

Conformity assessment of WEEE take-back schemes: The case of Switzerland*

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Abstract: In order to assure conformity with quality requirements of recycling operations and in order to minimize environmental impacts caused by the processing of WEEE, take-back schemes often maintain internal or external conformity assessment bodies. SENS, Swico Recycling and SLRS are three WEEE take-back schemes established in Switzerland in 1992, 1994 and 2005 respectively and they have created a conformity assessment strategy based on a common technical standard. This chapter describes the scope of monitoring and auditing, and the approach and important elements of this activity. It furthermore outlines reporting requirements and additional aspects and future trends.

Key words: WEEE, e-waste, recycling, conformity assessment, WEEE standard, control, monitoring.

5.1 Introduction

5.1.1 WEEE take-back schemes in Switzerland

Three producer responsibility organizations (PRO) for electrical and electronic equipment, the Swiss Foundation for Waste Management (Sens), the recycling section of the Swiss Association for Information, Communication and Organization Technology (Swico Recycling) and the Swiss Lighting Recycling Foundation (SLRS) are in charge of take-back operations of end-of-life (EoL) electrical and electronic equipment in Switzerland. Sens started operations in 1992 and nowadays pools 700 affiliates. The organization handles waste electrical and electronic equipment (WEEE) categories 1, 2, 6 and 7. Swico Recycling started in 1994 and today has 640 affiliates and is responsible for the WEEE categories 3, 4 and 9. Category 5 is handled by the Swiss Lighting Association which was founded in 2005 in order to set up a system for the recycling of lamps and luminaries. The non-profit activities of the PRO are financed through an advanced recycling fee (ARF) charged on new appliances, which has been introduced progressively for a wide range of electrical and electronic equipment categories. The ARF is added to the sales price of any

*This chapter is based on the experience gained by the group of auditors from Swico Recycling and Sens.

new appliance in order to finance the non-profit part of the current WEEE collection and treatment, so that consumers can return their old appliances to retailers, manufacturers and importers free of charge.

In 2010 Swico Recycling processed 56,600 tonnes of information and communication technology (ICT), consumer electronics and dental equipment. Sens processed 64,900 t of large and small domestic appliances, toys and tools. In addition 3100 t of illuminants were processed by SLRS. With an overall collection quantity of around 125,000 t, Switzerland reaches almost 16 kg per capita, which is among the highest collection rates in Europe. This high rate is mainly due to the high convenience level for returning EoL products by the consumer to the take-back schemes: Swico Recycling maintains around 650 and Sens around 440 collection sites. In addition to the collection sites thousands of retailers are obliged by law to take back EoL products they sell, independent of the brand, free of charge.

All over Switzerland, and in some cases abroad, 30 treatment operators contracted by SENS and Swico Recycling process the collected WEEE. A major share, 70–80% depending on the type of equipment, of the fractions resulting from the different recycling process steps gets recycled. Around 90 manual dismantling centers work under contracts with the treatment operators and dismantle the EoL equipment for either direct end processing or further mechanical processing. Most of the mixed fractions resulting from mechanical processing in the treatment facilities undergo an end processing in specialized facilities outside Switzerland. Printed wiring boards and highly concentrated metal fractions get final processing in specialized precious metal refineries in Europe. Table 1.1 displays the main features of the three take-back schemes.

A recent study on the Swiss take-back schemes for WEEE (Wäger *et al.*,

Table 5.1 Main characteristics of the WEEE take-back schemes in Switzerland

	Year	SENS	Swico Recycling	SLRS
Start of operation		1992	1994	2005
Number of affiliates	2010	700	640	230
Number of recycling partners	2011	21	8	10
Number of manual dismantling centres	2011	58	63	0
Number of collection sites	2010	436	650	436
Number of auditors for conformity assessments	2010	6	4	3
WEEE categories according Directive 2002/96/EC	2010	1/2/6/7	3/4/9	5
WEEE collected	2010	64,900 t/y	56,600 t/y	3100 t/y
	2010	124,600 t/y	(15.8 kg/inhabitant/y)	

1 2011) has shown the clear environmental benefit of recycling compared
2 with incineration in a municipal waste incinerator or landfilling. The main
3 environmental impacts of the take-back scenario come from metal treatment,
4 followed by cathode ray tube (CRT) device treatment and plastics treatment,
5 whereas collection and pre-processing only contribute marginally to the
6 environmental impacts. The highest share of the environmental benefits
7 from a take-back scheme can be achieved with secondary production from
8 battery treatment, metals treatment, cables treatment, and printed wire board
9 (PWB) treatment. The recycling of plastics results in clearly lower total
10 environmental impact compared with incineration and landfilling, similar
11 to the diminution for the metals.

