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**DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
ON BATTERIES AND ACCUMULATORS AND SPENT BATTERIES AND
ACCUMULATORS**

EXTENDED IMPACT ASSESSMENT

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1. WHAT ISSUE/PROBLEM IS THE POLICY/PROPOSAL EXPECTED TO TACKLE?

1.1. Introduction: Characteristics of the Battery Market

The battery market can be divided into primary (non-rechargeable) and secondary (rechargeable) types. Batteries can also be differentiated according to users, technologies or size (see table attached in Annex I). The most common market segmentation is to distinguish between portable batteries (used by households or professional users), automotive batteries (starter lighting ignition) and industrial batteries.

The consumer battery market in Western Europe¹ grew by approximately 70% (from 2.8 to 4.9 billion units per year) between 1985 and 1995 and was worth 3.8 billion € in 1995. In terms of weight, 4.9 billion units are equivalent to about 200,000 tonnes of batteries. With the exception of the rechargeable battery market in 2001, the battery market has been growing continuously during the last few years.² The global demand for batteries is projected to grow by more than five percent over the coming years, with the portable batteries market growing the fastest.³ In 2002, 1,207,260 tonnes of batteries were placed on the EU-15 market (158,270 tonnes of portable batteries, 859,500 tonnes of automotive batteries and 189,260 tonnes of industrial batteries).⁴ The market for rechargeable batteries is expected to grow faster than that for primary (non-rechargeable) batteries. An increased demand for health care devices, wireless phones (incl. 3G) and digital cameras is likely to be at the root of this.

Concrete data on employment in the EU battery market are unavailable due to dynamics of the sector (restructuring) and the global nature of the manufacturers. There are approximately 500 manufacturers of lead-acid batteries and accumulators world wide. Globally, it is estimated that the lead-acid battery industry provides employment for about 60,000-70,000 people. The EU accounts for 27% of this market. As regards the NiCd battery market, industry claims that 3,500 people are directly employed by nickel-cadmium (NiCd) battery producers in the EU-15.

1.2. What is the issue/problem given policy area expressed in economic, social and environmental terms including unsustainable trends?

Each year, approximately 800.000 tonnes of automotive batteries, 190.000 tonnes of industrial batteries and 160.000 tonnes of portable batteries are placed on the Community market. Batteries and accumulators pose not particular environmental concerns when they are in use or kept at home. However, sooner or later those batteries will become waste and risk of contributing to the final disposal of waste in the Community. In 2002, for example, 45.5% of the portable batteries and accumulators sold in the EU-15 that

¹ EU-15 plus Norway and Switzerland.

² Avicenne Development, "The World Wide Rechargeable Battery Market", Paris, April 2003

³ The Freedonia Group, "World Batteries" report, published in October 2002

⁴ "Impact Assessment on Selected Policy Options for Revision of the Battery Directive", Bio Intelligence, July 2003, pages 50, 36, 41.

year went to final disposal (incineration or landfill), instead of being collected and recycled.⁵

The environmental concerns related to batteries and accumulators are linked to the materials they contain. This is particularly the case for mercury, lead and cadmium. Commission Decision 2000/532/EC⁶ has established two categories of batteries: non-hazardous and hazardous batteries. Hazardous batteries are lead batteries, NiCd batteries and mercury-containing batteries. Mercury, various compounds of cadmium and lead are classified under Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.⁷

- **Mercury:** Mercury is known for a variety of documented, significant adverse impacts on human health and the environment. Mercury and its compounds are highly toxic, especially to the developing nervous system⁸.

Under Directive 67/548/EEC, mercury is classified as

- T; R 23 - Toxic by inhalation;
- R33 - Danger of cumulative effects; and
- N; R50-53 - Dangerous for the environment / Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Organic and inorganic mercury compounds in general are classified as

- T+; R26/27/28 - Very toxic by inhalation, in contact with skin and if swallowed
- R33: Danger of cumulative effects⁹
- N; R50-53 - Dangerous for the environment / Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

⁵ Annual sales in 2002 were estimated at 158720 tonnes and an estimated 72155 tonnes of portable batteries were set to landfill or incineration. "Impact Assessment on Selected Policy Options for Revision of the Battery Directive", Bio Intelligence 2003.

⁶ Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste, OJ L 226/3 of 06.09.2000.

⁷ OJ L 196, 16.8.1967, p. 1.

⁸ See Global Mercury Assessment, United Nations Environmental Programme, Chemicals; Geneva, Switzerland, December 2002

⁹ Inorganic mercury which is spread in the water is transformed to methylated mercury in the sediments at the bottoms. Methylated mercury easily accumulates in living organisms and becomes concentrated through the food chain via fish. Methylated mercury has chronic effects and causes damage to the brain.

Despite the restriction of the use of mercury in batteries and accumulators¹⁰, mercury batteries and accumulators produced before this restriction are still on the market. For example in Germany, GRS reported that the average mercury content of the general purpose batteries and accumulators was approximately 60 ppm in 1998, 100 ppm in 2002 and is expected to be 10 ppm in 2005. In 2001, it was estimated that six tons of mercury batteries and accumulators were still hoarded in Germany, since the rate of return for button cells containing mercury is only around 10% of sales volume.¹¹ In addition, a minority of batteries produced by factories in South-East Asia and imported into the EU still contain certain amounts of mercury.¹²

- Cadmium is a toxic and carcinogenic substance. The International Agency for Research on Cancer has identified Cd as a known human carcinogen. Epidemiologic studies of Cd-exposed workers show excess lung cancer. The main non-cancer endpoint of concern is kidney damage. Bone and hematologic disorders have also occurred at high level exposure. A wider range of organ toxicity has been demonstrated in animals¹³.

Under Directive 67/548/EEC, cadmium compounds in general are classified as

- Xn; R20/21/22 - harmful by inhalation, in contact with skin and if swallowed
- N; R50-53 - Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Due to the results of the risk assessment carried out under Regulation (EEC) 793/93, the following classification of cadmium and cadmium oxide is proposed for the 29th ATP of Directive 67/548/EEC

- T; R48/23/25 - Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
- T+; R26 - Very toxic by inhalation
- Carc. Cat. 2, R45 - Carcinogenic substance category 2¹⁴
- Muta. Cat.3, R68 - Mutagenic substance category 3¹⁵ / Possible risk of irreversible effects

¹⁰ Established by Directive 98/101/EC, amending Directive 91/157/EEC, O.J. L 1/1 of 5.1.1999.

¹¹ See press release of 5 June 2002 of the Bundeskartellamt, <http://www.umweltbundesamt.de/uba-info-presse-e/presse-informationen-e/p5602e.htm+mercury+batteries+Germany+2002&hl=fr&ie=UTF-8>.

¹² Communication on Environmental Taxes and Charges in the Single Market, COM(1997)009final.

¹³ See Risk Assessment, Cadmium oxide / Cadmium metal; Final Draft, July 2003 http://ecb.jrc.it/php-pgm/open_file.php?ITEM=Draft_RAR&CASNO=7440439&FICHIER=/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/DRAFT/R303_0307_env_hh.pdf

and Results of the 2nd SCOPE Environmental Cadmium workshop, University of Ghent, Belgium, September 2003 <http://www.icsu-scope.org/cdmeeting/2003meeting/cdindex.htm>

¹⁴ Substance which should be regarded as if it is carcinogenic to man.

¹⁵ Substance which cause concern for man owing to possible mutagenic effects.

- Repr. Cat.3; R62-63 - Substance toxic to reproduction category 3¹⁶ / Possible risk of impaired fertility and possible risk of harm to the unborn child
- N; R50-53 - Dangerous for the environment / Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Batteries have the highest concentration of cadmium compared to the other typical metal concentration of MSW constituents.¹⁷ The EU regional consumption of cadmium reaches the value of 2.638 tonnes, which are distributed for 75.2% to NiCd batteries, 14.9% to pigments, 5% to stabilisers and 5% in alloys and plating".¹⁸ Portable NiCd batteries and accumulators are reported to contain on average 13% of cadmium by weight and industrial NiCd batteries and accumulators 8% by weight.

- Lead: under Council Directive 67/548/EEC, lead compounds in general are classified as:
 - Repr. Cat.1, R61 - Substance toxic to reproduction category 1¹⁹ / May cause harm to the unborn child,
 - Repr. Cat.3, R62 - Substance toxic to reproduction category 3²⁰ / Possible risk of impaired fertility,
 - Xn; R20/22 - Harmful by inhalation and if swallowed,
 - R33 - Danger of cumulative effects,
 - N; R50-53 - Dangerous for the environment / Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Above certain concentrations, lead is toxic to humans. Continued or acute overexposure to lead can cause severe and cumulative health problems. Lead affects the major organs as well as the central nervous and circulatory systems. Lead exposure is most serious for young children because they absorb lead more easily than adults and are more susceptible to its harmful effects. During pregnancy, especially in the last trimester, lead can cross the placenta and affect the unborn child. Lead can have adverse effects on the ecosystem, including interference with growth and productivity of marine life, and toxicity of fish.²¹ The relative importance of any single source of exposure is difficult to predict and will

¹⁶ Substance which cause concern for human fertility / substance which cause concern for humans owing to possible developmental toxic effects

¹⁷ TRAR on the use of cadmium oxide in batteries, draft final report May 2003, page 67. This report states that the final contribution to the overall cadmium content is dependent on the weight distribution of the different waste components.

¹⁸ TRAR on the use of cadmium oxide in batteries, draft final report May 2003, page 28.

¹⁹ Substance known to cause developmental toxicity in humans

²⁰ substance which cause concern for humans owing to possible developmental toxic effects

²¹ see report "Risks to Health and the Environment related to the Use of Lead in Products"; TNO report STB-01-39 (Finals)

<http://europa.eu.int/comm/enterprise/chemicals/legislation/markrestr/studies/lead.pdf>

vary with geographic location, climate and local geochemistry. The main concern in regard to the presence of lead in landfills is the potential for the lead to leach and contaminate drinking water supplies.

As regards the use of lead in batteries and accumulators, lead-acid batteries and accumulators are the largest use of the global lead production. In 1997, it was reported that these batteries use about 73% of the total global lead production.²²

Other metals used in batteries, such as zinc, copper, manganese, lithium and nickel may also pose an environmental risk when they accumulate in the environment after disposal operations (landfill or incineration). Batteries and accumulators may also contain strong acids or bases and many are considered corrosive. As an illustration, Annex II provides an overview of the different material compositions of portable battery types.

Spent batteries and accumulators enter the environment when they are landfilled or incinerated. As regards portable batteries and accumulators, 45.5% of the annual sales in the EU-15 went to final disposal (incineration or landfill) in 2002.²³ Metals from batteries which are landfilled or incinerated may pollute lakes and streams, vaporise into the air when incinerated, or may leach into groundwater after landfilling and expose the environment to highly corrosive acids and bases. Although mercury, lead and cadmium are by far the most problematic substances in the battery waste stream, other metals contained in batteries, such as nickel, zinc, manganese and lithium, should also not be disposed of together with the ordinary household waste.²⁴

Directive 2000/76/EC on the incineration of waste sets stringent emission limit values, which could lead to a significant reduction in emissions of various pollutants to the atmosphere. At present incinerators have to meet emission limit values of 0.05 mg/m³ cadmium.²⁵ In case of incineration of batteries, metals such as cadmium, mercury, zinc, lead, nickel, lithium and manganese will be found in the bottom-ashes and fly ashes. Incineration of batteries thus contributes to emissions of heavy metals to air and reduces the quality of the fly ashes and bottom-ashes (incineration residues).

The main disposal route for spent batteries is landfilling. It is estimated that 75% of the disposed spent batteries are being landfilled. The main environmental concerns associated with the landfilling of batteries are related to the generation and eventual discharges of leachate into the environment.²⁶ A particular concern related to lithium batteries is their risk of explosion.

²² See, Lead Industry Profile at the on-line lead fact book, Icon 2001; <http://www.ldaint.org/factbook/factbookch3.htm>.

²³ Annual sales in 2002 were estimated at 158720 tonnes and 72155 tonnes of portable batteries were estimated to be landfilled or incinerated. "Impact Assessment on Selected Policy Options for Revision of the Battery Directive", Bio Intelligence 2003.

²⁴ Compare "Market, evolution of technological progress and environmental impact of batteries and accumulators", Environmental Resources Management (ERM), July 1997, p. 12.

²⁵ Directive 2000/76/EC on the incineration of waste, OJ L 332, 28.12.2000, p. 91; limit for new plants as from 12/2002 and for existing plants as from 12/2005.

²⁶ Leachate is generated as a result of the expulsion of liquid from the waste due to its own weight or compaction loading ('primary leachate') and the percolation of water through a landfill ('secondary leachate'). The source of percolating water could be precipitation, irrigation, groundwater or leachate recirculated through the landfill.

The environmental risks related to the disposal of cadmium batteries are assessed in the draft Targeted Risk Assessment Report “Cadmium (oxide) as used in batteries” (TRAR),²⁷ which is currently being peer-reviewed by the Scientific Committee on Toxicity, Eco-toxicity and the Environment (SCTEE).²⁸ According to the TRAR, the cadmium emissions of portable nickel-cadmium batteries due to incineration was calculated to be 323 – 1.617kg of cadmium per year to air and 35-176 kg of cadmium per year to water. Total cadmium emissions of portable nickel-cadmium batteries due to landfill was calculated at 131-655 kg of cadmium per year.²⁹

In 2002, 45.5% of the portable batteries and accumulators sold in the EU-15 that year went to final disposal (incineration or landfill).³⁰ It is estimated that in 2002 at EU level 2.044 tonnes of portable NiCd batteries were disposed of in the municipal solid waste stream.³¹ However, a large quantity of batteries and accumulators – even spent batteries - are kept at home, for many years, by end-users before being discarded (‘hoarding of batteries’). At EU level it is estimated that households hoard 37% of portable batteries and accumulators.³² With rechargeable batteries and accumulators, including NiCd batteries, the hoarding effect may be even higher.³³ At the moment, whenever the end-user decides to dispose of those batteries and accumulators conventionally, they may end up in the municipal solid waste stream. The TRAR states: *“If NiCd batteries cannot be collected efficaciously, the future cadmium content in the MSW stream is predicted to increase. The impact of this potential increase on future emissions has been assessed for MSW incineration only. The impact of a future change in the MSW composition on the composition of the leachate of a landfill could not be judged based on the current lack of knowledge and methodology”*.³⁴

In particular, the risks related to the uncertainties about the long-term leachate combined with the dangerous characteristics of materials used in batteries and accumulators require the adoption of risk management measures.

²⁷ Targeted Risk Assessment Report (TRAR), draft final report of May 2003, carried out by Belgium within the framework of Regulation 793/93 (OJ L 224 of 3.9.1993, 9.p 34)

²⁸ The SCTEE will give its opinion to the European Commission on the overall scientific quality of the report.

²⁹ See TRAR, draft final report of May 2003, page 133. The following assumptions are made: portable NiCd batteries account for 10-50% of the total MSW cadmium content, the total cadmium content of MSW on dry weight basis equal 10 g/tonne, and 24.4% of the spent portable nickel-cadmium batteries are sent to incineration activities and 75.6% to landfill activities.

³⁰ Annual sales in 2002 were estimated at 158720 tonnes and an estimated 72155 tonnes of portable batteries were sent to landfill or incineration. “Impact Assessment on Selected Policy Options for Revision of the Battery Directive”, Bio Intelligence 2003.

³¹ “Impact Assessment on Selected Policy Options for the Revision of the Battery Directive”, Bio Intelligence 2003.

³² “Impact Assessment on Selected Policy Options for the Revision of the Battery Directive”, Bio Intelligence 2003.

³³ The industry claims that 65-95% of portable NiCd batteries sold over the last 10 years are still being hoarded, source: CollectNiCad.

³⁴ TRAR, Final Draft May 2003, page 7. Furthermore, the TRAR itself also indicates the following lack of methodologies to assess certain impacts: *“neither the delayed cadmium emissions of the re-use of incineration residues nor the impact of future expected increase in cadmium content of bottom ash and fly ash on the re-usability of these incineration residues have been quantified”* (page 6) and *“the contamination of the groundwater compartment due to fugitive emissions of landfills have not been quantified in this TRAR since no guidance is available to perform these calculations”* (page 7).

Indeed, as long as efficient and effective collection and recycling systems are not in place throughout the EU,³⁵ an increasing amount of batteries risks ending up in landfills or incinerators thus increasing the environmental and health risks connected with heavy metals used in batteries. This trend is not sustainable and should be reversed.

In the current situation this trend does not seem to apply to industrial and automotive lead-acid batteries. This is because lead has a relatively high value, making collection and recycling economically attractive. Industry has set up collection systems for these batteries, thereby preventing the disposal of these batteries. However, lead prices are subject to fluctuations and, in the future, the economic incentive to collect and recycle these batteries could decline.

Given the potential health and environmental problems connected with heavy metals, such as lead in waste streams, appropriate measures seem advisable to also ensure that the current high collection and recycling of industrial and automotive lead-acid batteries continues.

Moreover, at present, many spent batteries which are collected and then disposed of, instead of being recycled.³⁶ Bio Intelligence reported that in 2002, out of the 22.361 tonnes of portable primary batteries collected, 19.643 tonnes were sent to a recycling facility.³⁷ For portable rechargeable batteries the entire amount collected (4.862 tonnes) was sent to a recycling facility. EPBA reported a recycling of 10.710 tonnes of portable primary batteries and 4.657 tonnes of portable rechargeable batteries in 2002.³⁸ This trend is also unsustainable and should be reversed as well.

On a resource management level, batteries are considered as an ore of secondary raw materials.³⁹ Valuable metals such as nickel, cobalt and silver could be recovered.

³⁵ Annex III gives a description of the collection and recycling of batteries and accumulators under the current Community legislation.

³⁶ In the UK, for example, collected industrial NiCd batteries are disposed of in landfills (see “Analysis of the Environmental Impacts and Financial Costs of a Possible New Directive on Batteries”, ERM 2000). In Sweden all alkaline manganese and zinc carbon batteries are put in landfills after collection. In Germany approximately 30% of the portable batteries collected separately are sent to landfills.

³⁷ “Impact Assessment on Selected Policy Options for the Revision of the Battery Directive”, Bio Intelligence 2003.

³⁸ See: <http://www.ebrarecycling.org/ArticlesPDF/pressreleases/EBRAPressrelease4-6.pdf>

³⁹ Compare for example the metallic content of a zinc ore (15%) with the zinc content of batteries (20%).

In terms of tonnage, the following estimated amount of metals would not go to landfills/incineration, but could be recovered:

Manganese:	20 000 tonnes/year
Zinc:	20 000 tonnes/year
Iron:	15 000 tonnes/year
Lead:	7 500 tonnes/year
Nickel:	2 000 tonnes /year
Cadmium:	1500 tonnes/year
Mercury:	28 tonnes/year

Additionally, a range of substances such as various acids, salts and plastics which are also contained in the batteries will be captured by the system and diverted from municipal waste to specific installations equipped to deal with waste batteries.

The use of recycled metals in battery production instead of virgin metals has positive environmental impacts through reduced energy use and reduced pollution related to the mining of the virgin source. As an example, using recycled cadmium and nickel require respectively 46% and 75% less primary energy compared with the extraction and refining of virgin metal.⁴⁰ For zinc, the relation between the energy needed for recycling and the energy needed for extraction from primary resources is 2.2 to 8.⁴¹ These figures are particularly important given the fact that the primary production of metals is the source of approximately 10% of global CO₂ emissions.

