Nordic Ecolabelling of

Rechargeable batteries

Version 4.4

Background for ecolabelling

16 June 2015

Nordic Ecolabelling

Nordic Ecolabelling of rechargeable batteries – Background for ecolabelling

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1 Summary

Version 4 of the criteria for rechargeable batteries contains a product group definition that closely matches the definition used in the European Union's Batteries Directive. This document no longer permits battery chargers to be ecolabelled separately. Nevertheless, ecolabelled rechargeable batteries may still be sold in combination packs with a charger, provided that it is made clear that the ecolabel applies to the batteries and not to the charger. Moreover, chargers sold with rechargeable batteries must fulfil certain requirements in order to ensure that products associated in the consumer's mind with a Nordic ecolabelled-labelled product are of high quality and have a satisfactory environmental profile.

Nordic Ecolabelling has found that the most relevant environmental impacts associated with batteries are as follows:

- The spread and use of metals from the batteries, particularly heavy metals.
- Energy consumed in the production of the batteries and their raw materials.
- Inappropriate handling of used batteries in the refuse flow.
- Over-use of batteries, inter alia, as a result of the use of rechargeable batteries in electrical appliances that drain the batteries or non-optimum charging.

A number of other parameters are also relevant in securing the lowest possible environmental impact from rechargeable batteries. These include the packaging used on the batteries and the use of nanotechnology in the batteries.

With a view to lowering battery consumption by consumers, Nordic Ecolabelling is focusing attention on reducing the flow of batteries in the retail trade and the refuse cycle, for example, by requiring rechargeable batteries to be of high quality, thus permitting repeated recharging, thereby reducing consumption.

There are differences between the constituent substances of batteries on the market today and the concentrations in which these substances occur. Accordingly, potential exists for distinguishing between more and less environmentally harmful types of battery. Nordic Ecolabelling will compile this information with a view to determining how requirements might be imposed on the constituent substances of batteries in the future. In addition, the stringent requirements applicable to arsenic, cadmium, lead and mercury continue to apply.

The highest energy consumption in the production process occurs during raw material extraction and processing, i.e. at an early stage in the production chain. It is difficult for licenceholders to acquire information about – let alone impose requirements on – the energy consumption of raw material suppliers. Thus, although Nordic Ecolabelling is aware that the energy consumed at an early stage of the production chain of batteries is highly relevant, no requirements are imposed as regards this factor.

In order to increase the reuse of batteries, as high a proportion as possible of used batteries needs to be collected. Given that the collection percentage in the Nordic countries is in the range of 20-40%, considerable potential exists for improvement. Consumers have ample opportunities to return their batteries, be it to refuse facilities,

battery collection containers or in connection with the collection of household refuse. Furthermore, the collection requirements of the authorities, as provided for in the European Union's Batteries Directive 2006/66/EC of 6 September 2006 are extensive. Thus, the authorities should have reasonable scope for achieving a high level of collection, although in practice this will require a change of behaviour on the part of consumers. Even so, there continue to be differences between the ways in which the authorities in the various Nordic countries ensure that collection takes place and the charges they impose on producers. The way in which the consumers handle batteries at the end of their useful life is difficult for Ecolabelling to control and for this reason Nordic Ecolabelling has not imposed refuse-handling requirements.

2 Basic facts about the criteria

Products that are eligible for ecolabelling

Nordic Ecolabelling has opted to offer the opportunity for the best rechargeable batteries on the market to be Nordic ecolabelled-labelled through the Criteria Document for Rechargeable Batteries. The market for rechargeable batteries is extensive (see the section entitled "The Nordic Market") and there are differences between the environmental properties and the quality of the various rechargeable batteries on the market, which in turn enables the Nordic Ecolabel to differentiate those batteries that are best in terms of their environmental properties and quality properties from the rest of the market.

Under these criteria a licence may be applied for for the following products: portable batteries that are rechargeable in accordance with the definition provided in the European Union's Batteries Directive 2006/66/EC of September 2006.

According to the European Union's Batteries Directive 2006/66/EC of 6 September 2006, a rechargeable battery is: Any source of electrical energy generated by direct conversion of chemical energy and consisting of one or more secondary battery cells (rechargeable).

Portable batteries are confined to: Any battery or button cell, or any battery pack or accumulator, that is sealed, can be hand-carried and is neither an industrial battery or accumulator nor an automotive battery or accumulator.

The criteria do not encompass primary (non-rechargeable) batteries, for which separate criteria exist.

The criteria do not encompass batteries that are built into or form a permanent part of electronic products and where replacement of the batteries is not possible.

Nordic ecolabelled licences are not available for chargers for rechargeable batteries alone. Batteries sold in combination packs with a charger are eligible for a Nordic Ecolabel (including where batteries are sold together with, for example, power tools where the charger is purchased together with the tool and battery or Nordic Ecolabelled batteries designed for particular applications where the battery is sold together with a charger as part of the electrical appliance). If so, the charger must fulfil the requirements of R5, R6 and R13. The entire combination pack must fulfil the packaging requirements (R7, R8 and R9). It must be made clear to the purchaser of combination packs of this type that the Nordic Ecolabel applies to the batteries and not to the charger or to other elements of the package.

By amending the product group definition to the above definition, Nordic Ecolabelling is in line with the product group definition in the European Union's Batteries Directive.

The product group allows scope for the inclusion of new battery types in the future.

There may be a risk that the requirements will not match new products or models and that Nordic Ecolabelling would accordingly be unable to ensure that only the best third of these new products or models would qualify for licences. This is particularly true in the case of the quality testing requirements. Nevertheless, Nordic Ecolabelling is of the view that these criteria are so general in their environmental requirements that this will safeguard us against any new models or products that are unfavourable in environmental terms. Moreover, scope will exist for extending the criteria by adding additional quality requirements relevant to the new products or models during the term of validity of the criteria.

The above product group definition ensures that car batteries and industrial batteries will not be eligible for licences, which has been the intention throughout.

Nordic Ecolabelling has also chosen to exclude batteries that are built into or form a fixed part of electrical products and that can accordingly not be replaced. This is because Nordic Ecolabelling does not impose further requirements on the electrical appliances into which the battery is built and it will accordingly not be possible to ensure that the product as a whole is environmentally-friendly. Furthermore, Nordic Ecolabelling is of the view that it is an unnecessary waste of resources to have to discard an electrical appliance simply because the battery no longer functions optimally.

In Version 4 of the Criteria, Nordic Ecolabelling has removed the option of Nordic Ecolabelling chargers separately. This is primarily because Nordic Ecolabelling is of the view that two products that are so different as a battery and a charger (which is an electrical appliance) should be included in the same product group. Even so, it is by no means unusual for rechargeable batteries to be sold in combination packs together with a charger. In order to ensure that these combination packs containing rechargeable batteries can also qualify for a Nordic Ecolabel, Nordic Ecolabelling has kept this option open.

The charger plays a major role in the useful life and performance of a rechargeable battery. For this reason, Nordic Ecolabelling has chosen to impose special quality requirements on chargers sold in combination with Nordic ecolabelled-labelled rechargeable batteries.

To avoid any doubt about what the Nordic Ecolabel applies to when rechargeable batteries are sold together with a charger, the section on Marketing specifies how the Swan logo must be positioned and contains a suggestion for an explanatory text for use when batteries and chargers are sold together in combination packs.

A different Nordic Ecolabelling criteria document allows primary batteries to be eco-labelled. Nordic Ecolabelling has not combined rechargeable batteries and disposable batteries in the same criteria document since there is an essential difference which in most cases will mean that rechargeable batteries represent a better choice from an environmental perspective: one of the products is a disposable product. When it runs out, it is discarded. The second product is reusable. When it runs out, it is recharged and

re-used. Furthermore, the chemical composition of primary batteries and rechargeable batteries is different.

Rechargeable batteries will in most cases represent a better choice in environmental terms than primary batteries, a fact that is inter alia confirmed by Climatop's LCA analysis of various batteries[1] and Nordic Ecolabelling's preference is that as many consumers as possible should use rechargeable batteries.

Motives for Nordic Ecolabelling

The main principles applied in prioritising the ecolabelling requirements are taken from the environmental profile of the product group. The main weight of the requirements is on the activities and processes with the greatest relevance, potential and controllability (RPC) as regards the life cycle of the product.

Relevance

Relevance is assessed on the basis of the environmental problems caused by the product group and the extent of these problems.

The extensive use of battery-powered appliances means that rechargeable batteries are widely used in the Nordic countries (see market data below). This of itself represents a good reason for assessing the environmental effects of batteries.

