Risk and international environmental policy

Emerging issues for the minerals sector

Anthony Cox and Peter Gooday
Australian Bureau of Agricultural and Resource Economics
GPO Box 1563, Canberra 2601

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Environmental policy is evolving rapidly in the international arena with an increasing number of multilateral environmental agreements being negotiated in a range of forums. The issue of risk management has figured prominently in these processes, with the OECD risk reduction strategy for lead and the Basel Convention being two recent examples of particular relevance to the minerals sector.

A common feature of these recent developments is the lack of an economic dimension when considering risk reduction measures at the international level. While considerable effort is being put into the scientific aspects of risk management, relatively little attention has been paid to the economic issues involved in risk reduction. Yet economic concerns are likely to be central to the successful adoption of international risk management measures. This is because any policy changes dealing with risk reduction entail economic costs and benefits which are unlikely to be evenly distributed across countries. Failure to fully understand and address these economic aspects may result in the introduction of less than optimal policies or the rejection of sensible environmental protection strategies.

In this paper, some of the key economic issues involved in the management of risk at the international level are reviewed together with the implications for the development of international environmental policy. The need for economic analysis to assist decision makers in fully understanding the range of implications of potential policy changes is illustrated through a case study of the OECD risk reduction strategy for lead.

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Introduction

The regulation of risk is becoming an increasingly important issue for the minerals sector at both the national and international levels. In common with many other potentially hazardous materials, minerals have been subject to environmental occupational health and safety legislation for many years. This is because many risks are not able to be efficiently managed at the individual level and some form of government involvement may be required.

The process of risk management has generally been addressed at a national level, with policies being framed in response to the social circumstances, economic priorities and environmental conditions of particular countries. In recent years, however, the issue of risk regulation has become more prominent in the international environmental agenda. This reflects the increased globalisation of environmental concerns which has gained considerable pace following the United Nations Conference on Environment and Development (UNCED) in 1992.

The report which resulted from the conference, known as *Agenda 21*, is of particular interest to the minerals sector. This report represented a milestone in the development of the international agenda for environmental issues and set the scene for many of the activities which have since been initiated. Chapter 19 of *Agenda 21* was devoted to the environmentally sound management of toxic chemicals (defined to include almost all the metals). Within this chapter, a number of key issues were addressed including expanding and accelerating the international assessment of chemical risks, encouraging information exchange on toxic chemicals and chemical risks, establishing risk reduction programs and strengthening national capabilities in the management of chemicals.

Largely as a result of *Agenda 21*, international attention has been increasingly focused on risk and risk management. However, there is some concern that the economic aspects of risk analysis and management have often been ignored in the process. The purpose in this paper is to review some of the key economic issues involved in the management of risk at the international level, and to highlight implications for the development of international environmental policy. The need for economic analysis to assist decision makers in fully understanding the range of implications of potential policy changes is illustrated through a case study of the OECD risk reduction strategy for lead. In the case study, the results of a modelling exercise are used to highlight some of the direct and indirect effects of mooted policy developments.

Emerging international agenda

As noted above, *Agenda 21* was instrumental in the development of international agendas on environmental issues. Chapter 19 of the report, dealing with the environmentally sound management of toxic chemicals, is of particular interest to the minerals sector. This is because metals are classified as chemicals and, because metals are persistent and bioaccumulative (that is, they cannot degrade into some other substance and often accumulate in the environment), they are deemed to be potentially toxic or hazardous under most definitions.

Six major issues were addressed within chapter 19·

- expanding and accelerating international assessment of chemical risks;
- harmonising classification and labelling of chemicals;
- encouraging information exchange on toxic chemicals and chemical risks;
- establishing risk reduction programs;
- strengthening national capabilities and capacities for management of chemicals; and
- preventing illegal international traffic in toxic and dangerous products.

Within each of these areas, a range of recommendations was presented for activities that should be undertaken. One of the main proposals emanating from this chapter was the need to strengthen international risk assessment. Bodies such as the European Union, the OECD and the International Program for Chemical Safety were identified as having common goals in this area. Indeed, a significant amount of work has been undertaken by these and other organisations in recent years in improving the exchange of information on the safety, use and emissions of chemicals, harmonising chemical testing procedures, labelling and classification, and so on.

