CHAPTER 6

International Collaboration in Risk Management

In the assessment and management of environmental risks, 'no man is an island' and nor is any nation. All assessments are made in the context of a wider community that creates greater opportunities than the individual person or single nation would have acting alone. The wider community also imposes constraints and creates areas of potential conflict.

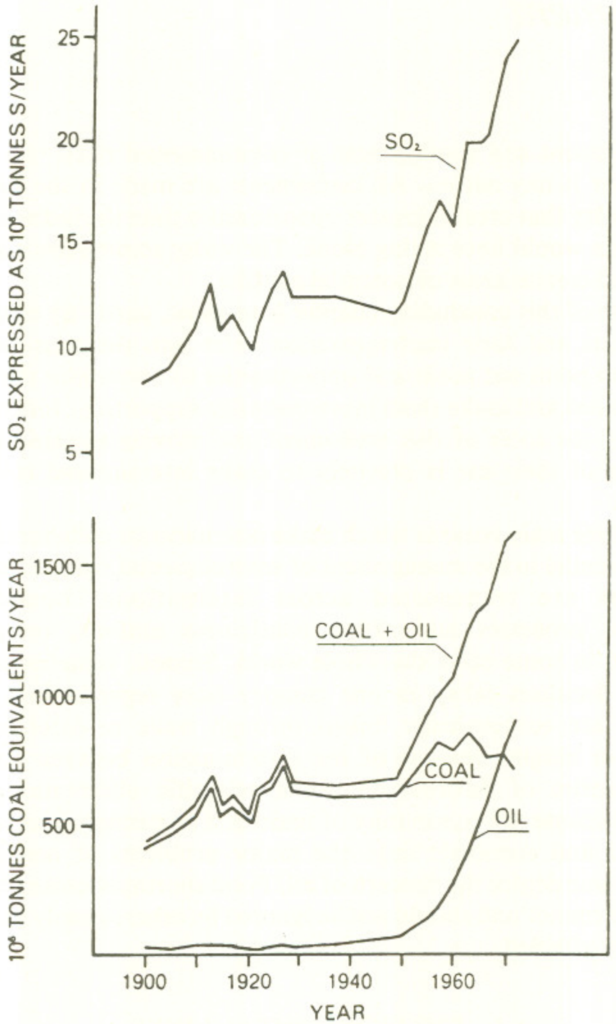
The purpose of this concluding chapter is to show, partly by example, how risk assessments and their implementation enter into the relations between nations, and to point out needs and opportunities to harmonize the actions of individual nations and make them more mutually supporting. Indeed a reason for developing the tools of risk assessment and moving towards a common understanding of their use is precisely to make international collaboration more feasible.

There are three main reasons which make international collaboration useful and indeed essential in the management of environmental risks. First, some of the problems are transported across international boundaries by environmental processes and affect contiguous nations, or groups of countries, and in some cases the whole world. Second, some environmental management decisions taken in one country have repercussions in others because they are economically linked through trade or international aid programmes or simply because of the dissemination between scientists of different countries of information about scientific observations on risk. Thirdly, just because the community of nations is so strongly knit together by environmental and economic links the major problems of one nation are inevitably in some degree the concern of all. Food shortages caused by drought in one country cannot and should not be ignored by others simply because they are not directly affected.

6.1 ENVIRONMENTAL LINKS

The environmental processes which link nations occur on very different scales of space and time. Some are quite limited in extent and concern only two contiguous states. This is often the case, for example, when two countries share a river basin as the United States and Canada share the Great Lakes — St. Lawrence Basin. Other environmental processes are regional in scope. The

Sahelian drought affected a group of countries extending from the Red Sea to the Atlantic, all the way across the southern margins of the Sahara Desert. Yet other environmental processes are global in extent and implications. DDT residues have been found in Antarctic penguins, and ozone-layer depletion potentially affects the earth's atmosphere above every country.



Source: Fjeld, 1976. (Reproduced by permission of the Norwegian Institute for Air Research)

Figure 6.1 Fossil fuel consumption and estimated anthropogenic SO_2 emissions in Europe, 1900-1972.

6.1.1 Trans-border Problems

Acid Precipitation For some time the major industrial nations have sought to reduce the health risks associated with sulphur dioxide and particulates in the atmosphere by building taller chimneys and smoke stacks at industrial plants. This has served to disperse the effluents over wider areas and thus reduce concentrations near the ground in populated and heavily industrialized areas.

The risk management policy adopted by individual nations has been successful in that in many localities *peak* concentrations of sulphur dioxide have been reduced. As shown in Figure 6.1 the total volume of sulphur dioxide emissions in Europe have continued to increase rapidly. In recent years it has come to be recognized that long-range transport of sulphur dioxide can have detrimental effects at great distances from the source. Sulphur dioxide is readily converted to sulphate (SO_4) aerosol form and these particles are carried downwind from industrial areas. There has been widespread acidification (lowered pH) of rain and snow in Europe and eastern North America from this source (Ambio, 1976). Truly global dispersion, however, is not achieved; some Southern Hemisphere soils even show sulphur deficiencies. There are strong indications that the increased acidity of precipitation is a main cause of the extensive fish kills observed in southern Scandinavia.

