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Increasingly intolerable boundaries: future control of environmental pollution

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Abstract

In recent years, there have been a number of toxic accidents on the sea and on land which have caused pollution down current, down wind and down stream. Four were dramatic and these four have led to substantial changes in the way we deal with risk to the environment. There have also been increasing concerns about a less spectacular but equally concerning problem, acid rain, though attempts to deal with this problem have been less successful. Perhaps the drama was lacking. In all these cases, unfortunately, the less developed countries can ill afford the costs of prevention and this means they are often the home of environmentally unfriendly development. While the current approaches to such problems will continue, it is likely that the countries on the receiving end of such pollution, especially if they have economic and military power, will seek more forceful solutions. One outcome may be a UN-sponsored environmental police force. © 2001 Elsevier Science B.V. All rights reserved.

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1. Four incidents

On 18 March 1967, the tanker *Torrey Canyon* ran aground on Pollard Rock by Seven Stones, a granite reef near the Scilly Isles outside UK territorial waters. Many of the ship's cargo tanks were damaged and over the next 48 h 30,000 of its 119,000 tonnes of oil escaped. Because of high winds and high seas, another 30,000 tonnes leaked during the next 7 days. Desperate to stop the oil pollution which had reached the coast of Cornwall and was drifting towards France (the oil did reach Brittany 3 weeks after the accident), the British bombed the wreckage and used napalm to set the remaining oil on fire. The British also used chemical dispersants to clean up the oil but that proved to be a mixed blessing: the dispersants used at that time were also toxic.

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On 10 July 1976, a rupture disk burst in a safety valve at the Icmesa plant in Lombardy, about 20 km north of Milan, Italy. A toxic cloud containing dioxins drifted towards communities downwind including Seveso, population 17,000, as well as Meda, Cesano Maderno and Desio. As news of the release gradually became known, fear grew to the point that Italy even sanctioned abortions because of mothers' trauma about possibly damaged fetuses. There were evacuations and some areas were fenced off. However, though some chickens and rabbits died at the time and there were reports of people experiencing inflammation of the skin and, over time, some increase in rare cancers, there is still no clear evidence if the release had a significant health impact on those living nearby ([5], p. 746). There was a slight increase in deaths caused by heart failure, something attributed not to the dioxin itself but to the "insecurity and stress caused by the chemical accident. . ." ([20], p. 4). Nevertheless, "Seveso unleashed a wave of anxiety, fear and criticism in the public; for many people it symbolizes the real or imagined hazards and risks of chemical production" ([20], p. 3).

On 26 April 1986, there was an explosion at a nuclear plant in Chernobyl, 130 km north of Kiev in what was then the Soviet Union. The explosion led to 31 deaths, 150 persons hospitalized with radiation sickness and an eventual evacuation of 130,000 persons. In 1957–58, the Soviets had managed to conceal an enormous accident involving nuclear waste ([16], p. 37). This time, scientists in Sweden and Finland began to notice unusual levels of airborne radioactive material — Sweden even evacuated a nuclear power plant believing that it was the cause of the radioactivity — so the Soviets had to admit what happened. Eventually most of Europe and North America recorded increased radiation, especially when elements from the explosion and fire passed by while it was raining.

On Saturday, 1 November 1986, a fire involving mainly agricultural chemicals broke out in the Sandoz warehouse in Schweizerhalle, Switzerland. Residents were warned to stay in their homes and close all windows but that warning was called off at seven the next morning. "Monday morning at the head office, everyone felt reassured, the firemen had done very good work, there were no victims — all that remained was to clean up the site. At the government's press conference on Monday, 3rd November, and at the Sandoz conference on Tuesday, everyone spoke of the accident in the past tense" ([14], p. 85). Unfortunately, water used to fight that fire — now polluted with chemicals — ran into the Rhine and flowed with deadly impact along the German–French border en route to Luxembourg and The Netherlands. The pollution led to the deaths of half a million fish including eels, a species that had, until then, been able to survive river pollution.