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5.1.2 Conformity assessment

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Conformity assessments of collection, logistics and treatment operations with
regard to specified requirements have been considered paramount from the
start of the system operations in 1992. Whereas conformity assessments of
the collection sites are realized as second party assessment, the treatment
operators get audited by means of a third party assessment.

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Swico Recycling has chosen the Swiss Federal Institute for Materials
Science and Technology (Empa) as its conformity assessment body. Empa
forms part of ETH's domain, which comprises the two federal technical
universities, ETH in Zurich and EPFL in Lausanne, and four external research
centers, Empa being one of them. Empa provides to Swico Recycling an
audit team currently of four auditors and additionally delivers services and
research activities in the area of WEEE management to Swico Recycling
and other public and private institutions. Sens and SLRS have mandated
different service providers which conduct the conformity assessments with
six auditors.

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5.1.3 Aims and subject of the conformity assessment of treatment operators

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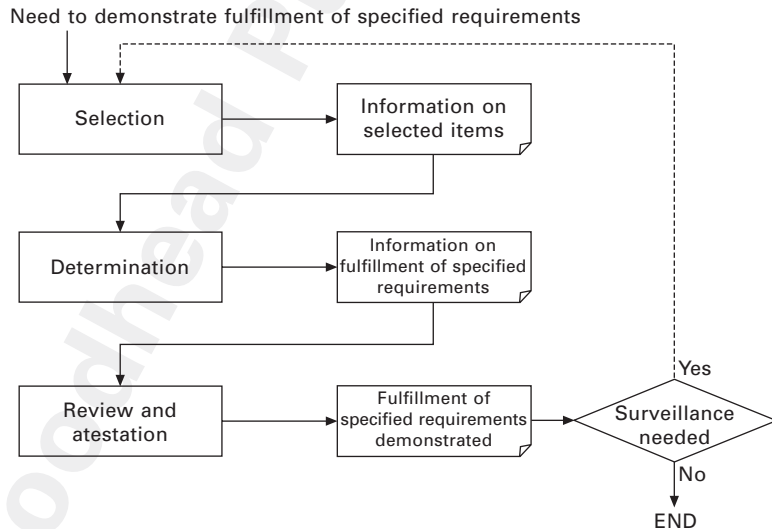
The aim of the conformity assessment is to assess whether a treatment
operator adheres to the prescribed quality standards and the environmental
aspects of the operation and to determine the performance against prescribed

recycling and recovery quotas stipulated for the different WEEE categories. The quality standard is formulated in the ‘Technical regulations on the recycling of electrical and electronic appliances from Swico Recycling and SENS’ (Sens, Swico Recycling, 2009). The main elements of the CA are a control of documentation, treatment processes, fraction qualities and legal compliance. Additionally, the material flows which are to be reported by the treatment operators on an annual basis to Empa are verified and evaluated in a material flow accounting system.

5.2 Approach of the conformity assessment

The conformity assessment approach is functional according to ISO 17000 (2004, 2010) covering three different phases (Fig. 5.1). Prior to the on-site conformity assessment it starts with a *selection phase* which includes planning and preparation activities in order to enable the subsequent determination phase. In this phase the assessment is planned and relevant documents are requested from the treatment operator. Reported mass flows and batch results are verified. At this stage, the choice for the most adequate procedures for the determination phase is made. This might include the decision on specific measures or samples to be taken in the course of the determination phase.