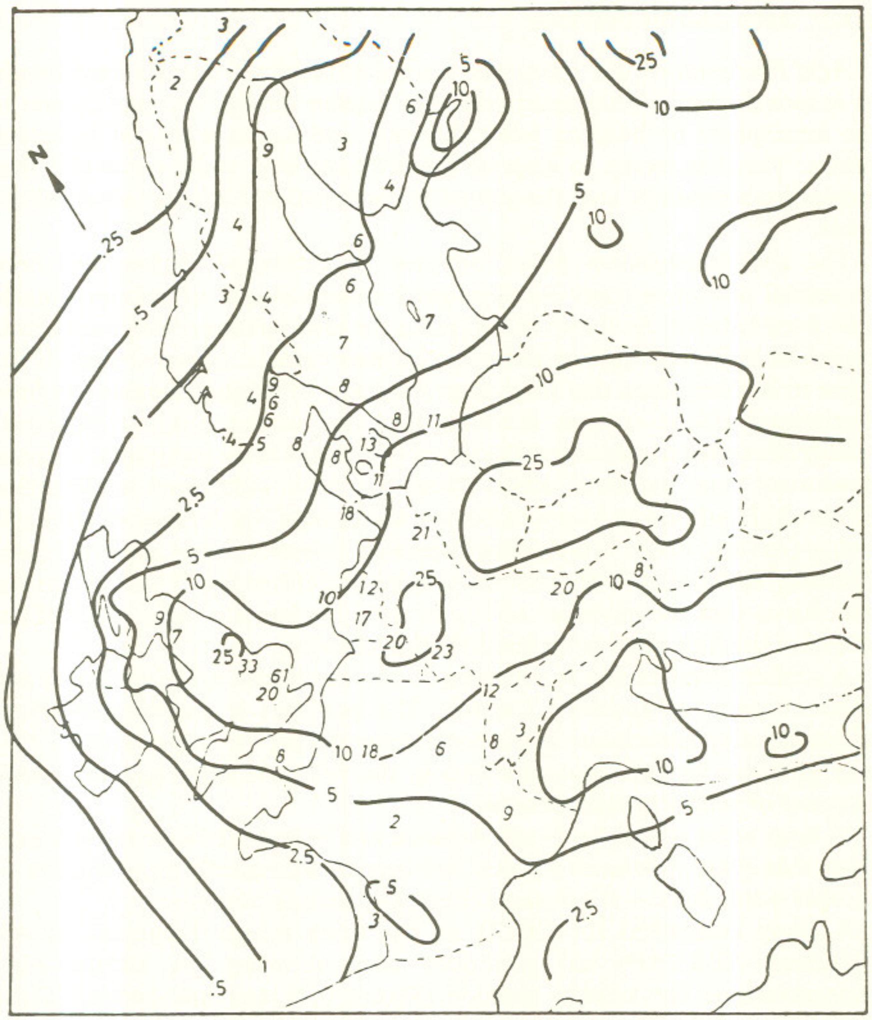
A similar phenomenon is occurring in the northeastern United States and adjacent parts of southern Canada. The problem is exacerbated where pollutants may accumulate in the snow cover during the winter season. This may give rise to high concentrations in the first meltwater and to sudden increases of acidity in exposed areas.

In large areas of eastern North America and Western Europe the risk now exists that many thousands of lakes will become biologically unproductive — in other words dead — if emissions of sulphur dioxide continue.

A study conducted for OECD on the Long Range Transport of Air Pollutants (LRTAP) has produced data showing the Europe-wide concentrations for sulphur dioxide (Figure 6.2) and has permitted the compilation of a table showing sulphur emitters and sulphur receivers (Table 6.1).

Clearly sulphur dioxide emissions have become in Europe a problem of trans-border dispersal, and international cooperation will be needed. Relocation of industry on the scale required is hardly a practicable solution. The reduction of emissions under certain weather conditions might be possible but it would require agreement on selection of the areas to be protected. The obvious control strategy for the regional air pollution problem seems to be a reduction of emissions primarily in large cities and in heavily industrialized regions. Statements of principle have been adopted at OECD and other international organizations concerning the necessity to reduce emissions.

How this would be carried out technically and at what cost has not yet been determined. Those countries contributing most on the emissions side are worried about the expense involved and tend to suggest alternative approaches



Source: OECD, 1977, p.9-7. (Reproduced by permission of OECD).

Figure 6.2 Estimated mean concentration field for SO_2 for 1974. Observed mean concentrations given by italic numbers. Unit $\mu g\ SO_2/m^3$

such as liming of rivers and lakes in Scandinavia. The Scandinavian countries point out that they have already reduced their own emissions considerably and that this is possible for other countries. Liming of the large areas affected involves considerable practical problems. The Scandinavian countries are now calling therefore for an international agreement to reduce air pollutants in Europe (Ottar, 1977).

