements of the North American standards are more detailed, especially in the case of e-Stewards. At the same time, R2 includes a clause that states that the destruction is not required if demanded otherwise by the client.
- **The Swico/SENS standard is the only standard that requires that WEEE is not processed together with (i.e., mixed with) metallic scrap or other waste types.**

4.7 Preparing for re-use

- **Swico/SENS does not cover this aspect with specific clauses.** WEEELabex contains some general requirements (such as obtain permits and documentation). Notably, these requirements cannot be found in the current version of the CENELEC standard anymore. The US standards, on the other hand, contain more detailed requirements about the preparation for re-use. Among them, e-Stewards provides the more stringent directives (the operator is only allowed to sell or donate equipment for re-use if they are completely functional). An R2 operator may sell equipment for re-use as long as the *key functionality* (which includes all functions that are sufficient to serve the original purpose of the equipment) was confirmed. Also, R2 operators may even sell non-functional equipment (for repair). Finally, the R2 operator does not need to comply with the requirements of

section 5 (de-pollution) and the requirements regarding exports out of section 3 for equipment that retains key functionality or full functionality.

4.8 General de-pollution principles

- **The components or types of materials which have to be removed are different.** While WEEELabex and CENELEC refer to the (same) list of Annex II of the EU directive 2002/96/CE, R2 mentions the materials at the end of the document. Swico/SENS names the categories of materials and components that require de-pollution in a detailed manner. e-Stewards contains lists of component categories related to de-pollution in several instances throughout the document. In the detailed table (Annex A), a summary of the categories considered for specific de-pollution requirements can be found (area shaded in grey; see also section 4.9).

4.9 Specific directives by category of equipment (for de-pollution)

- The specific Swico/SENS directives by category of equipment consist of six paragraphs in section D, and directives 2-6 of part II. The directives in section D describe when a component is considered hazardous waste (that has to be de-polluted), and contains instructions about what to do with these components, and how to handle them. The additional directives from part II cover the same topics, but go into even further detail.
- WEEELabex and CENELEC provide similar directives as Swico/SENS, but contain even more details than section D of the Swico/SENS standard. WEEELabex also provides a part II, similar to Swico/SENS, while CENELEC has excluded this section into a completely separate document (“specification for depollution”).
- There are no detailed or category-specific directives to be found in R2, apart from a few recommendations for 4 categories of equipment in 5 (c) and 5 (h).
- The e-Stewards document contains detailed directives about the handling and treatment of various equipment categories in section 4.4.6.6, but generally, these directives are less detailed than the ones specified in the European standards, in particular than the specific directives in the part II sections (or the separate document in the case of CENELEC) of these standards.

4.10 Storage of fractions

- Swico/SENS, R2 and e-Stewards all do not provide any requirements with respect to the storage of fractions, meaning that the general requirements for storage apply. WEEELabex and CENELEC, on the other hand, contain specific guidelines for the storage of fractions, but they very similar to the guidelines for general storage. CENELEC, as the only standard, demands that containers that had been used to storage fractions must be decontaminated after their use.

4.11 Recovery and recycling

- **One of the most important differences between the European and the American standards is that the first indicate recycling and recovery targets, while the latter don't.** Therefore, the European standards contain detailed directives about how to comply with these targets, and about the monitoring of compliance through tools such as calculation and/or batch experiments. Additionally, there are directives about the specific usage of these tools and their documentation. For the most part, these guidelines can be found in the Annexes of the respective documents.

4.12 Export and downstream

- **All standards contain detailed directives about this topic, but there are some mentionable differences:** e-Stewards, founded by the Basel Action Network (BAN), prohibits exports that do not comply with the BAN guidelines. R2 only requires that exports are legal in the country of origin as well as the country of the recipient, and that the recipients comply with a selection of sections of the R2 document (3, 4, 6, 7 and 10). WEEELabex and CENELEC, on the other hand, require that recipients comply with the full standard. Swico/SENS require that the recipients comply with the SENS/Swico standard too, and for exports out of the country, that the Swiss law is respected (particularly for combustible fractions).
- Further differences between the standards come to light when looking at the **documentation and monitoring of downstream activities** (downstream monitoring). While Swico/SENS requires that the operator demands “material flow proofs” from its clients, WEEELabex, on the other hand, does not require special documentation if the subsequent operator(s) comply with the same standard. In CENELEC, the downstream monitoring is softened even further, because the “monitoring chain” does not exist anymore – this is considered to be one of the most significant differences between WEEELabex and CENELEC (in its current version). An R2 operator has to perform “due diligence” by ensuring that its downstream vendors comply with some (but not all) sections of the standard, but does not require the operators to demand material flow proofs from other parties. For equipment for re-use or re-sale, the “due diligence” requirements are even waived. e-Stewards is much stricter overall, containing detailed requirements to enforce due diligence and monitoring of all downstream parties until the end of the recycling chain is reached. Contrary to R2, for equipment for re-use, the responsibility for compliance fully stays with the original operator, even when the equipment for re-use is handed to third parties.
- For a comparison of the requirements regarding downstream monitoring, please see section “documentation” (4.14).

4.13 Final disposal

- **As the only standard, Swico/SENS requires that combustible fractions that cannot be recovered are incinerated** (and not sent to landfills), in conformance with the Swiss laws. Generally, the standards prohibit the incineration and burying in landfills of hazardous waste, although R2 does allow it in some exceptional cases (extreme and rare circumstances).

4.14 Documentation

- All standards include detailed directives about the **documentation of the operators’ activities**. Three of them (WEEELabex, CENELEC and R2) also provide a specific amount of time for which the documentation has to be archived (between 3 and 5 years).
- **All standards require that material flows are documented.** Swico/SENS even comes with its own, separate document that describes this process. In CENELEC, a change of wording was introduced (compared to WEEELabex, on which it is based), such that is no longer necessary to *document* each accepted delivery, but just to *register* them. WEEELabex, CENELEC and e-Stewards also require that mass balances are calculated and documented, while this is only necessary in certain cases according to Swico/SENS (and not mentioned in R2). The European standards additionally contain directives regarding the quality assurance of the de-pollution processes. The North American standards, which do not provide recovery targets, also do not include specific obligations with respect to the quality assurance and documentation of de-pollution.

