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the Convention on Access to Information,
Public Participation in Decision-making and
Access to Justice in Environmental Matters

Working Group on Pollutant Release and Transfer Registers

ANALYSIS OF THE COSTS AND BENEFITS OF POLLUTANT RELEASE AND TRANSFER REGISTERS

Pursuant to the discussion on the costs and benefits of pollutant release and transfer registers during the second session of the Working Group on Pollutant Release and Transfer Registers (CEP/WG.5/AC.2/2001/5, paras. 47 to 50), an expert from the ECE Economic Analysis Division has prepared this analysis of costs and benefits of pollutant release and transfer registers for consideration by the Working Group.

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EXECUTIVE SUMMARY

The current study aims to provide objective information on the benefits and costs of pollutant release and transfer registers (PRTRs), accruing to or borne by the various stakeholders. It is meant to provide the Working Group with more information to assess the cost implications and, in qualitative terms, some potential benefits of PRTRs.

This analysis uses both a qualitative approach to costs and benefits and a quantitative approach to costs, and builds various plausible scenarios that capture a basic system over time for countries with different characteristics, as well as expansions to that system.

The study suffers from a number of limitations, partly due to the short time frame for completing the work, the limited amount of information received in response to the questionnaire and the lack of a budget for detailed research. Other factors which should be taken into account when interpreting its findings include the fact that a small number of simplified scenarios for developing PRTRs have been selected from a theoretically enormous array of permutations; the substantial regional and economic disparities which are only crudely captured through the division of the region into three economic subregions; and, finally, the difficulty in deciding what constitutes a ‘baseline’ in terms of the pre-existing regulatory framework. These factors taken together limit the extent to which particular country-specific conclusions may be drawn from the analysis and suggest that it is able to offer only general guidance as to possible costs and benefits to any given country.

From an economic point of view, the PRTR is a regulatory instrument which can correct a market failure arising from the presence of an economic externality, namely pollution, by spreading information. As a regulatory instrument, a PRTR is unique for a number of reasons, including the central participation of the public and its representative organs, its ability to exploit the importance of reputation to a corporation and its spin-off effects that strengthen other regulatory tools to achieve pollution abatement. Furthermore, a PRTR instrument can support the so-called polluter-pays principle.

The regulator’s main tasks, which define its main cost components through participation, include defining and setting up the PRTR system, ensuring its smooth running and managing any systemic changes.

Participating facilities are required to conform to their obligations under a PRTR instrument, involving determining reporting obligations, performing calculations, estimations and measurements, completing reports, keeping records, filing and, if relevant, substantiating confidentiality claims, and filing for changes to the substance list.

The systematic collection of data on emissions and transfers under a PRTR can be of value to facilities. A PRTR mechanism can lead to the development or implementation of more environmentally friendly technology and can often lead to cost savings and higher efficiency.

The public’s “right to know” has been identified by the negotiating parties as the prime objective of the PRTR under the Aarhus Convention. This can be considered to be a political right and, hence, very difficult to value. Citizens can hold regulators accountable for enforcing policies requiring public dissemination of information.

Under a PRTR mechanism, the public has no duties imposed by law. Its role is to act as the regulator's partner in correcting market failures, by means of corporate disciplining mechanisms uniquely under its control.

The public benefits from the system insofar as it induces reductions in pollution emissions that are hazardous to human health and the environment. A PRTR provides workers and communities access to information on chemicals from which they are potentially exposed to risks. This helps them to make informed choices and take appropriate action.

The quantitative estimation of costs is performed using an Excel spreadsheet model. A number of assumptions which determine the numerical outcomes are made. The model obtains results for three country types: an advanced market economy (AME), an advanced (ATE) and a less advanced transition economy (LATE). These differ from each other mainly in the levels of income that employees command and in the discount rate. The model also distinguishes three base scenarios characterized by different numbers of facilities participating in the basic system. The model includes expansions to the system in the form of changes in the number of facilities that participate, the average number of chemicals reported by a facility and the percentage of participating facilities that report under the system.

The estimation results suggest that by far the largest cost component is the one borne by the private sector. 1/ Individual facilities' costs vary widely, depending on the applicable levels of wages and salaries. Total private sector costs, calculated in present value and accounting for corporate taxes, vary widely, depending on the number of facilities that participate in the system. Years in which the system is either initially implemented or changed add familiarization expenses to facilities' costs. Regulators typically bear a small fraction of the system's costs.

For the AME, the cost to the regulator of a PRTR system covering 500 facilities (scenario A1) is US$ 635,000 in the first year, falling to between US$ 350,000 and US$ 400,000 in each subsequent year. These amounts more or less double for scenario B1 covering 2,000 facilities and quadruple for scenario C1 (8,000 facilities) to reach US$ 2.8 million in the first year and around US$ 1.9 million in the subsequent years.

Since a large part of the regulator's costs are the wages and salaries of its employees involved in managing a PRTR system, the costs to the regulator in an ATE and in a LATE are substantially reduced. In an ATE, the cost to the regulator of a system with 500 facilities is US$ 294,000 in the first year of operation and between US$ 162,000 and US$ 170,000 in the subsequent years.

In a LATE, these costs are even lower. Scenario A3 costs the regulator US$ 189,000 in the first year and comes to US$ 105,000 in the subsequent years, on average. Scenario B3 costs a bit more than double and scenario C3 approximately four times that amount.

Turning now to the costs for the whole private sector in an AME, the model calculates a total of US$ 14 million in the first year for scenario A1, four times that figure for scenario B1 and

1/ Throughout this study, "private sector" refers to all regulated entities within an economy. These can also include State-owned enterprises that are subject to regulation.

four times the figure in scenario B1 for the case of scenario C1. Costs to the private sector are directly proportional to the number of enterprises covered by the system (given a fixed average number of data items to be reported by a facility). These costs are lower in subsequent years of the programme, when participants have become acquainted with the system's requirements. The average annual costs to the private sector in an AME of a PRTR after the first year of implementation were around US$ 9 million for scenario A1, around US$ 36 million for scenario B1 and around US$ 144.5 million for scenario C1. This reflects an average cost per facility in an AME of less than US$ 28,700 in the first year of the programme and some US$ 18,000 per year in the subsequent years of the programme.

In an ATE, the system costs the private sector around US$ 4.9 million in scenario A2, US$ 19.6 million in scenario B2 and US$ 78.4 million in scenario C2 in the first year. These costs drop over the subsequent years so that, once implemented, the system costs the private sector on average US$ 3.6 million for scenario A2, US$ 14.3 million for scenario B2 and US$ 57.2 million for scenario C2. The total average cost is ca. US$ 9,800 per facility in the first year and some US$ 7,200 annually per facility once the system has been implemented.

Finally, in a LATE, the system costs the private sector around US$ 2 million in scenario A3, US$ 8 million in scenario B3 and US$ 32 million in scenario C3 in the first year. These costs drop over the subsequent years so that, once implemented, the system costs the private sector on average US$ 1.95 million for scenario A3, US$ 7.8 million for scenario B3 and US$ 31.2 million for scenario C3. The average annual cost per facility in the first year of the programme comes to around US$ 4,000 and drops to around US$ 3,900 per year over the subsequent years.

As far as the expansion of the modelled substance list expansion is concerned (scenario D), an increase of 20% in the reported substances per facility and an increase in the percentage of reporting facilities to 95% adds some 24% to the regulator's costs for the new system in all three country groups vis-à-vis the base scenario of 2,000 facilities (i.e. scenario B).

The private sector experiences an expansion in its annual costs of around 42% vis-à-vis scenario B, following the introduction of the new system. This applies to all country groups under study.

Turning to the substance list expansion with activity scope expansion (scenario E), namely increases of 20% in both the reported substances per facility and the participating facilities and an increase in the percentage of reporters to 95%, this adds some 56% to the regulator's costs for the new system in any of the country types in the first year and around 34% in subsequent years, both vis-à-vis the base scenario of 2,000 facilities (i.e. scenario B).

As far as the private sector is concerned, the costs are more than doubled upon introduction of a scenario E in the first year of the new system (vis-à-vis scenario B). In subsequent years, the increase in costs under scenario E totals around 70% (again, vis-à-vis scenario B). This applies across all three country groups.

I. DEFINING THE PROJECT

A. Purpose and short description of the study

1. The current study aims to provide objective information on the benefits and costs of pollutant release and transfer registers (PRTRs), accruing to or borne by the various stakeholders. It is meant to provide the Working Group with more information to assess the cost implications and, in qualitative terms, some potential benefits of PRTRs. 2/ This study uses information from specific countries' experience with PRTRs, relevant existing studies and answers received to the PRTR questionnaire. 3/

2. The analysis presents benefit and cost information where viable and distinguishes different scenarios, reflecting the Working Group's possible future choices. While it is clear that nothing has been finally decided yet regarding the shape of the future instrument, the options discussed here have been structured having regard to the indicators given by the Working Group at its first and second meetings.

3. This study builds different scenarios over time, to reflect the possibility of changes to the existing system or its expansion at a later date. Thus, set-up costs of the basic system are distinguished from incremental costs arising from expansion of the PRTR through the inclusion of additional reportable chemicals or reporting activities at a future date.

4. This analysis can also serve as the basis for identifying possible future needs for financial assistance to countries in transition, in order to assist them in establishing PRTRs.

5. Due to its limitations, discussed in section C, costing a PRTR under these circumstances is necessarily a rough and crude task. The maximum that can be hoped to be achieved through such a study is some rough guidance concerning the cost of a small number of simplified scenarios, designed to capture some of the choices that the Working Group faces in the most immediate future and a general indication of types of benefits which can be expected to accrue, but without quantification in this case.

6. The study does not attempt to place the identified costs in context, e.g. by comparison with the average turnover of the reporting sectors in question or with the average total budgets of the environmental regulatory authorities in the various country types.

2/ While most costs can be quantified in monetary values, many benefits cannot. Due to practical considerations and taking into account the terms of reference of this study, this study limits itself to discussing costs and benefits in qualitative terms and costs in quantitative terms. In this sense, it does not constitute a typical cost-benefit analysis. Moreover, it differs from standard cost-benefit analyses in that it does not quantitatively assess the costs or benefits of alternative programmes that might be implemented in the absence of a PRTR.

3/ Answers were received from Albania, Armenia, Australia, Belgium, Bulgaria, Georgia, Germany, Hungary, Italy, Lithuania, Netherlands, Norway, Slovakia, Switzerland, the United States, Yugoslavia, Friends of the Earth and the Regional Environmental Center for Central and Eastern Europe.

B. Pollutant release and transfer registers under the Aarhus Convention

7. A PRTR is an environmental catalogue or database of potentially harmful pollutant releases to air, water, land and transfers through waste. The database typically contains information on releases and transfers of polluting substances, reported annually by individual facilities. A PRTR usually involves collecting comparable release and transfer data of prescribed chemicals, storing the reported data in a publicly accessible database and disseminating the registered data to the public in the form of written analyses and the Internet.

1. Goals and core objectives

8. According to document CEP/WG.2/AC.2/2001/5, the rights of the public (to know) should be at the very forefront of the instrument, and both the right to know and the right to participate should be given emphasis in the objective. Pollution prevention and control, or contributions to this goal, were considered a second but nonetheless important objective of the instrument.

2. Core elements to achieve objectives

9. Key features of the proposed PRTR under the Aarhus Convention are expected to include periodic collection of information to allow tracking of trends over time; the use of common identifiers for chemicals, facilities and locations to facilitate comparison and aggregation of the data; computerization of the information for ease of analysis; and dissemination of the information to the public.

10. Potential applications of the PRTR data include mapping them to examine the proximity of pollution sources to population centres or to ecologically sensitive areas and to assess potential health or environmental impacts. The data can also be used to track progress by individual facilities or industrial sectors in reducing waste and minimizing pollution, or for identifying opportunities for improvement.

C. Limitations of study

11. This analysis suffers from a number of limitations. First, the time frame was short and, therefore, the study can only be viewed as providing a rough guide for some simplified cost scenarios.

12. Second, there was no budget for detailed information collection or for research assistance and, therefore, the study had to rely on information that was provided in answer to the questionnaire sent out and on available publications.

13. Third, responses to the questionnaire provided very little information on possible costs and benefits associated with PRTRs.

14. Fourth, a large array of decisions regarding the form of the PRTR are still outstanding. In theory, there are several million permutations, which could be the outcome of the decisions of the Working Group. It is clear that, given so many different outcomes, it was necessary to pick a small number of possible scenarios, which are selected from different points in the spectrum of views expressed.

15. Fifth, there are substantial economic disparities among the 55 members of the United Nations Economic Commission for Europe (UNECE) and potential Parties to the instrument. This means that the starting point for creating a PRTR, its design and scope all differ from one country to another. Disparities across regions limit the applicability of a “one-size-fits-all” study. While this suggests the need to view (and cost) each country separately, practical considerations and the time constraint meant that we had to group countries together for the analysis and determine representative cost-bounds for the main cost categories. Consequently, the analysis offers only general guidance as to possible costs and benefits to any given country and no country-specific deductions can be made on this basis.

16. Finally, the relevant costs and benefits of any particular environmental regulatory programme, such as a PRTR, are so-called marginal costs and benefits. These are the *additional* costs borne and benefits that accrue as a consequence of PRTR implementation, over and above the costs incurred and benefits already accruing from either voluntary action or other mandatory programmes already in place. However, due to time constraint and the different starting points in the countries under study, this study does not assess the costs or benefits of alternative programmes in quantitative terms. Inevitably, this means that our calculations overestimate the real resource costs of a PRTR.

17. We now turn in detail to the substantial regional and economic disparities and discuss the main differences, and their cost implications, in turn.

1. Economic and industrial infrastructure

18. Countries can differ widely in their economic and industrial infrastructure. Each country has different economic sectors that generate or experience different levels and types of pollutant releases and transfers. This will depend on the characteristics of the industrial sector in each country, including its overall size as a proportion of gross domestic product (GDP), its production activities, location, the pollution abatement technology already in place and many other factors.

19. A heavily industrialized country, perhaps with a large chemical sector, may face a considerably higher burden from a PRTR system as many more facilities will be covered than a country whose GDP is produced by activities less prone to PRTR-listed pollutant emissions and transfers.

20. If diffuse sources are included in a potential instrument, the size of an economy’s primary sector (agriculture) and of its transport sector will have important consequences on pollution levels and the cost of PRTR compliance.