The *determination phase* is equal to the on-site audit or inspection. It involves completing the information required to verify if specified requirements formulated in the technical guidelines are met. On-site audits at the treatment operator’s installations are scheduled annually, usually for



5.1 Functional approach to conformity assessment (according ISO17000: 2004).

1 the duration of one day. They are implemented by a team of two auditors.
2 In almost all cases the visits are preannounced; however, surprise visits take
3 place exceptionally, either when information provided through the operator's
4 own or external sources indicates the existence of deviations from normal
5 business operations, or as a matter of second control when previous audits
6 have revealed relevant non-conformity aspects and corrective measures have
7 been taken by the treatment operator.

8 The *review and attestation phase* constitutes the verification of all collected
9 information in order to decide whether conformity is met or not. The result
10 of the conformity assessment is reported to the treatment operator in the
11 form of a conformity assessment report (audit protocol). Owing to changes in
12 treatment operations, variation of input streams or changes in administrative or
13 legal requisites full conformity is only exceptionally achieved. In most cases
14 the deviations are of a minor nature. Corrective measures are formulated in
15 the conformity assessment report which the treatment operator has to fulfill
16 and document in a given period of time. If major deviations occur or even
17 non-compliance is concluded in relevant areas of the operation, an additional
18 audit can be required in the course of the same year in order to verify the
19 correct implementation of the corrective measures and the compliance
20 with the specified requirements. If the additional audit continues to reveal
21 non-conformity with the specified requirements, the contract between the
22 take-back scheme and the treatment operator can be ceased or resigned on
23 request of the audit team to the take-back scheme.

24 The conformity assessment report is handed over to Sens and SLRS,
25 whereas Swico Recycling does not request a full report but only a reporting
26 on non-conformity.

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28 **5.3 Scope and elements of the conformity** 29 **assessment**

30 **5.3.1 Technical regulations of Swico Recycling** 31 **and SENS**

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34 The technical regulations (Sens, Swico Recycling, 2009) are stipulated
35 as an integral part of the contract between the take-back scheme and the
36 treatment operator. They have been formulated, harmonized and continuously
37 developed further by the systems in the course of several years of experience
38 in processing WEEE.

39 The regulations cover the following aspects:

- 40 • *General part*: It defines aim and scope and provides the definition of
41 terms used in the regulations.
- 42 • *Legal compliance*: This part makes reference to the relevant legal
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framework and outlines the way compliance has to be verified and demonstrated by the treatment operator. 1
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- *General rules on treatment:* Principles for data destruction, manual disassembly and mechanical treatment are formulated. WEEE has to be processed separately from other wastes. A prohibition of mixing different fractions with the aim to lower the resulting concentrations of hazardous substances below legally regulated limits (limit values) is stipulated and the disposal path for non-recyclable fractions is prescribed. All combustible fractions have to be incinerated; non-combustible fractions have to be treated prior to landfilling if they do not reach the conditions for landfilling formulated in the national legislation. 3
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- *De-pollution:* The de-pollution procedures encompass the removal of batteries, accumulators, capacitors, plastics, asbestos, radioactive elements and mercury-containing components. Plastics need to be removed and incinerated if they do not comply with limit values set forth in the legislation for new products. Limit values are given for heavy metals (Cd, Cr-VI, Hg, and Pb) and brominated flame retardants (PBB, PBDE) (814.81 Ordinance 2005). 12
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- *Recovery:* Recycling partners have to accomplish the recycling and recovery targets set forth in the WEEE Directive. This is verified with batch trials. Changes in processes which influence recycling and recovery targets have to be reported to the conformity assessment body within one month. In particular cases the fulfillment of recycling and recovery targets can be calculated based on the annually reported mass flow data. 19
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- *Storage, handling and transport:* WEEE has to be stored in non-accessible areas; the storage quantity is limited to 20% of the average annual processed quantity. Equipment, components or fractions which are not detoxified need weatherproof covering unless the treatment operator can prove that the rainwater is properly collected on a sealed surface and that the rainwater runoff is regularly controlled and analyzed. Lamps and other contaminant-containing fractions such as batteries, capacitors, cathode ray tubes (CRT) and their components, flat screens (liquid crystal display, LCD) and their components, printed circuit boards, photoconductor drums, asbestos-containing components, toner cartridges, phosphor powder from lamps and mercury-containing fractions may not be stored outdoors. 26
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- *Documentation:* Documentation requirements comprise the company organization and responsibilities, work instructions and flow charts, materials accounting, proof of material flows and monitoring and checking of de-pollution quality. The material accounting system is a standardized recording of all material flows, and an annual compilation and reporting to the conformity assessment body, taking into account the stocks at the 38
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1 beginning and the end of the reporting period. Material flows to third
2 parties have to be controlled by the treatment operator who must assure
3 compliance with the technical regulations at all times. The conformity
4 assessment explicitly includes checking downstream flows by means
5 of a standardized format for documenting treatment operations by the
6 downstream vendor. The quality of de-pollution is monitored and checked
7 through key figures derived from the materials accounting, internally
8 calculated key figures, and, in the event of mechanical processing, through
9 chemical analyses of light-weight fractions (dust, shredder light-weight
10 fractions, etc.). An internal monitoring system has to be established
11 which allows monitoring de-pollution performance by the management
12 and a self-control by the employees.