1.3. What is (are) the underlying drivers?

The EU waste hierarchy defines the priorities in waste treatment. It gives preference firstly to waste prevention, then to recycling, then to energy recovery and finally to disposal. Indeed, the Communication from the Commission on the review of the Community Strategy for waste management assigns prevention of waste the first priority, followed by re-use and recovery and finally by safe disposal of waste. Moreover, in its Resolution of 24 February 1997 on a Community Strategy for waste management the Council reiterated its conviction that waste prevention should be a first priority for all rational waste policy, in relation to minimising waste production and the hazardous properties of waste.⁴²

The main impetus for this Proposal comes from the Sixth Community Environment Action Programme (6EAP) which lays down the key environmental objectives and priorities for the next ten years starting as from 22 July 2002.⁴³ In the field of the

⁴⁰ Rydh, C.J., Karlström, M. (2002) Life Cycle Inventory of Recycling Portable Nickel-Cadmium Batteries, Resources, Conservation and Recycling, No. 34, p. 289-309.

⁴¹ Metaller, materialflöden i samhället, Naturwardsverket, rapport 4506, p. 27.

⁴² OJ C 76, 11.03.1997, p. 1.

⁴³ OJ L 242, 10.9.2002, p. 1.

sustainable use and management of natural resources and wastes, the 6EAP identifies four specific objectives, including “*a significant reduction in the quantity of waste going to disposal and the volumes of hazardous waste produced, while avoiding an increase of emissions to air, water and soil*” and “*encouraging re-use for wastes that are still generated: the level of their hazardousness should be reduced and they should present as little risk as possible, preference should be given to recovery and especially recycling; the quantity of waste for disposal should be minimised and should be safely disposed of (...)*”⁴⁴

The 6EAP stipulates that those objectives shall be pursued by, among others, developing or revising the legislation on batteries.⁴⁵

Another underlying driver comes from Directive 2002/96 on waste electrical and electronic equipment.⁴⁶ This Directive calls for the revision of Directive 91/157/EEC as soon as possible.

Other underlying drivers for this revision are the commitment made by the Community, initially in Council resolution of 25 January 1988⁴⁷ and later in the Fifth Community Environment Action Programme, to take all the necessary measures to reduce the migration and accumulation of cadmium in the environment. This commitment has resulted in many pieces of Community legislation to prevent cadmium’s harmful effects aimed at reducing its emissions to air, soil and water. Directive 2000/53/EC on end-of-life vehicles already provides for the phase-out of cadmium in batteries used in vehicles by 31 December 2005.⁴⁸

Moreover, a new Community initiative in this area is driven by the current divergent situation in the Member States. For instance, some Member States already collect and recycle all the batteries on their territory, whereas others only collect and recycle hazardous batteries containing lead, mercury and cadmium. A new Community initiative in this area would contribute to a proper functioning of the internal market.

A new Community initiative in this area would also be in line with the Community policy of simplifying legislation as the current Battery Directives could then be repealed and replaced by one single legal instrument (see below paragraph 3.1).

1.4. What would happen under a ‘no policy change’ scenario?

If there is no change to current policy, batteries with their metal content such as cadmium, lead and zinc, will continue to accumulate and migrate in the environment. Given the hoarding effect, sooner or later consumers will also start discarding hoarded batteries. Under the current situation, collection of portable batteries can, under a worst case scenario, be as low as 5% of the annual sales, with 90% of the collected amount going to landfills or incinerators (see paragraph 4.1.1).

⁴⁴ See Article 8 (1) third and fourth indent of the 6EAP.

⁴⁵ See Article 8(2) fourth indent of the 6EAP.

⁴⁶ OJ L 37/24, 13.02.2003, recital 11.

⁴⁷ O.J. C 30 of 4.02.1988.

⁴⁸ The Commission may extend this deadline if proven justified by the analysis of the progressive substitution of cadmium in vehicles. See Article 2 of Commission decision 2002/525/EC of 27 June 2002, O.J. L 170/81 of 29.06.2002.

For spent industrial and automotive lead-acid batteries collection and recycling is currently driven by economic forces (see paragraph 1.3). However, if the lead price would fall drastically, this trend could be jeopardised.

The impacts in economical, economic and social terms of this ‘no policy change scenario’ are assessed in paragraph 4.1.1.

1.5. Who is affected?

The proposal affects stakeholders involved in battery manufacturing, sales, collection, sorting and recycling business, such as:

- producers of raw materials used in batteries (for example the zinc, lead, nickel and cadmium industry);
- producers of portable, industrial and automotive batteries and accumulators;
- producers of appliances which incorporate batteries and accumulators;
- retailers selling batteries, accumulators and appliances. These may range from large supermarkets to smaller specialised shops;
- waste collectors, recyclers and other businesses specialising in waste management;
- municipalities;
- consumers.

2. WHAT MAIN OBJECTIVE IS THE POLICY/PROPOSAL SUPPOSED TO REACH?

2.1. What is the overall policy objective in terms of expected effects?

The main policy objective is to introduce policy measures which should divert all spent batteries and accumulators from final disposal operations (landfill and incineration) and to ensure that collected batteries are sent to recycling facilities. Additional measures should be proposed with respect to batteries containing mercury, cadmium and lead since they are qualified as hazardous waste. The proposed measures should ensure that Member States adopt environmentally sound waste management practices which will lead to an efficient collection and recycling of spent batteries and a proper functioning of the internal market. . In general terms, the expected effects of the overall policy objective are a gradual movement from the situation in the left column to a situation in the right column:

Current situation	Expected effects of proposed measures
Landfilling/incineration of heavy metals used in batteries and accumulators	Reducing heavy metal content of batteries and accumulators
Burden on municipal landfill	Avoiding final disposal of batteries and accumulators
Leachate uncontrolled in the long term	
Low/inefficient collection of spent batteries and accumulators in the EU	High/efficient collection of spent batteries and accumulators in the EU
Low recycling of batteries and accumulators	High recycling carried out in or close to break-even point
Free riders on the battery market	Efficient measures against free riders
Low density of collection	Concentration of collection streams (possibly integrated with other waste streams)
High hoarding of portable batteries and accumulators	Reduce hoarding
No producer responsibility	Extended (or shared) producer responsibility ⁴⁹
Resources wasted	Recovery of resources
High collection costs	Lower collection costs through specific schemes
Lack of harmonisation	Clear legislative framework coherent with other Directives

2.2. Has account been taken of any previously established objectives?

The policy/proposal builds upon the objectives established by the current Battery Directive, namely to approximate the laws of the Member States on the recovery and controlled disposal of batteries and accumulators containing lead, mercury and cadmium.⁵⁰

Moreover, improving waste management in general is recognised as a major environmental challenge not only at Community level but also at international level. The plan of implementation agreed at the World Summit on Sustainable Development (Johannesburg 2002) builds on Agenda 21 and call for further action to “prevent and minimise waste and maximise reuse, recycling and the use of environmentally friendly alternative materials, with the participation of government authorities and all

⁴⁹ OECD Seminar on Extended Producer Responsibility, EPR: Programme Implementation and Assessment 13-14 December 2001 (Evaluation of EPR programmes for batteries)

⁵⁰ See Article 2 of Directive 91/157/EEC.

stakeholders, in order to minimise adverse effects on the environment and improve resource efficiency”.⁵¹

To re-incorporate waste in the economic cycle (‘closing the materials loop’), i.e. waste recovery, is recognised by the Communication from the Commission “Towards a Thematic Strategy on prevention and recycling of waste”⁵² as an important element of a comprehensive approach to resource management. The current proposal also takes account of the objectives of the recent Commission Communication on Integrated Product Policy.⁵³ This Communication sets as its objective the reduction of environmental impacts from products throughout their life-cycle, harnessing, where possible, a market driven approach, within which competitiveness concerns are integrated.

Other pieces of Community legislation also aim to improve the waste management of specific waste streams, such as Directive 94/62/EC on Packaging and Packaging Waste, Directive 2000/53/EC on end of life vehicles, Directive 2002/96/EC on waste electrical electronic equipment and Directive 2002/95 on the restriction of the use of hazardous substance in electrical and electronic equipment (RoHS Directive).

This policy/proposal also takes account of the fact that certain pieces of Community legislation reduce or phase-out the use of certain heavy metals in products. For example the RoHS Directive⁵⁴ phases-out the use of heavy metals such as cadmium and lead in electrical and electronic equipment.

The substitution of mercury, lead, hexavalent chromium and cadmium in vehicles was established by the Community legislator in Article 4 (2) (a) of Directive 2000/53/EC on end-of life vehicles⁵⁵ This Directive applies to both automotive lead-acid batteries and nickel-cadmium batteries used in electrical vehicles. However, the Community legislator established a list of exemptions from this substitution requirement in Annex II to this Directive. The use of lead in automotive batteries was exempted without time limitation. As the same time, the Community legislator requested the Commission to look into the feasibility of substituting cadmium in nickel-cadmium batteries used in electrical vehicles as a priority. Commission Decision 2002/525/EC, amending Annex II of this Directive, grants an exemption for the use of cadmium in batteries for electric vehicles until 31 December 2005.⁵⁶

A ban on cadmium in pigments, stabilisers and plating was established at EU level in 1991. In the context of the Water Framework Directive⁵⁷ cadmium was identified as a

⁵¹ http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm in particular paragraph 21.

⁵² Communication from the Commission “Towards a thematic strategy on the prevention and recycling of waste” of 27.05.2003, COM(2003) 301final.

⁵³ Communication from the Commission “Integrated Product Policy”, COM(2003)302 final of 18.6.2003.

⁵⁴ Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, OJ L37/19 of 13.02.2003.

⁵⁵ O.J. L 269/34 of 21.10.2000.

⁵⁶ See Commission decision 2002/525/EC of 27 June 2003, O.J. L170/81 of 29.06.2002. However, by 31 December 2004 the Commission will review this phase-out data.

⁵⁷ Directive 2000/60/EC of 23 October 2000, O.J. L 327 of 22.12.2000.

priority hazardous substance of which emissions have to cease by 2020. Finally, the Commission intends to propose to limit the cadmium content in fertilisers.⁵⁸

3. WHAT ARE THE MAIN POLICY OPTIONS AVAILABLE TO REACH THE OBJECTIVE?

3.1. What is the basic approach to reach the objective?

The basic approach to reach the objective is to propose a new Community initiative in this field. This is in line with the Commission's initiatives to achieve better law-making, as it should result in cost-effective and simple legislation thereby resolving the current situation of diverging national policies which could potentially lead to islands of high and low environmental protection, and consequently a lowering of environmental protection in the EU as a whole.⁵⁹

3.2. Which policy instruments have been considered?

3.2.1. No policy change scenario

In this scenario, the current Battery Directives, as implemented in the Member States, would remain in place without any change. This would mean that Member States would be required to organise efficient collection schemes for batteries and accumulators containing more than 0.0005% of mercury, more than 0.025% of cadmium and more than 0.4% of lead by weight.⁶⁰ Moreover, batteries and accumulators used in vehicles (automotive batteries and industrial batteries used in electrical vehicles), which fall under the scope of Directive 2000/53/EC, would have to meet the obligations of this Directive. Batteries and accumulators in end-of life vehicles would be collected together with the end-of life vehicle on the basis of the collection systems set up in accordance with Article 5 of this Directive. Similarly, in the future, batteries incorporated in waste of electrical and electronic equipment (WEEE) will be collected on the basis of the collection systems to be set up in accordance with Article 5 of Directive 2002/96/EC on waste electrical and electronic equipment.

3.2.2. Policy change: policy instruments

In case of a policy change, the most appropriate policy instrument for this policy change should be considered. The policy instruments range from legislative instruments to voluntary instruments.

Legislative instruments

The various policy instruments in the form of binding legislative acts at Community level are provided for in Article 249 of the EC Treaty, namely a:

- Regulation, which has a general application. It is binding in its entirety and directly applicable in all Member States;

⁵⁸ <http://europa.eu.int/comm/enterprise/chemicals/legislation/fertilizers/index.htm>.

⁵⁹ See Commission Communication COM(2002)275final of 6.6.2002: "European Governance: better lawmaking".

⁶⁰ See Article 7 of Directive 91/157/EEC.

- Directive, which is binding as to the result to be achieved. Member States are free to choose the form and methods to achieve this result;
- Decision, which is binding in its entirety upon those to whom it is addressed.

Voluntary agreements

Voluntary agreements could be concluded either at the national level to implement a piece of Community legislation or at Community level. In its recent “Communication on Environmental Agreements at Community level Within the Framework of the Action Plan on Simplification and Improvement of the Regulatory Environment”⁶¹, the Commission lays down the basic legal and procedural requirements for the conclusion of voluntary agreements at Community level and lays down the criteria for assessing proposed voluntary agreements.⁶²

This Communication clarifies that voluntary agreements can take the form either of self-regulation or co-regulation. *Self-regulation* does not involve a legally binding instrument and no formal process is introduced to closely monitor progress of the particular agreement. No enforcement measures can be taken if the economic operators that have chosen to engage themselves to reach an environmental objective do not reach this objective in practice.

In the case of *co-regulation*, environmental agreements are integrated in a more binding and formal manner into a legislative act. The Council and European Parliament establish the essential aspects, such as the environmental objective to be achieved, whereas the economic operators commit themselves to implementing the detailed modalities under an environmental agreement. Within the framework of a legislative act, co-regulation makes it possible to ensure that the objectives defined by the legislator can be implemented in the context of measures carried out by parties recognised as being active in the field concerned.

3.2.3. Policy change: prescriptive measures

3.2.3.1. Collection requirements for all spent batteries and accumulators

Directive 91/157/EEC requires Member States to set up efficient collection schemes for batteries with a certain mercury, cadmium and lead content.

Since experience with the current Directive has shown that consumers have difficulties distinguishing between portable batteries containing cadmium, mercury and lead covered by this Directive and other portable batteries (e.g. alkaline manganese and zinc-carbon batteries), it is considered necessary to extend the scope of the proposed policy/proposal to all portable batteries.

⁶¹ COM (2002)412 final of 17.7.2002.

⁶² COM (2002) 278 final of 5.6.2002. The Sixth Environmental Action Programme of the European Community explicitly lists ‘encouraging voluntary commitments and agreements to achieve clear environmental targets’ among the actions to take. Voluntary agreements have, according to the 6th EAP, “to conform to stringent criteria in terms of clear objectives, transparency and monitoring and have to be effective in achieving ambitious environmental objectives”.

This would enhance the collection rate of spent batteries and accumulators containing cadmium, mercury and lead, while, at the same time, reducing the risk of environmental contamination from other metals than cadmium, mercury and lead used in batteries and accumulators. Moreover, if the collected batteries and accumulators were processed for recycling, the natural resources needed for the battery production would be saved.

The setting of a minimum collection target at the EU level would allow monitoring whether all Member States have set up efficient collection schemes on their territory. In Directive 91/157/EEC such a target was missing, with the result that the collection efficiencies vary significantly between Member States.⁶³ The establishment of efficient collection systems in the Member States could also have a positive impact on the hoarding effect of portable batteries. Moreover, efficient collection schemes could lead to economies of scale (thus reducing the collection costs) and create employment opportunities in the battery collection sector and would give security to the battery recycling industry on the supply-side.

3.2.3.2. Recycling requirements for all spent batteries and accumulators

In order to meet the environmental objective of avoiding batteries ending up in the waste stream, all the batteries collected should in principle enter recycling processes. In other words, the collection requirements should be complemented with recycling requirements.

The setting of recycling requirements for collected batteries and accumulators would also contribute to resource savings, because all batteries contain metals which are recyclable. Portable general-purpose batteries contain metals, up to 70% of which could be recycled⁶⁴. Industrial and automotive lead-acid batteries contain metals which could be recycled up to 65% by average weight.⁶⁵ For nickel-cadmium batteries, industry has reported a recycling possibility of a minimum of 75% by average weight. Annex IV provides a detailed table showing the recoverable metals used in portable batteries as reported by Bio Intelligence. It is particularly important to recover the lead and cadmium of batteries sent to recycling processes, given that lead-acid batteries and nickel-cadmium batteries production use approximately 70% of the global production of lead and cadmium (see also paragraph 1.2).

Finally, it is important to move towards a level playing field across the EU for recycling, guaranteeing a high level of environmental protection with recycling being supported by an efficient internal market. This could be reached through extending the scope of the IPPC Directive to battery recycling operations (requiring recycling to take place according to best available technique reference documents) or by setting quality standards for recycling in Annex IIA of the Waste Framework Directive. Both options are under consideration within the framework of the Thematic Strategy on Prevention and Recycling⁶⁶ and will not be further assessed in this context. However, in line with Annex I of Directive 2000/53/EC on end-of life vehicles and Directive 2002/96/EC on waste electrical and electronic equipment, it could be considered to establish minimum

⁶³ Compare for example in 2002 a collection rate for portable batteries of 60% of the annual sales in Belgium with a rate of 0.5% of the annual sales in the UK.

⁶⁴ Source: Bio Intelligence Final report of July 2003, page 59

⁶⁵ Source: EBRA – e-mail of 25 July 2003.

⁶⁶ Communication from the Commission “Towards a thematic strategy on the prevention and recycling of waste” of 27.05.2003, COM(2003) 301final.

treatment requirements for the treatment of collected batteries. Such treatment requirements follow from the general requirements for the waste management of Directive 75/442/EC on waste and are also not further dealt with in this Extended Impact Assessment.

3.2.3.3. Phase-out of the use of cadmium in batteries where substitutes are available

A specific policy option related to cadmium in batteries, would be to restrict the use of cadmium in batteries and require a phase-out of the use of this substance if substitutes are available. In line with the environmental objective, this specific policy option should avoid that cadmium from batteries ends up in the environment (for environmental concerns related to this substances, see paragraph 1.2).

The policy option of restricting the use of cadmium in batteries where substitutes are available could affect (i) the large industrial Ni-Cd batteries accounting for 2% by weight of the industrial battery market and (ii) the portable Ni-Cd batteries accounting for 6.9 % by weight of the portable battery market. The market segments for portable Ni-Cd can be divided into four groups emergency lighting, cordless power tools, household appliances and specialised industrial applications.

Industrial Ni-Cd batteries are mainly used for stand-by power, railway/transit and space/aeronautics applications. Moreover, industrial Ni-Cd batteries can power electric vehicles. Due to the general requirement of Article 4 (2) (a) of Directive 2000/53/EC, it is prohibited to use cadmium batteries in vehicles. However, Annex II to this Directive grants an exemption from this prohibition until 31 December 2005. The Commission may extend this exemption, if proven justified by the progressive substitution of cadmium in batteries for vehicles.⁶⁷ This policy option applies without prejudice to the requirements of Directive 2000/53/EC.

3.2.3.4. Complementary policy options

Introduction of the producer responsibility principle

The policy measures necessary to avoid batteries and accumulators ending up in the waste stream will entail additional costs.⁶⁸ In line with other pieces of Community legislation, it has been considered to clarify that producers of batteries and accumulators should take the responsibility for certain phases of the waste management of their products.

Ban on landfill and incineration of spent industrial and automotive batteries and accumulators

Automotive and industrial batteries and accumulators pose specific environmental concerns due to their high lead and cadmium content. Therefore, it is important to ensure that those batteries do not end up in landfills/incinerators. Due to their large size and more professional applications, a ban on landfill and incineration of spent automotive and

⁶⁷ To this end, the Commission shall continue to analyse the progressive substitution of cadmium in electrical vehicles and publish its findings by 31 December 2004. (see Article 2 of Commission decision 2002/525/EC of 27 June 2002, O.J. L 170/81 of 29.06.2002).

⁶⁸ The actual cost depends on the implementation measure adopted by the Member State.

industrial batteries and accumulators could be introduced to prevent the final disposal of those batteries. Together with collection requirements for those batteries this measure could be the most efficient policy mix to guarantee a closed-loop system.

Monitoring of the waste stream on the amount of spent portable NiCd batteries.

Compared to industrial and automotive batteries, portable batteries have a higher risk of being disposed of in the municipal solid waste stream together with other household waste. Since their disposal depends on consumer behaviour, a ban on landfill and incineration would be difficult to enforce.