The European Portable Battery Association (EPBA) has not produced any common LCA reports covering the battery industry as a whole[2]. However, a number of battery producers have commissioned LCA analyses or similar studies on their products, although these are not officially available.

Studies conducted in the industry[3] reveal that there are a major environmental impacts associated with the incorrect use of batteries. If, for example, rechargeable batteries are installed in an appliance that is used infrequently, there is a risk that the rechargeable battery will run down during the period in which the appliance is not being used, leading the consumer to assume that the rechargeable battery can no longer be recharged optimally and needs replacing. This in turn will entail an increase in the consumption of rechargeable batteries.

According to a study conducted by Climatop into the CO_2 balance of a number of batteries[4], the energy used in the production of rechargeable batteries accounts for a large portion of the overall CO_2 consumption. Other studies have also shown that the energy consumed in the production of rechargeable batteries is a key factor. Energy consumed during the extraction of raw material represents the largest individual climate impact attributable to rechargeable batteries[5]. Imposing requirements on the energy consumed during production is accordingly highly relevant. In addition, a high proportion of the CO_2 consumption of a rechargeable battery is associated with the energy used for recharging, i.e. energy consumption during the use phase.

One study found that the use of LCA analyses represents a useful tool for describing the environmental aspects of batteries. It is important to appreciate, however, that LCA analyses may suffer from certain weaknesses since ecotoxicity represents a key environmental parameter for batteries, but cannot be readily included in an LCA analysis[6]. A further weakness associated with assessing the environmental impact of

batteries is the many parties involved in the life of a battery, each having very limited knowledge of other aspects of the life cycle of the battery.

Nordic Ecolabelling does not base its requirements exclusively on information from LCA analyses. Stringent requirements are also imposed on substances with a high ecotoxicity. The importance of including this in the Criteria for Batteries is confirmed by a study conducted by Århus Municipality in 2007, which found that the numbers and types of metals in batteries are extensive[7]. The dispersal of these metals, particularly heavy metals which are harmful to health and the environment, represents a major environmental problem. Dispersal occurs during the production of the batteries and during the handling of the end product.

The metals used in battery production are extracted as natural raw materials, many of which may represent limited resources. Other reports confirm that in addition to energy consumption, the environmental impact of batteries in terms of ecotoxicology and resource consumption are important[8]. If the point of departure is the electrical appliance in which the battery is used, a battery with a long life or one that allows for recycling will improve the environmental profile of the appliance as a whole, especially with regard to resource consumption.

However, the environment impact associated with the extraction of raw materials for batteries does not stop at high energy consumption and the use of limited resources. Some of these extraction processes are themselves associated with major local environmental impact. The U.S. Bureau of Mines estimates that 8 tonnes of sulphur will be generated in the production of 1 tonne of nickel[9]. A further example is the very destructive mining of lithium involving high water consumption, water pollution and an absence of animal life, all three being a function of the rising demand for efficient batteries[10].

Safeguarding these limited resources can take several forms:

1. Limit the use of these metals by producing batteries that do not contain those metals that are scarcest.
2. Limit the use of the metals by limiting the consumption of batteries. Ecolabelling attempts to influence this factor by imposing stringent quality requirements on batteries.
3. Using metals that derive from the processing of waste products. At present, however, the consumption of recycled metals is limited, since metals used in batteries are subject to strict cleanliness requirements[11]
4. Ensuring that the metals are collected and re-used appropriately in other products. This can inter alia be achieved by ensuring that efficient public collection procedures are in place and that consumers receive information on the need to submit the batteries for collection.

When used batteries are discarded by the consumer there is considerable potential for the overall environmental profile of the battery to be either improved or worsened. If the batteries are collected correctly and re-used, the environmental profile of the battery can be improved significantly, which will not be the case if the battery goes to incineration, a refuse tip, is used in landfill or (even worse) is discarded in nature. Here again, it is important to safeguard the re-use of scarce resources as well as to save energy, since the extraction of metals is a very energy intensive process[12].

Nordic Ecolabelling has found that the most relevant environmental impacts associated with batteries are:

- The spread and use of metals, especially heavy metals, from the batteries.
- Energy consumption in the production of the batteries and their input raw materials.
- Incorrect handling of used batteries in the waste flow.
- Over-use of the batteries, inter alia as a result of the use of rechargeable batteries in electrical appliances that drain the batteries or non-optimum charging.

Moreover, certain other parameters are also relevant in terms of ensuring that the environmental impact of the batteries is as low as possible. These include the packaging used on the batteries and the use of nanotechnology.

In Europe, annual consumption of primary packaging for batteries, especially cardboard and PET, is estimated to exceed 8000 tonnes (over 5000 tonnes of board and over 3000 tonnes of PET). Increasing the proportion of recycled cardboard and plastic in packaging reduces the resource consumption associated with the batteries. According to FTI (Repa), the energy expended in the production of packaging can be reduced by approximately 30% by using recycled plastic in the packaging. It is important to prioritise lower resource and energy consumption.

Extensive research is being conducted into the use of nanotechnology to improve materials and products, including batteries, particularly rechargeable batteries, where nanotechnology could be used to extend useful life[13]. This would be environmentally beneficial since battery replacement frequency would be reduced. For this reason, Nordic Ecolabelling does not wish to exclude the use of nanotechnological solutions in ecolabelled rechargeable batteries. However, nanoparticles must be handled with care, since the incorrect handling of nanomaterials can have health consequences, during both production and recycling.

According to Nordic Ecolabelling's information, batteries, particularly those built into computers and other electronic products, are flown to Europe from Asia. Even so, the Climatop report on batteries[14] found that energy consumed during transportation is of less significance as regards the type of batteries that they investigated.

The charger: The charger is a supplementary product to the main product, the rechargeable batteries. Battery producers purchase chargers from subcontractors and will accordingly have less scope for managing, controlling or gaining an insight into the material composition of the charger. There are major quality differences between chargers and as a consequence in the amount of electricity used by the chargers and the extent to which they "wear down" the batteries during charging[15].

Potential

Potential is assessed on the basis of the possible environmental gain within the product group in question and for the individual areas of the criteria on which requirements are imposed.

Several methods exist for reducing battery consumption by consumers. Many of these relate entirely to the provision of information on the environmental impact of energy consuming products and their effects on, e.g. the climate. However, in this document Nordic Ecolabelling has chosen to focus on the potential offered by the battery itself for securing a smaller flow of batteries in the retail trade and the waste flow.

There are differences between batteries in terms of their efficiency and this offers potential for assessing which batteries will have the lowest environmental impact because of their quality and accordingly longer useful life.

The most energy-intensive stage of the battery production process is the extraction and processing of the raw materials used in the battery[16]. At the present time, Nordic Ecolabelling does not have information on whether differences exist between the various producers of batteries or types of batteries as regards energy consumption during production. However, it is very likely that the climate impact caused by the production process will vary from producer to producer and battery type to battery type. Not solely because of differences in production methods or because raw materials are supplied by different suppliers, but also because of the energy sources used.

There are differences between the substances contained in the batteries available on the market today and the concentrations in which these substances occur. Accordingly, potential exists for distinguishing between battery types with a greater or lower environmental impact. Nordic Ecolabelling will compile information on this in order to assess how future requirements as to the constituent substances in batteries should be formulated. See also Section 4.1.1.

The Nordic countries have effective rules in place to ensure that batteries are collected. Consumers have ample opportunities to return their batteries either at recycling centres, battery collection containers or as part of the collection of household refuse. In addition, the collection requirements of the authorities as provided for in the European Union's Batteries Directive 2006/66/EC of 6 September 2006 are stringent. Nevertheless, Nordic Ecolabelling has found that the collection percentage in the Nordic countries is no more than 20-40% of the total number of batteries sold[17],[18], which must entail that the remaining 60-80% end up going for incineration together with other household refuse or are disposed of by other inappropriate means. Accordingly, potential exists for increasing the level of collection, thereby improving the environmental profile of batteries.

Nordic Ecolabelling has also registered that the individual Nordic countries interpret the requirements whereby the producers must contribute to the collection process differently. In one Nordic country the authorities do not require producers to be members of a recycling scheme for collecting and re-using spent batteries[19]. Other Nordic countries impose a charge on producers for each kilogram of battery sold, the proceeds of which go to cover the costs of collection and recycling. But, here again, there are differences between the Nordic countries, with some countries having a triviality limit for payment of the charge in the event of very low sales of batteries.

The use of recycled materials in batteries is limited, the primary reason being the need to use metals with a high degree of purity in order to ensure optimum performance[20].

The packaging used for batteries can consist of greater or smaller quantities of recycled materials, such as cardboard and plastic. It is possible to ensure that a high proportion of

recycled cardboard and plastic is used to package batteries and some producers are taking active steps to increase the proportion of recycled materials in packaging.

