ADDENDUM

TO THE GUIDANCE ON SOCIO-ECONOMIC ANALYSIS (SEA) – RESTRICTIONS

CALCULATION OF COMPLIANCE COSTS

27th October, 2010

EXPLANATORY NOTE

This addendum to the "Guidance on socio-economic analysis (SEA) – restrictions" provides practical information and further guidance on how to calculate compliance costs in the case of proposed restrictions. This addendum is also helpful when the economic and social impacts are analyzed (Chapters 3.5 and 3.6) as well as Appendices B, C, D, E and F of the Guidance on Socio-Economic Analysis (SEA) – Restrictions. It can be read as an appendix (Appendix I) to the SEA – Restrictions Guidance document. A similar appendix is included in the Guidance on SEA – Authorisation applications.

Contents

Glossary

Baseline scenario – term that describes the “business as usual” situation without restriction.

Capital cost –Investment or one-off cost that has a lifetime of several years.

Compliance costs – the cost to the manufacturer and the up and downstream users (i.e. the supply chain) complying with a “restriction” scenario. Compliance costs include the capital and operating costs that would accrue to the sectors affected by the “restriction” scenario.

Consumer surplus – denotes the net benefit that a consumer derives from consuming a good. It is equal to the absolute amount the consumer would willingly pay for a good less the amount they actually have to pay (i.e. the market price).

Depreciation – an accounting term referring to the reduction in “book” or accounting value of capital equipment during its working life. Strictly speaking it is not necessary to use this concept directly in assessing the costs of “restriction” scenarios but may be helpful when the residual value of capital is estimated.

Direct costs – the additional resources that a sector or economic interest has to employ in complying with a policy. For example, the cost of fitting abatement equipment to reduce pollution, or the additional cost of protective equipment. See “Compliance cost”.

Demand curve – a curve relating the price of a product to the amount demanded (per unit time) of that product.

Economic lifetime – the length of time that a piece of capital equipment will last, given a defined level of maintenance expenditure.

Gross Domestic Product – a measure of the total output of an economy in a year. It equals the market value of the net output within the borders of a country. It is equal to total Gross Domestic Income.

Inflation – a change in the overall level of prices in an economy. For example, suppose that the prices of all goods in an economy rise by 5% during the course of a year, but relative prices of different goods remain unchanged. The rate of inflation is then 5%.

Incremental costs – the costs that can properly be attributed to a “restriction” scenario, taking into account of what would have happened in the absence of the “restriction” scenario.

Investment cost – Capital or one-off cost that has a lifetime of several years.

Marginal cost – the additional cost of making a small change in some variable. For example, the cost of making an additional unit reduction in emissions.

Nominal price – the market price of a good or service at a point in time is called the nominal price. By contrast, the “real” price is the price of the good after factoring out the effects of inflation (a rise in the general price level) over time.

One-off cost –Cost that has a lifetime of several years, e.g. investment or capital costs. Also called fixed cost (as opposed to variable or operating or recurrent costs)

Operating cost – Recurrent or variable cost that reappears every year and usually depends on how much a particular machine produces. Examples are raw material costs, labour costs, energy costs or maintenance costs.

Opportunity cost – the benefit that could have been derived from using a given amount of resources in alternative “restriction” scenario, that is the value of foregone net-benefits created by the “next best” alternative.

Polluters pays principle – the principle that the polluter ought to bear the cost of abating pollution and/or of compensating those affected by the pollution

Price elasticity – a technical term that describes how demand for a good changes in response to changes in price. An elasticity of 1 means that an 1% increase in price leads to a fall in demand of 1%. An elasticity of 0.5 means that a 1% change in the price leads to a fall in demand of 0.5%. Such goods are called “necessity” or “inelastic”goods.

Private costs – the costs to a group or sector of implementing a policy. To be distinguished from social costs.

Producers surplus – denotes the difference between the true cost to a producer of producing a good (or volume of goods) and the price at which they can sell the goods.

Residual value of capital – relates to investment costs (e.g. buildings or equipment) that a firm has had to make to produce a good or a service prior to the introduction of or knowledge of the “restriction” scenario whose the impact is being analysed.

Real price – the price of a good or service after inflation has been stripped out. When comparing expenditures that have taken place at different times it may be necessary to adjust them for inflation to provide a proper measure of the resource use that the expenditures actually represent.

Recurrent cost – see “operating cost”

Risk assessment – a procedure for determining the risk that a substance poses to health and the environment

Social costs – denotes the opportunity cost to society and includes also external costs or externalities.

Supply curve – a curve relating the amount supplied of a product (per unit time) to the market price for the product.

1 Introduction

This addendum provides supplemental information and further guidance on the calculation of costs resulting from restriction of substance under REACH, i.e., substances included in Annex XVII of REACH. The addendum is also applicable when the competent authority or ECHA (referred to as "authority") carries out the analysis of the economic feasibility of the alternatives to the substance.

The addendum is intended to be used in conjunction with other sources of information. It builds on:

- Chapters 3.5 (Economic impacts), to some extent 3.6 (Social impacts) and Appendices B, C, D, E and F of the Guidance on SEA; as well as

- Chapter 5.6 (Socio-economic assessment) in the Guidance for the preparation of an Annex XV dossier for restrictions.

This addendum focuses on compliance costs[1]. Administrative costs also need to be analysed, where relevant. However, these issues are covered in Chapter 8.4 of the EU Impact Assessment Guidelines[2] and Chapter 10 of Part III of Annexes to the EU Impact Assessment Guidelines[3]. **Therefore, to avoid duplication, administrative costs are not presented in this addendum**.

The distribution of compliance costs between groups is an important issue. This is discussed in section B.3 (Social impacts) of Appendix B.

All market prices are distorted to some degree. In practice, the prices of all marketed goods or services incorporate elements of taxation, such as value-added tax, taxes on labour inputs, and taxes on some material input. However, in cost calculations in conjunction with the proposal for restriction, it is rare that such considerations would need to be addressed. Thus, this addendum does not address the possible correction of market prices as this is considered unnecessary in most cases and very difficult to do in practice even if such corrections would be warranted.

In practice – taking also into account that the VAT varies between Member States – the authority is likely to find it easy to use **"ex-factory prices" without value added taxes (VAT)**. Therefore, it is recommended that the authority preparing an Annex XV dossier uses such prices in its application unless it specifies them differently.

In this addendum costs are given usually in annual form (i.e. annualised costs) as this is considered standard when the proposal for restriction is made. These annualised costs can be aggregated to net present values, and the authorities are encouraged to

[1] Issues relating to "deadweight loss" are not addressed in this addendum. The reason is that they are normally very small compared to the compliance costs and their estimation would require additional information (e.g. price elasticities) which the authority would have often difficulties in obtaining.

[2] See http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf

[3] See http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_annex_en.pdf

present the net present value of the costs during the relevant period. This addendum shows also how to do this aggregation.

2 Economic costs

2.1 What are costs

Economics starts from the assumption that resources are scarce and that it is therefore important that they are sensibly used. By “resources” we mean things such as labour input, capital goods and land. We can also consider the environment and human health to be a scarce resource that is “used up” when we generate pollution.

In considering the “costs” in a “restriction” scenario we are really asking what society has to pay in terms of the other resources such as labour and capital in order to secure a cleaner environment or improved human health. Therefore, at the most fundamental level, the economic cost of a “restriction” scenario is the value to society of these other resources that are used up in order to implement it. This is counted as a cost because the resources that are used up are then not available for other purposes.

By using up resources to implement a “restriction” scenario we give up the opportunity to use the resources to do something else. For this reason we say that a “restriction” scenario has an 'opportunity cost' (See chapter 3.5 of the Guidance on SEA). Using this terminology, economic cost is then a sum of the opportunity costs of all inputs used in the production. When summing up cost of production one needs to take into account opportunity costs, not only market prices of inputs.