It is a characteristic of trans-border dispersal problems that the nations where the origin of the problem lies are reluctant to spend money solely to

Table 6.1 Estimated Budget for Total Deposition of Sulphur for 1974

Receivers \ Emitters	Austria	Belgium	Denmark	Federal Republic of Germany	Finland	France	The Netherlands	Norway	Sweden	Switzerland	United Kingdom and Ireland	Czechoslovakia	German Democratic Republic	Italy	Poland	Other areas	Undecided	Sum	Annual emission
Austria	60	6	0	40	0	20	2	0	0	5	20	20	20	30	7	20	30	300	221
Belgium	0	100	0	20	0	30	5	0	0	0	30	1	4	0	0	1	10	200	499
Denmark	0	1	60	6	0	3	1	0	2	0	10	1	6	0	2	2	10	100	312
Federal Republik of Germany	8	60	7	700	0	100	40	0	2	7	100	20	80	7	10	10	90	1300	1964
Finland	0	2	8	10	100	4	2	2	30	0	10	7	30	0	20	80	70	400	274
France	2	40	1	50	0	600	10	0	0	6	100	5	20	30	2	30	150	1000	1616
The Netherlands	0	10	1	10	0	10	60	0	0	0	30	1	4	0	1	0	10	150	391
Norway	0	4	8	10	1	9	4	30	9	0	60	3	10	0	5	4	100	250	91
Sweden	0	7	30	30	10	10	6	6	100	0	40	8	50	0	20	30	100	500	415
Switzerland	1	2	0	7	0	20	1	0	0	30	10	2	1	6	1	2	20	100	76
United Kingdom and Ireland	0	8	2	10	0	20	4	0	0	0	800	2	9	0	2	1	100	1000	2883*
Czechoslovakia, German Democratic Republic, Italy, Poland and other areas	60	60	80	400	40	200	40	9	50	10	600	900	1300	900	1000	4500	1000	11000	—
Sum	100	300	200	1300	150	1000	200	40	200	60	1800	1000	1500	1000	1100	4600	1900	17000	—

*including 80 × 10^3 tonnes S from Ireland

Numbers are rounded to one significant figure and accurate to within ±50 per cent. The sums are calculated from unrounded figures and thereafter rounded separately.
Unit: 10^3 tonnes S.

Source: OECD, 1977. (Reproduced by permission of OECD) protect their neighbours, and that for the most part the recipients of the problem can do little about it.

Many other examples of trans-border problems could be cited. These include, for example: the high levels of sulphur dioxide and particulates in Windsor, Ontario, Canada originating in the industrial areas of Detroit, Michigan, USA across the river; the pollution of the lower Rhine in Holland with effluents from German and Swiss industries upstream; the development of locust swarms or other pest infestations in one country and their migration to devour the crops in another; the construction of the Farrakka Barrage on the lower Ganges by India diverting water into the River Hooghly which would otherwise flow on into Bangladesh.

These are all examples of a natural environmental process which transfers a risk from one country to another. They are confined to problems involving adjacent countries, or those close linked in space. Their solution commonly requires bilateral agreements as in the work of the International Joint Commission involving the United States and Canada in the management of the Great Lakes, or regional groupings such as the member states of the Tchad Basic Commission (Cameroun, Chad, Niger and Nigeria). Contiguity or close proximity on the same continental land-mass is a necessary condition for these effects. Bilateral and multilateral agreements can be reached and agreement is generally facilitated if scientific studies of the risks involved have been carried out on a collaborative basis. The negotiations can proceed more effectively if there is agreement on the scientific character of the problem. The OECD study of acid rain in Europe is an example of scientific cooperation preceding the negotiations on the management decisions required.

Desertification The recent Sahelian drought in Africa from 1968-75 has served to focus worldwide attention on the problems of desertification. Climatic fluctuations exacerbated by resource exploitation activities such as deforestation, overgrazing, deep-well drilling and firewood gathering have now affected at least half of the countries in the world and 30 per cent of the world's land surface with desertification. Many of those affected are amongst the poorest nations and lack the economic resources to combat desert encroachment.

About sixty million people live on the margins of present deserts and are subject directly to risks of drought and desertification. It has been suggested that 6.7 per cent of the world's surface is *man-made* desert caused by deforestation, overgrazing, burning and farming. This is an area larger than Brazil (Kassas, 1975). In the southern Sahara alone 650,000 square kms of land suitable for agriculture or intensive grazing have become desert over the past fifty years (US AID, 1972). Elsewhere deserts are also expanding. In northern Chile, the Atacama Desert is advancing at 1.5 to 3 kilometres per year and the Thar Desert in India was estimated during the 1950's to have been enlarging at the rate of 0.8 kilometres a year for fifty years (Roy and Pandey, 1970).

Efforts to improve man's livelihood in wet years can increase vulnerability to drought and thus speed desertification. Almost all these efforts face the risk that by increasing population density and wealth, desertification will intensify.

The international collaboration required in the field of desertification includes financial and technical assistance to the countries most severely affected, and the exchange of knowledge and experience in methods of combatting desert encroachment. Collaborative research is also needed on an international basis.

6.1.2 Global Hazards

Acid precipitation and desert encroachment are largely regional in their effects. Other risks are globally distributed. The atmosphere's remarkable assimilative capacity distributes certain pollutants around each hemisphere quickly (because the winds are mainly from west or east), and from pole to equator within six to twelve months. Some pollutants — for example the oxides of nitrogen, NO_x — are quickly removed by falling rain. Others break up chemically into harmless materials. The larger particles fall out gravitationally, are scavenged by precipitation, or dissociate chemically. But there remain certain pollutants that resist all these cleansing mechanisms, and are hence diffused globally.