5 Conclusion/Key points

- The foci of the standards are different: e-Stewards attaches a lot of importance to export regulations and the health and safety of the employees, while all European standards (that are based on each other) set more value on the quality of material recovery, and on meeting specific recycling quotas. At the same time, the re-use of equipment has a higher importance in the North American standards.
- It should be kept in mind that Swico/SENS, WEEELabex and CENELEC (in the future) are standards that had been designed for being applied in a single country or a specific group of countries (the European Union), and are therefore strongly related to the legal frameworks and applicable law in these areas. The US American standards, on the other hand, can be applied all over the world. Therefore, they may include topics that seem to have a lower importance in the European documents, not because the latter omit these topics, but because these topics are already covered by the respective legal requirements within the area that the standards had been designed for.
- **Generally, it can be said that R2 is the most “open” and unspecific standard.** Therefore, it may be the one that is the easiest to comply with.
- WEEELabex and CENELEC are very similar to each other overall; still there are some notable differences too. In particular, the weakening of the monitoring requirements of downstream operators has been criticized in CENELEC. Generally, it can be said that in those cases where there are differences between the two documents, CENELEC has the *less* stringent requirements.

A. Detailed table¹

Table 1 Detailed comparison of the five standards.

		Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards
4.1 General information	Responsible organization	Swico and SENS	Weeeforum Association	European Union (EU)	R2 Solutions	BAN (Basel Action Network)
	Latest version	1.1	10.0	(No final version yet)	R2:2013	2.0
	Analyzed version	1.1	9.0	Draft from 29th of May 2013	R2:2013	1.0
	Languages	German, French	English, German, French, Spanish, Portuguese, Italian, Polish	English only (as of now), several translations in progress	English	English
	Mandatory standard?	Yes	No (voluntary)	Yes (in future; not yet)	No (voluntary)	No (voluntary)
	Certification	No	There's not certification, but verification ("Conformity Verification")	No	Yes	Yes
	Scope of application of the certification	(There is no certification)		(There is no certification)	<ul style="list-style-type: none"> ▪ Plants are/can be certified individually. It is not necessary that all plants of a company are certified ▪ Brokers can be certified 	<ul style="list-style-type: none"> ▪ All plants of a company have to be certified within 18 months ▪ Brokers cannot obtain the e-Stewards certificate
	Geographical scope (countries)	Switzerland (and some operators outside of Switzerland)	EU and EFTA (Island, Liechtenstein, Norway, Switzerland)	EU (and partly EFTA)	OECD, EU and EFTA countries, and some developing countries	Global
	# of certified operators	34 (among them, 6 outside of Switzerland)	(no number available)	(none)	511 in 17 countries (3rd of March, 2014)	68 in 3 countries (USA, Canada, England), more underway (3 rd of March, 2014)
	Direct costs (without costs of implementation)	No	No (but there are fees to participate in the organization)	No	Audits (US\$5000-US\$15'000+)	Audit costs, plus a service fee
4.2 Legal compliance and management principles	Legal compliance requirements	<ul style="list-style-type: none"> ▪ B.1.1/B.1.2: The operator shall comply with applicable law ▪ B.1.4: For plants in foreign countries: Laws according to their location; Swiss laws overrule in case of considerable discrepancies ▪ B.2.1/B.2.2: The operator shall be able to prove legal compliance 	<ul style="list-style-type: none"> ▪ 4.1.1: The operator shall comply with applicable law ▪ 4.1.1: The operator shall document legal compliance ▪ 4.1.2: Procedure to identify legal requirements 	<ul style="list-style-type: none"> ▪ 4.1: Procedure to identify legal requirements is not required (as in WEEELabex), but recommended 	<ul style="list-style-type: none"> ▪ 3: Legal compliance required; identification of legal requirements (including exports) and regular audits are mandatory 	<ul style="list-style-type: none"> ▪ 3.2.1 The operator shall obtain all necessary authorizations ▪ 4.3.2.3: The operator shall identify all legal requirements concerning security and privacy
	Management system (Environment, Health and Safety / EHS)	(No requirements)	<ul style="list-style-type: none"> ▪ 4.2: Required, shall demonstrate a continuous improvement 	<ul style="list-style-type: none"> ▪ 4.2: Required, shall demonstrate a continuous improvement 	<ul style="list-style-type: none"> ▪ 1: Required, management system shall be certified by an accredited standard (such as ISO or similar), annual update ▪ 4: Detailed directives (The operator shall demonstrate the knowledge and capabilities) 	<ul style="list-style-type: none"> ▪ ISO14001 is completely integrated and extended further, leading to very advanced management system requirements ▪ 4.2.1 SA 8000 (Social accountability) is recommended,

¹ The contents of this table only represent a summary of the original wording of each standard. Also, there may be inaccuracies due to the translation in the case of Swico/SENS. The reader is strongly advised to refer to the respective paragraphs in the original documents for a precise reference.