2.2 Types of costs

2.2.1 Distinguishing between social and private costs

As the ultimate focus of a socio-economic impact assessment is to determine the costs (and benefits) to society of a “restriction” scenario, an important aspect of the cost calculation process is the distinction between private and social costs. Therefore, the starting point for assessing the costs to society of a “restriction” scenario is usually to look at the impact on those particular groups or sectors affected. The costs incurred by a particular sector or group as a result of a “restriction” scenario are called the private costs. By contrast, the social costs are the costs of a policy to society as a whole – from an EU perspective this includes all 27 Member States, although costs to non-EU members need to be reflected, as relevant. These concepts are discussed in Chapter 3.7 (Trade, competition and economic development) in the Guidance on SEA.

When market prices reflect scarcity, private costs provide a good estimate of the costs to society as a whole. For example, consider the case of installing equipment to a factory to reduce workers’ exposure to chemicals. In this case expenditure incurred by the firm to buy and operate the equipment could be used as a good first estimate of the value to society of the resources used to improve workers’ health. This is because the price of the equipment would normally reflect the amount of labour, capital and energy required to make it.

In the case of restriction proposals **private costs are usually a good proxy for social costs** as long as the effect of any major distortions (e.g. externalities, monopoly pricing) is removed from prices.

A straightforward approach can be the following:

(1) estimate the private costs to the supply chain in question,

(2) estimate the private[4] costs or savings to any other relevant supply chains, and

(3) add the resulting figures from different groups or sectors up to give the total cost to society as a whole.

Where there is a clear difference between private and social costs, this needs to be reflected qualitatively at least. The overall focus of a cost analysis should ultimately be on costs to society. This is the appropriate level of analysis as required by the REACH regulation. Therefore, where it is clear that there is a difference between private and social costs this needs to be taken into account during the analysis.

Another important issue related to social costs are the effects on different groups. These should be described, particularly if one group, sector or region is affected in a disproportionate way.

2.2.2 Investment and operating costs

Investment and operating costs need to be treated differently in any cost calculation. Investment costs show up only once, or relatively infrequently. As an example of an investment cost is the cost of new equipment needed to change the production process in a restriction case. Investment costs are also called "one-off" or "capital" costs.

Operating costs are incurred each time a good is produced or consumed. An increase in the price of a raw material is an example of an operating cost, as the higher price has to be paid each time this input is used. For further details on investment and operating costs, see section B.2 (Economic impacts) in Appendix B (Estimating Impacts) as well as Appendix D (Discounting) in the Guidance on SEA.

A distinction between investment and operating costs needs to be made whenever the production costs change. However, there are also cases where the production costs remain unchanged while the characteristics of the goods produced change. In such cases investment and production costs of the downstream users may change, too, and thus, the distinction needs to be made. Below, both changes in production costs and the effects of the changes in the characteristics of goods are addressed.

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[4] In rare cases (i.e. if prices are distorted e.g. due to monopoly pricing) estimates of private cost needs to be adjusted e.g. in order to take into account any differences between private and social costs (essentially by removing the effect of taxes)

2.2.3 Changes in production costs

If the production costs of the substance, mixture or article change due to restriction, the market price of the good would change accordingly. This cost is often referred to as ”direct cost”. Such costs trickle down the supply chain either directly or with some delay. In economics, this would be called ”the price effect” of the change in the price of a good, assuming that the characteristics of the good do not change.

In almost all cases the compliance costs incurred by producers will eventually be passed on to consumers as higher prices for consumer goods, though this may only happen after a time lag. For instance, in the long run the increase in the costs reducing the SVHC content in an article would be passed on to downstream users of these articles. However, in the short run increases in compliance costs may be absorbed by the suppliers of goods or services as reduced profits. Double counting needs to be avoided, though: Costs that are passed on to consumers as higher prices should not be counted as a cost to both consumers and firms.

2.2.4 Changes in the characteristics of the good

In a typical compliance cost analysis it is assumed that the goods are homogeneous. If this is not the case due to changes in the characteristics of the good, this second category of costs needs to be estimated and taken into account.

In chemical regulation it is common, that the characteristics[5] of the good change due to regulation. Main examples of these are the <u>quality</u> or the <u>lifetime</u> of the good. The quality could be different (e.g. in a restriction scenario the composition of a good (such as paint) may change such that it needs to be applied three times instead of two), the operation conditions could be different (e.g. more electricity would be required when using the good) or one might need to replace the good more often (e.g. if it wears out faster than the good it is replacing).

While there can be a deterioration in the quality/lifetime or characteristics of the good, the change can be positive, too. For instance, the application times can become shorter, energy efficiency may improve or the product may last longer. The production cost and the price of the good could also increase while the characteristics of the product would do so, too. Thus, the authority needs to analyse the combined effects to the downstream users.

The changes in the characteristics of the good trickle down the supply chain so that there would be an increase or decrease in (usually) operating costs of the downstream user. A decrease in operation costs is a saving and needs to be estimated, too.

Examples of such effects are

– more or less labour input (paint more/less often),

– higher or lower other operating costs (more/less paint needed, higher/lower energy consumption etc.) or

[5] If the price changed the manufacturer would see this in compliance costs (see above).

– higher/lower replacement rate (change equipment more often).

In some cases it is easy to estimate such costs while in other cases it may only be possible to give the direction (increase or decrease) and perhaps some order of magnitude of such costs.

3 Calculating costs

In this section the general approach as well as some specific issues are discussed when calculating compliance costs. A specific issue is how to deal with a situation when a "restriction" scenario would make existing capital redundant. In other words, how to treat "residual capital" will be discussed. In addition, some issues concerning the estimation of other compliance costs (through the characteristic of the good) are discussed. The last section focuses on the issue that only additional costs should be calculated.

3.1 Changes in production costs

Changes in production costs can be calculated by multiplying a change in the unit cost of using or providing some good or service by the quantity of the good used or produced. The cost of replacing the substance considered for a restriction by another (more expensive) substance in the production process is an example of an increased production cost. The compliance costs can show up as increased expenditure and therefore, the starting point for an assessment of compliance costs is to look at the effects a "restriction" scenario has on the production costs.

To estimate the compliance cost the authority needs to know at least the change (usually increase) in the price of the good and the change in the quantity demanded (i.e. used).

Compliance cost (**C**) is the difference in the price of the good between the "baseline" scenario ($\mathbf{p_1}$) and the price in the "restriction" scenario ($\mathbf{p_2}$) multiplied by the number of units placed on the market in the "restriction" scenario ($\mathbf{q_2}$), as stated in equation 1:

