Title:
Final Impact Assessment for Recast of the Restriction of Hazardous Substances (RoHS) Directive
IA No: BIS 0381

Lead department or agency:
BIS

Other departments or agencies:
Defra, NMO

Impact Assessment (IA)

Date: 10/09/2012

Stage: Final

Source of intervention: EU

Type of measure: Secondary legislation

Contact for enquiries: Krupa Kothari/Peter Askew

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB on 2009 prices)	**In scope of One-In, One-Out?**	**Measure qualifies as**
-£450m	-£423m	-£35m	No	NA

What is the problem under consideration? Why is government intervention necessary?

The original RoHS Directive adopted in 2003 applies to 6 hazardous substances in new electrical and electronic equipment (EEE). Government intervention is necessary to establish an "even playing field" across member states and an effective functioning of the internal market in EEE through a common framework for the marketing of products and harmonisation of scope. This will reduce barriers to trade and reduce uncertainty around requirements. In addition there are negative externalities associated with hazardous substances in WEEE (Waste from EEE) going to landfill and the consequential risk of toxicity of humans, freshwater aquatic, sedimental and terrestrial - where social costs are greater than private costs.

What are the policy objectives and the intended effects?

-Support BIS departmental priority number 7: Stimulate exports & inward investment by promoting open & fair global markets, through alignment of the Directive with Regulation 768/2008 so RoHS becomes a CE mark directive with harmonised standards available to demonstrate compliance. -Support DEFRA's departmental priority number 2 to protect & enhance the natural environment by reducing quantities of the 6 hazardous substances (lead, mercury, cadmium, hexavalent chromium &2 flame retardants - PBB, & PBDE) used in wider scope of EEE in the EU. RoHS reduces risk of toxicity of WEEE & adverse consequential ecological & human/animal health impacts.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

This IA considers 'do nothing' (para 11-15) and option 1 - Recast of RoHS Directive. It also considers 'option' 2 which is the same as option 1 but includes the impact of Article 2.2. This is not an 'option' in the conventional sense, rather it's presented separately to show the additional impact of Article 2.2 (see para 147-149 for more detail)

The recast has been agreed at a European Level and was published in the Official Journal of the European Union in July 2011. Failure to transpose will lead to infraction proceedings and the risk of being sued by disadvantaged companies. The new RoHS Directive will improve the coherence with Community legislation. It will also provide additional environmental and health benefits from a widened scope.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 06/2017

Does implementation go beyond minimum EU requirements?			Yes / No / N/A		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** Yes	**< 20** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** 0.0091	**Non-traded:**	

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) that the benefits justify the costs.

Signed by the responsible Minister: Michael Fallon Date: 6 November 2012

Summary: Analysis & Evidence

Policy Option 1

Description: Recast of RoHS (without impact of Article 2.2)

FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 15	Net Benefit (Present Value (PV)) (£m)		
			Low: -764	**High:** -205	**Best Estimate:** -399

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	185	9	3.2	**209**
High	711		9.2	**768**
Best Estimate	369		5.2	**403**

Description and scale of key monetised costs by 'main affected groups'

Cost to UK manufacturers of medical devices, monitoring & control instrument and all products with an electric and electronic function (categories 8, 9, 11). Mainly modification of product designs & replacement of RoHS substances. Transition costs; R&D cost, approvals expenditure for medical devices, CE Mark costs, capital equipment replacement. Reoccurring cost; compliance costs, operating costs (energy, carbon, lead solder replacement metal costs, enforcement, exemptions (i.e. applications)

Other key non-monetised costs by 'main affected groups'

Higher transferred cost to the healthcare sector as the average price of equipment increases. Other sectors affected in the same way may to some extent pass on any additional costs to consumers. Environmental impact from using silver based solders to replace lead free solders (para 80).

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		0.28	**3.19**
High	Optional		0.31	**3.49**
Best Estimate			0.29	**3.32**

Description and scale of key monetised benefits by 'main affected groups'

Benefits to manufacturers of equipment that are removed from scope by the recast and incur savings in recurring compliance costs and operating costs (e.g. saving in disposal costs from reduced WEEE as a result of the spare parts principle (para 105), carbon/energy savings)

Health benefit to humans from reduced risk of exposure from mercury, lead and cadmium.

Other key non-monetised benefits by 'main affected groups'

Clarification of scope, harmonisation across the EU of enforcement and interpretation of requirements, compliance by CE marking and use of harmonised standards, costs avoided due to spare parts containing RoHS substances. Health benefit from reduction in use of hexavalent chromium, and two flame retardants. Significant environmental benefits from reduction in WEEE that includes 6 hazardous substances.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

Bottom up approach; transition costs (R&D, redesign cost etc). Recurring costs (e.g. compliance) assumed at 0.1% of turnover p.a additional costs from the use of silver-based lead-free solders for most products in categories 8 & 9. Health benefits are based on estimate of cost per tonne of hazardous substance avoided (mercury, cadmium, lead only). Transition costs will be incurred over a no. of yrs depending on product complexity, variety & the date that the product comes into scope.para 191+

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 33	**Benefits:** 0.2	**Net:** -33	No	NA

Evidence Base

Problem under Consideration – Objectives

1. The Restriction of the use of certain Hazardous Substances Directive 2011/65/EU was published in the Official Journal of the European Union In July 2011 with an implementation deadline of 2 January 2013. Under that timetable, the UK must transpose the requirements into UK legislation by this date. The RoHS recast Directive will support the following departmental objectives:

   - BIS departmental priority number 7: Stimulate exports and inward investment by promoting open and fair global markets through alignment of the Directive with Decision 768/2008 so RoHS becomes a CE mark directive with harmonised standards to demonstrate compliance. The objective being to create a "level playing field" across the internal market for electrical and electronic equipment (EEE) covered by RoHS by creating a better regulatory environment and reducing burden on business. This includes harmonisation requirements for scope and enforcement, clarity on definitions, assessment of product conformity and market surveillance.
   - DEFRA departmental priority number 2: to protect and enhance the natural environment by reducing quantities of the six hazardous substances used in wider scope of EEE in the EU. The recast will reduce risk of adverse consequential ecological and human/animal health impacts of EEE containing the hazardous substances within the scope of RoHS through an inclusion of additional product categories and moving from closed to open scope (with exemptions).

Rationale for Government Intervention

2. The RoHS Directive was adopted on the basis of the precautionary principal to protect human health and the environment from six hazardous substances. The rationale for intervention for the recast of the RoHS Directive is as below:

- *Negative externalities* associated with hazardous substances in WEEE (Waste EEE) going to landfill (and exported to countries where uncontrolled and unsafe recycling occur) and the consequential risk of human toxicity, freshwater aquatic and semimetal toxicity, terrestrial toxicity whereby the impacts are not priced into the market and the social costs are greater than private costs. The new RoHS recast Directive will provide additional environmental and health benefits from a widened scope.

- *Government failures*: There has been inconsistent interpretation of scope by Member States which could act as a barrier to trade due to lack of clarity in the Directive. Removal of these barriers would have a benefit to trade and growth. 2011/65/EU should provide more clearly defined scope to improve possibility of consistent interpretation across Member States and provide legal certainty for industry. It will also improve the coherence of the Directive with Community legislation. Furthermore, the introduction of consistent enforcement across the EU and an effective functioning of the internal market in EEE effected by RoHS through a common framework for the marketing of products and harmonisation of scope will help to create an 'even playing field' across Member States.

Background

3. The first RoHS Directive (Directive 2002/95/EC of the European Parliament and Council) was adopted on 27 January 2003 and came into force on 13 February 2003, the day of its publication in the Official Journal of the European Union. Member States had until 13 August 2004 to transpose the Directive into national legislation. The main prevention provision of the Directive (in terms of restricting the use of certain hazardous substances in new EEE) was to be achieved *"...from 1 July 2006."* (Article 4.1 of the RoHS Directive).
4. The RoHS Directive is an Internal Market Directive based on Article 95 replaced by Article 114 of the TFEU of the Treaty establishing the Community which has two main aims:

- To provide a European-wide legislative framework to restrict the use of certain hazardous substances in new EEE so that its use does not create barriers to trade

- Protection of human health and the environment

5. The first RoHS Directive has restricted the use of six hazardous substances in eight categories of new EEE that have been put on the European market since 1 July 2006. The six substances are: lead, mercury, cadmium, hexavalent chromium, and two flame retardants - poly-brominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE). It applies to eight of the categories of equipment taken from the WEEE directive: Category 1 - Large household appliances; Category 2 - Small household appliances; Category 3 – IT and telecommunications equipment; Category 4 – Consumer equipment; Category 5 – Lighting equipment; Category 6 – Electrical and electronic tools; Category 7 – Toys, leisure and sports equipment; and Category 10 – Automatic dispensers. The RoHS Directive also applies to electric light bulbs, and luminaries in households.
6. The first RoHS Directive excludes spare parts for the repair or re-use of EEE placed on the European market prior to 1 July 2006, large-scale stationary industrial tools; EEE intended to protect national security and/or for military purposes; EEE that is part of products that are not covered by the Directive; products where electricity is not the primary power source; and equipment within the scope of existing waste directives such as batteries and vehicles.
7. A number of Commission Decisions have been taken. These include a Decision to allow up to 0.1% by weight in homogeneous materials of lead, mercury, hexavalent chromium; PBB; and PBDE; and up to 0.01% by weight of cadmium; and a number of Decisions exempting a range of specific applications of the restricted substances. There are currently 39 items listed in the Annex to the first RoHS Directive as exemptions, although some have expired since they were adopted.
8. The UK transposed the first RoHS Directive into UK law by *The RoHS Regulations* (SI 2006 No.1463). These Regulations have since been updated and replaced by *The RoHS Regulations* of 2008 (SI 2008/37) and RoHS Amendment Regulation 2009 (SI 2009/581). The February 2011 version of Government Guidance Notes (URN 11/526) supports these Regulations. RoHS is enforced in the UK by the National Measurement Office.
9. The UK's RoHS Regulations were supported by a full Regulatory Impact Assessment (RIA) when they were made in Parliament. The RIA (2006) provided a qualitative assessment of benefits. Data limitations meant it was not possible to quantify health and environmental from the regulation. In terms of the costs of the RoHS Regulations, the RIA estimated that these would consist of research and development (R&D) costs, capital costs, additional operating expenditure, and administrative costs. The majority of the costs estimated were expected to be related to the restrictions on the use of lead as significant research is needed to change to lead-free solders whereas the cost of using alternatives to the other five substances has been borne mainly by chemical suppliers.

RoHS Recast Directive 2011/65/EU

10. The new RoHS Directive (option 1 in this IA) includes the following changes to the existing Directive:

    - Scope: Brought new items into scope of RoHS and created its own scope rather than linking to the scope of the WEEE Directive. Medical devices and control (category 8) and monitoring equipment medical (category 9) and other EEE not covered by any of the other categories (category 11). The application of RoHS to this EEE will be phased in over a period up to 2019.
    - The exemptions process to be simplified and the specific information required for requesting, renewing and revoking exemptions is to be included in Annex V of the Directive.
    - Change to the definition of 'dependent' and EEE, meaning a product with at least one intended electrical function is included.
    - Greater legislative consistency among EU harmonising measures and manufacturer requirements to self certify the conformity of their products (CE marking / EU declaration of conformity).
    - Greater clarity on which products fall within scope (including spare parts), harmonisation on the transposition of RoHS across Member States, as well as for producers demonstrating compliance through harmonisation of enforcement.

DO NOTHING (Cost and benefits of existing directive):

11. Table 1 presents the costs and benefits of 'doing nothing', that is continuation of the RoHS Directive without the recast.

Table 1: Summary of cost and benefits 2011 to 2025: Do nothing option (2011 prices)

(£/m)	Annual Average Cost (Constant Prices, exc. transition)	Total Cost (PV)	Annual Average Benefit (Constant Prices, exc. transition)	Total Benefit (PV)	Net PV
Low	12	142	0.17	16.8	-502
High	47	543	0.2	23.8	-119
Best Estimate	24	276	0.18	20.2	-244

12. The costs are incurred by manufacturers for continued compliance with the RoHS directive i.e. ensuring that certain parts and materials do not contain more than the limits of restricted substances. In addition an ongoing cost for using lead-free solders with associated increased energy consumption and resultant CO2 emissions will continue to accrue. There is also an expected enforcement cost of £450,000 for the National Measurement Office (NMO). The direct average annual impact on business would be around £23m from 2011 to 2025. The base year is 2011 because the recast was agreed at a European level and published in the OJ in the summer of 2011 – in expectation of legislative changes it's expected some costs will have already been incurred – these are included in the IA for the sake of completeness.

13. The monetised benefits include continued health benefits from the reduced use of Mercury, Cadmium and Lead. Non-monetised health benefits include the reduced use of hexavalent chromium, and two flame retardants - poly-brominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE). In addition environmental benefits from reduced level of hazardous substances being sent to landfill have not been monetised due to lack of data as with benefits from internal market harmonisation i.e. not having conflicting policies at a national level.

14. It is assumed that all products in scope now comply and so there are no transition costs. Recurring costs incurred are assumed to be 0.1% of turnover (for consumption in the UK). Low and high sensitivities estimated at 0.05 and 0.2% of turnover. The UK market has been assumed to be one sixth of the EU as GDP and population are about one sixth.

15. Business as usual is not considered a viable option for the UK government due to a reputational risk and impact of infraction proceedings as well as the risk of being sued by disadvantaged companies. In addition the benefits from the harmonisation of scope and internal market common framework would not be achieved. Environmental and health benefits from wider scope would also be lost.

Consultation

16. The European Commission undertook two consultation exercises on the Proposal to recast the RoHS Directive and has also held a number of stakeholder workshops. In addition, it has commissioned its own research which has resulted in the following reports:

- *Review of Directive 2002/95/EC (RoHS) Categories 8 and 9 – Final Report,* ERA Technology (2006) – 'the ERA Report'.
- *Study on RoHS and WEEE Directives Final Report,* Arcadis, Ecolas RPA (2008) – 'the Arcadis Report'.
- *Study to support the Impact Assessment of the RoHS Review Final Report,* Bio Intelligence (2008) – 'the Bio Report'.

- *Study on Hazardous Substances in Electrical and Electronic Equipment not regulated by the RoHS Directive,* Oko Institute.V (2008) – 'the Oko Report'

17. During negotiations of the recast, NGOs, manufacturers and trade associations lobbied Member States and members of the European Parliament. The European Parliament DG Internal Policy published a limited impact assessment of the European Parliament's proposals to restrict halogen-free substances and PVC.

18. *Original DTI IA (1996):* In estimating the potential costs of the Commission's Proposal the method used in the DTI's original RIA for the RoHS Directive was used to give two estimates. One estimate can be viewed as a 'top-down approach' based on transition costs as a percentage of turnover of the relevant sectors affected, and the other can be seen as a 'bottom-up approach' based on estimates of the resources that may need to be employed to achieve the objectives of the Proposal. This approach is also used here.

19. *EC draft IA on their proposals (2009)*: A possible cost to the UK could be estimated from the Commission's own IA for their proposed recast of RoHS which was based on an IA prepared by Bio Intelligence Services. Report. The Bio Report (Page 79-80) presents estimates of the size of the markets for Category 8 and Category 9 equipment based on estimates of total annual sales. Bio derives an estimate of the global market for medical devices covered by Category 8 of some 100 billion euro of sales. These estimates are based on estimates from COCIR (2007). It was assumed that these sales estimates represent 2006 sales.

20. Bio further assume that the EU represents one-third of global sales and so estimates the EU market for medical devices potentially to be covered by a recast RoHS Directive as worth some 33 billion euro. In this IA, 2008 PRODCOM Eurostat data for the UK production / sold figures for medical equipment with electrical functions are used (i.e. excluding syringes, etc.).

21. In terms of monitoring and control equipment (Category 9 equipment) Bio provide an estimate for global sales of industrial Category 9 test equipment of some €29 billion in 2005. Using an estimate that the EU represents 25 per cent of the world market, Bio provide a figure of some £7.2 billion as the size of the EU market for Category 9 equipment in terms of the value of sales.

22. Bio do not present an estimate of the size of the non-industrial Category 9 test equipment market for Europe, so any estimates produced using their estimates will be under-estimates of the total costs of including Category 9 equipment within RoHS, as non-industrial monitoring and control equipment are to come into the scope of RoHS in 2014 under the recast RoHS Directive. In this IA, 2008 PRODCOM Eurostat data for the UK production / sold figures for relevant categories are used.

23. The Bio Report says that the 'European health care industry associations' estimate the additional costs as a consequence of including Category 8 equipment in the scope of RoHS in the range of 1-4 per cent of the value of the market.