The use of nanotechnology in batteries can be environmentally beneficial because this technology can help ensure that the batteries have a longer life and provide a higher level of performance. However, nanoparticles must be handled with care in order to ensure that they do not pose a health risk to people handling the batteries.

Chargers: A study of 40 different battery chargers on sale on the Nordic market found major differences in the energy consumption of the individual chargers[21]. This affects not only the environmental impact of the charger itself, but also the environmental profile of the rechargeable batteries, since this will be linked to the properties of the charger.

Controllability

Controllability is assessed on the basis of the scope that exists for imposing requirements within the relevant environmental parameters with a potential for improvement.

Being able to choose the right battery with the best capacity for the electronic appliance in question, thereby ensuring a long and optimum useful life for the battery represents an economic and environmental benefit for consumers.

A report produced by Sagentia Catella AB[22] found that there are quality differences between the batteries on sale today and that it is possible to ensure that only the best one-third of the batteries on the market will be eligible for a Nordic Ecolabel licence by imposing strict requirements on the performance of the batteries.

Nordic Ecolabelling's information at present on the energy consumed in the production of batteries is based on very general data which cannot readily be used to impose specific requirements on energy consumption in raw material extraction or production. As has already been noted, raw material extraction and processing account for most of the energy consumed in the production process and this lies a long way back in the production chain. It is difficult for licenceholders to acquire information on – far less imposes requirements with respect to – the energy consumption of their raw material subcontracttors. Thus, although Nordic Ecolabelling acknowledges that energy consumption far back in the production chain of batteries is of great relevance, no requirements will be imposed on this factor. Nevertheless, Nordic Ecolabelling will consider whether this might be an area in which requirements could be imposed in a future revision.

There are differences between the constituent substances and concentrations of three substances that are harmful to health and the environment which are also focused on by the authorities (lead, cadmium and mercury) as well as arsenic, which may cause health damage. See also Section 4.1.2. This is an area that is particularly difficult for licence applicants to document. Since it is also an important environmental parameter for batteries, Nordic Ecolabelling imposes stringent requirements. Since Nordic Ecolabelling's knowledge of the consequences of prohibiting the use of various other metals in batteries is sparse, requirements have not been imposed with respect to other substances than the aforementioned four, based on their effect on health and the environment. However, Nordic Ecolabelling will use available data to assess the possibility of imposing requirements on other chemical substances in future revisions.

It is a goal that as high a proportion of used batteries should be collected as possible in order to increase the recycling of batteries. And with a collection percentage of 20-40% in the Nordic countries, potential exists for improvement. The challenge, however, is that the ways in which consumers handle batteries when their useful life has come to an end is not something that is easy for Ecolabelling to control. The licence is awarded to the producer or the dealer and these are required by law to defray the collection costs of the authorities, but they have neither an obligation nor the ability to control the customer's behaviour or the collection methods used by the authorities. European Union legislation ensures that collection schemes must be in place to safeguard the correct handling of batteries in all the Nordic countries and the rest of the EU. However, the individual Nordic countries interpret the European Union's rules on collection slightly differently and Nordic Ecolabelling wishes to ensure that the optimum conditions for collection exist in all the Nordic countries, while at the same time acknowledging that it is difficult to change people's behaviour.

The systems in place for collecting and recycling cardboard and plastic are becoming more and more efficient and the quality of recycled materials is also good. As a consequence, it has become easier to produce packaging from recycled materials and this is an area over which the producers of batteries have control. Accordingly, it is possible for Nordic Ecolabelling to require packaging to contain a high proportion of recycled materials. Some battery producers are already taking steps to increase the proportion of recycled materials in their packaging and have achieved a significant proportion.

The extent to which nanotechnology is used in battery production is not easy to guage, although repeated projects involving nanotechnology and battery developments are underway at research level[23]. If it is as successful as provisional results indicate, this research will soon be incorporated in the industrial production of batteries. In order to ensure that the implementation of this technology does not backfire and have negative effects for health, Nordic Ecolabelling has opted to impose requirements on the handling of nanomaterials during production, by the consumer and at the waste processing stage.

Chargers: Very often the charger will not be produced by the producer of the rechargeable batteries. It is not unreasonable to assume that battery producers have excellent scope for imposing requirements on chargers, within the same areas that Nordic Ecolabelling imposes requirements, as a condition for selling the charger in a combination pack together with the rechargeable batteries.

The version and validity of the criteria

Version 2 of the Nordic Ecolabel criteria document for rechargeable batteries was adopted in 1996 followed by version 3 in 2002. Version 4 of the criteria document was adopted on 7 December 2010. A number of adjustments were agreed upon at the management meeting on Feburary 16, 2012, and thus the criteria were changed to version 4.1. On 15 November 2012 the secretariat managers meeting decided to prolong the criteria until 31 December 2015, new version is 4.2. On 19 March 2014 the Nordic Ecolabelling Board decided to prolong the criteria until 30 June 2016, new version is 4.3. On 16 June 2015 the Nordic Ecolabelling's Criteria Group decided to prolong the criteria until 30 June 2017. On 17 November 2014 the Board of Directors decided to remove the general part of requirement R21 Marketing, new version is 4.4.

The Nordic market

Norway is used as an example of the Nordic market as a whole. This is partly because Norway records detailed information on imports of batteries and at the same time has no battery production of its own[24]. The project group is of the view that Norway can be viewed as representative of battery consumption throughout the Nordic region.

Breakdown of types of batteries on sale:

Primary/rechargeable battery	Type of battery	Imports to Norway
Rechargeable batteries	Galvanic manganese dioxide elements and batteries, alkaline	1,499,460 kg
	Galvanic manganese dioxide elements and batteries, zinc carbon type	44,585 kg
	Galvanic elements and batteries, lithium	169,067 kg
	Galvanic elements and batteries, zinc-air	18,850 kg
	Galvanic elements and batteries, silver oxide (specified as environmentally harmful in Norway)	9,300 kg
	Total imports of primary batteries to Norway	1,741,262 kg of which 9,300 kg is environmentally harmful
Rechargeable	Lead accumulators, e.g. for starting piston engines (specified as environmentally harmful in Norway)	10,739,151 kg
	Other lead batteries (specified as environmentally harmful in Norway)	4,927,865 kg
	Nickel-cadmium batteries, accumulators (specified as environmentally harmful in Norway)	202,969 kg
	Nickel-iron accumulators	3,429 kg
	Other rechargeable batteries	541,685 kg
	Total imports of rechargeable batteries to Norway	16,415,099 kg of which 15,869,985 kg environmentally harmful
	TOTAL imports of batteries to Norway	**18,156,361 kg**
	TOTAL imports of environmentally harmful batteries to Norway	**15,879,285 kg**

Source: Statistics Norway and Rebatt, Norway.
The definition of environmentally harmful batteries follows the definition used in the Norwegian recycling system[25]

If these figures are scaled up to the Nordic market as a whole (the assumption is that Norway represents one-fifth of the total Nordic market) the figures for total battery consumption in the Nordic countries (2009) are as follows:
Total consumption of primary batteries: approximately 8,700 tonnes.
Total consumption of rechargeable batteries: approximately 82,000 tonnes.
If Pb, NiFe and NiCd batteries are excluded, since they are not included in Nordic Ecolabelling's requirements, battery consumption (of relevance to ecolabelling) is approximately 2,700 tonnes of rechargeable batteries.
It should be noted that batteries imported to Norway/the Nordic region as "on board" batteries in electronic products are not included in the above accounts.

It is difficult to obtain a complete overview of sales of rechargeable batteries since a large proportion of these batteries are sold as accessories with other products, as a consequence of which no details are provided in import statistics.

Denmark has one producer of alkaline batteries, and Sweden has one producer of nickel-cadmium batteries. In addition there are firms in Sweden that produce battery packs for specific products, although the cells are manufactured outside Sweden.

The batteries sold on the Nordic market come from producers all over the world. Germany is a major European supplier of batteries, while Asia and China in particular, have also become an important source of batteries[26].

Other labelling schemes

The European Union's Batteries Directive 2006/66/EC of 6 September 2006 introduces extensive increases in stringency in the labelling of batteries with a view to ensuring that batteries are not disposed of in ordinary refuse (the pictogram "Diagonal line through refuse bin"). The Directive also requires batteries containing more than 0.0005% (5 ppm) of mercury, 0.002% (20 ppm) of cadmium and/or 0.004% (40 ppm) of lead to be labelled with their heavy metal content. In addition, the Directive prohibits the marketing of ordinary consumer batteries with mercury content in excess of 5 ppm and cadmium content in excess of 20 ppm. Thus the legislation already contains provisions on product labelling. The Nordic Ecolabel requirements applicable to the aforementioned heavy metals are stricter than those provided for in the Directive.

