Australian National University

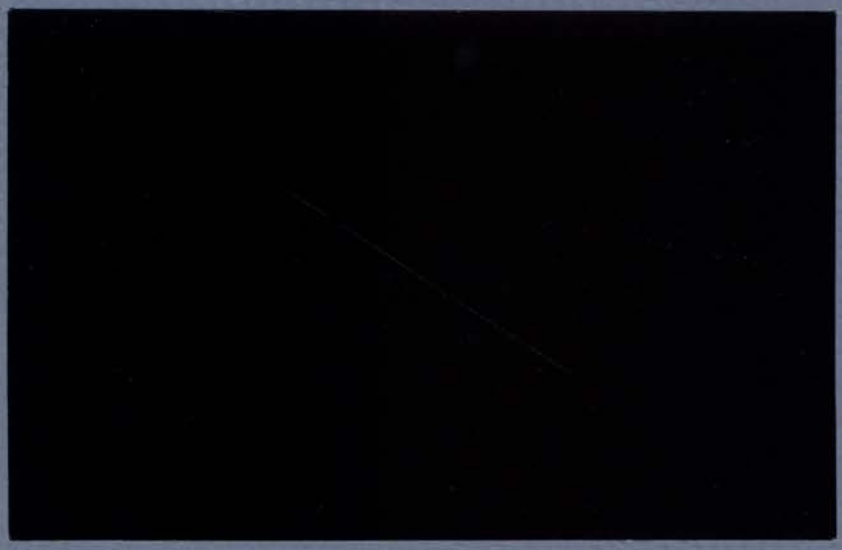
THE COSTS AND BENEFITS OF POLLUTION CONTROL

by

Stuart Harris

CRES R/GP2 (1975)

CENTRE FOR RESOURCE AND ENVIRONMENTAL STUDIES



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Introduction

I am pleased to be able to participate in this seminar because of the importance of the subject. I am also pleased to be here, however, because economists have been given relatively few opportunities to participate in public debate on these subjects - or perhaps have been reluctant to do so.

This is unfortunate because it has left the position of economists and the economics profession a little unclear insofar as its responsibilities and role in the environment and pollution debate are concerned. Moreover, economists do have something to contribute in the analysis of what options are open to a community in terms of the policies to adopt towards pollution and the means of implementing those policies.

This second aspect forms a significant part of my paper and I shall consequently return to explain what I mean in some detail. Before doing so let me talk for a few minutes about the first aspect.

This emerges specifically when one hears the common linking of the concept of economic growth with economists in some casual way; economists being automatically assumed not merely to support, but also to be protagonists for, maximum economic growth. Often, in such discussion,

economic growth itself is defined in ways which emphasise the crowded cities, the belching factories, the noisy streets and airports, the befouled waterways - and not the fewer working hours, the better educational opportunities, the healthier lives, the longer life expectations and the greater material security made possible by greater economic well being.

What economists tend to say - or should say - is that those who do not favour continued economic growth, defined to include non-monetary benefits as well as monetary ones, need to specify which of the benefits they would forego, as well as the disadvantages. Blaming economists for the bad aspects of economic growth, however, is like blaming meteorologists for bad weather or doctors for ill health.

I would not want to suggest that economic growth and pollution and environmental degradation are not associated - they are, but it is an association that is very complex. Some understanding of this association is necessary to understand what controls are possible on pollution and the benefits and costs associated with them.

More importantly, given the existence of pollution, the community is faced with a choice which can be seen in two different ways: how much pollution are people prepared to accept; or how much are people prepared to pay for its removal or abatement. Much of the discussion of pollution is in terms of what, in some absolute way, is acceptable or not. In some cases, such as toxic organic compounds or mercury deposits, this is probably justifiable.

The disputes between the various sides in the argument in the environmental debate, however, are not capable of being brought together unless it is recognised that the discussion has to be in terms of what price the community is prepared to pay for reducing or eliminating pollution.