24. Using the estimates in the Bio Report and the assumptions above, transition costs for the period 2010-2020 in the UK were estimated to have a present value in the region of £306 million - £1,160 million with an annualised equivalent cost of some £34 million - £129 million. The ongoing recurring costs (i.e. the compliance costs in 2020) of bringing Category 8 and 9 equipment into the scope of RoHS were estimated to have a present value of some £5 million - £8 million per annum (source: pg 22, UK RIA, 2009).

25. The 2009 UK RIA did not consider category 11 or other products newly included, nor products that will be excluded from scope as these were not in the Commission's proposals. Estimates of the cost are lower than that estimated in 2009. This is down to higher assumptions being used to estimate transition costs at 2-3% of turnover. ERA (technical specialist in RoHS) estimate that 1% of turnover is more reasonable, this is validated with bottom up cost estimates of R&D, new equipment etc which equate to approximately 1% of turnover.

26. In 2009, the UK Government published a consultation document on the Commission's proposals to recast the RoHS Directive (this did not include including category 11 in scope) and the WEEE Directive. The results suggested that the majority favoured retaining a scope defined by categories rather than all EEE (as is the case with the inclusion of category 11 in option 1 of this IA). However, the longer transition period negotiated by the UK government and the Commission Review and Commission Impact Assessment are both to be undertaken before this change

comes in. This allows opportunity for further amendment in the light of evidence and should act to ease industry concerns on the impact of moving to open scope with exclusion.

27. This IA builds on the negotiating stage IA for the recast RoHS Directive for which BIS commissioned ERA Technology to provide it with the relevant expertise to be able to formulate estimates of the potential costs and benefits of the Commission's proposals to the UK.

Policy Options under Consideration - Approach to Impact Assessment

28. This impact assessment considers

- 'do nothing' business as usual case of not amending the current RoHS Directive.
- **Option 1**: The impact of the recast of RoHS Directive (compared to do nothing)
- **Option 2** : The impact of the recast of RoHS Directive including Article 2.2- Impact (compared to do nothing) ** This is not an 'option' in the conventional sense, rather it's presented on a separate sheet so that it is clear what the additional impact of Article 2.2 is on the Recast. This is expected to be modified before 2019 when the impacts of Article 2.2 are felt (see paras 147-166).

29. An **alternative to regulation** considered was providing guidance to manufacturers in order to allow them to pursue voluntary agreements to comply with restriction of hazardous substances to additional product categories. However, this was not considered a viable option because this is unlikely to meet the Directive's requirement for enforcement across the single market and lead to an uneven playing field between manufacturers, whereby those who do not comply would not incurr any transitional costs from re-designing products etc. In addition, it would limit the benefits that would otherwise materialise from the internal market in products included within the scope of RoHS, this would have a detrimental impact on the competitiveness of UK manufacturers, assuming other member states complied under European legislation. In addition the environmental and health benefits from the reduction in use of hazardous substances would not be as significant, due to lower levels of compliance under a voluntary agreement scheme. For these reasons an amendment to the existing legislation was the preferred option.

30. The impact of option 1 is introduced by the recast stepwise in 2014, 2016, 2017 and 2019 and so costs and benefits are estimated up to 2025, rather than the usual 10 years.

31. There are environmental and health benefits due to reduction in the use of hazardous substances where restrictions are imposed. The recast also has benefits to business from removal of products from scope so avoiding compliance costs. Costs are estimated using a bottom up approach, which is verified using a top down approach as discussed further down in this IA.

OPTION 1: RECAST OF RoHS:

32. The recast RoHS Directive affects a wide range of EEE manufacturers, professional importers, component suppliers, product assemblers, and distributors/retailers of EEE. It also has an impact on the 'downstream' industry treating, recycling and disposing of WEEE. **See table 6a and b on page 30 for a summary of the estimates of annual costs and benefits.**

33. The 2006 RIA for the original RoHS Directive suggested that based on Standard Industrial Classification (SIC) data some 3,750-7,500 UK businesses could be affected by the RoHS Directive. The main impacts of the recast Directive will be on manufacturers, professional importers, component supplies, and product assemblers of Categories 8, 9 and 11 EEE although as RoHS will become a CE marking directive, distributors will also have obligations.

34. SIC code 33.10 data (2007) for Medical and surgical equipment and orthopaedic appliances contains 955 VAT registered businesses of which almost two-thirds have less than ten employees.

35. SIC Code 33.20 Instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment contains 1,820 businesses, again with two-thirds employing less than ten people.

36. SIC code 33.30 Industrial process control equipment contains 360 businesses. This implies that inclusion of Category 8 and 9 equipment in the RoHS Directive could impact on some 3,135 UK manufacturers although not all of these businesses will be producing electrical and electronic equipment. The actual number of electrical equipment manufactures is not known and a figure in the region of 30 - 50 per cent of this total, or ~1,000 to 1,500 may be a more reasonable estimate.

37. Manufacturers of Category 11 equipment and manufacturers of newly included products will also be affected but it is not possible to estimate the number of businesses affected. This is because a very diverse range of products are affected but within some types such as furniture, toys and safes, only a proportion have electrical functions. Distributors of electrical equipment will be affected for the first time and "Electronic Manufacturing in the UK" (6th edition, 2000, Europartners Consulting) list 59 electronics distributors.

Option 1: Costs of the Recast

38. Costs will result mainly from the wider scope so that manufacturers of equipment brought into scope potentially incur transition costs to modify their products. In addition reoccurring costs are assumed to be incurred due to the new CE marking requirements. There would also be increased costs for enforcement due to the wider scope. Direct costs to business are estimated at £33.2m this includes the cost of replacing lead free solders, energy cost, transition cost, exemption cost and compliance costs. The figure is higher than the estimate presented in the negotiating stage IA following an error correction. Direct benefits to business are estimated at £0.24m this is from reduced cost including savings from removal of compliance requirements for business no longer in scope and savings in the cost of disposal from WEEE avoided (see para 95)

BACKGROUND:

TRANSITION COST FROM INCUSION OF CATEGORY 8 AND 9 EEE IN SCOPE OF THE RECAST DIRECTIVE (Article 2.1 and Annex I)

39. The ERA report (2006) describes the differences in characteristics of category 8 and 9 equipment to products that are already in scope of RoHS. The number of specific types and models is larger with lower sales of individual models, many category 8 and 9 products are very complex and they often need to perform in relatively hostile conditions. These differences mean that the re-design and re-build costs from RoHS type restrictions applied to these categories of equipment are likely to be higher relative to products in categories 1,2, 5, 6, 7 and 10. However, the more diverse and complex industrial monitoring and control equipment have until 2017 and the complex in-vitro diagnostic products which require extensive testing before they can be approved under the in-vitro diagnostic directive have until 2016. As a result, it is expected that annual transition costs

will not be significantly greater than the costs found in the Consumer Electronics Association survey. Several publications quote transition cost resulting from RoHS as follows:

- The Commission's Impact Assessment 1-4 per cent of turnover
- The Arcadis Report (Page 100) On average 1.9% of turnover
- Consumer Electronics Association (CEA) on average amounts to 1.1% of industry revenue

40. This IA assumes transition costs will be around 1% of turnover between now and the date when the equipment is in scope of the recast and this is used for the top-down approach, as suggested by the CEA. Categories 8 and 9 were included for consideration within the original directive so these sectors will have already incurred costs from anticipation of compliance requirements. The costs in this IA assume all costs are incurred from 2011 onward – the base year in this IA is therefore 2011, starting from current year would amount to an omission of sunk costs as a result of the recast.

41. Research and development (R&D) expenditure will be required for manufacturers to substitute the restricted substances. There are also expected to be costs in terms of additional operating costs from using substitutes to the restricted substances, and recurring costs in terms of compliance with RoHS. There are not expected to be significant capital costs from the inclusion of Category 8 and 9 equipment in RoHS because most UK manufacturers of this equipment generally sub-contract out to third parties the assembly of printed circuit boards (PCBs) and specialist components although many of these are located in the UK and so may incur costs. It is probable that some UK sub-contractors will need to obtain new equipment suitable for lead-free processes and possibly also for chromate-free passivation treatments. These assumptions will be used for the bottom-up estimation of option 1 costs.

TRANSITION COST FROM CHANGE IN DEFINITION OF DEPENDENT (Annex I)

42. The original RoHS directive included in scope equipment that is dependent on electric currents and electromagnetic fields where "dependent" was not defined. EC guidance stated that dependent means that electricity is the primary energy source. As a result of EC guidance, products such as talking teddy bears and gas cookers have been excluded from scope in the UK and three other EU States although the other EU States interpreted this differently and required all products with electrical functions as being in scope. The recast directive includes a new definition of "dependent" as being at least one intended function and so the scope is not limited products where electricity must be the primary function. As a result, products that were previously excluded from scope in the UK are included as a result of the recast, such as toys with secondary electrical functions, Children's trainers with flashing LEDs, combustion powered garden etc. equipment for non-professional or dual use. Further examples can be found on pg22 of the BIOIS Report to the Commission[1], see table 10 for product list used in this IA (as per data available in prodcom).

TRANSITION COSTS FROM INCUSION OF CATEGORY 11 EEE IN SCOPE OF THE RECAST DIRECTIVE (Article 2.1)

43. Category 11: "other electrical and electronic equipment not covered by any of the categories 1-10" included in scope is very diverse and the size of the markets for these in the UK is difficult to establish as none of the product types are covered by PRODCOM categories. For example, there is a PRODCOM category for safes and strong boxes but this includes those with electrical functions as well as those with no electrical functions. For this IA, an estimate of the proportion that are electrical has had to be made using whatever information could be found, in most cases, marketing illustrates product ranges but this clearly will not be accurate. Newly included will be products where electricity is not the primary function as a result of the new definition of "dependent". This will affect for example gas cookers for which there are suitable PRODCOM codes and many, but not all have electrical functions. Electric bicycles (not type approved) are included in the bicycles PRODCOM category but most are not electric using other data sources or electric bicycles; the size of the market has been obtained. The market size for lights in

1. [1] http://rohs.biois.com/announcements-1/finalreport

wardrobes, talking teddy bears etc. is however completely unknown. In general, products in this category contain relatively little electronics and only low levels of RoHS substances. The cost of covering these products to comply will therefore be relatively small in comparison with categories 8 and 9. The impact on fixed installation equipment such as lifts in buildings is less clear as these can be relatively complex products. The first version of the new Commission FAQ document goes some way to seeking to clarify the scope here, but remains out for consultation as at August 2012. Until large-scale fixed installations are defined quantitatively, manufacturers will be uncertain whether their products need to comply although there is anecdotal evidence that most believe that they will. Table 10 at the end of this IA lists the PRODCOM categories that have been identified as containing products that will be in category 11 and others that will be included because of the new definition of "dependent". It also identifies a selection of products that have no identifiable PRODCOM category.

COST FROM APPLICATION FOR NEW EXEMPTIONS (Article 5 of recast Directive)

44. There are currently approximately 39 items listed in Annex III of the new Directive which applies to all categories, although some exemptions expired and several consist of sub-parts. Annex IV also includes 20 additional exemptions applicable to categories 8 and 9. The recast states that exemptions in Annex III will expire unless renewed after at most 5 years and in Annex IV after at most 7 years. Since the ERA review, industry has discovered the need for more exemptions which they will need to apply for and this will incur a cost. There will be an additional cost to UK manufacturers for preparation of applications for new exemptions and to renew existing exemptions. Although the cost will vary depending on the complexity of the technology and the number of apparent substitutes for which data is required, the expenditure for exemptions could be €1.76 million to €4.56 million every five to seven years based on the cost of substitution plans given in the EC's IA. This would be shared between all manufacturers worldwide and the cost to the UK would be a proportion of this based on the proportion of UK manufacturers requiring exemptions. We estimate that UK manufacturer costs could be in the region of £120,000-300,000 once every five years, given that the EU is estimated to represent 40 per cent of the global Category 8 and 9 markets (somewhat less for other categories) and if we assume UK is around one-sixth of this EU market in total. In addition to these costs there will be administration, travel (for meetings) and consultant costs. However, simplification of the requirements should reduce costs. It is not expected that products in category 11 will require many new exemptions but they will rely on some of those in Annex III

45. Two approaches have been adopted; a top down methodology has been used to validate bottom up results. The bottom-up results have provided the central estimates including that for the sensitivity analysis.

a) Top-down approach (calculated to validate bottom up estimates)

TRANSITION COSTS - METHODOLOGY:

46. 2008 UK PRODCOM Eurostat data is used to estimate the value of manufactured goods sold of Category 8, 9 and 11 (see table 10/11) and other newly included equipment produced by UK manufacturers. We then calculate the potential transition cost of the recast as a percentage (1 %) of this estimate of turnover.

47. The definition for transition cost includes; Research and development (R&D) expenditure, new equipment, cost of approvals for modified models, initial compliance cost expenditure (e.g. due to CE marking) and the costs of the proposals in relation to exemptions. Most of these costs apply to Category 8, 9 and newly included equipment although some will also apply to all types of equipment.

48. The total value of UK production /sales for the applicable types of equipment are obtained from PRODCOM Eurostat data. Data for the year 2008 is used for current values. For the sake of proportionality, this was not updated from the consultation stage IA to 2010 numbers, as the data have not changed much. Data for future years is calculated by multiplication of each year by the average percentage increase or decrease in sales over the last ~10 years which is calculated from historical UK PRODCOM data.

49. **Category 8** (monitoring and control instruments) – The total 2008 production / sales figure were obtained by adding the sub-categories that correspond to electrical medical products and so

syringes, for example were not included. There is no separate category for IVD and so the proportion of medical equipment was assumed to be 9% of the total using the estimate from the Bio IA (2008). Past UK production / sales for all medical categories was used to calculate an average annual increase of 5.7% which is used to extrapolate future production / sales data.

50. **Category 9** (medical devices)– The total 2008 production / sales figure was obtained by selecting those sub-categories for which data is available of measurement instruments that are in scope of RoHS (so exclude navigation equipment) and those that rely on electricity, excluding non-electric categories. Determining the proportions of consumer and professional / industrial is more difficult. It was assumed that 5 sub-categories include consumer products (electronic thermostats, electronic gas or smoke analysers, multimeters, electric burglar or fire alarms and similar apparatus for buildings, electrical burglar or fire alarms and similar apparatus- excluding of a kind used for motor vehicles or buildings). The proportions that are B2C (business to consumer) are not known and so for this IA, it was assumed that 80% of thermostats, smoke detectors and multimeters and half of all alarm systems are sold to consumers. This enables estimation of costs for consumer category 9 equipment included in scope from 2014 and professional category 9 equipment in scope from 2017. Future sales growth was calculated using the average annual growth of all measurement instruments categories over the past ~ 10 years at 1.8%

51. **Category 11** (open scope) – Calculation of the total value of equipment that will be included in scope from 2019 is difficult because there are no PRODCOM codes for many of the types of equipment affected. These are included as small proportions of more general categories but it has not been possible to find these proportions. Eurostat data is withheld for some categories and some include a proportion on non-electric equipment such as gas cookers with no electric functions. Therefore around 70% (£600m) of the total value of those categories with figures available (~£900 million) to account for non-electric versions (our estimate) and an estimated, additional £100 million added for other affected products from categories that could not be identified. Sales growth of Category 11 products is based on an average growth in sales across product groupings identified. See table 10 for list of products.

52. Transition costs for categories 8 and 9 estimated to be 1% of turnover (we assume this is the same as production / sales) but probably considerably less for category 11 because; these are mostly much simpler designs and they do not need to comply until 2019 (nearly 3 times as long as category 8). On the basis that R& D costs will be no more than 20% of those of most category 8 and 9 equipment due to the simpler design overall and as the costs can be spread over three times as long, then transition costs for category 11 are estimated to be ~0.1% of annual turnover for ~7 years (until 2019)

53. The results from the top- down analysis as presented in table 2 were used to verify the bottom up analysis, presented in table 3. This shows results were within ~25% of estimates for bottom up calculations.

Table 2: total transition cost estimates using top-down approach

Top down	Total Transition Costs (£/m)	Total Transition Costs (PV, £/m)
2011	49	49
2012	50	48
2013	52	48
2014	44	39
2015	35	31
2016	35	29
2017	20	16
2018	6	5
2019	3	2
Total	**293**	**268**

b) Bottom-up approach

54. This approach is based on estimates for each of the additional resources that may be needed as a consequence of the recast. The total costs are made up of the following:

55. Transition:

    a) Additional resources in terms of man-hours of research and development (R&D) staff;

    b) Compliance cost expenditure;

    c) Approvals expenditure (mainly needed for medical devices);

    d) Additional capital equipment expenditure;

    e) CE marking –setting up data management systems

56. Recurring

    a) Additional operating costs;

    b) Additional administration costs of the proposals in relation to exemptions (these latter costs apply to all equipment in scope)

    c) Reoccurring costs from CE marking.