Among these, for example, are the stable gas sulphur hexafluoride, SF_6, which is released from modern electrical switching gear. It has been detected in small concentrations from pole to pole, and high into the stratosphere. It has no known sink. There are many similar stable gases in the atmosphere undergoing this type of global dispersion. They do little harm if (i) they are optically neutral, and hence do not disturb the earth's radiation balance; (ii) they are non-toxic to man and biota; and (iii) they are chemically and photochemically stable and inert (i.e., they resist dissociation and reaction with other species). Sulphur hexafluoride meets all of these criteria. Unfortunately many other pollutants do not.

Carbon dioxide, for example, is being added to the atmosphere at an alarming rate. About four billion tonnes come from the burning of fossil fuel, and an amount variously estimated from two to eight billion tonnes is added through the destruction of forests, and the oxidation of soil humus. The oceans may absorb three billion tonnes by solution. The rest stays in the atmosphere, whose carbon content (near 700 billion tonnes) is rising at the rate of 3 per cent per decade. If the trend continues, atmospheric carbon content will double by about 2050 AD. This should have a significant warming effect and could cause major readjustments of world rainfall distribution (Perry and Landsberg, 1977; Keeling and Bacastow, 1977; US National Academy of Sciences 1977a; Woodwell, 1977; Kellogg, 1977), with unascertained social and economic impacts. To continue burning fossil fuels at present or increased rates thus poses a serious risk to future climatic stability and to climate-sensitive activities.

A similar dispersion has been achieved for the nine million tonnes of chlorofluoromethanes (CFMs) so far manufactured and used as spray-can propellants, plastic inflaters (polyurethane foam) and refrigerants. These gases are as widely dispersed as SF_6, but are dissociated above 20 km by hard ultraviolet radiation. The freed chlorine then attacks ozone (O_3), allowing a greater penetration to groundlevel of harmful ultraviolet-B radiation (wavelength 295-320 nanometres). It is possible that nitrous oxide from heavily fertilized land adds to this effect. A reduction of ozone of order five to ten per cent has been predicted in computer modelling exercises, and this may lead to a ten to twenty per cent increase in the incidence of skin cancer among fair-skinned people (USNAS, 1977b; Evans and Hare, forthcoming, 1979). However, the natural variability in stratospheric ozone amounts is so large that there is as yet no evidence for a downward trend, even though concentrations of chlorofluoromethanes have been increasing.

It is not yet possible to construct a table for the ozone depletion problem similar to the table of emitters and receivers of sulphur dioxide in Europe (Table 6.1). Development of such a balance sheet is fundamental to the attainment of any international agreements which may become necessary to safeguard the ozone layer. An early impression was created that the ozone problem was and would remain the concern of the larger industrial nations. A substantial proportion of the world's production of fluorocarbons is concentrated in the United States (Machta, 1976; Munn, 1977). Currently the sale of spray cans using fluorocarbons as propellants is banned in the United States, but not their manufacture or export. Total world use has continued to increase despite the ban in the United States.

Recently the possibility that nitrogen fixation may contribute to ozone depletion has been recognized. Natural processes fix nitrogen in the soil and air but man's contribution to the total is increasing (24 per cent of the total in 1974). In 1850 no industrially produced fertilizers were used; in 1950 3.8 million tonnes, or two per cent of the total, came from industrial fixation. If the growth in nitrogen fertilizers continues, the amount of nitrogen fixation by fertilizers alone may increase to between 100 and 200 MT/yr by the year 2000. It is denitrification which produces nitrogen oxide, N_2O, a gas capable of reaching the stratosphere. During denitrification of the soil, only a small and uncertain fraction (about 7 per cent) is believed to be converted to N_2O. The processes of denitrification in the soil and the sea are not well understood. In particular there is a lag between application of nitrogen fertilizer and denitrification which has been estimated as possibly lasting hundreds to thousands of years (Lin *et al.*, 1976).

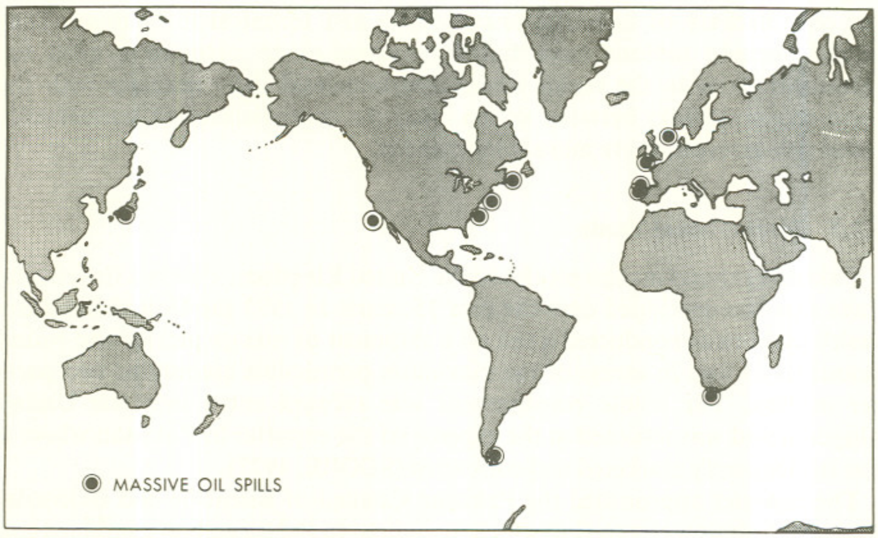
It is possible that nitrogen fertilizers will within decades become the major single source of atmosphere N_2O. Since all countries are potential users of nitrogen fertilizers and since rapid increase in their use is anticipated, especially in developing countries, it is clear that atmospheric ozone depletion is potentially at least a a matter of concern not only to industrial nations but to all countries of the world, especially perhaps the larger agricultural producers.