2. Not the only incidents

None of these incidents were the only ones of their kind. There have been tanker spills before and since off the coasts and in inland waters of Australia, Canada, Greece, Japan, Portugal, Puerto Rico, Singapore, South Africa, Thailand, Turkey and the USA. Since *Torrey Canyon*, Europe has experienced *Amoco Cadiz* also off the coast of Brittany, the *Braer* at the Shetland Isles and *Sea Empress* along the Coast of Wales. Prior to Chernobyl there were nuclear accidents in Canada, the UK and USA (including the highly publicized Three Mile Island) and since Chernobyl a second incident in Japan. There was a chemical plant fire and explosion in Flixborough, England prior to Seveso. Between Seveso and the

Schweizerhalle fire, there was a major release from a Union Carbide in Bhopal, India. There have been pollution problems on other border waterways including the Great Lakes along the Canada–US border and the Rio Grande, which separates the USA and Mexico.

But these four incidents — *Torrey Canyon*, Seveso, Chernobyl and the Sandoz fire — are especially important for two reasons. First, they all involved toxic releases that had enormous impact down current, down wind and down stream — in three of the four on other countries. Second, they all triggered major reactions. *Torrey Canyon* aroused the maritime community and the world to the dangers of tanker spills. Seveso, even though its toxic effects were confined to Italy, inspired the European move towards unified regulations covering chemical plant safety. Chernobyl seems to have been a turning point in worldwide acceptance of nuclear power. The Sandoz fire led to further European efforts to improve the safety of chemical plants and the ability to respond to chemical accidents and to much more aggressive attempts to clean up the polluted Rhine.

This article starts by reviewing what happened in the wake of these four incidents. Then it looks at a less dramatic but toxic problem — acid rain. Finally, it questions whether the current approaches to such problems are sufficient and concludes that they are not. In future, increasing worldwide concern is likely to increase the demands for better control of toxic substances. It seems reasonable to suggest that eventually those with the power to insist on action may use force to get their way. It is not inconceivable that in the decades to come there will be a UN environmental police, similar to the UN troops now used to bring about or enforce the peace though it is far from clear how that would work.

3. Torrey Canyon

Although *Exxon Valdez* received more media attention because it was an American media event and because it occurred in what was seen as the previously pristine Arctic, *Torrey Canyon* was the turning point in international action on marine spills. Marine pollution was not an issue when the International Maritime Organization (IMO) was created in 1948 though it was the topic for a special conference in the UK in 1954. However, that conference was on the dumping of oily waste not on accidental oil spills. *Torrey Canyon* changed that emphasis: “In March, 1967. . . *Torrey Canyon*. . . was, at the time, the worst oil pollution disaster ever and the impact on public opinion was enormous. For the first time, the general public were made aware of the dangers that the carriage of oil posed to the environment. . .” [13]. “Part of the reason for this reaction was that when compared to earlier tankers, *Torrey Canyon* was an incredible size; if she had been stood on end next to the Eiffel Tower, she would have reached within 3 m of the top [4]”.

As a result of *Torrey Canyon*, the IMO established rules that enable a government to act if an accident in international waters threatens its coastline. In effect, it retroactively endorsed the action by the British government by stating that it was legitimate for a country to intervene solely on environmental grounds. And, although it did list some requirements for such action, it did not limit intervention to oil spills or to tankers. The IMO also moved to control the deliberate dumping of oil after a ship had pumped out its tanks. Ships are now supposed to keep the remaining oil in their ballast tanks. In time that oil rises to the top and can be salvaged. The seawater below can then be discharged safely. While these actions

reduce deliberate discharges and improve the ability of countries to respond to spills, there are still considerable problems both in prevention and response. As the IMO admits, these conventions are not always effective.

When a government accepts an IMO Convention, it agrees to make it part of its own national law and to enforce it just like any other law. The problem is that some countries lack the expertise, experience and resources necessary to do this properly. Others perhaps put enforcement fairly low down on their list of priorities. The variation in compliance is enormous.

4. Seveso

The extent of the human consequences of the release from the Icmesa plant on health may still be a subject for debate but the impact of Seveso on the European approach to handling of chemical plant safety is not. As a result of Seveso and the earlier fire in Flixborough, the approach changed forever. “In the early 1970s there was still a tradition of confidentiality surrounding the operations of the chemical industry. Risk management was thought of as mainly an in-house operation, with little or no external interference, even in the part of public authorities. . . Awareness and concern about major accident hazards grew considerably as a result of the dioxin incident and encouraged the process for a European frame of regulation” ([5], p. 747).