Particularly significant was the recommendation that efforts be made to introduce broad based risk reduction programs for the elimination of unacceptable or unreasonable risks. This proposal specifically identified the substitution and phase out of chemicals as means of reducing risks. The proposal effectively endorsed the work which had already commenced within the OECD on chemicals risk reduction.

OECD risk reduction strategy for lead

Since 1990, the OECD has been working on a risk reduction program for several chemicals, with the program relating to lead being the most advanced (see Cox, Beil and Neck 1994 for a critique of the OECD strategy). Early phases of the program resulted in the publication of a monograph on lead risk reduction (OECD 1993), in which the approaches that have been practised successfully in various countries were reviewed. A workshop also took place in 1994 to examine the extent of transboundary pollution associated with lead products. Neither the monograph nor the workshop revealed significant areas for concerted international action, but several OECD members, most notably the United States and the European Union, exerted continued pressure to develop prescriptive action in the form of an OECD Council Act.

Debate over the OECD risk reduction strategy for lead came to a head at the OECD Joint Meeting of the Chemicals Group and Management Committee in June 1995. No consensus could be reached on the provisions to be included in a Council Act, so the pressure for an act subsided (at least temporarily) in the latter half of 1995. An *ad hoc* Working Group was established to review progress on the OECD risk reduction program, and the group is reporting back to the Joint Committee in February 1996 on risk reduction strategies which might be undertaken in the future given the experience of the lead strategy.

Basel Convention

Another international development given added impetus by *Agenda 21* is the Basel Convention on the transboundary movement of hazardous wastes and their disposal. The Basel Convention was conceived as a means of preventing the dumping of hazardous waste in countries which do not have the facilities to handle them safely, thereby reducing the risks associated with the inadequate handling of hazardous waste. The convention is also an attempt to encourage both developed and developing countries to improve their waste management practices and to develop cleaner production technologies.

However, the Basel Convention has evolved into a much wider-reaching instrument which imposes a strict regime of prior notice and consent on the movement of many waste streams between parties to the convention, and which prohibits movements between a party to the convention and a non-party. At the Third Conference of the Parties to the Basel Convention in September 1995, the scope of the convention was extended even further by the banning (effective from the end of 1997), of the movement of hazardous waste from developed countries to developing countries for recycling or recovery.

This last development is of particular concern to the minerals sector because, under the current definitions contained in the Convention, almost all forms of scrap metal are covered by the ban decision. While work is continuing within the Basel Convention's secretariat to refine the definitions to ensure that trade in scrap metals is not too adversely affected, it is by no means clear at this stage whether adequate definitions of what is meant by 'hazardous', 'waste' and 'environmentally sound' can be arrived at within the framework of international negotiations on risk management.

There are also signs that some of the principles of the convention may be extended to products containing hazardous substances, rather than to just waste streams. In line with chapter 19 of *Agenda 21*, the United Nations Environment Programme is considering the development of a prior informed consent procedure covering the international trade in certain hazardous chemicals. At this stage, the scope of the proposed instrument is uncertain, particularly in relation to the products to be included and the definition of key terms such as 'hazardous' and 'chemical in international trade' — for example, would the instrument apply only to chemicals in their raw form or to all products in which it was contained?

Issues for the minerals sector

A number of important implications for the minerals industry are emerging from this developing international agenda. First, the scientific basis for concerted international action needs to be well defined. In the case of the OECD lead risk reduction program, for example, the push for a Council Act ignored the conclusion from a number of OECD workshops that risks from lead exposure are essentially local in nature and are best addressed on a local scale. This ensures that risk management policies are appropriately targeted and account for the social preferences, environmental conditions and economic priorities of individual countries.

Second, 'hazard' and 'risk' need to be distinguished in developing risk management policies. The presence of a hazardous chemical in a product is only of concern if it represents an exposure risk, which depends on the particular circumstances governing the production, use and disposal of goods in particular countries. Both the Basel Convention and the OECD strategy for lead failed to recognise this distinction and did not undertake appropriate risk assessments of wastes, products (or proposed substitutes) or processes.