13 The regulations are complemented by five directives which cover (1)
14 recycling and recovery quota, (2) ICT and consumer electronics equipment, (3)
15 lamps and illuminants, (4) cooling appliances and (5) dental appliances.
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17 5.3.2 Main elements of the on-site audit

18 The elements and their sequence during the on-site audit are standardized. The
19 workflow can be adapted in case of a specific situation regarding a certain
20 WEEE category, such as flat screens, or regarding the treatment operator's
21 installations, such as new machineries or new processes.
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23 The on-site audit covers operational aspects (organizational chart, training
24 plan, treatment processes and infrastructure), legal compliance (authorizations
25 check, internal processes to verify legal compliance, health and safety),
26 decontamination (benchmarks batteries and condensers), process efficiency
27 (recycling and recovery rates), material accounting and mass flow control
28 (control of records, shipment to and further treatment by downstream vendors),
29 emission and immission control and ends with an on-site inspection of the
30 installations and processes.
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32 5.3.3 Measuring recycling performance

33 The treatment operators have to fulfill recycling and recovery quotas
34 prescribed in the technical regulations which are verified by the auditors on
35 an annual basis through batch test trials. These tests are performed each year
36 determining one of the WEEE streams which is processed by the respective
37 treatment operator. Batch trials are differentiated into small or large household
38 appliances, cooling appliances, IT equipment without screens, screens and
39 consumer electronics. Table 5.2 indicates the recycling and recovery quota
40 to be accomplished.
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42 The calculations of the recycling performance are realized in the standardized
43 reporting tool (Rep-Tool) which has been developed by the WEEE Forum

Table 5.2 Recycling and recovery quota according to Swico, Sens (2009)

WEEE Directive category	Appliance category	Recycling quota (%)	Recovery quota (%)
1	Large household appliances incl. refrigeration appliances	75	80
2	Small household appliances	50	70
3	IT and telecommunication equipment	65	75
4	Entertainment electronics	65	75
5a	Luminaires, light fittings	50	70
5b	Lamps, gas discharge lamps	80	80
6	Electrical tools, building, garden and hobby appliances	50	70
7	Toys, as well as sporting and recreational appliances	50	70
8	Medical equipment	No information	No information
9	Monitoring and controlling instruments	50	70
10	Automatic output appliances	75	80

on a pan-European level. The Swiss version has been slightly adapted as regards to the allocation of the different recycling technologies to material recycling, energy recovery, thermal disposal, landfill disposal or re-use. The Rep-Tool allows the calculation of the processed WEEE stream including all downstream operations undertaken by downstream operators. In the case of non-conformity the treatment operator has to adopt the process technology and/or change downstream operators.

5.3.4 De-pollution control

The de-pollution control follows a double approach. As a first step benchmarks for the removal of batteries and capacitors have to be monitored and reported by the treatment operators, which are then verified as part of the conformity assessment with the help of the material accounting tool (see Sections 5.3.5). As a second step for mechanical treatment processes limit values for Cd (100 mg/kg), PCB (50 mg/kg; PCB-congeners in accordance with DIN 51 527 Part 1 are determined and assessed) and Cu (10,000 mg/kg) are prescribed for dust and the shredder light fraction, which have to be undershot in daily treatment operations. The latter are monitored in the course of the batch tests and in addition have to be reported by the treatment operator, drawing a mixed sample during a predefined period of time.