Europe has a number of battery labelling schemes focussing on the environment.

Blaue Engel has criteria for rechargeable AlMg batteries and their chargers, the most recent version was published in May 2009. The primary focus of these criteria is to ensure that batteries can be recharged at least 25 times and that they do not contain substances on the EU's list of hazardous substances (Annex I to Directive 67/548/EEC), or are classified as CMR. Moreover, the cadmium content must not exceed 10 ppm or the mercury content 5 ppm. The requirements applicable to chargers focus on energy consumption at the end of charging.

During 2010 Blaue Engel was in the process of developing criteria for lithium-ion batteries.

Climatop is a Swiss CO_2 label which has concluded on the basis of a CO_2 balance calculation that rechargeable batteries represent the best choice for consumers in terms of the environment, and accordingly the label is awarded to rechargeable batteries[27].

In addition, according to EPBA, the French Grenelle Envt and the UK's Carbon Trust schemes offer ecolabels for batteries.

According to information provided by EPBA[28] the number of labelling schemes for batteries on the European market is large and non-cohesive. There are too many national or regional labelling schemes with different requirements, and it would be preferable for these labelling schemes to be coordinated in a common European labelling scheme or for the individual labelling schemes to impose the same requirements.

3 About the criteria development/revision process

The aim of the criteria development/revision process
With a view to achieving further environmental gains and to safeguard the credibility of the Nordic Ecolabel as an ecolabel that is awarded only to the best one-third of the products on sale on the market, Nordic Ecolabelling wished to tighten up the stringency of the requirements. During the criteria development work new parameters on which attention had not previously been focused in criteria documents proved to be of major significance for the environmental impact of the batteries. For this reason the revision focused not only on tightening up the existing requirements, but also on ensuring that relevant requirements were imposed.

About this criteria development/revision process
The revision of the criteria for Nordic Ecolabelling of batteries takes the form of an internal project at Nordic Ecolabelling with close consultation with relevant official bodies, test laboratories, producers and the like.

During the course of the investigation of the market and the applicable legislation Nordic Ecolabelling consulted collection organisations and national battery industry organisations. Our licenceholders and the European industry organisation, IPBA, have been appraised of the criteria development process and have responded to questions in connection with the setting of new requirements and the tightening up of existing requirements.

4 Motivation for the requirements

4.1 Environmental requirements

4.1.1 Content
Previously requirements were imposed only with respect to the three heavy metals harmful to health and the environment: mercury, cadmium and lead, which are also regulated in the EU's Batteries Directive, and arsenic. However, a report on constituent substances in used batteries collected in 2007 in Århus in Denmark found that larger or smaller concentrations of a wide range of other metals and chemical substances also occur in batteries. According to the report, tests were conducted for the presence of 25 different substances, some of which are known to have harmful effects on health and the environment. These include chromium and cobalt, which are classified toxic/harmful to health and environmentally harmful[29]. Virtually all of the 25 substances that were tested for were found in greater or smaller concentrations in the tested batteries[30].

The report classifies batteries into five major groups, pyrolusite and alkaline batteries are grouped together and button cells are not classified by type. Accordingly specific requirements cannot be imposed on particular substances in the individual battery on the basis of the information provided in this report.

A further reason for focusing on the constituent substances in the batteries is the consumption of limited resources and the environmental impact involved in extracting

some of these substances. A relevant example is the consumption of cobalt in Lithium-ion batteries, consumption being very high relative to the world's reserves of cobalt[31].

In many cases, considerable energy is consumed in extracting the metals, although the environmental impact associated with the extraction of the raw materials for the batteries does not stop at high energy consumption and the use of limited resources. Some of these extraction processes of themselves involve major environmental impact at local level[32],[33].

Detailed information on the constituent substances found in various types of batteries can be obtained from datasheets on the websites of the producers[34] and in official information produced by the battery industry specifying constituent substances occurring in large quantities (over 1%) or regulated by legislation[35].

Imposing requirements on the maximum permitted concentration of chemical substances or metals known to be harmful to health or the environment or known to constitute a limited resource is highly relevant in the case of batteries, given the high level of consumption of batteries in the Nordic countries (see the market data above) However, the available data on which such requirement might be based is limited, especially since Nordic Ecolabelling does not know the consequences of prohibiting or restricting such substances in terms of, e.g. quality. For this reason Nordic Ecolabelling has instead opted to require constituent substances to be declared so that in future versions this information can be used to assess the utility of and hazards associated with the substances and the extent to which substitutes might offer environmental benefits can be reviewed.

The requirement is as follows:

Content

Applicants must submit a specification detailing all constituent substances present in the battery (metals, other solid substances and liquid chemical substances). The specification must state the chemical name, concentration (as ppm or weight %) and a description of the purpose of the constituent substance.

Ingoing substances are defined, if not otherwise mentioned, as all substances in the product – including additives (e.g. preservatives or stabilisers) in the raw materials/ingredients, but not residuals from the production, incl. the production of raw materials.

Residuals from production of raw materials are defined as residuals, pollutants and contaminants derived from the production of the raw materials, which are present in the final product in amounts less than 100 ppm (0.0100 %w/w, 100 mg/kg), but not substances added to the raw materials or product intentionally and with a purpose – regardless of amount. Residuals in the raw materials above 1.0 % are regarded as ingoing substances. Known substances released from ingoing substances are also regarded as ingoing substances.

Declaration is made by the supplier based to the best of his/her knowledge at the given time, also based on information from raw material manufacturers, recipe and available knowledge on the product with reservations for new advances and new knowledge. Should such new knowledge arise, the undersigned is obliged to submit an updated declaration to Nordic Ecolabelling.

✉ Description of the composition of the battery in accordance with the requirement for each type of battery to which the application applies.

4.1.2 The metal content of batteries

As noted above, Nordic Ecolabelling is aware that substances that are harmful to the environment are used in rechargeable batteries and that some of these substances are known to offer direct technical benefits. Unfortunately, at the present time we do not have sufficient knowledge of how these harmful metals might be limited without reducing the performance of the battery. On the other hand, we have known for many years that certain harmful metals can be limited without detrimental effect for battery performance. Two of these (mercury and lead) are also encompassed by EU batteries legislation. These metals are:

Mercury, which is very hazardous to health and the environment, accumulates in the body and is known to be highly volatile.

Cadmium, which accumulates in the body, particularly the kidneys, and is known to be hazardous to health and the environment and in certain connections are carcinogenic, mutagenic or toxic for reproduction.

Lead, which is known to be toxic for reproduction, environmentally harmful and has negative effects on the nervous system[36].

Arsenic, which can occur in large quantities in rechargeable batteries[37]. Arsenic is classified as toxic (R23/R25) and hazardous to the environment (R50/53).

The EU's Batteries Directive 2006/66/EC of 6 September 2006 require batteries to be labelled if they contain concentrations of one or more of the three metals: mercury (max 5 ppm), cadmium (max 20ppm) and lead (max 40 ppm). In addition, the Directive prohibits the marketing of ordinary consumer batteries with content of mercury in excess of 5 ppm and of cadmium in excess of 20 ppm. At these levels, the legislation has ensured that these three heavy metals must not be added deliberately to portable batteries. Even so, pollutants may nevertheless occur. Nordic Ecolabelling opted as far back as in Version 3 of the Criteria to introduce stricter requirements than those of the authorities on this point, in order to ensure that only the best constituent substances with very low concentrations of pollutants of the above metals may be used in Nordic ecolabelled-labelled batteries.

In Version 4 of the Criteria, Nordic Ecolabelling has chosen to split this requirement up so that there is no longer a requirement that the total concentration of arsenic, lead and cadmium must not exceed 20 ppm. The reason that these substances now each have their own specific limit values is that Nordic Ecolabelling wishes to ensure that concentrations of all three substances are as low as possible and to coordinate the requirement with the requirements of the EU's Batteries Directive. Nevertheless, Nordic Ecolabelling imposes significantly tougher requirements on the three heavy metals than provided for in the EU Directive and, in addition, Nordic Ecolabelling also imposes a requirement as to the arsenic content.

The requirement refers to a test method for determining the content of the above metals developed for use on Alkaline Manganese (AlMg) batteries. Nordic Ecolabelling is aware that applications may be submitted for ecolabels for other types of rechargeable batteries. However, no other test methods exist than the method developed for AlMg, and this method is also commonly used on other types of battery.[38]. Nordic Ecolabelling has been

informed by a test laboratory that the specified test can also be used for testing for arsenic, although it is not ideally suited for this purpose[39].

