1 About cadmium

1,1	Hazardous properties of cadmium	Cadmium chemicals are classified as hazardous by the European Chemicals Bureau (ECB). Cadmium should not be released to the environment in an uncontrolled manner.	This is the reason why industry proposes to manage cadmium in "closed loop" which controls the use, collection, recycling and re-use of cadmium, preventing it to end up in the environment.
1,2	Will cadmium production be stopped if Nickel-Cadmium batteries are no longer produced?	Cadmium is not mined for use in batteries or other applications. Cadmium is produced as a by-product of zinc production. The production of zinc, and hence of cadmium will occur independently from the use (or non-use) of cadmium in applications, such as batteries.	Indeed, the non-refined cadmium produced as a by-product (impurity) of zinc refineries needs to be landfilled as hazardous waste.
1,3	Why is cadmium used today in batteries?	Due to its high performance level as an electrode material in batteries and when it is associated with nickel, cadmium is one of the best electrode materials in batteries	The cadmium electrode gives the battery the capacity to operate in extreme environments such as very low or very high temperatures. It provides high power to the battery which can be operated under high current drain and fast charging rate.
1,4	In a battery, can we substitute the cadmium metal by another metal ?	Each metallic element and compound gives a battery its unique set of performances. Replacing cadmium by another metal (such as zinc) or an alloy (metal hydride) does not give the same performance from a rechargeable battery.	The choice of a battery type is made in accordance with the technical requirements of each application. Hence, substitution is a natural process driven by market development and technological innovation.. Today, Nickel-Cadmium batteries are used in advanced applications requiring high current drain and high power, whilst in other applications market developments have led to selection of other technologies (see 2.2.).

2 Batteries in the economic sphere

2.1.	Where are Ni-Cd batteries used today?	Portable batteries are used mainly in cordless power tools applications and specialty appliances in niche markets. Less than 10% (by weight) are used in household products	Industrial batteries are used in stand-by power, railways, electric vehicles, photovoltaic (e.g. …) and safety applications, such as back-uppower supply for hospitals, building, road signalisation, eergency lighting...
2.2.	What has been the evolution of the application field for Nickel-Cadmium batteries ?	**Portable** Ni-Cd batteries were used in the first generation of telecommunication, electronic and computing equipments. In these applications requiring low currents Ni-Cd is replaced to-day by other technologies for technical reasons. The market of Ni-Cd batteries has changed to high-drain, high technical performances applications.	Over the last twenty years, **industrial** Ni-Cd batteries have known little change in their application fields. They are used in high-end, high value-added applications, where they compete with Lead-acid batteries.
2.3.	How long will a rechargeable battery stay in the economic sphere?	Date coding of spent rechargeable batteries has been made both on separately collected batteries and on batteries found in Municipal Solid Waste.	The results of these investigations reveal that more than 50 % of the Ni-Cd batteries identified have a life span of over 10 years, often going up to 15-20 years.
2.4.	Are portable Nickel-Cadmium batteries sold individually ?	More than 95 % of portable Ni-Cd batteries (by weight) are sold incorporated in equipment.	All industrial batteries are sold as an assembly of muti-cells with a weight varying from several hundreds of grams to several hundreds of kilograms.
2.5.	What is the market forecast for Ni-Cd batteries ?	Ni-Cd batteries will continue to be used in electrical and electronic equipment (EEE) where high current drain will be required in extreme operating conditions.	For industrial applications, future markets are mainly in standby and emergency power as well as in motive power and electric vehicles. For non-industrial applications, the Cordless Power Tool segment will dominate together with specialty applications such as electric bikes, gardening equipment and professional applications for motive power and high current performances.