However, due to the specific environmental concerns related to portable NiCd batteries it is important to avoid final disposal of those batteries and set up a closed-loop. In order to guarantee such a closed-loop, the monitoring of the municipal waste stream on the amount of spent portable NiCd batteries discarded annually is considered.⁶⁹

Market-based instruments (deposits)

Directive 91/157/EEC stipulates that Member States shall set up a deposit system, where appropriate, and that they may introduce economic instruments to encourage recycling.⁷⁰ Some Member States have adopted deposit schemes or other economic instruments at national level. For example, in Germany consumers pay a refundable deposit for automotive batteries of 7,7€. In Denmark, consumers pay a tax which is refunded by the Danish EPA to ReturBatt. In Italy, there is also a tax on lead-acid batteries.

The current assessment considered whether a deposit system at Community level could be a viable policy option.

3.2.3.5. Summary of the policy options and instruments

The following tables give a summary of the policy options and instruments which have been considered to reach the policy objective:

⁶⁹ This monitoring of the waste stream for portable nickel-cadmium batteries is recommended by CollectNiCd, the association for nickel-cadmium batteries.

⁷⁰ Article 7 of Directive 91/157/EEC.

No policy change				
Policy change: instruments	policy	Legislative instrument: – Regulation – Directive – Decision		Voluntary instrument: – Voluntary agreement at Community level – Voluntary agreement at national level
Policy change: prescriptive measures	Collection requirements Collection obligations for all ⁷¹ spent portable batteries and accumulators Collection obligations for all ⁷² spent automotive and industrial batteries and accumulators	Recycling requirements: Recycling obligations for all spent batteries and accumulators Additional policy measure: minimum treatment standards ⁷³	Phase-out of the use of cadmium in batteries where substitutes are available ⁷⁴	Complementary measures: Introduction of producer responsibility Ban on landfill and incineration for spent automotive and industrial batteries and accumulators Monitoring of the amount of spent portable NiCd batteries discarded in the municipal solid waste stream Market instruments (deposit schemes)

3.3. What designs and stringency levels have been considered?

Collection and recycling requirements

In order to ensure an efficient collection and recycling of spent batteries and accumulators, the Proposal could set minimum collection and recycling targets.

The following designs and stringency levels have been considered:

⁷¹ In addition to the collection obligation established by Article 7 of Directive 91/157/EEC. This Article already established collection obligations for batteries containing more than 0.0005% mercury, more than 0.025% of cadmium and more than 0.4% of lead by weight. Batteries incorporated in waste of electrical and electronic equipment (WEEE) could also be collected on the basis of this Directive.

⁷² In addition to the collection obligation established by Article 7 of Directive 91/157/EEC. Batteries incorporated in end-of life vehicles could also be collected on the basis of Directive 2000/53/EC.

⁷³ This policy option is not further assessed within the framework of this ExIA.

⁷⁴ This policy option is an alternative or complementary policy measure to the collection and recycling of batteries and accumulators containing cadmium and would apply without prejudice to Directive 2000/53/EC.

- mandatory or voluntary targets (see paragraph 3.4.3);
- high or low level of the targets;
- a range or fixed targets (see paragraph 3.4.3);
- specific (different) collection targets for portable nickel-cadmium batteries and accumulators;
- specific recycling requirements for nickel-cadmium and lead-acid batteries and accumulators.

Level of Producer Responsibility

For the introduction of the producer responsibility principle, the following designs and stringency levels were considered:

- Extended Producer Responsibility (“EPR”): producers of batteries and accumulators are fully responsible to finance the costs related to the end-of life management thereof;⁷⁵ or
- Shared Producer Responsibility: each actor in the collection chain (municipality, retailer, consumer, battery and equipment producers/importers, public authorities) should be fully responsible for his own action and financing.

3.4. Which options have been discarded at an early stage?

3.4.1. Legal instruments: Regulation and Decision

The choice for a Regulation or Decision were discarded at an early stage. A Regulation with direct application in the Member States is not appropriate for reaching the policy objective described in paragraph 2.1. A Regulation would not allow Member States to make a number of policy choices for the implementation of the policy objectives. A Regulation could not guarantee consistency with, for example, existing infrastructure for collecting batteries and accumulators on their territory. Moreover, the choice of a Regulation does not seem to be in conformity with the subsidiarity principle (see below under paragraph 3.6.2.)

A Decision would not also be appropriate for reaching the policy objective of diverting batteries from the final disposal phase because the policy objectives should be achieved by all Member States, instead of to a limited number of specific addressees.

⁷⁵ EPR covers: (i) Economic Responsibility - Responsibility in which a party covers all or part of the costs of managing the wastes at the end of the product’s life (including collection, processing and disposal); (ii) Informative Responsibility - Responsibility in which the producer is required to provide information on the product or its potential environmental impacts during stages of its life cycle; (iii) Liability - Responsibility for environmental damages caused by a product in its post-consumer phase; (iv) Ownership - Responsibility in which a party retains ownership of and responsibility for a product into the post consumer phase (e.g., through leasing and other arrangements); and (v) Physical Responsibility - Responsibility in which a party is involved in the physical management of the post-consumer product or its effects (e.g., through provision of collection, processing and disposal services).

3.4.2. *Voluntary instruments at Community level*

The conclusion of voluntary agreements with industry at Community level was also discarded at an early stage since such agreements at Community level would not be appropriate in order to reach the policy objectives:

- Many actors are involved in the production, collection and recycling of spent batteries and accumulators such as importers, appliance manufacturers, consumers, municipalities and retailers. As responsibilities are divided among many different actors, concluding voluntary agreements at Community level would become very complex. Experience with voluntary agreements at national level shows their lack of effectiveness. This is, for example, illustrated by a study evaluating the voluntary agreement concluded with battery producers in Germany in 1989.⁷⁶ The collection scheme of the voluntary agreement failed because the retail sector was identified as a bottleneck and consumers were reluctant to bring back spent batteries.⁷⁷
- Some Member States have already set up efficient national collection schemes in order to divert batteries from landfills and incinerators. The conclusion of voluntary agreements at Community level could hinder the working of those national schemes.
- Stakeholder submissions pointed out that there is a high risk of free-riders on the battery market.⁷⁸ Voluntary agreements at Community level will not be able to resolve the free rider issue.

3.4.3. *Voluntary or a range of targets for the collection of batteries*

As regards the option of setting targets in order to ensure the setting up of efficient collection schemes at national level, the option of setting voluntary targets was discarded at an early stage. Voluntary targets would not create any additional incentives for Member States to set up efficient collections systems compared to the current Community legislation, since voluntary targets would not be enforceable. As regards recycling, the current Battery Directive does not have any specific recycling requirements. Therefore, voluntary targets would have the same effect as a “no policy option” (see paragraph 1.4).

As one of the expected effects of the policy objective would be to obtain a minimum level of harmonisation throughout the EU⁷⁹, the setting of a range of targets resulting in

⁷⁶ “Case studies on negotiated environmental agreements – Germany: Self-Commitment on the Collection and Recovery of Spent Batteries and the Reduction of Mercury Content in Batteries”, H. Jørgens and Per-Olof Busch, FUB Berling, Neopol closing conference November 30-December 1, 2000.

⁷⁷ A similar experience happened in Denmark, when the Danish government concluded a voluntary agreement with industry for the collection of NiCd batteries in 1991. The aim of the voluntary agreement was to reach a collection rate of 75%. During the first years, the collection rate was only 35%. Therefore, the Danish government decided to abandon the voluntary agreement.

⁷⁸ Concrete numbers for assessing the free rider problem are not available. In the German voluntary agreement of 1989, the batteries industry estimated the free riders for the NiCd batteries at 25%, see Kiehne, “Collection and Recycling of NiCd batteries in Germany, State of the Art”, paper presented at the OECD Workshop Lyon September 23-25, 1997.

different targets for different (groups) of Member States was also discarded at an early stage. If a range of targets reflects a lower and higher level of ambition, in practice only the lower indicated level would be enforced.⁸⁰

3.4.4. *A deposit scheme at Community level*

The policy option of a deposit scheme⁸¹ at Community level was analysed and discarded at an early stage.⁸² Even though the setting up an EU-wide deposit system could guarantee the return of spent batteries, this policy option was mainly discarded for economic reasons. During the stakeholder consultation, industry expressed its concerns that the introduction of a Community wide deposit scheme would entail disproportionately high costs and risks of fraud.⁸³

Moreover, the introduction of a Community wide deposit scheme in a new policy instrument would be difficult to reconcile with the principle of subsidiarity, since it would restrict the Member States when choosing the best implementation measure for reaching the policy objective of the new policy instrument. Several existing national deposit schemes for batteries would probably have to be revised if a Community wide deposit scheme would come into place.

3.4.5. *Phase out of the use of cadmium in batteries where substitutes are available*

Both the policy option of a phase out of the use of cadmium in batteries where substitutes are available and the policy option of establishing collection and recycling requirements for cadmium batteries have the advantage that no or less virgin cadmium will be used in the batteries production. Additionally, where virgin cadmium is generated as a by-product from zinc production this cadmium could be managed directly at the production site in a more controlled manner than if cadmium would be used in batteries and accumulators.⁸⁴

The policy option was only considered so far as viable substitutes exist.⁸⁵ As regards the industrial NiCd battery segment, the existences of viable substitutes is questionable.⁸⁶

⁷⁹ See table in paragraph 2.1.

⁸⁰ A range of targets could be useful if the policy measure would aim at introducing both a minimum and maximum target to be achieved by the Member States, see for example Article 6 of Directive 96/62/EC on Packaging and Packaging Waste.

⁸¹ The principle of a deposit scheme is that the consumer can recover part of the purchase price of the product by returning the used product, or part thereof to a collection point. This increases the economic incentive for the consumer to return the spent batteries to the collection point and should, in principle lead to higher collection rates than a purely voluntary take-back system.

⁸² However, as an alternative, the introduction of a Community wide deposit scheme could serve as a sanction if the collection objectives of the proposal are not achieved.

⁸³ The setting up of the system requires measurements in order to (a) proof the purchase (through labelling of the battery, the package and a purchase ticket for the buyer), (b) sufficient number of collection points These costs include labelling and instruction system design and implementation; handling; storage; transportation; householder inconvenience costs associated with handling and returning spent batteries, publicity, refund control and other enforcement mechanisms, domestic product take-back implementation and management and imported product take-back and management. See also submission of EPBA within the framework of the stakeholder consultation.

⁸⁴ Directive 96/61/EC on integrated pollution prevention and control (IPPC Directive) and the BREF on non-ferrous metal industries, December 2001.

⁸⁵ Compare with the policy options outlined in the Stakeholder Consultation Document, see <http://europa.eu.int/comm/environment/waste/batteries/consultation.pdf>.

During the recent stakeholder consultation, users of industrial NiCd batteries confirmed those doubts about substitutes for industrial applications.⁸⁷ Moreover, as regards the portable NiCd battery segment, the availability of viable substitutes is disputed for the emergency lighting and cordless powertool applications for safety reasons.⁸⁸ At this moment, it is undisputed that commercial viable substitutes exist for portable nickel-cadmium batteries in household applications. The policy option of the phase-out of the use of cadmium in batteries thus limited to those applications. Annex V gives an overview of possible substitutes for NiCd batteries as reported by Bio Intelligence.

This policy option was discarded as it would only be suitable to achieve the environmental objective related to this specific policy option (avoiding cadmium from batteries ending up in the waste stream) to a limited extend:

- a phase-out limited to household appliances would not resolve the use of cadmium batteries in other appliances (cordless power tool, emergency lighting and industrial applications). In fact, the household appliances segment only represents a very small part of the total NiCd battery market,⁸⁹
- a large percentage of portable NiCd batteries in household appliances are currently stored at home (“hoarded”). It is estimated that 60% of the rechargeable portable batteries are hoarded.⁹⁰ These hoarded NiCd batteries in household applications would not be covered by this policy option and would thus still risk of ending up in the environment.
- Therefore, alternative policy options, such collection and recycling objectives creating a closed-loop system, could create an equivalent or even higher level of

⁸⁶ Compare for example, “Heavy metals in vehicles II”, Ökopol 2001, p. 36-44 on substitutes for industrial NiCd batteries for electrical vehicles and “Impact Assessment on Selected Policy Options for Revision of the Battery Directive”, Bio Intelligence 2003, p. 169 on substitutes for the entire industrial NiCd battery segment. The availability of substitutes for industrial nickel-cadmium batteries used in electrical vehicles will be further assessed within the framework of the revision of Annex II of Directive 2000/53/EC, see Article 2 of Commission Decision 2002/525/EC, O.J. L 170/81 of 29.6.2002.

⁸⁷ Users of industrial NiCd batteries who submitted this argument were (in non alphabetic order) by EMISA, the Finnish Maritime Administration, Solar Elektro BV, Chloride Industrial Systems SA, Sonlux Leuchten, Czech Railways joint stock company, Evenbat Gioia s.r.l., Chargeurs Batteries Services, NSB AB, Sonnenschein Lithium GmbH, Northern Lighthouse Board, HansaBattery Oy, BVG, Bombardier Transportation AB, Saft AB, Technid s.p.a., Alstom Transportation, Zeleznicna Spolocnost, Krafterelektronik AB, Sumitomo Corporation, Iverlux, Flourishing Transportation Facilities Co Ltd, Famostar Emergency BV, Saft SA, Amco Power Systems Ltd, Saft BV, SA Mouret, Benning, Tadiran Batteries Ltd, Siemens AS, AEG SVS Power Supply Systems GmbH, Statron GmbH, AT&T, Tadiran Batteries, AEG Computer & Industrial Systems AB, Statron AG, Saft, AEES, Alcad Ltd, GVEA, MSD - Site & Power, Forges Bazas, Alcatel, Friwo, BNSF, VR Ltd, Gépébus, PVI, Banverket, Keolis, NedTrain, Industrial Batteries Ltd, Saft Ltd, Ferak, Alstom Transportation SA and SNCF. See <http://europa.eu.int/comm/environment/waste/batteries/consultation.htm>.

⁸⁸ See “Impact Assessment on Selected Policy Options for Revision of the Battery Directive”, Bio Intelligence 2003. Compare with, for example, submission from Black & Decker in the public stakeholder consultation and “Substitution of rechargeable NiCd batteries”, A. Nilsson.

⁸⁹ The industrial application (24%) as well as the portable emergency-light application (19%) and specialties applications (6%) of NiCd battery segment is stable, whereas the cordless power tool (CPT) application (35%) is growing fast and the portable EEE application (16%) is declining.

⁹⁰ Bio Intelligence Fnal report of July 2003, page 54. Industry estimates that 66% of the portable rechargeable NiCd batteries are hoarded.

environmental protection. This discarded policy option, as well the alternative policy options to properly manage the risks related to the use of cadmium in batteries are assessed in paragraph 4.

3.5. Which are the trade-offs associated with the proposed option?

There is a trade-off between environmental protection and additional costs related to the proposed policy measures. It is evident that any measure, whether a cadmium ban or a closed loop system through recycling/collection, go hand in hand with higher costs.

When non-hazardous waste is addressed, another trade-off relates to recycling itself. Recycling, as also stated in the Commission's Communication "Towards a Thematic strategy on waste prevention and recycling", does not come at zero costs for the environment. The more is recycled the higher the environmental impacts. Many studies have looked at the relative merits of different waste management options, and have used different research techniques, such as cost-benefit analysis, economic evaluation and life cycle analysis. Annex VI gives a brief summary of two main studies in this field.

The overall indication is that the net benefits of recycling outweigh the environmental costs thereof. If one compares the energy of recycling and the costs of transporting waste products for recycling, the value that can be derived from recycling outweighs the transport costs in many cases. In addition, the use of recycled material in new products often generates less waste than the normal production with raw materials and usually results in less air pollution.⁹¹

3.6. How is subsidiarity and proportionality taken into account?

Environmental protection measures and measures with an impact on the internal market fall within both the competence of the Community and the Member States. Measures on spent batteries and accumulators constitute a clear example of this competence sharing. The principle of subsidiarity requires that the Community shall only take action⁹² if and insofar as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore be better achieved by the Community, by reason of scale of effects of the proposed action. The proportionality principle requires Community action to not go beyond what is necessary to obtain the objectives.⁹³

The present proposal takes account of the principles of subsidiarity and proportionality because:

- the pollution caused by the management of spent batteries and accumulators is of a transboundary nature. This is particularly true for the pollution of the air and water resulting from the incineration or landfilling of spent batteries and accumulators;
- divergent national measures covering, for instance, marketing restrictions on the heavy metals in batteries and accumulators, as well as marking requirements, can have

⁹¹ OECD Transport of Waste Products, Round Table 1999.

⁹² This principle only applies to areas which do not fall within the Communities' exclusive competence.

⁹³ See Article 5 of the EC Treaty.

a negative impact on the functioning of the internal market by creating barriers to trade and can distort competition;

- due to economies of scale, battery recycling becomes more efficient if large volumes of batteries and accumulators are processed. In particular, small Member States may not be able to collect sufficient volumes for economically sound recycling in their own country. Therefore, they depend on the battery collection within other Member States in order to operate their own recycling installations efficiently. The proposed Community legislation establishes principles at the Community level to avoid distortions of the internal market;
- the chosen form (a new Directive) sets minimum key elements and provides the legal obligations to introduce a Community-harmonised strategy for batteries and accumulators while leaving the Member States free to choose the most appropriate national measures (for example voluntary agreements) to reach those objectives;
- the chosen form of the legal act gives Member States alternative possibilities to reach the objectives of the proposal, whilst respecting the rules of the EC Treaty, in particular those relating to the internal market and competition.

4. WHAT ARE THE IMPACTS – POSITIVE AND NEGATIVE – EXPECTED FROM THE DIFFERENT OPTIONS IDENTIFIED?

4.1. What are the selected⁹⁴ options' expected positive and negative impacts, particularly in terms of economic, social and environmental consequences, including impacts on management of risks?

4.1.1. Impact assessment of the discarded 'no policy change' option

The current situation is described in paragraph 1. In case of a no policy change option, it is assumed that the existing national battery collection schemes adopted in accordance with Article 7 of Directive 91/157/EEC, will continue to exist.

This means that for spent automotive and industrial batteries, the collection and recycling based on the voluntary industry practices would continue, assuming that lead prices remain stable. However, if the lead prices decrease and remain low for several years, the current industry practice of collecting and recycling spent automotive and industrial batteries may cease. Only a few Member States have taken specific measures to ensure an efficient collection of these batteries. In Italy and Germany there is a deposit scheme for automotive batteries which would still guarantee their return. However, under the current scheme, the collection and recycling of those batteries mainly depends on the lead price and it not guaranteed.

The WEEE Directive may have a positive impact on the collection of portable batteries and accumulators. A recent study assumes that 30% of the batteries contained in WEEE would be collected with WEEE, in addition to quantities already collected today.⁹⁵

⁹⁴ Apart from the selected options, this paragraph also assesses the impacts of a no policy change option and the discarded policy option of a cadmium ban in batteries and accumulators.

In a no policy change option, the following scenario for the collection and recycling of spent batteries in 2007 could be developed⁹⁶:

No policy change - 2007	Collection in % of sales	Recycling plant input
Automotive batteries	80-95%	95-100%
Industrial batteries	80-90%	98%
Portable batteries	5-65%	10-100%

To make more precise predictions for the collection of portable batteries, a distinction could be made between the Member States which have set up efficient collection schemes for all portable batteries (Austria, Belgium, France, Germany, the Netherlands and Sweden) and Member States where separate collection schemes for all portable batteries were not very efficient in 2002⁹⁷:

No policy change 2007	Collection in % of sales	Collection in % of available for collection	Collection in grams per inhabitant	Recycling plant input
Member States with efficient collection schemes for all portable batteries in 2002	30-65%	60-85%	120-130	70-100%
Member States without efficient collection schemes for all portable batteries in 2002	5-20%	n.a.	20-80	10-100%

4.1.1.1. Environmental impacts

As described in paragraph 1, portable batteries and accumulators would continue finding their way into the municipal solid waste stream. Given the hoarding effect, sooner or later consumers will have to start discarding portable batteries currently stored at home. Under the no policy change option, most of these batteries would go to landfills or incinerators, with possible negative consequences for ground water, the food chain and air. As shown in the above table, the collection of portable batteries can, under a worst case scenario, be as low as 5% of the annual sales⁹⁸ with 90% of the amount collected going to landfills and incinerators.