5.3.5 Material accounting

On an annual basis the treatment operators have to report the input material differentiated into the main groups ICT and consumer electronic equipment ('Swico material'), large domestic appliances, cooling equipment and small domestic appliances, toys and sports equipment ('Sens goods') and lamps. The treatment operators in addition have to report the destinations of all equipment categories and all produced fractions to downstream vendors. The information provided by the treatment operators is processed in a web-based reporting tool to which only the conformity assessment bodies have access.

The information provided by the treatment operators helps to understand the operations, the valuable and the hazardous fractions produced as well as the de-pollution performance. It gives a clear picture of the activities performed by the treatment operator and allows the conformity assessment body to follow the treatment chain further to the downstream vendor. In addition the information provided on a material level is counterchecked with the quantities indemnified by the take-back schemes. The data can be compiled in such a way that it also allows for comparing the treatment operators in terms of quantities, processes and efficiency. The information provided in the material accounting tool is an important element in the on-site audit and additionally helps the company to keep track of its operations in terms of received equipment, produced fractions, costs and benefits of the operation.

5.3.6 Control of downstream vendors

During the on-site audit high attention is given to information provided by the treatment operators as regards to the further processing by downstream vendors. Their operation is verified through a proof provided through a specified format by the downstream vendor to the conformity assessment body. In this form the downstream vendor has to report the type of material received and the fractions produced thereof.

In addition on-site conformity assessments at downstream operators' facilities are undertaken annually based on the information provided by the treatment operators. Focus is given to critical fractions, for example CRT or LCD treatment facilities, plastic recycling and mixed plastic/metal fraction treatment partners.

5.3.7 Reporting

The information revealed, derived and compiled in the course of the conformity assessment is summarized in the audit report. The major part of the report,

although in a standardized format, has a descriptive nature. When it comes to technical or environmental information, organizational and legal aspects and performance data, template tables are to be filled in. It has been learnt in the course of more than 15 years of auditing that reports consisting only of checklists do not properly report the results of the conformity assessment to the treatment operator. Many of the aspects which form part of the conformity assessment need a dialogue and an expert discussion between the audit team and the company representatives. Therefore the audit team members need to have a good sense of proportion during the whole auditing process. The sense of proportion has proven to be a major need of the auditing process. The approach chosen for reporting reflects this need. The conformity assessment should not be seen as an inspection, but rather as a support of the treatment operator in its aim for continuous improvement. One-day spot-checks that end up with filling in long checklists are not a suitable way to establish a sense of cooperation. It will also not help to create confidence between the take-back scheme and the treatment operators, which is the basis for assuring that the performance level reached in the course of the spot-check reflects a typical situation during the whole year and not only at the occasion of the on-site audit.

5.3.8 Auditors

The requirements for auditors mandated by the take-back schemes are predefined. Auditors mandated should have a university degree in either engineering or natural sciences. They should have prior experience in auditing either under ISO 9000 or ISO 14000 schemes or have similar experiences and proof of knowledge on environmental legislation. If possible the auditors should bring first-hand experience in waste treatment and/or process engineering. They furthermore should come with a client-oriented attitude, good communication skills and highly developed analytical skills. Language skills should encompass German and English and preferably also French.

Indispensable requirements for auditors are impartiality and independence. Impartiality in the sense that observations and conclusions derived in the course of the conformity assessment process should be carried out in an objective and consistent way, disregarding the size, structure or importance of a treatment operator. Independence from the auditor is assured by the fact that they have to refrain from having individual mandates from treatment operators besides the auditing mandate given by the take-back schemes. The auditors have to fulfill confidentiality requirements in terms of disclosure of information provided by the treatment operators in the conformity assessment process. This information has to remain strictly confidential and cannot be used either for their own commercial purposes or against the competitors of the two take-back schemes. Only a high level of confidentiality prepares the

1 ground for a conformity assessment process which is not a pure inspection
2 but furthermore serves as a fruitful exchange and an open conversation
3 between auditor and treatment operator.