3 End of Life

3.1.	Is there a stock of Ni-Cd batteries in the economic sphere ?	Due to the very long lifetime of the equipment powered by Ni-Cd batteries, a significant percentage of batteries remain in the economic sphere for 15 to 20 years. This has been proven by market surveys and date coding on collected spent batteries.	An efficient collection and recycling system is required to collect the flow of batteries present in waste from electrical and electronic equipment (WEEE).
3.2.	Where are nickel-cadmium batteries going at the end of their service life	In the case of household batteries, spent batteries may end-up in two major waste streams categories.	a. the non-recycled waste stream and b. the collected spent batteries waste stream
3.3.	Are **Ni-Cd** batteries the main source of Cd in the environment?	The recently achieved Targeted Risk Assessment Report on the use of cadmium in batteries confrms that Ni-Cd batteries in Municipal Solid Waste (MSW) streams contribute only 1 to 2 % to the total cadmium emissions to the environment.	The main anthropogenic sources of cadmium emissions are the use of fertilizers, coal firing plants, iron and steel production, non-ferrous metals production….
3.4.	When Ni-Cd batteries are present in non-reccyled waste streams, do Ni-Cds pose a risk to the environment and human health.	When the fraction of cadmium in non-recycled waste streams is maintained under control, the exposure level of human beings to cadmium is also controlled and risk can be avoided.	Cadmium sources in non-recycled waste streams are numerous and well document. Among others they are: wood and bio-degradable materials, synthetic materials, non-ferrous metals alloys,… Spent Ni-Cds represent less than 50 of the cadmium sources in non-recycled waste streams.

3 End of Life

3.5.	Isn't it better to simply ban Ni-Cd batteries instead of setting up costly collection and recycling schemes?	The European Commission carefully looked at various policy options, including a possible ban. It came to the conclusion that a policy of efficient collection and recycling with binding, measurable targets is the appropriate way forward, offering a high level of protection against any potential risks that might emanate for Ni-Cd batteries.	The Commission's conclusions are based on the results of both the recent Targeted Risk Assessment Report on the use of cadmium in batteries, and the Extended Impact Assessment on policy options for the management of spent batteries. These show that the risk emanating from Ni-Cd batteries is small, and that in view of social, economic and environmental considerations ("sustainability"), a ban would not be justified.
3.6.	Are there accurate and affordable ways to measure batteries in Municipal Solid Waste (MSW) streams?	Measuring the composition of MSW streams is successfully done in several EU countries. There are two different methods for evaluating the spent battery content of MSW.	A first method ("sampling approach") is based on the collection and analysis of a representative sample of household waste in a given country. The second method ("sorting") is based on the continuous sorting of MSW before entering an incinerator or a landfill.

3 End of Life

3.7.	For portable Ni-Cd batteries, is the collection target of 80% high enough?	The Targeted Risk Assessment on cadmium in batteries and the Extended Impact Assessment show that a collection efficiency of 75% for portable Ni-Cd batteries is adequate to keep future potential emssions from batteries below a level that could pose a risk to health and environment.	Various collection schemes in EU Member States reached collection efficiencies for spent batetries between 60 % and 90 %.
3.8.	Are deposits an appropriate tool to increase collection rates?	Deposits are suitable for products with a short lifetime (e.g. refillable drink containers). However, given the long lifetime of rechargeable batteries on the market (sometimes up to 15-20 years)~~,~~, a deposit would have only a very limited impact on collection efficiency.	The main practical and economic problem is the refund of a deposit 20 years after the purchase time. When using deposts, the number of collection points is drastically reduced as the accounting system reduces the possibilities to leave spent batteries in non-commercial areas.
3.9.	Which economic instruments could be used to support the collection and recycling of spent batteries?	Experience from various Member States where the collection is financed show that the visible fee is the most appropriate financing tool. It ensures that each actor of the economic chain will participate in the financing of collection and recycling.	The aim of a visible fee is to avoid the incremental taxation and profit taking on a product during its transfer through the various economic actors.
3.10.	Will the WEEE Directive help to increase collection rates?	As about 95% of portable rechargeable batteries are sold together with electrical and electronic equipment, the WEEE Directive will increase collection rates.	Estimates on the quantities of brown goods returning as a result of implementing the WEEE Directive in the 15 Member States suggest that a doubling of the collected spent battery quantities is feasible

3 End of Life

3.11.	Are there significant emissions of cadmium from batteries present in landfills?	Surveys of scientific literature in the framework of the TRAR show that the level of cadmium emissions from Household Waste landfills remains below drinking water quality limits.	An independent German institute (FES - Nuremberg -Research and Development Centre of Hazardous Wastes) has been asked to evaluate the potential emissions of cadmium from landfills containing spent batteries. Results indicate that such emissions are not anticipated to increase significantly with time. Indeed the alkalinity of the landfill and of the battery content will lead to the immonbilisation of cadmium as insoluble cadmium carbonate.