Comparison of WEEE-Standards from Switzerland, Europe and the US

	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards	
				required to process the materials it accepts, maintain an appropriate administration, conduct a risk assessment, minimize the identified risks, prioritize appropriate strategies, use protocols, designate at least one qualified person to coordinate these activities, and identify probable emergency situations).	but not required <ul style="list-style-type: none"> 4.4.6.1 Additional detailed requirements (such as health and safety inspections at least every 3 years, documentation, maintaining a management plan for WEEE and conducting evaluations of ergonomics) 4.4.6.1.1 Very detailed requirements that include air testing and other requirements concerning employee health 	
Closure plan	(No requirements)	<ul style="list-style-type: none"> Insurance required (see below - 4.3.5), but no closure plan 	(No requirements)	<ul style="list-style-type: none"> 11: The operator shall develop and maintain a closure plan and sufficient financial instruments for an appropriate closure of the facility 	<ul style="list-style-type: none"> 4.4.6.8: Plan required, various contamination checks required 4.4.8: Legal and financial assurance for closure required 	
Insurance	(No requirements)	<ul style="list-style-type: none"> 4.3.5: The operator shall have insurance coverage or other financial instruments to cover a variety of risks, according to a provided list 	(No requirements)	<ul style="list-style-type: none"> 11: The operator shall demonstrate that risks have been identified, and that adequate insurance is available. 	<ul style="list-style-type: none"> 4.4.8: Insurance required; additionally, the operator shall communicate to clients what indemnification is and is not being offered 	
Control, training and documentation	These parts of the management system can be found in the respective sections within this table: Training (4.3), Treatment (4.6-4.9) and documentation (4.14)					
4.3 Training	Training	<ul style="list-style-type: none"> C.2.2: Employees shall be able to identify and evaluate equipment and contaminants G.2: Written instructions of all procedures and internal administrative processes must be available 	<ul style="list-style-type: none"> 4.4.1/4.4.2: Employees shall be familiar with EHS policies, and receive the appropriate instructions and training about relevant operations, emergencies, security and health 4.4.3: Information and materials must be easily accessible at all times 	<ul style="list-style-type: none"> 4.4: Employees shall be familiar with EHS policies, and receive the appropriate instructions and training about relevant operations, emergencies, security and health 4.4: Information and materials must be easily accessible at all times 4.4: Where the need for protective equipment has been identified, training for proper use shall be provided 	<ul style="list-style-type: none"> 4: Regular, documented training is required, including hazard assessment, safe management handling, spill prevention, engineering controls, equipment safety and use of personal protection equipment 8: Appropriate training on a regular basis for data destruction is required, see also section 5.6 	<ul style="list-style-type: none"> 4.4.2.1/4.4.2.2: The operator shall identify needs for health and safety training, and conduct training accordingly 4.4.6.1.1: Training for new employees, and when new hazards have been identified, new processes or materials have been implemented, etc. More details in Annex A: A.4.6.1.1 h
Employment of prisoners	(No requirements)	(No requirements)	(No requirements)	(No requirements)	4.2.1: Forbidden (in the whole recycling chain)	
4.4 Collection and transport	Transport	<ul style="list-style-type: none"> F.3: Reference to Swiss law; transport of lamps must be done without the risk of them being damaged 	<ul style="list-style-type: none"> Collection and transport (logistics) have separate standards 	(No requirements)	<ul style="list-style-type: none"> 12: The operator shall ensure that shipments are packaged appropriately 12: The operator shall verify the quality of transports (regulatory authorizations, insurance coverage, safety record during the previous 3 years) 	<ul style="list-style-type: none"> 4.4.6.2 e): Equipment for the re-use shall be packaged in a manner that will protect it from damage (see also Annex A)
4.5 Storage and handling	Maximum storage quantity	<ul style="list-style-type: none"> F.1.2: Maximum of 20% of the average amount treated annually 	<ul style="list-style-type: none"> 5.2.1: Where legal and regulatory requirements are 	<ul style="list-style-type: none"> 5.4: Amount of WEEE stored shall not exceed 100% of amount 	(No requirements)	<ul style="list-style-type: none"> 4.4.6.4: No maximum quantity, but a duration (12 months for

Comparison of WEEE-Standards from Switzerland, Europe and the US

	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards
		absent, maximum of 50% of amount treated annually <ul style="list-style-type: none"> 5.2.4: The quantity stored without weatherproof covering shall not exceed 100% of the average amount treated in a month 	treated annually		hazardous waste, or less if dictated by legal requirements)
Surface	<ul style="list-style-type: none"> F.1.4: Impermeable; water drainage into sewage system 	<ul style="list-style-type: none"> 5.2.2: Impermeable surfaces, spillage collection facilities and, where appropriate, decanters and cleanser-degreasers 	<ul style="list-style-type: none"> 5.4: Impermeable surfaces, spillage collection facilities, and, where appropriate, decanters and cleanser-degreasers 	<ul style="list-style-type: none"> 9: Required "as warranted", but vague 	<ul style="list-style-type: none"> 4.4.6.4 b): Required, but vague
Protection against weather	<ul style="list-style-type: none"> F.1.4/F.1.5: Yes, more detailed requirements (for equipment and fractions containing contaminants; some exceptions apply) F.1.7-F.1.9: Various types of equipment may not be stored in outside areas 	<ul style="list-style-type: none"> 5.2.2/5.2.3/5.2.5: Weatherproof surface for equipment intended for preparing for re-use, and for four types of equipment (CRT display appliances, flat panel displays, temperature exchange equipment, lamps). These four types also shall be placed in containers or stacked in a stable manner (5.2.6). 	<ul style="list-style-type: none"> 4.3/5.4: Weatherproof surface for equipment/fractions that may emit hazardous substances, for equipment intended for preparing for re-use, and for four types of equipment (CRT display appliances, flat panel displays, temperature exchange equipment, lamps). These four types also shall be placed in containers or stacked in a stable manner (5.3). 	<ul style="list-style-type: none"> 9: Required, but vague ("reasonable protection") 	<ul style="list-style-type: none"> 4.4.6.4 b): Required, but vague
Security	<ul style="list-style-type: none"> F.1.1: Non-authorized persons must not have Access to equipment and contaminated fractions 	<ul style="list-style-type: none"> See "safety" in 4.6 	<ul style="list-style-type: none"> 4.2: Required 	<ul style="list-style-type: none"> 9: Required, but not clearly defined 	<ul style="list-style-type: none"> 4.4.6.4 b): Required, but vague
Labelling	(No requirements)	<ul style="list-style-type: none"> 5.3.5: Substances, preparations and components shall be clearly labelled 	<ul style="list-style-type: none"> 5.5: Extracted materials shall be kept separate, and clearly labelled 	<ul style="list-style-type: none"> 9: Required (containers and/or storage areas) 	<ul style="list-style-type: none"> 4.4.6.2 d): Equipment for re-use shall be clearly labelled; list with detailed requirements containing 8 items 4.4.6.4 b): Required for all removed hazardous materials
Containers	(No requirements)	(No requirements)	<ul style="list-style-type: none"> 5.4: Decontamination of containers used to store WEEE required where storage has led to pollutant dispersion 5.8: Containers used for storage of fractions containing hazardous substances shall always be cleaned and decontaminated 	(No requirements)	(No requirements)
Handling	<ul style="list-style-type: none"> F.2: Screens may not be damaged; handling of various types of equipment (list with 9 items) shall be done with particular care and appropriate tools 	<ul style="list-style-type: none"> 5.1.1/5.1.3: Handling and storage with due care and appropriate tools 5.1.5: WEEE shall not be handled such that subsequent preparation for re-use, de-pollution or recovery is adversely affected or inhibited 	<ul style="list-style-type: none"> 5.1/5.3: Handling and storage with due care and appropriate tools 5.3: Uncontrolled tipping of containers with five defined types of equipment shall not be permitted 5.3: WEEE shall not be handled 	(No requirements, apart from "necessary controls" to secure the equipment upon acceptance in section 10)	(No requirements)