TRANSITION COSTS

R&D Expenditure

57. Research and development is required to replace the materials and parts that contain the restricted substances. Drop-in replacements are often not possible and so redesign of circuit boards and reliability testing are often required. For R&D we use an estimate based on the extent to which existing research and development staff may need to be diverted from current activities to undertake R&D on RoHS compliance for equipment brought into scope by the recast, or the extent to which new staff need to be employed to undertake such work. Below approach is taken:

58. **Category 8:** Estimates based on data from Eucomed (*Eucomed* is a trade association representing some 4500 designers, manufacturers and suppliers of medical technology in Europe) suggest that there are some 60,000 employees working in the UK on medical products. In line with the assumption that around 70% of total value of this industry is in EEE and it is assumed 0.5-2 per cent (1 percent as best estimate) of these will be required to undertake research on the RoHS restrictions applicable to Category 8 equipment, estimating that such researchers, technicians, etc. earn on average a FTE salary of £40,000 per annum and spend all their time on this research. This provides an estimate of the potential R&D costs for ensuring that Category 8 equipment is RoHS compliant and no less reliable than the products they replace. The average annual total cost over the 5 years that is incurred is estimated at £16m pa. The total cost for R&D over the 5 year period is estimated at £81m.

59. **Category 9:** There is no published data on how many employees work in R&D on Category 9 equipment but based on PRODCOM data, UK Category 9 equipment turnover is estimated to be three times that of Category 8 equipment. Converting category 9 equipment to comply with RoHS will be easier as most are industrial and manufacturers will have longer to comply and as a result, a significant proportion of existing models can be phased out and replaced by new compliant models. This will be easier than modifying existing models. Therefore, the estimate for R&D costs for Category 9 equipment is only double those for Category 8 equipment, not the three times that would be in proportion to turnover. The average annual total cost over the 5 years it is incurred is estimated at £52m pa. The total cost for R&D over the 5 year period is estimated at £260m.

60. **Category 11 and other products newly included in scope:** Many of these products are not designed or manufactured in the UK and many are fairly simple designs where modification to comply with RoHS will be relatively straightforward. This is the case with furniture with internal lights, sockets and switches and safes with electronic locks which are either simple designs or are produced mainly outside the UK. Some products such as talking teddy bears and trainers

with lights already comply because other Member States have included these in scope of their national RoHS legislation. For products made in the UK that need to be converted including lifts and gas cookers there will be a cost for R&D although the average annual transition cost is expected to be relatively small in comparison with categories 8 and 9, because of simpler product designs and a longer 7 year transition period. The average annual total cost over the 9 years that is incurred is estimated at £2.5m pa. The total cost for R&D over the 9 year period is estimated at £23m.

The total cost of R&D spend as noted in table 6b is therefore £81m + £260m + £23m = £364m

61. **Capital expenditure – new equipment:** "Electronics Manufacturing in the UK", 6th edition, 2003 (Europartners Consultants), indicates that there are around 150 sub-contractors of components and parts (in particular printed circuit boards (PCBs) for EEE operating in the UK currently. Most of these will be operating lead-free facilities. However, a certain amount would need to invest in lead-free equipment to produce Category 8, 9 and 11 components and parts when these categories of equipment are bought into the scope of RoHS.

62. If 5 per cent of sub-contractors need to purchase 1 wave soldering machine and 1 SMT reflow oven at a cost in the region of £25,000 and £30,000 respectively this would imply total costs in the region of £440,000.[2] Most of these costs could be expected to be incurred in 2012 to 2014 (and we assume an equal split per year) before Categories 8 and 9 equipment are bought into the scope of the RoHS Directive, as a switch to lead-free machines would be required to facilitate the necessary R&D to ensure timely compliance.

63. Very few other equipment costs are expected as the change to RoHS compliance does not usually need other production equipment to be changed. If an increase in chemical analysis is expected to demonstrate compliance, this would not necessarily require additional equipment as this work is usually sub-contracted to test labs that will already have suitable analysis equipment.

64. **Approvals Expenditure:** Medical devices are regulated by three separate European Directives (these are the Medical Devices Directive, the In-Vitro Diagnostic Medical Devices Directive, and the Active Implanted Medical Devices Directive). These Directives place obligations on such equipment to reach certain 'essential requirements' (for example, in terms of safety and performance) before they can be placed on the European market. Where a significant change is made to a medical device, the equipment cannot be sold in the EU until it has been approved by a Notified Body. This has associated costs for provision of the required information and reliability test data. Where a new product is placed on the EU market, this needs approval but there are no "additional" costs. Additional costs are incurred only when existing models are redesigned to comply with RoHS.

65. Other countries outside of the EU have their own regulations, and approvals must be gained in these countries too as manufacturers do not produce one EU version and another for the rest of the world. Gaining approvals in the USA, Japan, China, Korea, etc can be expensive and take a number of years to achieve. One large UK manufacturer estimates that compliance with medical device legislation worldwide costs in the range of 0.1 - 0.2 per cent of its turnover per annum. It is not believed that all Category 8 equipment that would need to become RoHS compliant will need to obtain re-approval as the timescale for compliance is long enough for new products to be developed that will replace old models before 2014. However, it is expected that a proportion will require significant modification and re-approval and so in this IA we use the figure at the bottom of this range (0.1%) to estimate 'best estimate' costs of gaining approval for equipment re-designed to achieve RoHS compliance. This cost is expected to be needed for a period of four years between 2011 and 2014. An example of the cost breakdown for 2011 and 2012 respectively; 2011: £77m (R&D) + £1.5m (medical approval) = £79m. 2012: £0.13m (distributors CE mark) + £1.6m (med approvals) + £0.15 (Capital Equipment Replacement) + £79m (R&D) = £81m.

Table 3: total transition cost estimates using bottom-up approach

2. [2] Estimate made by ERA based on experience of electronics industry

Bottom up	Total Transition Costs (£/m)	Total Transition Costs (PV, £/m)
2011	79	79
2012	81	78
2013	82	77
2014	58	52
2015	59	52
2016	3	2
2017	3	2
2018	3	2
2019	1	1
Total	**369**	**346**

*total may not be exact sum due to rounding

COMPLIANCE COSTS:

66. Recurring compliance costs will be incurred for information provision, assessment of materials declarations, chemical analysis, use of lead-free solders, supplier audits, and compilation of technical files. This is an additional cost to manufacturers of equipment that is brought into scope by the recast. The electronics industry has estimated a cost of an annual ~0.1 per cent of turnover which is likely to be slightly higher for categories 8 and 9 due to greater product variety and complexity as explained in the ERA category 8 & 9 RoHS review report (2006). Category 11 and products included as a result of the new definition of "dependent" are on average similar in complexity to products already in scope in categories 1, 2, 5, 6 and 7 and so 0.1% of turnover is a reasonable estimate. The expenditure on on-going compliance costs will be in accordance with the timetable of the draft of the recast Directive.

67. CE marking costs: CE marking is expected to have an impact on on-going compliance costs. Currently distributors of electrical equipment have no RoHS obligations unless they are also importers into the EU or are manufacturers. The recast imposes compliance requirements on distributors and so additional costs will be incurred, initially to set up systems to record and check data and then recurring costs to carry out checks for compliance. A UK distributor estimates that UK electrical equipment and component distributors will incur a transition cost of ~£130,000 then annual recurring costs of £20,000 per year (information provided by ECSN/AFDEC electrical equipment distributor trade association suggested an impact on £10,000 a year, however, we expect the costs to be higher as reflected in the assumption used). The impact on manufacturers and importers is however less clear. There will be a small additional cost from the need to keep technical files for 10 years (Article 7.c) as this is currently required for only 4 years in the UK. One point of view expressed by manufacturers is that compliance will be demonstrated by the approach being defined in an EU harmonised standard and this will require the same activities that manufacturers and importers should already be carrying out and so there will be no change in costs. Should Distributors choose to undertake testing (chemical analysis) as noted in Article 7.b; *carry out internal production control procedures in line with module A of Annex II to Decision 768/2008/EC* - there would be an additional cost. The total cost to distributors is estimated at around £0.3m from 2013-2025 (based on industry perception of costs on testing). The estimate is provided by stakeholder from large UK electronics distributor (on behalf of the AFDEC trade association).

68. In terms of other ongoing recurring compliance costs in relation to, for example:

- information provision,
- assessment of materials declarations,
- supplier audits to check reliability of materials declarations, etc.

69. An estimate of an annual ~0.1 per cent of turnover (in line with Consumer Electronics Association and UK industry estimates of current levels of expenditure for complying with RoHS) as being expended on complying with the RoHS Directive for Category 8, 9 and 11 equipment and equipment included as a result of the new definition of dependent once they are included in RoHS in accordance with the timetable of the recast Directive. This is lower than some published

COST OF USING ALTERNATIVE SUBSTANCES

70. **Increased energy consumption:** The only significant increase in operating costs will be due to soldering with lead-free alloys. These have higher melting points and so will consume more energy. The alternative material is also more expensive (tin and silver).

71. Lead-free soldering involves higher rates of energy use than lead soldering, because of the properties of the substitute alloys that are used, which generally have higher melting points. Estimates for increases in energy consumption vary but are of the order of 15 per cent, though some commentators suggest higher figures.

72. Based on estimates from the original 2006 UK RoHS RIA, we employ the following assumptions in this IA: we assume seven zone ovens are the average type used and consume on average 13.9 kWh to process tin-lead (SnPb) solder and 16 kWh with lead-free solder, a difference of 2.1 kWh. We assume ovens operate 5 days per week, 16 hours per day, 49 weeks per year, and take a typical electricity price at present in the region of 6.46p/kWh; we also assume there are some 2,000 soldering ovens in the UK. This figure is estimated by ERA/BIS as no accurate figure is published or known to oven manufacturers.

73. Category 8 and 9 equipment was determined by the ERA study (2008) to be around 2 per cent of all EEE by weight placed on the EU market. Most EEE such as washing machines, power drills, lighting, etc. has a very small weight content of printed circuit boards (PCBs) whereas some types of EEE have a relatively high weight of PCBs and this includes EEE in Categories 3, 4, 8, and 9 EEE. PCBs used in categories 8 and 9 represent an estimated 5 per cent of this EEE by weight (so ~100 ovens in the UK). Given this we estimate that Category 8 and 9 equipment uses 5 per cent of the operating capacity of ovens in the UK (100 ovens) and so the additional annual energy consumption will be 2.1 x 5 x 49 x 100 = 0.8 million kWh / year. There will be also be a much smaller increase in energy consumption for PCBs in category 11 equipment estimated at 100,000 kWh per year from 2019. The actual cost is not known and so has been estimated from the proportions of lead in solder (25 tonnes p.a. in UK) used in categories 8 and 9 compared to category 11 (~2 tonnes p.a.).

74. **Additional energy cost:** The assumptions in the above paragraph lead to estimates of increases in operating expenditure in terms of energy costs in the region of £51,680 per annum for Category 8 and 9 equipment to be produced with lead-free solder and thus be RoHS compliant. The estimated additional electricity cost for category 11 is £6,460 per year. Based on these calculations the additional total energy cost over the 12 years for categories 8 and 9 and 7 years for category 11 is estimated at £0.67m.

75. **Additional carbon dioxide emissions:** the greater use of energy from lead-free soldering is also expected to lead to additional emissions of C02, and these are estimated to be in the region of 320 tonnes of CO2 per annum from 2014 for categories 8 and 9 based on CO2 emissions from UK electricity generation of 0.39 kg CO2/kWh. A much smaller increase in CO2 emissions and electricity costs would be incurred from 2019 for category 11 estimated at 40 tonnes CO2 p.a. Total cost associated from the increase in emissions is estimated at £0.09m over the time period considered in this IA.

76. **Additional alloy costs:** The extra cost for lead-free alloys is primarily due to the use of silver. Tin lead solder contains about 37 – 40% lead whereas lead free alloys may contain up to 4% silver although alloys with lower concentrations are also used. Furthermore, tin/copper is used for low-priced, less complex products where reliability is less important. The ERA report (2006) on categories 8 and 9 states that category 8 and 9 equipment sold in the EU contains ~150 tonnes lead per year. If we assume that one sixth of this is used in the UK and 60% of solder will be replaced by an alloy containing 3% silver, then the annual increase in UK silver consumption resulting directly from the recast directive will be 1.2 tonnes. At current London Metals Exchange (LME) prices, this would add £0.91 million in the cost of silver. There will also be the cost of an

additional 21.9 tonnes of tin less the cost of 23.8 tonnes less lead for categories 8 and 9. The total cost of silver over the time period considered in this IA for categories 8 and 9 is estimated at **£11m**. The greater tin content (less the cost of lead which will be replaced) is estimated at **£4.7m** over the same period.

77. There will also be a smaller amount of silver consumed in solders used to make category 11 equipment costing an estimated £38,800 per year from 2019. In addition, there is an additional cost due to the higher tin content of the solders estimated to be 1.1 tonnes less the cost of 1.2 tonnes of lead for category 11. Metal prices are from the LME. The total cost of silver over the time period considered in this IA for categories 8 and 9 is estimated at **£0.28m.** The greater tin content (less the cost of lead which will be replaced) is estimated at **£0.14m** over the same period.

78. The additional costs of energy and silver would be included as part of the on-going compliance costs. However, the cost of additional silver is fairly high for category 8 and 9 equipment and so this will increase in reoccurring costs beyond the estimated cost of 0.1 – 0.2% of turnover. The additional silver will also potentially have environmental and health impacts which is an un-quantified cost.

    These costs outlined above are reflected in table **6b)** under "other operating costs":

    £11m + £0.28m + £4.7m + £0.14m + £0.09m + £0.67m = £17m

79. **Environmental and health impacts:** RoHS was adopted on the basis of the precautionary principal that the six RoHS substances are "hazardous", even though no risk was proven. When RoHS was adopted however, the hazards and risks of all possible substitutes were not considered, in part because these had not been identified for many applications. The correct use of the precautionary principal would be to consider all possible alternative materials. Clearly the six RoHS substances are hazardous and if they enter the food-chain or are inhaled could potentially be harmful. This could potentially occur from poorly managed landfill sites, unsafe burning of WEEE and from illegal dumping although there is no evidence that this has resulted in significant quantities of RoHS substances being emitted into the environment in the EU.

80. In switching from lead in solders to lead-free solders, initially an alloy containing tin, silver and copper was used and this is still common in complex products such as PCs and mobile phones, simpler equipment now uses cheaper tin copper solder. Silver extraction and refining is however not benign as it involves mining far larger quantities of materials than lead mining so uses more energy and produces more waste per tonne of metal produced and refining of silver uses very toxic cyanide that has on occasions caused serious pollution in the EU and elsewhere. A comparative life cycle assessment of lead-free and lead-based solders carried out by the US Environmental Protection Agency examined 16 environmental impact categories and found that alloys containing silver had larger environmental impacts than alloys containing lead for 11 of the 16 environmental impacts. This assessment did not however conclude that either silver or lead based solders are significantly better or worse in terms of overall health and environmental impacts.

EXEMPTIONS EXPENDITURE

81. As already outlined the UK manufacturer costs are estimated to be in the region of £120,000-300,000 (~£160,000) once every five years. All exemptions in Annex III will expire after at most 5 years unless renewed (Article 5.2) although up to 7 years is permitted for exemptions applicable to categories 8 and 9.

OTHER COSTS (Article 6):

82. As outlined in the Benefits section, the Commission appointed *Oko Institute* (2008) to undertake research on the possible inclusion in the RoHS Directive of hazardous substances additional to those covered by the existing text. As a result of this study, the Commission did not include additional substance restrictions in its proposals and the recast requires the Commission to carry out a further review to determine whether further substance restrictions are needed. The future cost of these potential restrictions is not part of this IA but the costs that industry will incur contributing to this review required would be included, in particular from the assessment of possible alternatives. It is however very difficult to estimate the size of this cost because it will depend on the amount of data expected for this study and the number of substances that will be considered.

NON – MONETISED COSTS

COMPETITION:

83. There could be a risk that manufacturing could relocate outside the EU to avoid transitional and reoccurring costs imposed by the RoHS Directive. There is only anecdotal evidence suggesting manufacturers relocated to countries without the same restrictions on hazardous substances when RoHS was adopted, as many needed to install new printed circuit board production lines in any case this may have been done aboard rather than replace their UK lines. Hence, trends may not necessarily be causal.