Prior to the release of the dioxins, the Icmesa plant in Italy was not known to be a source of risk. The only complaints came when some residents noticed noxious smells ([6], p. 90). After Seveso, the European Community adopted a set of regulations known as the Seveso directives. One key element is that both workers and the public have a *need to know* about hazards that threaten them and about safety procedures. The Seveso directives had another result. European wide standards for industrial safety and for public information in effect levelled the playing field in Europe. As long as these regulations are equally enforced no firm can take advantage of varying safety requirements.

5. Chernobyl

Since the incidents at Chernobyl and Three Mile Island in Pennsylvania, there has been a significant worldwide decline in acceptance of nuclear power. In the European Union, at present, seven members — Austria, Denmark, Greece, Ireland, Italy, Luxembourg and Portugal — do not have operating nuclear reactors for energy production.¹ In Sweden, voters have approved a referendum calling for an end to nuclear power although so far only one plant has been shut down. In Britain, it was decided not to build two planned units. In Finland, Parliament voted against the construction of new reactors though there is still discussion about this. In Germany, reactors sited in what was once East Germany were closed though Germany still has 20 plants operating. In Belgium — where 55% of electric power

¹ Some countries, such as Austria, still have experimental reactors for research. Others have reactors that are not operating. Italy, for example, had four reactors in operation at one point, Latina, Trino Vercellese, Garigliano and Caorso but all were shut down after an 8 November 1987 referendum.

is from nuclear power and seven plants are still operating — a special commission created conditions for new construction that effectively block construction of additional reactors.

There are similar developments outside the EU in Europe and elsewhere. For example, there are still five reactors operating in Switzerland but that country has imposed a moratorium on new construction. Similarly, in the US and Canada, existing plants are still operating, but no new plants are being built and those in the planning stage have been cancelled. For example, New Brunswick Hydro Electric Power Corporation has not gone ahead with plans to build a second plant beside the one operating at Point Lepreau, New Brunswick. The exceptions are South America, France and Asia. There are new reactors under construction in Argentina and Brazil, France and Japan, South Korea, China and Taiwan. India has five new reactors under construction.

The concerns however are in Eastern Europe. The USA Office of Energy Intelligence says Soviet-designed reactors “. . . pose significant safety risks because of inherent design deficiencies, deteriorating economies, political turmoil and weak regulatory oversight. As a class, these reactors continue to experience serious incidents, raising the spectre of another accident akin to Chernobyl. The US states that the four most dangerous nuclear power stations are Chernobyl in the Ukraine (Unit 2), Kozloduy in Bulgaria, Kola in Russia and Iganalina in Lithuania” [9]. Chernobyl (Unit 1) is still contained within the sarcophagus that was built in the wake of the explosion. It has now been in place for more than a decade and it has not been entirely effective. There are also doubts about how well it will work in the future. “In the long term, however, its stability and the quality of its confinement are in doubt. A collapse of the structure would lead to a release of radioactive dust and the exposure to radiation of those employed at the site” ([7], p. 8).

6. Sandoz Schweizerhalle fire

While Seveso began the process, as a result of the Sandoz Schweizerhalle fire there have been even more stringent policies towards chemical plant safety in Europe. The European Commission’s Seveso Directives establish requirements for the production and storage of hazardous materials if the quantities exceed a certain level. They also require operators of such locations to develop a major accident prevention policy and an emergency plan. There are requirements relating to the siting of new establishments and requirements for information to be available to and distributed to appropriate publics. Finally, there are requirements for appraisal or regular inspection of such sites.

The Sandoz fire also stimulated action about pollution on the Rhine. In the late nineteenth century, the salmon catch from the Rhine was in the hundred thousands but in the twentieth century the salmon and many other forms of life disappeared: the Rhine became known as the sewer of Europe. While there were attempts to control this pollution long before the Schweizerhalle fire, the fire made the issue a priority. In direct response to it, the International Commission for the Protection of the Rhine (ICPR) developed the Rhine Action Program. Its goals are to improve the Rhine for fish such as salmon, protect the Rhine as a source of drinking water, and to decrease contamination. There was also concern about the impact of pollutants from the Rhine entering the North Sea and destroying important breeding grounds down current along the coast of The Netherlands ([17], p. 2).