What is Pollution?

But first let us be reasonably clear what we mean by pollution. There is no simple or unique definition - it has a different emphasis for different people. Looking at it in a broad sense, it is, to the bushwalker, litter on paths and picnic spots; to the urban designer, it may be the noise of trains or aeroplanes; to the public health engineer, it may be putrid offal in a meatworks, bacteria in a swimming pool, or chemicals discharged into the city water supply source; to the social planner, it may be slum dwellings or unplanned housing development; to the suburban householder, it may be the noise of lawnmowers or motor cycles.

Pollution is not merely man-made. Nature is continually polluting the environment - bush and forest fires caused by lightning, and volcanic eruptions both pollute the atmosphere; and soil erosion through rainfall has occurred without man.

Nevertheless, the creation of pollution is principally a consequence of the activities of man, and as economic activities increase - principally in response to economic growth - so does the quantity of pollutants. Pollution is typically a by-product of production or consumption - the community's waste products - which are discharged into one or other forms of the environment: into the air, into water and onto the land.

What constitutes a pollutant is, however, not always predictable or obvious; it depends upon the circumstances. Feed lot effluent in the U.S. is a major pollutant, and is becoming a local problem in parts of Australia; quantities of this effluent, however, were being sold and shipped from the U.S. to the Middle East - it had ceased to be a pollutant and became a valuable by-product.

How much circumstances, rather than the physical or chemical nature of a residual, determine whether something is a pollutant is illustrated by a recent case in the U.S. when ordinary unadulterated river water was found to be a hazardous, deleterious and destructive substance by a U.S. court. In this example, drawn to my attention by colleage, Peter Young, a nuclear power plant which normally discharged heated water had ceased activities for repairs. It continued to pump water from a river through the plant and into a nearby creek. The substantial fish life - above half a million fish - that had been built up as a result of the warm water, died as a consequence of the thermal shock they suffered; the power company also

received a shock by way of a heavy fine.

A characteristic of pollutants which come essentially in two forms; as materials - liquid, gas and solid; and as energy - heat and noise, is that they are interrelated in a number of ways. Thus, one form of material can often be changed into another: coal burned for electricity generation gives off particulates which can be discharged to the atmosphere as a gas, or they can be scrubbed or washed out and the solid residual disposed of onto the land.

Again, restrictions on aircraft by way of modified landing and take-off patterns to reduce noise are, for example, likely to increase the gaseous residuals generated. Control policies need to keep these inter-relationships in mind since a control on one form of emission may merely give rise to a different pollutant discharge.

The essential point about pollution is that the laws of conservation of mass and energy imply that since nothing disappears, the size of the problem of disposal of residuals is, over time, and after allowing for material used in buildings and international trade flows, broadly equal to the weight of material inputs to production and cosumption activities.

The problem can be looked at from the point of view of the residuals produced, i.e. pollutants are a product, a product with a negative value produced in association

with the goods produced, which have a positive value - this has relevance to the type of control measures needed. Alternatively, the problem can be approached from the stand point of the environmental resource which provides certain services. While the services it provides - the ability to absorb society's wastes - are in excess of the demands made upon them, no problem emerges. Once the demands upon them exceed the capacity, the services become scarce and unless rationed in some way - by the price mechanism or by direct control - the environmental resource is damaged, perhaps permanently.

If, for example, a small amount of wastes are disposed of into a stream, the stream will be unaffected; if the residuals are organic wastes they may even be beneficial in providing food for fish. Wastes of a particularly toxic kind, such as mercury, can seldom be tolerated; less toxic wastes once they reach a certain level, over-tax the capacity of the stream to refresh itself - and it ceases to support living creatures and eventually becomes little more than a sewer.

Similarly the air can only absorb some relatively small amount of emissions into the atmosphere. When that capacity is exceeded we get photo chemical smogs and the like.