Comparison of WEEE-Standards from Switzerland, Europe and the US

	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards	
			such that subsequent preparation for re-use, de-pollution or recovery is adversely affected or inhibited			
4.6 General treatment principles	General treatment requirements	<ul style="list-style-type: none"> 4.3.1: Suitable infrastructure; evaluation; hazard identification/risk assessment mandatory 5.1.1/5.1.3: Handling and storage with due care and appropriate tools 5.3.5: Substances, preparations, components and fractions shall be kept separate to ensure integrity of the material stream 5.7: Compliance with EU directive 2002/96/CE is required; this includes a recommendation to follow the waste treatment hierarchy (re-use, materials recovery, energy recovery) 	<ul style="list-style-type: none"> 4.3: Suitable infrastructure; evaluation; hazard identification/risk assessment mandatory 5.2: Separation of WEEE and non-WEEE 5.5: Substances, preparations, components and fractions shall be kept separate and clearly labelled 	<ul style="list-style-type: none"> 2: The operator shall develop and adhere to a policy stating how it manages WEEE, based upon a hierarchy of responsible management strategies (re-use, materials recovery and energy recovery or land disposal) 5: The operator shall implement a “focus materials management plan”, that states how the recycler and its downstream vendors shall conform to the requirements in section 5 of the document 	<ul style="list-style-type: none"> 4.4.6.1: Maintain a management plan for WEEE 4.4.6: Identify and plan operations that are associated with identified significant environmental aspects and health and safety risks 4.4.6.4: The operator shall plan for disposition based on a treatment hierarchy (direct use-use, refurbishment for re-use, materials recovery, energy recovery or final disposal in landfills) 	
	Security	(No requirements)	<ul style="list-style-type: none"> 4.3.3: Access by unauthorized persons shall be avoided through respective facility design, organization and maintenance 4.3.4: Damage to and theft of WEEE shall be prevented 	<ul style="list-style-type: none"> 4.3: Access by unauthorized persons shall be avoided through respective facility design, organization and maintenance 		
	Data storage devices	<ul style="list-style-type: none"> B.1.3: Swiss law must be adhered to C.1: Re-use of data carriers is prohibited; data must be illegible after the treatment 	<ul style="list-style-type: none"> 5.3.3: Destruction of personal data stored on equipment is required 	<ul style="list-style-type: none"> 5.1: It shall be ensured that confidential and personal data is destroyed or permanently deleted 	<ul style="list-style-type: none"> 8: Destruction of data is required (following National Institute of Standards and Technology (NIST) guidelines or another generally-accepted standard), unless otherwise requested by customer 8: Records, training and monitoring required 8: If data destruction is handled by a downstream vendor, the original operator shall maintain responsibility, and shall ensure conformity with section 8 	<ul style="list-style-type: none"> 4.2.1: The operator shall make customers aware of data security issues, and address their requirements 4.4.6.3: If operator may not provide data security services. In that case, the customer must sign a waiver. Otherwise, detailed requirements apply (contract with customers, quality assurance, following NIST requirements with additional procedures, documentation and information about indemnification and liability)
	Mixing (Dilution)	<ul style="list-style-type: none"> C.2.5: WEEE shall not be treated together with other waste types C.3: Mixing of substances with the goal of diluting contaminants is prohibited 	<ul style="list-style-type: none"> 5.3.4: Mixing of substances with the goal of diluting contaminants is prohibited 5.5: WEEE and fractions containing hazardous wastes shall be treated separately from other wastes, and shall not be mixed, with exceptions (permit required, 	<ul style="list-style-type: none"> 5.5: Mixing of substances with the goal of diluting contaminants is prohibited 5.7: WEEE and fractions containing hazardous wastes shall be treated separately from other wastes, and shall not be mixed, with exceptions (permit required, 	(No requirements, but there are no recycling/recovery targets)	(No requirements, but there are no recycling/recovery targets)