It can be difficult to obtain precise test results for arsenic, since the findings can be ”polluted” by the content of other metals when testing on rechargeable batteries. Nordic Ecolabelling has therefore chosen to set the permitted arsenic content at a max. of 10 ppm. The aim is to ensure that the content of arsenic in Nordic ecolabelled-labelled batteries is as low as possible, while at the same time making allowances for the uncertainty attaching to the measurement method.

The requirement is as follows:

Metal content of batteries

The metal content of the battery must not exceed the following limits:

Metal	Content
Mercury	≤ 0.1 ppm
Cadmium	≤ 5.0 ppm
Lead	≤ 5.0 ppm
Arsenic	≤ 10.0 ppm

It should be noted that the EU's Battery Directive 2006/66/EC permits a maximum cadmium content of 20 ppm and a maximum mercury content of 5 ppm. The test laboratory may need special equipment in order to test batteries for a mercury content of <0.1 ppm..

At least four examples of the product in question must be analysed and all four must meet the requirement.

Analysis results specified as < , i.e. ”less than”, will be interpreted as = , i.e. “equal to”, for the purposes of the application.

The metal content of the batteries must be analysed in accordance with ”Battery Industry Standard Analytical Method. For the determination of Mercury, Cadmium and Lead in Alkaline Manganese Cells Using AAS, ICP-AES and ”Cold Vapour”. European Portable Battery Association (EPBA), Battery Association of Japan (BAJ) National Electrical Manufactures Association (NEMA; USA). April 1998”.

Similar test methods may be approved if assessed and adjudged to be equivalent to the recommended method by an independent third party.

✉ Report from the analysis body showing the metal content of the batteries.

✉ Declaration confirming that the institution performing the analysis is impartial and fulfils the general requirement applicable to test laboratories as described in the requirements applicable to the analysis laboratory/test institutions below.

4.1.3 Nanotechnology in batteries

Nordic Ecolabelling is concerned about the uncontrolled use of nanoparticles because of the lack of knowledge about the effects on health and the environment associated with nanoparticle production, use and waste processing. Nevertheless, it is proposed that nanoparticles should be permitted in battery anodes on the following grounds:
The Interdisciplinary Nanoscience Center at the University of Århus informs us that researchers at Stanford University have developed rechargeable batteries that can retain ten times more power than normal lithium batteries[40]. This is revolutionary in terms of

progress and for the environment it means that batteries will have a far longer life thereby helping to reduce resource consumption.

The European Agency for Safety and Health at Work (EN2) writes in a report entitled "Workplace exposure to nanoparticles" that guidelines on the handling of nanoparticles at the workplace already exist, but that it may be necessary to tailor these guidelines to the individual production site.

Based on the general lack of knowledge about the properties of nanoparticles as regards health and the environment, Nordic Ecolabelling wishes to apply the precautionary principle and has for the present chosen to impose the following requirements on nanoparticles in the Criteria for Rechargeable Batteries: information on the nanoparticles' name and size, handling of nanoparticles in the production of batteries and when processing as waste.

Following the criteria's adoption, Nordic Ecolabelling's attention were drawn to the fact that this technology were irrelevant not only to the anode, but also the cathode. Thus the requirement was changed to allow nanoparticles in cathode, as well as the same requirements that applies to the anode. This alteration was made to criteria version 4.1.

The requirements are henceforth:

Nanotechnology

Nanoparticles may be present only in the electrodes (anode/cathode material) for the purpose of increasing the energy efficiency of the batteries.

If nanoparticles are present in the electrodes (anode/cathode material), then the applicant must specify the extent to which the energy efficiency of the battery is improved.

✉ Declaration from the applicant stating either: that nanotechnology is not used in the battery, or: that nanotechnology is used only in anode material in order to increase the energy efficiency of the batteries and the extent to which this improves the energy efficiency of the battery.

Appendix 4 may be used.

Information on batteries containing nanoparticles

If nanoparticles are used in the batteries, the producer must publish information on how batteries containing nanoparticles are to be handled by battery recycling firms. This information must focus particular attention on measures aimed at shielding employees from exposure to nanoparticles. "Publish" means making the information available on a website or the equivalent.

✉ Copy of information aimed at battery recycling firms concerning the correct method of handling batteries containing nanoparticles. In addition, a description must be provided of how this information is made available to recycling and waste processing firms.

4.1.4 Requirements applicable to plastic in battery chargers

The environmental problems associated with chlorinated plastic occur primarily during the production of the raw material and in waste processing[41], [42]. Chlorine production also

generates waste containing, inter alia, dioxins, heavy metals and hexachlorobenzene. In a Green Paper entitled Environmental Issues of PVC, the European Union commissioned four studies to evaluate technical aspects of alternatives to processing PVC as waste: mechanical recycling, chemical recycling, incineration and landfill. The first priority is to prevent the formation of waste. The Commission is also of the view that material recycling is preferable to energy generation.

PVC is incinerated in part in controlled conditions in incinerators, in part in undesired incineration in landfill sites. The combustion of chlorine results in the development of hydrochloric acids as well as smaller quantities of organic chloro-compounds, including benzenes and phenols, furans, PCB and polychlorinated naphthalenes. The pollutants are numerous in number and knowledge about them is relatively limited. If the technology and safety at the production facility are as they should be, the PVC Information Council Denmark[43] is of the view that most other dioxin emissions will be captured, but not all. For further information on the environmental impact associated with chlorinated plastic, see Section 4.1.6.

Stabilising chemicals are added to chlorinated plastics in order to enable them to withstand the temperatures necessary to product the product. The stabilisers may be based on lead, metal alloys (such as barium-zinc and calcium-zinc), tin or cadmium[44]. See Section 4.1.2 for the environmental and health problems associated with lead and cadmium. In Europe, the industry has not used cadmium since 2001[45] and has also made significant progress on phasing out lead, particularly in the Nordic countries where lead is no longer used in PVC[46]. However, battery chargers are not produced exclusively in the Nordic countries or in Europe, but largely in Asia where the process of phasing out these substances has not progressed as far. It is accordingly highly relevant to include a requirement prohibiting the use of cadmium and lead in plastic.

Chloro-paraffins are added to some plastic products, inter alia, as flame-retardants or softening agents. Chloro-paraffins do not break down readily and are bioaccumulative. For this reason, Nordic Ecolabelling wishes to prohibit the use of these substances in plastics chargers for use with Nordic ecolabelled-labelled rechargeable batteries.

Flame-retardants are necessary in order to ensure that the plastic in electrical products does not catch fire when heated up by the electrical current. The same applies to chargers. There is risk that flame-retardants will emit fumes while the charger is in use, when they are heated up. For this reason, Ecolabelling wishes to ensure that these flame-retardants are not classified as carcinogenic, toxic for reproduction or mutagenic, to reduce the risk to consumers when charging Nordic ecolabelled-labelled rechargeable batteries.

Halogenated flame-retardants contain substances that are harmful to health and the environment, are highly toxic to waterborne organisms, carcinogenic or harmful to health in other ways. The halogenated flame-retardants do not break down readily in the environment, which increases the risk of harmful effects from the substances. The requirement is therefore imposed that halogenated flame-retardants must not occur in chargers for Nordic ecolabelled-labelled rechargeable batteries[47].

The requirement is as follows:

Requirements applicable to plastic in battery chargers

If the rechargeable batteries are sold together with a charger, the charger must fulfil the following requirements:

- The plastic in the casing must be labelled in accordance with ISO 11469.
- The plastic in the casing must not be chlorinated plastic.
- Cadmium and lead must not be actively added to the plastic in the casing and cables.
- Chloro-paraffins must not be actively added to the plastic in the casing and cables.
- Halogenated organic flame-retardants or flame retardants with risk classifications within the following areas must not be present in the plastic in the casing or cables: Carcinogenic, mutagenic or toxic for reproduction in accordance with European Union chemicals legislation.

The following risk classifications are carcinogenic in accordance with Directive 67/548/EEC: R45, R49, R40.
The following risk classifications are mutagenic in accordance with Directive 67/548/EEC: R46 and R68.
The following risk classifications are toxic for reproduction in accordance with Directive 67/548/EEC: R60, R61, R62, R63, R60-61 and R62-63.
The following hazard statements are carcinogenic in accordance with the CLP Regulation 1272/2008/EC and GHS: H350, H350i, H351.
The following hazard statements are mutagenic in accordance with the CLP Regulation 1272/2008/EC and GHS: H340 and H341.
The following hazard statements are toxic for reproduction in accordance with the CLP Regulation 1272/2008/EC and GHS: H360F, H360D, H361f, H361d, H360FD, H361fd, H360Fd, H360Df.