$$\mathbf{C = (p_2 - p_1)\ q_2} \qquad \mathbf{(1)}$$

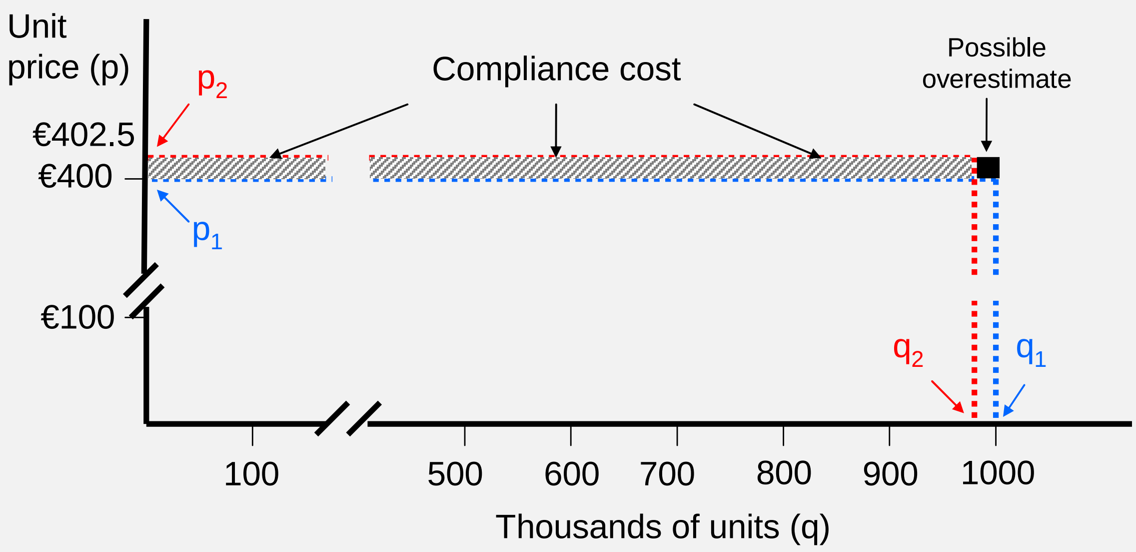
If the authority does not have a reliable enough estimate of the annual number of goods sold on the market in the "restriction" scenario ($\mathbf{q_2}$), it can use instead the quantity in the "baseline" scenario ($\mathbf{q_1}$). In this case the compliance cost can be calculated as shown in equation 2:

$$\mathbf{C = (p_2 - p_1)\ q_1} \qquad \mathbf{(2)}$$

The following box gives an example of compliance costs. Note that the example contains only compliance costs accruing from changes in production costs. It also shows how a (usually small) overestimation of compliance costs takes place when using equation 2.

Example of compliance costs: Changes in production costs

Consider that in the "restriction" scenario the cost of producing a good increases from €400 to €402.5 as a result of using a different production process. The compliance cost is the additional cost per unit (€2.5) multiplied by the number of goods sold on the market. This can be represented on a chart as follows:



The chart presents the number of units sold per year (**q**) at prices in the "baseline" scenario (**p_1**) and "restriction" scenario (**p_2**). In this example, if the original market price of the unit is €400 (**p_1**) then the number of units bought would be 1 million (**q_1**). If the price rises to €402.5 (**p_2**), the authority estimated that the number bought drops to 992 500 (**q_2**).

If the authority knows that the number of units sold annually would be reduced from 1 million (**q_1**) to 992,500 (**q_2**) in the "restriction" scenario, the similar estimation of compliance cost (using the equation 1) is €2.5x992500=€2,481,250, i.e. €2.48 million.

If the authority does not know what the quantities sold would be in the "restriction" scenario, he can use equation (2) and estimate the costs to be €2.5x1million=€2.5 million.

If the authority does not know the quantity of units sold in the "restriction" scenario, he is likely to overestimate the compliance cost, to some extent. In this case the overestimation would be €0.02 million (i.e. 0.75%) i.e. rather small. Often, in practice, it is sufficient to use the equation 2 when lacking information on (**q_2**).

3.2 Change in the characteristics of the good

There are other compliance costs that are not necessarily linked to expenditure of the supplier but to the characteristics of the good. Thus, the costs of the downstream user or the consumer may be affected indirectly due to the change in the characteristic of the good.

For example, if a measure increases the time spent on the activity (e.g. painting) it has a direct additional labour cost (to painters[6]). In this case the compliance cost can be converted into money terms by multiplying time lost by the downstream user (e.g. in minutes) by an estimate of the money value that people attach to time (e.g. in the case of painters the hourly wages[7]). This additional cost could be linked to the overall product that is being analysed (e.g. litres or tonnes of paint) and used in the cost calculation. The example in the box illustrates the issue.

Example: Change in the characteristics of a paint

As an example, let's assume that use of substance is restricted and an alternative substance would be used. As a consequence, the characteristic of an end product (e.g. paint applied by professional painters) would change so the paint would take 10 hours to dry instead of 1 hour.

It has been estimated that on average all painters would spend an additional 2 hours (**h**) per working day for applying the paint. The wages (**w**) are estimated to be €20/hour. A painter is estimated to use 4 liters of paint a day (**q**). In the "baseline" scenario 1 million liters of paint would be used per year. In this example, the price of the paint would not change in the "restriction" scenario (only the characteristic of the paint)

The authority needs to estimate the compliance costs (**C**) of the downstream users in the EU due to change in the characteristics of the paint. He needs to know how long it took to paint 1 million liters (**Q**) in the "baseline" scenario. This is 1 million liters / 4 liters/working day, i.e. 250,000 working days. When the use of substance is restricted the additional amount of labour required is 2 hours per day (**h**), i.e. 250,000 working days x 2 hours/working day = 500,000 hours.

The hourly wages (**w**) of painters are estimated to be €20/h. Thus, the additional cost to the downstream users would be €20/hour x 500,000 hours, i.e. €10 million per year. In other words, the "restriction" scenario would increase the demand for painters by 500,000 hours[1] with a cost of €10 million. Formally the above is given in the following equation:

$$\mathbf{C} = (\mathbf{Q}/\mathbf{q}) \times \mathbf{h} \times \mathbf{w}$$

Where

- **Q** = 1 million liters
- **q** = 4 liters of paint per working day
- **h** = 2 hours working day
- **w** = €20 per hour

[6] There could also be an indirect cost to "do-it-yourself" consumers who would use the paint.

[7] In the case of consumers, one would normally estimate the "opportunity cost" of free time. Often a certain fraction (e.g. 50%) of salary is used as an estimate for this.

Compliance costs to the downstream users and or consumers arise due to reductions in: i) product quality (including, e.g. reliability) or ii) product life. These types of changes are normally associated with changes to product standards or the inputs that can be used for a process or the technology that can be used. As far as possible these types of direct costs should be quantified and then valued. The precise procedure followed will vary from case to case. Where it is not possible to quantify these effects it is nevertheless important to list them in qualitative terms and give an indication of their importance.

It is important to note that the compliance costs of downstream users may change (increase or decrease) either because the costs of the (upstream) producers are passed on to downstream users or because the characteristics of the good change (become better or worse for the downstream user). It is quite possible that the price increases and the quality improves at the same time.

Often the substance itself has characteristics that are desirable and thus embedded in the product. Therefore, it is likely that when calculating the compliance costs of the "restriction" scenario the effects of changes in the characteristics of the goods are important. Thus, these costs would need to be analysed.

3.3 Treatment of residual value of capital

Residual value of capital relates to investment costs (e.g. buildings or equipment) that a firm has had to make to produce a good or a service prior to the introduction or knowledge of the "restriction" scenario whose impact is being analysed. The analysis of residual value of capital is straightforward to the extent that the capital can be sold on the market or retrofitted for a new production process. In such a case the original investment costs would not be included in the analysis (as the company can offset the cost by the revenue gained from selling the building, land or equipment). However, a problem may arise if the capital is bound to the production process in such a manner that it does not have any reasonable value on the market.

A difficulty arises if a "restriction" scenario leads to a significant reduction in the value of existing (capital) assets because they cannot be reallocated to some other function. An example of this is the closing down of a production line in the case of restriction.

The authority could make an estimate of the net revenues (i.e. revenues minus operating costs) that the specific residual capital could bring to the companies in question. In this manner the authority could estimate the foregone net revenues and thus, include this in the analysis.

It may prove to be difficult to estimate the foregone revenues, partly because the authority may have difficulties in linking the revenue to the specific residual capital, and even more difficult to verify this e.g. by the Socio-Economic Analysis Committee of the European Chemicals Agency when it gives an opinion. Thus, the authority could estimate the residual value of the capital stock instead of the forgone revenues. This estimate is likely to be easier to make and verify.