For spent industrial and automotive batteries and accumulators, environmental impacts may occur when the voluntary industry practice of collection and recycling stops.

⁹⁵ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence 2003, page 70.

⁹⁶ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive”, Bio Intelligence 2003, pages 76-77.

⁹⁷ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence 2003 page 15.

⁹⁸ Compare with the current collection rate of 17% of the annual sales in the EU-15.

4.1.1.2. Economic impacts

In the absence of any measure, there does not seem to be any additional economic impact. By contrast, under the no policy change option, recycling companies would not benefit from increased activity. Keeping the status quo would not only hamper more recycling business activities, but would also not give incentives to develop better technologies and /or to exploit economies of scale further.

4.1.1.3. Social impacts

This policy option does not seem to have major social impacts.

However, this policy option could have negative social impacts, in the sense of avoided jobs. Recycling companies would not create more jobs, as demand would be stagnant. Increased collection activities could also, to a certain extent (when batteries are collected separately) lead to job creation.

4.1.2. Impact assessment of the discarded policy option of the phase-out of the use of cadmium in batteries where substitutes are available

As follows from the above, this policy option applies to portable NiCd batteries used in household appliances (see paragraph 3).

4.1.2.1. Environmental impacts

In 1999, Belgium started a specific Targeted Risk Assessment on the use of cadmium (oxide) in batteries within the framework of Regulation 793/93 (TRAR). On 30 May 2003, the Belgian rapporteur circulated a draft final report of the TRAR. This report is at present under peer-review by the Scientific Committee on Toxicity, Eco-toxicity and the Environment (SCTEE) which will give its opinion to the Commission on the quality of the risk assessment.

A summary of all the EU emissions from different parts of the life cycle of Ni-Cd batteries are described in the following table⁹⁹

⁹⁹ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003 p. 154.

Table: Summary of the distributions in kg (total in EU) of Cd emissions to different environmental compartments during the total life cycle of Ni-Cd batteries (realistic scenario: 24.4 % incineration and 75.6 % landfilling). Scenario 10 mg/kg dry wt. Cadmium (current situation).

Life cycle stages	Emission distribution in kg/year				
	Air	Water	Urban/ind. soil/agr. soil	Ground-water	Total release
1 Manufacturing of Ni-Cd batteries and/or battery packs	51	65	0	0	116
2 Incorporation into battery powered devices and applications	0	0	0	0	0
3 Use, recharging and maintenance by end users	/	/	/	/	/
4 Recycling (incomplete data)					
• Collection					
• Processing	1.8	0.1	0	0	1.9
• Recovery					
5 Disposal (10-50 % Ni-Cd batteries contribution)					
• Incineration (24.4 %)	323-1,617	35-176	N/A	N/A	358-1,793
• Landfilling (75.6%)	N/A	55-275	63-314	13-66	131-655
Total	376-1,670	155-516	63-314	13-66	6072,566

/ = no direct emissions (indirect cadmium emissions associated with the energy consumption used to recharge the batteries are deemed negligible). N/A = Not applicable

However, due to lack of certain methodologies, not all environmental impacts related to the use of cadmium in portable nickel-cadmium batteries could be quantified. Indeed, the TRAR indicates: “neither the delayed cadmium emissions of the re-use of incineration residues nor the impact of future expected increase in cadmium content of bottom ash and fly ash on the re-usability of these incineration residues have been quantified” (page 6) and “the contamination of the groundwater compartment due to fugitive emissions of landfills have not been quantified in this TRAR since no guidance is available to perform these calculations” (page 7) and “If NiCd batteries cannot be collected efficaciously, the future cadmium content in the MSW stream is predicted to increase. The impact of this potential increase on future emissions has been assessed for MSW incineration only. The

*impact of a future change in the MSW composition on the composition of the leachate of a landfill could not be judged based on the current lack of knowledge and methodology”.*¹⁰⁰

Another recent study concludes that the replacement of NiCd batteries by NiMH and Li-ion batteries would result in decreased negative environmental impacts. This study assesses the lithosphere extraction indicator (LEI) which is the ratio of anthropogenic to natural metal flows and the significance of battery production related to global metal mining. NiCd batteries would have the greatest environmental impacts due to their high LEIs. In the case of a complete replacement of NiCd batteries by NiMH or Li-based batteries, the LEI for Ni (5.6) would change by -0.1-0.5% and the LEI for cadmium would decrease from 4.4 to 3.0 (-31%). In the meanwhile, the mobilisation of metals considered less hazardous than cadmium would increase less than 7%.¹⁰¹ Details of this study are given in [Annex VII](#).

Since cadmium batteries are classified as ‘hazardous’ waste and its substitutes are not, one could conclude that a phase-out of the use of cadmium in batteries where substitutes are available would, in any case, result in decreased environmental impacts in the future, even though on the basis of the scientific information currently available one could argue about the scale of those impacts.

4.1.2.2. Economic impacts

Few data are available about the costs related to this policy option. Industry estimates that a turnover of approximately € 1 billion is generated by the NiCd battery production activities. However, since the policy option is only limited to a small part of the NiCd battery market, the economic impacts for the manufacturers are expected to be less than this.

However, the substitutes for NiCd batteries in household appliances are more expensive than the NiCd batteries and have a shorter life-time, so this policy option could result in a price increase for rechargeable batteries used in household appliances for consumers. Bio Intelligence has estimated the additional costs for consumers at € 825 to 1,995 million per year. The additional costs related to the fact that more waste is to be treated are estimated between € 0-1.3 million.

4.1.2.3. Social impacts

The EU produces approximately one third of the global cadmium production and exports 40% of it. Industry estimates a job loss of 10,000 jobs in the zinc and cadmium production industry if a general cadmium ban in all battery applications were to be implemented. Furthermore, industry claims that 3,500 people are directly employed by NiCd battery producers in the EU.¹⁰² However, as all producers also produce the substitutes to the portable NiCd batteries in household appliances (such as NiMH and Li-

¹⁰⁰ TRAR, Final Draft May 2003, page 7.

¹⁰¹ See Rydh, C.J., Svärd, B. (2003) Impact on global metal flows arising from the use of portable rechargeable batteries, *The Science of the Total Environment*, Vol. 302, No. 1-3, p. 167-184

¹⁰² NiCd producers are EMISA (Spain), FRIWO (D), HOPPECKE (D), SAFT AB (S), SAFT Bordeaux (FR), SAFT Nersac (FR), GAZ (D), Philips/Panasonic (B).

ion batteries), this policy option might eventually have limited negative effects on employment.

Bio Intelligence estimates that this policy option may lead to the creation of jobs, due to the fact that the substitutes have a shorter lifetime. Consequently, more batteries substituting the portable NiCd batteries seem necessary to replace them.

4.1.3. *Impact assessment of collection and recycling of batteries and accumulators*

4.1.3.1. Environmental impacts

Environmental benefits

From an environmental point of view, collection and recycling of spent batteries generates environmental benefits of various types:

- less batteries (used, hoarded and new ones) are sent to landfill and incineration. These have greater pollution and disamenity effects than recycling, and display risks of long term uncontrolled leaching of priority hazardous substances;¹⁰³
- the reduction in the use of virgin metals in the battery production and the increased use of recycled metals also have positive environmental impacts, e.g. less energy consumption, and help to close the material loop.
- emissions to the environment at early stages of the batteries' life cycle occur through water contamination and air emissions. These emissions are avoided when materials are recycled.

These positive environmental impacts are, however, difficult to quantify.

The environmental benefits related to a reduction of the final disposal depend on a large number of factors such as the battery chemistry involved, whether or not legislative standards are stringent, whether or not they are respected, and in which environment a waste treatment installation is located. Through disposal 13 to 66 kg cadmium are estimated to be transferred to groundwater. These emissions approach 0 from recycling (see table under paragraph 4.1.2).

¹⁰³ For the negative environmental impacts related to the landfilling and incineration of all types of batteries, see *Abfallverhalten neuartiger Batterien. Mengen, Inhaltstoffe, Verwertungs- und Behandlungsmethoden von Batterien*. Umweltbundesamt. Texte 36/93. Forschungsbericht 1003 10 610 UBA –FB 93-089, p. 115-128).

In terms of tonnage, the following estimated amount of metals would not go to landfills/incineration, but could be recovered:

Manganese:	20 000 tonnes/year
Zinc:	20 000 tonnes/year
Iron:	15 000 tonnes/year
Lead:	7 500 tonnes/year
Nickel:	2 000 tonnes /year
Cadmium:	1500 tonnes/year
Mercury:	28 tonnes/year

By means of recycling, a wide range of substances such as various acids, salts and plastics which are also contained in the batteries will be captured by the system and diverted from municipal waste to specific installations equipped to deal with waste batteries.

The use of recycled metals in battery production instead of virgin metals has positive environmental impacts through reduced energy use and reduced pollution related to the mining of the virgin source. Using recycled nickel requires less primary energy compared with the extraction and refining of the virgin metal.¹⁰⁴ For zinc, the relation between the energy needed for recycling and the energy needed for extraction from primary resources is 2.2 to 8.¹⁰⁵ These figures are particularly important given the fact that the primary production of metals is the source of approximately 10% of global CO₂ emissions.

Environmental costs

Negative environmental impacts could be related to the transportation involved in the collection and recycling of batteries (see for a general assessment, [Annex VI](#)). The transportation involved in the collection depends mainly on the collection system chosen.

Currently in the EU there are several different types of collection schemes for waste products, such as:

- dedicated kerbside collection, i.e. specific collection of batteries at the kerbside;
- integrated (kerbside) collection, i.e. collection of batteries together with other wastes for example paper;
- bring systems, i.e. collection at municipal or retail sites where all waste materials are collected; and

¹⁰⁴ Rydh, C.J., Karlström, M. (2002) Life Cycle Inventory of Recycling Portable Nickel-Cadmium Batteries, Resources, Conservation and Recycling, No. 34, p. 289-309.

¹⁰⁵ Metaller, materialflöden i samhället, Naturwardsverket, rapport 4506, p. 27.

- take-back systems, i.e. collection of batteries at retail stores (OEM reverse-logistics and reverse-distribution channels).

The transportation distances from the collection points to the recyclers depend on the location of both points. If the distances are very long, one could argue that the environmental benefits are outweighed by the environmental costs related to the transportation distances.¹⁰⁶

The basic idea is to minimise the transportation related to the collection schemes and thus the environmental impacts and transportation costs. In bring schemes, it is assumed that consumers only take back batteries as part of another trip and that they do not make specific trips to deliver batteries at the collection points. In some effective collection systems batteries are even mailed out directly to the recycling company¹⁰⁷ or the recycler arranges for the collection at different sites. Transport distances would also be minimised through an integrated waste collection,¹⁰⁸ for example part of the collection of portable rechargeable batteries could take place together with WEEE and the part of the collection of automotive batteries could take place through the structures set up by the ELV Directive. No additional transportation would then be involved.

In line with the general conclusions reached in Annex VI, one could conclude that the environmental impact associated with the transport of separated portable batteries to recycling facilities is compensated by the use of recycled materials and by lower emissions in raw material extraction and refining activities.¹⁰⁹ However, the actual transport distances involved in the collection and recycling of batteries depends on the situation in each individual Member States. In order to tackle this trade-off, the new policy/proposal could therefore stipulate that Member States should ensure that when establishing collection and recycling schemes for batteries and accumulators, negative externalities related to transport distances should be minimised.

Conclusions on environmental impacts

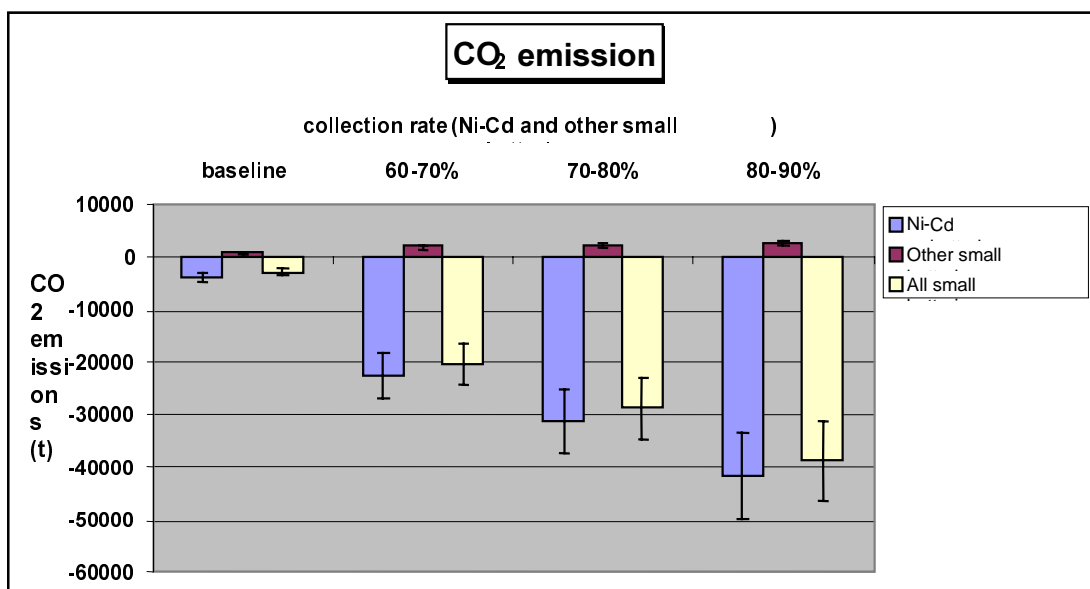
When assessing the environmental impacts related to the collection and recycling of automotive batteries, the Bio Intelligence study shows to the importance of considering the amount of recycled lead used. The environmental benefits of collection and recycling increases with the increase in the use of recycled lead in the lead acid batteries. Moreover, higher recycling rates would also create more environmental benefits, as illustrated by the following figure:

¹⁰⁶ ERM (2000).

¹⁰⁷ In the U.S., The Big Green Box™ is a national pre-paid program that offers companies, consumers, municipalities, and other generators, a low cost, easy, and flexible way to recycle their batteries and portable electronic devices. Once The Big Green Box™ is purchased, all shipping, handling, and recycling fees are included. The Big Green Box™ includes a UN approved, pre-labelled container, pre-paid shipping to and from the recycling facility, and of course, all recycling fees. Once recycled the client receives a certificate of recycling and liability release.

¹⁰⁸ Another example of integrated waste collection is the KCA scheme in the Netherlands, where batteries are collected together with other 'small chemical waste' such as paint, medicines and pesticides.

¹⁰⁹ ERM study claims that an increase in collection rate, particularly with kerbside collection, will increase global warming, resource depletion - offsetting any economic benefits from recycling - due to transportation and set up of infrastructure.



The same study concludes that the environmental benefits of collecting all portable batteries outweigh the environmental costs, if, following collection, only the portable batteries containing cadmium are processed for recycling.¹¹⁰ Indeed, most of the environmental indicators examined (CO₂ emissions, SO_x emissions, primary energy use) are positive irrespective of the collection and recycling rates. However, collection schemes may cause high NO_x emissions, causing environmental damage but, with increased collection rates, the negative environmental impact related to the NO_x emissions decreases, because the recycling of NiCd batteries results in environmental benefits which compensate for the emissions generated by additional transport.

As indicated in the following figures, as the collection rates of all portable batteries increases, so do the predicted environmental benefits:

No reliable LCA studies are available to identify the environmental benefits of the recycling after separate collection of portable batteries other than portable NiCd batteries (either in dedicated plants or in metal plants). However, the negative environmental impacts related to transport distances should be minimised at national level on a case by case basis.

4.1.3.2. Economic impacts

Economic benefits

There are four main economic benefits of collecting and recycling all types of spent batteries and accumulators:

- production and energy costs savings for the virgin materials used in batteries, which can be replaced by recycled materials;

¹¹⁰ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 136

- disposal cost savings due to higher levels of recycling, in particular costs related to landfill;
- lower recycling costs because of higher collection rates and economies of scale; and
- avoidance of costs for retrieving the damage caused by landfilled batteries containing hazardous substances disposed by mistake with other types of batteries.

However, these benefits are difficult to quantify. Hence they could not be taken into consideration in the assessment below.

Economic costs related to the collection and recycling¹¹¹ of industrial and automotive batteries

For the collection of spent industrial and automotive batteries, it is proposed to either establish a minimum mandatory collection target or an obligatory take-back system.

The obligatory take-back system reflects the current industry practices for the collection of those batteries. Therefore, this does not seem to involve any additional costs for the economic operators.

Establishing mandatory collection targets would require the implementation of a monitoring system, which does not exist today, in most Member States. This would entail additional costs compared to the obligatory take-back scheme.

Regarding the economic impact of mandatory targets, only two sources of data were found.

- Denmark has introduced fees for automotive batteries. Producers have to pay fees of € 875 000 per year to a collection scheme , i.e. about 80 €/ t of spent batteries sold.
- ERM estimated a cost of between € 133 and 171 per tonne, according to the level of mandatory collection rates (respectively 95% and 80%).¹¹²
- Other additional costs are not likely to be significant, even for Member States where the recycling of automotive batteries is less developed (because lead recycling is financially self sufficient).
- Indeed, market efficiency could be hurt by setting up a mandatory collection target of 90-100% with very high recycling plant input targets. This could oblige industry to reduce the temporary storage they use for a hedging effect which would affect their capacity to adjust when faced with low lead prices. If this

¹¹¹ On the economics of recycling in general, "The economics of technological Innovation in Recycling", Annyck Chalier and Jeffrey Parker, 1999 "Towards advancement of a recycling-Oriented economic system", METI Japan, Planning Working Group Waste and Recycle Subcommittee, February 2002.

¹¹² *Analysis of the Environmental Impact and Financial Costs of a Possible New European Directive on Batteries* – November 2000

were to occur lead recycling could cease to be financially self sufficient, which would oblige producers to create a collection system to finance recycling.¹¹³ However, if a mandatory collection target of 90-100% were set with 75% recycling plant input target this risk would not exist.¹¹⁴

The recycling of spent automotive and industrial batteries generally has net economic benefits. It is estimated that in the current situation 90-100% of the collected automotive and industrial batteries and accumulators are sent to recycling plants.

Revenue from the sales of recycled lead from spent automotive batteries amounted to € 265-350 per tonne in the period 1995-1999. Compared to the total collection and recycling costs of those batteries, which vary between € 270-350 per tonne, net revenues rang from € minus 77 per tonne to € +93 per tonne.¹¹⁵

Like for automotive batteries, the collection and recycling of nickel-cadmium industrial batteries has net benefits. The collection and recycling of nickel-cadmium industrial batteries still has net costs ranging from € 0-300 per tonne. This is expected to decrease due to the increase in nickel recovery.¹¹⁶ However, these costs are already incurred by industry.