These are, of course, familiar points - but some qualifications may be less so. We have said that the production of residuals in quantities sufficient to pollute in Australia is associated with economic growth and the

activities that man participates in when he has achieved substantial economic income. We tend, of course, to think of it as a modern phenomenon, although the first smoke abatement law was passed in England in the thirteenth century. Air pollution is probably less now in Europe - and probably was even before the 1956 Clean Air Act - than when Dickens was writing about the ever present and all pervading fogs in Britain. Nevertheless, to a degree, our rapidly increasing awareness of the problem of pollution in Australia has arisen from the postwar rapid increase in production of goods and services that also implies a rapid increase in the production of residuals. To a degree, however, we have concentrated our wastes; we tend to forget that when we look at the smoke emissions of power stations these are, to a degree, substituting for the previous individual smoke emissions of large numbers of individual households and factories.

Our concern for the environment also reflects the fact that as our income goes up we are able to indulge our tastes for more of the things that make up the quality of life - including the environment. Hence in part our concerns in Australia about the environment reflect not only the increase in pollution but also that as we grow wealthier we want a better environment, i.e. we will tolerate less pollution.

The Benefits of Pollution Control

The costs of pollution control are far from easy to measure, but they are easier to measure than the benefits of such controls. A firm can usually estimate

how much it will cost it to meet a specified set of health standards or to avoid some ecologically or environmentally damaging residual disposal. On the other hand, although most Australians would consider the fouling of beaches with human and industrial waste as involving them in substantial amenity losses, to estimate the monetary benefits of cleaning up such beaches in, say, Sydney or Melbourne would be particularly difficult.

Nevertheless, the only way to obtain some perspective at least is by looking at some of the estimated costs of pollution since these are the costs which will be reduced or eliminated by pollution control.

The damage that pollution does is in terms of personal ill health or death, or changes in the use and appearance of land or water or in the appearance and cleanliness of the air - damages of both an economic and non-economic nature.

While overseas experience is often not all that relevant to Australian circumstances, the U.S., as ever, is better able to provide figures - or more willing to make guesses about environmental costs. In a context in which, in the U.S., pollutants released each year into the air amount to about 1 ton per person, the annual health cost in the U.S. of respiratory disease - calculated on the conservative basis of earnings foregone - has been estimated at almost $5 billion. It is also estimated that a 50% reduction in pollution levels would eliminate nearly half of this. Other costs, beyond the earnings foregone, such as medical services required, laundry and cleaning costs, building maintenance, air filtering systems and the like,

are also incurred at substantial levels. Air pollution costs in total in the US were estimated at about $16 billion per year - or some $80 per head per year.

In Britain, some $750 m. per year has been estimated as the cost of air pollution alone, of which some $250 m. represents damage to health.

Air pollution in Australia has not as yet reached the proportions that exist in the US, Europe or Japan though substantial problems have emerged in particular locations. We are perhaps closer to the big league in the case of water pollution. The difficulties of measurement here are even greater and even the US had been unable to provide data on an aggregate basis. The costs in terms of enlarged sewerage treatment plants, and for filtration plants for water supply in Australia would themselves be substantial, and are additional to the general amenity costs arising from loss of recreation amenities and fish life.

The benefits of pollution control can be illustrated more directly by the UK experience following the Clean Air Act. Although population and energy consumption have risen significantly, smoke and sulphur dioxide in the air have dropped significantly, visibility has increased substantially and Central London now gets 50% more winter sunshine. The difficulties of

measuring benefits of this kind are obvious.

Nevertheless, the question becomes, how much should or does a society want to pay for cleaning up what proportion of its pollution? This brings us to the question of the costs of pollution control.

The Costs of Pollution Control

The costs of pollution control are similarly difficult to estimate but, as we have indicated, in some respects, less so than the benefits. Estimates that have been made indicate that the costs of control are also large. In the U.S., where the problems of pollution had, in some respects, become greater than elsewhere - and the proposed improvements called for in the legislation were rather more far reaching, the cost to private industry of implementing the Clean Air legislation has been estimated at $35 billion over four years, most of which would be to deal with motor vehicle emissions.