84. Relocation of UK firms is not considered a big risk. The categories of equipment that will be included in scope within the recast that are produced within the UK tend to be relatively complex products made in fairly small numbers although there are some exceptions such as thermostats (category 9). As most of the products are produced in fairly small numbers, most UK manufacturers will use UK based sub-contractors to manufacture their PCBs and so there is less incentive to relocate production.

85. All manufacturers and importers that supply the EU market must supply RoHS compliant equipment, hence all are affected equally. However there are two circumstances where this may not be true:

86. Exporters of EEE to Europe and beyond compete in countries outside the EU with local competitors that do not supply to the EU market and so have no RoHS compliance costs.

87. Where EU suppliers convert their products that are in “grey areas” (uncertainty whether they are in scope) to comply and compete in the EU with non-EU suppliers that sell non-compliant products. The scope of RoHS has been clarified by the recast and so this should be less of an issue but one new potential problem area exists where the supplier claims that their equipment is intended for excluded applications such as large-scale stationary industrial tools (LSIT) or large-scale fixed installations (LSFI) whereas this equipment may be used in other “in-scope” applications. For example, instruments that monitor production processes would be excluded from scope if they are an integral part of LSIT but not if they are used within factories and are not integral to the process, i.e. they could be unplugged and used elsewhere. The status of these products depends on how they are installed. Some EU-based manufacturers believe that this could be used as a loophole by some manufacturers, especially those based in Asia, who they believe could export non-compliant equipment to the EU and compete with UK manufacturers of equipment that has been redesigned to comply. Effective enforcement would overcome this issue but relies on clear definitions and uniform interpretation in all EU States.

IMPACT ON CONSUMERS:

88. Since RoHS came into force in 2006, manufacturers’ costs have increased because of their obligations. Initially this was a transition cost estimated at 1 -2% of turnover over several years. Since 2006, recurring costs are only ~0.1% which is smaller than margins for all types of EEE. In general for equipment in categories already in scope, most products are made in large numbers and there are many competitors for each type of product. Products in categories 8 and 9 are more complex. Those in category 11 are similar to existing products in scope and the transition costs smaller for some types of equipment.

89. Simpler category 8 equipment and consumer category 9 and 11 equipment should incur a relatively low modification cost. There are a relatively large number of industrial category 9 products that are made by only 1 or 2 manufacturers and transition costs will be relatively high although profit margins are also high. The most complex medical equipment such as MRI, CT and radiotherapy are very difficult and expensive to modify, there are few manufacturers for many of these types of product and although margins are fairly good, some of this cost can be expected to be passed through to consumers. Overall it is expected there will be some cost pass through of costs from manufacturers to consumers. There is a potential negative impact on the health sector in the UK that could result from the RoHS recast. Most healthcare in the UK is provided by the National Health Service (NHS) in a budget constrained environment which may be negatively effected by increased prices if suppliers pass on cost increases to consumers.

Option 1. Benefits of the RoHS Recast

MONETISED HEALTH BENEFITS

90. The Commission's IA says that the RoHS Directive can reduce the risks of exposure to hazardous substances of workers producing EEE, of consumers when using EEE, and of those operating in the 'downstream' industry dismantling, treating, and recovering WEEE. However, workers producing EEE in Europe should be protected by a range of health and safety legislation in relation to exposure to hazardous substances (e.g. COSHH in UK). Workers in the EU have in the past suffered from lead poisoning (mainly at lead refineries), cadmium poisoning (mainly from battery production and brazing) and cases of cancer due to hexavalent chromium have been recorded. These risks are now well known and so as long as the appropriate safety precautions that are required by EU legislation are followed, these issues should no longer occur. Health and Safety at Work legislation also applies to those operating in the 'downstream' industry, treating and recovering WEEE. There is no evidence that exposure of consumers to EEE made with RoHS substances is harmful. The European Commission has reviewed research and carried out comprehensive risk assessments on PBDE's, hexavalent chromium, and cadmium which showed that with existing risk control measures, consumers are not exposed to any significant degree from these hazardous substances in the EEE that they purchase and use. The only concerns were with Deca-BDE where results were not totally conclusive and further research is needed and with penta- and octa-BDE which were banned in the EU by the Marketing and Use Directive in 2004.

91. The EC IA did not monetise the benefits of reducing the quantities of most of the RoHS substances due to data limitations. There is currently no measurable increase in blood-lead levels (or any other hazardous substances) in the UK population that can be attributed to EEE. Defra published "Valuation of the external costs and benefits to health and environment of waste management options" (December 2004) which looks at the costs in terms of health impacts of options for management of waste containing hazardous substances including lead. The study estimates health impacts from mathematical models of landfill and incineration and estimates of pollution from these disposal options. The estimated health impacts are from emissions of pollutants and the impacts used in this IA are based on the study, as noted below:

- Lead from £976 - £1464 / tonne. Best estimate = £1,220 / tonne[3]
- Cadmium from £61 – £700 / tonne. Best estimate = £201/tonne

92. Sensitivity tests were conducted using upper and lower bounds as presented. It is extremely unlikely that 100% of the RoHS substances in WEEE will be emitted at end of life. WEEE will either be recycled and recorded, collected and recycled without being recorded, sold to users outside the UK or sent to landfill. RoHS substances should not escape from well managed landfill sites except for mercury which is relatively volatile and so will slowly vaporise. Pollution of ground water by lead and other RoHS substances can occur at poorly run landfill sites. Reducing the hazardous substance content will reduce the risk of substances escaping.

93. An unknown percentage of WEEE is land-filled or exported for reuse. Where WEEE is recycled, most of the lead (>90%) is usually recovered although cadmium is not usually recovered. Therefore the quantities emitted will be less than the quantities used but the proportions are not known and so we estimate 10% to 30% will for lead and 95% to 100% potentially all of the cadmium could be emitted. Therefore, for this study, monetised health benefits correspond to the reduction of 10-30% of lead used and 95% to 100% of cadmium used being emitted.

94. In addition The "UK Impact Assessment for Regulation (EC) No 1102/2008 - Mercury export ban" has quantified the health benefits for reduced mercury emissions based on the effect of mercury of reduction of IQ and resultant earnings loss. This IA assumed a reduction of 24 tonnes mercury per year giving an annual benefit of £13.5 million and a 40 year present value of £299.9 million. The annual reductions in UK mercury emissions that are directly due to RoHS are estimated to be:

3. [3] Only one value was published (i.e. best estimate). The range is based on 20% range for upper and lower bounds.

- Mercury from £500k – £700k / tonne. Best estimate: £600k / tonnes

COST OF WASTE DISPOSAL

95. Overall it is assumed impact on cost of waste disposal is neutral per tonne of waste disposed. Although waste disposal costs will fall as the volume of WEEE falls due to the spare parts principle (para 105). The cost per tonne of waste disposed is assume to be neutral for the following reasons:

- Hexavalent chromium being replaced with less hazardous substitutes is cost neutral because although there is a saving in hazardous waste disposal costs, theses savings are similar to the increase in process costs with the new materials. Only traces occur in WEEE which present no risk and it is not recovered.
- Lead – The cost of recycling WEEE without lead and with lead is almost identical because the processes used are the same. Tin and lead are usually recycled together so if lead were absent, the same process would be used to recover tin only.
- Cadmium – Cadmium is not usually recovered as the concentration in most WEEE is very low. Therefore RoHS has no impact on recycling costs
- Mercury – Mercury is present in WEEE at very low concentrations (except in lamps) and so is not recovered and has no impact on costs. Mercury recovery from fluorescent lamps is relatively expensive but the process cost is not dependent on lamp mercury content. To date RoHS has reduced the mercury content but some is still permitted by exemptions so the recycling cost is unchanged.
- PBB & PBDE – Flame retardants are needed in certain plastics so alternatives must be used in RoHS compliant equipment. The recycling processes used for plastics are the same irrespective of choice of flame retardant. The process is usually physical separation to obtain low grade mixed plastics which are used where quality is unimportant. It is possible to burn these plastics to recover bromine for reuse but this is not carried out commercially and will be the same process for all types of brominated flame retardant.

REGULATORY CERTAINTY ON SCOPE:

96. The RoHS Directive currently takes its scope from the WEEE Directive and includes eight of the ten WEEE categories. The WEEE directive Article 2.1 excludes equipment that is part of products that are out of scope of the WEEE directive and it also excludes equipment intended solely for military and national security. These exclusions are not specifically stated in the RoHS directive. The recast clarifies this situation by specifically including these exclusions in Article 2.4 (a) and (c).

97. The scope of RoHS was unclear and as a result interpreted differently by Member States. This is particularly an issue for equipment that is part of buildings, i.e. “fixed installations”. Some States have interpreted the WEEE Article 2.1 to exclude fixed installations that are integral parts of buildings whereas other States assume that these are all in scope. Many manufacturers and some trade associations have assumed that industrial and professional fixed installations are excluded from scope, in part due to guidance published by the European Commission that specifically refers to fixed installations in the explanation for WEEE Article 2.1. This has created legal uncertainty so that it is not clear whether equipment containing RoHS substances is being placed on the EU market illegally or if manufacturers are removing RoHS substances where this is not a requirement. The recast aims to clarify the scope by including a list of specific exclusions in Article 2.4 which includes *c) equipment which is specifically designed and to be installed as part of another type of equipment that is excluded or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment*. This is a re-worded and more specific version of the exclusion in WEEE Article 2.1. Equipment that is excluded is also listed in recast Article 2.4 and this includes the new exclusion: e*) large-scale fixed installations*. This clearly excludes large-scale infrastructure such as railway signalling and probably also equipment installed in very large buildings in July 2012 the Commission issued guidance on the interpretation of large-scale in a consultative version of its FAQ document. Professional and industrial fixed installation equipment is often the same design for smaller/medium and large-size

buildings and manufacturers will not want to produce a RoHS and a non-RoHS version of each product. A clear interpretation will give benefits to industry if all Member States have the same interpretation. There will also be a benefit where products should be in scope but as this is not clear they contain RoHS substances. The latter is expected to be relatively minor because where doubt exists or where some EU States assume equipment is in scope and others believe they are excluded, most (but not all) manufacturers already comply with RoHS.

98. Large-scale stationary industrial tools (LSIT) are already excluded from Directive 2002/95/EC as a sub-part of category 6 but the original directive did not provide a definition of these. The recast aims to clarify the definition of LSIT by including a specific exclusion in Article 2.4 (d) and including a definition in Article 3(c). This is a new definition which aims to be clearer and avoid differing interpretations. The new definition also explains that large-scale stationary industrial tools equipment can be used in a research and development facility as well as an industrial manufacturing facility. This gives a clear benefit as new production processes will be developed in research facilities using identical equipment to the large-scale stationary industrial tool that is being developed for the new manufacturing process. Therefore the research and the manufacturing equipment designs must be identical and if one is excluded from scope, so must the other. This is a significant change because equipment intended for research was not necessarily excluded from scope by directive 2002/95/EC – this removes any anti-competitive impact for these businesses to remain in the EU.

99. Equipment designed to be sent into space – this has always been assumed to be excluded but this was unclear. This new exclusion provides legal certainty and so may reduce industries costs.

100. The recast directive specifically includes in scope “cables” (Article 4.1). Previously this was unclear and although any cables that are part of equipment in scope of RoHS would also be in scope, it was not clear whether the types of cables that are not designed to be used with a specific type of product were in scope. This change provides legal certainty and would give a small reduction in the use of RoHS substances (it is assumed that most already comply and for those that do not, RoHS substances are used only infrequently as solder (with lead) and more often as a PVC stabiliser (lead) and Deca-BDE may be used as a flame retardant

101. **Reduction in compliance costs from new exclusions:** The size of compliance costs for EEE is typically 0.1% of turnover (industry estimates) and so the benefit of new exclusions equate to these costs no longer incurred. New exclusions consist of two types of equipment removed from scope and so manufacturers, these are:

102. *Non-road mobile machinery made available exclusively for professional use* – will affect professional mobile “electrical tools” such as ride-on lawnmowers. The 2008 PRODCOM value for electric lawnmowers “production / sales” was £50,000,000 although the majority of these will be intended for consumers. If the professional market is £10 million then the saving to UK industry would be 0.1% x £10 million = £10,000 per year. There will also be a saving in R&D if compliant versions are being developed. Electric fork lift trucks are regarded as electric tools and are currently in scope of RoHS. There is no UK figure published for the two PRODCOM Eurostat categories for self-propelled fork lift trucks with electric motors which will be removed from scope. There is however a EU 27 total so if it is assumed that the UK has one sixth of this market, the UK total market value would be ~£700 million per year and so the annual compliance cost saving would be 0.1% x £700 million = £700,000 per year. However as the majority of these fork lift trucks are not produced in the UK, the actual figure is probably somewhat smaller than is estimated in this IA (a list of PRODCOM categories affected by this new exclusion in given in table 11 at the end of this IA).

103. *Equipment specifically designed solely for the purposes of research and development only made available on a business to business basis* – This is a new exclusion that applies only to equipment built specifically for research and development and would not exclude test and analytical equipment that may be used for research as well as other purposes such as testing, quality control, etc. The type of R&D equipment excluded is often constructed by the end-user for their own use and so is out of scope of RoHS as it is not placed on the EU market. However some equipment is built by one legal entity for another and so is placed on the market. An example is printed circuit boards built by manufacturers of integrated circuits to allow researchers to design new products that include these integrated circuits. These development boards are used only for research and are never used in finished products. Equipment specifically designed

solely for the purposes of research and development only made available on a business to business basis –the UK market for development and evaluation boards is ~£8 million based on data supplied by the ECSN/AFDEC distributor trade association. Most are not produced in the UK although some UK distributors have assumed they needed to comply and so have already incurred costs. This exclusion will also affect custom built electrical equipment supplied to research institutes and universities but no market figures are published. The total is likely to be relatively small and so a total of £10 million has been estimated for these excluded products. If the compliance cost is 0.1% of turnover, excluding these gives a benefit of £10,000 p.a.

104. Overall Article 2.4 includes six additional exclusions that were not included in the original RoHS directive as listed below, only the last 2 are monetised because the rest result from the change in scope of RoHS by the recast from a closed scope (only equipment in 8 categories) to an open scope which would include equipment that isn't specifically excluded. The exclusions are:

- equipment designed to be sent to space,
- means of transport for person or goods, excluding electric two wheeled vehicles which are not type approved,
- active implantable medical devices,
- photovoltaic panels intended to be used in a system that is designed, assembled and installed by professionals for permanent use at a defined location to produce energy from solar light for public, commercial, industrial and residential applications,
- equipment specifically designed solely for the purpose of R&D only made available on a business to business basis and (para 105)
- non-road mobile machinery made available exclusively for professional use (para 104).

105. *Spare Parts/ Repair as Produced Principle (Article 4.4 of recast Directive):* Currently under the RoHS Directive spare parts for the repair of EEE that was first placed on the market prior to the RoHS Directive coming into effect (i.e. prior to 1 July 2006) are exempt from the RoHS Directive. This is to ensure that EEE can be repaired or upgraded and does not arise as waste prematurely. The current RoHS Directive does not define 'spare parts,' which reduces legal certainty and can cause compliance issues and so the recast Directive includes a new definition of 'spare parts' (Article 3(27)).

106. The Recast introduces the 'Repair as produced principle' (Article 4.4f of the recast Directive). In the context of RoHS this means that EEE which benefits from an exemption to RoHS can be repaired with spare parts that are themselves not compliant with RoHS after the exemption has expired as long as the equipment was placed on the EU market when the exemption was in force. This again is to ensure that waste is not produced prematurely, and will bring benefits, although these are difficult to quantify accurately. But, taking an example of a supercomputer, if this requires a replacement part covered by an exemption but this exemption has been deleted (e.g. because a manufacturer now developed a substitute that can be used in new designs of supercomputers), but this substitute cannot be retro-fitted to older equipment, then the 'Repair as produced principle' could save significant resources, and avoid premature obsolescence, in not requiring replacement of the whole existing supercomputer with a new one, costing potentially several millions of pounds. However, it is difficult to value the potential benefits here because they depend on exemptions being removed (which is difficult to predict) and the type and volume of existing equipment affected subsequently.