Economic costs related to the collection and recycling of portable batteries

Costs related to collection of spent portable batteries depend, in the first place, on the type of collection system chosen by the Member States.¹¹⁷

Kerbside collection normally incurs higher collection costs than bring schemes.¹¹⁸ In general, as batteries are small items, the kerbside collection scheme does not seem to be most appropriate unless it is part of an integrated waste management system. In an integrated waste management system, the collection of batteries does not seem to entail any additional cost. Magnetic separation (approx. € 30-50 per tonne) is a way to keep the costs down.¹¹⁹

The total costs related to the collection and recycling of spent portable batteries could be subdivided into the following categories:

Variable costs

- Collection points (equipment)

¹¹³ For instance with a compensation fund fed when lead market price is high as is done in some countries for packaging paper recycling.

¹¹⁴ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 80

¹¹⁵ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 39

¹¹⁶ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 43

¹¹⁷ For different collection schemes, see paragraph 4.1.3.

¹¹⁸ UK *Audit Commission, 1997. Waste Matters: Good Practice in Waste Management. Audit Commission for Local Authorities and the National Health Service in England and Wales, London. Williams P, 1998. Waste Treatment and Disposal. John Wiley and Sons, Chichester.*

¹¹⁹ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 66

- Collection (logistic)
- Sorting
- Transport
- Recycling

Fixed costs

- Public relations and communication
- Administration

Costs related to collection (equipment and logistics) and transport are around € 300-550 per tonne.¹²⁰ Collection costs would normally be affected by some economies of scale. As up to 50% of the total collection cost appear to be fixed (cost of promoting battery collection and administrative costs),¹²¹ the cost per tonne should decrease with a higher collection rate. Moreover, advertising and awareness campaign costs appear to be high in the start-up phase of the collection system and when dedicated campaigns are undertaken. Empirical evidence shows that the communication and awareness programmes of existing battery collection systems may absorb between 8 to 20% of the annual budget or around € 0.10-0.26 per inhabitant for a relatively high collection rate (above 50%-60% of batteries sales in the same year).

Average recycling costs for spent portable batteries range from € 400-900 per tonne.¹²² Since recycling is more labour intensive than landfill or waste incineration, it is a more expensive way of treating end products (disposal costs for spent batteries and accumulators range between € 50-120 per tonne).

The actual recycling costs depend on a number of different factors, such as:

- the battery type processed for recycling;
- the recycling technology used (hydrometallurgic, pyrometallurgic, electrometallurgic);¹²³
- whether the type of recycling plant is or isn't dedicated; and
- the value of the recovered metals.¹²⁴ For example, the highest recycling fees apply to NiCd and Li-ion because demand for cadmium is low and in Li-ion there is little retrievable metal. The recycling costs of alkaline batteries are 33%

¹²⁰ EPBA, July 2003.

¹²¹ See the costs related to the collection schemes in the Netherlands, Germany and Belgium, "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003 pages 203, 202, 200

¹²² EPBA data submitted in July 2003. In September 2003, EBRA submitted that the costs related to the recycling in metals plants range from € 180- 700 tonnes and the costs of recycling in dedicated plants range from € 600-100 per tonnes.

¹²³ "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003, p. 57

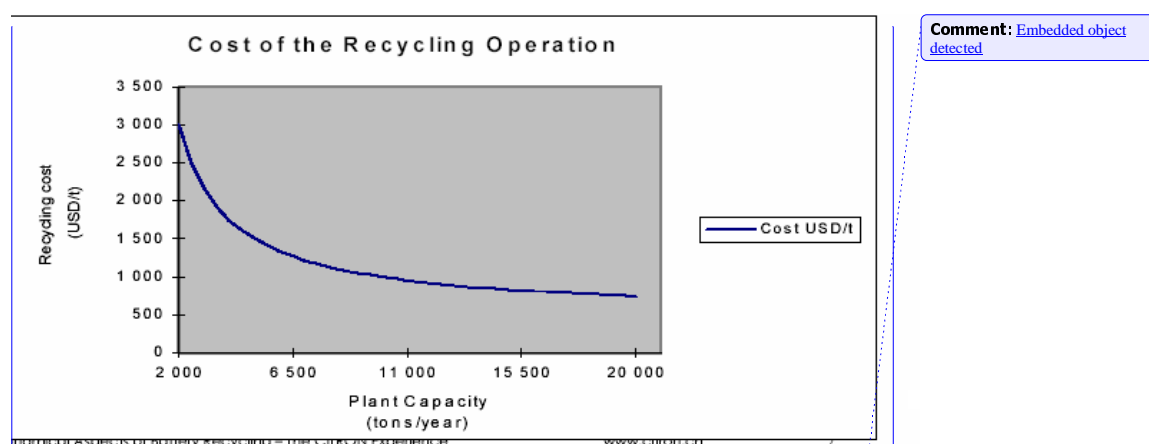
¹²⁴ This shows that the recycling of industrial and automotive batteries is already financially viable.

lower than the costs of recycling of NiCd batteries while the recycling of NiMH batteries is reported to have net recycling benefits.

Pilot projects¹²⁵ using a hydro-metallurgical process to recycle general purpose batteries have shown that a dedicated plant treating 5,000 tonnes is economically viable or even profitable, including write-off of capital, within five years. The recycling would be financially viable even without the "gate fee". This fee, charged by the recyclers, is normally estimated at around € 800 per tonne in other recycling plants.

For all recycling plants, the operating costs depend mainly on the size of the plant. Economies of scale would tend to reduce the recycling costs since up to 90% of the total costs in a thermal process are fixed costs.

The following graph shows the economies of scale in a typical multifunction recycling plant.

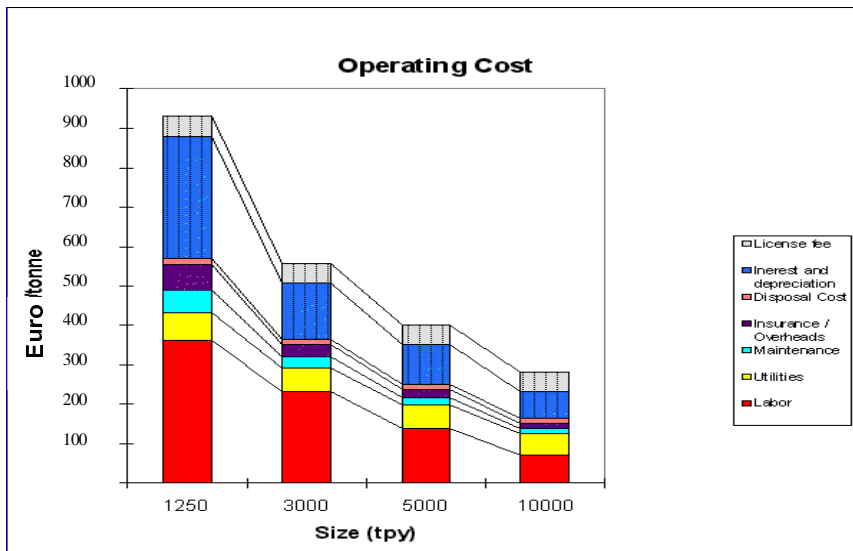


The recycling costs of portable batteries free of mercury¹²⁶ or cadmium are much lower. The following chart shows an example of a low cost process for portable batteries which includes demercurisation of batteries by oxidative treatment in a plant located in Germany.

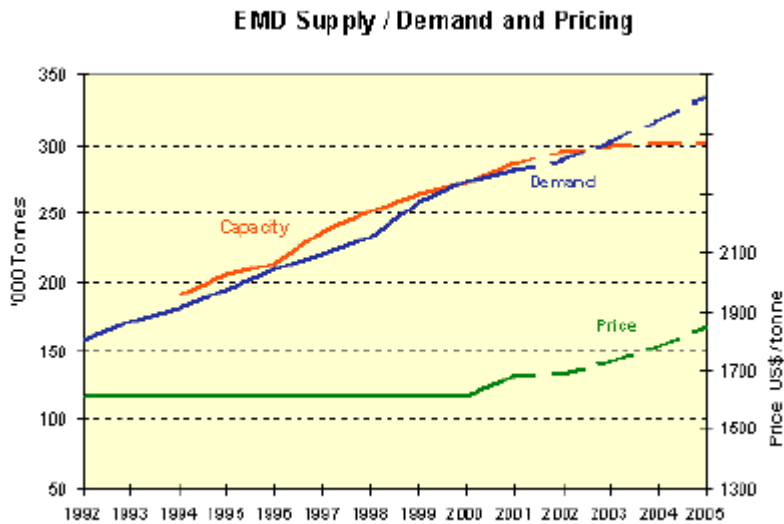
¹²⁵ C-Tech Innovation Ltd "The recovery and recycling of valuable materials from spent domestic batteries" Final Report July 2002

¹²⁶ Collection in several European countries shows average mercury (Hg) concentrations between 250 and 600 mg/kg for mixed cells. The mercury content affects recycling process and its costs.

Comment: Embedded object detected



Whether or not recycling of portable batteries brings net benefits, depends on the value of the recovered material. This is the main reason why the recycling of lead-acid batteries and accumulators is economically attractive. The recycling of other battery with other compositions may show net benefits in the future. For instance, battery manufacturers expect an increased demand for Electrolytic Manganese Dioxide (EMD represents about 30% of raw material costs in manufacturing dry-cell batteries), growing at 4-6% per year, which recycling production could meet, as shown by the following graph:



Recycling costs have decreased over the years, mainly for primary portable batteries, because the quantity has increased, thereby leading to economies of scale and making competition on the recycling market more effective.¹²⁷ The increased recycling of primary batteries in the metals industry (due to less mercury in the waste stream) has led to the optimisation of the recycling costs.¹²⁸

¹²⁷ EPBA July 2003.

¹²⁸ EPBA, July 2003.

Conclusion on the total collection and recycling costs for spent portable batteries

As shown above, the total costs for the collection and recycling of spent portable batteries are influenced by a large number of factors.

Current annual costs related to the collection and recycling of all portable batteries in the Member States range from € 1,113 per tonne in Austria to € 3,734 per tonne¹²⁹ in Belgium. See Annex VIII for a breakdown of these costs.

As a general trend, the costs of these existing systems decreased, whereas the tonnes collected and processed for recycling increased at the same time.¹³⁰ This implies that the costs to start up an efficient collection and recycling system for all portable batteries and accumulators are relatively high, but that these costs decrease over time, partly due to economies of scale. However, at a certain point, the collection and recycling costs will increase again due to an increase of the collection rate.

Bio Intelligence built an economic model to show the additional costs related to a higher collection rate for low and high collection and recycling costs with different inputs in recycling plants.

Annex IX shows the curve in the high costs scenario and a recycling input of 90-100%.

On the basis of the curve calculated by Bio Intelligence, the cost per tonne collected increase by € 100-150 per tonne collected with a 10 point increase in relatively low collection rates¹³¹, and more than € 1000 per tonne collected with a 10 point increase of high collection rates (from 50 to 100%).¹³²

Currently Austria, Belgium, the Netherlands, Germany and Sweden already achieve collection rates of spent portable batteries between 30-60% of annual sales (120-240 grams per inhabitant). According to the economic model used by Bio Intelligence the costs for achieving collection rates between 30-60% of the annual sales range from 1,182 to 1,828 €/tonne (low cost scenario) and from € 1,846 to € 3,435 per tonne (high cost scenario).

¹²⁹ In the Belgian system, 1000€/tonne are used for marking the Bebat products. Since those costs are specific to the BEBAT scheme and not related to the general collection and recycling costs, these costs are deducted from the total costs.

¹³⁰ For example in Germany, in 2000, 9,100 tonnes of spent portable batteries were collected at a cost of 1,169€/tonne. In 2001, 11,256 tonnes of spent portable batteries were collected at (increase of 2,156 tonnes) a cost of 1,115€/tonne (decrease of 54€/tonne). Similarly, in the Netherlands, 1,562 tonnes of spent portable batteries were collected at a cost of 5,058 €/tonne in 1998. In 2002, 2,348 tonnes were collected (increase of 786 tonnes) at a cost of 3,765€/tonne (decrease of 1,293€/tonne).

¹³¹ This equals 120-160 grams per inhabitant.

¹³² This equals 200-400 grams per inhabitant. This is because of both communication and administration costs: - communication costs regularly increase as collection rates increases. For example, to double the collection rate from 30 to 60% of spent batteries (45% to 85% of spent batteries available for collection with current level of hoarding), PR and communication budgets are estimated to be multiplied by 10 to avoid domestic hoarding (i.e. from 250 to 2500 € / t collected). - As for administration costs, economies of scale are observed until about 50 – 60% of collection rate, then a step of increase is considered necessary to ensure collection of higher quantities.

In countries where no separate collection exists, the disposal of spent portable batteries would cost € 120 per tonne in a high costs scenario.¹³³ The costs of setting up collection and recycling schemes would be 10 to 40 times higher, depending on the collection rate chosen. However, due to the implementation of Directive 91/157/EEC all Member States have set up schemes for the collection of spent batteries and accumulators with a certain cadmium, mercury or lead content.

4.1.3.3. Social impacts

As regards the social effects, new collection and recycling companies are likely to appear. Bearing in mind that the current rate of collection and recycling of spent portable batteries is low, the potential, as regards job creation and competitiveness in this sector, could be considerable.

Bio Intelligence calculated the potential job creation for different collection rates (see table below). A collection rate of up to 200 grams per inhabitant / 50% of annual sales would correspond to a collection of 74,000 tonnes. This would correspond to 4,331 jobs in the collection business. The following table gives an overview of the additional job creation at different collection rates, as developed by Bio Intelligence:

Collection rate in % of annual sales	10-20	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
Ktonnes of batteries collected	25	41	58	74	91	107	125	140	157
Total jobs created	1238-1444	2063-2406	2888-3369	3713-4331	4538-5294	5363-6256	6188-7219	7013-8181	7838-9144

4.1.4. Impact assessment on different collection and recycling requirements for NiCd batteries

The impacts of the collection and recycling of all spent batteries and accumulators are assessed in the previous section. As follows from paragraph 3.4, a different collection target for nickel-cadmium batteries and differentiated recycling requirements for nickel-cadmium and lead-acid batteries were also considered as a policy option. This section focuses on the impacts related to specific collection and recycling requirements for NiCd batteries only.

4.1.4.1. Environmental impacts

From an environmental perspective, LCAs indicate that the optimum recycling rate for NiCd batteries tends to be close to 100%.¹³⁴ Studies show that NiCd battery recycling is

¹³³ "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003.

¹³⁴ „Rechargeable Battery Management and Recycling: A Green Design Educational Module", Rebecca Lankey and Francis McMichael,, 1999.

energy efficient even with very long distances to the processing facilities.¹³⁵ Excluding the use-phase of the battery, 65% of the primary energy is used in the manufacture of batteries, while 32% is used in the production of raw materials. Recycled cadmium and nickel metal require 46% and 75% less primary energy respectively, compared with extraction and refining of virgin metal. Less than 1% of the energy is used for collecting and sorting.

Similarly, the report of BIO Intelligence states that the collection and recycling of portable NiCd batteries¹³⁶ has positive environmental effects for all the environmental indicators examined (dissipative losses of cadmium, CO₂ emissions, SO_x emissions and NO_x emissions and primary energy consumption), irrespective of the level of collection and recycling rates.

4.1.4.2. Economic impacts

According to CollectNiCad the following parameters influence the economics of collection and recycling of portable NiCd batteries:

- economy of scale effects;
- country population density and related logistics issues;
- operation of dedicated collection programs versus participation in more general collection schemes;
- sorting efficiency;
- type of public awareness campaigns;
- consumer behaviour etc.

The collection costs, if only portable NiCd batteries are targeted, are maximised as only small quantities are collected. Germany showed collection costs of € 2,000-2,500 per tonne of a dedicated NiCd batteries collection scheme.¹³⁷

The recycling costs related to portable NiCd batteries vary depending on the recycling technology used. In dedicated recycling plants, the net recycling costs vary between € 0-300 per tonne.¹³⁸ In non-dedicated recycling plants, net recycling costs amount to approximately € 100 per tonne. The recycling costs of dedicated plants are likely to decrease in the future because of economies of scale and/or the development of new technologies.

¹³⁵ "Life Cycle Assessment of Recycling Portable Nickel-Cadmium Batteries", Carl Johan Rydh1 and Magnus Karlström, 2002.

¹³⁶ If the NiCd batteries are collected and recycled together with other portable batteries, the report was not able to conclude on the environmental impacts.

¹³⁷ ZVEI data 1996.

¹³⁸ Compare to Wiaux who states that the net recycling costs amount to 135€/tonne (1000€ recycling costs, value of recovered nickel: 800€/tonne and value of recovered cadmium: 65€/tonne. B&D submitted that the costs of recycling NiCd batteries is slightly negative compared to the market value of nickel and cadmium extracted, but this is less than 1% of the value of the cells and could be covered by a levy on the sales.

In Denmark the costs related to the collection and recycling of NiCd batteries amount to € 2,830 per tonne.¹³⁹

4.1.4.3. Social impacts

In line with the general conclusions in the previous section, differentiated recycling requirements for specific battery types, such as NiCd batteries could have positive impacts on employment in the recycling business.

4.1.5. *Impact assessment of a ban on landfill and incineration for spent automotive and industrial batteries*

A ban on landfill and incineration of spent automotive and industrial batteries would be complementary to the collection requirements for spent industrial and automotive batteries.

Even though no concrete data are available, several sources estimate that 90% of spent automotive and industrial batteries are being processed for recycling and not landfilled or incinerated. However, in the UK "the current practice is to dispose of industrial NiCds [batteries] to landfill."¹⁴⁰

There are no concrete data about the amount of spent automotive and industrial batteries currently being landfilled or incinerated in the EU-15. The total amount is estimated at 31,500 tonnes for the year 2002.¹⁴¹

4.1.5.1. Environmental impacts

The landfill of spent industrial and automotive batteries raises particular concerns as these contain up to 73% of lead or up to 8% of cadmium. The total environmental benefits of a ban on landfill for spent automotive and industrial batteries are difficult to quantify, since the heavy metal leachate¹⁴² from batteries in landfill is difficult to predict on the basis of current knowledge.

- The degree of leaching depends on the chemical nature of the heavy metal and the leaching conditions. During the operation and the after-care of the landfill the leachate can be collected and emissions can be controlled. However, leachate collection will not continue for more than 50 to 100 years. After that

¹³⁹ "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003, page 62

¹⁴⁰ See *Analysis of the Environmental Impact and Financial Costs of a Possible New Directive on Batteries*, Environmental Resources Management, November 2000, p. 67.

¹⁴¹ Using data provided by Bio Intelligence draft Final report of July 2003: On the basis of available data between 95-100% of the collected automotive batteries are recycled. If 5% were landfilled this would amount to 23,350 tonnes of spent automotive batteries in 2002. As regards spent industrial lead-acid batteries, if 90% of the amount available for collection were collected this would be 162,427 tonnes of collected industrial lead-acid batteries. If 95% would be recycled and 5% were landfilled this would be 8,100 tonnes.

¹⁴² Leachate is generated as a result of the expulsion of liquid from the waste due to its own weight or compaction loading (termed primary leachate) and the percolation of water through a landfill (termed secondary leachate). The source of percolating water could be precipitation, irrigation, groundwater or leachate recirculated through the landfill.

the contaminants in the leachate, which have not yet been released, will be emitted to the environment.

In its opinion on the report on cadmium in polymers and metal plating¹⁴³ the Scientific Committee on Toxicity, Ecotoxicity and the Environment (SCTEE) noted that the lack of information on long-term emissions of cadmium from landfills constitutes a serious problem and recommends further research in this field as a high priority.

Due to the high amount of heavy metals used in automotive and industrial batteries, the ban on landfilling/incinerating those batteries would have positive environmental impacts.

4.1.5.2. Economic impacts

The economic impacts of this policy option seem to be minimal. Since the recycling of lead-acid batteries generally has net economic benefits (average of €16 per tonne), the ban on landfill/incineration would avoid the disposal costs of landfilling spent lead-acid batteries, estimated at € 120 per tonne.