Total costs of pollution abatement from 1972 to 1976 to meet the legislative requirements would amount to some 1.5% of GNP in the U.S. annually over these years. Not all of this was a net cost - allowing for existing expenditure levels, additional costs would be well under 1% of GNP per annum.

Estimates for OECD countries as a whole suggest lower expenditure rates of around 0.2% to 0.3% of GNP to bring pollution levels down to 1968 levels - but the U.S. requirements would generally be more stringent. Moreover,

the motor vehicle problem is a major component of US pollution, and this is less important in the UK as it is in Australia. For the UK it has been suggested that new expenditures needed to achieve further improvement sought in rivers and in the air would amount to only about 0.7% of GNP.

The point about all of these figures is not that they are accurate - they are obviously not. They do suggest, however, that the amounts involved are large in absolute terms, involving substantial real costs to the community; at the same time, considering the importance of the environment, they are relatively small in proportion to the GNP - within the range of marginal movements in year to year rates of growth of GNP. They suggest, too, that economic growth is possible while improving the environment.

In Australia, costs are again likely to be less. The costs of pollution control already being expended through sewerage, smoke abatement, water treatment, recycling arrangements and other waste disposal procedures, however, are already probably quite high. BHP told a Senate Committee in 1969 that it had spend $25 million on air pollution control measures in NSW alone and expected to spend several millions more in succeeding years. Capital expenditure in 1974-75 by State and local authorities for "protection of the environment" is estimated at $341 m. It also reminds us that pollution control in the form of garbage collection and sewerage have been around for some considerable time.

From general principles, however, one would expect the benefits of pollution control to exceed the costs of control - it would not be logical to spend a dollar on abatement when the abatement was not worth a dollar. Of course, in practice this does happen and very large sums are spent on achieving a small objective in an environmental sense. This raises immense problems of measurement to which I have already referred - how can you measure the value of a clean river or a picnic ground free of broken bottles and empty beer cans or the quiet of a suburban street on the preservation of the spherical eel. Yet the money required to remove or prevent this pollution is real and measurable enough and it does have alternative uses to which it can be put. The pressures will - and should - exist to quantify the benefits, as well as the costs, of pollution control.

Although it is illogical to spend more than one dollar on abatement if less than one dollar of benefit is obtained, the converse is not true. It may not be necessary to spend a dollar to get a dollar's worth of benefit. Moreover the actual costs of pollution control are not fixed - they will depend upon a number of considerations which relate technical and economic factors in pollution control. The first concerns how fast society wants to proceed in cleaning up its pollution. To introduce pollution control technology into existing plant and equipment - whether emission adaptors on motor vehicles or sulphur stripper in coal fired power stations - is more difficult and more expensive than building these controls into new vehicles or into new plants.

A second concern is how far society wishes to go in cleaning up its pollution. In the U.S., the EPA has specified that water being discharged in the U.S. by a period some years ahead must be 100% pure, reaching that point by graduated stages. The costs of achieving the last few percent may be as great as the whole of the remainder. One estimate put the cost of overcoming 85-90% of U.S. water pollution at $61 billion; increasing the standard to 95-99% added another $58 billion; and 100% freedom from pollution would require an additional $200 billion. It is also true that the benefits of a reduction in pollution from high levels to moderate levels, per unit reduction, are likely to be greater than the benefits, per unit of moving from a moderate level to a low level.

What this does suggest is that the optimum level of pollution is very unlikely to be zero.

A further point is that the costs of pollution control will depend upon the efficiency of those controls. This can be considered from two aspects. In the first place there are a number of ways in which pollution can be dealt with, though as we have seen, virtually all goods produced and consumed must ultimately be recycled or discharged into the environment.

Recycling is a major area of possible development in the field of preventing environmental disruption; other ways of limiting the amounts discharged could be by changing demand away from heavy polluting products, by changing production processes - e.g. from open hearth to electric furnace steel making - or by changing to less

polluting raw materials - from cyanides to sulphates in electroplating.