107. The recast states that spare parts recovered from EEE that put onto the EU market prior to 1 July 2006 are exempt from the substance restrictions and so may be used to construct new equipment until 1 July 2016 as long as this is used in an auditable B2B closed loop system (Article 4.5). This would benefit those manufacturers of B2B equipment that take back their own equipment and re-use parts in new equipment. This is fairly common in the photocopier sector and with some types of games machines (e.g. "fruit machines"). This will benefit these businesses as they won't have to replace parts, consequentially reducing waste and consumption of energy and raw materials on new parts. Figures for energy savings and reduction in CO2 emissions have been calculated by printer and copier manufacturers and included in their submission to the European Commission for an exemption in July 2005. Games machines

manufacturers also requested an exemption but did not provide data on energy saved or the impact on CO2 emissions.

108. Benefits based on the 2005 exemption request by the printer / copier industry are:

- Printers and copiers – EU stock = 930,000, replaced every 5 years (often passed to second users then disposal after up to 10 years)
- Games machines – 50,000 EU sales per year, replaced every ~5 years so stock = ~250,000 (i.e. ~ 25% of printers and copiers - assume similar mass of replacement parts per machine)
- Printers and copiers calculated EU reduction in CO2 emissions = 592,000 GJ p.a. in EU. UK = $\frac{1}{6}^{th}$ of EU so = 100GJ p.a.
- Printers and copiers calculated EU reduction in energy consumption = 32,000 tonnes CO2 p.a. in EU. UK = $\frac{1}{6}^{th}$ of EU so = 5300 tonnes CO2 p.a.
- Estimated games machines EU reduction in CO2 emissions = 148,000 GJ p.a. in EU. UK = $\frac{1}{6}^{th}$ of EU so = 25GJ p.a.
- Estimated games machines EU reduction in energy consumption = 8,000 tonnes CO2 p.a. in EU. UK = $\frac{1}{6}^{th}$ of EU so = 1300 tonnes CO2 p.a.

109. There will also be a reduction in WEEE calculated for printers and copiers at 2,480 tonnes p.a. in the UK and also ~ 600 tonnes from games machines.

110. Total maximum benefits for the UK are estimated at 125 GJ reduction in energy consumption, 6600 tonnes reduction in CO2 emissions and ~3000 tonnes reduction in WEEE. In practice, the benefits of the recast will be somewhat smaller because printer, copier and games machines manufacturers have not been able to re-use non-RoHS compliant parts in equipment placed on the market after 1 July 2006 and so today, nearly 5 years later a significant proportion of equipment will have already been replaced by compliant versions. Typically, B2B printers, copiers and games machines have lives of 8 – 10 years. Therefore, since July 2006, at least half of the EU stock will have reached end of life although some manufacturers may have been retaining older non-compliant parts in the hope that they will be allowed to use these. Therefore, for this impact assessment, we have assumed that half of the quantity of non-RoHS parts can be used so that the benefit is from not needing to replace these. Therefore the estimated benefits will be half of the estimated values that were calculated from the copier / printer industries 2005 exemption request, i.e.: 62GJ, 3300 tonnes CO2 and 1500 tonnes WEEE p.a. There will also be a financial benefit but this was not quantified by the printer, copier or games machines manufacturers as cost is not an exemption criteria. There will be financial benefit from not disposing of the parts and this benefit has been estimated at £300,000 per full year for avoiding waste disposal costs (1500 tonnes at a cost of disposal typically £200 / tonne) and an annual saving in energy (electricity at an average UK industry price of 6.46p / kWh) of £1112 per full year.

111. The re-use of spare parts such as X-ray tube components is common in the medical sector but this category will be included in scope in 2014 and so will have this benefit only for two years whereas, in principal, medical products in scope of RoHS could give benefits in less parts needing to be made and less waste from a much longer period. The benefit of being able to re-use these parts is not included in this IA as this is no change from the current situation.

SIMPLIFICATION OF LEGISLATION (Article 5 of recast Directive)

112. The current RoHS Directive provides for a committee procedure to enable exemptions to the restrictions on hazardous substances to be granted for certain applications and materials. About 39 exemptions have been included in the Annex of the current RoHS Directive (since the last review).

113. The recast aims to make the exemption request procedure simpler, quicker in terms of response and more transparent by introducing additional obligations on the European Commission (Article 5.4). Article 5.5 also gives a timetable for exemption renewal requests and Article 5.6 allows a transposition period where renewal requests are rejected. Clarification of the exemptions procedure in Annex V of what an applicant needs to provide should speed up the assessment of exemption requests. It is difficult to quantify the overall benefit from such increased clarity and simplification.

114. Currently, exemptions need to be reviewed at least every four years, but are to remain as exemptions unless such a review positively recommends that the exemption is no longer warranted, or if an expiry date is set when the exemption is granted. The recast does not include a review procedure as this is replaced by automatic expiry after up to 5 years for categories 1 – 7, 10 and 11 and up to 7 years for categories 8 and 9 unless they are renewed. Although planned review of exemptions is needed, it is not clear that the approach in the recast to exemptions is appropriate for all. For example, some of the current exemptions such as 7a (lead in high melting point solders) are unlikely to find technical solutions to replacement of the use of hazardous substances in the next 10-20 years at least. This is also likely to be the case for some of the applications for medical devices and so the maximum expiry period is could be too short for some exemptions.

115. Since RoHS was adopted in 2002, there have been many exemptions requested and granted but the number per year has significantly decreased. Manufacturers have found substitutes for several applications, so several exemptions have been deleted or limited in their scope. With the inclusion in scope of exemptions 8 and 9, some exemptions will be needed. Those reviewed and recommended for granting by ERA are included in Annex IV. It is likely manufacturers of category 8 and 9 equipment discover further applications needing exemptions. This constitutes a cost to industry due to the recast that will be discussed in the costs section below.

116. The recast aims to make the exemption request procedure simpler and more transparent by introducing additional obligations on the European Commission and also gives a timetable for exemption renewal requests and allows a transposition period where renewal requests are rejected. However, additional information may need to be supplied by applicant. To ensure that applications include all of the required information, requests will need to include the information in Annex V. This could increase applicants' costs but by providing all of the information required granting should be more certain and potential large costs can be avoided from failing due to applicant not providing enough evidence. Overall, industry should benefit from legal certainty and reduced costs from a reduced rate of rejected exemption applications.

117. There will still be a requirement for exemption requests to be 'turned around' as quickly as possible (particularly following assessment by consultants) to reduce uncertainty and enable industry to invest with confidence. The Arcadis Report (page V) notes that *"..the exemption process itself, often taking more than a year to complete, is considered to be a barrier to research and development for new innovations."* This is particularly the case where research and development is undertaken by Universities on behalf of businesses, which can often use students who are available for only one to three years, and so delays of over a year can disrupt such research, and add to costs and uncertainty. It has been common for the time taken from request to publication in the OJ to be much longer than two years which is often unacceptable to industry. The timescale in Article 5 in effect force the Commission to complete renewal request evaluation and confirmation within 1 year. There is no time limit for new requests which could constitute an additional cost to manufacturers of newly included categories of equipment if a similar timescale is not worked to.

INTERNAL MARKET BENEFITS OF CONFORMITY ASSESSMENT (Articles 7-18 of recast Directive)

118. Articles 7-18 of the recast RoHS Directive introduce product conformity assessment requirements and market surveillance mechanisms in line with the European *"Marketing of Products" package* (*Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93*; and *Decision No. 768/2008/EC of the European Parliament and of the Council*). Under draft Articles 7-18, manufactures, their authorised representatives, professional importers and distributors of new EEE have obligations to ensure that new EEE they place on, or sell within, the European market conforms to the RoHS Directive, is CE marked to demonstrate such conformity, and is supported by relevant technical documentation. **Benefits of CE marking** are likely to arise from:

119. **More uniform enforcement** across the EU so that UK manufacturers do not face unfair competition from non-compliant products. Currently enforcement is not uniform across the EU with many countries being less diligent than the UK. Although National Measurement Office report fairly low levels of non-compliance, a recent Swedish report stated that 22% of tested

articles did not comply with RoHS (Kemi)[4]. More uniform enforcement would benefit EU manufacturers by removing unfair competition but it is not possible to quantify this benefit.

120. **Identification of importer**; Supply chains in the EU can be complex and it is often difficult to identify the original importer. The recast places obligations on distributors in the supply chain so that identification of the original importer will be more straightforward resulting in less non-compliance

121. **Harmonised method for demonstrating compliance**: Currently, there is no prescribed method of demonstrating compliance and so manufacturers are uncertain of the level of effort required. Some clearly do less than needed whereas others do more. The recast will allow manufacturers and importers to demonstrate compliance by harmonised standards giving increased legal certainty. A standard is currently being written and should be available soon after the recast enters force.

122. The majority of manufacturers support the inclusion of categories 8 and 9 in scope to avoid competing with lower priced non-compliant equipment as many have already incurred expenditure on complying with RoHS in anticipation of these categories being included. This view is not however supported by manufacturers of the largest and most complex medical equipment because the technical challenges and costs for these are considerable and have yet to be incurred.

FIRST MOVER ADVANTAGE:

123. The Commission's IA (2008) suggests possible 'first mover advantage' from the RoHS Directive. While this is possible for the 'downstream' industry, it is not clear that manufacturers or producers of EEE within Europe will gain any such advantages given that the RoHS Directive applies to products placed on the European market irrespective of where they are produced. There is also a potential disadvantage to European producers competing in markets where the RoHS restrictions do not apply and where their competitors do not need to incur the costs of complying with the RoHS restrictions.

ENVIRONMENTAL AND HEALTH BENEFITS

124. Inclusion of categories 8, 9, 11 mean several types of equipment will be brought into scope. This change will have an environmental and health benefit through the reduction of the restricted substances.

125. As most EU States assume new products included in scope through the recast are already in scope, it is likely that most already comply with RoHS and so the decrease in use of the restricted substances will be very small but as the EU market will be harmonised, manufacturers of compliant products should not be penalised by non-compliant competition.

126. It has not been possible to estimate environmental benefits due to lack of data. Health benefits have been difficult to quantify. Based on the tonnage of mercury, cadmium and lead avoided due to RoHS Categories 8, 9, 11 there monetised benefit of £305k to 2025 (see para 90-94). The health benefits from reduced amounts Hexavalent chromium, PBB and PBDE are not monetised, due to lack of evidence.

127. **Environmental and health benefits from inclusion of category 8 & 9:** The EU's IA notes: *Environmental benefits are likely to be significant: several tonnes of the heavy metals banned under RoHS (>1400 tonnes of lead, approximately 2,2 tonnes of cadmium) are used in medical devices and control and monitoring instruments, which account for 0,2-03% of waste from electrical and electronic equipment by weight; these substances by improper waste management may be released to the environment (only 49,7% of waste medical devices and 65,2% of waste control and monitoring instruments are separately collected); restricting the use of these substances through RoHS will in the medium to long term eliminate their presence in the products and in the waste thereof; further analysis shows that even in scenarios assuming much higher recycling rates there is some environmental benefit from including these categories of equipment in the scope of RoHS.*

4. [4] http://www.kemi.se/templates/News____6548.aspx / http://www.kemi.se/templates/News____6548.aspx

128. Medical devices (Category 8 equipment of the WEEE Directive), and Monitoring and Control Instruments (Category 9 of the WEEE Directive) are currently excluded from the scope of the RoHS Directive but will be included as a result of the recast. The Bio Report and the Commission's IA both say that Categories 8 and 9 equipment were originally excluded from the RoHS Directive because of issues over their reliability if they had to employ lead-free solder.

129. ERA Technology was asked by the Commission to determine whether it would be possible to include Categories 8 and 9 in the scope of the RoHS directive (*Review of Directive 2002/95/EC Categories 8 and 9,* (2006). This work estimated that the amounts of the restricted substances used in the manufacture of Categories 8 and 9 equipment in the EU were in the region of: 1400 tonnes of lead; 2.2 tonnes of cadmium; 0.03 tonnes of mercury; and 0.8 tonnes of hexavalent chromium per annum.

130. The Bio Report (page 41) estimates the amount of hazardous substances that could be saved from use through a range of different options for inclusion of Categories 8 and 9 equipment within the scope of RoHS. For the option that is closest to the one presented in the recast Directive, the Bio Report implies that over ten years (from 2010 to 2020) inclusion of Category 8 and 9 equipment within RoHS could reduce lead use by some 20 per cent; Cadmium use by some 5 per cent; Mercury use by some 35 per cent; and Hexavalent Chromium use by some 60 per cent. In terms of tonnages this amounts to some 2800 tonnes of lead, 1.1 tonnes of cadmium, 105 kg of mercury, and 4.8 tonnes of hexavalent chromium not being used in EEE across the EU over a ten year period to 2020.

131. The ERA Report (2006) provides estimates of the reduction in the hazardous substances that could result from inclusion in RoHS of Category 8 and 9 equipment. These estimates take into account expected exemptions and voluntary substitutions. Using these estimates (Table 11, Page 71 of ERA Report) and the assumption that the UK uses Category 8 and 9 equipment in proportion to its share of EU GDP, would imply estimated benefits to the UK of a reduction in these hazardous as presented in table 4.

132. **Table 4: Reduction in hazardous substance from inclusion of Category 8 and 9, estimated weight / year (from 2014 (date of enforcement) to 2025).**

Substance	Category 8 & 9 products (estimated weight/yr)
Lead	99,000kg
Cadmium	10kg
Mercury	2kg
Hexavalent chromium	133kg
PBDE	1667kg

133. We have assumed that there will be a gradual decline in the amount of lead used for exempt applications such as counterweights as new models are designed without lead.

134. As the reduction in the amounts of RoHS substances due to RoHS are not small and much larger amounts are emitted by other sources, the Bio IA presented an analysis of the potential negative impacts of the substances restricted by RoHS as they apply to the estimated volumes currently used in Categories 8 and 9 equipment (table 4). The Commissions IA concludes *"..the impacts of RoHS substances in Cat.8 and 9 equipment are extremely small."* (Page 49).

Table 5 Toxicity potential of ROHS restricted substances contained in Category 8 and 9 products 2010-2020 *(Bio Report – page 45, page 49)* per inhabitant of EU27.

Indicator	Unit	Normalised Scenario 1	Normalised Scenario 2
Human toxicity	Kg 1.4-DB eq	0.00001%	0.00033%
Freshwater aquatic ecotoxicity	Kg 1.4-DB eq	0.00012%	0.00046%
Freshwater sedimental ecotoxicity	Kg 1.4-DB eq	0.00029%	0.00115%
Terrestrial ecotoxicity	Kg 1.4-DB eq	0.00090%	0.00034%

135. Table 2 shows the toxicity potential of the RoHS substances in categories 8 and 9 for two scenarios. Scenario 1 assumes that 90% of WEEE is recycled, 6% is land-filled and 4% is incinerated. Scenario 2 is 57% recycled, 27% land-filled and 16% incinerated. The toxicity potential values for these two scenarios are compared with the impact generated by EU27 inhabitants per year. Therefore, for example, the human toxicity caused by scenario 2 is 0.00033% of the total human toxicity caused by EU27 inhabitants per year. These results show that the RoHS substances in category 8 and 9 are a very small percentage of the total EU impacts.

136. The results also suggest that recycling enables a significant decrease in the potential toxicity impacts of end of life treatment of EEE containing hazardous substances. Lead appears to be the biggest contributor to potential impacts which is coherent with the fact that lead amounts contained in EEE are higher than the quantities of other substances. As regards human toxicity, potential impacts linked to the presence of chromium are more significant than the other hazardous substances.

137. **Environmental and health benefits from inclusion in scope of category 11 (Article 2.1 and Annex I)** This includes equipment that is currently excluded from scope but will be included in category 11 or due to the “dependent” definition change, so the scope is not limited to products where electricity must be the primary function. There will be benefits from a reduction in the quantities of the restricted substances used in the manufacture of the equipment and waste arising at end of life. There has been no formal review or impact assessment carried out on equipment in category 11 or affected by the dependent definition change and so there is no data available on the quantities of the restricted substances that these products contain.

138. The restricted substances will mainly be associated with electrical circuitry although hexavalent chromium could be used to treat any aluminium and zinc coated parts. Many of the types of equipment that are believed to be included in category 11 are relatively large but have only small proportions of electrical circuitry. Lifts and escalators for example use large quantities of steel and have fairly large electric motors but the mass of electrical circuitry is relatively small in comparison with complex medical devices such as MRI or CT which have very large quantities of electronics. A similar situation exists with products affected by the change of definition of dependent. As these products do not rely on electricity for their primary function, electrical circuitry will usually be a relatively minor part of these products. For example, as gas cooker can weigh typically 45 kg whereas the electrical circuitry is for a clock display, timer, igniter and possibly safety controls for the gas supply weigh in total less than 1kg (data from EuP Lot 22 study on ovens). Furthermore, not all gas cookers have electrical functions. The electrical circuitry is also fairly simple in most products although a few such as motor speed controllers will use more complex printed circuit board designs. However, in comparison with, for example, typical medical equipment and test instruments, category 11 equipment and equipment brought into scope due to the definition change will have a much lower proportion by weight of electronics and therefore also will contain lower proportions of the restricted substances.

