4 RESULTS FROM NATIONAL RESPONSES

The frequency of disasters in non-OECD countries is growing, especially in Asia. the decrease in the number of disasters in OECD countries and the parallel increase in non-OECD countries leads to the conclusions that for the time being technological disasters are mostly a problem for non-OECD countries. (OECD 1992b).

4.1 Responses

Through questionnaires and letters, forty five countries provided information about what they regard as major accidents.(Apendix VI - VId) It is clear that different responders have interpreted the requests for information differently, depending on their own perception of environmental damage, severity of incident or whether international assistance could have helped. The responses varied extensively;

- some provided lists of all industrial accidents eg India has provided a list of 559 incidents that have been recorded in recent years, covering everything from Bhopal to incidents of minor environmental and humanitarian significance..
- some identified specific accidents that were considered major in the country and could have been environmentally damaging, eg Slovenia provided a list of 54 incidents, Hong Kong a list of 11 emergencies that had the potential for environmental damage.
- some have concentrated on one or two incidents that they perceived as being especially serious eg Mexico concentrated on the San Juan Ixhuatepec and Guadalajara disasters
- some highlighted chronic incidents which became emergencies or which threaten to become emergencies. eg Mozambique has a problem of disposing of waste chemicals, Cyprus had a problem of cleaning up dioxin pollution.
- some indicated that no relevant accidents had occurred in the last ten years in their country

The fact that so many countries filled in the questionnaire and replied to letters can reasonably be seen as indicative of the importance attached to the problems of chemical response in developing countries. However, despite the extremely high response rate it is likely that the information contained is only suitable for limited analysis because of several problems which will affect the dataset:

- agreed measures of accident severity and environmental damage are lacking
- many countries do not require accident reporting and do not keep records about accidents
- records that are maintained often contain insufficient information to allow useful analysis, especially from an environmental impact perspective
- some countries appeared reluctant to share accident information
- replies to follow-up specific recorded accidents have not yet been received

From the information provided an assessment can be made of whether the problem of environmentally damaging emergencies do exist in a significant scale. Although it must be accepted that such poor data will mean no conclusive proof can be offered, it is likely that the responses at the very least provide a qualitative indication that such emergencies are occurring frequently in developing countries. Obviously, the data that is provided is unlikely to be as consistent or as detailed as that provided under the compulsory notification scheme of the OECD countries, but the information that is available allows some lessons to be identified. The few case studies that follow provided sufficient information to enable some tentative conclusions to be reached. They are not the only cases provided by the national responses, but they do provide a range of information and lessons. They are not presented as definitive proof, but as an example that illustrates certain pertinent points. Proof will require a much more detailed investigation that is beyond the scope of

this report. Even then some of the difficulties highlighted in section 3 will make the success of such a project doubtful. The best that can be realistically expected is an indication that environmentally significant accidents are occurring.

4.2 Emergency variables

While the quality and quantity of information received varied considerably, the following range of type, location and cause of incident were identified from the data:

Table 4 Types of identified emergencies involving hazardous substances

FACTOR	VARIABLE	EXPLANATION
Timing	Acute	where damage occurring is immediate and the response needs to be very rapid to be effective
	Chronic	where long term pollution causes cumulative damage to a point where it turns into an imminent threat requires remediative action
	Imminent Threat	where a potential emergency has been recognized and action can be taken to ameliorate the condition.
Source	Fixed facility	storage sites. waste dumps. factories and refineries
	Pipelines	
	Transport	trains. lorries. river craft
Trigger	Human error	often caused by lack of training. awareness or poor management
	Deliberate damage	eg dumping of waste or criminal sabotage of facilities
	Engineering failure	often caused by lack of maintenance and use of outmoded technology
	External cause	eg natural hazard such as earthquake rupturing a pipeline
	War and civil strife	causes particularly complex environmental problems
Vector	Air	potential for long range transboundary pollution
	Water	can affect both surface and ground waters with potential for great environmental and humanitarian impact. Can also involve transboundary impacts
	Soil	tends to be more localized damage. though pollutants can seep through to damage ground water with unseen. though severe. consequences

Such a broad assessment is not definitive: however it does indicate the range of emergencies encountered with the country responses. Obviously some emergencies will involve more than one element eg human error causing a failure in outmoded and badly maintained plant or an explosion in a holding tank rupturing a pipeline.