21. Large economies can benefit from economies of scale when implementing a PRTR system.

2. Environmental regulations and PRTR-like systems

22. Certain countries already have PRTR-like systems in place that cover some of the environmental media and a subset of chemical substances likely to be included in a potential PRTR instrument. These systems have introduced the legal obligation on facilities to measure, calculate and estimate a variety of pollutants. Therefore, any PRTR instrument under the Aarhus Convention would be likely to add fewer costs for those countries that already have a functioning PRTR-like system in place than for those that do not.

23. Most countries have environmental regulations in place to limit the right to pollute specified substances and place a substantial burden on facilities to measure, estimate and calculate emissions (and transfers) of chemicals. Subsection 3 discusses the different types of environmental regulatory mechanisms that are prevalent. If such schemes are in place, introducing PRTR reporting requirements is expected to add little in the way of costs, as many of the tasks required by a PRTR system are already performed under different programmes. This applies in particular to measurements, calculation and estimations of emissions and transfers and to filing this information.

3. Institutions/approaches to economic regulation

24. The degree of institutional decentralization and the approach to economic regulation adopted by a country both have consequences for the costs of introducing a PRTR system.

25. Countries with high decentralization and federal or regional structures with distributed and highly separated competence require additional information exchange, coordination and multiple operations, all of which are likely to increase costs vis-à-vis a centralized institutional structure. However, the context considered in this study is one of a highly centralized environmental regulatory structure.

26. In countries where regulatory institutions are functioning soundly and where all economic agents have collected a considerable amount of experience with economic regulation, especially environmental regulation, the PRTR system costs can be expected to be smaller. This is due, in part, to the smaller learning and acquaintance effort needed to understand the procedures required to meet PRTR obligations. Also, due to the greater experience and knowledge collected and the understanding of what is required of them, economic agents are less likely to make mistakes in the procedure.

27. The presence or absence of pervasive corruption within economic regulatory institutions is also likely to make a difference to economic costs. Corruption is known to be economically inefficient by causing a misallocation of resources and, thereby, a distortion of costs. These distortions are difficult to quantify but can be relevant when costs of a PRTR system to that country are considered.

4. Environmental, health and safety management systems

28. In some countries, large facilities often already have so-called environmental, health and safety (EHS) management systems in place. EHS management systems are designed to collect environmental and health information on a facility’s production processes and to publish this information on a regular basis. In this way, some environmental information, including pollution abatement efforts, levels of emissions, reduction targets and other relevant information reaches the public. Facilities tend to regard this voluntary system as yielding many advantages, such as supplying information about their own environmental performance that can lead to cost-savings through increases in efficiency and can enhance their environmental public image and reputation.

29. In order to publish this information, a facility performs measurements, calculations and estimations of its pollutant emissions, very similarly to what is required by a PRTR system. If a facility must then also comply with a PRTR, it would have a relatively smaller cost burden to bear than if it had no voluntary EHS system in place.

30. Therefore, if countries have a large number of facilities that already operate EHS systems, it would be safe to say that, in these countries, the introduction of a PRTR system would not impose as significant a cost as in other countries whose facilities have no such systems in place.

5. Market-transition dichotomy

31. Many Central and East European countries and newly independent States have very scarce resources to address pressing environmental issues. The uniqueness of their economic situation presents a special set of issues and challenges for developing a PRTR system. 4/

32. Advanced market economies and transition economies sometimes vary widely in their economic structures. For example, some transition countries are large agricultural economies and, therefore, the costs of complying with a PRTR instrument covering diffuse sources may be more significant than for countries that have small primary and transport sectors.

33. Labour costs, arguably the most important cost component of a PRTR system, also vary very considerably between advanced market and transition economies. Equally, there are wide gaps in labour costs among transition economies themselves, reflecting the heterogeneity of these economies.

34. Countries have different environmental priorities. For example, many countries are concerned with assessing the current environmental situation while other are trying to measure the performance of recent environmental policy changes. Different countries prioritize different pollution sources and potentially hazardous substances. Moreover, some countries have a number of different pollutant reporting systems addressing various issues and topics, while others do not have any system in place.

D. Organization of the study

35. The study is organized as follows. Chapter II discusses the costs and benefits to various stakeholders of a PRTR in qualitative terms. This chapter views the PRTR within the context of a regulatory instrument, which defines stakeholders' tasks under the system and, hence, the resulting costs and benefits. Chapter III turns to the specific PRTR being negotiated under the Aarhus Convention. In this chapter, different potential negotiating outcomes that define the instrument are described. As mentioned above, to make the study manageable, we chose a number of discrete scenarios from the spectrum of opinions expressed within the Working Group on PRTR. We attempt to distinguish between different implementation phases of a possible PRTR. This chapter also describes the geographical and economic disparities across the 55-strong group of UNECE member States. These include different sizes of economies, industrial structures, institutions and approaches to regulation. Despite the obvious limitations of the study, we attempt to give negotiating parties an idea of possible costs by quantifying various cost items in the remainder of chapter III, based on available data. Conclusions and the main results of this analysis are summarized in chapter IV.

4/ See OECD (1997).

II. COSTS AND BENEFITS ACCRUING TO RELEVANT STAKEHOLDERS UNDER A PRTR

36. This chapter discusses costs and benefits of a PRTR mechanism from the point of view of the main stakeholders in qualitative terms. It aims to provide a comprehensive enumeration of the different types of costs and benefits that are relevant to a PRTR programme.

37. In assessing the costs and benefits of a PRTR, like those of any policy measure, it is necessary to focus on *incremental* costs and benefits. An analysis of these must identify the extent to which a policy promotes substitutes for activities of a similar nature that would occur without the policy. This means that displaced activities should be explicitly recorded as avoided costs and that only incremental gains should be identified as benefits of the policy.

A. The PRTR: a novel regulatory instrument?

1. Salient features of a PRTR

38. From an economic point of view, the PRTR is a regulatory instrument which corrects a market failure arising from the presence of an economic externality, namely pollution. The crucial feature of externalities is that they are goods people care about but are not sold on the market. The presence of externalities and other market failures create large economic inefficiencies. Governments see their role in correcting these.

39. There are a large number of regulatory options available to policy makers to achieve pollution abatement, such as taxes or permits. These are market mechanisms which effectively reallocate the property right to pollute a prescribed amount within a specified time period. A PRTR can be viewed as novel type of regulatory mechanism which, by making information publicly available, may prompt facilities to reduce their emissions and transfers through pollution abatement efforts. 5/ Its unique features arise from the availability of information.

40. As a regulatory instrument, a PRTR is unique for a number of reasons. What is unusual about it is the central involvement of the public and its representative organs, such as trade unions and non-governmental organizations (NGOs), albeit in an informal role, in the regulatory process. As a consequence of this involvement, regulatory costs, which would normally be borne by the regulator, can be shared with the public. Equally unusual is that it manages to exploit the role of reputation and its significance to today's corporation. Finally, by spreading information, it strengthens the effectiveness of other regulatory tools to achieve pollution abatement, 6/ such as the use of performance monitoring and benchmarking, thereby magnifying its first-round direct effect.

5/ Fung and O'Rourke (2000) view the Toxics Release Inventory (TRI) in the United States as such a novel regulatory tool.

6/ See Karkkainen (2001).

41. Information plays the key role under a PRTR system. Such a system enables a widely accessible, objective, cross-media measure of facility-level environmental performance with open-ended end-uses. It produces data standards which can be easily managed and aggregated, yielding performance comparisons across firms, industries, regions and countries and across time. Such standards also facilitate making the data available to the public through an electronic database. In fact, it is difficult to view the PRTR in isolation from contemporary information technology, which has developed the technological capacity to store, manipulate and disseminate such large amounts of information in a cost-effective and rapid manner.

42. Viewing the PRTR from the economic regulatory perspective defines stakeholders' roles and their interactions. Stakeholders identified as relevant to the discussion on PRTRs, 7/ include the regulator (at the centralized, federal, regional and local levels), facilities, the public, NGOs and trade unions. Facilities take the role of the regulated party. When looking more closely at the underlying incentives faced by each party, it becomes clear that the public, NGOs and trade unions have similar objectives and frequently act together to pursue these.

43. Each of these groups has different incentives and objectives, which will determine the costs and benefits accruing to each individual group. Many of these costs and benefits are difficult to quantify, without making restrictive and possibly invalidating assumptions. For this reason, we review the roles, objectives and incentives of various stakeholders in the process and discuss related costs and benefits of their participation.

44. Vis-à-vis regulatory mechanisms such as "best available technology" (BAT) or the emissions standards approach, the informational burden rests to a greater extent with the regulated party. The facility is put in charge of evaluating pollution-control and pollution-prevention technologies. This corresponds to an improvement in the incentive structures among the stakeholders in that the regulated entity is considerably better placed to understand the costs, needs and pollution abatement technologies associated with its own business and industry. In exchange, the entity is granted broad discretion to set plans, priorities, improvement targets and implementation strategies tailored to its individual circumstances.

45. It is generally assumed that under a PRTR system, a facility is expected to cover the costs of complying with the regulation, costs to its corporate brand and reputation, sometimes reflected in declining shareholder value, and the costs of pollution abatement.

46. Under some systems, facilities might also be expected to cover the costs imposed on parties external to the facility as a consequence of its activities. Typically, these costs would include both damages to the environment as well as the administrative costs incurred by the regulator. Certain regional systems, such as the one operating in Massachusetts since 1989, incorporate a provision

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7/ Stakeholders are identified in annex II to the report of the first meeting of the Aarhus Convention's Task Force on PRTRs (CEP/WG.5/2000/5, para. 85-88).

which involves collection of a fee from polluting facilities to cover the regulator's costs. 8/ Thus, in these circumstances, a PRTR can support the so-called polluter pays principle (PPP), which reflects the notion that those who cause pollution should bear the full cost of the economic externality.

2. Regulatory approaches 9/

47. The baseline for any cost analysis is usually the current system in place, as this provides the basis for decisions regarding new alternatives. Therefore, a cost analysis typically characterises the current system. However, our discussion of the limitations to the study in chapter I, section C, showed that countries under the Aarhus Convention have vastly different systems in place. Therefore, each country has a different starting point from which the costs associated with a PRTR would usually have to be compared. This is clearly not possible due to the lack of information 10/ and the time constraints this study faces.

48. Due to these constraints, this analysis will not quantitatively cost any alternative regulatory schemes (see footnote 2) but limit itself to listing possible alternative or complementary mechanisms that could be seen to be available to policy makers.

(a) Voluntary reporting programmes

49. A voluntary reporting programme is based on facilities' voluntary disclosure of emissions and transfers. Under such a programme, there are no legally enforceable disclosure requirements.

50. Some observers have suggested that voluntary reporting programmes have not worked satisfactorily in the past and have failed to obtain the sought unilateral disclosure of pollutant releases. 11/ Reports suggest 12/ that, despite disclosure by some ground-breaking firms, no precedent has been set for comprehensive voluntary reporting of toxic pollution across an entire industry.

8/ For example, under the Massachusetts Toxics Use Reduction Act, toxics use fees that are based on the number of employees at a facility and the number of chemicals it uses cover programme costs. These fees are limited to an annual $31,450 per facility and generate roughly $5 million a year. However, they are not closely enough linked to the quantities or toxicity of the chemicals used to be regarded as conforming fully to the polluter pays principle.

9/ For details on these approaches, see Baumol and Oates (1993), Hahn (1990), Hahn and Stavins (1992), OECD (1992) and US EPA (1980).

10/ Information concerning the present system in place was one aspect of the questionnaire. However, few countries provided any information about this.

11/ Clearly, this view is open to debate. For example, the European Chemical Industry Council (CEFIC) believes that it is unfair to state that VRPs have failed but concedes that something different or more extensive is needed from reporting by industry.

12/ See Working Group on Community Right-to-Know (2001).

51. However, other voluntary programmes have been viewed as overall successes, for example the United States 33/50 toxic substances programme under which many companies have established voluntary targets for reducing the use of various toxic chemicals. 13/ Other examples of successful programmes include the “Energy Star” energy-efficiency labelling programme and the “Design for the Environment” programme. The latter seeks to form voluntary partnerships with industry to develop environmentally safer alternatives to existing products and processes that prevent the need to clean up pollution created as by-products in manufacturing processes.

(b) Traditional design-based command and control

52. Design-based command-and-control regulations have a long history in environmental policy. Typically, these may either prescribe a particular technology for compliance (best available technology (BAT)) or else specify an upper limit on the level of emission which must be complied with, but leaving the choice of means to the facility.

53. This type of regulatory mechanism has the advantage that it is easy to monitor compliance and enforcement and encourages technological innovation.

(c) Market-oriented approaches

54. Environmental regulation offers numerous market-based approaches. These make use of private-sector incentives and market information, thereby increasing economic efficiency vis-à-vis other command-type approaches. Market-oriented regulatory mechanisms include taxes, fees or charges, subsidies or marketable permits.

55. Taxes, fees, charges or subsidies are based on a price fixed for each unit of emissions. Facilities then decide how much to control the emissions, based on these prices and the costs of the control. This mechanism encourages pollution abatement.

56. Marketable permit systems set a ceiling on the total amount of permissible pollution and then issue tradable permits that allow facilities the right to pollute a specified amount for a specified time period.

57. In most countries, legislation must be enacted to establish the legal and institutional basis for a national PRTR system and the legal provisions for enforcement. However, the costs of this task vary widely from one country to another, depending on a large number of country-specific factors, such as parliamentary working traditions, power constellations and whether it is possible to modify existing environmental laws to provide a framework into which a PRTR system could be incorporated, all of which are too country-specific to attempt a quantification.

B. The environmental regulator

58. Within the PRTR system, a regulator can be seen to be acting on behalf of the citizens of its country. The regulator is seen to have a duty to identify and collect data and information to protect and benefit the public. In this function, the environmental regulator mainly incurs costs from its participation, while benefits accrue largely to the public at large. However, we shall see that the regulator can also draw on the PRTR system to obtain substantial benefits for its wider work.

13/ See web sites www.epa.gov/opei and www.epa.gov/p2 for more details.

59. Under a PRTR, the regulator plays an important role, identifying a target list of pollutants (identified at relatively low cost, under low-information-threshold criteria) and monitoring regulated entities for compliance with relatively simple and straightforward reporting requirements. 14/ These can reasonably be expected to represent a fraction of the tasks that the regulator would be required to perform anyway under conventional forms of regulation.