139. The uses of the restricted substances will be quite varied cutting across sectors. Lead is used primarily in solders, alloys, as a PVC additive and in optical glass and other currently exempt

applications. Cadmium will be used primarily in electric power contacts, mercury will be very uncommon being used in a few displays and fluorescent lamps (e.g. in lifts), hexavalent chromium will be more common and used as a passivation coating and the flame retardant Deca-BDE is used in plastics although this will have already declined because of RoHS. The other PBDE flame retardants are already banned by REACH and PBB is used only in high voltage power cables. Very approximate estimates of the amounts of the restricted substances avoided per year by inclusion of category 11 and the new "dependent" definition have been made for the UK from 2019 using 2008 PRODCOM Eurostat data for product categories believed to be affected (see separate spreadsheet). These estimated figures are:

Table 6: Reduction in hazardous substance from inclusion of Category 11 and change in definition of 'dependent' (from 2019 (date of enforcement) to 2025)

Substance	Category 11 products and additional products included by change of dependent definition. Estimated weight/year
Lead	200kg
Cadmium	2.5kg
Mercury	0.1kg
Hexavalent Chromium	100kg
PBDE	500kg

140. The above figures are estimated from UK production / sold Eurostat statistics and so do not include the restricted substances in equipment imported into the UK or consumer products that are manufactured primarily outside the EU such as toys. In addition some product groups may not have been accounted for. Therefore the actual figures for the amounts of restricted substances in these types of equipment that reach end of life in the UK will be somewhat higher but is impossible to quantify at this time. The monetised health benefits from the inclusion of category 11 based on the above for reduction in lead, cadmium and mercury start in 2019. Other health and environmental benefits for inclusion of category 11 were not assessed by the EU's 2009 IA.

INTERNATIONAL HEALTH BENEFITS

141. Adoption of the RoHS directive has resulted in a significant reduction in the quantities of the RoHS substances being used in new EEE placed on the EU market, the recast will further enhance this trend. One consequence will be a reduced adverse impact on the health of people in developing countries attributed to recycling WEEE originating in the EU using unsafe processes some of which was with WEEE. Lead poisoning was a particular problem. Recycling WEEE with no hazardous substances would avoid possible harm to workers and the Commission's IA discusses the 'illegal trade' in WEEE in the sense that WEEE is exported for recycling or dumping overseas to lower standards/requirements than exist in Europe.

142. This takes place to avoid cost (dismantling can be labour intensive) but also because there is a growing demand for scrap materials, particularly in China. The RoHS Directive is justified here on the grounds it will prevent exposure to those involved in dismantling RoHS compliant WEEE outside of Europe.

143. However, any 'illegal trade' in WEEE is contrary to the European Waste Framework Directive, and contrary to the European Shipments of Waste Regulations. The WEEE directive is also being recast and one aim is to close loopholes that may be used to illegally export WEEE although currently, less than 40% of UK WEEE is accounted for as described above. In 2011, five years after RoHS entered into force, a significant amount of older pre-2006 non-compliant EEE continued to reach end of life as typical lives often much more than 5 years. Some WEEE from the EU has continued to be exported to developing countries despite EU legislation and the introduction of restrictions in countries such as China.

144. However, some traditional destination countries for illegal WEEE (e.g. China/India) are increasing the rate at which they recycle WEEE safely. As EEE designed for the Indian and Chinese markets does not need to comply with EU legislation and so is made with lead-based solders, the impact of EU RoHS restrictions is much less significant in these countries. Unsafe recycling has

FORCED BEHAVIOUR CHANGE:

145. The Commission's Bio IA says that hazardous substances are often used in EEE because they are *"...the cheapest technical solution..."*, Based on this notion the RoHS recast will help to overcome 'myopic behaviour' in new product categories. However, it is not clear that this is always the case. There are specific properties of lead, cadmium, mercury and hexavalent chromium which by their nature make them the best technical solutions across a range of applications and often they are not the cheapest. For example, lead-based optical glass is more expensive than lead-free optical glass (because of the additional hygiene precautions which need to be taken when using lead), and so is used only where its specific technical properties are needed. There is however an aversion by manufacturers to change materials due to concerns that the alternatives will not be as reliable (due to a lack of field data) so manufacturers tend not to replace substances unless the hygiene costs become unacceptable (as has sometimes been the case with hexavalent chromium) or if forced by legislation such as RoHS.

146. The RoHS directive clearly had a very significant impact on UK manufacturers and there have been benefits in the reduction in use of hazardous substances as described above. If the RoHS Directive were to be repealed today, it is doubtful whether there would be significant changes to electrical equipment as lead-free soldering is now "standard" and tin/lead is now less common – the recast will broaden this trend to other product groupings.

OPTION 2 - IMPACT OF ARTICLE 2.2

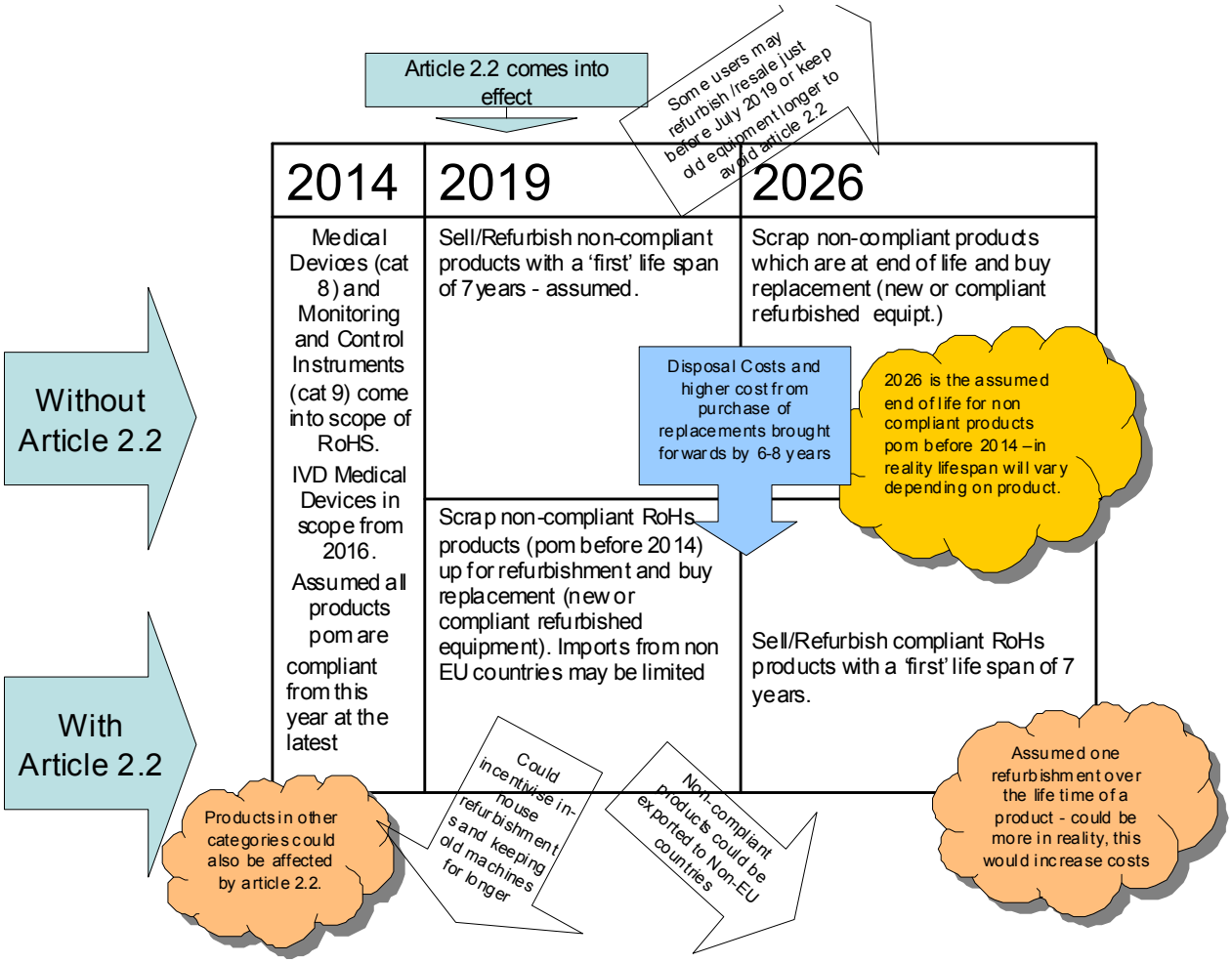
147. As well as the new RoHS Directive expanding the scope of the previous Directive, Article 2.2 has an additional impact on the second hand markets in products newly captured in its scope from 2019. The effect is that non-compliant products already in the distribution chain or in use will not be able to be resold after this date despite having been placed on the market in accordance with the existing law before that date. The full impact of this Article has only recently been identified by the Commission's consultants in their report[5] (BIOis/ERA 2012 Report) to assist the Commission in making an EU impact assessment. That IA, when produced, will inform the Commission's 2014 review of the Directive which is intended to address any scope problems in advance of the 2019 deadline. The Commission plan to include this issue in their review.

148. The most affected sectors are Medical Devices (Category 8) and Monitoring and Control Instruments (Category 9). This is mainly due to the value and long lifespan of large products in these categories. It should be noted that both of these categories will only come into scope of RoHS from 2014 (see figure 1), and some products within these categories don't have to comply until later (e.g. in vitro medical devices have until 2016). The worst case scenario is that all equipment in this sector that is legally placed on the market before 2014 could not be resold on the EU market after 2019 if it did not comply with the Directive. Manufacturing industry and equipment users inform us that "trading in" of large, high value medical equipment (such as MRI scanners) for refurbishment and resale is standard practice. The practical effect in the UK is likely to be an increase in cost for the NHS as they would no longer be able to trade in old equipment that was being replaced.

[5] "Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive" Final Report by BIO Intelligence Service and ERA Technology submitted to the European Commission 6 July 2012

149. An urgent EU wide solution to Article 2.2 is being sought as most users operate across the EU and need to maintain the single market for their products. The UK will copy out the Directive with the Article in place, in order to meet our obligation to transpose the Directive by 2 January 2013, but will aim to persuade the Commission to bring forward an urgent proposal that would address the problem and be acceptable to Member States and the European Parliament.

Fig 1: Illustration of the impact of Article 2.2 against the counterfactual of no Article 2.2



Costs

150. Monetised costs of Article 2.2 are estimated at £51m (present value prices), a summary of the cost breakdown are noted below in table 7 below and a summary of assumptions in paras 222-226. As shown in figure 1, Article 2.2 means non-compliant newly included EEE captured within the scope of the new directive cannot be resold on the EU market after 22 July 2019. A product becomes obsolete, even though it would otherwise retain an economic value for some years to come. The costs of premature waste recycling and treatment and the additional cost incurred by the user from having to buy a new product if they wished to replace it – are both costs which would be incurred earlier than without Article 2.2. In line with the theory of pure time preference as agents prefer to incur costs later rather than now, the difference in the present value costs are taken to estimate the costs being incurred earlier than they would've otherwise. Given the market for refurbished goods is likely to shrink as a result (with all non-compliant goods no longer eligible for refurbishment and resale within the EU) it has been assumed that new products will need to be purchased earlier than would have without Article 2.2. It is possible that the directive would incentivise hospitals and users to refurbish and keep older equipment given the restriction on resale. Sensitivities for Article 2.2 have been estimated taking +/- 20% off all costs – lack of data makes it difficult to assess range of costs using a more considered approach. A summary of costs are noted below

Table 7: Summary of cost from Article 2.2

Costs	Cost (PV/£m)	Cost (Constant prices/£m)
loss of resale/lease revenue	£5	7.53
higher energy consumed from increased virgin production	£0.4	0.59
higher cost of new equipment incurred earlier than without Article 2.2	£45	These costs arise earlier than they would without article 2.2. Using standard discounting the difference in PV costs are estimated reflecting social time preferences
premature waste disposal /treatment net costs	£0.02	
Total cost of Article 2.2	**£51**	**£8**

*may not sum due to rounding

Additional cost from replacing products prematurely

151. For Category 8 it is assumed that new equipment will have a ~35% higher price compared to refurbished equipment (source: BIOis, ERA 2012[6]). The value of the refurbished market for the UK is derived from EU level estimate (BIOis, ERA 2012). For Category 9 it is assumed that new equipment will have a 25% higher price than second hand products and the value of the refurbished market is 25% of the estimated total market value for category 9 equipment extrapolated from Prodcom data (industry proposed assumptions). Prices are forecasted to rise by inflation only (2.5% per annum, HMT deflators). It is assumed that the lifespan of the product is 6-8 years (medical equipment is refurbished after 7 years according to COCIR, no published data available for category 9 so the same assumption is used) and given Categories 8 and 9 are in scope from 2014 all products placed on the market (pom) are assumed to be compliant from 2014. Given the assumption about lifespan, costs could be incurred any point from 2019 + 6-8 years – it is assumed that without Article 2.2 additional costs from replacing products would have been incurred later, in 2026-28.[7] The present value (PV) difference is taken between 2026-28 and 2019-2021. It is assumed the products only see one refurbishment. The table shows the PV difference in additional costs for new equipment, incurred earlier as a result of Article 2.2. It should be noted that product lifespan will vary across products and could be longer than that used as a simplifying assumption – this would have the effect of increasing costs, as the PV difference would be taken over a longer period of time and be greater as a result. The assumption that product lifespan doubles post refurbishments in applied for simplicity as there is no real data available and given variation in the 'first' life span that would be expected in reality. Also, it's possible that the impact could be felt earlier if consumers expect enforcement of article 2.2 and have full information about its impact and stop buying non-compliant products earlier as a result, this would lead to a possible increase in costs overall.

Additional cost from treating and recycling waste prematurely

152. The cost of premature treatment of waste is estimated based on the same principle of pure time preference, noted above. The average net cost of treating a tonne of RoHS waste is estimated at £127 (Source – internal KPMG report, not published). Data on the net cost of recycling is not publically available but it is possible that the net costs of treatment could fall over time with technological advancements and a rise in the price of scrap materials from these products – for the sake of simplicity and due to lack of data the cost of treatment and recycling is projected to remain flat over time i.e. decreasing in real terms. Tonnes of UK waste generated are derived from EU estimates (BIO report, 2012). Again as costs are incurred earlier the difference in PV estimates from 2026-2028 to 2019-2021 are taken. There could also be a distributional impact,

[6] "Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive" Final Report by BIO Intelligence Service and ERA Technology submitted to the European Commission 6 July 2012

[7] This assumes that there is only one refurbishment and that after refurbishment /resale in 2019-2021 the product lifespan doubles and lasts another 6- 8 years up to 2026-28 – at which the point the product reaches it's end of life and is scrapped and a replacement is purchased.

for instance the NHS may have planned to sell off equipment before its final end of life and would never have incurred the cost of disposal which would have been passed onto the second user.

Table 8: Temporal difference in costs of purchasing replacement products and waste disposal *earlier* than without Article 2.2

Temporal difference in earlier costs being incurred:	**Higher cost of new equipment incurred earlier than would be otherwise (£/m)**
Category 8	2.3
Category 9	42.8
Sub Total	**45.1**
	Premature waste disposal /treatment net costs (£/m)
Category 8	0.01
Category 9	0.01
Sub Total	**0.02**

*may not sum due to rounding

Cost from loss in economic value from prematurely classifying product as obsolete

153. As mentioned there is also a loss in the economic value of declaring a functioning product that has not reached the end of its final life obsolete in terms of the second hand market. This is reflected in the resale value of the product or lost revenue to the user who would otherwise re-sell / lease the product if they wanted to replace it.
154. The lost revenue to hospitals from inability to re-sell medical equipment is estimated at £7.5m over 2019-2021 (constant prices) / £5.5m (PV prices). This is derived from EU level estimate from the BIOis, ERA 2012 Report by apportioning the UK market share of 9% in EU medical imaging devices market. It has not been possible to estimate loss of revenue from inability to sell used equipment for other categories / users due to lack of data on volumes and values of resold business to consumer products in the UK.