✉ Documentation showing that the casing is labelled in accordance with ISO 11469.

✉ The manufacturer of the charger must provide a declaration that the requirements applicable to the plastic in the battery charger have been fulfilled (Appendix 3).

Safety data sheets for flame-retardants used in the casing and cables.

4.1.5 Charger, size of batteries

In order to ensure that consumers do not need to buy as many chargers as they have various battery sizes, thereby increasing environmental impact as a consequence of increased charger production, Nordic Ecolabelling's preference is that chargers that are sold together with ecolabelled rechargeable batteries should permit multiple battery sizes to be charged. As the present volume of chargers that charge three types of batteries is reduced – since few, if any, exist at all – this was changed in criteria version 4.1 to two battery sizes.
The product group definition in Version 4 of the Criteria for Rechargeable Batteries permits the ecolabelling of a broader range of types of rechargeable batteries than solely ordinary household batteries. Nordic Ecolabelling appreciates that this may be a requirement that is very difficult to meet and may in some cases be unnecessary to impose as regards more specialist rechargeable batteries designed for use in one or a limited number of electrical appliances (such as batteries for computers, cameras or power tools).

The requirement is henceforth:

Charger, battery sizes

This requirement applies only to chargers for rechargeable batteries of the following sizes:

AAA: HR03, AA: HR6, C:HR14, D: HR20, 9V:HR 22.

If the rechargeable batteries are sold together with a charger, the charger must be suitable for use with a minimum of two battery sizes.

✉ The manufacturer of the charger must submit a declaration confirming that the charger can be used for charging a minimum of two battery sizes (Appendix 3). A description/documentation of the charger confirming this must be attached.

4.1.6 Packaging, chlorinated plastic

The environmental problems associated with chlorinated plastic occur primarily during the production of the raw material and at the waste processing stage[48], [49]. Chlorine production also generates waste containing, inter alia, dioxins, heavy metals and hexachlorobenzene.

The incineration of PVC waste has proved to be associated with a number of undesirable environmental effects. Acid is formed when PVC is combusted and this is neutralised by means of the addition of lime. In addition, smaller quantities of chloro-organic compounds are formed, including benzenes and phenols, furans, PCB and polychlorinated naphthalenes. There are many of these pollutants and knowledge of their properties is relatively limited.

When dry and semi-dry flue gas cleaning systems are used, a greater quantity of flue gas waste is created than the quantity introduced (1 kg PVC results in approx. 2 kg residual product in dry/semi dry cleaning).
The flue gas cleaning product must be treated as hazardous waste. Dumping PVC waste is not a sustainable solution for the longer term, both because this represents a waste of resources and also because it is associated with a number of undesirable environmental effects[50]. For further information on the environmental impact associated with PVC and chlorinated plastic, see Section 4.1.4.

If PVC or other chlorinated plastic is used for packaging, there is a considerable risk that this packaging will go to incineration together with other household refuse and thereby cause an unnecessary environmental impact.

The use of PVC in packaging is limited in scope. This requirement has been imposed in order to ensure that PVC packaging is not used on ecolabelled batteries.

The requirement is as follows:

Packing, chlorinated plastics

Chlorinated plastics must not be used as packaging.

✉ Description of the types of packaging used, both primary and secondary. Declaration that no chlorinated plastics are used in the packaging (See Appendix 2).

4.1.7 Primary packaging, recycled material

The annual consumption of primary packaging on batteries in Europe, particularly cardboard and PET, is estimated to be in excess of 8000 tonnes (over 5000 tonnes of cardboard and over 3000 tonnes of PET)[51].
Increasing the proportion of recycled cardboard and plastic in packaging will reduce overall resource consumption in connection with batteries.
According to FTI (Repa) (Packaging and Newspaper Collection) the energy consumed in the production of packaging can be reduced by approximately 30% by using recycled plastic in the packaging. Prioritising lower resource and energy consumption is desirable.

Nordic Ecolabelling has reviewed the proportion of recycled materials in the packaging of one producer that has worked on reducing packaging-related resource consumption and we have concluded that a figure of 80% for post-consumer recycled material in packaging is an ambitious, but attainable, level.

The requirement is as follows:

Primary packaging, recycled portion

The total proportion of post-consumer recycled material in the primary packaging for the batteries must be at least 80 weight %.

Post-consumer material is defined in accordance with ISO 14021(2001 as): Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes return of material from the distribution chain.

☒ Documentation from packaging suppliers showing the proportion of post-consumer recycled material in their products.

☒ Statement showing that the total proportion of post-consumer recycled material in the primary packaging exceeds 80 weight %.

4.1.8 Collection systems for batteries and packaging

The Nordic countries have effective rules in place to ensure that batteries are collected. Consumers have ample opportunities to return their batteries either at recycling centres, battery collection containers or as part of the collection of household refuse. In addition, the collection requirements of the authorities as provided for in the European Union's Batteries Directive 2006/66/EC of 6 September 2006 are stringent. Nevertheless, Nordic Ecolabelling has found that the collection percentage in the Nordic countries is no more than 20-40% of the total number of batteries sold[52],[53], which must entail that the remaining 60-80% end up going for incineration together with other household refuse or are disposed of by other inappropriate means. Accordingly, potential exists for increasing the level of collection, thereby improving the environmental profile of batteries. The challenge here however is that it is difficult for ecolabelling to control the way in which consumers handle batteries at the end of their useful life. The licence is awarded to the producer or the dealer who are required by law to defray the collection costs of the authorities, but have no control over the behaviour of their customers or the collection methods used by the authorities. Under EU legislation, collection systems must be in place to ensure that batteries are correctly handled in all Nordic countries and the rest of the EU.

Nordic Ecolabelling has also registered that the individual Nordic countries interpret the requirements whereby the producers must contribute to the collection process differently. In one Nordic country the authorities do not require producers to be members of a recycling scheme for collecting and re-using spent batteries[54]. Other Nordic countries impose a charge on producers for each kilogram of battery sold, the proceeds of which go to cover the costs of collection and recycling. But, here again, there are differences between the Nordic countries, with some countries having a triviality limit for payment of the charge in the event of very low sales of batteries. Nordic Ecolabelling wishes to ensure that the optimum conditions for collection are in place in all the Nordic countries and accordingly the requirement is imposed that in countries in which voluntary battery collection schemes operate the licenceholder must be a member of such schemes.

Packaging collection systems could also be improved. Organisations in the Nordic countries ensure that packaging is collected more efficiently, and it is Nordic Ecolabelling's wish that this environmental consideration should also be taken in the case of batteries.

The requirement is as follows:

Collection system for batteries and packaging

The relevant national rules, laws and/or industry-wide agreements concerning collection systems for packaging and batteries must be fulfilled in the Nordic countries in which the ecolabelled products are on sale. The following systems have been established:

Norway, packaging: www.grontpunkt.no, Norway, batteries: www.batteriretur.no.

Sweden, packaging: www.repa.se, Sweden, batteries: Statutory participation in collection scheme by manufacturers.

Finland, packaging: www.pyr.fi, Finland, batteries: Statutory participation in collection scheme by manufacturers.

Denmark, packaging: None. Denmark, batteries: Statutory participation in collection scheme by manufacturers.

Iceland: None

✉ Copy of agreement and/or copy of invoice for the collection system for the packaging in question.

4.1.9 Consumer information on batteries

The EU's Battery Directive 2006/66/EC provides that rechargeable batteries must be labelled with their capacity in mAh. However, the Sagentia Catella Report[55] notes that there are examples of this labelling "drowning" in other numerical values specified on the battery, which might be misinterpreted as representing the capacity of the battery. By imposing the requirement that capacity must be marked clearly, Nordic Ecolabelling is seeking to ensure that the customer receives thorough information enabling him or her to purchase the right type of battery for their needs.

The requirement is as follows:

Consumer information on the battery

The batteries must carry a clear indication of their capacity in accordance with the requirements applicable to capacity labelling provided for in the EU's Batteries Directive 2006/66/EC.

"Clear indication" means that the capacity labelling shall be expressed in terms of a unit (mAh) and that other numerical markings on the battery must not be such that the customer is likely to be mislead into thinking that they represent the capacity labelling.

✉ A sample of the information provided on the battery.