Comparison of WEEE-Standards from Switzerland, Europe and the US

	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards	
4.7 Preparing for re-use	(No requirements)	<p>no adverse effects)</p> <ul style="list-style-type: none"> 4.6.1/4.6.3: Obtaining permissions, trained persons for testing procedures, and conformity with European standards and other requirements is/are required 4.6.4: Documentation of all tests, copies of labels, destinations and acceptors, and amounts and types of WEEE prepared for re-use 	<p>no adverse effects)</p> <ul style="list-style-type: none"> (No requirements) 	<ul style="list-style-type: none"> 6: For shipments, conformity with provision 7 (labelling), 8 (data sanitation) and 12 (handling and packaging) is required 6: The operator shall, prior to shipping, identify each shipment as either (1) R2/Ready for Reuse (full functionality), (2) R2/Ready for Resale (key functionality) and/or (3) R2/Ready for Repair (without functionality); there are detailed directives for each category. Generally, equipment needs to be tested, but exceptions apply (R2/Ready for Repair does not; neither do "collectible electronics" and "specialty electronics", as long as they don't account for more than 1% of the units) 6: The operator need not conform with requirements of section 5 and exporting requirements of section 3 for shipments that are R2/Ready for Reuse and R2/Ready for Resale 	<ul style="list-style-type: none"> 4.4.6.2: The operator shall only donate or sell for re-use equipment and components that are fully functional. Results of tests shall be recorded. Data shall be destroyed (in accordance with section 4.4.6.3). Detailed documentation required. Also, the operator shall assure that the equipment is destined for re-use by providing evidence of reuse markets (copy of invoice and bills of lading). Further requirements apply (4.4.6.2 g-j). 	
4.8 De-pollution	List of critical materials	<ul style="list-style-type: none"> 5.3.1: According to EU directive 2002/96/CE (for a list, see section 4.9 in this table) 	<ul style="list-style-type: none"> 5.5: According to Annex F and part 2 (for a list, see section 4.9 in this table) 	<ul style="list-style-type: none"> From the "definitions" part of the document: Materials are called "focus materials" (for a list, see section 4.9 in this table) 	<ul style="list-style-type: none"> In accordance with 3.43, 4.4.6.4 and 4.4.6.6 (for a list, see section 4.9 in this table) 	
	De-pollution (treatment of critical materials)	<ul style="list-style-type: none"> C.2.3: Hazardous substances in section D shall be extracted and disposed according to the provisions in that section C.2.4: Appropriate measures shall be taken so that hazardous substances are not be released or distributed onto other fractions 	<ul style="list-style-type: none"> 5.3.2: Components shall not be damaged or destroyed in a way that hazardous substances are released or distributed 5.3.6: In case of doubt regarding the presence of hazardous substances, components shall be treated as if they contain the substances (see also detailed list in 5.3.6) 	<ul style="list-style-type: none"> 5.5: The operator shall have procedures to identify WEEE which are known to contain substances from Annex F 5.5: De-pollution of materials in Annex F, in accordance with Annex A 5.5: The treatment shall result in the removal of substances in Annex F, in accordance with Annex A 5.5: Components shall not be damaged or destroyed in a way that hazardous substances are released or distributed 5.5: In case of doubt regarding the presence of hazardous substances, components shall be treated as if they contain the 	<ul style="list-style-type: none"> 5: Removal of "focus materials" and print cartridges, using safe and effective methods, required prior to shredding or materials recovery, with two exceptions 5: The operator shall send removed focus materials to processing, recovery, or treatment, meeting regulatory requirements. More detailed requirements for three types of equipment (items containing mercury, circuit boards and items containing PCB) 	<ul style="list-style-type: none"> 4.4.6.4: The operator shall remove all hazardous components and materials (see list in 4.4.6.4, and Annex A) before the equipment is treated using potentially hazardous processing technologies (such as shredding), and manage these extracted materials appropriately, complying with legal requirements, and the downstream requirements of this standard

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		Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards
						substances (there is no list as the one in WEEELabex)
4.9 Specific directives (for de-pollution) by category of equipment	Batteries	D1	A4 (Batteries and accumulators)	F/A5 (Batteries and accumulators)	(Definition: "focus materials")	3.43 4.4.6.4 a) 4.4.6.4 b) 5. 4.4.6.6 f)
	Capacitors and other pieces that contain acids or other liquids in an internal circuit	D2	5.1.2 A2 (Capacitors)	5.1 F/A2 (Capacitors)	(Definition: "focus materials")	4.4.6.4 (PCB)
	Plastics	D3	A6 (Plastics containing certain types of brominated flame retardants)	F/A6 (Plastics)	5(c)(3) (PCB)	4.4.6.6 h) 4.4.6.6 (PCB)
	Asbestos and ceramic fibers	D4	5.1.2 A8 (Asbestos)	5.1 F/A8 (Asbestos)		
	Components containing radioactive substances	D5	5.1.2 (Smoke detectors) A9 (Components containing radioactive substances)	5.1 (Smoke detectors) F/A9 (Components containing radioactive substances)		3.43 4.4.6.4
	Components containing mercury	D6	A3 (Components containing mercury)	F/A4 (Components containing mercury)	5(c)(1) (Definition: "focus materials")	4.4.6.4 4.4.6.6 a)
	Printed circuit boards		A5 (Printed circuit boards)	F/A3 (Printed circuit boards)	5(c)(1) (Definition: "focus materials")	3.43 4.4.6.4 (PCB) 4.4.6.6 b)
	Toners, cartridges and other printer parts	Directive 2 / Parte 3		F	5(h)	3.43 4.4.6.4 4.4.6.6 g)
	CRT screens	Directive 2 / Parts 1/2 (Liquid cristal screens and cathode ray tuves)	5.1.2/5.1.4	5.1 F Part II (separate document)	(Definition: "focus materials")	3.43 4.4.6.4 4.4.6.6 c) - 4.4.6.6 e) 4.4.6.6 l) (Glicol based refrigerants)
	Liquid cristal screens (flat screens)	Directive 2 / Parts 1/2 (Liquid cristal screens and cathode ray tuves)		F Part II (separate document)		3.43 (Leaded plasma displays)
	Heat exchange equipment / PFC & VOC	Directive 4	5.1.2/5.1.4 A7 (Volatile fluorocarbons and volatile hydrocarbons) Part II	5.1 F/A7 (Volatile fluorocarbons and volatile hydrocarbons)		
	Lamps	Directive 3 (Lamps)	4.3.2 Personal protective equipment 5.1.2/5.1.4	F Parte II (separate document)		3.43
	Electrical ballasts	Directive 6				
	Dental equipment	Directive 5				
	Others		A10 (Other components)	5.1 (Photovoltaic panels)		3.43 4.4.6.6 i) (Bag house dust, filter residues, sweeps, slag, others) 4.4.6.6 j) (Components containing selenium, such as printer drums and solar panels)