Although all targets were not been met, some things improved dramatically. For example, the total phosphorous, nitrogen, cadmium and micropollutants in the Rhine were down by nearly 50% by the target date of 1995. In addition, removal of small dams and installation of ramps for migratory fish has improved the river channel. There has also been restocking. Though the numbers are still extremely low, there are now salmon in the Rhine. Even before the Sandoz fire, Dutch interests sued the Alsatian potassium works in France in the regional court in Rotterdam, arguing that they were being damaged by downstream pollution. When the European Court of Justice ruled such actions were permissible, the City of Rotterdam increased its public relations campaign for a clean up of the Rhine. This successfully increased pressure not only on the French potassium industry but also on the German chemical companies. It is now clear it is possible to take legal action in Europe against an upstream polluter.

While *Torrey Canyon*, Seveso, Chernobyl and the Sandoz fire are dramatic examples of trans-national impact, they were all one-time incidents. There are broader problems that can not be pinned down to a specific time and place and where the responsibility appears much more widespread if not universal. These appear less likely to trigger action than these more dramatic events or to put it another way it appears that action is more likely to be stimulated when there is a single, dramatic event. The story of acid rain illustrates this point.

7. Acid rain

Acid rain is rain, snow or fog that has become polluted by acid and carries that acid with damaging effects to earth. There are two common pollutants in acid rain — sulphur dioxide (SO_2) and nitrogen oxide (NO) — though these are not the only sources of the acid in acid rain. The SO_2 comes largely from coal-fired power generators and natural gas processing. The NO comes from combustion of fuels in motor vehicles, residential and commercial furnaces, electrical utility boilers and other equipment. It is a classic example of a problem created in one jurisdiction impacting another. For example, half the acid deposits in Eastern Canada come from the USA. In some areas, such as the Muskoka-Haliburton area north of Toronto, that rises to three-quarters. Similarly, the acid rain in Japan comes from Korea and China (where plants burning soft coal are the main source of power), the acid rain in Norway from England and Scotland.

Acid rain increases the acidity of ponds, streams and lakes until fish can no longer live in those bodies of water. It also gradually destroys plant life in those bodies of water destroying the food source for water fowl. There is increasing evidence that acid rain damages the protective coating of wax on leaves and is thus destroying the ability of trees to breathe. It is also causing severe damage to buildings as stone, stained glass and painting is eaten away. St. Paul's Cathedral in London is having its stone work eaten away by acid rain. In Rome the statue of Marcus Aurelius has been removed to protect it from air pollution though a perfect copy remains in Piazza del Campidoglio where it was placed by Michelangelo.

Whether acid rain impacts an area may be determined by wind patterns. For example, the prevailing winds across the North Sea bring the acid to Scandinavia from England and Scotland. In contrast, the prevailing west to east winds across Canada tend to keep industrial pollutants away from the Canadian prairies. The impact of acid rain can also be

affected by soil conditions. In Western Canada, the water and soil systems are generally more alkaline and can neutralize the acid. However, in Eastern Canada, the area known as the Pre-Cambrian Shield, the bedrock is granite and the lakes are substantially contaminated by acid rain.

In North America, partly as a result of the efforts of a lobby group called the Canadian Coalition on Acid Rain 1970, the USA passed a number of statutes known as the *Clean Air Acts*, intended to reduce the emissions of acid rain. The original act was passed in 1970 but — when it failed to result in targets being met — was amended in 1977 and again in 1990. In Canada, in response to international protocols, Canada reduced its overall SO₂ emissions to three million tonnes annually. Under a new protocol, Canada is required not just to reduce emissions nationally but to reduce emissions in areas where they are causing significant damage such as the eastern provinces of Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island. This is known as the sulphur oxide management area (SOMA) and, once again, the targets are being met.

There have been similar efforts elsewhere spurred on by the United Nations Economic Commission for Europe (UN-ECE). Under the 1985 Helsinki Protocol, sulphur emissions were to be reduced by 30% by the target year of 1993. There are further requirements for reductions under a new 1994 Oslo Protocol: the targets for that protocol are set for the year 2000. A new protocol dealing with additional acids is being negotiated. There is also a proposal that the area being impacted be cut roughly in half by the year 2010.