The analysis of country responses can be broken down into how countries perceived their ability to respond. Some suggested they could cope with any accidents that might happen within their country. While that is exactly what is hoped to be achieved in all countries, such a view is idealistic and some responses taking this line reflects political stance as much as realistic ability to respond.. Most countries said they had only limited ability to respond to emergencies involving hazardous substances. Some admitted they had absolutely no ability to respond, despite having chemicals or even chemical industries in the country. These countries will be the focus for any future international response assistance.

4.3 Countries with Self sufficient Response capability

Several countries replied that they could deal with virtually every emergency involving hazardous substances with their own resources; this would require an efficient emergency response strategy, sufficient trained personnel and adequate equipment. Therefore such responses tend to be found in the bigger, more industrialized countries such as China and Russia. Two examples supplied by the national authorities illustrate their capacity:

Case Study 1. China

The response to the questionnaire notes that ten major or catastrophic pollution accidents occur every year. A typical example is a transport accident on 17 August 1989 in which seven barrels of yellow phosphorus fell into a river. The cause was a combination of heavy rain and bad road conditions. Drinking water for 50,000 people were affected and the river ecosystem was polluted.. The rare Chinese Paddle fish and Rouge fish were identified as being particularly affected. The Yichang Environmental Protection Bureau, Public Health and Changjiang Water Route Protection Agency responded to the emergency, sending experts to survey and monitor water quality and help in the clear-up operations.

However, the official response did not mention many disasters which have been identified in the West, for example a recent explosion in a chemical plant in Shenzen in which some 70 people were killed, was not mentioned as being a significant emergency, even though fire fighting back-up was apparently requested from Hong Kong (Reuters 1993). The seriousness of any environmental impact is not known. However, the APELL newsletter No.5 1992 edition states that a national reporting system for environmentally polluting accidents has been established and that 23 issues of case reports on such accidents have been produced. The newsletter also states that a circular has been prepared by the Chinese authorities specifically addressing severe environmental pollution accidents, reporting that about 70 serious industrial accidents resulting in major instances of environmental pollution have been recorded. (UNEP IE/PAC 1992b). Although relations between China and the western world are still at a delicate stage, APELL has made strong inroads into the country and there is hope that eventually a full exchange of accident information will be possible so that lessons can be applied wherever they are relevant.

Case Study 2. Lithuania (when in Soviet Union), 20 march 1989

This massive accident started at the Azot chemical plant in the city of Jonava. At 11.00am an isothermal tank holding liquid ammonia exploded, releasing 7000 tonnes into the environment. The response notes *'for scale of emission of a strongly active poisonous substance, this accident has no parallel in world practice'* Such a release represents 1400% of the Seveso directive threshold for ammonia of 50tt. The report suggests that the spilt ammonia affected an area of some 10,000m².

The explosion thrust the holding tank forwards, destroying the protective reinforced concrete housing and gantries supporting pipelines. A natural gas pipeline ruptured and mixed with the ammonia. The mixture caught fire, in turn igniting a store of nitrogen-phosphorus-potassium fertilizer. As this burned, ammonia, nitrogen oxides and chlorine were emitted As the report notes *'the danger arose that a cloud of polluted air would spread for tens of kilometres in the direction of the wind a change in weather conditions towards the evening sharply worsened the situation and the Emergency Commission decided to evacuate the town of Jonava. Alongside the pollution of the atmosphere, there was a risk that dangerous products would fall out into the river Neris. Special water conservation measures had to be taken.'*

During the emergency 55 members of the plant were injured and six died at the site. From the time of the accident it took 25 minutes to warn the town of Jonava and 60 minutes to alert the public. The response operations started within 30 minutes and efforts were stepped up in stages under the direction of the Civil Defence, the Emergency Commission of the Republic, the military district and subsequently the USSR Civil Defence Protection Team and the USSR Ministry of Fertilizers. Within 48 hours the source of the pollution was contained. The response from the Russian Emergency Commission for this accident noted that *'through active massed reaction and location of hazards, a large scale ecological catastrophe was successfully averted'*. The Lithuanian response notes that Ukrainian miners provided assistance during the emergency. Since Lithuania has become an independent state the ability to respond to major emergencies such as described above has changed. They obviously no longer have the resources, or political constraints, of the former USSR and therefore should a similar accident happen the response, and the reliance on outside aid would be very different from the response described above.