Environmental impact

155. There will also be an increased quantity of raw materials and energy consumed to produce new EEE to replace products which are scrapped prematurely. COCIR have calculated that using a refurbished medical device instead of building a new device will reduce production phase energy consumption by up to 73%. Industry estimates of energy required for virgin production suggest 93.33 MWh is required to produce 1 ton of medical imaging equipment on the average. The amount of resource and energy required will vary depending on the product –for simplicity, the estimate for imaging equipment is used for Cat 8 and 9 products. It is assumed the volume of new products that may need to be produced is equivalent to the 190 tonnes of premature waste generated as a result of Article 2.2. The cost from additional carbon emissions due to virgin production is estimated at £0.4m. However, this doesn't take into account the full environmental impact, the BIOis, ERA 2012 Report notes that "the quantity of materials used will be much larger than the additional estimated tonnage of waste generated per year due to Article 2(2) because production of raw materials creates large quantities of waste and equipment manufacture consumes process chemicals, which also creates waste."

Impact on business of Article 2.2

156. With respect to Medical Devices (cat 8) the manufacturers of the most affected part of the sector – imaging equipment such as MRIs - are companies such as Siemens and Hitachi. However, the bulk of costs will be imposed on users of products i.e. hospitals, as a result of large, high value medical equipment being captured by Article 2.2. The direct impact on business estimate (£35.4m), on the front sheet only includes impacts on business. As NHS is public sector it is excluded from this calculation. It is not possible to obtain data broken down by type of user, making it difficult to assess the impact on business users specifically. For category 8 the bulk of the impact is expected to be on the NHS – additional cost to business users for category 8 is therefore not estimated (bar treatment of premature waste costs). For category 9 - it's assumed

[8]. Therefore 65% of higher additional, earlier, cost paid for new products to replace non compliant ones that have come to an end of their life is taken as a cost to business. The premature treatment and recycling of waste for category 8 and 9 is a cost to business, as the WEEE directive states that all states all separately collected WEEE must be financed by producers in line with their market share. The PV difference is taken for all these costs, given their temporal nature.

Non monetised costs:

Costs to users for other categories

157. Article 2.2 impacts on products that were outside the scope of RoHS 1, but fall within the scope of RoHS 2. The monetised costs don't reflect costs incurred by product users in category 11 (newly in scope), however there are unlikely to be significant impacts as the re-sale / refurbishment market isn't as widely used and products tend to have a shorter life span. However some products will be affected. Lost revenue from inability of category 9 users to re-sell products is not monetised, due to no data being available on size and prices within the second hand market. Business that specialise in the business to consumer second hand market such as refurbishment companies may also see a decline in business. However, manufacturers may see an increase in sales of products if new items are bought to replace non-compliant ones.

Distributional impacts

158. There are potential distributional impacts, for instance the NHS may have planned to sell of equipment before its final end of life and would never have incurred the cost of disposal which would've been passed onto the second user.

Health impacts

159. The BIOis, ERA 2012 Report notes "*EU hospitals will be able to afford less new equipment each year from 2019 onwards and this will have a negative effect on the health of patients in EU hospitals. This will be because hospitals will not be able to buy as much new equipment each year and so the average age of medical equipment used in EU hospitals will gradually increase as old equipment replacement is delayed. It is known that the performance of old equipment for diagnosis accuracy and treatment success is inferior to newer machines although it is not possible to quantify this as there are many variables that influence medical treatment success rates. Old equipment also tends to be less reliable and so there will be delays to treatment when breakdowns occur and this can have serious implications to patients. The National Radiotherapy Advisory Group advised the UK Government in 2007 that radiotherapy equipment should be replaced every 10 years because old equipment suffers from breakdowns due to wear causing longer recovery times, is less accurate and so causes more side-effects.*

160. *Equipment types such as X-ray, CT, MRI and ultrasound can be and are used in EU hospitals for much longer periods than 10 years before disposal (typical lifetimes are 20 – 30 years) but newer equipment will give superior performance so that full recovery is more likely and shorter treatment times are possible. As a result, the healthcare costs from using older equipment (excluding capital equipment costs) could be higher overall than if newer equipment were available. There will be an impact on patient's health if the average equipment age were to increase by a few years but the extent is impossible to quantify. This is because there have been improvements in diagnosis expertise, drug treatments and advances in technology so that the success rates achieved some years ago cannot be directly compared with success rates today with newer equipment. COCIR has studied the age profile of medical equipment used in EU hospitals and*

[8] non household may include public sector bodies.

believes that it is already older than it should be and their report explains the implications of using older equipment. Ideally, EU hospitals should buy more new equipment and so Article 2(2) would force some hospitals to buy new instead of refurbished older machines but as budgets will not increase, the end result will be that the average age will increase".

161. As noted it is possible Article 2.2 could incentivise hospitals to keep machines for longer rather than lose money from being scrapped prematurely (without the option of trading in). Equally it is possible hospitals could 'self' refurbish and keep for longer. This wouldn't necessarily adversely impact on the quality of the refurbishment or final product. The impact on the health of the patient is therefore not clear.

Impact on Jobs

162. It is possible, that UK waste treatment centres and refurbishment centres could lose out on business if waste is diverted abroad., with negative implications on jobs Furthermore, as noted in the BIOis, ERA 2012 Report "Medical equipment manufacturers themselves will be affected as their market for refurbished equipment will shrink and so there may be an impact on EU jobs." Manufacturers may be able to sell more new systems so their total turnover may not be even be positively affected. Overall any impact on jobs is likely to be marginal.

SME Impact

163. Discussion with UK industry representatives representing the manufacturers of the smaller, cheaper medical equipment such as blood analysers whose members are mostly SMEs, note they are unlikely to be affected by the issue of reselling refurbished equipment after 2019. They are already aware that from July 2014 when medical equipment comes into scope they will have to ensure that equipment being placed on the market for the first time is compliant. As their equipment does not last as long as the heavy medical equipment such as the MRI scanners they are unlikely to have pre 2014 (non compliant) equipment coming up for refurbishment at 2019. In any case only a small amount is refurbished in this part of the sector.

Rationale and evidence that justify the level of analysis used in the IA (proportionality approach);

164. The full impact of this Article has only just been identified by the Commission's consultants in their report[9] (BIOis/ERA 2012 Report) to assist the Commission in making an EU impact assessment. At the time of negotiations the impact was not realised and there was no debate on the issue in respect of the effect on re-sale of categories 8 & 9 equipment.

165. An urgent EU wide solution to Article 2.2 is being sought as most users operate across the EU and need to maintain the single market for their products. The UK will copy out the Directive with the Article in place, in order to meet our obligation to transpose the Directive by 2 January 2013, but will aim to persuade the Commission to bring forward an urgent proposal that would address the problem and be acceptable to Member States and the European Parliament.

166. Due to limited data and evidence it has not been possible to estimate the full costs and benefits. It would have not been possible to do so without committing resource to commission a fact finding investigation. Given the expectation that the impact of the Article will be modified before 2019 when it starts to have adverse impacts, this would not be proportionate to the effort required.

Conclusion (both options)

[9] "Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive" Final Report by BIO Intelligence Service and ERA Technology submitted to the European Commission 6 July 2012

167. Option 1 determines the additional costs and benefits of the recast RoHS directive over a 15 year period to 2025. Option 2 does the same but is included on a separate sheet to show the additional impact of the recast RoHS directive including Article 2.2. Summary tables of results are as below.

168. The RoHS recast Directive 2011/65/EU has been agreed at EU level and must be implemented by 2 January 2013.

169. Manufacturers will as a result incur cost from the need to redesign electrical products, purchase new equipment, check compliance of components, additional energy and more expensive materials.

170. It was not possible to monetise all benefits due to lack of evidence. The recast clarifies several definitions which will harmonise interpretation of requirements across EU States. In addition conformity assessments will improve the functioning of the internal market for products captured within the scope of RoHS. Benefits from widening the scope of RoHS as a result of a reduction in the use of the six hazardous substances which will generate additional health benefits and environmental benefits.

Table 6a: Average annual costs and benefits option 1 (£/m) (excluding transition costs)

	Average annual benefit (£/m) constant prices			Average annual cost exc. transition (£/m) constant prices		
	Best	**Low**	**High**	**Best**	**Low**	**High**
2011				0.1	0.1	0.1
2012	0.38	0.38	0.38	0.1	0.1	0.1
2013	0.48	0.48	0.48	0.1	0.1	0.1
2014	0.50	0.49	0.52	2.5	2.0	3.5
2015	0.51	0.50	0.53	3.3	2.4	5.1
2016	0.49	0.48	0.51	3.5	2.5	5.5
2017	0.17	0.15	0.19	5.1	3.3	8.7
2018	0.17	0.16	0.19	6.7	4.1	11.9
2019	0.18	0.16	0.20	7.4	4.5	13.2
2020	0.18	0.17	0.20	7.7	4.6	13.9
2021	0.19	0.17	0.21	7.9	4.7	14.3
2022	0.19	0.18	0.21	8.1	4.8	14.7
2023	0.20	0.18	0.22	8.3	5.0	15.1
2024	0.20	0.19	0.22	8.7	5.2	15.9
2025	0.21	0.19	0.23	8.8	5.2	16.1
Total	**4.0**	**3.9**	**4.3**	**78.3**	**48.5**	**138.0**
Average Annual	**0.29**	**0.28**	**0.31**	**5.2**	**3.2**	**9.2**

Table 6b: Breakdown of costs and benefits option 1 (best scenario)

Transition costs	Total Costs (£/m)
Research and Development	364
Approvals expenditure for medical devices	5
CE Mark Costs (ie. setting up data management systems)	0.1
Capital Equipment Replacement	0.4
Transition Cost Total	**369**

Re-occuring cost	
Compliance costs	60
Other operating costs (energy, carbon, solder replacement metal costs)	17
Enforcement (NMO)	1.3
Exemptions (ie. applications)	0.5
Reoccuring Costs Total	**78**

Total	448

Re-occuring Benefits	Total Benefits (£/m)
Health benefit from reduction in use of lead, cadmium and mercury	0.3
Saving in compliance cost	2.0
Saving on operating costs (carbon, energy, WEEE disposal)	1.7

Total	4

Table 6b Average annual costs incurred from Article 2.2 (present value estimates)

	Costs PV (£/m)
2019	**17**
2020	**17**
2021	**17**
Total	**51**

Table 6c. Total Transition costs of RoHS recast directive including the impact of Article 2.2.

	Transitional Cost (£/m
Transition Cost (excluding Article 2.2)	369
Transition cost (Article 2.2)	53
Total	423

*Transition cost for article 2.2 (breakdown): loss of resale/lease revenue (£8m, constant prices) + higher energy consumed from increased virgin production (£0.6m, constant prices) +higher cost of new equipment incurred earlier than without Article 2.2 (£45m, PV prices) +premature waste disposal /treatment net costs (£0.02m PV prices). Cost may not sum due to rounding.

SPECIFIC IMPACT TESTS

Small Firms Impact Test

171. All manufacturers irrespective of size are expected to comply with RoHS. The amount of effort required depends on the number and complexity of products and in general large firms have more than small firms. Small firms have fewer resources and so always have difficulty complying with environmental legislation although in general they wait until large firms are complying to benefit from their experience. The Regulations are not expected to have a disproportionate impact on SME's. See para 163 for impact of Article 2.2 on SMEs.

172. Microbusiness Exemption Rule: Under the microbusiness exemption rule whereby regulation exempts organisations of 10 or fewer employees and start-ups, this measure is out of scope because it relates to the EU.

Competition assessment

173. The RoHS Directive is an 'Internal Market' Directive with one of its aims being the protection and promotion of a 'level playing field' for the European Internal Market in EEE. EEE production is characterised by a large number of businesses both domestically and internationally. Within the broad category of EEE there are also a large number of separate markets each of which can have quite different characteristics. RoHS should affect all manufacturers, importers and distributors equally, as long as enforcement is effective and so the recast RoHS Directive should not have a detrimental impact on competition within the EU.

174. There may however be an issue in relation to UK manufacturers selling to non-EU countries where there are competitors who do not sell in the EU. Category 8 and 9 equipment is generally produced in relatively small numbers, and so it would be costly to produce more than one version of a model for the world market. For example, UK manufacturers will sell the same products in the EU, the USA and in Asia. Some US and Asian companies not exporting to Europe will not need to produce RoHS compliant versions. When this situation arises it could place UK manufacturers at a competitive disadvantage in US and Asian markets as they will have a lower cost base. However, other countries outside of Europe will have own legislation on environmental and human protection from waste disposal. Also the small additional reoccurring cost (0.01% of turnover) is not expected to have a significant impact.

Statutory Equality Duties

175. After an initial screening as to the potential impact of this regulation on race, disability and gender equality it has been decided that there will not be a major impact upon minority groups in terms of numbers affected or the seriousness of the likely impact, or both.

Greenhouse Gas Assessment

176. Lead soldering will need to be replaced with lead-free soldering for products within the scope of RoHS. Lead free soldering is a more energy intensive process. This IA estimates additional emissions of C02 in the region of 320 tonnes of CO2 per annum from 2014 for categories 8 and 9 based on CO2 emissions from UK electricity generation of 0.39kg. A much smaller increase in CO2 emissions and electricity costs would be incurred from 2019 for category 11 estimated at 40 tonnes CO2 p.a. This is based on an assumption about the proportion of lead in solder used in categories 8 and 9 (25 tonnes p.a. in UK) compared to category 11 (~2 tonnes p.a.).

Wider Environmental Issues

177. It is expected that RoHS recast will reduce human toxicity, freshwater aquatic and semimetal toxicity and terrestrial toxicity from hazardous substances in WEEE.

178. **Biodiversity**: It is not clear whether the overall impact on biodiversity will be positive due to lack of comprehensive analysis. Reduction in the use of hazardous substances will reduce the rate at

which WEEE that contains these substances will be incinerated, reducing the risk of emitting pollutants that will affect air quality, or discharge of effluents effecting water quality. As noted by the European Commissions Impact Assessment estimated that the impact is likely to be small as the volume of substance diverted from unsafe disposal /incineration due to the Recast will be marginal. See para 135.

179. The impact of alternative substances used to replace the 6 hazardous substances is not always benign. The negative impact from increasing the demand for non-lead solders will reduce any net environmental benefit from greater use of silver which has detrimental impacts on the environment in the production/ refining stages of the lifecycle. See para 89 for discussion.

180. Environmental benefits are likely to spill over to developing nations where WEEE with hazardous substances can be diverted land (See para 144 for qualitative assessment). Harm could be caused to the environment by disposal of liquid wastes to land and water harming the underwater ecosystem and agricultural.

181. ***Waste Management:*** As the amount of WEEE containing hazardous substances falls there will be a reduction in waste management costs – this is in line with waste prevention agenda in the hierarchy of waste management as set out by DEFRA waste policy. Generally speaking safe disposal / recycling of WEEE that contains hazardous substances is more costly than that which does not. Costs savings from the Repair as Produced Principle (Article 4.4 of recast Directive) that allows EEE which benefits from an exemption to RoHs to be replaced with non compliant spare parts, will reduce the risk of parts becoming obsolete and becoming WEEE prematurely. (see para 109)

182. ***Air Quality:*** reduction in hazardous waste can reduce the risk of human toxicity as the volume incinerated is likely to fall. Human toxicity from cadmium and mercury that escaped in the air is estimated to have a larger impact relative to the other 5 substances in RoHS. However, only a fraction of the estimated tonnes of reduced cadmium and mercury will not be collected for recycling and not sent to landfill so treated by municipal incinerators.

Health and Well-Being Assessment

183. After an initial screening of the health and well-being assessment as per guidelines from Department of Health it has been determined that health IA is not required. The IA has monetised the impact of reduction in mercury, cadmium and lead on health.

Sustainable Development

184. The regulations are not expected to have significant impacts on sustainable development.

Direct costs and benefits to business calculations (OIOO)

185. Under the One In, One Out rule whereby a measure of net cost to business (a One In) cannot be implemented unless an equivalent regulation of net cost is removed or simplified (a One Out), the preferred government option in this IA is not adding any additional layer of legislation as it uses existing legislation to address the identified market failures. This cannot be banked as a One IN because EU measures are currently exempt from OIOO.

186. The proposed legislation does not gold plate because it does not go over the minimum EU requirements. The Recast of the RoHS Directive is a directly applicable EU measure. It must be transposed within 18 months of publication (est. November/December 2012). Therefore, the legislation is being implemented at the latest possible transposition date.

187. Direct cost to business includes the additional costs to transitional cost of redesign and R&D as well as ongoing cost from compliance on enforcement.