8. Governance

Acid rain is not the only toxic problem being tackled by government action. A study published in 1995 reported:

- The number of US federal laws dealing with the environment has doubled since 1970.
- The number of acts and regulations concerning the environment in the UK has gone from 100 in 1970 to 300 in 1995.
- The number of multilateral agreements on the environment, which totalled about 50 in 1970, now totals 200 ([2], p. 10).

In North America, there have been relatively successful actions along both the north and south borders of the USA. In the north, Canada and the USA have been concerned about pollution for most of this century. Writing in 1972, for example, Arnold Heeney, a member of the Canada–US International Joint Commission, (IJC), wrote:

“... water pollution has become the most important preoccupation of the IJC. Reports of the increasing pollution of North America’s water resources and the fearful prospects of critical shortages of clean water in some regions have given rise to increasing public anxiety in both Canada and the USA. . . . Pollution is no respecter of political boundaries, and the consequences of lakes and rivers which straddle the international border is more than likely to affect the health and property on both sides of the line” ([11], p. 185).

The result has been a substantial attempt to clean up many border rivers but especially the Great Lakes, though this has not always been successful. At this moment, there are major

concerns in Canada because of US plans to divert lake water into the Red River, a move which might dramatically affect the fish population of that river.

In the south, along the US–Mexico border, developments came much later, after major industrial developments on the Mexican side of the Rio Grande. However, since Mexico has become part of the North American Free Trade Agreement (NAFTA) US–Mexico border cooperation has expanded. There are now two agencies — the Border Environment Cooperation Commission and the North American Development Bank — established to fund water supply, wastewater and solid waste treatment on both sides of the US–Mexican border.

Cooperative solutions are likely where all parties have a mutual interest in doing something. For example, both Canada and the USA are contributors to and affected by pollution on the Great Lakes. Both benefit from measures to reduce or eliminate such problems. That was also true when there was substantial industrial development just south of the US–Mexican border. They are, however, less effective when there are differing interests in action. For example along the Rhine:

“The primary cause of pollution belongs to the chemical industry in the upper-lying states of Switzerland and Germany as well as the French potassium mines in Alsace and the German coal works in the Ruhr and Lippe. The Rhine is polluted through the emission of a large mixture of chemical waste, salt and heavy metals. The costs are being carried by the lower-lying states such as The Netherlands, which primarily uses the Rhine for drinking water and agriculture. Furthermore, rising toxic mud loads from the Rhine are placing an increasing costs on the city of Rotterdam who has to remove the unusable and toxic mud from Rotterdam harbor to special waste deposits” ([10], p. 4).

“... for complex water quality issues, like on the Rhine, the benefits from international cooperation cannot stand up against the domestic economic and political cost of antagonizing major domestic interests if there is no strong political mandate to do so. Thus, for water quality issues the international relations factors tend to be significant only when there is a demand within the country itself to improve its own water quality” ([15], p. 123).

To put that more bluntly, there is enormous pressure for action from The Netherlands where the impact of pollution is the greatest. There is resistance to action in Germany where the polluters would have to bear the cost of cleanup. Resistance of that kind is probably the greatest where the producers are much stronger economically and in countries more politically powerful than those affected. The problems are especially severe when the target country can do little on its own: Norway, for example, receives 90% of its acid rain from elsewhere, mainly England and Scotland. Its best efforts internally barely touch its problems with acid rain.

Even if there is an obvious need for action, that action must be taken in the countries where the chemicals originate. This has proved difficult in the USA where individual states have not enforced regulations about pollutants or where locally powerful politicians have opposed enforcement. It has proved difficult at sea where some countries are less willing or less able than others to make certain that the laws are being followed. It is almost impossible in the case of nuclear power. For example, in what was once the East Bloc, resources are not available to monitor the safety procedures being used. It has even proved difficult to get countries that have admitted their responsibility to pay the full cost of effective action ([15], p. 123).

The Chernobyl leak and the Sandoz fire both occurred in industrial plants. As a result of those and other plant-based incidents most plants handling chemicals now have first-rate procedures for safe handling of toxic substances and — most important — for responding immediately and effectively when incidents occur at the plants. But accidents occur away from plants as well as in them. In Canada, in November 1979, for example, 217,000 persons were evacuated from Mississauga, just west of Toronto when five chemicals — caustic soda, styrene, toluene, chlorine and propane — leaked after a train derailment [19]. As Scanlon pointed out in a report in Canada commissioned by the public and private sector, such accidents are much less likely to be properly handled: “Success in dealing with internal incidents is not a basis for preparedness for external ones. . . . In fact the climate of success that surrounds internal incidents may be the breeding ground for failure when external incidents occur” ([18], p. 35).