Research on the ozone layer continues to expand under international auspices (UNEP, 1978) and a World Plan of Action has been formulated (UNEP, 1977).

Global hazards differ from trans-border dispersal problems in degree only. They concern those natural environmental processes which can become so pervasive that the common property resources of the entire global community are affected. The main common property resources are the atmosphere, the oceans and outer space. Man-induced changes now threaten the stability of the world's climatic zones (Hare, 1977).

Marine oil spills Contamination of the marine environment by petroleum hydrocarbons is one of the major ecological problems facing the world community today. A detailed report by the US National Academy of Sciences (1975) estimated that 6.1 million metric tons of oil enter the oceans annually. The distribution of massive oil spills 1967-77 resulting from accidents involving tankers or ocean oil wells, is shown in Figure 6.3.

The causes of this problem are two-fold — the heavy reliance on enormous quantities of imported petroleum by the western industrial nations and the increasing size of oil tankers. For example, US imports increased from 3.4 million barrels per day in 1970 to 8.3 million barrels a day by 1977. Both the size and number of tankers has increased. Before 1950 there was only one tanker above 50,000 dwt. By 1965 there were 47 tankers in the 50,000 dwt. to 200,000 dwt. classes, and by the late 1960s there were 131 tankers above



Source: Grundlach, 1977.

Figure 6.3 Distribution of massive oil spills in the world 1967-78

200,000 dwt. in operation. Both the fleet and the size of individual tankers continues to grow. Massive spills have therefore become inevitable and seem bound to increase.

From all the major incidents, experience has shown that impact is highly variable. Coastal zones are likely to suffer severe damage to wildlife, shellfish production and to recreational amenities. Spills offshore cause only minor environmental impairment (Grundlach, 1977).

Fish depletion Between 1950 and 1970 the world fish catch rose from 21 million to 70 million metric tons. It grew at over five per cent annually which was twice as fast as the world population and gave hopes for a solution to world protein shortages. By the 1970s however serious stresses in the marine resources were seen and for the first time, the total global fish catch maintained a decline over several years. Overexploitation had wiped out some species of fish and depleted many others to a fraction of their potential yields (Eckholm, 1976, pp.155-6).

6.2 SOCIO-ECONOMIC LINKS

The socio-economic connections between nations grow steadily stronger and more pervasive. It is a well established axiom of international trade and finance that economic weakness or collapse in one nation works to the detriment of all. Such a strong recognition of interdependence has not yet been achieved in environmental affairs. National self-interest still outstrips collaborative action in the case of many environmental risks. The risks persist not only because of scientific uncertainties and technical difficulties. They persist because nations have failed to agree or to perceive a need for agreement. It is in the realm where environmental risks intersect with the socio-economic links between nations that the contributions of scientifically based risk-assessment are more sorely needed.

6.2.1 International Trade

Pakistan exports mango pickles to the United Kingdom. This is a flourishing trade that has developed over the past 15 years. In 1973 the United Kingdom health authorities conducted a test on a shipment of mango pickles and found quantities of lead in excess of the maximum permissible amount of two parts per million. The whole consignment was refused entry into the United Kingdom and was returned at the expense of the exporter to Pakistan where it was subsequently marketed and consumed (SCOPE, 1977).

The exporter approached the Pakistan Council of Scientific and Industrial Research Laboratories to find which ingredient in the cargo had contained too much lead. Each ingredient was analysed and the lead was eventually traced to turmeric. Turmeric from a number of sources and regions in Pakistan was then analysed and it was found that lead was present in large quantities in those samples of turmeric grown near cities and not far from roads. Turmeric from the more inaccessible rural areas was uncontaminated. The PCSIR considers that lead from petrol used by automobiles in the more urbanized regions of the country is the source of lead in tumeric and in mango pickles. Care is now taken to use turmeric from the rural areas in the manufacture of mango pickles. The exporter has also recognized the need to meet standards set in countries to which his products are exported and now has a small quality control laboratory for testing purposes (SCOPE, 1977).

The standard for lead in food in Pakistan is the same as that in the United Kingdom. The adoption of a standard does not necessarily mean, in Pakistan as elsewhere, that it will be enforced. The monitoring and inspection required to ensure enforcement of standards is expensive (Beg, 1977).

This example is a small illustration of a widespread and general problem in risk management. Nations for whom international trade is an important factor in their economic health and development are naturally concerned about the effects that environmental risk assessment decisions may have on their international trade position, on their national income and on the prosperity or viability of specific economic activities, such as manufacturing, resource development, urbanization, and public services such as water supply, transport, and so on.

Fears are most frequently and strongly expressed about the effect of environmental standards which if imposed in one country and not others may result in adverse consequences for an industry, for the nation's balance of payments, for real income levels and for the nation's long-term comparative advantage. This sort of fear is especially great where other (competitor) countries adopt lower environmental standards, or directly or indirectly subsidize the cost of environmental quality controls.