For industrial NiCd batteries, the ban on landfill would have an average additional costs of € 30 per tonne (comparing the average recycling costs of € 150 per tonne with the cost of € 120 per tonne for landfilling).¹⁴⁴

4.1.5.3. Social impacts

The social impacts do not seem to be very significant either. The quantity of spent automotive and industrial batteries currently landfilled in the EU is estimated at 31 500 tonnes.¹⁴⁵ If this would be the additional amount of batteries that would be collected and recycled instead of landfilled, this could create 420 additional jobs.¹⁴⁶

4.1.6. *Impact assessment of introducing producer responsibility for the collection and recycling of all batteries*

4.1.6.1. Environmental impacts

Producers of batteries and accumulators design the product, determine its specifications and select its materials. The introduction of the producer responsibility principle, in line with Article 174 of the EC Treaty, would encourage producers to design and manufacture their products in an improved way thereby ensuring the longest possible product life, and if it is scrapped, the best methods for recovery and disposal.

¹⁴³ CSTEE, Opinion on the Report on “The risks to health and environment by cadmium used as a colouring agent or a stabiliser in polymers and for metal plating” (Risk&Policy Analysts LTD, 2001), Brussels, 30 October 2001.

¹⁴⁴ “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003, page 176.

¹⁴⁵ 23,350 spent automotive batteries plus 56 spent industrial NiCd batteries plus 8,100 spent industrial lead-acid batteries.

¹⁴⁶ The employment assessment departs from the assumption of 32 additional jobs per 2400 extra tonnes of batteries collected.

4.1.6.2. Economic impacts

Shared responsibility means fewer costs for producers and more costs for municipalities, retailers and consumers. If actors other than the producers would bear the costs related to the collection points and the PR and communication costs, these costs could, according to Bio Intelligence's economic model, range from between € 310 per tonne at a collection rate of 30% of annual sales (or 120 grams per inhabitant) to € 3,560 per tonne at a collection rate of 80% of the annual sales (or 320 grams per inhabitant).¹⁴⁷

Since the collection and recycling of automotive and industrial spent batteries generally creates net economic benefits, full producer responsibility for those batteries does not seem to create any additional costs compared to the current situation.

4.1.6.3. Social impacts

The introduction of full producer responsibility would be in line with the polluter pays principle. Shared responsibility for the collection and recycling of spent portable batteries and accumulators reflects the involvement of different actors in this field and may have positive impacts on consumer behaviour for the take-back of spent batteries.

4.1.7. *Impact assessment on the monitoring requirements of the municipal solid waste stream on portable NiCd batteries*

4.1.7.1. Environmental impacts

The monitoring of the municipal solid waste stream on the amount of spent portable NiCd batteries and accumulators would be necessary to guarantee the closed loop system for those batteries. On the basis of the results of this monitoring exercise, the proposed measures could, if necessary be revised.

This policy option thus ensures that the environmental objectives of the proposed measure will be met. Therefore it will maximise the positive environmental impacts envisaged by the proposal.

4.1.7.2. Economic impacts

Monitoring of the waste stream entails additional costs. Those costs obviously depend on the monitoring method, the frequency and the amount of municipal solid waste monitored.

Several Member States have already performed monitoring campaigns of the amount of portable NiCd batteries found in the MSW stream, which reportedly¹⁴⁸ have cost € 30.000 in France, € 100.000 in Belgium and € 150.000 in Germany. Industry has reported that in any case the total costs will not be more than 1% of the annual budget of the national battery collection associations.

¹⁴⁷ "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003.

¹⁴⁸ Oral statement of CollectNiCad during meeting of 25 February 2003.

4.1.7.3. Social impacts

The monitoring of the municipal solid waste stream could have positive impacts on employment. Moreover, it could have positive impacts on the general consumer behaviour in the sense that the results of the monitoring may create an additional incentive for consumers not to discard their spent portable batteries and accumulators together with the other household waste. The results of the monitoring campaign could thus also be used by the Member States to adjust their information campaigns for consumers.

4.2. How large are the additional ('marginal') effects that can be attributed to the policy proposal, i.e. those effects over and above the 'no policy change' scenario? Description in qualified and, where possible, also in quantitative and monetary terms.

4.2.1. Portable batteries and accumulators

The reported relatively wide variation in the costs of collection and recycling schemes of portable batteries and accumulators may be attributed to the following factors:

- method and maturity of the collection system;
- effectiveness and efficiency of the collection system;
- efficiency of transport, sorting and recycling system;
- awareness campaign and environmental consciousness;
- recovered materials income.

The relatively wide range in costs shows the uncertainty over present and future costs and variations between Member States' systems. Actual and reported costs are not always fully comparable as an itemised breakdown is not always available.¹⁴⁹ From an accounting point of view, awareness and promotion expenditures are budgeted annually. However, being included within capital expenditure they tend to be front-loaded at the establishment of the collection system, but they could be included by calculating depreciation using a straight line over several years. Moreover, the involvement of the recyclers and other participants in the chain, and contracts negotiated, are factors which can affect the way in which costs are accounted for.

Variations in the cost of battery collection and recycling do not just exist between the different waste management options, but also within those options. Costs are simply not uniform across different parts of Member States, for example for geographic and demographic reasons.

Cost reductions will arise both through 'learning by doing', and to some extent, through increases in participation, though net costs (as opposed to gross costs) are vulnerable to swings in materials prices, which obviously affects revenue streams. The influence of

¹⁴⁹ For instance, apart from the recycling plants, what is being reported for collection does not always include capital costs, and even if they do, how they derived and included.

'less tangible factors' such as scheme age and the information processes used to promote participation, are of great influence for batteries, as other countries' experience suggests.

In any case, the collection and recycling of all spent portable batteries and accumulators would entail additional costs since this a more expensive waste management option than final disposal.

For those countries with an effective and efficient collection and recycling systems for all portable batteries and accumulators there will be no extra costs on the basis of the policy options related to the collection and recycling of all spent batteries. On the contrary, they will benefit from economies of scale and further development of business and technologies. Moreover, all Member States will benefit from the setting up of the infrastructure for the collection of WEEE based on Directive 2002/96/EC and of ELV on the basis of Directive 2000/53/EC.

On the basis of the economic model built by Bio Intelligence, the mid-point range for establishing the collection rate for spent batteries would be 50% of annual sales (or 200 grams per inhabitant). In 2002, this represented 78.000 tonnes of portable batteries. From this point on, the costs rise significantly. At this rate, the average collection and recycling costs could be estimated at € 1,846 per tonne.¹⁵⁰ Based on the current experiences of collecting all portable batteries in the EU, this collection rate would cost an average of € 2,423 per tonne.¹⁵¹

Total costs for a collection rate of 50% of the annual sales/200 grams per inhabitant could be estimated at ranging from € 148 to 194 million (assuming annual sales for portable batteries of 160,000 tonnes).¹⁵² However, in practice this figure will be lower since this calculation does not take into consideration that, at this moment, Member States have already set up collection systems for the collection of batteries and accumulators covered by Directive 91/157/EEC. If one assumes that 28,000 tonnes of portable batteries would already be collected on the basis of the existing schemes¹⁵³, the total cost estimate would be lowered to a range of € 96 – 126 million.

4.2.2. *Industrial and automotive batteries and accumulators*

The collection and recycling of spent automotive and industrial batteries and accumulators is already taking place on the basis of industry practices. The policy options related to these batteries are not expected to have significant impacts. Here the important element is the legal backing to guarantee a closed-loop system.

¹⁵⁰ Those costs are based on a high cost scenario with a recycling input of 90-100%, see "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003 page 107

¹⁵¹ Average of the cheapest (Austria) and most expensive (Belgium) collection scheme currently in place, see [Annex VIII](#).

¹⁵² 50% of 160,000 should be collected, which is 80,000 tonnes times the costs per tonne.

¹⁵³ Compare to the amount of 27,218 tonnes of spent portable batteries which were collected on the basis of the existing schemes in 2002

4.3. Are there especially severe impacts on a particular social group, economic sector (including size-class of enterprises) or region?

The demand for batteries is relatively price-inelastic since the demand depends on the use of other products such as electrical and electronic equipment. The extent to which the cost of collection and recycling are being passed on to consumers could result in higher prices for batteries. Taking into account a collection rate of 50% of the annual sales/200 grams per inhabitant and estimating that households use 0.5 kg of portable batteries per year, the additional price would be € 1 or € 2 per household per year if the costs are entirely passed on to consumers.

The Acceding States are expected to comply with the existing Community legislation on batteries upon accession. It is estimated that the costs related to the proposed policy measures for the Acceding States are the same as for the current Member States which have not yet set up efficient collection schemes for the collection of all portable batteries.¹⁵⁴

However, since, on the average, the GDP of the Acceding Countries is lower than the GDP of the current Member States, one could assume that the battery consumption in Acceding States is lower than the battery consumption in the current Member States. Therefore, it may be more difficult for Acceding States to achieve a high volume of collection of spent portable batteries.

4.4. Are there impacts outside the Union on the Candidate Countries and/or other countries ('external impacts')?

The product requirements of the current proposal would apply on a non-discriminatory basis to all batteries and accumulators placed on the Community market and the waste management measures would apply to the whole of the territory of the Community.

The environmental benefits related to the new proposal would also have a positive impact in the entire Union, but most of all in those Member States which have not set up efficient collection systems yet.

The policy measure of establishing collection and recycling obligations for spent portable batteries and accumulators could create investments in recycling facilities in the current Member States as well as Acceding States and in Candidate Countries and could thus have a positive impact on employment. Moreover, export of batteries for recycling may make the market more competitive than would be the case if only national recycling facilities were to be used. The policy proposal will thus contribute to the functioning of the internal market and competition among recyclers.

The policy measures do not seem to lead to any negative impacts on Developing Countries.

4.5. What are the impacts over time?

Positive impacts on the environment (less heavy metals from batteries in the groundwater from landfills and in the air from incineration) and employment in the battery collection

¹⁵⁴ At this moment, only Austria, Belgium, France, Germany, the Netherlands and Sweden have set up collection schemes for the collection of all portable batteries.

and recycling business.¹⁵⁵ Recycling requires a mix of low skilled (collection) and high skilled (processing) local employment.

The economic costs related to the collection and recycling of spent batteries and accumulators are expected to decrease over time, when the collection system has been set up and is running for several years.

4.6. What are the results of any scenario, risk or sensitivity analysis undertaken?

Two main risk factors are important for collection and recycling systems for spent batteries: consumer behaviour (for portable batteries) and price of the recovered materials under different contracts.

The former determines the rate of participation in any scheme and thus the final collection rate. The latter, related to the recycling rate, sees the economic values of recovered metals fluctuate over time with a relatively high volatility of the reference markets.

While consumer behaviour may be targeted through campaigns or a mix of collection options and financing schemes, the demand for scrap metals depends on industry structure and the availability of production technologies that use scrap feeds to yield value added products. This complex market relies on the decisions of many independent actors including scrap dealers, brokers, dismantlers, and smelters and does not necessarily follow open market prices. For instance, a lack of demand for recovered material would reduce the recycling rates, and companies could also incur additional costs if metals were stored until global economic conditions improved.

Since there are different organisations playing different roles in the collection and recycling of batteries, it is difficult to account for all outlays on an equal footing and place schemes on a level playing field in terms of the efficiency of the resources they deploy and their costs. In other words, the mix of options chosen for collecting and financing and not just the real operational costs affect the efficiency and effectiveness of a system. The perceived opportunity cost of investments would be expected to be rather different depending on who is involved (for example, manufacturers, retailers, municipalities, non-profit entities and commercial entities). It would be difficult to level the playing field in terms of involvement and accounting for such outlays. Should it be done by a policy proposal the risks are of downplaying the potential strengths and weaknesses of different types of operators within different niches of the battery waste management industry.

5. HOW TO MONITOR AND EVALUATE THE RESULTS AND IMPACTS OF THE PROPOSAL AFTER IMPLEMENTATION?

5.1. How will the policy be implemented?

At Community level, the policy will be implemented by a Directive from the European Parliament and the Council on batteries and accumulators.

¹⁵⁵ However, the increased activities in the recycling industry may substitute for activities in the metals extraction industry. Therefore, one could also assume that the impacts on employment will be neutral.

Member States would be responsible for the implementation of the objectives of this new Directive on their national territory. If they do not exist already, efficient collection schemes need to set up for all spent batteries. In order to achieve the best possible results, the Commission will encourage Member States to share information on best practices within the framework of the Committee established on the basis of Article 18 of Directive 75/442/EEC.

5.2. How will the policy be monitored?

The principal monitoring instrument for the Commission is a report on the implementation which Member States will have to submit to the Commission every three years. This timeframe coincides with the timetable set out in Article 5 of Council Directive 91/692/EEC of 23 December 1991.

The Commission will publish a final report on implementation of the Directive as well as the collection and recycling targets in the Official Journal of the European Communities.

In order to monitor the specific environmental concerns related to the portable NiCd batteries, which risk of ending up in the municipal solid waste stream, Member States are required to monitor the municipal solid waste stream on the amount of spent portable NiCd batteries found.

In order to avoid free riders on the market, Member States are required to set up a register of producers who put their products on the Community market.

5.3. What are the arrangements for any ex-post evaluation in the policy?

The Commission will evaluate the impacts of the Directive on the basis of the aforementioned reporting obligation of the Member States. Without prejudice to its right of initiative, the Commission may propose amendments to the Directive particularly to adjust the collection and recycling requirements and the use of hazardous substances in batteries and accumulators.

6. STAKEHOLDER CONSULTATION

6.1. Which interested parties were consulted, when in the process, and for what purpose?

A public, on-line stakeholder consultation was launched on 25 February 2003, with the publication of a Consultation Document on the web. The stakeholder consultation ran until 28 April 2003. The non-confidential contributions were published on the website on 4 June 2003.

The purpose of this on-line stakeholder consultation was to get input from all interested parties on a wide range of policy options listed in the Consultation Document. This stakeholder consultation took place at an early stage in the process. The results from the consultation are therefore a useful element for the selection of the final policy options.

A stakeholder meeting took place on 15 July 2003 in order to discuss the main outcome of the on-line stakeholder consultation and to clarify certain issues.

6.2. What were the results of the consultation?

The Commission received contributions from 149 stakeholders (including national, local and regional authorities, industry, battery associations, trade associations, NGOs and consumer and retail organisations). A considerable number of international stakeholders also contributed to the consultation. This stakeholder interest shows the importance of the debate launched by the Commission services. A list of the contributing stakeholders is attached in Annex X.

One of the proposed policy options in the Consultation Document was to extend the scope of the current Battery Directive to all batteries and accumulators placed on the Community market. Most participating governments and other stakeholders supported this policy option. However, some stakeholders requested an exemption from the scope for primary batteries (alkaline manganese and zinc carbon), micro batteries and batteries for national security, space and military applications.

The Consultation Document indicated that spent batteries and accumulators, in particular when they are incinerated or landfilled, are an important source of emissions of heavy metals which may constitute a significant source of environmental damage and risk to human health. The Consultation Document proposed a ban on the use of cadmium in batteries as one of the policy options, where viable substitutes are available.

This policy option was supported by a few participating governments, NGOs and the association for appliance manufacturers. One NGO held a petition in France against the use of cadmium in batteries, which was signed by approx. 800 citizens.

- The International Cadmium Association and producers of NiCd batteries strongly opposed this policy option. They were supported by many economic operators using NiCd batteries. Those economic operators submitted a standard letter against any restriction of the use of NiCd batteries in industrial applications (emergency lighting, power tools, railway and metro systems).
- The Consultation Document proposed different collection rates of all batteries and accumulators placed on the Community market with a possibility of separate collection rates for automotive batteries and batteries containing cadmium.
- Most stakeholders agreed to different collection targets for portable batteries on the one hand and industrial/automotive batteries on the other hand. For portable batteries most stakeholders favoured a lower level of targets, whereas for industrial and automotive batteries, most stakeholders favoured a higher level of collection targets.
- Most governments seemed to favour mandatory targets whereas, for portable batteries, some parts of industry favoured indicative targets.

The Consultation Document also asked for input on the calculation method to be used for the collection targets. Some stakeholders indicated that the difficulties related to the setting of the calculation method are the lifetime and hoarding aspects of batteries.

Stakeholders made various suggestions:

- common calculation method should be established in a separate Commission decision;
- a method based on annual sales taking into account life-time and hoarding;
- a method based on grams per inhabitant;
- a method based on batteries collected and found in the municipal solid waste stream; and
- a method taking into account imports, exports and weight.
- The Consultation Document proposed different recycling targets for different battery types (portable, automotive, and batteries containing cadmium) as a possible policy option. Those recycling targets could either relate to the quantities entering the recycling plant (input) or the quantities of materials actually recovered (output). Most stakeholders agreed that the recycling input should be close to 100%. Some stakeholders stated that the recycling output is difficult to calculate in a non-dedicated recycling plant. Other stakeholders suggested establishing higher recycling targets for batteries containing cadmium, mercury or lead. A number of stakeholders favoured voluntary recycling targets for portable batteries. Most stakeholders favoured a lower level recycling target for portable batteries and a higher level recycling target for industrial and automotive batteries. Some stakeholders suggested establishing harmonised dismantling and recycling standards.

The Consultation Document requested input on the introduction of producer responsibility for the collection and recycling of batteries and accumulators. Some stakeholders favoured full producer responsibility. Other stakeholders wanted the responsibility to be shared between different actors (producers, retailers, municipalities and consumers). Some stakeholders suggested deciding responsibility depending on the hazardousness of the battery type.

Most government and NGOs favoured economic instruments such as deposit schemes whereas most economic operators and battery associations were against the introduction of deposit schemes for economic reasons. Some stakeholders, in particular battery producers, favoured the introduction of a visible fee. Other stakeholders, notably retailers strongly opposed such a visible fee.

The final expression of the producer responsibility principle can be implemented in different ways depending on degrees of responsibility and whether a voluntary or mandatory approach has been pursued. The Consultation Document asked for input on voluntary agreements. Most stakeholders were in favour of voluntary agreements at national level for the collection of industrial and automotive batteries and accumulators. Some stakeholders feared that the conclusion of voluntary agreements would not resolve the free rider problem. Other stakeholders were of the opinion that it would be impossible to conclude voluntary agreements because of the various actors involved in the collection and recycling of batteries and accumulators (producers, municipalities, retailers, consumers etc).

In addition to the policy options mentioned in the Consultation Document, a lot of stakeholders pointed out that the free rider issue is an important problem on the battery market which should be resolved within the framework of a new Directive.

Some stakeholders made specific comments on the need to inform consumers to bring back spent batteries and accumulators. Also, some stakeholders made specific comments on the infrastructure of the collection. Some stakeholders stated that the Battery Directive should take maximum advantage of existing collection and recycling schemes (e.g. retailers, municipalities, and the WEEE Directive) rather than insisting on new or alternative schemes.

6.3. How were the minimum standards for consultation met?

In developing this proposal, the minimum standards for consultation, as set out in Commission Communication COM (2002)277 final, were met as follows:

1. Clear content of the consultation

The stakeholder consultation had a clear content, since the Consultation Document provided the stakeholders with a summary of the context, scope and objectives of the consultation including a description of the specific policy options which the Commission services considered.

2. Publication

The Consultation Document was published on the web site and announced on the single access point. Moreover, Member States and dedicated stakeholders affected by the policy and those with a direct interest were informed and invited to submit comments by separate e-mail.

3. Time limit for participation

The consultation started on 25 February and ended on 28 April 2003, giving the stakeholders 2 months to submit written comments. The Commission received by far the overwhelming majority of contributions on the closing date of the consultation, 28 April 2003. However, the Commission received some contributions after the closing date. All contributions received were taken into consideration for the present proposal.