The reduction in the value of this productive capital is part of the cost of the "restriction" scenario. For example, suppose that a restriction of substance would lead to plant closure. The owner of the plant is unlikely to be able to recoup the value of the invested capital by selling off the equipment second hand. In such cases the residual value of the capital should be estimated and annualized so that it can be compared with other costs. Examples of such calculations are given in Table 8 in Scenario 3 in the chapter 5.3.4.

3.4 Ensuring that only additional costs are included

There are a number of ways in which the costs can be incorrectly estimated. One important case is where one forgets that it is only the additional (i.e. incremental) effects of a "restriction" scenario that should be estimated. It is important to make sure that the costs identified are really attributable to the restriction scenario. This means that it is important to pay attention to what would have happened in the absence of any "restriction" scenario (i.e. the "baseline" scenario).

The following example illustrates the issue. Suppose that a "restriction" scenario requires a company to replace a piece of equipment with a more up-to-date, modern appliance. For instance emission controls may lead to the closure of old, polluting filtering equipment in a plant and the installation of a new one that costs €1 million. At first sight the cost of this "restriction" scenario is the cost of installing the new equipment less any difference in operating costs between the old and new equipment.

For simplicity, it is assumed that the operating costs of the two filters are the same. It appears then that the cost of the "restriction" scenario is €1 million.

But it needs to be considered that the old filter would have been replaced at the end of its lifetime, e.g. in five years time. Therefore, the cost of the "restriction" scenario is **the cost of bringing forward the expenditure on the new filter by five years** and not the full cost of the new filter.

The authority can estimate the cost of this very simply by using the annualised cost approach, which is equivalent to having to pay an additional five years "rent". This cost can easily be calculated (Table 1).

Table 1: Annualising costs and calculating the additional cost of bringing forward an investment by 5 years

Investment cost	€1000000				
Discount rate	4%				
Lifetime of filtering equipment	20 Years				
Annualized cost:	€73582	(using =pmt(4%;1000000;0;0)			

Year:	**1**	**2**	**3**	**4**	**5**
a. Cost	€73582	€73582	€73582	€73582	€73582
b. Discount factor	0.9615	0.9246	0.8890	0.8548	0.8219
c. Discounted cost (axb)	€70752	€68030	€65414	€62898	€60479
d. Total cost (Present value)	€327573				

Note: Discount rate is 4%. Discounting starts from the beginning of the 1st year.

Using the above assumptions on the lifetime (20 years) of the filtering equipment and discount rate (4%) the annualized cost is €73582 per annum. Therefore, the cost of the "restriction" scenario would be €73582 per year for the next five years as the old filter could have been used in the "baseline" scenario. This series of payments has a present value. With 4% discount rate the present value is €327573. Thus, **the cost of this policy is €0.33 million and not €1 million** as an authority may have incorrectly estimated.

4 Steps to assess the costs

4.1 Introduction and caveats

This section discusses the approach to assessing the compliance costs with the following caveats

- All costs refer to those incurred after the "restriction" scenario has taken place.
- If the authority has information about projections of quantities (e.g. input to the process or output of the process)[8] demanded in the future, he should use them.

The analysis of issues identified above can be quite complex and is often plagued by lack of information. Therefore, it is not expected that changes in future demand (due to price changes) are analysed in standard cases. Thus, the steps below do not include such complications.

All prices need to be adjusted to one currency (Euro) and one price level (e.g. 2009). Market exchange rates should be used for the current year (e.g. 2009) and GDP deflator in the EU for other years. These steps are not covered in this chapter, as such conversions are explained in detail in Chapter 3.7. of the Guidance on SEA.

In addition to the steps presented below, the cost analysis can include a sensitivity analysis or other analytical methods to test how uncertainties may alter the

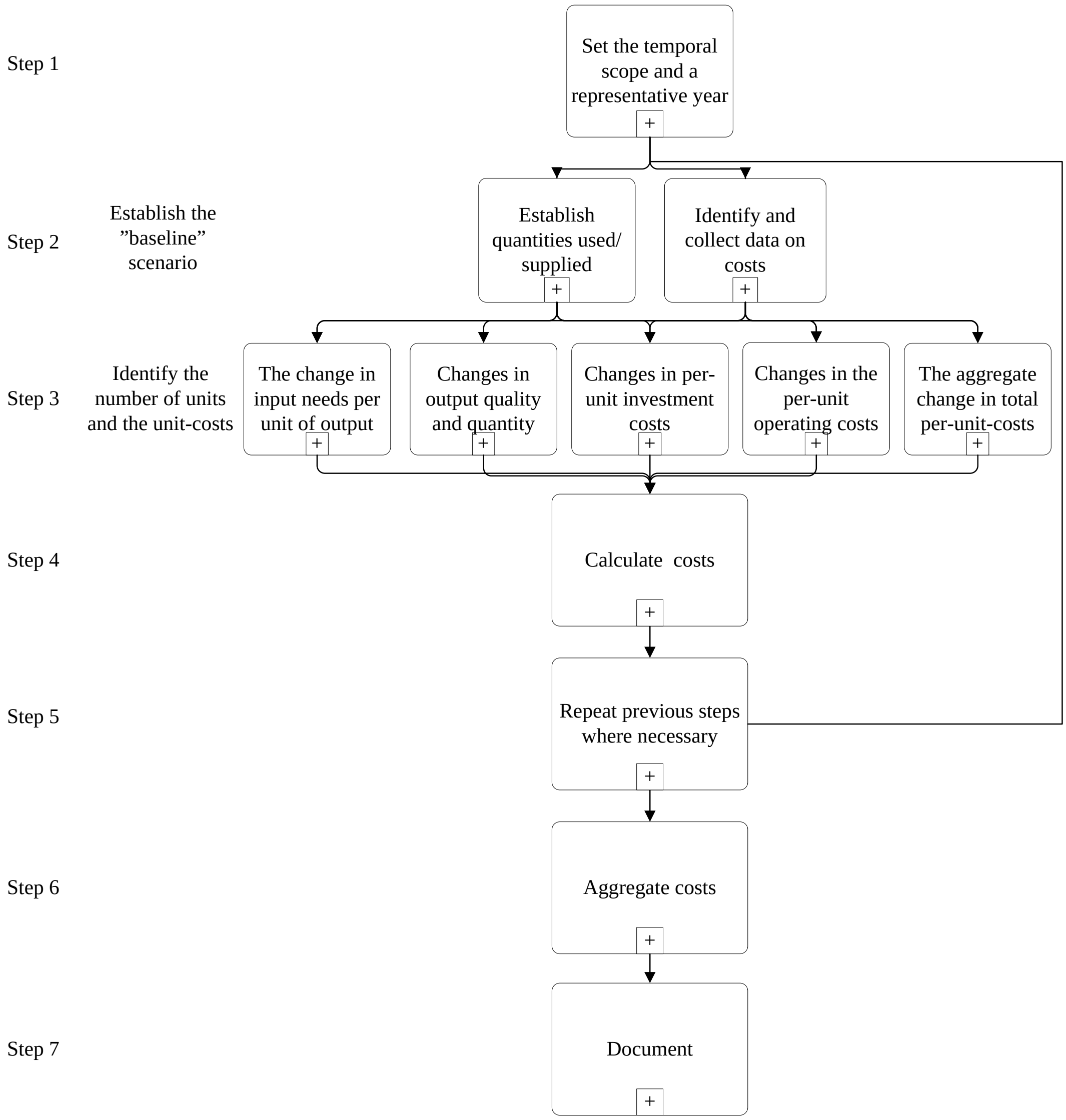
[8] Inputs are used in the production process, e.g. materials (e.g. Substance A to produce coated wire), to produce intermediate goods (e.g. coated wire), which is used in another production process (e.g. motors to washing machines) to deliver outputs, i.e. goods (e.g., washing machines) or services.

conclusions of the analysis. Chapter 4.4 and Appendix E of the SEA Guidance on describe different techniques for conducting uncertainty analysis.