4.1.10 Working conditions

In certain parts of the world the production of batteries involves heavy manual labour, with anything up to several hundred workers collecting the batteries. Some of the constituent substances in batteries are very harmful to health and are handled manually. Working conditions must accordingly be good in order to avert permanent damage to the health of the workers as a result of this work. At the same time, however, companies using a high proportion of manual labour are often located in countries in which the scope for securing good working conditions and freedom of speech is limited. There are examples of strikes amongst battery factory workers who have been exposed to high concentrations of toxic substances and whose working conditions are also poor in other respects[56]. Moreover, the working conditions at suppliers to battery producers of raw materials (especially metals) are a cause for concern in many parts of the world. Again, this is hard physical work (e.g. mining) or involves working with chemicals that are very harmful to health and the environment. Many of these raw materials are extracted in countries in which there is limited scope for securing good working conditions or freedom of speech.

Nordic Ecolabelling is of the view that is important that Nordic ecolabelled-labelled products should not only be the best choice in terms of the environment, but that the working conditions of the workers who produce the products should also be satisfactory. For this reason, in this version of the Criteria Document for Rechargeable Batteries, Nordic Ecolabelling has chosen to impose the requirement that licenceholders must have a code of conduct in place and that this code should be communicated to suppliers/subcontractors. Nordic Ecolabelling appreciates that it may be very difficult to ensure that the working environment at all subcontractors in all parts of the battery production chain are satisfactory. Nevertheless, Nordic Ecolabelling is confident that the more times that production facilities and raw material suppliers are confronted with a requirement/signal from their customers that a code of conduct must be met, the greater the possibility that conditions will be improved.

The requirement is as follows:

Working conditions

The licenceholder must have a code of conduct in place in accordance with the ten principles provided for in the United Nations Global Compact.

The licenceholder must ensure that the code of conduct is communicated to all suppliers/subcontractors together with a request that these should also comply with a code of conduct that follows the ten principles provided for in the United Nations Global Compact.

NB: The principles embodied in the United Nations Global Compact include the following: human rights, employee rights, environmental protection and anti-corruption safeguards. Further information can be found at http://www.unglobalcompact.org .

If nanoparticles are used in the batteries, safeguards must be in place to ensure that employees are not exposed to the nanoparticles during production of the batteries and during internal refuse processing of the nanoparticles and batteries.

☒ Copy of the licenceholder's "Code of Conduct".

Description of the way in which subcontractors and producers are notified of the licenceholders' code of conduct and of the licenceholders' request that they have a code of conduct in place that follows the ten principles in the United Nations Global Compact.

☒ If nanoparticles are used in the batteries: Description of measures put in place to ensure that employees are not exposed to the nanoparticles. Description of the way in which waste and residues of nanoparticles are sorted and processed.

4.1.11 The quality of rechargeable batteries

Nordic Ecolabelling is of the view that one important parameter for the environmental impact of batteries is the overuse of batteries. The fewer batteries that are used, the lower the overall environmental impact of batteries are. Accordingly, it is important to ensure that Nordic Ecolabel licences are awarded only to rechargeable batteries that offer the highest quality in the form of the number of charge/discharge cycles and the capacity attainable after multiple rechargings.

In 2008, Nordic Ecolabelling commissioned Sagentia Catella[57] to investigate battery operating times. Based on their experience of testing battery quality, they were tasked with setting the level of the requirements for batteries in such a way that only the best one-third of the batteries available on the market today will meet the requirements. In addition, they also assessed whether the standards referred to were up to date.

Sagentia Catella's proposals as to the stringency of the requirements and the wordings used were drawn up on the basis of the product group definition for the Criteria for Rechargeable Batteries contained in Version 3 of the document. Since the proposed new product group definition opens the way for a wide range of other types of rechargeable batteries, Nordic Ecolabelling has found it necessary to conduct further investigations into whether the level of the requirements should be changed. Following discussions with licenceholders, Nordic Ecolabelling has decided upon a stricter level of requirement for battery endurance than the level proposed by Sagentia Catella. The wording of the requirements is in accordance with the proposal in the report. However, in the spring of 2010 Sagentia Catella (now known as Interteck) proposed a number of modifications to the test wording which will ensure that the test is more applicable to the type of batteries to which Nordic Ecolabelling has modified the requirements. Nordic Ecolabelling's background for assessing the proposed requirement level in relation to batteries of sizes used in normal households has been limited. Nordic Ecolabelling wishes to make it possible for ordinary consumers to find Nordic Ecolabelled rechargeable batteries in sizes that are relevant to their requirements. If it transpires that the level of the requirements excludes batteries of sizes that are used in households, then Nordic Ecolabelling will consider the possibility of an amendment to/differentiation of the quality requirement for household batteries.

Following the adaptation of criteria version 4.0, Nordic Ecolabelling noted that the requirement for nickel metal hydride batteries (NiMH) were too strict, since the requirement does not differ between lithiumion (LiIon) and nickel metal hydride. Even though the LiIon service exceeds that of NiMH, LiIon does not exist in the type of batteries typically used in common households, thus it was necessary to adjust the requirement subsequently, so that NiMH could also be ecolabelled. The requirement for quality were therefore differentiated, introducing separate requirments for LiIon and for NiMH in criteria version 4.1. The requirement were worked out and the levels found with the assistance of consultants from Etteplan as well as exchanges with licenseholders and/or potential licenseholders.

The requirement is henceforth:

The quality of rechargeable batteries

Quality testing must be performed by an impartial test laboratory which fulfils the general requirements applicable to test institutions provided for in the chapter headed "Analysis laboratory/test institution"

For LiIon and other batteries/cells that are not NiMH two tests must be performed: Initial capacity testing and cycle life testing (cf. Table 1 and 2). Initial capacity testing is performed in order to ensure that the capacity of the cells/batteries corresponds to the actual discharge ability of fresh cells/batteries. Cycle life testing is performed in order to ensure that the cells/batteries have an appropriate number of charge/discharge cycles offering an acceptable level of performance.

Each test must include at least four batteries of each size and brand model.

C is the nominal capacity of the battery and is stated on the battery as mAh. The highest capacity value specified on the cell must be used for the purposes of testing.

The test starts by discharging the battery to its final voltage C/5 current (residual discharge capacity).

Cycle No.	Charging	Discharging
1-5	In accordance with the recommendations of the manufacturer	0.2C cut-off voltage[1]

[1] *Cut-off voltage will vary depending on the chemical composition of the battery in question. A typical cut-off voltage for conventional Li-ion/LiP cells is 3V/cell and 1V/cell for NiMH.*

Nickel-metal hydride (NiMH) batteries and cells:

The conditions during capacity testing must be in accordance with the, at the time of application applicable, IEC 61951-2 standard for NiMH cells and batteries.

Li-ion/LiP batteries and cells:

The conditions during capacity testing must be in accordance with the, at the time of application applicable, IEC 61960 standard for Li-ion/LiP cells and batteries.

Batteries and cells other than Li-ion/LiP or NiMH batteries and cells:

The conditions during capacity testing must be in accordance with the relevant standard for the type of battery in question. The independent test laboratory performing the test must perform a written assessment to determine which standard is relevant for the type of battery in question.

Cycle life testing:

All tested batteries must meet the following requirements:

- **The discharge time for cycle 799 must be at least 30 minutes (correspond to 50% of remaining capacity)**
- **The discharge time for cycle 800 must be at least 3.5 timer hours (correspond to 70% of remaining capacity)**

Table 2 provides test specifications

Table 2

Cycle No.	Charging	Rest period during charged phase	Discharging	Rest period during discharged phase
1-799	In accordance with the recommendations of the dealer	30 minutes	1.0C to cut-off voltage[1]	30 minutes
800	In accordance with the recommendations of the dealer	1 hour	0.2C to cut-off voltage[1]	

[1] *Cut-off voltage will vary depending on the chemical composition of the battery in question. A typical cut-off voltage for conventional Li-ion/LiP cells is 3V/cell and 1V/cell for NiMH.*

For NiMH batteries and cells two tests must be performed: Initial capacity testing and cycle life testing (cf. Table 3 and 4). Initial capacity testing is performed in order to ensure that the capacity of the cells/batteries corresponds o the actual discharge ability of fresh cells/batteries. Cycle life testing is performed in order to ensure that the cells/batteries have an appropriate number of charge/discharge cycles offering an acceptable level of performance. Each test must include at least four batteries of each size and brand model. C is the nominal capacity of the battery and is stated on the battery as mAh. The highest capacity value specified on the cell must be used for the purposes of testing.

Initial capacity testing:
All tested batteries must meet the following requirements:
As a minimum, one of five cycles performed during the test must have a discharge period of at least five hours.
All (four) tested cells/batteries must meet the requirement.

Initial capacity testing
The initial capacity test is performed in accordance with Table 3 below. The conditions of the initial capacity test must be in accordance with the version of the standard applicable at the time of application, as referred to in IEC 61951-2 valid for NiMH cells and batteries.