Finally, the economic aspects of any concerted international risk reduction programs need to be addressed to ensure that there will be an expected net social benefit from any policy changes. In general, there are two parts to making decisions about which risks to regulate and the extent to which they should be regulated: risk assessment (the scientific or technical component) and risk management (the economic and policy component). While increasing attention has been focused on the scientific aspects of risk assessment in the international arena (for example, Stonehouse and Mumford 1994; Wirth 1994), the same cannot be said for the economic issues involved. This can be largely explained by a relative lack of experience in many countries (except, perhaps, in the United States) and international organisations in using economic tools to develop risk management strategies. It is this economic aspect of the emerging international agenda which will be examined in the remainder of this paper.

Economic issues

The literature covering the economics of risk management in relation to public health and the environment is extensive, and it is not the intention in this paper to review this material. Rather, there are a few key points in the literature which are particularly relevant to international regulation of risk, and it is worth reviewing them in some detail. These points relate to the need for tradeoffs between the costs and benefits of risk management programs, and to the trade aspects of concerted international measures to manage risks.

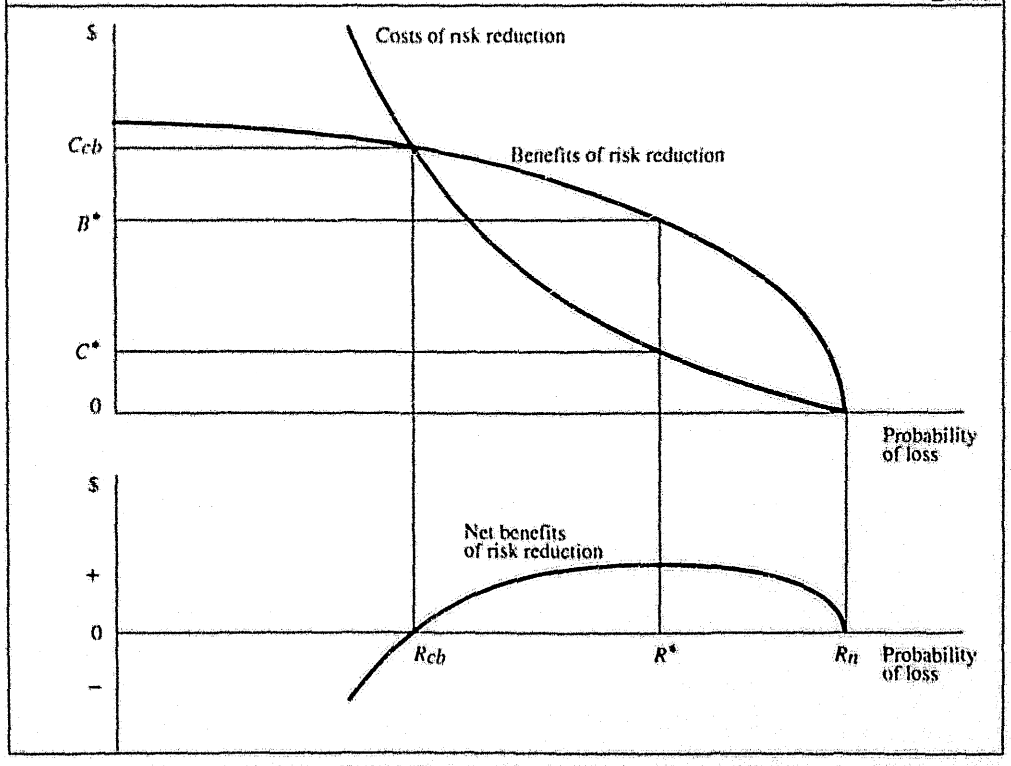
Risk tradeoffs

A fundamental outcome of a consideration of the economics of risk management is the need to make tradeoffs between the benefits and costs of alternative risk management programs (for example, Viscusi 1992; Breyer 1993). Individuals, and society as a whole, are faced with the problem of reducing risk subject to the limited resources at their disposal. As a result, they are forced to choose between spending resources on risk reducing strategies and using those resources to purchase other goods and services. This is the same problem consumers face when purchasing any good or service, and implies that a similar economic framework should be used in determining which risk reducing strategies to purchase and the degree (or quantity) of risk reduction to purchase.