Each step has been illustrated by examples on the basis of Chapter 5.

4.2 Steps

The following graph presents practical steps that would be taken in a cost calculation.



In the table below the practical steps have been identified to help when carrying out a cost calculation. As shown in the graph above many steps are likely to be carried out in parallel (e.g. projections of quantities produced are linked with prices).

Step	Description	Example(s) or comments
Step 1	**Define the temporal scope of the analysis and choose a representative year (steady state) for the analysis**	(e.g. 2020 when all factors affecting relevant costs under "restriction" scenario would have taken place. If net present value is calculated for e.g. 2010-2024)
Step 2	**Establish the baseline**	This is the starting point against which the scenarios are compared with.
2.1	Establish the number/quantity of input and output units today. Based on anticipated trends project future demand to the representative year	(e.g. 0.58 kg of Substance A per washing machine is used in the coating of wire) (e.g. 1 million washing machines placed on the market per year). (e.g. with 3% annual growth 1 million machines in 2010 would be 1.34 million machines in 2020).
2.2:	Identify and collect data on costs	
2.2.1	Collect investment cost (i.e. capital expenditure) per unit of output	(e.g. €400 per machine);
2.2.2	Collect operating costs (usually for one year). These include maintenance, labour, monitoring, compliance and other costs	(e.g. €40 operating costs per machine per year);
Step 3	**Identify the number of units and the unit cost associated with the "restriction" scenario. i.e. additional (incremental) costs due to compliance with restriction scenario**	
3.1	Estimate the change in the number of input units required to produce one unit of output	(0.058 kg of Substance B per washing machine is used in the coating of wire)
3.2	Identify changes in the number of output units produced if relevant for the analysis (e.g. change	(e.g. 1.34 million washing machines established above would not change.) The detailed example assumes that there is no change in the number of washing machines placed on the market.

	in production of goods)	
3.3:	Assess changes in investment costs per unit of output	Investment costs are also called "capital" costs or "one-off" costs
3.3.1	Estimate investment cost of producers and, as relevant, the residual value of capital	Note that the increase can be to the producer (in which case the cost will be passed on to the consumer) or to the consumer itself. (e.g.. plant retrofitting capital costs, building of a new waste water facility, R&D investment, etc.) For instance, €1 million investment in production facilities to accommodate the replacement of Substance A with substance B. (e.g. the price of a washing machine would increase by €2.5,) Note that the washing machine is a durable good having an economic lifetime of 10 years on the average. (e.g. an old plant would still have a lifetime of 8 years but can no longer be used for producing the good. The residual capital is €1 million.)
3.3.2	Estimate the direct price increase related to the good placed on the market and annualise these additional investment costs using 4% discount rate and calculate the cost per unit	(e.g. if lifetime of the €1 million investment is 15 years for producing 1 million washing machines per year, the annualised additional cost is €89941 per annum or **€0.09** per washing machine) (e.g. the annualised cost of an increase of the price of a washing machine by €2.5 with a lifetime of 10 years and 4% discount rate is (using =pmt(4%;10 years; €2.5;0;0)) **€0.31** per washing machine per annum.) (e.g. the annualised cost of residual capital of buildings (€1 million) to wire producer (8 years lifetime left) [using =pmt(4%;8 years; €1million;0;0)/1 million] **€0.149** per washing machine per annum.)

3.3.3	(If relevant) estimate any changes in the investment costs to the downstream users that are due to the changes in the **characteristics** of the good.	(e.g. if the characteristic of the good implied that the lifetime of a washing machine[9] reduce from 10 years to 2 years. In both cases the cost of the washing machine is the same. i.e. €400).
3.3.4	Estimate the difference (price increase) due to the change in the characteristics of the good. Annualise these additional investment costs using 4% discount rate and calculate the cost per unit	(e.g. the reduction of the lifetime of a washing machine from 10 to 2 years implies that the annualised cost of a €400 investment cost would increase from €49.32 (using =pmt(4%;10 years; €400;0;0) to €212.08 (using =pmt(4%;2 years; €400;0;0). The difference between the two (€212.08 -€49.32=) **€162.76** is the annualised increase of investment cost that is related to the reduction of the lifetime of the washing machine.)
3.4.	Assess changes in the operating costs[10] per unit of output:	
3.4.1	Estimate changes in unit costs for the producer. Evaluate potential cost savings due to the “restriction” scenario.	(e.g. Imported wire will cost 50% more than wire bought in the EU. Thus the price of the motor (and thus the washing machine) would increase by €2.5 per unit.) (e.g. the price of Substance B in coating wires is 10% cheaper than Substance A leading to a saving of **€0.058** per machine). In this case the authority should ask himself why these savings are not materialising already now. The most likely reason is higher investment cost (see above) related to the “restriction” scenario.
3.4.2	Estimate the costs due to changes in the characteristic of the good.	(e.g. the operating costs of one washing machine would increase by **€2.4** per year. because of additional energy costs)

[9] Note that the company may produce goods that have a long life time (like washing machines) or consumables (like washing powder).

[10] Operating costs may increase e.g. because the alternative materials/substances are more expensive, it is more complicated/time consuming to use the alternative substance/technique (i.e. labour costs increase). The action could also introduce new expenditures such as expenditures to operate waste management facility. For details, see Chapter 3.5 and Appendix G of the Guidance on SEA.

		(e.g. if the application time would be longer and thus the consumers would spend 0.5 hours per year more using the machine of e.g. €10/hour x 0.5 hours=) €5/year. This is not used in the detailed example in Annex 2).
3.5	Calculate the total per unit costs in the representative year by adding together – as relevant – the annualized investment costs (sections 3.3.3 and 3.3.5) and operating costs (sections 3.4.1 and 3.4.2) Describe (qualitatively) any additional costs that the authority was not able to quantify which are relevant to the analysis.	(e.g. Annualised investment cost in (Step 3.3.2) €0.09 Saving when using substance B (Step 3.4.1) -€0.058 Operating costs of one washing machine (Step 3.4.2) €2.4 Total €2.432 per washing machine per year (e.g. Scenario of importing coated wire Additional cost per washing machine per year (Step 3.3.2) €0.31 per washing machine per year) (e.g. Scenario in the reduction of the lifetime of the washing machine Annualised increase of investment cost (Step 3.3.4) €162.76 per washing machine per year) (e.g. “The additional costs of maintaining the machines using another substance are not known. They are assumed to be small and thus not estimated”).
Step 4	**Calculate the compliance cost by multiplying the number of units (in step 3.2) by the cost/prices per unit (in step 3.5)**	(e.g. 1 million washing machines x €162.76/year = €162.76 million euros per annum in 2020 in the scenario of reducing the lifetime of the washing machine). (e.g. 1 million washing machines x €0.31/year = €0.31 million euros per annum in 2020 in the scenario of importing wire).

		Note that the costs of complying with the "restriction" scenario depend on the response of the producers of motors. From the above it can be deducted that the option for importing wire would be cheaper. The €0.31 million is considered the compliance cost and is taken further in the aggregation of the results. However, the costs of the alternative scenario should be reported, too.
Step 5	**Repeat steps 2-4 for any other services/goods affected.**	
Step 6	**Calculate <u>total</u> compliance costs by aggregating the costs for all services/goods affected (i.e. add together the compliance costs of step 5).**	Avoid double counting.
Step 7	**Document the results according to the reporting format**	(see technical guidance document or specific reporting format) Consider reporting annualised costs in a given year without discounting to present date. The authority can also calculate the net present value (using the cumulative year approach) during the relevant time period (as established in Step 1).