However, reports in the Russian press suggest that the situation will get worse; a report in the "Nezavisimaya gazeta" suggests that *the frequency of accidents at industrial facilities has reached unheard-of proportions in Russia, assuming the scope of a national disaster, and that the battle against the consequences of that disaster is environmental problem no.1....according to current data, despite an overall drop in production of 18% in 1992, the total number of industrial*

accidents increased by 17% in comparison with 1991. There are two serious pipeline accidents in Russia every day, and serious accidents once a week on some form of transport and once a month in industry. major industrial disasters occur roughly once every six months...in the chemical industry alone, some 1,500 accidents (four per day occur every day due to the leakage of hazardous products and to explosions and fires)...one of the most accident-prone sectors today is railroad and pipeline transport. The total length of all oil and gas pipelines in Russia is 550,000km. Approximately 10% of them have been in operation for more than 35 years, yet even pipelines that have been operating for 10 years less than that are considered unsafe. So it is clear why the number of breaks in them is now measured not just in thousands but in tens of thousands: 28,000 in 1991 alone....in the first quarter of this year alone, 34,000 tons of oil was lost this way. The situation with respect to the transport of hazardous freight by rail has sharply deteriorated. In just a year, the number of accidents involving such cargo has increased by 150%...According to specialists predictions, in the not-too-distant future we can expect an increase in industrial disasters...the main factor that provides grounds for such gloomy predictions is the extremely worn-out condition of the equipment at precisely those enterprises where accidents pose the greatest danger...Russia is forced to spend 1%-2% of its gross domestic product annually to deal with the consequences of various technology-related disasters. In future this figure, to all appearances, will increase to 4%-5%, exceeding such items of expenditure as health care and environmental protection..(Baiduzy 1993, quoted in Current Digest of the Post-Soviet Press).

Other sources concur with the press article above that leakage from pipelines is a major environmental problem and one that is likely to get worse. In 1988 some 698 breaks were recorded in the Tyumen region of western Siberia alone, leading to an estimated loss of more than 1 million tons of oil, about 9% of all Soviet (not just Russian) output. In the first six months of 1990, the number of breaks allegedly rose 15 % over the first half of 1989 to a total of 1,132. Part of the problem is the high water content of the oil, caused by the excessive injection of water into the oil reservoir in a bid to maintain pressure. By 1989 two thirds of the liquid pumped from the oil reservoir was water. (Feshbach and Friendly 1992). The oil is then transported in poorly maintained pipelines without insulation from the frozen ground. The heat of the oil can melt some of the surrounding ice and the pipeline sinks into the soft earth. The combination of old infrastructure, high water content in the liquid transported and the melted water surrounding the pipeline means that corrosion can be a major problem. It has been suggested that some 27,000 tons of petroleum and chemical pollutants are spilled into the waterways of the former Soviet Union every year. (Fesbach and Friendly 1992).

Several national responses echoed the sentiments, if not the scale, of the problems reported in the press. Former soviet republics that used to rely on Moscow for spare parts and expertise without having to worry about hard currency are now having to compete on the world market with no back-up and no money. As a result the factory equipment is far from adequate. The official Russian Federation response to the UNCUEA questionnaire included an analysis of emergencies in 1992. The document indicates that emergency operations *of a man-made or ecological nature* rose from 1991 to 1992 by a factor of 2.8. The increases in accidents has been further broken down to show that over the year:

Table 5. Breakdown of emergencies in Russian Federation 1991-1992

DESCRIPTION OF EMERGENCY	RECORDED INCIDENTS 1991	RECORDED INCIDENTS 1992	CHANGE OVER ONE YEAR
Fires in residential and social or cultural buildings	17	333	up 1858%
Fires and explosions in industrial buildings/installations	35	96	up 174%
Fires in transport	3	30	up 900%
Railway accidents	34	101	up 197%
Air disasters	8	50	up 525%
Accidents in trunk pipelines	16	43	up 169%
Accidents in petroleum production and processing facilities	15	43	up 187%
Emissions (or risk of emission) of Strongly Active Toxic Substances (SATS) [read as hazardous substances]	26	45	up 73%
Discovery of SATS and radioactive sources	6	30	up 400%
Industrial accidents in power generating systems	4	17	up 325%
Outbreaks of mass poisonings and infectious diseases			

(State Committee of Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters 1993)