Comparison of WEEE-Standards from Switzerland, Europe and the US

		Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards
4.10 Storage of fractions		<ul style="list-style-type: none"> General requirements for storage apply (F.1.5/F.1.6) 	<ul style="list-style-type: none"> 5.6: Storage such that dispersal of hazardous material to the environment is prevented; some fractions must be stored under weatherproof covering (list) 	<ul style="list-style-type: none"> 5.8: Storage such that dispersal of hazardous material to the environment is prevented; some fractions must be stored under weatherproof covering (list of 10 types) 5.8: Containers used for storage of fractions containing hazardous substances shall be cleaned and decontaminated 		
4.11 Recovery and recycling	Recycling and recovery rates / targets	<ul style="list-style-type: none"> E.1.1-E.1.4: Yes, verification through batches. E.1.3: Changes in processes that may lead to different rates must be reported to regulatory body within a month 	<ul style="list-style-type: none"> 5.7.1: Targets laid down in EU directive 2002/96/CE 5.7.2/5.7.5: Calculation according to Annex D 	<ul style="list-style-type: none"> 5.9: Determination of recycling and recovery rates at least once a year (according to Annex C and EU Directive 2012/19/EU. Calculation method (mass balance or batch) depends on type o operations performed (number of waste categories and whether non-WEEE is also treated) 	(No requirements)	(No requirements)
4.12 Export and downstream	Exports to other countries	<ul style="list-style-type: none"> Respective Swiss laws apply C.3.3: Equipment that has not been de-polluted completely shall not be mixed with other types of waste, or handed to third parties that are not affiliates of SENS/Swico 	<ul style="list-style-type: none"> 4.7.1: Compliance with EU Directive 2008/98/EC 4.7.4: Exports to outside EU/EFTA territory are prohibited, except when equipment has been tested and prepared for re-use (according to section 4.6), or unless the operator at the destination can demonstrate compliance with WEEELabex and EU Directive 2002/96/EC 4.7.3: Components/fractions that contain radioactive wastes shall not be exported outside of EU/EFTA territory 	(Same as in WEEELabex, implied by 4.6 through EU legislation)	<ul style="list-style-type: none"> 3: Shall be legal in exporting, transit, and importing countries; the operator shall document the legality. The documentation may consist of original documentation from the importing or exporting country's competent authority or a copy of a law or court ruling 6: The operator need not conform exporting requirements of section 3 for shipments that are R2/Ready for Reuse and R2/Ready for Resale (see section 4.7) 	<ul style="list-style-type: none"> 4.2.1/4.4.6.7: Exports prohibited if they violate the Basel Convention, the Basel Convention Decisions, the OECD Decisions, or national laws: Shipments from OECD/EU countries may only be exported to other OECD/EU countries. Waste shall not be traded between any Basel Party and any non-Party to the Basel Convention (including the US), unless all countries are member states of the OECD or have concluded a special agreement as allowed under the Basel Convention. All allowed exports shall be approved by the competent authority of the importing and transit countries. See also Appendix A
	Downstream monitoring	See section 5.14 (documentation and monitoring of downstream operations)				
4.13 Final disposal	Disposal of fractions	<ul style="list-style-type: none"> C.4.1: Combustible fractions that cannot be recovered shall be incinerated C.4.2: Non-combustible fractions shall be prepared for landfill according to regulations 	<ul style="list-style-type: none"> 5.7: Compliance with EU Directive 2002/96/EC 5.8.1: Appropriate technologies to destroy organic carbon, to reduce contaminated leachate and carbon containing emissions from landfills, and to reduce the volume of fractions 5.8.2/5.8.3: Hazardous substances or preparations shall 	<ul style="list-style-type: none"> 5.10: Detailed guidelines for mixed materials 5.10: The principles of waste hierarchy shall be adhered to 5.10: Prior to landfill disposal, hazardous substances or preparations shall be broken down into non-hazardous ones, be immobilized, or be properly managed such that they are not 	<ul style="list-style-type: none"> 5: The operator shall not use energy recovery, incineration, or land disposal as a management strategy for focus materials (or equipment containing such), unless applicable law requires so. It is also permitted in "extreme and rare circumstances" beyond the control of the operator, as long as still legal 	<ul style="list-style-type: none"> 4.4.6.6: The incineration and landfilling of hazardous waste is prohibited