4. Acknowledgement and feedback

Acknowledgement has taken place in the form of an individual response (by e-mail if the electronic address was known and otherwise by regular mail). All non-confidential contributions were made public on the web site on 4 June 2003. A stakeholder meeting was organised on 15 July 2003. The main purpose of this meeting was to give feedback on the results of on-line stakeholder consultation and to clarify certain issues raised by the stakeholders during the consultation process. The presentation held by the Commission services during this meeting will be published on the following web page: <http://europa.eu.int/comm/environment/waste/batteries/index.htm>. The Extended Impact Assessment and the Explanatory Memorandum provide further feedback on the policy choices of the Commission. A list of stakeholders attending the meeting is included in Annex X.

5. Specific elements for focused consultations

The Commission ensured that relevant parties had an opportunity to express their opinions by:

- sending separate mailings to the parties affected by the policy, those involved in the implementation and those with a direct interest with the invitation to submit written comments;
- by organising bilateral meetings in particular with the parties directly affected by the policy.

7. COMMISSION DRAFT PROPOSAL AND JUSTIFICATION

7.1. What is the final policy choice and why?

On the basis of this assessment, the final policy instrument chosen is a new Directive. A Directive is the most appropriate policy instrument in light of both the objective and the content of the present proposal. A new Directive revising and repealing the current Battery Directives would set a framework for the collection and recycling of spent batteries and, with respect to the organisation of the system, would guarantee a proper functioning of the internal market.¹⁵⁶ This policy instrument would at the same time leave Member States the option to choose the most appropriate implementation measures for their national territory at the lowest cost. Moreover, for the collection of spent batteries and accumulators, Member States could benefit from existing collection infrastructure or from infrastructure (to be) set up under other pieces of Community legislation, such as Directive 2000/53/EC on end-of life vehicles and Directive 2002/96/EC on waste electrical and electronic equipment.

This is likely to lead to a win-win situation: the policy objectives would be achieved while Member States and industry would, at the same time, have more flexibility and lower implementation and compliance costs.

Member States are furthermore encouraged to use environmental agreements to implement certain obligations of the Directive. The proposal would lay down the essential aspects, notably the environmental objective, to achieve at a given deadline as well as monitoring requirements. The economic operators would commit themselves to implementing the detailed modalities under an environmental agreement at national level. The conclusion of voluntary agreements at national level could ensure that the objectives can be implemented by parties active in the field concerned. Those parties could take the national situation (existing collection infrastructure, consumer behaviour, etc) into consideration when concluding the national environmental agreements. This approach is consistent with other pieces of Community waste legislation: see for example, Article 10 of Directive 2000/53/EC on end-of life vehicles and Article 17 of Directive 2002/96/EC on waste electrical and electronic equipment.

¹⁵⁶ In this context, the principles laid down in the Communication from the Commission on the Single Market and the Environment, COM (1999)263, have been taken into account.

The proposed measures aim to avoid that spent batteries and accumulators end up in the environment following landfill or incineration by establishing a closed-loop system.

7.1.1. What specific measures apply to portable batteries and accumulators?

The setting up of national collection systems to allow consumers to return spent portable batteries free of charge.

The main challenge is to motivate consumers to bring back their spent batteries. Therefore, it is proposed to set an overall collection target of 160 grams per inhabitant. The method of using grams/inhabitant is relatively easy as it would avoid difficult estimations about the life-span and hoarding and allows using data which readily available. Moreover this method would be in line with the method used in the WEEE Directive. The quantity of 160 grams is proposed as this would be the most cost-efficient target, on the basis of Bio Intelligence's economic model (see [Annex IX](#)). The efficiency of national collection schemes for portable batteries will be evaluated on the basis of this target.

In principle all collected batteries should be processed for recycling. However some portable batteries could be unsuitable for recycling. Therefore it is proposed that at least 90% of the total amount of portable batteries collected should enter recycling processes.

For the additional costs related to the collection and recycling of all portable batteries, it is proposed to establish a shared producer responsibility principle, in order to divide the costs between all the actors (producers, retailers, consumers and municipalities) involved in those activities.

7.1.2. What specific measures apply to portable NiCd batteries and accumulators?

Member States are required to monitor the waste stream on the amount of portable NiCd batteries.

Moreover, an additional collection target of 80% of the spent portable NiCd batteries generated annually is proposed, in order to evaluate whether the environmental objectives of the Proposal are met. This is 80% of the total quantity collected through collection schemes and discarded in the municipal solid waste stream.

A recycling target (input) of 100% of the portable NiCd batteries is proposed.

It is proposed to set minimum recycling efficiencies of all the cadmium and 75% by weight of the portable NiCd batteries.

What specific measures apply to industrial and automotive batteries and accumulators?

An obligatory take-back scheme for the collection of those batteries. Normally spent automotive batteries are collected through schemes set up under the ELV Directive. If necessary, Member States are required to set up additional collection schemes for those batteries.

A prohibition on disposal in landfills or by incineration.

In principle all collected batteries should be processed for recycling. Therefore, a recycling target (input) of 100% of the total amount of collected batteries is proposed.

Taking into account that the battery production uses approximately 70% of the global lead and cadmium production, it is proposed to set minimum recycling efficiencies of all the cadmium and 75% by weight of the industrial NiCd batteries and minimum recycling efficiencies of all the lead and 65% by weight of the automotive and industrial lead-acid batteries.

7.2. Why was more/less ambitious option not chosen?

Less ambitious options, the "no policy change option" and environmental agreement at Community level, were not chosen because they would either not address the heavy metal problem in landfills and incinerators at all or at least not in an enforceable, reliable way.

More ambitious options, like higher collection and recycling rates were not chosen because of cost implications.

A ban on the use of cadmium in portable batteries and accumulators was not chosen, since the proposed measures are expected to provide an equivalent level of environmental protection at lower costs. Such a ban would not cover existing and hoarded portable NiCd batteries and accumulators. For household appliances, the trend now seems to be towards substitution of NiCd batteries by other types (e.g. NiMH and Li-Ion).

7.3. Which are the trade-offs associated to the chosen option?

In order to stop batteries and accumulators from going to landfills and incinerators, all batteries have to be collected, as the collection of specific battery types is not efficient. This entails additional costs, in particular for those Member States without efficient collection schemes. Moreover, in order to close the material loop, all collected batteries should be processed for recycling. In some cases, recycling may also entail higher costs than the disposal operations. Additional measures to guarantee the closed loop system, such as a ban on landfill/incineration and the monitoring of the municipal solid waste stream also entails additional costs.

Moreover, collecting and recycling all spent batteries and accumulators could also cause negative environmental impacts due to longer transport distances. This trade-off should, however, be addressed at national level.

7.4. In the case of poor data or knowledge at present, why is a decision to be taken now rather than be put off until better information is available?

Specific data are not always available, like reliable life-cycle-assessments for the recycling of general-purpose batteries, but this does not affect the knowledge base for the proposal.

Moreover, there is no precise data on the long-term effects of leachate from landfills on the environment. However, this would not justify waiting for more data or knowledge. On the contrary, action now, addressing the amount of batteries already on the market

and hoarded, may be less expensive than dealing with high heavy metal levels from batteries and accumulators, accumulated and migrated in the environment at a later stage.

7.5. Have any accompanying measures to maximise positive and minimise negative impacts been taken?

In order to maximise the positive effects of this proposal, Member States should monitor the municipal solid waste stream on the amount of portable nickel-cadmium batteries discarded. On the basis of those results, it is proposed to evaluate the necessity to prohibit the use of heavy metals in batteries on a regular basis, taking into account new scientific evidence and technological developments.

Moreover, it is proposed to evaluate the collection and recycling objectives on a regular basis, in particular in view of the objectives of the proposed Directive.

ANNEX I: OVERVIEW OF THE SEGMENTATION OF THE BATTERY MARKET:

Source: “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003.

Users	Technology	Typical Uses	Type of batteries
Households & Professional users	General Purpose (alkaline manganese AIMn and zinc carbon ZnC)	Clocks, portable audio and devices, torches, toys and cameras	Non rechargeable (primary)
	Lithium (Li)	Photographic equipment, remote controls and electronics	
	Button cells (zinc air, silver oxide, manganese oxide and lithium)	Watches, hearing aids, calculators	
	Nickel Cadmium (NiCd)	Cordless phones, power tools and emergency lighting	
	Nickel Metal Hydride (NiMH)	Cellular and cordless phones	
	Lithium Ion (Li-ion)	Cellular phones, laptops and palms	
	Lead Acid	Hobby applications	
Industrial	Lead Acid	Automotive/Motorcycle Starter, Lighting and Ignition (SLI)	Rechargeable (secondary)
	Lead Acid Standby	Alarm systems, emergency back-up systems, e.g.rail and telecommunications applications	Starter batteries
	Lead Acid Traction	Motive power sources, e.g. forklift trucks, milk floats	Industrial batteries
	Nickel Cadmium (NiCd) standby	Motive and standby applications, e.g.satellite and rail applications	Large (> kg)
	Nickel Cadmium (NiCd) motive power	Electrical vehicles	
	Nickel Metal Hydride (NiMH)	Hybrid vehicles	

ANNEX II: OVERVIEW OF MATERIAL COMPOSITION OF DIFFERENT BATTERIES IN % BY WEIGHT:

Battery type	Mercury	Cadmium	Lead	Zinc	Nickel	Manganese	Iron	Cobalt
Zinc-carbon	0.0005	0.007	0.15-2	35		18	21	
Alkaline Manganese	0.0013	0.0074	0.040 - 2	35		28	28	
Portable NiCd		15-20		0.060	15-20	0.083	29-40	0.6
Portable NiMH					25-46	0.81-3.0	20-25	1.0-4.5
Portable Li-based					12-15	10-15	4.7-25	12-20
Button cells	2							
Lead Acid batteries			65-70					
Valve-regulated lead acid		0.3						

Source: adapted from Rydh 2003; EPBA Quantifying the environmental benefits of ecolabelling systems – changes in the mercury content of alkaline manganese dioxide batteries, Carl Johan Rydh, University of Kalmar, Report SIS Ecolabelling 1999-04-01.

ANNEX III: COLLECTION AND RECYCLING OF BATTERIES UNDER CURRENT COMMUNITY LEGISLATION

1. Scope

The current Community legislation on batteries and accumulators, laid down in Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances¹⁵⁷ amended by Commission Directive 98/101/EC,¹⁵⁸ applies to primary and secondary (rechargeable) batteries containing more than:

- 0.0005% mercury by weight;
- 0.025% cadmium by weight; and
- 0.4% lead by weight.

Consequently, it does not cover the entire Battery market; which is illustrated by the following table:

Category	Battery Chemistry	Covered by the current Battery Directive
Portable	Alkaline manganese	
	Zinc carbon	
	Lithium	
	Mercury oxide	Yes
	Silver oxide	
	Zinc air	
	Manganese oxide	
	Lithium manganese	
	Nickel Cadmium	Yes
	Lead Acid	Yes
	Nickel Metal Hydride	
Automotive	Lead-acid	Yes
Industrial	Sealed lead acid	Yes

¹⁵⁷ OJ L 78, 26.3.1991, p. 38.

¹⁵⁸ OJ L 1, 5.1.1999, p. 1, adapting to technical progress Council Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances.

	Lead Acid	Yes
	Lead Acid	Yes
	Nickel Cadmium	Yes
	Zinc air	
	Silver zinc	

2. Collection

Article 7 of Directive 91/157/EEC requires Member States to ensure the efficient organisation of separate collection of the batteries covered by the Directive. These schemes are divergent which has led to inconsistencies and inefficiencies in overall battery collection in the EU.

As an illustration, the following table gives an overview of the *portable battery collection* in 9 EU countries in 2002:

Country	Collection rate in % of sales in 2002	Grams per inhabitant
Austria	44	179
Belgium	59	228
France	16	69
Germany	39	157
Netherlands	32	116
Sweden	55	193
Spain	14	61
UK	0.5	2

Source: "Impact Assessment on Selected Policy Options for Revision of the Battery Directive" Bio Intelligence, 2003.

Little reliable data exists on the collection of spent *automotive batteries* in the EU. A large part of spent automotive batteries will be collected together with the end-of life vehicle on the basis of Directive 2000/53/EC.¹⁵⁹

¹⁵⁹ Annex I of this Directive requires these batteries to be removed from the end-of life vehicle after collection.

The following table gives an overview of the collection rates expressed in a % of the annual sales in 5 EU countries:

Country	Base year	Tonnes of automotive batteries sold in the base year	Tonnes of spent automotive batteries collected in the base year	Collection rate in % of sales
Austria	1999	10,500	16,000	152 ¹⁶⁰
France	2001	100,749	91,400	91
Germany	1999	235,304	182,678	78
Sweden	2001	42,000	32,000	76
UK	2002	111,853	86,837	78

Source: “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003.

Few data exist on the collected amount of spent *industrial batteries* in the EU. The only recent data concerns the collection of industrial NiCd batteries, which account for approx. 2% of the total industrial battery segment:

Industrial battery segment	% of total industrial battery segment	Tonnes of industrial batteries sold	Tonnes of industrial batteries collected	Collection rate in % of sales
Lead acid Standby	60	115,000	Not available	Not available
Lead acid traction	36	67,500	Not available	Not available
NiCd	2	3,600	2,800	78
Others	2	2,990	Not available	Not available

Source: “Impact Assessment on Selected Policy Options for Revision of the Battery Directive” Bio Intelligence, 2003

3. Recycling

EBRA reported the recycling of the following batteries in tonnes for 2002:

Battery type	Quantities recycling (in tonnes)
Zinc-carbon, alkaline and zinc air	10.710 tonnes
Nickel-cadmium	4.657 tonnes
Nickel-metalhydride	229 tonnes

¹⁶⁰ Due to fluctuations in the sales price of lead, industry temporarily stores spent lead acid batteries, before they are processed for recycling.

Lithium (primary and secondary)	205 tonnes
Button cells (including mercury oxide)	38 tonnes
Total	15.839 tonnes

See: <http://www.ebrarecycling.org/ArticlesPDF/pressreleases/EBRApressrelease4-6.pdf>

ANNEX IV: RECYCLABLE MATERIALS OF PORTABLE BATTERIES

Metals recoverable % weight per battery (1)
--

Non rechargeable batteries

General purpose	Zn	20%
	Mn	20%
	Fe	20%
	Cu	10%
	Total	70%

Button cells	Zn	26%
	Hg	34%
	Fe	30%
	Total	90%

Rechargeable batteries

Lead acid	Lead	58%
	Total	58%

NiCd	Cd	15%
	Ni	25%
	Steel	35%
	Total	75%

NiMH	Ni	40%
	Steel	18%
	Total	58%

Li-ion	Acier	22%
	Cobalt	17%
	Total	39%

Source: www.screlec.fr, June 2003

ANNEX V: AVAILABILITY OF SUBSTITUTES FOR THE USE OF CADMIUM IN BATTERIES AND ACCUMULATORS

Source: Bio Intelligence, July 2003

battery segment	application		battery technology available in the market					EU NiCd battery sales (tonnes/year, 1999)
			NiCd	Lead-acid	Ni-MH	Li-ion	Li-polymer	
portable batteries (< 1 kg)	household	-cellular telephones, -portable computers, -camcorders, -digital cameras, -remote control toys, - other small household appliances (small vacuum cleaners, shavers, ...)	X	X	X	X	X	3 600
		cordless power tools	X		X			3 950
	professional	cordless power tools	X		X			1 800
		emergency lighting systems (building, aircraft ...)	X	X				3 050
		medical equipment	X	?	?	?	?	200
industrial use (> 1 kg)	stationary	-power supply (hospital operating theaters, offshore oil rigs, standby power in industry, emergency power system in airports, large telecommunication station, ...), -power back-up (large computer systems in banks and insurance companies, ...)	(X)	X				2 600
	mobile	railways, aircraft (braking and security functions)	X	(X)				
	specialized	space and military applications (engine starting, emergency back-up functions)	X	?	?	?	?	200
electric vehicles	off-road vehicles		(X)	X				
	on-road vehicles		X	(X)	x (pilot)	x (pilot)	x (pilot)	600

ANNEX VI: SUMMARY OF TWO STUDIES ON IMPACTS OF DIFFERENT WASTE MANAGEMENT OPTIONS

A report for Friends of the Earth, UK Waste and Waste Watch, on the economics of different waste management options for municipal waste, used a cost-benefit analysis to prove the hypothesis that "although the financial costs of recycling are greater than that for other methods of dealing with waste, to the extent that one is able to incorporate the environmental costs and benefits associated with all methods, the overall economic analysis will show that when one accounts for all the costs and benefits, the net results show recycling is the best option in respect of materials recovered from the household waste stream".¹⁶¹

Another study (Coopers & Lybrand, 1997)¹⁶² compares incineration, landfill and recycling the different fractions of the municipal solid waste. The results of these studies generally support the view that recycling has net environmental benefits over incineration and landfill (with the possible exception of certain materials, such as plastic film).

The results of the study are shown below (options with negative external cost have net environmental benefits).¹⁶³

External costs and benefits of different waste management options	
Waste management option	External cost estimate, £ per tonne of waste, 1999 prices
Landfill	3
Incineration (displacing electricity from coal-fired power stations)	-17
Incineration (displacing average-mix electricity generation)	10
Recycling	-161
- Ferrous metal	-297
- Non-ferrous metal	-929

¹⁶¹ Dr Elisabeth Broome, Prashant Vaze and Dr Dominic Hogg: "Beyond the bin: The Economics of Waste Management Options, A final report to Friends of the Earth, UK Waste and Waste Watch", Ecotec Research and Consultin Ltd.

¹⁶² Coopers & Lybrand/CSERGE, "Costs and benefits of the Different Municipal Waste Management Systems: objectives and instruments for the year 2000", Office for the Official Publication of the European Communities 1997.

¹⁶³ One criticism of the study was that it did not consider certain issues, such as the environmental costs associated with different municipal solid waste options, toxic air pollutants from incineration and landfill, and disamenity impacts and leachate. EFIEA, "Applying Integrated Environmental Assessment to EU Waste Policy – A Scoping paper for the European Forum on Integrated Environmental Assessment", May 2003.

- Glass	-196
- Paper	-69
- Plastic film	17
-Rigid plastic	-48
- Textiles	-66
<i>Source: adapted from Coopers & Lybrand (1997)</i>	

ANNEX VII: SUMMARY OF STUDY “IMPACT ON GLOBAL METAL FLOWS ARISING FROM THE USE OF PORTABLE RECHARGEABLE BATTERIES”, RYDTH, C.J. AND SVÄRD, B.

This study assesses the use of portable rechargeable battery cells and their effects on global metal flows for the following three cases: (1) the base case, which reflects the global production of batteries in 1999; (2) the global production of portable nickel-cadmium batteries in 1999, assumed to be replaced by other battery types; and (3) assessment of the projected battery market in 2009.

The study included the following battery technologies: nickel-cadmium (NiCd), nickel-metal hydride (NiMH) (AB₅, AB₂,) and lithium-based batteries (Li-ion: Co, Ni, Mn; Li-polymer: V). Based on the lithospheric extraction indicator (LEI), which is the ratio of anthropogenic to natural metal flows, and the significance of battery production related to global metal mining, the potential environmental impact of metals used in different battery types was evaluated.

The LEIs and average metal demand for the battery market in 1999, expressed as a percentage of global mining output in 1999, were estimated to be as follows: Ni 5.6 (2.0%), Cd 4.4 (37%), Li 0.65 (3.8%), V 0.33 (6.5%), Co 0.18 (15%), Nd 0.18 (8.4%), La 0.10 (9.5%), Ce 0.083 (4.4%) and Pr 0.073 (9.4%).