Clearly a degree of international collaboration is required if major trading nations are to continue to take steps to reduce the risks of environmental contamination resulting for example from industrial pollution. A difficulty in this process is that the adoption of the same standards or the same degree of risk can have disproportionate effects in different economic circumstances. The requirement to meet a particular emission standard for automobiles is more difficult to achieve in some makes of cars than in others, for example. The problem of producing cars (or other goods meeting different standards for different markets) complicates production runs and disadvantages some more than others.

Such effects clearly create the possibility that decisions taken in the interests of risk reduction or safety may in fact be used as restrictive trade practices. It is reported for example (d'Arge and Kneese, 1972) that the French government requires inspection of production procedures for quality control of pharmaceuticals and that this has effectively frozen foreign manufacturers out of the French market.

Another example is a law in the Federal Republic of Germany adopted in 1974 restricting the lead content of gasoline to 0.15 grams per litre (Sterling, The monitoring, testing, screening processes which accompany these risks in the industrial nations are expensive and require much scientifically trained manpower. Since both money and trained manpower are in short supply in most developing countries and there is a temptation to seek the short-run benefits and to discount the new risks so generated.

Where development assistance is involved in projects that create new risks it is important that the recipient country be fully informed of the character and possible consequences of the risk. It is also important that neither country should automatically assume that the same standards of safety will apply.

The risks attendant upon development activities must be more fully examined and understood by both donors and recipients. The decision on the acceptability of the risks or the safety levels or standards to be attained is primarily that of the recipient country.

The risks are not always obvious. In the case of the Bangladesh cyclone disaster, the Sahelian drought and the Iraq mercury poisoning, the full risk system in all its ramifications was not explored. To the extent that the risks were known and understood by experts, their knowledge was not effectively communicated or acted upon.

6.2.3 Risks to Internationally Valued or Unique Sites

The Government of India is building a large oil refinery in Math'usa some 30 miles from the Taj Mahal. Sulphur dioxide emissions from the refinery combined with water vapours in the atmosphere will form an acid rain, that if present in sufficient quantity over a period of time could react with the marble (calcium carbonate) structure of the Taj. The white polished surface of the Taj Mahal, famous for its luminescence in the moonlight, could become discoloured, then pitted and scarred.

Told in this fashion the story suggests a cause for international concern. The Taj Mahal belongs to India, but also in a wider sense it is part of the common cultural heritage of mankind. If the Taj were to be irreparably damaged, the world and not just India would be the poorer.

A risk assessment has been carried out. It involves forecasts of the amount of sulphur dioxide to be emitted by the refinery under several alternative control technologies. It involves atmospheric diffusion models to calculate how much of the emission would reach the Taj. There is a low inversion layer in the area most of the time for a 6-8 months period. The prevailing winds are northeasterly for nine months of the year, which places the Taj exactly downwind of the refinery.

There is little reliable information on the chemical reaction rates between the marble used in the Taj and SO_x. Inferences can be made from some Swedish data about limestone and SO_2.

If control equipment is used, and if low sulphur-content crude oil is used then the additional SO_2 at the site of the Taj Mahal is calculated to be in the order of $0.1 \mu g/m^3$ (micrograms per cubic metre). From estimates of reaction rates it appears that no damage would occur at levels as high as $20\mu g/m^3$. From observation in the vicinity of the Taj Mahal however, existing levels are already in the vicinity of 40μ g/m^3 due to numerous small scale industries and other sources in the vicinity of Agra.

The conclusion of the risk assessment therefore, is that there is a risk to the Taj Mahal, but that the contribution of the proposed refinery is very small in relation to the existing levels of pollution from other sources. The management implication drawn by the study and accepted by the Government of India is that the refinery should be built on the approved site, and that emission control technology and low-sulphur content crude should be used. At the same time it is evident that a substantial clean-up effort is required for the other, already existing sources of SO_2 in the region, if the Taj Mahal is not to suffer damage.

If such action is taken it will reduce the risk to the Taj Mahal, but not eliminate it. Is the level of risk acceptable? The Archaeological Survey of India and some Indian scientists are reported to be concerned (Sri Vatsa, 1977). They are not convinced that the safeguards are adequate or will be adequately enforced. Indian industrial licensing laws, they point out, do not include pollution control standards. The treasures of the Taj cannot be moved; the site of the refinery can be. Not only is the debate being conducted in India, but the opponents of the refinery have formed an International Action Committee which has appealed to scientists and intellectuals throughout the world for help in persuading the Government of India to relocate the refinery.

The appeal is based on the notion that the Taj Mahal is more than an Indian architectural site. It is argued that all people have an interest in the preservation of the Taj. Such a view led UNESCO to lead an international effort to save Egyptian archaeological sites from submergence under the waters of the High Aswan Dam. Similarly concern has been expressed in many countries for the preservation of Venice (slowly sinking) and the Acropolis in Athens (being corroded by air pollution).

When development involves the creation of an environmental risk to an internationally valued or unique site, nations may expect other countries to take a close interest in the safeguarding of such monuments or sites. There are already examples where the principle of international cooperation has been accepted. So far this has always been with the approval of the country in which the monument or site is located. If, in the interests of development any country wishes to place at risk part of the common cultural heritage of man within its own borders, other nations and peoples have no recourse but to moral persuasion.