4 Collection and recycling

4.1.	Is recycling of cadmium a well established practise?	In Europe the collection and recycling of nickel cadmium batteries is a well established business. In the 1980s when the market for Ni-Cd batteries took off and the value of recovered materials was higher than the processing costs, making recycling a profitable business that is well established in various parts of the world (EU, USA and Asia).	In the 1990s the price fluctuations of metals such as nickel, camium and scrap iron modified significantly the economic value of recycling. Today, when the price of nickel is higher than 8.0 €/kg, the recycling business is profitable. If not, additional financing is needed, particularly through collective and/or private collection and recycling schemes. (following sentence unclear) Sometimes the overall "colection + recycling" operation needs to be financed in order to cover financially the various operations. This is particularly achieved through Collective Schemes for spent battery collection and recycling.

4.2.	Closing the loop: reality or utopia?	The company Saft in Sweden is probably the only producer of batteries in the world to have integrated battery manufacturing and recycling. This has been done since 1980 in the Oskarshamn plant in Sweden.	The recovered cadmium from spent Ni-Cd batteries is re-used in new batteries after distillation, melting and refining. Such Closed Loop operations are achieved for the nickel and cadmium content of Ni-Cd accumulators through spent battery collection schemes and the European Recycling Industry of Ni-Cd batteries.

4.3.	How far can we close the loop?	There are two waste streams of spent batteries where cadmium cannot be recovered. The stream that is landfilled and the stream that is incinerated.	The objective of RECHARGE is to reduce the content of spent Ni-Cd in these streams to the minimum. This is why RECHARGE is in favour of a ban on the landfilling of collected spent Ni-Cd batteries.

4 Collection and recycling

4.4.	How can we **stop spent batteries escaping** from the loop?	The objective is to collect all industrial Ni-Cd batteries reaching an end of life and to have all of them processed for recycling. For portable batteries, the objective is to minimise the presence of spent portable Ni-Cd batteries in MSW. The following elements will be implemented to reach such an objective:	**1.** Implementation of an new battery Directive requesting the collection and recycling of all types of batteries, their financing and fixing binding targets. **2.** Participation of all producers in WEEE collection programs (individual or collective) **3.** Progressive shift of the market from household to professional and industrial applications.

5 Indusrtry's position

5.1.	Is the Ni-Cd Industry pro-active or reactive?	The Ni-Cd battery industry has been pro-active for more than twenty years in promoting collection and recycling of Ni-Cd batteries. This comes in addition to the day-to-day business organised by the Ni-Cd battery recycling industry.	Ni-Cd producers and OEMS (Original Equipment Manufacturers) participate in nationwide collection and recycling programs. In certain MS they have opened their own collection schemes from which batteries are shipped to recyclers. The development of these intiatives was slowed down by the lack of coherence of the 1991/157 directive and the difficulty to implement it in a majority of MS.
5.2.	What is the role of RECHARGE	RECHARGE is actively promoting the collection and recycling of all types of Ni-Cd batteries. RECHARGE actively supports a coherent and effective EU Battery Directive with binding targets. Such a Directive will assist the proactive parts of industry to further increase collection and recycling, while preventing free riders.	The association also carries out an extensive data acquisition program to evaluate five key market elements. 1. Sales quantities, 2. Quantities collected separately 3. Quantities processed for recycling, 4. Quantity of batteries in MSW, 5. Evaluation of batteries in Hoarding. - Data are published on the Web Site and available to the public.