Some of the reasons offered for the massive increase in emergencies include violations of technical rules, failure to comply with project documentation, utilization of equipment without safety devices and a poor level of technological discipline when conducting welding operations, gas supply operations or blasting operations. Other aspects noted include the use of worn or badly functioning equipment and deliberate actions. The report, by the Chief of the Emergency Situations Control Unit, notes: *The sharp rise in the number of cases of loss of strongly active toxic substances and radioactivity sources gives rise to concern. The causes of this situation include, first and foremost, violations of rules governing the storage and transport of substances of this type, non-observance of safety rules when handling them, and lack of proper monitoring at all stages of the production process...in 1992, 88 breakdowns were recorded in trunk pipelines, including compressor stations and oil re pumping stations. All were due to non-observance of operating regimes, inefficient diagnosis of the physical state of pipelines or poor industrial discipline...The epidemiological situation is affected by the unsatisfactory state of the ecology. According to specialist estimates, only 15% of urban dwellers are living in areas where the level of air pollution is within acceptable limits. Almost half of the 60 million cu.m of drinking water piped to the population falls short of hygiene standards. Concentrations of noxious substances in air samples taken at 67.2% of the country's industrial facilities exceed the maximum acceptable limit. Generally speaking, the growth trend in emergency situations in 1992 indicates that the conditions generating them are not only continuing but worsening.* (Russian Federation 1993).

That was for 1992; the situation for 1993 looks even bleaker. The Chief of the Planning Directorate compared the situation from January to September 1993 with the same period in 1992. He recorded that emergencies in municipal utility networks had risen by a factor of 1.5 and, perhaps more alarming, that the number of accidents involving strongly active toxic substances rose more than threefold. (Russian Federation 1993). Other countries have noted similar problems:

Case Study 3. Tadzhikistan 1986

- An unknown amount of chlorine was released from the Javansky electrochemical plant, causing extremely high air pollution' up to 1.5km from the plant, damaging human health and agriculture. Another similar incident occurred in 1990. Since 1990-1993, more than 80 such releases of chlorine have been recorded at the plant. Investigations carried out by the Ministry of Environment for the former republic noted that *'it is practically impossible to prevent accidental releases of chlorine gas from this plant because of the obsolete equipment.'* Because of the financial problems facing the country, there is no opportunity to improve the equipment through retrofitting and the Ministry of Environment note that *'up to now, this plant itself was able to respond to emergencies, but in the future such accidents could become large-scale'*

Case Study 4. Ukraine.
The Ukraine Ministry for Environmental Protection listed 85 major accidents involving hazardous substances since 1985, including 12 cases of 'significant leakage' of mercury between 1989-1993.

- The Ministry for Environmental Protection note similar problems to Tadzhikstan, admitting that 60-80% of their chemical plants are *'worn out'* because of the shortage of money to upgrade or replace broken equipment. The Ministry note that the use of outmoded technology *'has resulted in critical pollution extending over large areas, in some cases beyond national boundaries'* and that they are now in the process of developing a number of new industries such as the manufacture of pesticides, herbicides, aniline and nitrobenzene. They also note that with the use of their Civil Defence units, the country could probably handle 95% of chemical accidents without external assistance.

Lessons
- This problem of obsolete technology being used in developing countries and countries in economic transition is obvious; any programmes for improving prevention depend on the ability of the country to incorporate realistic measures at both the policy and plant level. Here is just one example of a Government Ministry admitting that it is *'practically impossible'* to prevent future releases.
- Therefore, if obsolete equipment has to be used in an attempt to generate wealth, then it is extremely important that contingency plans are developed to strengthen the Preparedness of the country to deal with emergencies and their Response capability is improved to minimize the damage to human health and the broader environment.
- National capacity building is therefore vital. Even when a country cannot afford to improve its industrial plant, training and planning can make a difference to the successful management of the inevitable emergencies.
- Obviously this is a short term approach and the ideal is to improve the industrial plant to a level where Prevention policies can make a significant contribution to reducing risk. However, the means to achieving this level of safety is beyond the scope of this report.
- As countries develop new industries in an attempt to generate wealth, it is important that the opportunity is taken to ensure the planning for Prevention, Preparedness, Response and Recovery are initiated at the earliest possible stage of development.

Such problems noted above are probably widespread based on the assumption that most developing countries want to industrialize to raise money and yet are too poor to provide adequate facilities in terms of health, safety and environmental protection.

4.4 Countries unable to respond adequately but have not used external assistance

Despite these examples of countries suggesting that they can cope in all but the most extreme circumstances, many other countries admit they have no such capacity. As mentioned in section 2, the success of any response depends on the following broad needs:

- an organized contingency plan and national/local strategy for response to chemical emergencies
- adequate levels of training in chemical response
- adequate equipment and resources for tackling chemical emergencies
- the availability of information about chemicals and appropriate response in a form useful to responders.
- specialized backup for environmental and public health assessment

All these factors need to be considered: there is no point having excellently trained responders with no equipment; similarly there is no point having well equipped responders who don't know how to tackle the emergency. Similarly, even if the initial response is successful but follow-up assessment is ignored, long term environmental or public health damage can be missed. However, in the response to the questionnaire it appears that an adequate combination of the above is rare;

- some countries have training but inadequate equipment
- some countries have neither training nor equipment
- some countries have no contingency plans
- few have adequate access to information in a form useful for responders
- even less have adequate facilities for environmental or even public health assessment.