The residuals that are produced can also be modified, and so become less deleterious, after they have been generated - by being dissolved in water, or being cooled, or by having toxic materials extracted.

The capacity of the environment to absorb pollutant materials can also be enlarged - by raising chimney heights, storing water for release when river flow is low, or adding oxygen to rivers or lakes.

To determine which method is most efficient requires the detailed examination of the technical issues involved. They also cost money. There is a need therefore for close working relationships between the engineers, the chemists and so on, on the one hand, and the economists on the other, to see which is the most effective and least cost means of achieving a given pollution control objective.

The second problem is that the costs of pollution are, in the economist's jargon, external to the process of production or consumption which gives rise to them.

Without community action modern industrial systems do not normally include in the cost of what they produce, the external costs in which they involve society when they release toxic gasses or particulates the air, overload the land with solid waste or discharge effluents in rivers and seas. These costs become costs to the community - hidden costs and often heavy costs, whether in terms of high taxation and public spending or by the destruction of amenity or risk of ill health. These are

costs which cannot be avoided - they are paid by citizens as taxpayers or consumers or victims.

The essential difficulty of the environment is that it is a resource that is not owned by anyone except society in general - it is what is known as a common property resource. In the past, in Britain, each village had its common - a collectively owned piece of ground on which each villager could graze his animals at will without charge - it was a free good. There was in fact an incentive to an individual to put more stock on the common provided the value of product was positive since the use of the common was free. Eventually, the commons were often over-stocked and all stock suffered. But there was no incentive for any individual to reduce the number of his stock because he could not be sure that if he did so, others would not simply add more of their own stock. Only collective action by the village as a whole could achieve rational management of the common.

The problem of the environment is analogous. In the absence of community action, the individual businessman or consumer has no incentive on his own to take any action to limit the disposal of residuals. In the absence of government controls, if any single producer or consumer stops disposing of his residuals there is no assurance that anyone else will. In the case of the businessman, there is the added difficulty that if he incurs costs to reduce his emissions, he may be collectively disadvantaged unless his competitors do likewise. He may be less resistant,

therefore, to community action of a general nature - which applies also to his competitors - although he is unwilling to take action unilaterally.

It should be noted, incidentally that although the market system has, until fairly recently, enabled producers and consumers to use many of the resources of the environment freely or almost so - not completely in the case of sewers or garbage disposals - this is not simply, as some suggest, a feature of the capitalist market system, that creates pollution. Smog caps are evident over Chinese cities and the well known example in Cleveland of the river set alight by a careless flame has been matched by the Iset River at Svendlovsk in the USSR.

The control of pollution generally has, as its aim, to relate the costs of pollution control to the process which causes them. The basic principle that "the polluter should pay" has been accepted as a general principle by the OECD countries, and the Australian Government has specifically supported this principle - and indeed much of the existing state legislation in practice has this effect. At times, of course, just what the source of pollution is may be difficult to determine and the principle needs qualification.

There are alternative approaches - to let the beneficiary pay, for example. On the practical grounds that the beneficiaries are normally very numerous compared with the polluter, and the greater practical problems of dealing with new pollutant sources, the levy or change tends to have advantages.

A further approach is to treat the issues as a community problem to be met from the public budget and to pay subsidies to polluters to stop or reduce production of polluting residuals. The payment of subsidies has the practical disadvantage that if it applied without a limit on new sources of pollution, substantial scope would exist for abuse. Moreover, the real argument for subsidy is that it is inequitable to bring about what may be severe income losses for those already in business; this argument would not apply to new business activities. In the US, for practical administrative reasons, subsidies tend to be directed to a specified form of technology, eg. waste treatment plants, and they consequently discourage the developmental use other - better - technologies. There is, however, a case for treating as a community responsibility, and subsidising from public funds, the restoration of past environmental damage.