5 Example – Cost of substituting "Substance A"

Caveats

This example is purely illustrative and should not be taken as representing a real world situation. Inclusion of this example does not therefore in any way imply that production of washing machines involves any undesirable impacts.

This example was developed in the context of the preparation of Appendix I in "Guidance on socio-economic analysis – authorisation". It was decided that the numerical example is kept the same in both examples. It is recognised that the cases of applications for authorisation and preparation of an Annex XV report on restriction are different.

5.1 Introduction

5.1.1 The problem

This example concerns "Substance A" which has adverse impacts on workers' health at manufacturing sites when wire is coated. The authority aims to estimate compliance costs in case where (i) Substance A was no longer available from 2010 onwards or (ii) the costs of eliminating workers' exposure (through filtering the emissions from the process) from 2010 onwards.

5.1.2 Main drivers of the analysis

Manufacturers supply Substance A to formulators who incorporate it into a mixture. The mixture is used by downstream users for coating wires, which in turn are used in motors for washing machines. Substance A allows the wire to be coated in a manner that prolongs significantly the lifetime of the wire and thus, of the motor. Consequently, the lifetime of the washing machine is about 10 years. If the wires were not coated at all, the lifetime of the engine would be only two years.

5.1.3 Scope of the analysis

This example is an illustration of compliance costs for the purpose of restricting use of Substance A (as part of an Annex XV restriction report). It focuses on calculation of the cost to comply with the substitution Substance A or reducing the process emissions to non-existent. In the process a number of costs have not been addressed for simplification purposes. These include the regulatory cost for authorities and companies.

This example illustrates only the compliance costs of a "restriction" scenario. Thus, health impacts (change in worker health risks) of the "restriction" scenario have not been estimated, nor have distributional or other socio-economic impacts (e.g. possible employment effects) been estimated.

It is assumed that the authority has access to real prices for the cost calculations. In other words, this example is not addressing the issue of how to get real prices from the market.

Throughout the analysis a 4% discount rate is used to assess costs occurring at different points in time. This is in line with the SEA Guidance document as well as the European Commission's Impact Assessment Guidelines.

As most data are available for current production and consumption levels, it will be easiest to undertake the analysis using the current year. What is important is that all cost and price data refer to the same year. Using the current year would be the simplest approach. Here in this illustrative example the analysis is undertaken as all figures are scaled as a first step to 2007 and the analysis starts from the assumption that the "restriction" scenario would start from 2010 onwards.

All values used in this example refer to 2007 price level. In other words, the prices are 'real' as the effect of inflation has been removed from the prices.

5.2 The "baseline" scenario

To simplify the example, the current production and consumption volumes of (e.g. 2007 at the time of writing this example) Substance A is used as the basis for the cost calculations as it is assumed that there are no trends in the use of the substance[11]. Consequently it is assumed that there is no change in the demand for Substance A in coating wires for washing machines either. In the EU, some 1 million electrical motors (using wire coated with Substance A) are used as components in the production of 1 million household washing machines[12].

5.3 "Restriction" Scenarios

5.3.1 What would happen if Substance A was not available

If wires were not coated at all, the lifetime of the motor would be reduced from 10 to two years on average. Not coating wires would imply that washing machines would need to be replaced every second year, implying an increased annual cost of €162.76[13] per washing machine. Such an analysis could have been made in the

[11] Otherwise the analysis would need to take into account the increasing or decreasing trend in demand for the substance or the end product (i.e. washing machines).

[12] Thus, the human health related problem of workers using Substance A during manufacturing of coated wire (which are not discussed in this example) would remain unchanged in the "baseline" scenario, too.

[13] With 4% discount rate and the price of €400 per washing machine, the following annualised costs can be calculated:

Lifetime with coating of wire with Substance A	10	years
Lifetime without coating of wire	2	years
Annualised cost with coating of wire with Substance A	€49.32	per year
Annualised cost without coating of wire	€212.08	per year
Difference	€162.76	per year

In Step 3.5.2 it has been shown to what extent this is an overestimate, and how it is possible to correct for this, assuming that the price elasticity is known.

analysis of alternatives. In sum, not coating wire is so costly that this option is not analysed further.

As a result of the regulation of Substance A, the following “restriction” scenarios were identified as possible:[14]

(1) The producers of the wire would use an alternative substance – called Substance B – to coat the wires. Using Substance B would require a change in the design of the motor including an investment of €1 million in the production facilities for the engine and would reduce the energy efficiency of the motor by 10%. The investment would have a lifetime of 15 years. However, Substance B is 10% cheaper than Substance A.

(2) The producers of the wire could invest in filtering equipment that would reduce workers exposure to a non-existent level. The investment of the equipment costs would be € 10 million with a lifetime of 20 years.

(3) The production of the coated wires (using substance A) would cease in the EU and coated wires would be imported to the EU. This would result in additional transportation costs. In this scenario, the wire would have the same quality and product specifications as the wire produced in the EU with Substance A. Therefore, there would be no impact on the energy efficiency.

(4) The producers of electrical motors would cease production in the EU and the motors would be manufactured outside of the EU.

(5) Consumers would purchase household appliances produced outside of the EU[15].

To simplify this example the costs of only Scenarios 1, 2 and 3 are analysed further. The analysis of the import of motors (Scenario 4) or washing machines (Scenario 5) would be similar to Scenario 3 (import of the wires coated with Substance A).

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[14] These are the most realistic “restriction” scenarios. The following responses could also be considered:

i) Consumers would buy household appliances without the coated wires and they would therefore have to replace the motor five times during the lifetime of the washing machine.

ii) The producers of household appliances would change from electrical motors to another type of motor or another type of washing machine not requiring such a motor.

The scenario where the lifetime of the motors is significantly reduced is an unlikely response as replacing a motor in an existing household appliance would be expensive and cumbersome for consumers. Replacing the electrical motor (that requires the wiring) with another type of engine (e.g. combustion engine) that would not require this type of wiring could in principle be an alternative. However, combustion engines cannot be used in apartments for safety reasons. Other types of engine technologies are not known to exist.

In addition, it is assumed that washing machines will be needed in the future and thus a scenario with “no washing machines" was not considered realistic and not analysed further.

[15] In other words, production of washing machines using coated wires would cease in the EU. Note that EU consumers can purchase washing machines from abroad (without the restriction).

5.3.2 Relevant time period

In this example, the relevant time period is dependent upon the investment cycle, i.e. the one-off costs for process improvements required to substitute Substance A with Substance B. The investment related to the use of Substance B is assumed to be €1 million investment cost for new equipment with a lifespan of 15 years. The capacity to produce motors and thus, washing machines is assumed to be 1 million machines per year.

As the lifespan of the investment is 15 years, **in this example, the relevant time period is 15 years.** For the purposes of this analysis, the same investment cycle of 15 years is also used for the second (filtering) and third scenarios (import of coated wire).

A longer time period would be warranted if a significant change in technology (e.g., to produce washing machines) or in the demand for the product/service (i.e. washing of clothes) occurred**.**

In this example, costs are calculated in two ways:

In the <u>*representative year approach*</u> (i.e. where all costs are expressed as equivalent annualised costs) these effects will be analysed for a particular year during this investment period. In this example, 2020 is selected as the representative (steady state) year.

In the <u>*cumulative approach*,</u> the net present value of socio-economic costs of using Substance B will be analysed over the next 15 years (between 2010 and 2024).

The lifecycle of the washing machine (10 years in the baseline) is assumed to be the same for washing machines using motors with domestically produced wire coated with Substance B (Scenario 1) or with Substance A (Scenario 2) or with imported wire coated with Substance A (Scenario 3).