The basic features of such a framework are well documented in the economic literature (for example, Tietenberg 1992; Turner, Pearce and Bateman 1994).The socially optimal level of risk reduction occurs where the net benefits of risk reduction (total benefits less total costs) are maximised. A simple schematic representation of this problem is illustrated in figure A. The horizontal axis measures the level of risk associated with a particular adverse outcome which, if it occurs, results in a loss (expressed as a monetary loss in this case). The level of risk depicted by R_n can be thought of as the 'natural' level of risk — that is, the risk that would exist in the absence of any risk reducing strategies.

The benefits shown represent the sum of the amounts that individuals would be willing to pay for the reduced risk of loss resulting from a particular outcome (see Hinchy and Fisher 1991 for more detail on the shape of this curve). The costs shown represent the total costs to society of implementing a particular risk reducing strategy. For ease of explanation, suppose that the various levels of risk are associated with a range of risk reducing policies. The cost curve in figure A is drawn under the assumption that the costs of reducing risk increase as the level of risk approaches zero. The net benefits curve shown in the lower panel is obtained by subtracting the cost curve from the benefit curve. The socially optimal level of risk is given by R^*, the benefits of reducing risk to this level are B^*, while the costs are C^*.

A Socially optimal level of risk



The benefits and costs of risk reduction are equal for two levels of risk: R_n (the 'natural' level of risk) and R_{cb}. A risk level of R_n requires that no risk reduction strategies be employed, while a risk level of R_{cb} requires that C_{cb} be spent to obtain benefits of the same amount. Society is indifferent between these two scenarios. For risk levels between R_n and R_{cb}, the benefits of risk reduction outweigh the costs with the net benefits maximised at R^*. For levels of risk lower than R_{cb}, the costs of risk reduction outweigh the benefits. It is important to note that a zero level of risk is only optimal under special circumstances. Clearly, many of the risks facing individuals can be managed adequately by the individuals themselves through changes in behaviour, the purchase of risk reducing products, insuring against specific events, or a combination of all three. Some risks, however, cannot be adequately managed at the individual level and may require government intervention. These risks usually involve an externality in one form or another.

There are a wide variety of externalities which may apply in situations where risk reducing strategies are considered — for example, the pollution of common property resources and the provision of certain types of information such as public health and safety information. In situations involving externalities, there is a possible rationale for government intervention. However, to determine whether risk reducing and risk preventing policies result in improvements in welfare and, if so, in the optimal level of risk reduction, it is necessary to define and measure the benefits and costs of changes in risk.

Recognising the need for tradeoffs between the benefits and costs of risk reduction raises questions about international risk reduction activities, particularly with respect to their scope, effectiveness and efficiency. For example, the costs and benefits of policies can generally be fully captured at a national level, reflecting the social circumstances, economic priorities and environmental characteristics of particular countries. What then is the role for international organisations in promoting coordinated risk reduction schemes? Economic theory suggests that an internationally coordinated approach to risk management should take place only in the event of transboundary pollution being demonstrated to be an issue. However, there is an apparent confusion between trade in potentially hazardous products and transboundary pollution, and this seems to be at the heart of many of the problems surrounding the push for international risk regulation.

Trade aspects of international risk regulation

Trade issues can arise in a number of ways in an evaluation of the need for concerted risk reduction activities. On the one hand, it might be argued that trade is part of the problem, in the sense that because trade takes place it necessarily imposes or magnifies risks. Alternatively, trade measures have been viewed as part of the solution — for example, restraints on trade might be seen as a means of solving a domestic environmental problem.

In this section of the paper, aspects of the relationship between trade and environmental policy are considered, especially in so far as it touches on international risk reduction activities.

Environmental problems are largely caused by production and consumption activities, not by international trade (Anderson and Blackhurst 1992). While it can be argued that trade can be held directly responsible for environmental degradation in some instances (for example, in relation to hazardous wastes and endangered species), these are special cases. Governments have decided to collectively control trade in these areas within the framework of multilateral environmental agreements. However, these agreements have met fairly restrictive criteria: there is consensus that a high priority problem of global concern exists, that collective action is the only way to effectively address the problem, and that trade measures are an effective and appropriate means of implementing collective action.