60. The regulator's main tasks include defining and setting up the PRTR system, ensuring its smooth running and managing any systemic changes. 15/

1. Defining the system

61. According to the scheme envisaged by the negotiations to date, each Party to the protocol would draw up a national list of chemicals, which as a minimum included the mandatory list, which would form part of the PRTR legal instrument. Where the mandatory list is only a subset of the country-specific list, setting up their own system will include costs related to screening and testing chemicals.

62. In this case, the regulator has the important task of screening and testing chemical substances for human toxicity and adverse environmental effects and prioritizing these based on knowledge of human toxicity and hazards to the environment. This applies both to the initial country list as well as to any subsequent additions to the country list, based on the introduction of new chemicals into production processes, environmental changes or new scientific information which has come to light concerning human toxicity or hazards to the environment. The larger the list, the more complicated the prioritization task may become.

63. The burden of testing and screening chemicals naturally depends upon the extent to which the national list includes pollutants not on the protocol's mandatory list. 16/ The regulator must acquire information regarding the risk-related potential impacts of toxic chemical releases on human health and the environment if this information has not already been collected within the more general framework of environmental regulation.

64. Within this context, the regulator must also set thresholds for the chemicals to be included. However, this burden is limited by the fact that PRTR systems typically do not require the regulator to produce the extensive, costly and time-consuming studies necessary to establish quantified exposure levels, dose-response curves and threshold levels of significant or unreasonable risk that

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14/ See Karkkainen (2001).

15/ According to the Netherlands Ministry of Housing, Spatial Planning and the Environment, the total running costs for its PRTR comes to around $2.05 million. Environment Australia estimates its costs of collecting the data to be around US$ 258,000.

16/ For diffuse sources, the challenge is even greater as the emitting sources are very diverse and pollution loadings vary by product and production methods, by size, topography, soil characteristics, surface and groundwater flows, climate, ground cover, exposure to wind.

are often imposed through other regulation techniques. 17/

65. The costs related to these tasks concern scientific labour inputs to study and prepare reports on each chemical not already included in the mandatory list. However, the cost of this task can be minimized by relying on existing studies. 18/ This type of scientific knowledge can reasonably be expected to be highly transferable from one country to another.

2. Setting up the system

66. Once the rules have been defined, a regulator's task can be seen as making the rules operational. The regulator's main system set-up tasks, some of which are recurrent, include:

- Notifying facilities of their reporting requirements and assisting facilities' compliance;
- Purchasing software and hardware for the information management system;
- Preparing and distributing the report forms;
- Ensuring public accessibility; and
- Helping the public to access the register.

(a) Notification of reporting requirements and support to facilities

67. One of the regulator's tasks is to inform facilities of their reporting obligations. This is likely to involve developing instruction manuals, mass mailings to facilities within the relevant sectors, working with a wide variety of trade associations representing reporting industries and organizing local or national training seminars for the regulatory administrative staff in order to train them in providing technical assistance to reporting facilities. It could also include conducting workshops to explain the reporting requirements to the regulated community and to present ways of improving the estimation of releases. Guidance materials, such as instruction manuals, might be delivered on paper, CD-ROM or via the Internet. It could also involve setting up a telephone helpline. These aids would help facilities to understand their obligations under the PRTR regulatory measure.

68. The regulator might also consider preparing various tools to assist facilities with compliance. This could mean developing "smart" software, as was done in the United States, to help each facility to determine its reporting requirements and its emissions and transfers. Guidance documents to aid facilities may also be developed for individual industries or for specific chemicals. These documents would require scientific research inputs and would need to be updated regularly.

17/ Under the United States system, where exhaustive procedures are followed to determine whether a pollutant should be included in the list, it is sufficient to make the low threshold determination that a pollutant "can reasonably be anticipated to cause" chronic health effects and serious diseases at some level of exposure. This signifies a considerably lower burden of proof on the regulator in the case of a legal challenge to threshold levels.

18/ For example, in the United States, work has been done by the National Academy of Sciences. Information on health and ecotoxicity of most 650 chemicals included in the United States Toxic Release Inventory is available via the Internet in the form of the software package TRIFACTS located at http://www.nlm.nih.gov/pubs/factsheets/trifs.html. For toxicity information, see also http://www.epa.gov/tri/chemical.htm#ToxicityInfo.

69. Labour costs associated with these tasks relate to the training of the regulator's staff by attending local or national seminars, the labour input to prepare and deliver seminars and workshops to inform reporting facilities of their requirements and the preparation of the instruction manual. Labour costs are also likely to come from coordination activities with trade associations, the operation of a telephone helpline, enforcement activities and the preparation of scientific briefs (for individual industries or specific chemicals) and to develop the software for compliance assistance.

70. Material or other costs would include accommodation and travel expenses in connection with the seminars, the publication of the paper documents, the stamping of the CD-ROMs, the mailing costs for sending the documents to all the facilities covered by the PRTR system, material costs associated with setting up a telephone helpline and the telephone calls and the relevant fraction of the overhead costs of the regulator.

71. Due to the evolving nature of the PRTR mechanism, the documentation (instruction manual and industry- or chemical-specific scientific briefs) is likely to need updating on a regular basis. For this reason, this task is likely to include a recurrent cost component of both labour and materials. Cost savings are likely to be achievable by distributing the guidance material and updates via the Internet only.

(b) Purchasing software and hardware for the information management system

72. The regulator's second main task is to purchase the necessary computing capacity to store and process the PRTR information. This could involve upgrading the current computer system in place to enable it to deal with the PRTR data. It would also include selecting and testing new software and hardware.

73. The labour costs involved relate to the selection and testing of new materials and to planning and implementing a system change or new computer system. These tasks would have to be performed by a computer engineer.

74. Material costs include the purchase of upgrading material and additional hardware. Software costs relate to the purchase of licences to use the software. These are likely to be mainly one-off costs. Costs of software upgrades and support are recurrent.

75. Other recurrent costs relate to any additional computing capacity required to store and process the information once the system has been in place for several years.

(c) Preparing and distributing the report forms

76. Third, the regulator must prepare and distribute the reporting forms. This implies devising the exact format of the reporting form and its design. By the time of entry into force of the proposed protocol, it is assumed that only electronic reporting will be considered for use.

77. The regulator uses mainly labour inputs to perform this task. Administrators must draft a reporting form based on the PRTR legislation. How much time is needed to perform this task depends on how specifically the information requirements have been spelled out in the legal instrument, although administrators can also draw on the report forms that other countries have

developed. Computer engineers must post it on the web and make it electronically deliverable. They must also structure the computing system to handle the completed incoming forms.

78. The cost of devising a reporting form and of setting up the database to handle data inputs directly from facilities is a one-off cost. However, due to anticipated future changes to the system, there may be recurrent costs associated with this task, which are discussed in paragraphs 110-114.

(d) Ensuring public accessibility

79. The regulator also has a duty to adapt and maintain the database system to make it publicly accessible. The costs associated with adapting the system electronically to make it accessible to the public include a one-off cost for software development or purchase. Recurrent costs relate to system hardware upgrades to cope with the sheer quantity of the data, the development of new software or licensing costs of new software, Internet connections and CD-ROM production. This would make this cost partly recurrent. Equally, system maintenance costs are recurrent. 19/

(e) Helping the public to access the register

80. As (PRTR) information is a public good, its value increases with higher use. Therefore, it is in the regulator's interests to conduct outreach activities to make key groups and the public aware of the PRTR mechanism. Targets of such efforts are journalists, educators, libraries, public interest, labour and environmental groups, trade associations and regional regulatory institutions. The regulator can encourage these individuals and groups to acquaint new users with the PRTR data and to provide feedback once the system becomes operational.

81. Furthermore, the regulator would be expected to ensure that the public has access to the database and that, as far as possible, it understands how to use the information contained therein. As far as access is concerned, this could be improved by delivering the PRTR data either in CD-ROM format or by mail to any interested individuals. It could involve liaising with public libraries and perhaps even providing additional Internet access facilities to these (or other public places) that could be designated only for PRTR use, depending on expected demand. Once online, the public can be provided with a searchable Internet site including geographical information system (GIS) mapping opportunities. GIS mapping help could be given by means of a short step-by-step online demonstration of the software. Further assistance could be provided via a telephone helpline to address questions by the public. It may also involve holding workshops.

82. The costs associated with these options include labour inputs by a computer engineer to adapt GIS mapping tools to public use, including a step-by-step demonstration, to operationalize and to provide continuous computer support to any PRTR-designated systems in public libraries

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19/ Cost estimates for making the data publicly accessible were available for the United States and the Netherlands. The former gave an estimate for the development of an Internet-based search engine (called TRIExplorer) costing $350,000 to develop over two years. The annual cost was estimated to be $80,000. The Netherlands developed a system called "Datawarehouse", which cost around $1.23 million. Friends of the Earth set up a pioneering web site, Factory Watch, which combined interactive electronic maps and the emissions database of the Government of the United Kingdom to permit easy public access from an Internet connection. They estimate the burden to have been 2 person years of work for the initial web publication, including some data validation, database management, programming, artwork and editing and some data analysis. Updating the site imposes a burden of about 3 person months.

(or other public places) and for any computer-related helpline inquiries. Administrative labour inputs would include manning the telephone helpline, organizing and providing training at possible public workshops or courses and answering written queries.

83. Material costs would include hardware and software for PRTR-designated systems in public libraries (or other public places), travel and accommodation of administrative staff involved in workshops, printing and copying of training packages and PRTR raw data, stamping CD-ROMs and mailing of raw data to individuals.

84. Costs could be minimized by standardizing the public training programme to develop standard information packages that can be delivered by regional environmental offices (or post offices) all over the country and by choosing to deliver documents via the Internet, where reasonable. An informational training network could be established via regional environmental offices or schools or universities or NGOs working in this area with the aim of providing training to parties that would disseminate this knowledge to reach the widest possible interested audience.

85. However, it can be argued that including these costs as consequent on a PRTR is unreasonable and that the regulator's effort of helping the public access the register may well form part of its normal public relations tasks.

3. Running the PRTR

86. The regulator's main running tasks include 20/

- Processing the submitted data;
- Validating the quality of the data;
- Enforcement actions;
- Dealing with confidentiality claims;
- Analysing the data; and
- Disseminating the data.

(a) Processing the submitted data

87. The regulator is in charge of managing and storing the submitted data and any updates that it receives on an ongoing basis. The tasks involved, and their respective costs, will vary, depending on the reporting media allowed under the system. By the time of entry into force of the PRTR protocol, it is likely that reporting forms will be delivered electronically.

20/ In the United States, one of the Government's roles has been to defend itself in costly litigation. In a number of court cases, the Government's right to include certain chemicals on the substance list has been questioned. However, it is expected that litigation will be unlikely to arise to the same degree in other countries. For example, the European Union's European Pollutant Emission Register (EPER) system is subject to the so-called precautionary principle, which forms part of a structured approach to the analysis of risk, as well as being relevant to risk management. It covers cases where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU. Corporate cases in the United States include (i) Dayton Power and Light Co. v. Browner, (ii) National Oilseed Processors Association v. Browner, (iii) Tozzi v. United States EPA, (iv) Troy Corp. v. Browner. One example of a citizens' suit is Council of Commuter Organizations v. Metropolitan Transport Authority.

88. In the absence of electronic reporting, the regulator must input all the data manually into electronic format (with a view to making it accessible to the public electronically). The risk of manual data entry is that a significant number of errors can creep in, and therefore allowing manual form submissions raises the regulator's burden by necessitating data entry and subsequent careful data screening and corrections.

89. Manual reporting can be expected to add significant costs to the PRTR system. Additional costs arise from the large labour input required to enter the data, the resulting burden of cross-checking data entries for mistakes and correcting these. The United States experience shows that due to the manual reporting mode, the cost of data entry and handling is substantial (about US$ 6 million a year for a volume of 100,000+ report forms out of a total annual budget of US$ 16 million for administering the whole TRI programme). Additional costs also include material costs of making printouts of the database entries and sending them back to the facilities for verification.

90. Electronic reporting greatly facilitates the regulator's task and leads to substantial cost savings. It saves the regulator the burden of inputting data manually and thereby decreases the turnover time between receiving the data from the facilities and making them publicly available. This could make the PRTR system more effective. Electronic reporting has the advantage that automated data quality checks can be implemented on data entry. 21/ It also avoids data entry errors, the resulting screening and corrections, and the need to print out final database entries and mail these to the reporting facilities for verification.

91. Once the data are received, it falls on the regulator to screen for mistakes in or inconsistencies of the submitted data and to notify significant errors to the respondent. It must also process reporting facilities' corrected submissions.

92. Costs associated with an electronic reporting mode relate almost exclusively to labour. Inputs would be required from a computer engineer to programme the initial electronic data checks, relying on labour inputs from the regulator's administrative staff. The engineer would also have to develop software to ensure that the data submissions are integrated smoothly into the database. Recurrent costs will be incurred in this category every time there is a change to the reporting form.

(b) Data quality assessment

93. In the light of the central role played by information under a PRTR system, one of the primary activities of a regulator must be to check the reliability and completeness of the PRTR data. To improve reliability, the regulator may choose formal, extensive and systemic validation of the submitted PRTR data. However, whether this is necessary to achieve an acceptable degree of data reliability is a moot point. A number of negotiating parties have argued that only minimal data validation is needed, such as ad hoc checks of a small number of reporting facilities. Pilot studies may be of help in guiding policy-makers to establish their preferences in this area.

21/ In Australia, most data validation is performed on an automated basis at the time that the data are loaded into the main database. Environment Australia estimates this facility cost to be A$ 20,000 (ca. US$ 25,850), which includes a data deposit feature as well as validation.

94. Extensive data quality assessment tasks might include identifying the suspect release data, relying on data analysis, trends (see para. 106) and rankings (see para. 97), contacting facilities to discuss how to improve and correct estimates and conducting on-site visits to discuss the estimations or calculations, check estimation records or perform estimations or calculations again 22/ (see para. 97). Training the regulated community in proper estimating techniques and form completion, as well as operating a technical hotline and issuing chemical or industry-specific guidance documents (all discussed in paras. 67-71) are all expected to improve the data quality. Many of these tasks would normally be carried out by an independent contractor hired by the regulator.