The two principle approaches to pollution reduction which at the same time relate the costs of pollution to the process from which it results, are direct controls or the price mechanism.

In practice, of course, most governments have tended to make use predominantly of controls by establishing standards which are adhered to with some related charges - or penalties are imposed. Obviously in certain circumstances, the use of regulations seems essential - no pricing arrangement seems sufficiently strong to prevent the discharge of toxic metals such as mercury or cadmium.

For other purposes, however, more effective use of the price mechanism - a tax on the polluting activity, a charge on the beneficiary or a subsidy - seems to have some substantial advantages over regulations in a wide range of circumstances. The principal method that economists favour is a charge or tax which is levied on discharges into a water course, into the atmosphere, or onto land (refunds on beer cans) on a per unit basis - the cost to a firm, or to an individual, is consequently related to the contribution actually made to pollution. Such incentives are also more likely to provide an incentive to avoid disposal of the residual or at least to reduce its volume or polluting capacity significantly.

The arguments about the relative merits of effluent or per unit charges or direct controls - or for that matter between subsidies and levies - are too complex to enter into here. Moreover, the experience in Australia of more stringent controls is relatively recent and does not yet enable too many conclusions to be drawn. Nevertheless, the essential point is that the community has a very real interest in the costs of pollution control, and the costs of achieving a given standard of level of pollution control may vary substantially, depending upon the mechanisms that are used. In practice there will obviously be a mixture of various methods, but there appear to be good arguments for businessmen, local authorities and community representatives to look at the case for making more extensive use

of the price mechanism in the control of pollution.

Control systems have frequently tended to require a uniform reduction of wastes by each industrial enterprise, local government or other source. These have tended to be aimed at a technical objective and to seek generally to achieve this objective by a technological means. At times the objective itself needs to come under critical scrutiny; but even accepting the given technical objectives, so far as water systems are concerned, much of the evidence from overseas suggests that the preferred control procedures would be ones which adjusted the degree of pollution removal required of each activity to minimise the total cost of pollution abatement for the river system as a whole. The use of economic incentives to encourage the adoption of whatever was the most economic method of achieving a given pollution control objective resulted in sharply lower costs compared with the existing approach which relied on uniform treatment of all wastes.

The U.S. Council of Environment Quality calculated that in a study of air pollution in Kansas City, a given reduction imposed equally on all polluters would cost $16 m. per year, whereas the same overall reduction spread according to the relative cost abatement schedules of the various firms would cost, in total, $7.5 m.

The use of economic incentives has the advantage that it encourages a pattern of pollution management by firms and authorities that is economic and it provides incentives to adopt improved technology as it emerges.

It should perhaps be noted that while I am no expert on the details of the legislation of the various States, that of the Victorian Environment Protection Act, at least insofar as it deals with the disposal of industrial or trade wastes into water courses, seems to go some way towards embodying economic incentives in its regulations.

Summary and Concluding Remarks

Pollution and the environmental consequences affect everyone; the costs of pollution are high but the costs of controlling it are high - and may be irrationally high if emotion gets too far ahead of logic.

The issues of environmental pollution are ones which generate a great deal of emotion. It is a subject on which there is still a great deal of misunderstanding. One commentator referring to the situation in which it had been estimated that moving a proposed site of the third London Airport to another for environmental reasons would cost $30 million, said that the protagonists from the environment lobby were disappointed; they would have been more satisfied at the extent of their victory if the costs had been $60 million.

I discussed earlier the fact that the costs of pollution itself are external to the industrial process, or to the consumption activity, and so do not normally enter into the decision process. Similarly, the costs of pollution controls are external to the protagonists of

A lack of effective action on pollution may create health hazards for parents or for their children; it may lead to a loss of water amenities or beach playgrounds and so on. Excessive action, on the other hand, may waste resources that implies the loss of other needed community amenities such as pre-schools and health centres. It is these choices that the planning process has to deal with.

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