9. Other concerns

There is another problem, the developed countries that are stronger economically are more able to bear the costs of environmental action than the less-developed countries. To less-developed countries the costs of environmental safeguards may raise unacceptable barriers to industrial development. They therefore set lower standards and multinational companies exploit these. This allows the development of industries that create problems, such as happened in Bhopal. Yet, for such countries, the price of environmental action may be the loss of development. “Today’s wealthy nations had 100–200 years to address the environmental issues of industrialization and urbanization and face continuing difficulties. The newly developing world faces an accelerated timetable, with generations of problems bunched together and hardened by population growth and poverty” ([2], p. 13).

The industrialized nations of Europe and North America are now the leaders in efforts to clean things up even though the pollution they want to deal with is a direct result of their own industrial development. Through the World Trade Organization they are slowly trying to press their new standards on others. But less-developed nations are still trying to attract industrial development, and one of their advantages is not just cheaper labour but fewer demands for environmental constraints. Even if these countries adapt to obvious risks, they may ignore others: “In the long run those systems that use short-range adaptive strategies to high-probability vulnerabilities will expose themselves to long-range low probability events and will experience disasters” ([3], p. 156).

Furthermore, the impact of these disasters, as the examples above illustrate, will not be confined to these countries, they will spill over into neighbouring countries, perhaps even further. However, there is one other element that may affect the way industrial firms deal with planning for and response to toxic incidents. A pilot study suggests that public perception of the way companies deal with such incidents can affect the value of their stock and, thus, the bottom line. The article compares the effects of an oil spill in Pennsylvania that contaminated the Monongahela River to the Exxon Valdez. It concludes that good corporate citizenship may also be profitable [8].

10. Action required

In the short run, toxic problems will be dealt with through diplomacy. There will be more bilateral agreements, such as the ones along the Canada–USA and Mexico–USA borders. There will be more multinational activity such as along the Rhine. There will be regional efforts like the development of safety procedures for chemical facilities in Europe. And there will be international efforts such the ones developed by the IMO to control major tanker spills.

Even where diplomacy leads to agreements, there will continue to be problems for there are — as yet — no ways in which one country can enforce environmental action in another, unless it uses its economic power — through embargoes or trade sanctions — or unless it demands the right to invade another jurisdiction's sovereignty and carry out inspections. While such intrusive solutions have been accepted between previous cold war opponents in the case of nuclear weapons, they have not yet been seen as valid solutions to environmental problems. The IMO, for example, bluntly rejects the idea of some kind of international pollution police force:

“It is sometimes said the IMO should have some sort of authority to enforce its regulations. This seems to imply the creation of a team of inspectors and a fleet of patrol boats crewed by officials with the right to board any ships they suspected of contravening IMO regulations. In practice, the creation of such a force would be financially enormous — it would mean recruiting hundreds, probably thousands of people — and politically impossible. Most Governments would never agree to allow ships flying their flag to be boarded in international waters and any attempt to introduce a system of penalties and punishments would seem to be even more unacceptable” [12].

The problems are illustrated by the fact that *Torrey Canyon* was owned by Union Oil, under charter to BP Tanker, sailing under a Liberian flag with an Italian captain and crew. Moreover, Liberia, the country where *Torrey Canyon* was registered had no rules of procedure for inquiries involving its ships and no guidance about who could be admitted as an observer. In addition, stating that it had limited financial resources, Liberia held the *Torrey Canyon* inquiry *in camera*. It said it could not afford the cost of providing accommodation for spectators or the media ([4], p. 185).

Even in the European Community where the Seveso directives are supposed to apply evenly to all member states, the way the directives are implemented varies from country to country: “As an example, in the UK industry is given the onus to inform the public. . . . In other countries (Denmark) leaflets are distributed by fire brigades and these concern all the installations in the community. France has launched wide information campaigns for industrial zones via cooperation between authorities and industries” ([1], p. 4). In short, the requirements may be Europe-wide but their enforcement and the way enforcement is carried out is still a matter for each member state.