95. Data checks can be kept to a minimum by automating this process, as in the Australian case (see footnote 21).

96. The costs of data quality assessment can be significant depending on the degree of validation being carried out. If this level exceeds automated validation, the costs would involve mainly labour inputs. Administrative staff would need to perform the preliminary data analysis with a view to identifying suspect release data. These costs overlap with the data analysis activities that need to be performed anyway (see para. 107). Engineers would be needed to contact the facilities and discuss the data and to perform site visits, estimation or calculation exercises. Costs will vary greatly according to which chemicals form part of the PRTR system and how expensive the emissions and transfers are to estimate or calculate and how many facilities are determined to have submitted suspect data. 23/

(c) Enforcement actions

97. The regulator must also determine non-compliance. Enforcement actions falling on the regulator include determining non-compliance and, where established, may also involve issuing fines depending on the regulator's legal competencies. 24/ This burden is likely to include some information-gathering to identify potential non-reporters. To prioritize sites for PRTR enforcement action, the regulator can rank facilities according to the extent of the violation, the scale of releases or transfers, their potential risk to human health and the environment, the history of legal violations by a facility and trends established through the analysis of reported PRTR data. This task relies on inputs from the analysis of the data (see paras. 106-107). Furthermore, the regulator may need to conduct on-site visits, technical discussions and the measurement, calculation or estimation of emissions and transfers and checks (see para. 155). This task is also likely to require following up complaints made by consumers.

22/ According to the German Umweltbundesamt, validating the data accounts for the largest share of costs of a PRTR. For a reliable quantification of emissions, it estimates that twelve measurements are required per year and material with a cost of US$ 23 to $695 per analysis is required. The Netherlands Ministry of the Environment estimates data validation to cost around $288,000 per year.

23/ According to the State Environment Agency of North Rhine-Westphalia (Germany), the costs of the extensive validation efforts under their reporting system of air emissions makes up roughly one third of the costs of the system, i.e. roughly DM 1.2 million.

24/ In certain countries, the regulator can issue fines, while in other countries, fines are exclusively under the remit of the judiciary.

98. The costs of enforcement activities involve mainly labour inputs and vary based on the extensiveness of validation efforts. 25/ Administrative staff would need to perform the preliminary data analysis with a view to identifying non-reporters. Engineers would be needed to contact the facilities and discuss their volumes of emissions and transfers, to perform any site visits for measurement, calculation or estimation exercises. Costs will vary greatly according to which chemicals form part of the PRTR system and how expensive the emissions and transfers are to measure, estimate or calculate and how many facilities are suspected of being non-reporters.

99. Monitoring and enforcement costs incurred by the regulator can be either opportunity costs of other activities that are displaced to accommodate expenditures for the new programme or the private costs imposed on taxpayers to support the increased government expenditure necessary to implement the programme. These costs are typically based on the cost of necessary administrative activities.

100. In certain cases, the regulator must also determine the level of fines and enforce these. 26/ A system of determining fines for regulatory non-compliance is likely to be in place anyway and the regulator can adapt this system to the PRTR instrument. For this reason, one might expect this item to impose only a small additional cost to the system or even make up a net income. Fines represent revenue for the regulator, which helps to offset some of the costs of the PRTR system.

(d) Dealing with confidentiality claims

101. Situations in which confidentiality claims are made are expected to be specified, at least in outline, in the protocol. 27/ Typically, in a confidentiality claim, an entity has provided evidence to substantiate its claim that disclosure might cause the claimant commercial harm. Regulators must process and store this information and review the information for completeness, compliance with the legal requirements to prove confidentiality and, in certain cases, frivolousness. Depending on the confidentiality procedure defined by the protocol and the regulator's legal remit (see footnote 24), if the information is deemed not to be confidential and it is determined that the facility's claim was frivolous, the regulator may be entitled to impose a fine. This generates revenue for the regulator. If the claim is accepted, the regulator must securely store it and prevent public access accordingly. These data are not made available to the public.

102. The United States Environmental Protection Agency has developed a standardized claim-substantiation form and this could be considered as another potential task for the regulator under this heading. The form can reduce confusion about the information to be supplied to meet the statutory criteria and can guide reporting facilities to determine whether they have a sufficiently strong case to make a confidentiality claim. According to the Agency, 28/ the standardized substantiation form has:

25/ In the United States, the Environmental Protection Agency's (EPA) compliance monitoring is minimal and, hence, costs have been relatively low. The EPA inspects only approximately 3% of firms in a given year. While this means that persistent non-reporters may go undetected because there is no reliable way to identify them (EPA estimates that one third of regulated facilities fail to comply with reporting requirements each year), the system appears to work well despite these limitations.

26/ See footnote 24

27/ The criteria for allowing confidentiality in the United States are listed in footnote 33 and US EPA (2000b).

28/ See US EPA (2000b), p.5.

- Enabled reporters to adequately understand and develop information necessary to submit a sufficient claim;
- Enabled the regulator to ensure that all submissions are evaluated on the basis of comparable information;
- Served as an efficient identifier of the trade secret status of the document and, hence, ensured the use of appropriate Agency handling and routing procedures protective of the confidentiality.

103. Confidentiality claims by entities impose costs on the regulator. The latter uses administrative labour inputs to draft a standardized reporting form (if applicable), to process the claim, research it, store it as trade secret information and, in certain cases, determine and impose a fine for frivolous or vexatious claims.

104. Costs of processing and storing the confidentiality claim relate to activities such as affixing document-control number labels and trade-secret cover sheets, processing the basic information about the claims, checking completeness and storing the submissions. Fixed costs are incurred for the maintenance and operation of the existing storage and filing system for confidentiality claims. Variable costs include those to inventory new claims, store, retrieve and check claims for completeness and review claims.

105. Costs of reviewing the confidentiality claim encompass those related to responding to public requests that the regulator should review specific claims. The costs of this process depend, to a large extent, on the merits of the claims and decisions that facilities make to contest the regulator's findings if a confidentiality claim is disallowed. The costs are also a function of the number of public claims filed and the number and magnitude of the regulator's own reviews. 29/ United States experience suggests that the number of public review claims is likely to be negligible, estimated at an average of one a year.

(e) Analysing the data

106. Another component of the regulator's running costs concerns the regular (statistical and economic) analysis and interpretation of the PRTR data and resulting trends.

107. This cost component involves labour time spent on data analysis. The analysis of the data would also be used as input for the data validation process and for the determination of non-compliance and the subsequent issue of fines.

29/ In some cases, notably the United States, heavy costs can be imposed by legal action if a (public) petitioner, the regulator or the facility takes legal action in the context of the review of confidentiality claims. However, no estimates of these costs have been attempted in the United States context due to the difficulty of estimating legal costs and because there were no cases under existing programmes on which to base such estimates.

(f) Disseminating the analytical outputs

108. This cost component involves labour time spent on preparing the document to be published and on dissemination activities, including public relations activities. Material costs include printing and publishing and mailing costs.

109. Some of these costs can be minimized by delivering the analysis in electronic format to save printing, publishing and dissemination costs.

4. Managing changes to the system

110. Amending reporting requirements, including or deleting chemicals on the substance list, changing thresholds and the activities covered (see paras. 183-198), also falls on the regulator. These changes can arise as scientific information becomes available which suggests that additional chemicals should be included in the list, that certain chemicals should be deleted from the list or that thresholds should be changed to reflect this information. Equally, environmental changes and expediencies may require such changes.

111. Initially, it is difficult for the regulator to gauge what percentage of polluters will actually be covered by the PRTR regulations. If the initially defined PRTR system covers too few polluters, then clearly there is a case for changing the thresholds or the activities covered under the initial scheme.

112. Revising substance lists may place a large burden on the regulator in that it may necessitate an intensive review that includes chemical and toxicity analyses of the chemical or chemicals to be included. These tasks and the resulting costs were already discussed in the context of adding chemicals to the mandatory list to form the national list (see para.61).

113. However, changing the substance list at a later stage also has a number of consequences for other activities already performed and the consequent costs are likely to be high. For example, list amendments require additional resources to:

- Inform facilities of new compliance requirements, including updating the instruction manual and industry-specific information and possibly preparing additional information materials related to the new chemicals;
- Update the compliance assistance tools, including the smart software, to deal with the new chemicals or to do away with the chemicals taken off the substance list;
- Inform regulatory staff and train them in providing information and updates on the new regulatory requirements;
- Change the software that enables the submitted (or manually entered) electronic data to be stored in the database;
- Inform the public and all its constituent parts of such changes;
- Deal with processing (net) 30/ additional data, their validation and enforcement activities;
- Check (net) additional confidentiality claims;

30/ This relates to the additional data, net of the deleted data consequent on the deletion of chemicals from the substance list.

- Cover the (net) additional chemicals in the data analysis; and
- Possibly expand the data storage capacity.

114. Due to the evolution of scientific knowledge, list changes are likely to be inevitable. 31/ However, cost savings are likely to be achievable by anticipating future needs, as far as possible, and by avoiding frequent list changes or those that are expected to add little overall value.

C. Regulated facilities

115. Under a PRTR system, facilities are under a legal duty to comply with regulations, thereby incurring costs. The legal obligation imposed on a facility is simply to report emissions and transfers above a specified threshold.

1. PRTR obligations and related tasks

116. Facilities are required to conform to their obligations under a PRTR. 32/ This is likely to involve activities such as:

- Determining reporting obligations on a preliminary basis;
- Performing measurements, calculations and estimations;
- Completing and submitting reports;
- Keeping records and filing;
- Confidentiality claims;
- Participation in the consultation process; and
- Possibly notifying suppliers in the supply chain.

(a) Preliminary determination of reporting obligations

117. To determine their potential reporting obligations under a PRTR system, firms must assess the quantities of listed toxic chemicals manufactured, processed or otherwise used at the facility. This requires approximate measurement, calculation or estimation of their emissions and transfers, using purchasing records or production data to make threshold determinations.

118. To assess whether they have compliance obligations, facilities must acquaint themselves with the compliance rules and compliance assessment software and to this end may need to attend training workshops organized by the regulator, contact the telephone helpline or study other guidance materials made available by the regulator.

119. The costs involved relate to labour inputs by engineers and technical staff to familiarize themselves with the definitions, exemptions and threshold requirements under a PRTR programme, including attending workshops, studying the guidance materials and making enquiries, to review the list of chemicals and to conduct a preliminary assessment of reporting requirements.

31/ This is at least what is suggested by the Australian and the United States experience of systems already in place.
32/ Environment Australia estimates the costs of a facility's participation in the PRTR to be around US$ 1034 a year.

120. These costs are imposed on facilities that would not necessarily report under the system if, after performing this task, they established that they were not exceeding the set threshold. According to the United States Environmental Protection Agency, these costs will diminish after the first reporting year.

121. Generally, companies could be expected to already have an approximate idea of whether they are using, releasing or transferring the listed substances, and, if so, in what approximate quantities. Therefore, in many cases, the task of determining whether or not there is an obligation to report should not be too onerous.

(b) Performing calculations, measurements and estimations

122. Once the facility has determined that it must report under the PRTR, it must complete the reporting form and submit it, typically on an annual basis.

123. This task requires the facility to perform in-depth measurement, calculation or estimation of the emissions and transfers, based on the preliminary compliance determination discussed above (see para. 117). It is also required to validate these determinations. Measurement involves actual monitoring of a substance, at the facility, via a given discharge route. This can involve either continuous measurement or short-term or spot measurements. Calculations are based on data collected at the facility and can be derived either through a mass-balance approach or by using emission factors derived from similar facilities with similar processes. Finally, estimations are based on more generic data, derived from similar facilities or processes and are based on the use of emission factors.

124. According to the United States Environmental Protection Agency, the costs of calculating reporting requirements diminish in subsequent years because the facility has conducted the necessary reviews of its operations and it understands the reporting requirements.

125. The costs of this activity depend on which method is used to assess emissions and transfers and on the specific chemicals that need to be evaluated. The cost of this task encompasses the labour inputs required to search data sources, to perform in-depth measurements, calculations or estimations in order to assess the legal reporting obligations under the instrument, to review this information and to report the data for submission to the regulator. These costs are recurrent as this information is typically required annually. However, it is expected that over time experience will cut the labour time required for this task due to the learning curve.

126. The costs of this task may not be fully attributable to a PRTR, since firms may perform many of the required measurements, calculation or estimations to comply with other legislation or for their own internal purposes.

(c) Completing reports

127. Once facilities have made the required calculations, measurements or estimations, they are required to report these to the regulator. This requires filling in and submitting the PRTR reporting form to the authorities.

128. The costs of this task are likely to involve small labour inputs to transcribe the data from the calculations, measurements and estimations into the (electronic) reporting form and to submit it.

(d) Keeping records and filing

129. Reporting facilities are typically required to maintain records for a specified number of years. This means that they may need to file documents, calculations and other information used to prepare their report submissions, such as prior years' data, inventory data and purchase records, process diagrams that indicate releases and waste management activities, monitoring records, flowmeter data, manufacturers' estimates of efficiencies, worksheets, engineering calculations and other notes.

130. The cost of this activity involves mainly labour costs to organize the filing system and progressively supplement it with the correct documents. Materials inputs would be likely to include filing materials and office furniture. Such costs are expected to be negligible.

(e) Confidentiality claims

131. During the reporting process, a facility may establish that making some information required by a PRTR public may cause it commercial harm. In this case, it will apply for a specific portion of the information it submits to the regulator to remain barred from public access.

132. If the facility claims that the identity of a chemical is a trade secret, it must provide supporting documentation to substantiate this. The substantiation is designed to gather sufficient factual support to indicate whether the claim will meet the criteria for confidentiality, set out in the instrument. The burden is on the industry to prove that the data may be withheld from the public.33/ Typically, the facility can be expected to submit an explanation containing the reasons, including specific descriptions, why the subject information satisfies the criteria for confidentiality.

133. Where such cases arise, the costs of such a burden can be quite substantial for the facility. However, confidentiality claims are relatively rare. 34/

(f) Participation in the consultation process

134. Facilities may also request changes to either add or delete a chemical from the substance list. This would entail collecting information that purported to prove that the chemical meets or does not meet the criteria for inclusion in the list.

135. This can be an expensive task for a facility, as it would likely involve a literature search and compilation and presentation of the findings to the regulator. Mostly, scientific labour inputs would be required for this activity.

33/ In the United States, this entails indicating that the identity of the chemical has not yet been revealed, that a competitive advantage would be lost if the identity were revealed and that reverse engineering could not be performed to reveal the true identity of the substance if confidentiality was granted.