Most responding countries noted that they had insufficient capacity to deal with emergencies involving hazardous substances. A small sample of the responses is reproduced below:

Table 6-Sample of country response capabilities as recorded by questionnaire

COUNTRY	RECORDED RESPONSE CAPABILITY
Uganda	*"grossly inadequate with no expected improvement in capacity"*
Nigeria	*"institutional provision for response exists but the capacity is far from adequate"*
Mongolia	*"all accidents involving hazardous chemicals will exceed the national as well as local level capability since no such exists"*
Jordan	*"there is no capacity to deal with major accidents"*
Barbados	*"no hazardous chemical spill contingency plan and no clean-up equipment or trained personnel"*
Philippines	*"do not have sufficient resources eg trained personnel and equipment, to respond to a major accident"*
Kenya	*"there is no emergency response capability in my country"*
Jamaica	*"at present emergency response is limited to the Fire Department, they are hampered by low levels of training in responding to hazmat incidents - lack of equipment to adequately deal with these incidents - lack of knowledge of the types of material being used by some of the facilities"*
Ethiopia	*"as far as emergency response capability in the country is concerned, there is no such organization set up which is organized to handle such responses etc. furthermore, the human resource in this area of practice is very much limited"*
Poland	*"in case of major accident the amount of available specialized equipment might pose a limit for fighting the results of accident"*

(For a more detailed examination of country needs, see Schulberg, Report no 3 in this series)

Training

In any emergency involving hazardous substances, an extraordinary strain is placed on those responsible for first response. Any countries that manufacture, transport or use chemicals need to have an ability to respond adequately to problems that will inevitably arise from time to time. However, it appears that very few developing countries have any training in hazardous materials response, let alone a series of levels of competence from First responder Awareness to Hazardous Materials Technician. In the light of such limited competence to deal with hazardous materials it is not surprising that there are reports of first responders actually increasing the damage of a spill by inappropriate action caused by poor training. For example, there are reports of PCBs being released into a reservoir in a Central American country when firemen responded to a fire in an electrical transformer. Similarly police responding to an incident in Pakistan decided they did not know how to proceed and so dumped highly toxic chemicals into a river.

Alongside training in first response, it is important that any environmental contamination is recognized. This requires specialist training to be able to assess the aftermath of an incident. Some countries, such as Honduras and Slovenia have access to professionals who know what to look for, how to carry out the analysis and realize the significance of any findings. Only then can the environmental impact of an incident be established. This is especially important in emergencies that have not involved human injury or death; a common response would be to simply ignore any environmental impact through lack of awareness and training. However, having access to environmental monitoring teams is no guarantee that the first responders are aware of the problems:

Case Study 5. Honduras, 23.9.92

- A transport accident caused a spill of paraquat from a road tanker. The firefighters washed the chemical off the road and into the nearby Las Medinas stream. The company responsible for the chemical did not notify the authorities immediately and the Centre for the Study and Control of Pollution (CSCP) assessed the site thirty six hours later; they found pollution in the stream and instructed the company responsible for the chemical to remove the remaining drums and neutralize the spilled paraquat. The company only removed their containers and the CSCP had to neutralize the residue. The geography of the stream and surrounding vegetation helped to contain the toxic effects.

Lessons

- the need for adequate training for firefighters in HazMat response
- the value of thorough follow-up assessment by trained specialists to monitor environment and health implications, the result of which can then be fed back into the prevention and preparedness cycle.
- the need for adequate legislation to ensure safety measures are adequate and notification procedures are adhered to.

In some countries industry has rightly taken a lead in providing training for local fire services. This is a reflection of moral responsibility for the outcome of an accident involving chemicals and provides an important source of training for hard-pressed fire crews. For example, in Mexico the chemical industry organization ANIQ has provided training for 700 police, fire and civil defence officials under their PREP programme (Preparedness for Emergency Responsibility).

Equipment

There is little point in having well trained professionals who have no equipment with which to respond to an emergency. This includes personal protection equipment such as breathing apparatus and chemical exposure suits through to specialized equipment to model, contain and neutralize spills, decontaminate a site. Several countries responded that they had no such levels of equipment with which to control an emergency.