While invasions of sovereignty either on the high seas or in Europe or anywhere else for environmental reasons do not seem imminent they do appear to be the only long-term solution to problems that may eventually threaten the survival of the world. That would suggest that eventually some sort of UN action would be mandated. At first, this idea

appears most unlikely. However, there was probably the same disbelief that the UN would ever sanction first a 'police action' in Korea, then peacekeeping forces, or that NATO would intervene by force in an internal conflict in the Balkans. Given the magnitude of the problem, it seems reasonable to suggest that the time will come when growing concern about environmental threats will no longer allow a government to tolerate chemical or nuclear plants being constructed upwind or upstream from its borders or allow some nations to be lax about the enforcement of rules about safe handling of toxic cargoes. The breaking point will occur when the countries with economic, political and military power decide that action is required and that they have the power to take that action. At that point, the weaker countries will either submit or there will be major conflicts.

In the long run, however, plans for some sort of inspection will be supported by sufficient countries to lead to a demand for UN action. That may be controversial at first, may even be vetoed by some of those countries least able to afford such controls and most able to resist international action by force. In the long run, however, it is hard to see how the continual pollution of one country by another can be allowed to continue. The pressure for action will grow.

11. Discussion and conclusions

The incidents and phenomena discussed here — *Torrey Canyon*, Seveso, Chernobyl, the Sandoz Schweizerhalle fire and acid rain — may, at first glance, seem to be dissimilar. In fact, all illustrate how events that occur in one jurisdiction can impact on another. Taken together, they suggest that governments are becoming increasingly less able to control the problems that impact on them when environmental issues are concerned. It is true that there have been some attempts to deal with these issues bilaterally, multinationally and regionally as well as internationally. But it is also true that on the whole some governments are mainly creating problems and others finding it difficult to solve them and that, at the moment, there appears to be no obvious solution to that dilemma.

Although UN environmental police may be the eventual solution to the problems of down wind, down current and down stream pollution, it does not seem likely that this will occur overnight. Just as it took the experience of the League of Nations, where sanctions were often discussed but not applied, it will take time to develop consensus for such action. There will be more attempts to enforce environmental controls through international courts. There will be more bilateral and regional agreements. There will likely be efforts to find ways of verifying agreements and, gradually, ways of enacting penalties against those who do not conform.

In terms of shipping, for example, no matter where a ship is licensed or where it picks up its cargo it must eventually deliver that cargo to a country anxious to buy oil and that country can — and in my opinion will — enforce rules about safe handling of such cargoes. In addition, most multinational firms building in area where controls are not so strong or not enforced also have plants in countries where such rules are enforced. It is not uncommon for countries to insist that rules be followed both at home and abroad. Penalties can be applied at home for actions not taken abroad.

While forecasting the future is always problematical, it seems reasonable to suggest that attempts to impose bilateral, multinational and regional solutions will continue to be less

than satisfactory because of the inability of existing agencies to enforce compliance. The next logical step would be some sort of punitive measure against non-compliance, something similar to the trade embargoes that have been tried against countries that committed other sorts of offences. While trade embargoes may have some effect on countries that are doing some things considered undesirable (e.g. apartheid in South Africa) trade embargoes used for environmental action might encourage rather than discourage unsatisfactory industrial development.

It is hard to avoid the thought that at some point, some governments will decide that they can no longer tolerate environmental degradation and that they will feel compelled to act. It is not hard to foresee the day when the environmental super powers or, under pressure from them, the United Nations Organization, organizes new types of military units known as environment keepers rather than peacekeepers. While this seems logical, it will require some thought. Would such intervention simply force the offending country to shut down the polluter? Who would bear the economic consequences of such a shutdown? What if a shutdown was not all that was required? (That would certainly be true for Chernobyl.) Who would pay for the costs of the action required and where would the expertise be found? These are not easy questions to answer.

Yet, even though the very nations that created the problem are the ones that now clamour for action to deal with it, they may be forced in everyone's interest to prevent others from doing what they did. And the problems discussed in this paper may be only the start. Already Canada has had to spend thousands of person hours and millions of dollars cleaning up after the Soviet nuclear-powered satellite Cosmos 954 dropped at least 500 pieces of radioactive debris in the Canadian Arctic. Environmental pollution now comes not only from sources down wind, down current and downstream. It may also come from above and it may come from actions taken decades earlier.

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