34/ For example, in the United States, only about 16 confidentiality claims were filed under the relevant law relating to the TRI when the basic system was in place. Subsequent expansions of the system, including adding over 300 chemicals to the substance list and widening the scope of activities covered, led to an additional 13 confidentiality claims on average.

136. On the other hand, this represents an opportunity rather than an obligation for a company. Also, the number of submissions of this nature are expected to be small. 35/

(g) Possibly notifying suppliers in the supply chain

137. Under a PRTR, suppliers of facilities in certain Standard Industrial Classification (SIC) codes may be required to develop and distribute a notice if the mixtures or trade-name products that they manufacture or process, and subsequently distribute, contain listed toxic chemicals.

138. This task includes the time required to inform customers, either by letter or through a predetermined reporting form.

D. The public sphere

139. A defining characteristic of this group is that the public has no duties under a PRTR mechanism. Its participation in the scheme is not imposed by law, suggesting that its perceived benefits clearly outweigh the costs of its participation in the scheme. 36/

140. The public's role in a PRTR system is to act as the regulator's partner in correcting market failures, by means of corporate disciplining mechanisms uniquely under its control. The public also acts as a watchdog for the regulator, making the latter aware of any deficiencies in the system and providing it with valuable research inputs to improve the system.

141. As the public sphere has many different embodiments, including trade unions, NGOs, community residents, employees, consumers, environmental organizations, researchers, journalists, activists and elected officials, it is impossible to quantify, with any precision or claim to reasonableness, the costs incurred by each and every one of these constituents in their numerous and changing activities.

142. They put the data in the public sphere to numerous uses. The main functions of the public sphere within the PRTR system include:

- Training to use PRTR data and analytical tools;
- Preparing and disseminating the analysis of the data;
- Campaigning; and
- Providing legal counsel to certain affected parties.

35/ In the United States, only 11 a year are made on average.

36/ This may be because, by acting on its behalf, the regulator bears much of the costs of the PRTR, and the public does not count these costs although, ultimately, the taxpayer bears these costs unless other administrative costs are reduced to accommodate the new programme. It may also be that the benefits to the public outweigh both its costs and the regulator's costs.

143. This analysis does not attempt to quantify the public's costs of participation, as these are voluntary and a function of the effort that any public interest grouping chooses to spend in any given time period. It would be close to impossible to reasonably estimate such costs.

1. Training to use PRTR data and analytical tools

144. To participate in PRTR data analysis, the public must be conversant with the use of analytical tools such as GIS mapping and other software related to the PRTR data. This means that it will have to acquaint itself with these tools or to formally undergo training. Public groups may also organize and provide training sessions.

2. Preparing and disseminating the analysis of the data

145. On the basis of PRTR data, public interest groups can set environmental management priorities, raise awareness and educate the public about toxic chemical emissions and potential risk. 37/ In this context, the data can be used to compile reports of offending facilities and to hold them more accountable for the full extent of their toxic pollution. The data can be used to track trends over time, to identify regional pollution sources or to monitor compliance with voluntary reduction targets set by facilities. Sometimes, this research is used to make recommendations for amending legislation.

146. To undertake the analysis, public interest groups typically use analytical tools such as dynamic GIS mapping. Other tasks can include devising benchmark measures, such as the scorecard system operated by the NGO Environmental Defense of the United States or the jobs-to-emissions ratio. The latter calculates the number of pounds of emissions per job in a given industry and location. This ratio is then compared to a national or other average to determine relative performance and can also be tracked over time to evaluate improvements.

147. Dissemination can occur at low cost, mainly via groups' web pages or by e-mail. Some publications may be printed as reports and imply publishing and printing costs. Groups must also bear the labour costs of analysing the data, setting up web sites and web pages and updating these, overhead costs and public relations activities to raise awareness of the issues at stake.

3. Campaigning

148. Campaigning is a core activity that the public engages in. To achieve results, it makes use of a number of tools at its disposal, including political, market and community pressures and consumer boycotts, all of which serve as threats to a facility's reputation and standing and can have very negative effects on its profitability. These instruments serve to discipline poor corporate environmental performers and reward superior performance.

37/ For example, in the United States, Orum and Wohlberg (1994) report that well over 100 state and local reports and more than 30 national TRI reports had been compiled by public interest groups at the time of writing. Also the Environmental Protection Agency has reported that 1,500 community groups use the data in their dealings with local government and industry.

149. Communities can use PRTR data to begin dialogues with local facilities and to encourage them to reduce emissions and transfers, develop pollution reduction targets and improve safety measures. 38/ Extensive negative publicity can sometimes lead to negotiations to cut emissions and transfers between activists and initially reticent facilities.39/ Trade unions can also play a role in calling for emissions and transfers reductions and put pressure on facilities to agree to these. 40/

150. Access to industry information enhances citizens' political stature and ability to push for risk reduction and protection of public health. Equipped with evidence of toxic threats to the community, citizen groups can secure State funding for toxics monitoring.

4. Providing legal counsel to certain affected parties

151. On the basis of the data, public interest groups may also assist individuals in pursuing legal claims through the courts. Their interest in doing so may be to set a valuable legal precedent or to enforce perceived justice.

E. Benefits 41/

1. Benefits to regulator

152. Many public policies in areas concerning air, water, waste, radiation, emergency response (including compensation and liability), health, regulation enforcement and compliance, ethnic minorities, low-income households and research are linked to a PRTR. Policy makers in these areas can benefit enormously by making use of PRTR data as inputs into their decision-making.

38/ According to National Wildlife Federation (1990), Phantom Reductions: Tracking Toxic Trends, a number of prominent companies in the United States made commitments to reduce toxic chemical emissions, including AT&T, which committed to a 100% reduction in TRI chemicals to air between 1987 and 2000; Dow Chemical, which committed to a 50% reduction in TRI chemicals to air between 1988 and 1995; Dupont, which committed to a 60% reduction in TRI chemicals to air between 1987 and 1993, a 90% of reduction in TRI carcinogens to all media between 1987 and 2000, a 100% reduction in TRI chemicals to land between 1987 and 2000, and a 35% reduction in all hazardous waste between 1990 and 2000; GE Plastics, which committed to a 75% reduction in TRI chemicals to all media between 1987 and 1992; Merck & Co., which committed to a 100% reduction in TRI carcinogens to air between 1987 and 1993 and to a 90% reduction in TRI chemicals to all media between 1987 and 1995; 3M, which committed to a 70% reduction in all toxic chemicals to air between 1987 and 1993 and to a 90% reduction in all toxic chemicals to all media between 1987 and 2000; Monsanto, which committed to a 90% reduction in TRI chemicals to air between 1987 and 1992 and a 70% reduction in TRI chemicals to all media between 1987 and 1995; Occidental Chemicals, which committed to a 10% reduction in TRI chemicals to air each year; Union Carbide, which committed to a 67% reduction in TRI chemicals to air, water and land between 1987 and 1993 and to a 30% reduction of off-site chemicals between 1987 and 1993; and Upjohn, which committed to a 90% reduction in TRI chemicals to all media between 1987 and 1992.

39/ For example, in the case of Syntex Chemicals, an identified major Colorado polluter, extensive negative publicity led to negotiations between activists and the facility concerning emission reductions by 50% over a number of years. This also led to the setting-up of a community advisory panel to facilitate communications between the facility and the community.

40/ For example, in Minnesota, the Amalgamated Clothing and Textile Workers Union called for emission reductions at a local facility found to be one of the largest emitters of carcinogens to air in the country. Contract negotiations between the union and the facility resulted in an agreement to reduce the use of toxic chemicals by 90% over a period of several years.

41/ Some delegations hold that some or all of these benefits may also be available under the BAT regulatory approach.

Therefore, it could be of value to streamline existing policies in these areas to take into account the information provided by a PRTR system. The costs to these policy areas of adapting the PRTR information and the clear spin-off benefits arising from the existence of a PRTR system are difficult to quantify, however. Potential uses of the PRTR information in different policy areas are discussed below.

153. In the area of air and water pollution and waste prevention, PRTR data and trends can be used as a screening tool to prioritize proposed regulations and industrial source categories to promote pollution prevention in rule-making for these three areas. For example, the data can be used to estimate the number of major sources of air or water pollutants and, if necessary, adapt legislation to cover the main sources if these are missing or the thresholds defined in existing pollution abatement legislation to these findings. Potential water or sediment contamination sources can be identified on the basis of the PRTR data. Trends in the PRTR data can be used as indicators to track progress in implementing legislation in these areas. Finally, the data can be used to identify chemicals that experienced a dramatic overall increase in discharges or releases, which could be good candidates for future development of regulatory controls, related to these media.

154. As far as health policies are concerned, these could benefit from an improved understanding of the health effects of emissions and transfers of the chemicals in a PRTR, especially those that arise in geographical pockets most exposed to certain chemicals, and their resulting costs to the public health-care system. This could be achieved by developing risk-screening models which would provide comparative information regarding toxicity and the risk-related potential impacts of toxic releases on human health, exposure potential and the size of receptor populations, which would all be mapped onto the PRTR data.

155. The PRTR data can also play a role in enforcement activities. In this context, the data can be used to assess the effectiveness of environmental laws in reducing risks from sites. The sites can be ranked, based on these data, according to their releases of pollutants, potential risk to human health and the environment and their history of legal violations. This information can provide a means to prioritize sites for enforcement (see para. 97). Further, it can be very helpful to enforcement staff in identifying pollution prevention projects that can significantly reduce emissions and transfers or those that help prevent or minimize the release of extremely hazardous substances, which is an important informational input for the enforcement of alternative regulatory mechanisms.

156. The trends found in the PRTR data may also be used to assess whether or not certain minorities or income groups of society are particularly susceptible to higher-than-average emissions in the areas in which they reside. 42/ This information is important to form public policies to protect lower-income groups and minorities.

157. PRTR data can provide substantive inputs into academic research.

42/ For example, in the United States, a population-weighted average emission for each county was used to establish that minority groups except Native Americans tended to live in counties where TRI air emissions levels were higher than in counties where non-minorities lived. However, surprisingly, the data also suggested that household incomes tended to be higher in counties with higher TRI air releases.

2. Benefits to facilities

158. The legal obligation imposed on a facility through a PRTR is simply to report emissions and transfers above a specified threshold. However, this may set into action other mechanisms, which lead facilities de facto to reduce their emissions and transfers and to implement sometimes costly pollution abatement technologies.

159. It may be difficult to disentangle the direct effects and resulting costs of a PRTR system from the indirect effects and costs of "voluntary" environmental action that they would take anyway, in the absence of such a mechanism. While facilities engage in certain costly pollution abatement without a legal obligation to do so, it would be wrong to view such actions and their costs as entirely unrelated to the PRTR system.

160. The systematic collection of data on emissions and transfers under a PRTR can be considerably more valuable to facilities 43/ than the fragmentary data submitted for other regulatory mechanisms, which do not centre on the so-called "right to know". 44/ This is because the systematic data provided by a PRTR has led companies to initiate changes such as the use of alternative chemicals, improved chemical use controls, increased equipment efficiency, improved manufacturing process and reduced point source and fugitive emissions. 45/

161. A PRTR mechanism encourages cooperation and the exchange of information between a facility's management and its technical engineers, which can lead to the development or implementation of more environmentally friendly technology and to cost savings and higher efficiency. In existing PRTR systems, many company managers have discovered that pollutant emissions can be a source of lost revenue. Many companies have reported significant cost savings through the implementation of cleaner production initiatives and from the use of recycled materials

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43/ Anecdotal evidence collected by the United States-based Working Group on Community Right-to-Know suggests that the TRI has yielded valuable information for facilities that they were not previously aware of. For example, Richard Harding of Eastman Gelatine was quoted by *North Shore Sunday* (Danvers, Mass.) of 12 August 1990, "From our company's point of view, [TRI] helped us to discover a problem that we weren't aware of. We discovered we had leaking sewers and potential contamination of our water supplies." Further, Elizabeth Fisher of Rohm and Haas is quoted by the *International Conference Proceedings on Reporting Releases of Toxic Chemicals (Vienna, Austria)* in November 1991 as admitting that "for the first time, engineers have had to scrutinize their processes as a whole and quantify the wastes released to all media…in some cases [this] has revealed valuable information for process improvements…". On 24 July 1989, Randy Emery of Amoco was quoted in the *Houston Chronicle*: "[TRI] really forces us to look at the numbers in a condensed way, and it dawned on us that these were big numbers." Donald Berry of Dow Chemical, quoted in *Bay City Times (Mich.)* of 12 September 1994, admitted that Dow executives were surprised by the size of the TRI numbers. Steven Schoger of BP Chemicals was quoted in the July 1991 issue of *Occupational Hazards* as saying, "It's not necessarily that we didn't want to [reduce emissions] before. We never had the information we needed to know if progress was being made." Tom Gilroy of Chemical Manufacturers Association was quoted in *Atlanta Journal and Constitution* of 22 August 1991 as saying, "A lot of CEOs of our member companies were shocked. They didn't know emissions were that high." Finally, in its 1993 *Corporate Environmental Report*, Ciba Geigy wrote: "The initial demand for environmental reporting came from the public. But in responding, we have discovered that the information is extremely useful to our own management. We have learned about our successes, our inadequacies and the gaps in our knowledge."

44/ See Karkainnen (2001).

45/ A study conducted by the United States General Accounting Office in 1991 reported that representatives of the Chemical Manufacturers Association viewed TRI as a tool to help facilities identify equipment leaks and other inefficiencies that increased their emissions.

previously considered to be waste.46/

162. Moreover, a PRTR can serve as a useful foundation for pollution prevention within industry. Firms can compare, rank and track environmental performance among production processes, facilities, operating units and competitor firms. The data enable management to establish performance baselines, set improvement targets and track progress towards implementing these. These are important elements of turning corporate environmental goals into specific performance.

163. These comparison exercises also foster the transfer of technology within and among companies.

164. A PRTR can capitalize on its overall compatibility and overlap with leading edge corporate management, which aims to project an environmentally responsible public image. In the United States context, mandatory production and disclosure of TRI information has prompted many firms to undertake ambitious voluntary emission reduction programmes, often reaching far beyond the threshold levels. According to one Environmental Protection Agency survey, some 70% of reporting facilities under the TRI scheme indicate that they have made improvements under the influence of the TRI. 47/

165. Corporate environmental progress towards achieving its goals is an ongoing and open-ended process. A PRTR unleashes the potential for competitive forces to discipline firms. Competition drives facilities to continuously improve their environmental performance to enhance their public image and score highly in the comparative benchmarking exercises typical of PRTR systems in place. This contrasts sharply to the fixed environmental standards imposed by other regulatory mechanisms that set ceilings, which, once met, have no such continuity effect.