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	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards	
		be destroyed or immobilised prior to disposal in authorised landfills	released into the environment			
4.14 Documentation	General requirements	<ul style="list-style-type: none"> See also 5.2 G.1: Documentation of organigram, education, monitoring and operational incidents 	<ul style="list-style-type: none"> 5.9.1: Extensive list containing 13 items 5.9.3: Secure storage during five years (or more, if stipulated by legislation or authorities) [Collection/Logistics] 5.5.2: Documentation of logistics and transports; storage during three years (or more, if stipulated by legislation, authorities or clients) 	<ul style="list-style-type: none"> 4.1: The operator shall maintain a record documenting compliance with this standard 6: Extensive list containing 10 items 6: Secure storage during three years, five for batch documents 	<ul style="list-style-type: none"> 7: The operator shall maintain contracts, bills of lading and other commercially-accepted documentacion for at least three years 13: The operator shall provide access to documents and records necessary to demonstrate conformity with the standard 	<ul style="list-style-type: none"> All requirements of ISO:14001 (for example 4.4.4, 4.4.5) 4.4.6.1 c), 4.4.6.1.1 a): Maintain documentation about what hazardous substances may be present in the waste 4.5.1.2: The operator shall provide a variety of data to a central database on an annual basis (list of 6 items) 4.5.4.1: The operator shall maintain records to demonstrate conformity to all requirements in this standard (see also Appendix A)
	Documentation of material flows	<ul style="list-style-type: none"> G.3: The operator shall maintain detailed documentation of all material flows, in accordance with a separate guidance document ("Wegleitung Stoffbuchhaltung") 	<ul style="list-style-type: none"> 5.9.2: Annual mass balance (of all material flows) is required 4.5.1: The operator shall document the origin and downstream treatment chain as long as WEEE has not reached end-of-waste status. If downstream operators comply with WEEELabex, special documentation shall not be necessary 	<ul style="list-style-type: none"> 6: Annual mass balance (of all material flows) is required 4.5: Record the origin of each accepted delivery; record downstream treatment until end; information about output fractions (detailed requirements depending on type of fraction, list with 6 items) 5.2: Weigh and record each delivery received, before and after separation of WEEE 	<ul style="list-style-type: none"> 7: Records sufficient to document material flow shall be maintained. Non-Focus-Materials need not be tracked beyond the first tier downstream. The operator shall also registrar all names and locations of all downstream vendors in the recycling chain 	<ul style="list-style-type: none"> 4.5.1.1: Required; calculation of mass balance (at least every six months, preferably monthly), monitoring of destinations, documentation of customers, creating and maintaining a detailed up-to-date downstream flow 4.4.6.2 h): Mass balance shall include equipment in refurbishment operations (equipment for re-use)
	Mass balance	<ul style="list-style-type: none"> E.1.4: Annual mass balance can be used for verifying recycling rates instead of batches in some specific cases 	Yes (see above: documentation of material flows), annually	Yes (see above: documentation of material flows), annually	No	Yes (see above: Documentation of material flows), at least every six months, preferably monthly
	Documentation and monitoring of downstream operations	<ul style="list-style-type: none"> G.4.1: The company is responsible for the entire disposal process until the final disposal or the start of recovery processes G.4.2/G.4.3: The operator shall obtain "proofs of material flow" (Stoffflussnachweis) for all fractions that are handed to third parties for further treatment 	<ul style="list-style-type: none"> 4.5.1: The operator shall document the origin and downstream treatment chain as long as WEEE has not reached end-of-waste status. If downstream operators comply with WEEELabex, special documentation shall not be necessary 4.5.2: Responsibility of downstream monitoring remains where WEEE is handed to dealers or brokers, or is shipped across borders 4.7.2/4.7.3: No operator shall initiate, contribute to, or allow 	<ul style="list-style-type: none"> 4.5: Record the origin of each accepted delivery; record downstream treatment until end; information about output fractions (detailed requirements depending on type of fraction, list with 6 items). The "downstream responsibility chain" feature of WEEELabex (see left) is not present in this form. 4.6: No operator shall initiate, contribute to, or allow shipments that would result in treatment that is not in compliance with this standard 5.5: WEEE transferred to third 	<ul style="list-style-type: none"> 5: In order to perform due diligence on downstream vendors, the operator shall select vendors that comply with a list of 7 requirements (including the "focus materials management plan" of the operator [see 4.6], sections 3, 4, 6, 7 and 10 of the standard, and applicable law), and the downstream vendors shall maintain responsibility through the recycling chain) 5: The operator shall confirm at least annually, and document, that the downstream facilities conform to the requirements 	<ul style="list-style-type: none"> 4.3.2.2: Assure conformance with legal requirements, and maintain records (see also Appendix A) 4.4.6.5: The operator shall be accountable for management of hazardous waste in conformance with the standard throughout the entire recycling chain. The operator shall establish, implement and maintain a documented system of direct controls and accountability for the recycling chain, including a) perform initial due diligence, b) sign and enforce contracts with next tier downstream recyclers, c)

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	Swico/SENS	WEEELabex	CENELEC	R2	e-Stewards
		shipments that would result in treatment that is not in compliance with the objectives of WEEELabex or the EU Directive 2002/96/EC	parties shall be accompanied by information on de-pollution already undertaken <ul style="list-style-type: none"> 5.7: Inform downstream operators of potential presence of hazardous material Section 4.5.2 of WEEELabex is implied in section 4.4 of this standard 	mentioned above <ul style="list-style-type: none"> 6: The operator need not conform with requirements of section 5 (see above) and exporting requirements of section 3 for shipments that are R2/Ready for Reuse and R2/Ready for Resale (see also 4.7) 	assure on-going downstream conformance to the standard, d) verify that all intermediaries are facilitating deliveries only to recyclers that have been approved, e) take full responsibility for requirements with respect to re-use, even if operations are outsourced, and f) provide customers with access to information. Each section (a-f) contains more detailed requirements. <ul style="list-style-type: none"> 4.4.6.5: Downstream operators shall provide records to both downstream and upstream, and allow both scheduled and unscheduled audits, and hold accountable their downstream operators and intermediaries to meet these requirements
Documentation and monitoring of de-pollution and recovery	<ul style="list-style-type: none"> G.5: Mandatory, detailed requirements in G.5.1 – G.5.6 	<ul style="list-style-type: none"> 5.4: Quantification of outgoing stream, establishment of mass balance or analysis of representative samples of relevant fractions 5.7.3: At least once every two years; additional assessment batches after significant changes of input quality or treatment technology (Annex C) 	<ul style="list-style-type: none"> 5.6: According to Annexes B and D, monitoring of de-pollution is required using one or more of the following three methods: comparison with target value, mass balance, or analysis of representative samples. Documentation is required See also recycling and recovery targets (above) 		