Table 3

Cycle no.	**Charge**	**Rest period during charged phase**	**Discharge**	**Rest period during discharged phase**
1-5	0.1C in 16 hours	1 hour	0.2C to 1.0 V/cells	1 hour

Cycle life testing:
The cycle life testing must be performed in accordance with Table 4 and meet the requirements of Table 5.

Table 4 – Test summary

Cycle no.	**Charge**	**Rest period during charged phase**	**Discharge**	**Rest period during discharged phase**
1	0.1C in 16 hours	30 minutes	1.0C to 1.0 V	30 minutes
2-48	0.3C in 4 hours	30 minutes	1.0C to 1.0 V	30 minutes
49	0.3C in 4 hours	24 hours	1.0C to 1.0 V	30 minutes
50	0.1C in 16 hours	1 hour	0.2C to 1.0 V	30 minutes

Table 5 – Requriements

Type of cell	**Stated capacity**	**Amount of cycles**	**Requirement (1C, second-last cycle)**	**Requirement (0.2C, last cycle)**
LR03 (AAA)	< 850 mAh	500	30 minutes	4 hours
LR03 (AAA)	≥ 850 mAh	400	30 minutes	4 hours
LR06 (AA)	< 2000 mAh	500	30 minutes	4 hours
LR06 (AA)	≥ 2000 mAh ≤ 2500 mAh	400	30 minutes	4 hours
LR06 (AA)	> 2500 mAh	300	30 minutes	4 hours
LR14 (C)	-	500	30 minutes	4 hours
LR20 (D)	-	500	30 minutes	4 hours
Other	-	400	30 minutes	4 hours

☒ The result of testing in accordance with the description in the requirement conducted by an impartial test institution.

☒ Declaration from the testing institute confirming that the batteries are tested in accordance with the version of the standard applicable at the time of application, as referred to in the requirement.

☒ Declaration confirming that the testing institute is impartial and fulfills the general requirements applicable to testing institutes, as provided for in the chapter "Analysis laboratory/test institution" below.

4.1.12 Charger quality

The charger is a supplementary product to the main product, i.e. the rechargeable batteries. Battery producers purchase chargers from subcontractors, which limits their ability to manage, control or maintain an overview over the design and quality of the charger. Even so, they should have scope for imposing requirements on the charger if it is to be sold in a combination pack with the rechargeable batteries. There are considerable differences in quality between the chargers and, accordingly, in the amount of current they use and the amount of wear they cause the batteries during charging[58].

A study of 40 different battery chargers on sale on the Nordic market found major differences in the energy consumption of the individual chargers[59]. This affects not only the environmental impact of the charger itself, but also the environmental profile of the rechargeable batteries, since this will be linked to the properties of the charger.

The requirement is as follows:

Charger quality

If the rechargeable batteries are sold together with a charger, the charger must fulfil the following requirements:

Testing of the charger:

The quality of the charger must be tested by a test laboratory that is impartial and fulfils the general requirements applicable to the test institutions provided for in the chapter "Analysis laboratory/test institution".

C = The maximum capacity (expressed as mAh) specified on the batteries that the charger is sold together with.

The reference charge is defined as a constant charge at 1C, cut off at $-\Delta V = 5$ mV/cell.

Discharge to the cut-off requirement of 1 V/cell.

The rest time is set at 20 minutes between each cycle of charge/discharge and discharge/charge.

Condition of battery and termination of charged capacity at 7 cycles:

Cycle 1	Residual Discharge	C/5
Cycle 2-5	Conditioning	1C
Cycle 6	Determining reference charge 1C	
Cycle 7	Charging of battery in charger	

Cycle 1-6 to be performed in equipment for testing rechargeable batteries.

The charging phase is registered in cycles 6 and 7 to determine the charged capacity for the reference charger and the test charger.

After 7 cycles the average trickle charge and no-load current for the charger is measured.

The measurement must produce the following results:

- The charger must automatically stop charging when the battery is fully charged. Fully charged is defined as a reference charge with a cut-off of $-\Delta V = 5$ mV $\pm$ 10%.
- The maximum trickle charge current must on average be $\leq$ C/20, based on the lowest battery capacity that the charger is recommended to charge by the dealer.

- The maximum no-load current must on average be < C/50, based on the lowest battery capacity that the dealer recommends the charger is recommended to charge.

✉ Results of test as described in the requirement, performed by an impartial test institution.

✉ Declaration confirming that the test institution is impartial and fulfils the general requirements applicable to the test institutions provided for in the chapter "Analysis laboratory/test institution" below.

4.1.13 The requirements of the authorities and quality requirements

In order to ensure that the product continues to fulfil the Nordic Ecolabelling requirements at all times during the period of validity of the licence, Nordic Ecolabelling requires that quality control procedures be in place at the licenceholder and, where applicable, subcontractors/suppliers. In addition, licenceholders must have no unresolved issues with the authorities, this with a view to ensuring that Nordic Ecolabel licence will be awarded only to businesses that operate within the law.

The requirements are as follows:

Responsibility for the Nordic Ecolabel

One person at the licenceholder and at the producer if the latter is not the same as the former must be allocated responsibility for fulfilment of the Nordic Ecolabel requirements and one person must be allocated responsibility for contact with Nordic Ecolabelling.

✉ Organogram showing the persons responsible for the above duties.

Documentation

The licenceholder must be able to present a copy of the application and the basis for calculations and data (including test reports, documents from subcontractors and the like) underlying the documentation submitted in connection with the application.

☺ On-site inspection.

The quality of the rechargeable batteries

The licenceholder must guarantee that the quality of the Nordic Ecolabelled rechargeable batteries will not decline while the licence remains in force.

✉ Procedures for registering and where necessary handling complaints concerning the quality of the Nordic Ecolabelled rechargeable batteries.

Planned changes

Planned changes which impact on the Nordic Ecolabel requirements must be reported in writing to Nordic Ecolabelling.

✉ Procedures showing how planned changes are handled.

Unforeseen deviations

Unforeseen deviations which impact on the Nordic Ecolabel requirements must be reported in writing to Nordic Ecolabelling and logged in a journal.

✉ Procedures showing how unforeseen deviations are handled.

Traceability

The licenceholder must be able to trace the Nordic Ecolabelled rechargeable battery in the production process.

✉ Description/procedures for how this requirement is fulfilled.

Laws and Regulations

The licenceholder must ensure that the applicable regulations governing safety, working environment, environmental legislation and plant-specific terms/permits are followed at all production sites at which the Nordic Ecolabelled products are produced.

✉ Documentation in which the licenceholder confirms fulfilment of the requirement and reporting to the regulatory authority. Appendix 5 must be completed and submitted to Nordic Ecolabelling.

Marketing

The general part of the requirement is removed as decided by the Board of Directors 17 November 2014.

If the Nordic ecolabelled-labelled rechargeable batteries are sold together with a charger, it must be made clear to the consumer, for example by means of the positioning of the Swan logo and the text on the packaging, that the Nordic Ecolabel applies to the batteries only and not to the charger.

✉ If the Nordic Ecolabelled batteries are sold together with a charger, a sample of the packaging must be submitted, clearly showing that the Nordic Ecolabel applies to the batteries only and not to the charger.

5 Changes compared to earlier versions

- The product group definition has been extended and is in accordance with the definition used in the European Union's Batteries Directive.
- It is no longer possible to Nordic Ecolabel a charger under these criteria. Nevertheless, chargers must fulfil certain requirements if they are to be sold together with Nordic Ecolabelled rechargeable batteries.
- Requirements relating to information about the contents of the batteries have been introduced.
- The requirements relating to the metal content of batteries have been reworded so that each of the four metals has a separate requirement level.
- Requirements have been introduced on the handling of, and information on the use, of nanotechnology.
- The requirements applicable to plastic in battery chargers have been updated.
- The requirement that packaging material must comprise a high proportion of recycled materials has been introduced.
- The requirement that the licenceholder must have a code of conduct in place has been introduced.
- The requirements applicable to the quality of rechargeable batteries have been made more stringent and reworded.

- The quality requirements for chargers have been made more stringent and reworded.
- The quality requirements and requirements of the authorities have been updated in relation to Nordic Ecolabelling's standard template.

6 New criteria

The possibility should be considered of imposing further requirements on constituent substances, particularly heavy metals and the use of solvents in the production of the batteries.
The possibility of imposing requirements on energy consumption during the production of the batteries should be considered.
The possibility of imposing transport requirements on certain types of rechargeable batteries should be considered.
Collection figures in the Nordic countries should be monitored with a view to determining whether further requirements as to consumer information should be imposed.
The possibility of imposing the requirement that further consumer information on optimum use/charging of rechargeable batteries should be considered.

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