166. The costs of these voluntary activities, such as investing in and implementing new abatement technologies, while not strictly compliance costs, can be viewed as an indirect consequence of a PRTR system.

3. Benefits to the public

167. A PRTR provides workers and communities access to information on chemicals from which they are potentially exposed to risks. This helps them to make informed choices and take appropriate actions. In this sense, a PRTR system can make a significant contribution to environmental democracy.

46/ See UNITAR (1997). Also, there is considerable anecdotal evidence from the United States, collected by the Working Group on Community Right-to-Know, suggesting that the TRI processes lead to cost-saving measures for facilities. Randy Hinton of Vinings Industries was quoted in *The Atlanta Constitution* of 22 August 1991 as admitting that "[TRI] has helped Vinings save money because we did have to go out and actually calculate what we were losing. We could determine we were losing such-and-such chemical. It's cost us time and aggravation and headaches, but in the long run it has saved us money." Also, J. Ronald Condray of Monsanto was quoted in *World Wildlife Fund fact sheet*, April 1992, as saying, "The TRI provides a means where the public can track our progress and do so on a consistent, measurable basis. We are convinced that this activity will ultimately result in cost savings for the company and a competitive advantage." Elin Oak of the Florida Phosphate Council was reported in *The Ledger (Lakeland, Fl.)* on 20 April 1994 as saying that "[I]t is not only economically sensible to reduce these [TRI] numbers, it is also sensible from the standpoint of this industry's commitment to environmental stewardship."

47/ See Lynn, F. et al (1992), The Toxic Release Inventory, Environmental Democracy in Action, Office of Toxic Substances: EPA, United States.

168. The public also benefits from the system insofar as it induces reductions in pollution emissions and transfers that are hazardous to human health and the environment. However, it is very difficult to disentangle the cuts in pollutant emissions and transfers arising as a direct consequence of a PRTR system from those that would anyway have been achieved in its absence, through productivity growth and the ensuing application of modern pollution abatement techniques. For example, between its inception in 1988 and 1997, chemicals listed on the United States Toxics Release Inventory have declined by 42.8% despite a production increase of some 18%. 48/ However, it is difficult to know what percentage of those reductions is attributable directly to the implementation of TRI and what percentage would have been achieved even in the absence of a TRI.

169. The public "right to know" has been identified by the negotiating parties as the prime objective of the PRTR under the Aarhus Convention. 49/ This is considered to be a political right and, hence, is very difficult to value. Citizens can hold regulators accountable for enforcing policies requiring public dissemination of information. A PRTR therefore empowers the public to participate in regulatory decision-making about public information access policies and strategies.

III. SELECTED COST SCENARIOS OF A POTENTIAL PRTR UNDER THE AARHUS CONVENTION

170. This chapter reviews selected cost scenarios over time of a potential PRTR system under the Aarhus Convention. It begins by discussing some key features of a potential PRTR under the Aarhus Convention. Next, the burdens on the regulator and on the regulated parties are estimated and monetary values are assigned to these. Costs are discounted to allow for costs occurring in different time periods to be given a common unit of measurement and sensitivity analysis tests how key variables affect the estimation outcome. Finally, some possible expansions are considered, including their estimated burdens on and costs to the key stakeholders.

A. Identifying possible scenarios for a basic PRTR

171. Documentation of the Working Group's past discussions suggests that the PRTR under the Aarhus Convention may be implemented in different phases. This section discusses potential features of a basic system. Our model assumes that the basic system lasts for three years, before substantial changes to the system are introduced in a possible expansion.

172. For the basic system, we assume that reporting is mandatory and performed on an annual basis, the instrument will be multi-media, off-site transfers will be included, the reporting forms will be submitted electronically to the regulator and, finally, data validation will be minimal.

48/ See United States EPA (1999a). Also, the Regional Environmental Center for Central and Eastern Europe reports that in the first eight years of operation of the Canadian reporting system, its chemical industry documented a 90% reduction in releases of NPRI substances and a 60% reduction in total releases while production increased by 27%.

49/ See CEP/WG.5/AC.2/2001/5, para. 25.

1. Substance list and thresholds

173. The potential substance list for a basic system may vary. A minimum list would include the 55 substances contained in category I of document CEP/WG.5/AC.2/2001/5, annex I, part I, section 4, but exclude those linked only to diffuse sources/pesticides. The maximum list is likely to be formed from the mandatory and voluntary lists contained in annexes III and IV, respectively, to CEP/WG.5/AC.2/2001/7, totalling 260 substances.

174. A middle category, lying somewhere between these boundaries, might be made up of categories I and II from CEP/WG.5/AC.2/2001/5, annex I, part I, section 4.

175. Our numerical model defines different scenarios that are calculated based on varying the number of facilities reporting under a potential system and the average number of reporting forms they submit. Each substance commands one reporting form. To our knowledge, there is no reliable mechanism to map the list of substances to the exact number of facilities that would be reporting under any form of system, which in turn would determine the costs of the system.

2. Activities/facilities covered by instrument

176. As far as activities covered by the instrument are concerned, category I listed in CEP/WG.5/AC.2/2001/5, annex I, part II, section 4, could be considered a minimum option, while category II in CEP/WG.5/AC.2/2001/5, annex I, part II, section 4, could be considered a middle category. Category III in CEP/WG.5/AC.2/2001/5, annex I, part II, section 4, might be considered to reflect the maximum category.

177. As mentioned in paragraph 175 related to substances, there is also no reliable mechanism to map the activities covered by a potential instrument to the number of facilities that would be covered, which is what determines the costs. Our model estimates different cost scenarios based on the de facto number of facilities covered by the instrument and policy makers may be guided by the cost outcomes of these to assess which activities to cover, which substances to list and which thresholds to choose, all of which will ultimately determine exactly the number of facilities that report under the instrument.

3. Off-site transfers

178. Off-site transfers are discharges of a toxic chemical to the environment that occur as a result of a facility's transferring waste containing a PRTR-listed chemical off-site for disposal. These are generally released either to a landfill or a surface impoundment at an off-site facility or are injected underground. Where there is no known disposal method, it is also possible to transfer a chemical off-site for "storage", which is typically included as an off-site transfer if the chemical will remain at its storage site indefinitely.

179. Off-site transfers are envisaged in the basic system of the instrument. Specifically, off-site waste, as defined in the Basle Convention, plus indirect discharges to water via municipal sewerage might be included in the basic system.

180. Our model does not differentiate the costs of off-site transfers individually but includes them in the overall burdens on stakeholders captured by our calculations.

4. Data validation

181. Data validation can take the form of minimal ad hoc checks or extensive and formal auditing.

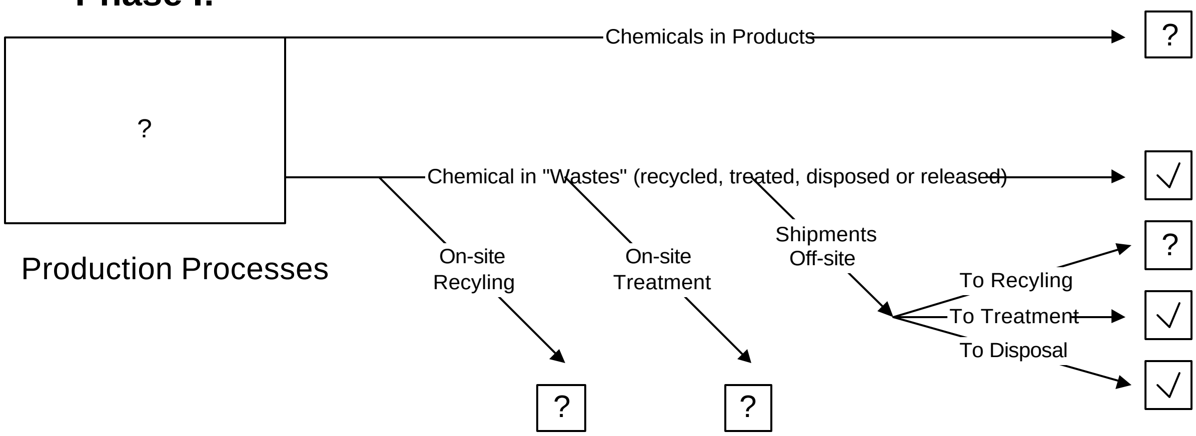
182. Our model is based on the former option but does not include any cost scenario for the latter option, due to the lack of data.

B. Identifying possible scenarios for an expanded PRTR

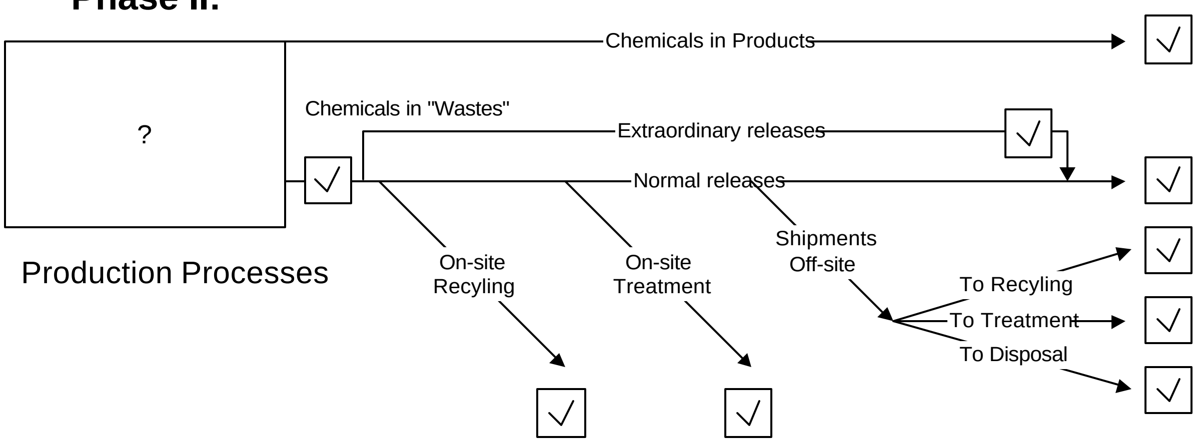
183. Once the basic system is in place, it is conceivable that some changes will be introduced in a later phase. We discuss some of the options facing policy makers. The expanded system is modelled to include changes in the number of facilities that perform the tasks described above, familiarization costs and higher labour input burdens on new reporters and on existing reporters that result from list expansions.

184. The following diagram summarizes some possible extensions to the basic system.

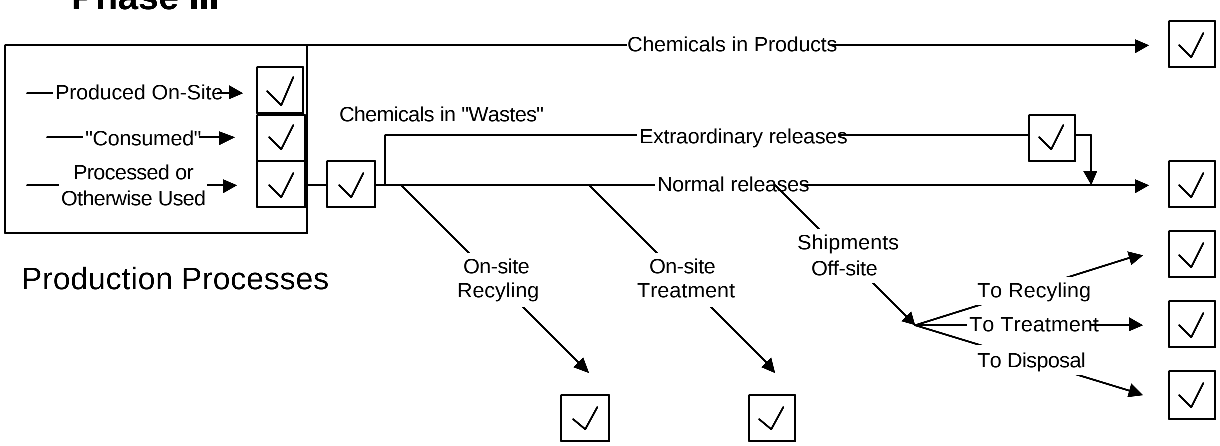
Phase I:



Phase II:



Phase III



1. Substance list changes and threshold changes

185. The most likely change to the system may be considered the expansion or change of the substance list.

186. According to the United States Environmental Protection Agency, additional chemicals do not add to the regulator's costs. Additional costs are incurred from the policy work necessary to determine whether to add the chemical to the PRTR list.

187. As far as facilities are concerned, the Agency reports that the addition of chemicals in the United States system has not increased the number of reports submitted by facilities, which has in fact gone down slightly from around 4.32, when the basic system was in place, to 3.5, even though the number of chemicals on the TRI list nearly doubled.

2. Changes to the scope of activities covered

188. Another likely system expansion involves changing or expanding the activities covered by the PRTR instrument.

3. Changes to release or transfer pathways

(a) Diffuse sources

189. In a possible expansion, diffuse sources such as transport and agriculture may be added to the instrument. Due to the lack of available cost information, this has not been costed. 50/

(b) On-site releases

190. On-site releases include emissions to the air, discharges to bodies of water, releases at the facility to land, as well as releases into underground injection wells.

191. There appears to be general agreement that on-site transfers, if appropriately defined, could be included as a PRTR element in the future.

(c) Product stream

192. Pollution via products may also form part of the expanded system. This is not costed due to the lack of cost information.

4. Other possible expansions

(a) Reduction targets

193. Reduction targets may be included in an expanded system. These are not costed due to the lack of cost information.

50/ The State Environment Agency of North Rhine-Westphalia gave a rough estimate of the costs of including diffuse sources in its air emissions reporting system. This was estimated as DM 1.5 million or around 40% of the system's total costs.

(b) Materials and energy inputs

194. Information on inputs, also known as materials accounting, can provide valuable help to parties attempting to assess the pollution emissions of facilities. In the United States, there is some public pressure to implement the "right to know more", which is seeking to have this information included in the United States system.