B. Terms and definitions

backlight	part of the flat panel module found in some flat panel displays technologies that illuminates the panel to make the image visible	WEEELabex (3.1)
Basel Convention	The Basel Convention regarding the control of cross-border movements of toxic waste and its disposal is an international, multilateral treaty. It has been ratified by 175 countries, and its goal is to protect the environment and the human health against prejudicial effects stemming from the generation, cross-border movement and disposal of toxic waste and other types of waste	Others
batch	manual or mechanical processing of a definite and well -defined amount of WEEE or fractions thereof to determine the yields and compositions of the resulting output fractions and de - pollution performance	WEEELabex (3.2)
collection	gathering of WEEE, including the preliminary sorting and preliminary storage of WEEE for the purposes of transport to a WEEE treatment facility	WEEELabex (3.3)
collection facility	location designated for the gathering of WEEE from private households to facilitate separate collection	WEEELabex (3.4)
component	element of an appliance with a distinct proper function as part of a device as a larger unit	WEEELabex (3.5)
CRT (Cathode Ray Tube)	vacuum tube containing an electron gun and a fluorescent screen used to create images in the form of light emitted from the fluorescent screen	WEEELabex (3.6)
CRT display appliance	complete TV set or whole computer monitor containing a cathode ray tube (CRT) or CRT with related deflection coil	WEEELabex (3.7)
data destruction	process during which the data carrier is destroyed. Its effectiveness depends on the storage density of the carrier and/or the chosen destruction process; the process may leave behind data that is recoverable by laboratory methods	Others
de-pollution	selective treatment during which hazardous wastes and other components are removed from WEEE	WEEELabex (3.8)
disassembly and dismantling	refers to the process of separation of the main components of unused electrical and electronic equipment, or parts thereof (partial disassembly), or the disassembly of this equipment into all its components and materials (complete disassembly), whereas materials are classified as plastics, glass, ferrous metals, non- ferrous metals (such as aluminum and copper) and potentially dangerous metals (such as mercury and lead, among others)	Others
disposal	any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy	WEEELabex (3.9)
end-of-waste	fractions may cease to become waste and be regarded as a secondary product following a recovery or recycling operation in compliance with specific criteria according to Article 6 of Directive 2008/98/EC	WEEELabex (3.10)
energy recovery	use principally as a fuel or other means to generate energy; including reprocessing into materials that are to be used as fuels	WEEELabex (3.11)

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energy recovery	use of materials with the main purpose of “generating” (useful) energy, through combustion or other means, including the transformation of materials that will be used as combustibles later	Others
final disposal	the process of separating and confining certain non-recoverable materials and components originating from Waste Electrical and Electronic Equipment (WEEE) in specifically chosen sites that have been designed and duly authorized to avoid contamination and damage or risks to the human health and the environment. This includes incineration processes	Others
flat panel	part of the flat panel module of the flat panel display in which the image is produced	WEEELabex (3.21)
flat panel display	thin screen equipment, larger than 100 square centimetres (cm ²), using technologies that produce and display an image without the use of cathode ray tubes	WEEELabex (3.12)
flat panel module	part of the flat panel display containing the components that produces images, including the lighting and the diffusive elements and excluding the casings, printed circuit boards and speakers	WEEELabex (3.19)
fraction	separate material stream generated by treatment of WEEE, including de-pollution, dismantling or any other treatment process	WEEELabex (3.13)
hazardous waste	waste which displays one or more hazardous properties	WEEELabex (3.14)
lamps	gas discharge lamps and retrofit LED lamps within the scope of Directive 2002/96/EC	WEEELabex (3.15)
logistics	Process of planning, implementing, and controlling the efficient and effective flow of WEEE in order to achieve appropriate treatment. Logistics involves sorting, handling, storage, and preparation for transport with the intention to deliver to treatment facilities	WEEELabex (3.16)
logistics facility	location for receiving WEEE in order to sort, store, and for prepare for transport, with the intention to deliver to treatment facilities	WEEELabex (3.17)
material flow	the movement and storage of materials, objects and secondary products (in mass or piece) per unit of time, considering dismantling and conversion processes	Others
material recovery	any recovery operation excluding energy recovery and reprocessing into materials which are to be used as fuel	WEEELabex (3.18)
operator	entity performing operations with WEEE in accordance with this normative document	WEEELabex (3.20)
Packing	A container that contains various packaging	Others
preparing for re-use	checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other preprocessing	WEEELabex (3.22)

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recovery	any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy	WEEELabex (3.23)
Recycler	person or entity, public or private, that carries out some of the operations that together form the WEEE management (transport, storage, disassembly, recovery or final disposal), having the appropriate authorization for these operations, and conforming to established national norms	Others
recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations	WEEELabex (3.24)
removal	Manual, mechanical or metallurgic handling with the result that hazardous substances, preparations and components are contained as an identifiable (part of a) stream at the end of the treatment process.	WEEELabex (3.25)
re-use	any operation by which products or components that are not waste are used again for the same purpose for which they were conceived	WEEELabex (3.26)
reuse and/or recovery of waste from computers and peripherals	the processing and recovery of materials from waste, with the aim of using them for the same purpose as originally intended, or other processes	Others
treatment	recovery or disposal operations, including any preparation prior to recovery or disposal	WEEELabex (3.27)
treatment facility	location where WEEE undergoes treatment	WEEELabex (3.28)
UEEE (Used Electrical and Electronic Equipment)	UEEE is electrical and electronic equipment that has been put into service and used but has subsequently been taken out of service and not yet discarded as waste	WEEELabex (3.29)
waste	any substance or object that the holder discards or intends or is required to discard	WEEELabex (3.30)
WEEE (Waste Electrical and Electronic Equipment)	electrical or electronic equipment which is waste, including all components, subassemblies and consumables which are part of the product at the time of discarding	WEEELabex (3.31)