Some of the arguments supporting collective action to restrain trade in the context of risk reduction, particularly as part of the OECD risk reduction strategy, go well beyond these criteria. The general proposition seems to be that any trade in a hazardous chemical (or trade in products containing that hazardous chemical) constitutes transboundary pollution. For example, it is often argued that cadmium is a pollutant which is not a necessary ingredient in fertilisers yet can be introduced into some food commodities when used in fertilisers (Brydon, Morgenroth and Sigman 1993). When food commodities containing cadmium cross frontiers, this constitutes transboundary pollution and, therefore, an international agreement restraining such trade is justified. It can be similarly argued that trade in non-food products containing cadmium should be restrained. For example, nickel cadmium batteries are sold across borders, where they are disposed of and enter the waste stream. Hence, trade in nickel cadmium batteries is a transboundary pollution problem.

Neither argument is persuasive. The presence of a hazardous chemical in a traded good is only of concern if it represents an exposure risk, and the simple fact of trade cannot be accepted as an argument for trade measures or for collective action at the international level. Even where an exposure risk can be demonstrated, alternative means of resolving the problem must be considered — for example through exposure management techniques.

In the example of cadmium in food, a food standard approach would appear to allow individual countries to act promptly and effectively in line with their own assessment of risk and exposure. In the case of nickel cadmium batteries, there is an implicit argument that the whole life cycle of the product needs to be taken into account. That is, even if a product does not represent an exposure risk in its traded form, it will eventually enter the waste stream and, to that extent, may be seen as a kind of long term transboundary pollution. This also ignores the scope for appropriate risk management strategies to deal with exposure problems, assuming instead that cadmium in the waste stream is necessarily a problem that cannot be managed.

Another argument in support of international trade restrictions is based on concerns about competitiveness. For example, a country may decide to implement a chemical substitution policy which imposes higher economic costs on local industry. To prevent these higher costs adversely affecting the international competitiveness of domestic industry, there is an incentive to try to impose those costs on industries elsewhere through an international agreement to ban or restrict trade in that chemical.

However, economic considerations do not justify proposals for trade measures or trade provisions in multilateral environmental agreements. It has been established in a number of studies that there have been no documented cases of systematic adverse impacts on competitiveness from disparate environmental regulations, and no loss of markets (domestic or abroad) as a result of eco-dumping (for example, Low and Yeats 1992). Neither has there been evidence of significant industrial migration to countries with lower environmental standards. There is certainly no support for the proposition that concerns over competitiveness are a valid reason to press for harmonisation of environmental policy standards through international agreements.

Thus, when might trade measures be warranted on environmental grounds? This may be the case in a surprisingly small number of situations. It is important to distinguish between domestic environmental issues, where no international action is generally warranted, and those where some form of international 'public good' is involved. Even where there are international externalities, the full implications of the use of trade measures needs to be carefully assessed.

Collective trade measures might also be considered by countries that believe such measures provide more effective and efficient control of the import and export of products than is possible for countries acting individually. Implicit in this approach is the notion that the costs of administering import controls can be avoided if the control can be exercised at source through an international agreement. This might be the case where target countries do not have the resources to properly monitor import regulations and domestic activity related to hazardous materials. This principle underpins the Basel Convention. However, a more economically efficient outcome might be achieved by assisting the target countries (these are developing countries in the case of the Basel Convention) to build the necessary technical expertise and infrastructure to manage their own affairs without recourse to trade distorting international agreements.

Sovereignty concerns

Attempts to harmonise environmental policies bring into focus the issue of national sovereignty and its relevance to the resolution of international environmental questions. Concerns over sovereignty can arise when the internationalisation of otherwise purely domestic issues results from the desire of some groups to have a say in determining environmental policies in other countries. This issue underpins much of the current debate over the direction and scope of international risk reduction programs. In the case of the OECD Council Act on lead risk reduction, for example, it is clear that the environmental and health impacts are mostly localised and, thus, are most amenable to national or, at most, regional responses.

Differences in environmental policies and standards between countries are conceptually similar to the competitive implications of many other policy differences between countries. Differences in wage levels and working conditions, expenditure on education or taxation policies, for example, are accepted internationally as legitimate areas in which countries have the sovereign right to determine their own approach. In situations where there are no transboundary effects, and where the international community generally accepts that sovereign nations have the right to set policies within their own borders, there can be little justification for concerted international measures such as the OECD Council Act.