195. Materials accounting could form part of an expanded system but is not costed due to the lack of cost information.

(c) Radioactive substances

196. Information about radioactive substances may also form part of an expanded system. This is not costed due to the lack of cost information.

(d) Noise

197. Noise information may also form part of an expanded system. This is not costed due to the lack of cost information.

(e) GMOs

198. Finally, information regarding GMOs may also form part of an expanded system. This is not costed due to the lack of cost information.

C. Model features and assumptions

1. Type of model

199. The type of model we use is the direct compliance cost method. This approach to estimating social costs requires less information than alternative modelling tools, including partial or general equilibrium analyses.

2. System life cycle

200. The system life cycle ends when the system is terminated or replaced by a system that has significant differences in processing, operational capabilities, resource requirements or system outputs. When this is judged to take place is clearly a subjective choice. In some cases, a 10% change is judged to be significant, while in other cases a 30% change is considered to be significant.

201. We chose a three-year system life cycle for a possible basic scenario. This is based on the assumption that likely changes to the system in a future phase, such as a change to the substance list or to the activities covered under the protocol, would be substantive enough to significantly change the base system. Three years seems to be a reasonable choice for keeping an initial system in place before making substantive changes to it. The basic system costs distinguish set-up from maintenance costs.

202. A new three-year life cycle is modelled to take into account possible systemic changes. These are modelled to include changes in the number of facilities that perform the tasks described

above, familiarization costs and higher labour input burdens on new reporters and on existing reporters that result from list expansions (see paras. 185-188). Adding release or transfer pathways (see paras. 189-192) and other expansions (see paras. 193-198) have not been costed as no relevant information was forthcoming.

3. Cost categories

203. Our approach is to estimate the cost of resources for the main activities identified in chapter II, sections B and C. The cost categories include material costs, personnel costs, indirect (overhead) costs, depreciation and annual costs.

204. In cost analyses, personnel costs are typically divided into prevailing wage rates and salaries. If these are given in hourly rates, we use the factor 2,080 to obtain the number of hours employees are paid annually. 51/ Fringe benefits are included at a rate of 40%, considered to be a reasonable approximation of the summed cost factors for retirement and employee insurance and health benefits.

205. Overhead costs typically include fixed costs such as rent, depreciation, advertising, taxes, utilities, legal or secretarial support, accounting, headquarters management, data processing management and insurance. Overhead is expressed as a percentage of labour costs, including fringe benefits. The figure of 17% is considered to be a reasonable approximation of the overhead costs associated with the employment of personnel. Hence, the formula for determining the "fully burdened" cost of an employee is the direct annual salary/wage rate multiplied by 1.40 x 1.17=1.638.

206. Depreciation is used to spread the cost of tangible capital assets over an asset's useful life (the number of years it functions as designed). It is computed by comparing the original cost or value with the estimated value when it can no longer perform the functions for which it was designed. We use straight-line depreciation, which spreads the loss in value uniformly over the asset's lifetime.

207. Costs vary across the system's life cycle. Annual costs refer to cost elements that are estimated for each year of the basic system cycle, such as those relating to start-up and maintenance.

4. Intangible costs

208. This analysis attempts to include estimates of the projected costs which are as comprehensive as possible. Costs to which monetary values cannot be easily assigned can be included along with tangibles. To achieve these, such intangibles can be assigned relative numeric values for comparison purposes. These can then be evaluated alongside tangibles.

51/ This is based on the United States Government's recommendations contained in OMB Circular A-76, Supplemental Handbook, Part II – Preparing the Cost Comparison Estimates, Chapter 2 – Developing the Cost of Government Performance, B., Personnel Line 1, 6d – Annual salary/wages.

5. Other economic costs

209. The cost categories we estimate were described in chapter II. These include real-resource compliance costs and governmental regulatory costs. However, to capture total social costs, other economic costs are also relevant.

210. The total social cost is the sum of the opportunity costs incurred by stakeholders because of a new regulatory policy. Opportunity costs are the value of the goods and services lost by stakeholders as a consequence of their use to comply with the regulation and from reductions in output. 52/

211. These other economic costs include social welfare losses, transition costs and indirect costs. For the sake of completeness, we discuss these three categories briefly. Social welfare losses are those declines in consumer and producer surpluses associated with the rise in the price (or decreases in the output) of goods and services that occur as a consequence of the environmental programme. Transition costs include the value of resources that are displaced and must be reallocated, consequent on regulation-induced reductions in production, e.g. unemployed labour, firm closings, disrupted production, etc. These are offset by regulation-induced increases in resource use in both primary and related markets, such as more labour and capital inputs needed for pollution abatement. Finally, indirect costs encompass the adverse effects of policies on productivity, innovation, product quality and changes in markets indirectly affected by the environmental programme. These may have impacts on net levels of measured consumer and producer surplus.

212. Estimating these costs would require far more detailed analysis and data and would stretch far beyond the scope of this study. While it is not possible to accommodate these costs in a model of our type, cost estimations of this type can be handled in fairly complex dynamic models, based on a general equilibrium framework. These models are capable of capturing a very wide range of economic effects by modelling different sectors that make up a full but simplified real-world economy. However, they also suffer from a number of drawbacks which can greatly limit the relevance of their results.

6. Nominal vs. real values

213. Economic cost analyses are often most readily carried out using real or constant monetary values. However, where future costs are given in nominal terms, it is recommended that the analysis should use nominal values rather than convert these into constant monetary values. Conversion from nominal into real values is readily accomplished by dividing nominal costs by $(1+\pi)^t$, where π is the expected rate of inflation and t is the duration of the project. However, this requires an assumption about future inflation, which is highly uncertain and variable across different countries. Discounting, which is discussed below, must be adapted to whether the cost figures are given in nominal or real terms. Our estimates are provided in nominal terms.

52/ These costs do not take into account any of the health, environmental, safety or other benefits discussed in chapter II, which offset the social welfare costs.

7. Discounting

214. The costs of the PRTR mechanism are paid out at different points over time. Therefore, once costs for each year of the system's life cycle have been estimated, it is necessary to convert them to a common unit of measurement, i.e. into present value terms. This is done by adjusting future values to render them comparable to the values placed on current consumption and costs. Discounting reflects the time value of money and is conceptually founded on the assumption that present consumption is valued more than future consumption. The higher the discount rate, the lower the present value of future cash flows.

215. The proper discount rate to use depends on whether costs are measured in real or nominal terms. In the case of real costs to be discounted, the present (or discounted) value (PV) of a future amount is calculated using the following formula $PV = \sum_{t=0}^{T} C_t \cdot (1+\delta)^{\theta - t}$, where C_t denotes costs in each time period, *t* years and runs from the first year of the project (t=0) to the last year of the project (t=T), θ is the adjustment factor to formalize the assumption that costs occur as lump sums at a specified part of the year and δ is the discount rate. The adjustment factor, θ, can take the values 0, 0.5 or 1 to reflect the assumption that costs occur at lump sums at the end of the year, in the middle of the year or at the beginning of the year, respectively. The second term on the right of the PV equation is known as the discount factor. In the above formula, C_0 represents start-up costs that occur immediately upon implementation.

216. Nominal costs require nominal discount rates to be used, while real costs require real discount rates.

217. Discounting may be unnecessary if all costs occur in the same period or if costs are largely constant over the relevant time frame. In these cases, discounting may not add much value over and above an analysis based on a single year's cost data. Short time periods produce less dramatic effects of the chosen discount rate on the stream of costs (PV).

218. Despite its relative conceptual simplicity, choosing a discount rate can be contentious in practice. Risk considerations play an important role in the controversy surrounding the selection of a discount rate. In modern financial theory, the discount rate reflects the risk associated with a project. If there are high levels of uncertainty about future costs of a programme, then the discount rate should be adjusted upwards to reflect these risks. However, relative to the uncertainty associated with costing certain activities of a programme and taking into account the short life cycle of the basic system, it seems unreasonable to place too much weight on the controversy surrounding the discount rate. Added to this is the perception that most environmental projects are either risk-free or reduce risk.

219. We use the cost formula to discount nominal estimates of flows, with a nominal interest rate of 5% a year to reflect nominal interest rates on marketable securities of comparable maturity to the period of analysis, i.e. three-year maturities. We assume that T=2 to reflect the basic system's life cycle. We take θ to equal 0.5.

8. Sensitivity analysis

220. Sensitivity analysis tests the sensitivity and reliability of the results obtained from the cost analysis. It does this by means of identifying those input parameters that have the greatest influence on the outcome and varies these parameters to evaluate how the outcome is changed. This yields information on the sensitivity of the overall outcome towards the key input parameters. Sensitive parameters warrant assumptions, data sources and analyses to be revisited to ensure that the best possible value is used for that parameter.

221. Input parameters that are good candidates for testing are those that are both significant cost factors and have a wide range of maximum and minimum estimated values.

222. We identify the following parameter inputs as relevant to our sensitivity analysis: system development costs, maintenance costs, the system's life cycle and the discount rate.

D. Estimation results

1. Scenarios

223. *The numerical outcomes depend critically on the assumptions that describe the model.* Assumptions have been made based on best available judgment but, if these can be improved upon, the new assumptions can very easily be integrated into the model to obtain new cost outcomes.

224. It is assumed that the PRTR system will be mandatory, with an annual reporting cycle and allowing only electronic reporting forms.

225. Key assumptions of the model relate to the average annual hours burden in a given year and across time for various tasks that have to be performed under the system, income levels, the size of the private sector, the discount and corporate tax rates and the fixed and variable cost functions of the regulator.

226. Specifically, a number of key assumptions are singled out and discussed briefly. Each task performed by a typical private sector facility is assumed to place an average annual hours burden on the facility. These numbers are largely drawn from the United States experience. Assumptions were also made about how these burdens may change across time. It was considered that certain tasks would be less cumbersome once experience had been gained in a previous year. For those tasks, the annual hours burden was reduced to half the first year's burden.

227. Assumptions relating to income levels were relevant for differing income grades in the private and public sectors. A distinction was made between an advanced market-type economy (AME), an advanced transition-type economy (ATE) and a less-advanced transition economy (LATE), as a function of income levels and the discount rate.

228. To represent an advanced market economy, we drew on United States figures. These were felt to be representative of other advanced market economies' wage rates and salaries. For advanced transition economies, we applied an adjustment factor of 0.35 to the advanced market economies' wage rates and salaries, while for less-advanced transition economies, we used 0.15 to reflect the

differences in labour costs. While it is true that in advanced transition or in less-advanced transition economies, there may be less PRTR-related expertise available, which might require these countries to buy expertise - expensively - from abroad, this is likely to affect only the costs in the first year of operation. Due to the high degree of human capital formation existing in these countries, the learning process could be expected to take place rapidly. In addition, a great deal of the expertise is already being transferred to participants from those countries, through training seminars (under the auspices of the Organisation for Economic Co-operation and Development (OECD) or the United Nations Environment Programme (UNEP). These training costs are already largely borne by the donor community, thereby not imposing any substantial additional costs to ATE or LATE countries. Therefore, the model has abstracted from this consideration. For each scenario, the market-type economy is designated with a number 1, the advanced transition-type economy with a number 2 and the less-advanced transition economy with a number 3, following the letter which describes the specific scenario.

229. We assumed a corporate tax rate of 30% across the board, while assumptions concerning the prevailing nominal discount rate varied across country type. For the advanced market economy, we used 5%, for the advanced transition economy 10% and for the LAT economy 20%.

230. The costs to the regulator are functions of the wage rates, the fixed and variable number of full-time equivalents of its employees and its fixed and variable material costs. 53/ The first cost function relates to the number of full-time equivalents (FTEs) of employees needed to perform the regulatory tasks. This is made up of a fixed number of employees that deliver the basic system and an additional number of FTEs, determined as a function of the number of data elements to be processed under a given system, itself a function of the number of reports submitted, i.e. of the number of facilities reporting under a given system.

231. The second function relates to material costs and has a fixed component which must be incurred whatever the basic system in place and a flexible component which, as above, depends on the number of data elements to be processed under a given system.

232. In the case of a small system (500 facilities participating), we assume that only five FTEs are required to make the system operational. In a larger system of 2,000 operating facilities, we assume that ten FTEs are employed to operate the system, while in the large system of 8,000 participating facilities, we assume that 15 FTEs are required to run the system. In each of these cases, an additional FTE is added for each million data items in a given system.

233. We also varied the fixed material cost element across the system size, determined by the number of facilities participating. For the small system (500 facilities), we assumed a fixed cost of US$ 100,000; for the medium-sized system (2,000 facilities), we assumed a fixed cost of US$ 200,000; and for the large system (8,000 facilities), we assumed a fixed component of US$ 400,000. Across all the systems, we assumed that in the second and subsequent years of the system, the initial fixed costs incurred in the first year would be cut by half. A variable cost of US$ 20,000 was added for each million data items that the system is required to process in a given year.

234. Finally, a number of key assumptions were made to determine the number of participating facilities and the nature of their participation and number of data items in a given system. Three scenarios were built to capture different numbers of facilities required to participate under the

53/ The variable elements of these two functions in turn depend on the number of data items per report and the number of reports actually processed.

system. The first scenario comprises 500 facilities, to reflect either smaller countries or an instrument with very limited coverage. Another scenario has 2,000 participating facilities to reflect medium-sized countries or an instrument which, by its definition of activities covered, introduces this number of facilities to the instrument. Finally, a scenario of 8,000 facilities was chosen to cover large countries or an instrument which covers a large number of activities through its scope.

235. It is assumed that the number of facilities initially assessing their reporting obligations under a PRTR decreases by 2% a year throughout the "lifetime" of both the basic system and any expanded system. Thus the number of facilities actually performing in-depth measurements, calculations and estimations and submitting forms is taken to be a diminishing percentage of the initial participating facilities, through the life cycles of both basic and expanded systems. Based on numbers obtained from the United Kingdom, it is assumed that, in the first year, some 86% of facilities covered by the instrument actually go ahead and become reporters that must perform in-depth measurements, calculations and estimations, as opposed to those facilities that assess, at a preliminary level, that they do not pass the defined thresholds.

236. Also based on United Kingdom numbers, it is assumed that each facility reports on average on 12 substances. Drawing on United States numbers, it is assumed that each report (one per chemical) contains 100 data elements. The number of data items to be processed depends on the number of data elements per report (assumed to be 100) and the number of forms submitted. The model also assumes that there is no requirement of supplier notification.