The use of Ni and Cd is of the greatest environmental interest, due to their high LEIs. In the case of the complete replacement of portable NiCd batteries by NiMH or Li-based batteries, the LEI for Ni (5.6) would change by -0.1% to 0.5% and the LEI for Cd would decrease from 4.4 to 3.0 (-31%). Meanwhile, the mobilisation of metals considered less hazardous than Cd (LEI<0.65) would increase less than 7.%. Based on this assessment, the replacement of NiCd batteries would result in decreased environmental impact.

To decrease the impact on global metal flows arising from the use of portable batteries the following points should be considered: (1) development of battery technologies should aim at high energy density and long service life, (2) metals with high natural occurrence should be used, and (3) metals from disused batteries should be recovered and regulations implemented to decrease the need for mining of virgin metals. The method used enables an assessment early in the cause-effect chain, when few data about toxic effects are available. It can also be used to determine whether environmental problems are shifted from one to another.

Rydh, C.J., Svärd, B. (2003) *Impact on global metal flows arising from the use of portable rechargeable batteries, The Science of the Total Environment, Vol. 302, No. 1-3, p. 167-184*

This study can be viewed at:

http://homepage.te.hik.se/personal/tryca/battery/Rydh_2003_Battery_metal_flows.pdf

ANNEX VIII: COSTS RELATED TO COLLECTION AND RECYCLING IN ALL PORTABLE BATTERY COLLECTION SCHEMES

Cost in € per tonne in 2002¹⁶⁴	NL	DE	FR	AT¹⁶⁵	BE
Costs of promoting battery collection	1 568	267	290		1658 ¹⁶⁶
Administrative costs	400	250	500		870
Collection points (equipment)	450	150			56
Collection (logistics)			457		250
Costs of sorting ¹⁶⁷	200	150	152		246
Costs of transportation					
Costs of recycling	900	268	1000		540
Labelling costs for participants to the system					1000 ¹⁶⁸
Provision					113
Total	3 518	1 115	2 400	1 113	3 734 ¹⁶⁹

Source: contacts with BEBAT, GRS and Bio Intelligence Final report of July 2003, pages 199-203

¹⁶⁴ US and Switzerland run collection and recycling systems based on maximum costs of around 2,500-2,800 € per tonne

¹⁶⁵ 2001 data instead of 2002.

¹⁶⁶ These high communication costs are reported to be the result of the legal threat of an eco-tax if the collection rates fixed by the Belgian law are not met.

¹⁶⁷ General-purpose batteries (alkaline manganese and zinc-carbon batteries) can also be recycled in the steel industry. However, steel recycling plants requires a mercury free waste stream which implies the sorting of collected batteries to eliminate the mercury batteries sold prior to 2000, containing more than 5 ppm mercury. Sorting batteries is either electro-dynamics (also separate NiCd and NiMh) or X-ray sensor. A UV detector can recognise mercury free. It is expected that from 2004 onwards, the batteries becoming waste will no longer contain more than 5 ppm of mercury. Therefore, the sorting of general-purpose batteries will no longer be necessary if they are being processed in non-dedicated recycling plants. Recent experiences with automatic sorting have resulted in lower sorting costs. The average price of automatic sorting is estimated to be below €200. See “Experiences with an industrial SORBAREC-X-ray sorting plant after 18 months in operation”, Dr. Steven Rausch, Thure Molchin, Dr. Klaus Nowak, Günter Timm, ICBR 2003.

¹⁶⁸ Those costs are specific to the Belgian system in order to determine the members of the BEBAT scheme.

¹⁶⁹ Total costs minus 1000€ marking since those are specific costs to the Belgian system.

ANNEX IX: COST CURVE OF COLLECTION AND RECYCLING COSTS IN HIGH COST SCENARIO (MODEL DEVELOPED BY BIO INTELLIGENCE)

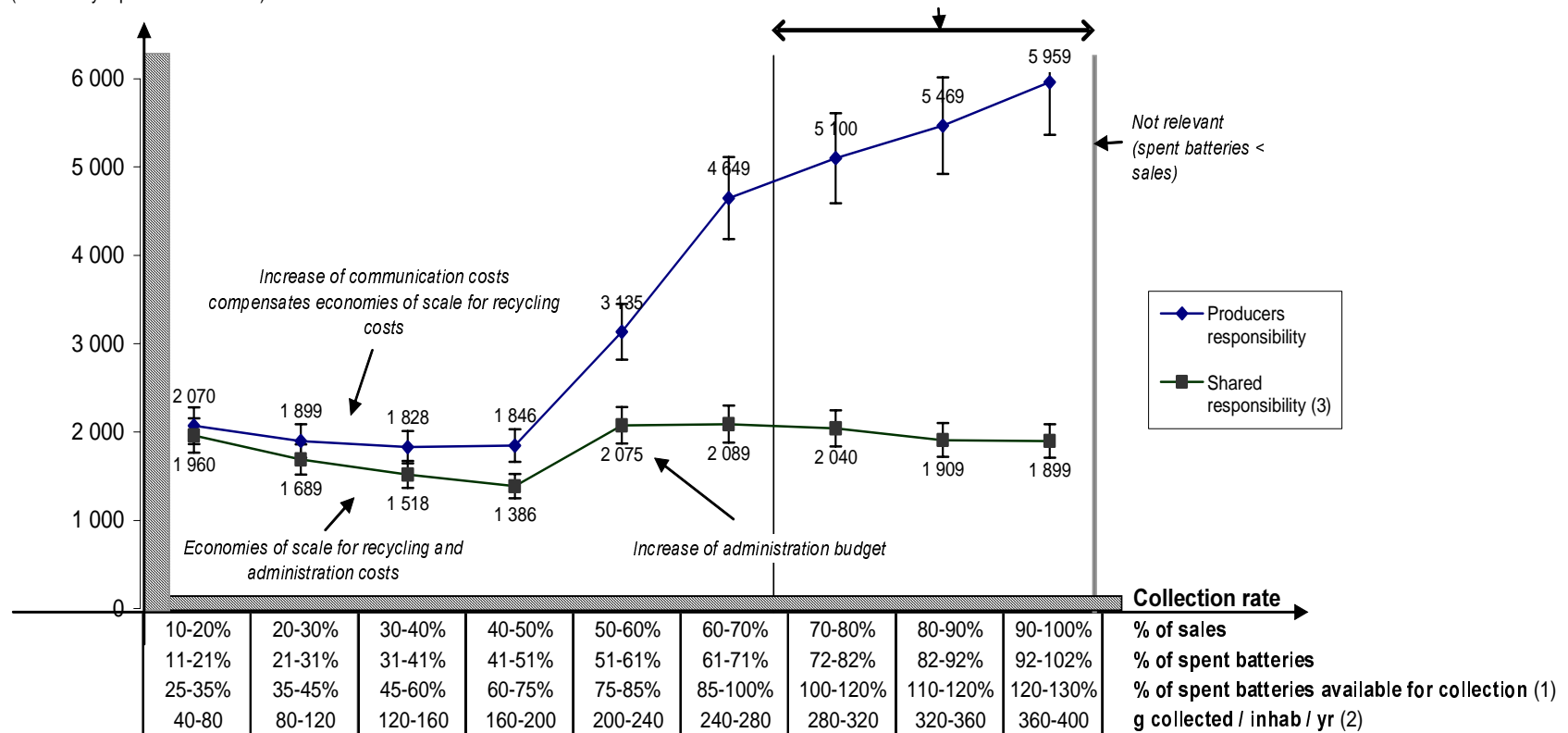
See following page

Small Batteries - Scenario H_{90-100%}
 Collection system: **High cost**
 Recycling: **High cost with economies of scale**
 Collected batteries sent to recycling: **90 - 100%**

Euros / tonne collected

Total collection and recycling costs paid for by producers
Euros / t of small batteries
separately collected in view of recycling
 (uncertainty represented: +/-10%)

High cost communication programmes:
 - to reduce hoarding behaviors in order to increase spent batteries available for collection
 - to encourage refractory persons to participate to separate collection



Baseline scenario
 - Minimum of 3% of sales collected following the implementation of WEEE directive
 - Average of 90 Euros / t of batteries disposed of

(1) Equivalence between collection rate as % of sales and collection rate as % of spent batteries available for collection based on the current average current hoarding behaviors of households and professional users in the EU
 (2) Based on the EU average situation of 165 kt of small batteries sold in 2007 (158 kt in 2002 + 1% average growth rate per year) and 390 Millions inhabitants
 (3) In case of shared responsibilities, the cost difference between the two curbs is paid for by public authorities and/or retailers

ANNEX X: LIST OF CONTRIBUTING STAKEHOLDERS

List of stakeholders who participated in the on-line stakeholder consultation

The following list does not include stakeholders who have specifically requested confidentiality (8 in total). The names appear in alphabetical order per classification used by the Commission services for the publication of the contributions on-line (4 June 2003). This order does not bear any relation to the order in which the contributions have been received, nor to the relative importance of the contributions.

Member States

- (1) Danish Ministry of Environment
- (2) Dutch Ministry of Environment
- (3) French Ministry of Environment
- (4) Greek Ministry of Environment
- (5) Spanish Ministry of Environment
- (6) Swedish Ministry of Environment
- (7) UK Department of Trade and Industry (DTI)

Acceding States

- (1) Czech Republic Ministry of Environment
- (2) Latvian Ministry of Environment
- (3) Slovak Government Waste Management Department

Other States

- (1) Mission of PR of China to the EU
- (2) Permanent Delegation of Turkey to the EU
- (3) Swiss Federal Agency for the Environment

Local and Regional Authorities

- (1) Basildon District Council (UK)
- (2) Council of European Municipalities and Regions
- (3) County Surveyors Society (CSS, UK)
- (4) Finnish Maritime Administration
- (5) Local Government Association (UK)
- (6) Mayor of Municipality of Oskarshamn (SE)

Battery Associations

- (1) AGEFA (Association for importers and wholesalers of EEE and national battery association (PT)
- (2) ANIE-CSI Portable Battery Group (IT)
- (3) ANIE-CSI Battery Group (IT)
- (4) Asimelec (ES)
- (5) Battery International Council (Japan)
- (6) Batteriforeningen (DE)
- (7) British Battery Manufacturer Association (BBMA) (UK)
- (8) CollectNiCad
- (9) Czech Portable Battery Association (CZ)
- (10) Battery International Council (USA)
- (11) European Battery Recycling Association (EBRA)

- (12) European Portable Battery Association (EPBA)
- (13) EUROBAT (industrial and automotive batteries manufacturers and suppliers)
- (14) Finnish Battery Association (FI)
- (15) FRANBAT (French Industrial and automotive battery manufacturers),
- (16) Hungarian Portable Battery Association
- (17) NEFIBAT (NL)
- (18) Polish Portable Battery Association (PPBA)
- (19) Portable Rechargeable Battery Association (PRBA)
- (20) Syndicat des Fabricants de piles et Accumulateurs portables (SPAP)
- (21) Stowarzyszenie Producentów i Importerów Akumulatorów i Baterii w Polsce SPIAB (Association of Battery Producers and Importers in Poland)
- (22) Swedish Battery Association
- (23) Umweltforum Batterien (UFB)
- (24) ZVEI Fachverband Batterien (DE)

Joint Industry Positions

- (1) Battery Industry Coalition (CollectNiCad – EPBA – EUROBAT-
- (2) Joint submission of EUROMETAUX – EPBA – EUROBAT – CollectNiCad

NGOs and consumer organisations

- (1) Action Santé Environnement
- (2) EEB (European Environmental Bureau)
- (3) NABU (German branch of BirdLife Environment)
- (4) Tierra Incognita (petition against cadmium signed by 670 people)

Economic operators

- (1) AEES (FR)
- (2) AEG – SVS Power Supply Systems GmbH (DE)
- (3) AEG Computer and Industrial Systems AB (SE)
- (4) Aero Quality Sales Ltd (UK)
- (5) Alcad Ltd AB (SE)
- (6) Altatel (FR)
- (7) Alstom Transport (FR)
- (8) Alstom Transportation (USA)
- (9) AMCO Power Systems Ltd (India)
- (10) AT&T (USA)
- (11) Black & Decker Europe
- (12) Banverket (SE)
- (13) Benning (FR)
- (14) Burlington Northern Santa Fe Railway (BNSF)
- (15) Bombardier Transportation AB (SE)
- (16) Berliner Verkehrsbetriebe UB-Strassenbahn (DE)
- (17) CBS Chargeurs Batteries Services (FR)
- (18) Chloride Industrial Systems SA (FR)
- (19) Czech Railways (CZ)
- (20) Duracell
- (21) EMISA (ES)
- (22) Evenbat Gioia s.r.l. (IT)
- (23) Famostar (NL)
- (24) Ferak (CZ)
- (25) Flourishing Transportation Facilities Co Ltd (Taiwan)
- (26) Forges Bazar (Morocco)

- (27) FRIWO (DE)
- (28) Gaz Battery GmbH (DE)
- (29) G&P Batteries Ltd (UK)
- (30) Gépébus (FR)
- (31) Germanos SA (EL)
- (32) Hansabattery Oy (FI)
- (33) IB Industrial Batteries Ltd (UK)
- (34) INCO Europe Ltd (UK)
- (35) INMETCO International Metals Reclamation Company Inc (USA)
- (36) Iverlux (ES)
- (37) Keolis (FR)
- (38) Kraftelektronic (SE)
- (39) MSD Site&Power UAD
- (40) Mouret SA (FR)
- (41) Nedtrain (NL)
- (42) Northern Lighthouse Board (UK)
- (43) NSB Norwegian State Railways (NO)
- (44) PVI (FR)
- (45) Saft IBG (Morocco)
- (46) Saft UK
- (47) Saft Oskarhamn (SE)
- (48) Saft Nersac (FR)
- (49) Saft Bordeaux (FR)
- (50) Saft B.V. (NL)
- (51) Sanyo Energy Europe (DE)
- (52) Siemens AS (NO)
- (53) SNCF (FR)
- (54) Solar Elektro B.V. (NL)
- (55) Sonlux GmbH (DE)
- (56) Sonnenschein Lithium GmbH (DE)
- (57) Statron AG (CZ)
- (58) Statron Austria (AT)
- (59) Sumitomo Corporation (Japan)
- (60) Tadiran (Israel)
- (61) Tadiran Batteries (USA)
- (62) Technid (IT)
- (63) Volvo (SE)
- (64) VR Ltd (UK)
- (65) Zeleznicna spolocnost a.s. Bratislava (ZSSK) (SI)

EU Retail – and consumer organisations

- (1) BEUC
- (2) EURO COOP (European Community of Consumer Co-operatives)
- (3) EuroCommerce a.i.b.s. (Business Representation of the Retail, International Trade and Wholesale sectors to the European Union)

Trade associations

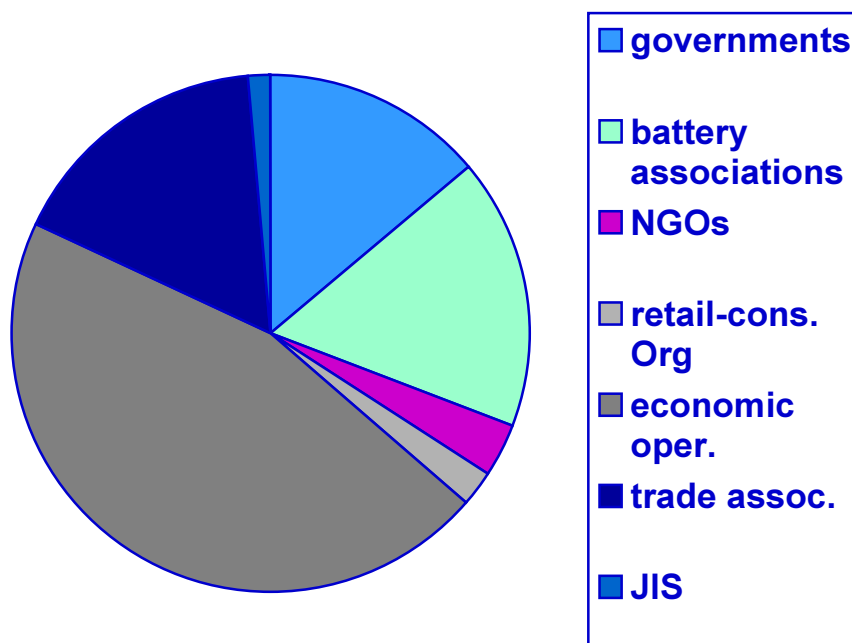
- (1) International Cadmium Association
- (2) British Metals Recycling Association (BMRA) (UK)
- (3) CECED - European Committee of Domestic Appliance Manufacturers

- (4) C.E.L.M.A.Federation of National Manufacturers Associations for Luminaires and Electrotechnical Components for Luminaires in the European Union
- (5) CLEPA (association of automotive supplies), see EUROBAT (FR)
- (6) European Power Tool Association (EPTA)
- (7) Environmental Services Association (ESA)
- (8) EU Committee of the American Chamber of Commerce
- (9) Eurofer (European Confederation of Iron and Steel Industries)
- (10) Federation of Electricity and Electronics (FEE) (BE)
- (11) Fachverband der Elektro und Elektronikindustrie (FEI) (AT)
- (12) FIEC (European Construction Industry Federation)
- (13) GISEL (association for emergency lighting manufacturers) (FR)
- (14) Golden Valley Electric Association (GVEA) (USA)
- (15) National Electrical Manufacturers Association (NEMA) (USA)
- (16) National Household Hazardous Waste Forum (NHHF)
- (17) Power Tool Institute, Inc (USA)
- (18) RMI Retail Motor Industry Federation (UK)
- (19) SMMT (trade association for the motor industry) (UK)
- (20) Swedish Federation of Trade (SE)

Academic Contributions

- (1) Veronika Langrova (CZ)

The main contributors were economic operators (65), trade associations (24), battery associations (24), governments (7 current Member States, 3 Acceding States, 3 non EU countries and 6 local and regional authorities), NGOs (4), EU retail- and consumer organisations (3) and joint industry submissions (2), as illustrated by the following chart:



List of Stakeholders who participated in the Stakeholder meeting of 15 July 2003 (in order of registration)

- (1) FIEC (European Construction Industry Federation)
- (2) Sanyo Energy (Europe)
- (3) UNIFE
- (4) EPTA (European Power Tool Association)
- (5) Eurocommerce
- (6) Eurobat
- (7) European Battery Recycling Association
- (8) UK Government - Dept. of Trade & Industry –
- (9) International Cadmium Association
- (10) SAFT ALCATEL, France (CollectNiCad)
- (11) Titalyse sa, Switzerland (CollectNiCad)
- (12) EURO COOP (European Community of Consumer Cooperatives)
- (13) Black & Decker Europe
- (14) INCO Europe Ltd (London Office)
- (15) SAFT ALCATEL
- (16) CLEPA
- (17) Chinese mission to the EU
- (18) Robert Bosch GmbH,
- (19) Northern Lighthouse Board, (NLB)
- (20) UK Government - Dept. for Environment,
- (21) Umweltbundesamt - German Federal Environmental Agency
- (22) G & P Batteries Ltd
- (23) Eurometaux
- (24) Council of European Municipalities and Regions (CEMR)
- (25) CELMA Working Group
- (26) EMISA
- (27) FEE - The Federation of Electrical and Electronic Equipment
- (28) BEBAT
- (29) Panasonic
- (30) Duracell (Gillette)
- (31) EPBA – European Portable Battery Association
- (32) SAFT ALCATEL, Sweden
- (33) SAFT FERAK, Czech Republic
- (34) CECED, European Committee of Domestic Appliance Manufacturers
- (35) British Battery Manufacturers Association (BBMA)
- (36) BMW, Germany
- (37) Advent International, France
- (38) Electrolux Home Products N.V.
- (39) Imperial College Centre for Environmental Technology (ICCET), UK
- (40) Aero Quality Sales Ltd

From the Commission services, DG ENV, DG ENTR and DG MARKT were present during this meeting.