5.3.3 Scenario 1: Costs if Substance B is used

In this example, the consultation with the supply chain gave the following estimates which are the basis for making the cost calculations:

- Change in investment cost
    - Substituting Substance A with Substance B costs of €1 million (with a lifespan of 15 years and assuming bringing forward a reinvestment in the equipment by 10 years (i.e. the investment needed to use substance A has been already used for 5 years));
- Change in recurrent costs due to price change
    - Substance B is 10% less expensive than Substance A;
    - Price of Substance A is €10 per kg;

  - Quantity of Substance A (or its substitute Substance B) used per motor and therefore, per washing machine is 0.058 kg;

- Change in recurrent cost due to increased energy consumption

  - Additional electricity consumption with washing machines with motors using Substance B of 20 kWh/year; and

  - Price of electricity of €0.12 per kWh in 2007.[16]

The additional cost of substituting Substance A with Substance B is a one-off investment cost of €1 million for changing the production facilities. The new equipment is estimated to have a lifespan of 15 years. Using the annualising function [with 4% discount rate and 15 year lifetime, i.e. =PMT(4%;15;1;0;0)] the annualised investment costs will be €89941 or €0.0899 per washing machine (in 2007 price levels). **The "restriction" scenario on Substance A would result in an increase of investment costs of €0.0899 per washing machine per annum.**

Substance B is 10% less expensive, i.e., there are savings in the material cost of €58000 per year[17]. **Given that each year 1 million machines are produced, the recurrent cost of producing one washing machine would decline by €0.058 per annum.**[18]

Additional electricity consumption of washing machines with motors using Substance B is 20 kWh/year over the 10 year life time of the washing machine. The average EU electricity price for consumers was about €0.12 per kWh in 2007.[19] Thus, **the additional recurrent costs to consumers would be €2.4[20] per washing machine per annum.**

Table 2 summarises the additional costs per washing machine

Table 2: Scenario 1: Additional cost per washing machine if Substance A is substituted by Substance B (2007 price level)

	€ per washing machine produced
Annualised investment cost to shift from A to B (lifetime of equipment 15 years)	0.089
Annualised effect of Substance B being 10% less expensive	-0.058
Annualised energy cost per washing machine (€0.12 / kWh x 20 kWh)	2.400
Total	**2.432**

[16] Eurostat: Consumer price EU-27 average 1st January 2007; see: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-080/EN/KS-SF-07-080-EN.PDF

[17] Total expenditure on using Substance A is 0.058 kg/motor * €10/kg * 1,000,000 motor = €580,000. Taking 10% of €580,000. gives €58,000

[18] €58,000/1,000000=€0.058

[19] Eurostat: Consumer price EU-27 average 1st January 2007; see: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-080/EN/KS-SF-07-080-EN.PDF

[20] (20 kWh x €0.12/kWh=) €2.4

Given that the cost per annum in 2010 was €2.43 (measured in 2007 price level) per washing machine, Table 3 shows the costs of using Substance B instead of A. The impact for 10 million washing machines in 2020 would be **€24.32 million** (measured in 2007 price level). This would be the costs using the *representative year approach*.

Concerning the investment cycle of 15 years for 1 million washing machines produced each year between 2010 and 2024 the present value of these costs are **€175.26 million in 2010** (see Table 3) (measured in 2007 price level). This would be the costs using the *cumulative approach*.

Table 3 Scenario 1: Cost of using Substance B instead of A in 2020 and during 2010 and 2024 (measured in 2007 price level)

	Cost per one washing machine per annum (€)	Number of new washing machines marketing use (millions)	total cost (€millions)
2010	2.43	1	2.43
2011	2.43	2	4.86
2012	2.43	3	7.30
2013	2.43	4	9.73
2014	2.43	5	12.16
2015	2.43	6	14.59
2016	2.43	7	17.02
2017	2.43	8	19.46
2018	2.43	9	21.89
2019	2.43	10	24.32
2020	2.43	10	**24.32**
2021	2.43	10	24.32
2022	2.43	10	24.32
2023	2.43	10	24.32
2024	2.43	10	24.32
Present Value for 2010-24			**175.26**

As discussed earlier there is some uncertainty about how many washing cycles would be carried out and thus, the related electricity consumption. Assuming that this uncertainty is in the range of 25% this range can be applied to the energy costs. Given that the additional electricity cost per washing machine was 2.4 per annum, the uncertainty range for 10 million machines would be €6 million per annum[21]. Thus, the costs would be either that much (i.e. **€18.32 million per annum**) or higher (i.e. **€30.32 per annum**) when expressed by using the representative year approach.

The present value of the uncertainty of 25% in energy costs is €43.24 per annum (this calculation is not shown). Thus, using the cumulative approach, the present value

[21] (25% x €2.4 x 10 million=)

would range **from €132.02 to €218.50 million for 2010-2024**. These uncertainty ranges will be used when the results are summarised.

5.3.4 Scenario 2: Cost of installing filtering equipment

It is possible to invest in filtering equipment in the manufacturing site where the wire is coated. In this case the health risk for the workers would become redundant. However, the investment cost of the equipment is €10 million and the lifetime of the equipment is 20 years. Using the annualising function [with 4% discount rate and 20 year lifetime, i.e. (=PMT(4%;20;10;0;0)] the annualised investment costs will be €735818 or €0.735818 per washing machine (in 2007 price levels). **The "restriction" scenario on Substance A would result in an increase of investment costs of filtering of €0.7358 <u>per</u> washing machine per annum.**

The operating costs of the filtering equipment consist of labour costs of ½ person per annum (i.e. 900 hours per annum) and additional energy costs concerning 300 MWh. **Additional labour costs** are calculated using average industrial wages of €20/hour i.e. 900x€20= €18000 or **€0.018 <u>per</u> washing machine per annum. Additional energy cost** of the filtering equipment are (€0.12 / kWh x 300000 kWh) €36000 or **€0.036 <u>per</u> washing machine per annum.**

In Table 4 the annualised investment and operating costs are aggregated per one washing machine. Given that the additional cost of filtering equipment was €0.7898 per washing machine Table 5 gives the compliance cost in 2020 for 10 million washing machines (€7.90 million) as well as the present value for the stream between 2010 and 2024 (€56.92 million). All these costs are measured in 2007 price level.

Table 4: Scenario 2: Additional cost per washing machine if filtering equipment is installed (2007 price level)

	€ per washing machine produced
Annualised investment cost of €10 million (lifetime of equipment 20 years)	0.7358
Annualised effect higher labour costs	0.0180
Annualised energy cost per washing machine (€0.12 / kWh x 300 000 kWh)	0.0360
Total	**0.7898**

Table 5 – Scenario 2: Cost of installing filtering equipment in 2020 and during 2010-24(measured in 2007 price level)

	Cost per washing machine per annum (€)	Number of new washing machines in use (million)	Total cost (€million)
2010	0.7898	1	0.7898
2011	0.7898	2	1.5796
2012	0.7898	3	2.3694
2013	0.7898	4	3.1592
2014	0.7898	5	3.9490
2015	0.7898	6	4.7388
2016	0.7898	7	5.5286
2017	0.7898	8	6.3184
2018	0.7898	9	7.1082
2019	0.7898	10	7.8982
2020	0.7898	10	**7.8982**
2021	0.7898	10	7.8982
2022	0.7898	10	7.8982
2023	0.7898	10	7.8982
2024	0.7898	10	7.8982
Present Value for 2010-24			**56.92**

Sensitivity analysis

It seems clear that the discount rate of the investment cost in Scenario 2 is important. Therefore, Table 6 is reproduced below with 6% discount rate (instead of 4%). The annualised cost of the investment would increase from [=PMT(4%;20;10;0;0)] €0.7358 to [=PMT(6%;20;10;0;0)] €0.8718 per washing machine. The additional labour and energy costs are unaffected.