Case Study 6. Bryansk, Kaluga, Chelyabinsk regions of Russian Federation

- The All-Russian Research Institute of Forestry Chemization (sic) highlighted the problems they face in responding to major forest fires that occur every year around the region. Because of prior pollution, the areas are contaminated with radionuclides such as caesium-137, strontium-90 and plutonium-239 The fires re-spread the contamination and endanger the fire-fighters who respond to the emergencies. The response details that international requests have been made for assistance in the form of specific modeling and analysis equipment. To date no such assistance has been provided. This is the one example that specifically mentioned that assistance had been requested in the form of equipment but none has been forthcoming.

Although this example involved radionuclides which are specifically outside the scope of the report, this response to the questionnaire highlighted a problem that is applicable to every emergency involving hazardous substances. However, the provision of suitable equipment to the people who have to deal with emergencies involving hazardous substances is just another need that many developing countries are finding difficult to meet.

Strategy

This entails, at the least, a local contingency plan so that responders know how different incidents should be tackled and by whom. There are already several international programmes helping countries to develop Preparedness and Prevention planning for such emergencies. e.g. the ILO Major Hazard Control manual and Code of Practice and the UNEP IE/PAC Awareness and Preparedness for Emergencies at Local Level.(see Ockwell and Yeater, paper 2 in this series, for more information). Such initiatives are important and can help countries develop a strategy around which the other aspects of emergency response can be formed. Some countries have already recognized the value of a strategy for responding to such incidents and have established data management, analysis and planning aspects into a trained and equipped emergency service:

Case Study 6. Slovenia

- The Republic of Slovenia provided a list of 54 major accidents that resulted in the release of potentially toxic chemicals. However, unlike many other countries they have developed an integrated strategy to incorporate Prevention. Preparedness. Response and Recovery as important elements of their industrialization policy. This includes the establishment of professional emergency response units including a mobile Ecological Laboratory that can be taken immediately to the scene of an emergency and carry out analysis and monitoring. This was funded within a UNDP project.
- The establishment of a service to collect and process data *on the elimination of consequences of disasters and their rehabilitation* (Republic Administration for Protection and Rescue 1993) means that detailed information on past accidents can be incorporated as feedback into the prevention and preparedness component of the disaster management cycle of Prevention-Preparedness-Response-Recovery-Prevention. This has helped Slovenia develop risk assessment models of their industry as part of a Geographic Information System which will be used as a decision-making tool in future industrial development.

The combination of strategy, training ands equipment for a valid response service is a vital importance to developing countries and countries in economic transition where policies to prevent accidents involving hazardous substances often fall far short of what is required. Therefore, national capacity building covering Prevention, Preparedness, Response and Recovery.
is a vital element of any industrialization programme. However, transboundary emergencies can cause unexpected problems for any response organization. Pollution of rivers and atmospheric releases are the two main types of incident which are likely to affect another country. In the developed world the Schweizerhalle case demonstrated the problems of transboundary pollution and the need for adequate early warning and communications systems. Several countries noted problems of transboundary pollution.

Case Study 8. Moldova

This transboundary emergency was caused by the breaching of a chemical waste barricade at a potassium plant in Stebnic in the Ukraine. The chemicals polluted the Dniester river which flows through Moldova. More than 1.4 million tonnes of sulphate, chlorine, sodium and potassium, at concentrations of up to 37 grams per litre, entered the river, killing all fauna and flora along a 100km stretch of the river. No international assistance was requested because Moldova was a member of the USSR at this time.

It is important to realize that by the time the incident had occurred there was little the Moldovan government could do short of blocking off water inlets. However, analysis of the situation is important to identify the progression of the pollution and aid modeling of impact. In many cases countries need to call for outside expertise in order to cope with the problem in the latter phases of response and provide advice for recovery.