6.2.4 Exchange of Information and Scientific Knowledge

When the United States decided on 18 October 1969 to impose a complete ban on all uses of cyclamates (artificial sweeteners) the action was swiftly repeated in more than 30 other countries. For example, Sweden took action on

20 October. Decision in developing countries generally came a little later. For example, Uruguay took action on 4 November, Nicaragua on 20 November, Ethiopia on 2 December, Saudi Arabia on 26 January 1970, Philippines on 4 August 1970.

When Canada and the United States announced a similar decision about saccharin in 1977 it was not widely followed and seemed to have been largely rejected outside North America.

The first cases of Minimata disease, an epidemic neurological disease, occurred in Japan in 1953. It was not until 1959 that methyl mercury was positively identifiied as the cause. By 1964 mercury seed dressing had been implicated in the poisoning of seed-eating birds in Sweden (Löfroth, 1970). In 1962 scientific papers on the Japanese experience were published in English for the first time identifying mercury-containing industrial waste-water as the cause of Minimata disease. Five years passed before monitoring of mercury levels began in Canada in 1967 and the first research results did not appear until 1969 (Fimreite, 1969). High levels of mercury were found in Ontario fish leading to the suspension of commercial fishing in some waters.

In Nigeria there are no regulations or standards concerning the import, sale or use of chemical pesticides. Manufacturers can sell pesticides in Nigeria even if they have been banned or had their use restricted in the country of origin. The level of pesticide use in Nigeria is relatively small today but it can be expected to increase rapidly in future.

The dissemination, use and exchange of scientific information about environmental risks is an extremely haphazard process. In some cases information that could be beneficially shared appears not to reach those who could use it, or to do so only after long delays. In other instances new information from laboratory tests or experiments is followed by swift action in a number of widely separated countries. On other occasions similar information goes largely unnoticed or ignored.

Sometimes it appears that there is too much information for some governments to absorb or react to. For example, the information generated by the US Environmental Protection Agency is too voluminous for most countries to be able to decide what applies to their own situation. This problem of information overload is likely to be further exacerbated by the large volume of scientific data that will be generated under the US Toxic Substances Control Act of 1976. Many countries will lack the scientific manpower or the funds to make decisions about what, if any, of it is relevant to their own circumstances.

Much of the scientific information about pollution risks that has emerged in the past has not been important to many developing countries. The scale of industrial development proceeds however, and as the use of chemicals expands in agriculture, there will be increasing need for developing countries to be aware of the new risks that are being introduced. The training of manpower in the environmental sciences should accompany and not follow the environmental inputs of development; and more consideration needs to be given to the international dissemination of environmental risk data and the capacity of countries to judge it in the light of their own circumstances, and to use it effectively.

6.3 COMMON NATIONAL PROBLEMS

A third reason for international collaboration in risk management is simply that many countries face large problems which are essentially similar to those found elsewhere. The environmental risks generated do not necessarily cross international boundaries, nor are they necessarily involved in the socio-economic links between countries. There is clearly a class of environmental risks however, about which it is helpful to share information, scientific knowledge and management experience.

An example of a common national problem of this sort is water supply. According to World Health Organization statistics there were 1,026 million people living in rural areas in 90 developing countries in 1970 without access to safe supplies of drinking water (Burton, 1977).

The risk to health from bacteriological contamination of drinking water has been recognized as a priority problem and the period 1980-89 has been designated the International Drinking Water Decade. A variety of activities is planned for the Decade including a major expansion of development assistance.

There are clear advantages in the international recognition of such problems and the development of concerted action, even though the problems themselves are unconnected by environmental or economic links.

Other similar problems include malnutrition, poor housing and sanitary conditions, excessive noise, soil loss and land transformation, deforestation and natural hazards such as drought, earthquake, flood or tropical cyclones.

The establishment of procedures for collaboration in these areas may set helpful precedents for later joint action to deal with industrial pollution and global risks of climatic change and the like.

6.4 EMERGING NEEDS AND SUGGESTED ACTIONS

Not much more than a decade ago the work that is now being done by international environmental organizations like SCOPE and UNEP would have been considered utopian. Indeed the very existence of these and other such organizations was but a dream. That they now exist, are well established and are doing work to some good effect, is testimony both to the continued adaptive capacity of human institutions and to the seriousness of the environmental risks which rush upon us.

The adequacy of existing institutions to deal with a growing number of environmental risks is a subject of continuing debate and reappraisal. The scene changes and sometimes changes rapidly. At the time of the UN Environment Conference held at Stockholm in 1972 the nations of the world perceived their interests to be at variance with each other in the environmental realm (Falk, 1972). To a remarkable degree the perception of *antagonistic interests* has been replaced with a perception of the *common interests* of mankind. This is a crucial change because it is only as the sense of common interest grows that an international order can be created in which environmental risks are managed rationally and for the benefit and survival of all men.

The range of international risks described in the foregoing pages makes clear that international collaboration needs further strengthening and development to cope with existing problems and the new risks that are certain to emerge as the impact of human activities on the resources of the biosphere continues to grow.

We see a number of avenues for development in this direction. In none of them is the path clear, but all need to be sought out and followed if an effective and successful management of environmental risks is to be achieved internationally.

6.4.1 National Risk Management Institutions

Perhaps of greatest importance is the development and strengthening of national risk management institutions. The style and character of the institutions needs to be commensurate with the problems and priorities of the individual nations. The concept of environmental risk management can only make headway on an international scale when national governments are familiar with the ideas and techniques required and use them in their own areas of jurisdiction. For this reason we think there is need for collaboration between nations and action by international organizations to help all nations develop and strengthen risk management capacities.