4 Auditors are contracted individually or (in the case of Swico Recycling)
5 as an institution which has to facilitate a number of auditors fulfilling the
6 above-mentioned criteria. These auditors in addition to the auditing tasks
7 have to participate in regular technical meetings, training and occasionally
8 represent the take-back schemes towards public authorities on district or
9 national level or in the technical groups of the European WEEE Forum.

10 The auditor usually audits the same company for a period of three years
11 but then is subject to rotation with other auditors from the audit team. Some
12 continuity in the auditing process is beneficial for both sides, the treatment
13 operator and the auditor, and will make subsequent audits more efficient;
14 however, in order to prevent too much closeness between the auditor and
15 the treatment operator a change of auditor has proven to be a good way of
16 optimizing continuity and independence.

17 18 5.3.9 Delegated law enforcement 19

20 The environmental authorities of three districts in Switzerland (Zurich, Aargau
21 and Thurgau) have mandated Swico Recycling and Sens in the delegated
22 enforcement of the legislation pertaining to WEEE. This implies that the
23 control to be done by law through the environmental authorities is delegated
24 to Swico Recycling and Sens who, as part of the conformity assessment,
25 check legal compliance at treatment operator's site. This process results
26 in a reduction or renouncement of the control previously realized by the
27 public environmental authority, which in return decreases the control load
28 on both the public authority and the treatment operator. Such public-private
29 cooperation between authorities and private sector organizations already exists
30 in different areas in Switzerland, as for example in the control of excavation
31 sites, construction waste processing facilities and the painting sector. It
32 has proven to be an efficient and effective means for reduction of costs of
33 control and reduction of control overlaps by public authorities and private
34 organizations. It furthermore shows the confidence in the professionalism of
35 the auditing schemes of the private sector.

36 37 **5.4 Future trends** 38

39 5.4.1 WEEELABEX standard 40

41 The adoption of the pan-European WEEELABEX Standard by the WEEE
42 Forum General Assembly on 1 April 2011 in Amsterdam will result in a
43 new conformity assessment scheme for the participating collective take-

back schemes (WEEE Forum, 2011). The introduction of the standard is foreseen for 1 January 2013 for those schemes which form part to the group of first movers. The procedures and formats in Switzerland will have to be adjusted to those established within the WEEELABEX Standard. This will particularly be the case for the on-site audit which will be based on new procedures and formats. However, experience from those systems which have operated conformity assessment procedures for many years will be brought in and the final approach will most probably not differ fundamentally from the one established.

5.4.2 Product stewardship standards

Different international standards have evolved in the last years related to the sound disposal of WEEE:

- The EPEAT Standard (Electronic Product Environmental Assessment Tool) operated by the Green Electronics Council started in 2005 and is now a widely recognized and accepted product standard for electronics (see: www.epeat.net). Over 1200 products are already EPEAT certified. The standard includes requirements for EOL waste management which follow the plug-in guidelines (US-EPA, 2004) based on the e-cycling initiative from the US-EPA. Certification procedures are based fully on a 3rd party approach.
- The e-stewards (www.e-stewards.org) launched by the Basel Action Network (BAN) is a standard on EOL-Management of WEEE (BAN, 2009a, 2009b). In comparison to WEEE-Labex it requires full ISO 14000 conformity, occupational health and safety requirements and adherence to the Basel Convention and OECD trade rules. Conformance verification with the standard is following a third party conformity assessment approach. Auditors need to be qualified EMS auditors and need further qualification by the BAN designated training provider.
- The Responsible Recycling (r2) standard (John Lingelbach of Decisions & Agreements, LLC, 2008) from the US Environmental Protection Agency (EPA) is a third party certification scheme. It has been criticized for not banning export of WEEE or components of WEEE to developing countries. It also does not fix clear Work and Health Safety requirements.