Costs to Public Sector – Monitoring and Enforcement

188. There are changes that will affect the workload of National Measurement Office who monitor and enforce RoHS in the UK. These are the larger scope that will include categories 8, 9 and 11 and RoHS becoming a CE mark directive. There will be a requirement to assess the additional documentation. In addition, the recast places obligations on distributors and so the number of legal entities with legal obligations that require monitoring will increase. When harmonised standards are available, this should reduce workload to some extent as this clarifies the procedures that manufacturers and importers need to follow. Overall, it is estimated that the workload to achieve the same level of effective enforcement would increase by about 20% as a result of the recast. This is based on:
189. Wider scope – includes categories 8, 9 and 11. According to the Environment Agency, 5443 companies had registered in 2011 as WEEE producers. This total includes all categories 1 – 10 including categories 8 and 9 but excludes category 11. It is estimated that in the UK there may be as many as 1000 - 1500 category 8 and 9 equipment producers (see paragraph 39) which would require an additional member of staff and there will also be an unknown number of category 11 producers.
190. As there are new compliance requirements placed on industry, the enforcement body will have additional obligations adding potentially a few more percent to its workload.

Assumptions and Risks

191. The UK's consumption of EEE and production of EEE in categories 8, 9 and 11 is one sixth that of the EU because the UK's GDP and population are both ~ one sixth that of the EU.
192. Carbon prices used are from DECC and assumed to be traded as electricity is from the national grid.
193. Euro / UK pound exchange where used was current rate, at the time spreadsheet prepared was €1.18 = £1.
194. Monetised health benefits of lead and cadmium are from 2004 DEFRA waste study. Monetised health benefit of mercury is from DEFRA IA for mercury.

Assumptions behind the do nothing option described from para 10.

195. Transition costs – none as RoHS already in scope.
196. Recurring costs –0.05%, 0.1%, 0.2% of turnover
197. Turnover – from 2003 market research increasing by 4% p. a. estimated by European Commission as basis for WEEE directive.
198. Benefits arise from reduced use of the restricted substances, the quantities are estimated as described in the IA.

Cost validation: top down estimates of transition costs (page 13)

199. Transition costs – 1% of turnover each year from 2011 until equipment in scope plus medical device approval costs (this is an additional cost to those for products already in scope of RoHS)
200. Recurring costs – 0.1% of turnover each year after products in scope plus additional lead-free soldering costs
201. Turnover of categories 8, 9 and 11 calculated from 2008 PRODCOM Eurostat. Estimated turnover of category 11 makes assumptions of the proportion of PRODCOM categories that have electrical functions
202. Growth projections – annual % growth of turnover was calculated from UK PRODCOM consumption data over past ~10 years for category 8 and 9 products. It was not possible to predict category 11 growth as some products in category 11 are decreasing in terms of UK manufacture and others increasing. Therefore we assume zero growth.

Benefit assumptions

203. Benefits from reduction in use of the restricted substances. The amounts for categories 8 and 9 are based on figures in the ERA report which were supplied by manufacturers. Category 11 figures are estimated from the proportions of products that are electrical and typical RoHS substance concentrations in electrical equipment
204. Benefit from new spare part exemption for pre-July 2006 parts re-used in new professional EEE in closed loop systems based on data in printer industries 2005 exemption request and assumes half of those parts available in 2005 are still available because life of copiers and printers is up to 10 years and half of this has elapsed.
205. At end of life, cadmium and mercury except in fluorescent lamps are usually not recovered by recycling and so we have assumed that all cadmium and mercury might be emitted at end of life. Cadmium is relatively reactive, has a volatile oxide and has water soluble salts and mercury is a liquid which slowly vaporises. Most of the lead in WEEE is recovered by recycling and the fate of lead in well-managed landfill sites has been studied and found to remain within the landfill material and is not released. Therefore we assume that only a small proportion, up to 20% is released at end of life from i) a very small proportion emitted from incinerators, ii) where WEEE is recycled by unsafe methods in developing countries and iii) small proportions might be emitted from badly managed landfill sites.

bottom-up costs

206. Labour costs calculated from number of employees in EU medical industry from EUCOMED. Assumes 1% of employees carry out R&D into RoHS compliance (note that larger medical equipment manufacturers typically spend ~5% of turnover on new product development)
207. Number of employees for category 9 R&D calculated from ratio of UK turnover of categories 9 and 8 but due to longer timescale for professional Category 9,we assumes 0.67% of employees work on R&D although turnover is 3 times category 8.
208. Category 11 is also based on equivalent turnover but only one tenth of the number employees for category 8 due to simpler designs and longer time to comply
209. Assumes 2000 solder machines in UK and 5% used for categories 8 and 9

Assumptions and Rationale for estimation of tonnes of hazardous substance avoided due to the existing RoHS directive (para 11)

210. Using figures from the Arcadis Report, the Commission's IA quotes numbers stating that there has been a reduction of 89,800 tonnes of lead, 4,300 tonnes of cadmium, 537 tonnes of hexavalent chromium, 22 tonnes of mercury and 12,600 tonnes of the flame retardant PBDE. For the following reasons, the benefits from RoHS in terms of the avoided use of certain hazardous materials and substances may be significantly less than suggested in 'The Arcadis Report' (except for hexavalent chromium) and presented in the Commission's IA, for the reasons noted below:

211. Arcadis Report states that they did not obtain data from electrical equipment manufacturers of the chemical composition of typical electrical products. Some of their estimates for RoHS substances present in Table 4.35 of their Report are too high for typical equipment that was being placed on the EU market prior to RoHS coming into force (i.e. at the end of 2002).

212. The use of cadmium in pigments and stabilisers was banned by Directive 91/338/EC prior to RoHS, and its use as a braze alloy in refrigerators was also discontinued prior to RoHS as it had caused deaths and safer alloys were available and being used. The quantities of lead in several of the product listed also appear high. For example, the figure for 716-1549 grams of lead per photocopier is not consistent with the volumes of lead likely to be used in 'modern' photocopiers placed on the market just prior to RoHS being adopted at the end of 2002. Printer and copier manufacturers quote a typical lead content of 0.03% in a 400kg printer in their RoHS exemption request in 2005 which indicates that average printers (similar to copiers) would be 120 grams of lead. A Report by Van Holsteijn en Kemna (VHK) for the Commission (*Methodology Study Eco-design of Energy Using Products* (2005)), to provide supporting data for the Energy using Products (EuP) Directive, also shows levels of hazardous substances used in pre-RoHS EEE at significantly lower levels than those quoted in the Arcadis Report.

213. **Lead**: Annual average world consumption of lead is in the region of 8 million tonnes, according to the London Metals Exchange, of which around 0.6% was estimated (www.indium.com/ dynamo/download.php?docid=21) as being used in electronic soldering (some 48,000 tonnes) before RoHS was adopted. We have estimated that around 20 per cent of the world's EEE is sold in Europe, and of this some 60 per cent is in the scope of the RoHS Directive (48,000 x 60% x 20% = 5,760). Lead is also used as a PVC stabiliser, and some lead used for EEE is recycled lead. A large amount of lead was used to make cathode ray tubes but this application is exempt from RoHS. Considering these uses, we have estimated that the RoHS Directive has restricted the use of lead in EEE by about some 12,000 tonnes in 2011 and not the 89,800 tonnes quoted in the Arcadis Report. The difference between these figures is consistent with the difference in lead content of copier / printers (see paragraph 30, above).

214. **Cadmium**: The main use of cadmium in EEE is also used in alloys such as in switch contacts, although these are currently exempt from RoHS. Work for the European Commission undertaken in 2002 (*Heavy Metals In* Waste', Feb 2002, COWI) suggested that 30-40 tonnes of cadmium were used for 'alloys' in the EU in 2000 (although this excludes EEE imported into the EU). A significant proportion of this total is used in applications outside of the scope of RoHS but here is no data on the proportion used in EEE in scope of RoHS we will use an estimate of half of the 30 – 40 tonnes of cadmium in alloys may be a reasonable estimate of the amount used in equipment in scope of RoHS. In addition, there is also cadmium in imported EEE and so RoHS has reduced the amount of cadmium by about 35 tonnes per year in the EU and not the Arcadis estimate of 4,300 tonnes.

215. **Mercury**: For mercury, the main use of mercury in pre-RoHS was in fluorescent tubes although RoHS has an exemption with maximum quantities per lamp. The report "Mercury flows in Europe and the world: the impact of decommissioned chlor-alkali plants published Feb 2004 states that in 2000, 21 tonnes of mercury was used in lamps in the EU. Since then, mainly due to RoHS, the quantity of mercury used in this application has decreased significantly as lamps with lower mercury content have been developed. Since the 1990s, the amount of mercury used per lamp has decreased by more than 50% and so RoHS has contributed to at least a **10 tonnes p.a.** reduction in mercury use in the EU.

216. **Hexavalent chromium:** Many manufacturers of EEE have phased out the use of hexavalent chromium (CrVI) passivation processes because of RoHS. Industry estimates that 15% of the 9000 tonnes of hexavalent chromium used in the EU is for electronic equipment which is **1350 tonnes p.a**.

217. **PBB & PBDE flame retardants:** The main use of PBB is in high voltage transmission cable insulation which is outside of the scope of RoHS, and so the benefits from restricting PBB under RoHS are unclear. By 2004, there were only three commercial PBDEs being manufactured and two of these; octa-BDE and penta-BDE were banned by the Marketing and Use Directive (2003/11/EC) which pre-dated the RoHS restrictions. One source estimates that pre-RoHS, ~7600 tonnes of Deca-BDE was used in electrical equipment in the EU[10] and so we estimate that about 1000 tonnes was used in the UK.

218. For the purposes of this IA, the following products are assumed to be within scope of category 11. For all products (except electric bikes) 70% of the product turnover was assumed to contain EEE.

Assumptions for Article 2.2

219. Value of refurbished category 9 equipment per annum (£): 725m (PRODCOM data) assumed to be as 25% of the value of UK market in Cat 9 equipment (£ 2.9bn) – based on industry assessment.

220. Additional cost paid for new equipment relative to refurbished equipment assumed at 25% (industry estimate) therefore additional cost of buying new equipment rather than refurbished is 25% x £725m = 181,250,000 per annum (projected growth in line with inflation only – HMT deflators). The business impact is assumed to be 65% of the total additional cost – industry

[10] "Deca-BDE and Alternatives in Electrical and Electronic Equipment", Danish Ministry of the Environment, 2006 state that 7600 tonnes of Deca-BDE was used in the EU. About 80% used in EEE and one-sixth in the UK = 1000 tonnes p.a.

estimate corroborated by sense checking against Environmental Agency data that shows 75% of EEE put on market for Category 9 is ‘non domestic’ EEE.

221. For category 8 estimated additional cost to EU hospital of buying new equipment instead if refurbished equipment is derived from EU, Bios report (2012) estimate of value of refurbished medical equipment (€200m) and the assumption that the additional cost of new equipment is 35% higher than refurbished equipment. The UK estimate is derived by taking 6% of EU estimate in line with UK share of GDP in EU. The estimated loss to EU hospital from inability of EU hospitals to sell used equipment is again derived from EU estimate references in the Bios report (2012).

222. Premature waste generated derived from Bios report (2012) is assumed to be 6% of EU estimate (in line with UK share of GDP in EU). Cost of treating/recycling mixed waste assumed at £127 per tonne, based on internal consultancy report (KPMG).

223. Assumed equipment is replaced every 6-8 years for the sake of simplicity. Equipment could last a longer / shorter time depending on product. Increase in carbon emissions from increase in virgin production of category 8 and 9 equipment based on industry estimate that 93.33 MWh is required to produce 1 ton of medical imaging equipment on the average, industry estimates that using a refurbished medical device instead of building a new device will reduce production phase energy consumption by 73% (73% * 93.33). It is assumed that new equipment bought prematurely is equal to amount of premature waste generated as noted in para above.

Table 10: Category 11 products in scope

Products included in category 11 or in scope due to change in definition of "dependent"
Base metal automatic door closers
Non-motorized bicycles and other cycles, without ball bearings (including delivery tricycles) (only electrical bicycles)
Non-motorized bicycles and other cycles with ball bearings (including delivery tricycles) (only electrical bicycles)
Base metal armoured or reinforced safes and strong-boxes (only those with electronic locks)
Base metal armoured or reinforced doors and safe deposit lockers for strong-rooms (only those with electronic locks)
Iron or steel gas domestic cooking appliances and plate warmers, with an oven (including those with subsidiary boilers for central heating, separate ovens for both gas and other fuels) (those with electrical functions)
Iron or steel gas domestic cooking appliances and plate warmers (including those with subsidiary boilers for central heating, for both gas and other fuels; excluding those with ovens) (those with electrical functions)
Other domestic cooking appliances and plate warmers, of iron or steel or of copper, non electric) (those with electrical functions)
Iron or steel gas domestic appliances with an exhaust outlet, including heaters, grates, fires and braziers, for both gas and other fuels (excluding cooking appliances and plate warmers) (those with electrical functions)
Iron or steel gas domestic appliances, including heaters, grates, fires and braziers, for both gas and other fuels radiators (excluding cooking appliances, plate warmers and appliances with an exhaust outlet) (those with electrical functions)
Iron or steel liquid fuel domestic appliances, including heaters, grates, fires and braziers (excluding cooking appliances and plate warmers) (those with electrical functions)
Iron or steel solid fuel domestic appliances, including heaters, grates, fires and braziers (excluding cooking appliances and plate warmers) (those with electrical functions)
Air heaters or hot air distributors n.e.c., of iron or steel, non-electric (those with electrical functions)
Non-electric instantaneous or storage water heaters (those with electrical functions)
Electrically operated lifts and skip hoists (except those in large-scale fixed installations)
Lifts and skip hoists (excluding electrically operated) (only if they have electrical functions)
Escalators and moving walkways (except those in large-scale fixed installations)
Overhead travelling cranes on fixed support (unless part of a large-scale stationary industrial tool)
Transporter cranes, gantry cranes and bridge cranes (electrical only)
Tower cranes and portal or pedestal jib cranes (electrical only)
Lifting equipment (excluding overhead travelling cranes, tower, transporter, gantry, portal, bridge or pedestal jib cranes, mobile lifting frames or straddle carriers, self-propelled machinery) (electrical types)
Air conditioning machines with refrigeration unit (excluding those used in motor vehicles, self-contained or split-systems machines) (not 'window or wall air conditioning systems, self-contained or split-systems as these are already in scope in category 1)

Products included in category 11 or in scope due to change in definition of "dependent"
Air conditioning machines not containing a refrigeration unit; central station air handling units; vav boxes and terminals, constant volume units and fan coil units (not 'window or wall air conditioning systems, self-contained or split-systems as these are already in scope in category 1)
Sockets, switches, swimming pools, furniture with electrical parts, pipe organs, life jackets with lights, mirrors with decorative lights, electric suitcase, heated ski jackets. (examples of other electrical products that have no identifiable PRODCOM category)

Table 11 PRODCOM categories will be removed from scope by Option 1 as a result of the new exclusion for mobile non-road machinery

Mobile lifting frames on tyres and straddle carriers
Self-propelled lifting equipment, of a kind mounted to run on rails in servicing building sites, quarries and the like
Self-propelled fork-lift trucks powered by an electric motor, with a lifting height >=1m
Self-propelled fork-lift trucks powered by an electric motor, with a lifting height <1m
Self-propelled trucks fitted with lifting or handling equipment, non-powered by an electric motor
Fork-lift trucks and other works trucks fitted with lifting or handling equipment (excluding self-propelled trucks)
Works trucks, self-propelled, not fitted with lifting or handling equipment, of the type used in factories, warehouses, dock areas or airports for short distance transport of goods; tractors of the type used on railway station platforms
Electric mowers for lawns, parks, golf courses or sports grounds (professional types only)

SOURCES

No.	publication
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6	*UK RoHS impact assessment for Commission's proposals to recast RoHS, May 2009: http://www.bis.gov.uk/assets/biscore/business-sectors/docs/09-1620-recast-rohs-directive-impact-assessment*
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9	Van Holsteijn en Kemna (VHK) for the Commission (*Methodology Study Eco-design of Energy Using Products* (2005)
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16	Printer and copier manufacturers and included in their submission to the European Commission for an exemption in July 2005. The source is item 20 of http://ec.europa.eu/environment/waste/rohs_consult.htm http://circa.europa.eu/Public/irc/env/rohs/library?l=/stakeholders_comments/individual_businesses/xerox_oce/050704_modifiedpdf/_EN_1.0_&a=d.
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18	BIOis, ERA; *Measures to be implemented and additional impact assessment with regard to*

scope changes, pursuant to the new RoHS Directive, Final Report. European Commission, DG ENV. 06 July 2012

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