Table 7 gives the compliance cost in 2020 for 10 million washing machines with 6% discount rate (€9.26 million) as well as the present value for the stream between 2010 and 2024 (€66.72 million). Given higher discount rate, the costs in tables 6 and 7 are higher than in tables 4 and 5, respectively.

Table 6: Scenario 2: Sensitivity analysis – Additional cost per washing machine if filtering equipment is installed (2007 price level) – using 6% discount rate

	€ per washing machine produced
Annualised investment cost of €10 million (lifetime of equipment 20 years)	0.8718
Annualised effect of higher labour costs	0.0180
Annualised energy cost per washing machine (€0.12 / kWh x 300 000 kWh)	0.0360
Total	**0.9258**

Table 7 – Scenario 2: Sensitivity analysis – Cost of installing filtering equipment in 2020 and during 2010-24 (measured in 2007 price level) – using 6% discount rate

	Cost per washing machine per annum (€)	Number of new washing machines in use (million)	Total cost (€million)
2010	0.9258	1	0.9258
2011	0.9258	2	1.8517
2012	0.9258	3	2.7775
2013	0.9258	4	3.7034
2014	0.9258	5	4.6292
2015	0.9258	6	5.5551
2016	0.9258	7	6.4809
2017	0.9258	8	7.4068
2018	0.9258	9	8.3326
2019	0.9258	10	9.2585
2020	0.9258	10	**9.2585**
2021	0.9258	10	9.2585
2022	0.9258	10	9.2585
2023	0.9258	10	9.2585
2024	0.9258	10	9.2585
Present Value for 2010-24			**66.72**

5.3.5 Scenario 3: Costs if coated wire is produced outside the EU

In Scenario 3, the costs include any additional costs of the wires or the motors being produced and imported from outside the EU. In this scenario the higher costs to use imported wire relate to higher quality control and additional transportation costs.

The following is the basis for making the cost calculations for the EU motor producers:

- Cost of production in the EU of coated wire for one motor is €5;
- The motor producers in the EU estimate that they would have to pay 50% more for coated wire if it was imported into the EU. These comprise of additional quality control and transportation costs.

The additional cost of purchasing coated wired from outside the EU would be equal to €2.5[22] per motor and thus per washing machine. Given the lifetime of the washing machine (10 years) this additional cost of €2.5 can be annualised. **The annualised**

[22] 50% x €5=€2.5

additional cost[23] of importing the wire is thus €0.308 per washing machine per year.[24]

The following are used in cost calculations (in 2007 price level) for the EU wire producers:

- an estimated loss in buildings of €1 million with 8 years remaining lifetime.
- an estimated loss in equipment of €2 million with 5 years remaining lifetime.

Using the annualising function [with 4% interest rate and 8 years of remaining lifetime i.e. =PMT(4%;8;1;0;0)] the annualised costs for the buildings is €148500. **This would be equal to €0.149 per washing machine** (measured in 2007 price level).

Using the annualising function [with 4% interest rate and 5 years of remaining lifetime) i.e. =PMT(4%;5;2;0;0)] the annualised costs for remaining equipment is €449254. **This would be equal to €0.449 per washing machine** (measured in 2007 price level).

Table 8 summarises the additional costs of Scenario 3.

Table 8: Scenario 3: Additional cost per washing machine in 2010 if the coated wire is imported (measured in 2007 price level)

	€ per washing machine produced
Annualised cost of wire being €2.5 more expensive (10 years lifetime)	0.308
Annualised cost of residual capital of buildings (€1 million) to wire producer (8 years lifetime left)	0.149
Annualised cost of residual capital of scrapped equipment (€2 million) for wire producer (5 years lifetime left)	0.449
Total	**0.906**

Given that the cost per annum in 2010 was €0.906 per washing machine Table 9 gives the costs of discontinuing wire production in the EU. The impact for 10 million washing machines would be **€9.06 million** in 2020. This would be the costs using the *representative year approach.*

Considering the placing 1 of million washing machines each year on the market during the investment cycle of 15 years (from 2010 to 2024) the present value of these costs is **€65.29 million** in 2010 (see Table 9). This would be the costs using the *cumulative approach.*

[23] Additional cost compared to the ”baseline” scenario (continued use of Substance A in the coating of wire).

[24] Use the Excel function PMT(4%;10;2.5;0;0), where 4% is the discount rate, 10 is the lifetime of the motor (in years), 2.5 is the cost per motor (in euros), the first 0 is the resale value amount (in euros) at the end of the lifetime of the investment (it is zero because the washing machine has come to end of its lifetime and has no commercial value) and the last 0 indicates that one starts to discount from the beginning of the year

Table 9: Scenario 3: Cost of relocating wire production outside the EU in 2020 and during 2010-24 (measured in 2007 price level)

	Cost per washing machine per annum (€)	Number of new washing machines in use (millions)	total cost (€millions)
2010	0.91	1	0.91
2011	0.91	2	1.81
2012	0.91	3	2.72
2013	0.91	4	3.62
2014	0.91	5	4.53
2015	0.91	6	5.44
2016	0.91	7	6.34
2017	0.91	8	7.25
2018	0.91	9	8.15
2019	0.91	10	9.06
2020	0.91	10	**9.06**
2021	0.91	10	9.06
2022	0.91	10	9.06
2023	0.91	10	9.06
2024	0.91	10	9.06
Present Value for 2010-24			**65.29**

5.4. Summary

Table 10 summarises the annualised and cumulative costs of the scenarios.

There are some uncertainties relating to the analysis. The main one relates to the actual energy consumption related to the use of washing machines. In Section 3.3 it was assumed that the uncertainty range was 25% around the energy efficiency loss if Substance B was used instead of Substance A.

Table 10: Summary of the costs of three scenarios in 2020 (measured in 2007 price level), millions of euros – 4% discount rate used unless specified otherwise

	Scenario 1	Scenario 2	Scenario 3
Annual cost in 2020			
Minimum estimate (25% lower energy costs)	€18.32	n.a.	n.a.
Central estimate	€24.32	€7.90	€9.06
Maximum estimate (25% higher energy costs)	€30.32	n.a.	n.a.
Using 6% discount rate	n.s.	*€9.26*	n.a.
Cumulative cost in 2010-24 (Present Value)			
Minimum estimate (25% lower energy costs)	€132.02	n.a.	n.a.
Central estimate	€175.26	€56.92	€65.29
Maximum estimate (25% higher energy costs)	€218.50	n.a.	n.a.
Using 6% discount rate	*n.s.*	*€66.72*	n.a.

Scenario 1: Substance B is used instead of Substance A;
Scenario 2: Substance A is used but filtering equipment is installed
Scenario 3: Suitable coated wire is imported into the EU (changing the discount rate would not change the results)

The cost of Scenario 2 was estimated to be €7.9 million per annum in 2020. Cumulatively the present value of the costs for 2010-24 is €56.92 million.

The cost of Scenario 3 was estimated to be €9.06 million per annum in 2020. Cumulatively the present value of the costs for 2010-24 is €65.29 million.

The costs of Scenarios 2 and 3 are much lower than the cost of Scenario 1.

The likely response to a restriction concerning the human health impacts of Substance A is either that the EU producers invest in filtering equipment in its site or his customers import the coated wire from outside the EU. In the former case the compliance cost would be €7.9 million and in the latter case €9.06 million per annum in 2020. However, with 6% discount rate the compliance cost of Scenario 2 would be €9.26 million, i.e. slightly higher than in Scenario 3. **In sum, the compliance cost is estimated to be between €7.9 and €9.06 million per annum in 2020. This is equivalent of the compliance costs being (cumulatively) between €56.9 and €65.3 million during 2010-24.**