237. Finally, it is assumed that the number of applications for a chemical substance list change is 2 for the scenario with 500 facilities, 4 for the scenario with 2,000 and 6 for the scenario with 8,000. The number of confidentiality claims is assumed to be equal to the number of applications for a chemical substance list change.

238. The characteristics of the different scenarios are summarized in the table below. The first scenario (scenario A) is a basic system with 500 facilities initially participating in the PRTR. Scenarios B and C capture the basic system for 2,000 and 8,000 facilities, respectively. 54/

239. Over time, the PRTR could be expanded to cover other industrial sectors and other chemicals that have adverse impacts on the environment. Changes to the system could also involve lowering the reporting thresholds of chemicals already on the substance list.

240. Scenario D is meant to reflect a substance list expansion or lowering of thresholds which affects only the range of facilities already covered under the system. It results in participating facilities reporting more substances on average. Specifically, it is based on scenario B (2,000 facilities) with a 20% increase in the average number of substances reported per facility after the

54/ Note that these are only the facilities that are initially required to assess whether or not they have reporting requirements under a possible PRTR instrument. The number of facilities actually submitting forms will be somewhat smaller.

third year of the system, i.e. in t=3, and an increase of reporting facilities to 95% of the total facilities participating. 55/

241. Finally, scenario E is meant to capture both a substance list expansion, identical to the one in scenario D, as well as an expansion of the activity coverage also after the third year of operation. Specifically, it is based on scenario D with a 20% increase in the number of participating facilities, defined by the instrument's activity scope.

Table 1: Characteristics of scenarios

	AME	**ATE**	**LATE**
Basic system with 500 facilities	Scenario A1	Scenario A2	Scenario A3
Basic system with 2,000 facilities	Scenario B1	Scenario B2	Scenario B3
Basic system with 8,000 facilities	Scenario C1	Scenario C2	Scenario C3
Basic system of 2,000 facilities with 20% increase in substances reported per facility in t=3 and increase in percentage of reporters to 95% in t=3	Scenario D1	Scenario D2	Scenario D3
Basic system of 2,000 facilities with 20% increase in substances reported per facility in t=3 and increase in percentage of reporters to 95% in t=3with a 20% increase in participating facilities in t=3	Scenario E1	Scenario E2	Scenario E3

2. Estimation results

242. The following table provides a summary of the estimation results for all the scenarios considered above.

55/ Under such a scenario, it is assumed that while the number of reporting facilities decreases at a rate of 2% a year as facilities cut their levels of releases and transfers and fall out of the reporting category, a substance list expansion is assumed to work in the opposite direction by increasing the number of facilities reporting from the pool of facilities defined by the activity scope. Such an expansion is also assumed to raise the average number of chemicals reported by a facility.

Table 2: Main results

			t=0	t=1	t=2	t=3	t=4	t=5
500 facilities	Scenario A1	**Total average cost per facility** (US$ p.a)	28,702	16,325	17,190	18,077	18,987	19,917
		Total cost to private sector (US$ p.a)	14,351,065	8,162,341	8,594,844	9,038,734	9,493,495	9,958,502
		Total cost to regulator (US$ p.a)	635,183	353,226	359,058	364,832	370,547	376,205
2,000 facilities	Scenario B1	**Total average cost per facility** (US$ p.a)	28,683	16,304	17,167	18,054	18,961	19,889
		Total cost to private sector (US$ p.a)	57,365,471	32,608,122	34,334,937	36,107,080	37,922,477	39,778,614
		Total cost to regulator (US$ p.a)	1,389,342	825,107	836,335	847,330	858,092	868,622
8,000 facilities	Scenario C1	**Total average cost per facility** (US$ p.a)	28,671	16,291	17,154	18,039	18,945	19,872
		Total cost to private sector (US$ p.a)	229,364,909	130,329,386	137,228,649	144,308,683	151,561,151	158,975,971
		Total cost to regulator (US$ p.a)	2,778,897	1,880,942	1,895,599	1,909,327	1,922,125	1,933,994
Scenario B1 with 20% increase in substances reported per facility in t=3 and increase in percentage of reporters to 95% in t=3	Scenario D1	**Total average cost per facility** (US$ p.a)	28,683	16,304	17,167	25,598	26,990	28,428
		Total cost to private sector (US$ p.a)	57,365,471	32,608,122	34,334,937	51,196,907	53,980,807	56,855,630
		Total cost to regulator (US$ p.a)	1,389,342	825,107	836,335	1,049,280	1,063,233	1,076,907
Scenario D1 with 20% increase in participating facilities in t=3	Scenario E1	**Total average cost per facility** (US$ p.a)	28,683	16,304	17,167	39,068	32,388	34,113
		Total cost to private sector (US$ p.a)	57,365,471	32,608,122	34,334,937	78,136,198	64,776,968	68,226,756
		Total cost to regulator (US$ p.a)	1,389,342	825,107	836,335	1,319,856	1,150,096	1,163,601
500 facilities	Scenario A2	**Total average cost per facility** (US$ p.a)	9,815	5,848	6,451	7,108	7,821	8,594
		Total cost to private sector (US$ p.a)	4,907,436	2,924,076	3,225,636	3,553,762	3,910,301	4,297,160
		Total cost to regulator (US$ p.a)	294,023	162,686	164,571	166,435	168,280	170,104
2,000 facilities	Scenario B2	**Total average cost per facility** (US$ p.a)	9,808	5,841	6,443	7,098	7,810	8,582
		Total cost to private sector (US$ p.a)	19,616,480	11,681,531	12,885,866	14,196,233	15,619,992	17,164,736
		Total cost to regulator (US$ p.a)	643,121	380,021	383,326	386,550	389,693	392,754
8,000 facilities	Scenario C2	**Total average cost per facility** (US$ p.a)	9,804	5,836	6,438	7,092	7,803	8,575
		Total cost to private sector (US$ p.a)	78,432,759	46,689,190	51,501,769	56,737,892	62,426,933	68,599,186
		Total cost to regulator (US$ p.a)	1,340,050	893,279	895,913	898,222	900,205	901,863
Scenario B2 with 20% increase in substances reported per facility in t=3 and increase in percentage of reporters to 95% in t=3	Scenario D2	**Total average cost per facility** (US$ p.a)	9,808	5,841	6,443	10,064	11,117	12,267
		Total cost to private sector (US$ p.a)	19,616,480	11,681,531	12,885,866	20,128,712	22,234,301	24,533,581
		Total cost to regulator (US$ p.a)	643,121	380,021	383,326	467,804	471,938	475,975
Scenario D2 with 20% increase in participating facilities in t=3	Scenario E2	**Total average cost per facility** (US$ p.a)	9,808	5,841	6,443	15,360	13,341	14,720
		Total cost to private sector (US$ p.a)	19,616,480	11,681,531	12,885,866	30,720,438	26,681,161	29,440,298
		Total cost to regulator (US$ p.a)	643,121	380,021	383,326	602,116	522,304	526,131
500 facilities	Scenario A3	**Total average cost per facility** (US$ p.a)	4,027	2,618	3,150	3,786	4,545	5,449
		Total cost to private sector (US$ p.a)	2,013,648	1,308,899	1,575,148	1,893,141	2,272,445	2,724,289
		Total cost to regulator (US$ p.a)	189,058	104,061	104,732	105,394	106,048	106,692
2,000 facilities	Scenario B3	**Total average cost per facility** (US$ p.a)	4,025	2,614	3,146	3,781	4,539	5,441
		Total cost to private sector (US$ p.a)	8,049,150	5,228,984	6,292,449	7,562,541	9,077,452	10,882,004
		Total cost to regulator (US$ p.a)	413,528	243,079	243,947	244,781	245,579	246,342
8,000 facilities	Scenario C3	**Total average cost per facility** (US$ p.a)	4,023	2,612	3,144	3,778	4,535	5,436
		Total cost to private sector (US$ p.a)	32,182,993	20,899,401	25,149,433	30,225,105	36,278,989	43,490,130
		Total cost to regulator (US$ p.a)	897,355	589,402	588,336	587,131	585,787	584,303
Scenario B3 with 20% increase in substances reported per facility in t=3 and increase in percentage of reporters to 95% in t=3	Scenario D3	**Total average cost per facility** (US$ p.a)	4,025	2,614	3,146	5,361	6,461	7,777
		Total cost to private sector (US$ p.a)	8,049,150	5,228,984	6,292,449	10,722,859	12,921,313	15,553,663
		Total cost to regulator (US$ p.a)	413,528	243,079	243,947	288,899	290,012	291,084
Scenario D3 with 20% increase in participating facilities in t=3	Scenario E3	**Total average cost per facility** (US$ p.a)	4,025	2,614	3,146	8,183	7,753	9,332
		Total cost to private sector (US$ p.a)	8,049,150	5,228,984	6,292,449	16,365,226	15,505,576	18,664,396
		Total cost to regulator (US$ p.a)	413,528	243,079	243,947	381,286	329,148	329,999

243. For the AME, the cost to the regulator of a PRTR system covering 500 facilities (scenario A1) is US$ 635,183 in the first year and between US$ 350,000 and US$ 400,000 in each subsequent year. These amounts more or less double for scenario B1 covering 2,000 facilities. The cost to the regulator in scenario C1 again doubles vis-à-vis scenario B1, while the number of facilities in scenario C1 is four times as high as in scenario B1. Even for 8,000 facilities, the results for scenario C1 show that the costs to the regulator of US$ 2.8 million in the first year and around US$ 1.9 million in the subsequent years appear to represent only a modest amount for a regulatory framework in an AME. While we have not attempted to obtain the cost of alternative regulatory instruments, it would appear that the costs calculated by this model are small compared to other environmental regulatory systems, which often lack good regulatory results.

244. Since a large part of the regulator's costs are the wages and salaries of its employees involved in managing a PRTR system, the costs to the regulator in an ATE and in a LATE are substantially reduced. In an ATE, the cost to the regulator of a system with 500 facilities is US$ 294,000 in the first year of operation and between US$ 162,000 and US$ 170,000 a year in the subsequent years.

245. In a LATE, these costs are even lower. Scenario A3 costs the regulator US$ 189,058 in the first year and comes to around US$ 105,000 in the subsequent years, on average. Scenario B3 costs a bit more than double and scenario C3 approximately four times that amount.

246. Turning now to the costs for the whole private sector in an AME, the model calculates a total of US$ 14 million in the first year for scenario A1, four times that figure for Scenario B1 and four times the figure in scenario B1 for scenario C1. Costs to the private sector are directly proportional to the number of enterprises covered by the system (given a fixed average number of data items to be reported by a facility). This reflects an average cost per facility in an AME of less than US$ 28,700 in the first year of the programme. Private sector costs drop substantially in subsequent years, when participants have become acquainted with the system's requirements. The average annual costs to the private sector in an AME of a PRTR after the first year of implementation are around US$ 9 million for scenario A1, around US$ 36 million for scenario B1 and around US$ 144.5 million for scenario C1, while average costs per facility in an AME during the same time period amount to US$ 18,000.

247. In an ATE, the system costs the private sector around US$ 4.9 million in scenario A2, US$ 19.6 million in scenario B2 and US$ 78.4 million in scenario C2 in the first year. For an ATE, the total average cost is ca. US$ 9,800 per facility in the first year. The private sector costs drop over the subsequent years so that, once implemented, the system costs the private sector on average US$ 3.6 million for scenario A2, US$ 14.3 million for scenario B2 and US$ 57.2 million for scenario C2. This implies that the average cost per facility declines to around US$ 7,200 once the system has been implemented.

248. Finally, in a LATE, the system costs the private sector around US$ 2 million in scenario A3, US$ 8 million in scenario B3 and US$ 32 million in scenario C3 in the first year. For a LATE, the average annual cost per facility in the first year of the programme comes to around US$ 4,000. These total private sector costs drop over the subsequent years so that, once implemented, the system costs the private sector on average US$ 1.95 million for scenario A3, US$ 7.8 million for scenario B3 and US$ 31.2 million for scenario C3. Per facility, this comes down to less than US$ 3,900 annually.

249. As far as the expansion of the modelled substance list is concerned (scenario D), an increase of 20% in the reported substances per facility and an increase in the percentage of reporting facilities to 95%, this adds some 24% to the regulator's costs for the new system in all three country groups vis-à-vis the base scenario of 2,000 facilities (i.e. scenario B).

250. The private sector experiences an expansion in its annual costs of around 42% vis-à-vis scenario B, following the introduction of the new system. This applies to all country groups under study.

251. Turning to the substance list expansion with activity scope expansion (scenario E), namely increases of 20% in both the reported substances per facility and the participating facilities and an increase in the percentage of reporters to 95%, this adds some 56% to the regulator's costs for the new system in any of the country types in the first year and around 34% in subsequent years, both vis-à-vis the base scenario of 2,000 facilities (i.e. scenario B).

252. As far as the private sector is concerned, the costs are more than doubled upon introduction of scenario E in the first year of the new system. In subsequent years, the increase in costs of this second expansion totals around 70%. This applies across all three country groups.

IV. CONCLUDING REMARKS

253. The monetary figures obtained in this study are only tentative as they are produced from the modelling assumptions. They should be viewed only as possibly providing rough guidance concerning the cost of a small number of simplified scenarios, designed to capture some of the choices the working group faces in the most immediate future.

254. However, they seem to suggest that such a system imposes relatively modest costs on the regulator, which diminish after the first year of implementation. Regulated facilities face high costs in the initial year, but these are reduced considerably in the subsequent years of the programme. However, this largely reflects the substantial number of facilities participating in a PRTR scheme; average annual costs to individual facilities turn out to be relatively modest. Due to economies of scale, a system with four times the number of facilities increases the costs of the system to the regulator by a factor of only two. A systemic expansion is not found to impose large extra costs on the regulator. However, every expansion of the system involving an increase in the number of participating facilities will impose additional learning and acquaintance costs in the first year of implementation.

255. These costs are likely to overestimate the real resources needed as they represent the gross costs of a PRTR instrument, without taking into account either the costs of those components of a PRTR system which might already exist within the environmental regulatory framework, or the costs of a viable alternative mechanism which would achieve the same objective. Furthermore, the study has not examined the cost savings that may be achievable by technology and software transfer among countries.

256. A key issue in this context is whether other measures to reduce pollution are more cost-effective than a PRTR, i.e. how a PRTR ranks among other options in terms of cost-effectiveness. It is equally important to consider an instrument’s effectiveness in achieving its aim.

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