Case study: the OECD risk reduction strategy for lead

As noted in the introduction, over the past five years, the OECD has been reviewing the risk reduction strategies for lead that are in place in member countries. As part of this process, considerable attention has been given to the possible development of an OECD Council Act aimed at harmonising member countries' policies for dealing with risks from exposure to lead. The central feature of the draft Council Act prepared by the United States and the European Union during this process included a proposal to phase out the use of lead in many non-recyclable applications (such as lead in paint, crystal and gasoline) in the OECD.

A major criticism of the OECD strategy has been that no economic analysis of the impact of the proposal was conducted (Hughes 1995). Hence, a dynamic, spatial equilibrium model of the world lead and zinc markets was constructed by ABARE and used to undertake a quantitative assessment of some of the potential economic effects on the lead–zinc markets of policy changes proposed as part of the OECD risk reduction strategy for lead. An overview of the main features of the model is provided in the box, and further detail can be found in Thorpe, Klijn and Cox (1995).

Description of the lead–zinc model

A dynamic, non-linear, spatial equilibrium model of the world lead and zinc markets has been constructed for the purpose of analysing the effects of possible changes in international policy. A full description of the model, including the key features below, is provided in Thorpe, Klijn and Cox (1995).

- The world is disaggregated into eight regions — Australia, the United States, Canada, Mexico, other OECD countries, Peru, former centrally planned economies (the former Soviet Union, Eastern Europe and centrally planned Asian countries) and other non-OECD countries.
- The commodities modelled are lead, zinc, silver, copper and gold in concentrate form; refined lead, zinc and silver; and lead scrap.
- There is joint production of ores/concentrates.
- Secondary lead production is explicitly modelled.
- The model is dynamic to reflect the process of capacity expansion and asset price formation in mining and processing.
- A distinction is made between the consumption of recyclable lead (such as lead in batteries) and non-recyclable lead (such as lead in petrol and paint).
- The time horizon in the model is the twenty years from 1993 to 2012 (from a base year of 1992).
- Competitive conditions are assumed for the world and regional markets.

The model consists of a set of equations governing the volumes of production and consumption; the cost of production and prices of concentrates, refined metal and lead scrap; ore reserves; capacity expansions; and market clearance conditions. These equations were solved for each year between 1993 and 2012 using projected time paths for real gross domestic product in each region and projected prices of the byproducts, copper and gold, contained in concentrates.

Assuming that existing policies continue, results obtained from the model for the estimated time paths of prices and volumes — for ore mining and concentrating activity; lead, zinc and silver in concentrate; refined lead, zinc and silver; lead scrap; ore reserves and capacity expansion — comprised the 'base case' scenario against which the potential effects of policy changes were evaluated.

A policy induced change in a key variable (in this case, OECD consumption of non-recyclable lead) was then imposed on the model, and variations in the resulting time paths of key variables were interpreted as the potential effects of the policy change.

In contrast to most other models of metals markets (for example, Dammert and Chhabra 1990), the model explicitly incorporates recycling and secondary production, co-production of metals and the process of capacity expansion in mining and processing. The model of the lead–zinc market can be applied to a variety of policy issues, including developments in international environmental policy.

Such analysis is necessary to ensure that the likely ramifications of any policy change are fully understood, and to assess whether the expected benefits from the policy change outweigh the expected costs. Quantitative analysis using the lead–zinc model will not provide estimates of the benefits of risk reduction. However, it will provide an important indication of the potential costs to the lead–zinc industry of adopting various options under the OECD risk reduction strategy.

In the remainder of this section, some key results from a policy simulation are presented together with a number of policy insights which can be drawn from the analysis.

Policy scenario and simulation results

Under a policy scenario motivated by the draft Council Act, governments of OECD member countries are assumed to announce in 1995 that non-recyclable lead use will be phased out over the period 1996–2005. It is assumed that lead use will be reduced gradually, to ease the adjustment burden on lead producers and lead users. Starting in 1996, non-recyclable lead use is assumed to be reduced each year in each member country by 10 per cent of the 1992 level of use. In 1992, OECD non-recyclable lead use, at 1.13 million tonnes, accounted for 22 per cent of global lead use.