4.5 Countries which have used external assistance

Twelve countries noted that they had sought bilateral or multilateral aid in the past ten years. However, although such external assistance has often proved valuable, requests are rarely made for such help. For example, the US EPA note that have responded to thirteen relevant international emergencies in the past ten years. (Makris 1993). Several possible reasons can explain why there have been relatively few requests for international assistance:

- national response teams were able to cope adequately
- the significance of the emergency was not immediately recognized
- a perception that any response would take too long
- countries did not want to rely on foreign aid
- a lack of knowledge about the possibilities of assistance
- the fact that bilateral aid in this area is relatively new
- possible panic caused by the circumstances of the emergency making rational judgement difficult

However, several case studies illustrate both the value and the problems of supplying international assistance to emergencies happening in a foreign country. Several types of international assistance were identified;

- brokerage services
- information and advice
- operational support
- post accident analysis

Brokerage

Brokerage services are where a third party provides an introduction to a suitable expert for a 'client' country. This can provide rapid and effective aid by cutting down the amount of time a country spends looking for help. Obviously the prerequisite is that the country in need of help must know an organization or person who is in a position to act as broker. Assuming this basic level of knowledge the use of this technique for assistance has been proven to be effective. Such assistance is more likely to be of benefit in responding to chronic/imminent threat incidents, but would also be valuable in the latter phases of response and recovery in acute emergencies. The main limiting factor of the value of such a service is

- the time taken to find out who to contact initially to act as broker
- the time taken for the broker to identify the best source of information or equipment
- the time taken to organize the transference of the relevant knowledge

Case Study 9. Cyprus, 1987

A scrap yard at Limassol had been found to be polluted by PCBs leaking from dumped electrical transformers. Up to 100 tonnes of Askarel had been dumped in a shallow quarry and the liquid had penetrated the soil so that concentrations of 400ppm of PCB were discovered at 21m depth and 700ppm at 16m depth. This can be compared with maximum allowable concentrations of 10ppm in the Netherlands. A valuable groundwater aquifer used for drinking and irrigation occurs 30m under the site. The Ministry of Agriculture and Natural Resources requested advice from the IRPTC in UNEP. Brokerage services were provided and Harwell Laboratories in the UK sent an expert to assess the site and provide recommendations for the cleanup operation.

Lessons

- the validity of the brokerage role in providing access to international expertise and resources
- the fine line between chronic and acute pollution. Although the incident was not initially one requiring urgent assistance, if the aquifer had been contaminated it would have made any cleanup much more complicated, if not impossible. Therefore, early recognition of a future problem can enable proactive response to limit the damage.

Case Study 10. Karachi, Pakistan May 1993

2.5 tonnes of highly toxic and explosive chemical, metadinitrobenzene, were dumped near a railway station. Toxic fumes killed three people and one was permanently crippled. Eleven were hospitalized for 1-3 weeks. The local police impounded the material and, not knowing what it was, dumped it into the Lyari River. The outcry from the local environmentalists caused the local administration to approach the IUCN Pakistan office for advice. They provided some technical assistance to identify the chemical but for proper disposal of such a large amount of chemical the IUCN contacted the UNDP Sustainable Development Network based in Islamabad. The UNDP report says that the various government and non-governmental agencies that were involved in the operation had little idea about the safe handling and disposal of the chemical. UNDP then sent a request for information on Electronic Mail. More than 50 organizations and individuals sent in information about the best procedure. Responses were received from as far apart as Brazil, Finland, new Zealand and Switzerland as well as UK, USA and Germany.

Lessons

- The value of brokerage by UN organizations in putting clients in touch with expertise
- The potential for e-mail as an information networking tool
- The possibility that a formal register and network of nationally recognized experts would enhance the speed of response and ensure the credibility of advice

Information

This again is a simple and cost effective use of expertise; simply telling a country what they need to know to respond effectively to a particular type of incident. Obviously the information needs to be in a form suitable for immediate action, so firefighters would not want a treatise on the scientific background to a chemical; they need to know how to best deal with the chemical given their resources and expertise. Gaining access to such information will vary from simply calling up a personal contact to contacting an international organization, consultancy or national authority. Obviously in times of stress it makes it easier if a personal contact is known, thereby reducing the effort needed to find the best source of advice. For example there is a record of an ammonia leak from a factory in an African country when the plant manager called a personal contact and chemical safety expert in Scandinavia to ask advice on how to best deal with the spill

The is also the potential for providing information in the recovery/clean-up phase of an incident; while there may be time constraints they will inevitably be less pressing than in the initial response phase. It appears that in some cases the local responders will be able to deal with the initial response to an emergency involving hazardous substances but require advice on the long term clean-up and recovery.

Case Study 11. Malaysia, 7 May 1991

- A fireworks factory exploded causing 22 deaths and 103 injuries. Twenty two different types of chemical used in the preparation of fireworks were involved in the accident, including yellow phosphorus. The initial response was conducted by eight Malaysian Government and State departments but the extensive cleanup operations was managed by the Department of Environment who called upon China who had provided the yellow phosphorus and the UNEP IRPTC/NFP for information on chemical characteristics and disposal advice.