In addition to these international standards on EOL management of WEEE, many original equipment manufacturers (OEM) have their own corporate standards like Hewlett Packard (Hewlett Packard Development Company, L.P., 2008). The increasing number of international standards asked for by OEMs, take-back schemes or national authorities makes it more and more cumbersome for recyclers to keep track with the different obligations and requirements which they have to fulfill. Various types of audits by different

1 entities in different periodical cycles do not necessarily improve recycling
2 performance and material yield. It would be beneficial if OEMs and take-
3 back schemes (which mostly operate on their behalf) would come up with
4 a harmonized set of standards applicable on a global scale, for example
5 either established through the International Standard Organization or the
6 OECD.

8 5.4.3 Recovery of critical metals

10 The occurrence of critical metals in EoL products as cited, for example,
11 in OECD, (2010) and the increasing shift of these substances from natural
12 resources into secondary commodities poses a new challenge which none of
13 the existing standards addresses. The principal goal behind all standards is
14 the reduction of the release of toxic substances from EoL equipment along
15 the reverse supply chain into the environment, the achievement of predefined
16 recycling and recovery quota and – in some cases – the prevention of illegal
17 international trade. Recycling and recovery quota determine the recovery rate
18 for bulk metals and plastics, the recovery of critical metals is not taken into
19 consideration. This upcoming need will require a shift in policy orientation.
20 Recovery of these metals is not incentivized by market rules; policy makers
21 should therefore incorporate the prevention of loss of critical technological
22 metals along the reverse supply chain as a claim in the legal framework.
23 Financial compensation by take-back schemes to the treatment operators
24 for those critical metals for which the economic benefit is not a key driver
25 should be sought and developed. Plus, the technology chain from collection,
26 logistics, manual and mechanical pre-treatment to end-processing should be
27 optimized in a way that the material yield of valuable and critical substances
28 can be optimized.

30 5.5 Conclusions

32 Driven by economic growth and changes in lifestyle the consumption of
33 electric and electronic equipment has increased substantially and in parallel
34 has catalyzed the generation of WEEE. In the mid-1990s producers, importers
35 and distributors in Switzerland started to establish collective take back-
36 schemes for EoL electrical and electronic equipment. Being a tourist hot-spot
37 and due to the high level of environmental consciousness, which by itself
38 is rationalized by the high population density and environmental education,
39 return of these goods to the take-back schemes has increased and has reached
40 more than 15 kg/inhabitant*/y in 2010. Although being a hilly and scattered
41 country with small villages and remote areas, consumer convenience for
42 product return is high, with on the one hand municipal collection points in
43 almost all municipalities and on the other hand the possibility of returning

these goods at points of sale of goods of the same type but not necessarily the same brand. 1
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From the very beginning the take-back schemes have introduced a conformity assessment scheme for collection, logistics and treatment operations. The conformity assessment for treatment operators is realized as a third party assessment and adherence to technical, organizational, legal, and environmental and health and safety requirements is checked on an annual basis through external auditors. Technical regulations on the recycling of electrical and electronic appliances have been developed which ensure a level playing field for all services providers within the take-back schemes. Audit processes are well established and accepted by the treatment operators. They are designed in such a way that the auditing process serves as a basis for increasing system performance. 3
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Driven by the pan-European WEEE Forum, future trends go towards standardized technical requirements and harmonized audit procedures all over Europe stipulated in the WEEELABEX Standard (WEEE Forum, 2011). On a global scale different non-governmental organizations (NGOs) and governments have initiated the formulation and implementation of standards on the management of EoL electronic goods. This trend will continue to contribute in making recycling of WEEE more sustainable worldwide. However the increasing number of actors in this field has made it more and more difficult for the treatment operators to keep track with the latest developments. Harmonization on a global scale through for example the International Standard Organization or the OECD might become necessary in the near future in order to assure a global level playing field. 14
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One of the major challenges for the future of standard development and conformity assessment procedures will be how to address the recovery of critical metals present in different components of electrical and electronic goods. There is a need to develop resource strategies for take-back schemes which address not only depollution from hazardous substances and the recovery of basic and precious metals, but also the recovery of critical metals. Such substances are present in high dissipation and the economy will not in all cases be the driving force for increasing resource recovery and conservation. Take-back schemes and along with them the conformity assessment systems have to address this issue if sustainable material management should be realized. 26
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17 Chemical Risk Reduction, ORRChem), see: [http://www.admin.ch/ch/e/rs/
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