Summary results for the key price, production and consumption variables are presented in table 1. The results from the policy simulation are compared with base case projections obtained under an assumed continuation of existing government policies on the production, use and recycling of lead. The effect of the policy change is calculated as the percentage variation in the endogenous variables from the base case.

As might be expected, the world price of lead is estimated to be lower than in the base case throughout the period 1996–2012, and around 10 per cent below the base case at the end of the simulation period in 2012. The fall in lead prices relative to the base case leads to slightly increased consumption of lead in recyclable applications in non-OECD countries, up 0.8 per cent in 2012. At the end of the simulation period, consumption of lead in non-recyclable uses in non-OECD countries is estimated to be 6.0 per cent higher than in the base case.

World production of lead from lead–zinc mines declines the most relative to the base case — output is below the base case in all regions, with the United States experiencing the largest reduction and Australia the smallest (table 2) — while other outputs from lead–zinc mines fall only marginally.

The projected net cost to the world's lead–zinc mining industry of the policy change is US$1072 million (in 1995 dollars) calculated as the change in the 1995 value of the capital stock and ore reserves in lead–zinc mining resulting from the policy announcement (table 3). The announcement in 1995 of the phase out of non-recyclable lead is estimated to result in an immediate downward revision of the prices of lead–zinc mine assets in all regions relative to the base case. The change in the 1995 value of the mine assets in each region represents the cost (in that region) to the lead producing industry of the phase-out of non-recyclable uses of lead. The estimated global cost to the lead–zinc industry is the sum of the regional costs.

The costs to the lead–zinc mining industry are not shared equally among regions. Most notably, the simulated costs are highest in Australia, the United States and the former centrally planned economies, and less significant for Peru and for the other OECD countries. In Canada, the contribution of lead to total revenue from lead–zinc mining is far smaller than in other regions. Thus, the revenue effects of the slightly higher zinc prices partly offset that of lower lead prices. This is not the case for Australia and the United States where lead contributes a higher share of the revenue from lead–zinc mines. However, producers in Australia, are generally less reliant on revenue from lead than are the producers in the United States. Production of all metals declines relative to the base case in the United States, Mexico, the former centrally planned economies and the other OECD countries (table 2).

Production of secondary lead is significantly below the base case under this policy simulation. Secondary lead production in the OECD countries is projected to be around 26 per cent below the base case in 2012, with production in non-OECD countries nearly 64 per cent below the base case (table 1).

Once again, the regional impacts of the policy change on secondary lead production differ (table 2). In the base case, secondary lead industry capacity expands in all regions in which

Table 1: Simulated effects of a phase out of non-recyclable lead consumption in the OECD a

Variable	Region	Variation from base case in 2012
		%
Lead price	World	–10.8
Zinc price	World	0.7
Silver price	World	0.0
Production of lead in concentrate	World	–11.9
	OECD	–12.6
	Non-OECD	–9.4
Production of zinc in concentrate	World	–0.3
Production of silver in concentrate	World	–0.5
Production of copper in concentrate	World	–0.4
Production of gold in concentrate	World	–2.1
Primary lead production	World	–11.9
Lead recycling rate b	OECD	–25.8
	Non-OECD	–63.4
Secondary lead production	OECD	–25.9
	Non-OECD	–63.6
Recyclable lead consumption	OECD	0.0
	Non-OECD	0.8
Non-recyclable lead consumption	OECD	–100.0
	Non-OECD	5.8

a Non-recyclable uses of lead are assumed to be phased out, at 10 per cent a year, over a ten year period beginning in 1996.
b Defined as the ratio of secondary production to recyclable lead consumption.

Table 2: Simulated change in output as a result of a phase out of non-recyclable lead consumption in the OECD Percentage variation from base case in 2012

	Change from base case in output of:			
	Lead a	Zinc a	Silver a	Secondary lead
	%	%	%	%
Australia	–8.4	4.1	3.6	–67.2
Canada	–12.0	0.5	0.0	–11.4
United States	–16.2	–5.3	–5.7	–20.1
Mexico	–13.8	–4.1	–4.5	–2.9
Other OECD countries	–12.2	–1.3	–1.7	–33.9
Peru	–10.6	0.9	0.5	na
Former centrally planned economies b	–9.3	–1.8	–2.2	na
Other non-OECD countries	–8.7	0.9	0.5	–60.1 c

a Changes in output from lead- zinc mines. b Includes the former Soviet Union, Eastern Europe and centrally planned Asian countries. c Total of all non-OECD countries. na Not available.