Lessons

- the importance of prevention and preparedness in hazardous installations; a special committee is being set up in Malaysia to screen and control all such installations and to ensure the preparation of emergency response plans.
- often emergency response teams can deal with the immediate incident effects but detailed advice is needed for cleanup operations.

Operational Assistance

In some emergencies a third party can make a valuable contribution on-site. Such incidents tend to have long response phases such as in cases of river pollution. However, the use of external equipment and expertise can also be useful in assessing the impact of a spill, identifying solutions and making recommendations. In some circumstances specialist response equipment can be flown in to be used in both response and recovery phases. A review of environemntal accidents condusted by the Commission of the European Communities noted: ***In the accidents involving fixed or processing installations, there is often some time between the occurrence of the incident and the release of chemicals to the environment.*** (Community Documentation Centre on Industrial Risk 1992). Therefore, there are some scenarios where external assistance can not just help in recovery phases of a disaster, but could conceivably help in the response phase. It is important to note that such operations need a lot of time to enable a suitable donor country to be identified, a team to be assembled, cleared through any bureaucratic problems and actually be placed on-site. However, once on site they can provide not just technical support but also advise on general crisis management and provide a psychological support for the overwhelmed emergency managers. The idea of a 'backstop' to help countries should all else fail has been reported as being an important psychological support. This will be even more important in developing countries where the national response capacity is often very poor and easily overwhelmed.

Knowledge of available international assistance

It can be seen that mechanisms do already exist to provide brokerage, information and operational assistance at the bilateral level. They have proved their value and should be encouraged. However, one problem that has been mentioned by countries is that such provision is only of any use when the potential client country is aware of the existence of such a service.

Case Study 15. Kenya, 1986

- When a chemical store at Nakuru caught fire, nobody knew how to respond in an appropriate manner. There is no chemical response capability in Kenya. Consequently, the fire was allowed to burn itself out. Government representatives indicated that attempts had been made to find out the best way to dispose of the resulting ash. However, no information could be found and the ash was simply washed into a nearby lake, causing significant pollution of the lake ecosystem. Although there is no proof, the pollution has been blamed for the movement of the famous Lake Nakuru flamingo population.
- The remaining unburned chemicals needed urgent disposal but the Kenyan authorities did not know how to proceed. There is no designated chemical landfill in the country but the authorities wanted to ensure the chemicals were put somewhere where the public could not be harmed. As a result the remaining tonnes of waste chemical were tipped into the crater of a nearby volcano where they remain five years later. The authorities are concerned about the possible contamination if the volcano erupts but at the moment there is neither the knowledge nor financial resources available to satisfactorily resolve the disposal problem.

Lessons

- the importance of accurate information on response to emergencies involving hazardous substances
- the likelihood that any external assistance would be required in the latter phases of response and in the recovery phase of the emergency. By the time contact could have been made with external experts, there would be nothing that could be done to help with initial response. This in turn illustrates the need for national capacity building.
- the government representative indicated that had an information service been known to be available, they would have used it. However although there are several existing response and information services around the world, in this case it appears that either nobody knew about them or did not know how to contact them. Another issue is the problem of panic when an emergency overwhelms the local capacity. Personal contacts between donors and clients could help prevent this mental blockage of whom to contact for help.

Information is only available for emergencies where countries knew that bilateral aid could help, knew how to contact them and were prepared to accept assistance from a particular country. It is impossible to identify how many other incidents exist where such bilateral assistance could have helped but the countries did not ask for help for the reasons indicated above.

4.6 Countries with no accidents recorded

Even countries who have not yet recorded instances of major chemical emergencies advocate the need to address the issue: A response from the UNDP representative in Mongolia notes that *we are not aware of any specific major accidents within the last ten years...but in this connection it must be remembered that the prevailing public and governmental awareness of the importance of environmental issues is a relatively new concept...However, the long term negative impact on the environment from the [tannery, wool scouring and mining] activities is obvious. This is especially clear since cleaning facilities and production methods are inadequate and obsolete. (UNDP 1993).* Many of the countries recognize that accidents in the past reflect that particular stage of industrialization and that future industrialization scenarios will probably be reflected by increases in environmentally significant emergencies. This could explain why some 21 questionnaire returns indicated that although the country had not suffered from such emergencies, they appreciated that the future will be very different and that therefore any assistance that could be provided would be welcomed. More information about the perceived future needs of countries is found in the Schulberg paper.