This process is in fact going on in many ways through many of the specialized agencies of the UN system. National capacity is best developed on national problems and hence an important area for collaboration is in the category of *common national problems* described above. The UN Disaster Relief Office is helping nations to find better ways of coping with natural hazards and disasters. The World Health Organization plays a leading role alongside others in helping to overcome public health risks associated, for example, with inadequate and unsafe supplies of drinking water. Many other examples of this sort could be cited. The important point here is that strengthening of national risk management capacity is an essential preliminary to the development of more coordinated international responses. The International Referral System being developed and operated through UNEP is an important step in this direction.

6.4.2 International Activities

An important priority at the international level is getting the facts straight. Progress is difficult to achieve as long as there are areas of wide scientific disagreement. A common scientific basis of understanding is difficult to achieve *within* nations and environmental disputes are often characterized by expert testimony from scientific witnesses who disagree. At the international level procedures need to be strengthened for establishing as large an area of agreement among scientists as possible. The use of the International Council of Scientific Unions (and its constituent bodies) as one means of drawing on scientific expertise in a relatively unbiased fashion is one direction that can be followed. For any environmental risk problem that entails physical linkages between countries, the kind of trade-off table produced for sulphur (see Table 6.1) by OECD specialists is a very large step towards effective management. Clearly such scientifically agreed estimates can still be challenged, and their existence does not by itself provide any guarantee that progress towards a solution will follow, but the more authoritative the statements of international scientific groups and the wider the area of agreement, the greater the prospects for international agreement on required actions.

While seeking areas of scientific agreement, there is a hierarchy of steps in international collaboration that can be followed at the same time (Eldin, 1973). First there is need to exchange information on national experience. The more that such exchange can be arranged the better. Useful lessons can be learned in the process of exchange and the exchange itself helps to build common understandings of environmental risks and the *alternatives* open to management.

A second step is to harmonize national decisions. Clearly this requires detailed and sometimes lengthy negotiations. There are many examples where national decisions on environmental questions have been harmonized as well as many that have not. One successful mechanism for harmonizing national decisions has been the International Joint Commission established between the United States and Canada for the management of the Great Lakes under the Boundary Waters Treaty of 1909 (Ross, 1972). This Commission is composed of six members, three from each country, who try to act in unison to achieve the best solution in the *common interest* of the two countries. Thus in the words of former Chairman Heeney, we 'act, not as delegates striving for national advantages under instructions from their respective governments, but as members of a single body' (Heeney, 1966). The method of harmonizing national decisions necessarily varies according to the situation and the nations involved, but the need to seek such arrangements is now widely recognized.

A third and more difficult step is to integrate environmental management policy with international trade and development policy. The danger of policies adopted in the name of environmental protection becoming, in effect, non-tariff barriers to international trade is very real and serious. As matters of environmental risk assume larger significance in the affairs of nations, as we believe they must, then there is increasing need for a voice representing the common interests of mankind in a safe environment to be heard in the councils of international economic affairs. To the extent that this voice lacks authority, the environmental future will be more in jeopardy from short-run and sectional economic interests. Serious consideration is therefore needed about ways and means to ensure that environmental risks are considered at the highest levels of international discussion on economic affairs.

There is hidden in the descriptions of the ways in which risk assessments and risk management enters into relations between nations a thinly veiled implication of massive proportions. What happens when a truly global risk of serious and pressing proportions is established? This *could* turn out to be the case with the ozone layer depletion risk. It *could* turn out to be the case with changes in the carbon cycle and the associated risk of climatic change or instability. It *could* turn out to be the case with any one of a number of chemical products, the use of which has become or will become heavy and widespread on a global basis.

These risks are present now, but they are all sufficiently uncertain or apparently far enough into the future that serious action can be delayed. But not forever. From the point of view of scientific risk assessment, and from the perspective offered by the present spectrum of environmental risks, it seems to be only a matter of time before a truly global risk of serious and *pressing* proportions appears. This is not an overdramatization. It is a fact of life.

The international mechanisms that now exist and the institutional procedures currently available seem unlikely to be able to respond effectively. The difficulties will be greater the more that the distribution of the risks and benefits are seen to be unequal among the nations.

Recent experience with efforts at concerted international action may be viewed as a learning process and as a training ground for the more serious and urgent decisions that will be required in the future. The United Nations Conference on the Law of the Sea; the World Plan of Action for the Control of Desertification; and the International Drinking Water Decade, are examples of current progress in international cooperation.

Further development in two directions seems indicated:

(1) Attention must increasingly be given to the formulation of a series of step-by-step actions and the mechanisms to be used to safeguard and assert the common interests of mankind *even* when, or more correctly, *especially* when they conflict with the short-term interests of some nations.

(2) As a prerequisite to such action, the capacity of the international scientific community to provide unbiased reports reflecting as large an area of scientific agreement as possible, needs to be greatly strengthened.

Scientific collaboration is one important strategy in combatting environmental risks. But perhaps equally important is a wider understanding of the part of all those involved in risk assessment of the multifaceted nature of the environmental problems that we face. This report has sought to show how risk assessors can move away from responding to hazards in an *ad hoc* fashion towards actions that are more systematic, more accountable and more anticipatory.