Table 3: Simulated net costs to the lead–zinc mining and secondary lead industries as a result of a phase out of non-recyclable lead consumption in the OECD a

	Net cost to lead–zinc mining industry	Net cost to secondary lead industry
	US$m	US$m
Australia	307	1
Canada	56	1
United States	288	10
Mexico	58	0
Other OECD countries	49	14
Peru	25	na
Former centrally planned economies	185	na
Other non-OECD countries	104	14 b
Total	1 072	40

a Net costs (in 1995 US dollars) are defined as the change in the value of 1995 opening capital stocks (including reserves for the mining industry). b Total non-OECD countries. na Not available.

an industry existed in the base year. (There are no official statistics on secondary production in Peru and the former centrally planned economies.) However, under the simulation of a phase out of non-recyclable lead use, expansion of secondary production becomes uneconomic in Australia over the whole projection period and in the non-OECD countries over the period to 2005, resulting in a contraction in the industry.

The reason for the substantial fall in secondary production worldwide lies in the reduced rate of recycling caused by lower lead prices under the policy. The lower lead prices have an amplified effect on the price of lead scrap because many of the secondary processing and collection costs per unit of scrap are inflexible. The lower scrap prices in each region reduce the incentive to recycle, particularly in regions with currently low rates of recycling. This effect is only partly moderated by the slightly higher use of recyclable lead products and thus higher potential scrap availability. On balance, the availability of scrap for reprocessing and, hence, the output of secondary lead are substantially lower under the phase out policy.

Policy implications

Phasing out some lead products as envisaged under the draft Council Act may seem an attractive option for reducing the risks from exposure to lead emanating from particular exposure pathways. However, a reduction in market incentives to recycle lead, when pursuing policies to phase out non-recyclable uses of lead, is likely to have the unintended effect of increasing risks to human health and the environment. Much of this risk would probably stem from increased quantities of used lead acid batteries going to landfill, incineration or storage. The reduction in recycling and associated increase in risks would occur in both OECD and non-OECD countries.

A reduced incentive to recycle lead in non-OECD countries, together with increased production and consumption of mined lead and lead based products in these countries, may increase the risk to their populations from exposure to lead. Such countries, in general, have less stringent and less well enforced regulations on lead exposure (including emissions standards and occupational health and safety standards) and less access to technology to minimise exposure risks. Given that the objective of the OECD risk reduction strategy is to reduce the risks to human health and the environment from exposure to lead, it would seem that an important consideration in deliberating the desirability of policy change should be the likely adverse effects on non-OECD countries.

Apart from the potential for increased exposure to lead to have unintended adverse effects on human health and the environment in OECD and non-OECD countries, the significant economic costs associated with such a policy change should also be taken into account by decision makers. With estimated global costs to the lead–zinc industry of US$1.1 billion for the policy option analysed in this paper, there appears to be a substantial probability of a Council Act causing considerable industrial dislocation in OECD and non-OECD countries. This would occur from the direct losses incurred by companies, their employees and the communities in which they operate, and also from the less than optimal allocation of investment funds to activities earning lower net economic returns to society.

Conclusion

Environmental policy is evolving rapidly in the international arena with an increasing number of multilateral environmental agreements being negotiated in a range of forums. The issue of risk and risk management has figured prominently in these processes and were given significant impetus by *Agenda 21*. These developments are particularly relevant to the minerals sector because metals are classified as chemicals, many having potentially hazardous characteristics when produced, used or disposed of inappropriately. The OECD risk reduction strategy for lead and the Basel Convention are two recent examples of international policy developments which have generated concern within the industry.

A common feature of these recent developments is the lack of an economic dimension when considering risk reduction measures. While considerable effort is being put into the scientific aspects of risk management, relatively little attention has been paid to the economic issues involved in risk reduction. However, economic concerns are likely to be central to the successful adoption of international risk management measures. This is because any policy changes dealing with risk reduction entail economic costs and benefits which are unlikely to be evenly distributed across countries. Failure to fully understand and address these economic aspects may result in the introduction of less than optimal policies or the rejection of sensible environmental protection strategies.

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