UNEP

ICMM
International Council
on Mining & Metals

Good practice in emergency preparedness and response


Good practice in emergency preparedness and response

By Alan C Emery
United Kingdom

September 2005

'Prevention is not only more humane than cure; it is also much cheaper. Above all let us not forget that disaster prevention is a moral imperative, no less than reducing the risks of war'.

United Nations Secretary-General
Kofi Annan, July 1999.

Contents

Foreword

Awareness and Preparedness for Emergencies at Local Level (APELL) is a tool for bringing people, principally company staff, community representatives and local authorities, together to allow effective communication about risks and planning for emergency response. Successful mining and metals operations require the support of the communities in which they operate, and experience has shown that open and informed communication between emergency response partners about potential risks results in better organised emergency response.

This publication acts as a companion to UNEP's APELL for Mining (2001). That document was prepared to assist mining companies to apply UNEP's APELL process, which had previously largely been used in the chemicals industry. In 2003, ICMM considered that it was necessary to take the APELL process further by analysing emergency preparedness and response capabilities within both its corporate and association membership. With UNEP's guidance and input, we questioned members on their performance and systems in this critical area. Our analysis showed that, while ICMM members' technical preparations for emergencies are good, more effort is required in working with neighbouring communities.

As part of their Sustainable Development Framework, ICMM members have committed themselves to implementing ten principles and measuring their performance against them. The fourth principle refers to the need to "inform potentially affected parties of significant risks from mining, minerals and metals operations and of the measures that will be taken to manage the potential risks effectively" and to "develop, maintain and test effective emergency response procedures in collaboration with potentially affected parties". The fifth principle is a commitment to "seek continual improvement of our health and safety performance", and the tenth principle includes a commitment to "engage with and respond to stakeholders through open consultation processes". This report provides guidance on meeting these commitments by effective use of the APELL framework.

Thoroughly implementing the model plan described in chapter 2 is no easy task. However, the examples provided by the case studies in chapter 3 and the reference material in the appendices provides both inspiration and information to achieve this important assignment.

It should be stressed that emergency planning, like most management challenges, is a process of continuous improvement. We would welcome comments on the report as feedback from readers will help us continue to provide focused guidance as further experience is gained.

Paul Mitchell
Secretary General

Chapter 1. Introduction

Almost 40 years ago a mountain of coal waste slid down a hillside in Wales and a generation of children in one village were smothered in a sea of slime and mud. In the years since, there have been many other disasters that have blighted the mining and metals industry's otherwise excellent progress in the areas of social and environmental responsibility. (For example, there have been 49 tailings dam failures in the last 25 years.[1]) Between them, they have resulted in accidental releases to the environment, threats to human health and livelihoods, fatalities in adjacent communities and physical damage to property and farmland. Several of these incidents have had heavy financial consequences for the companies involved. All have seriously damaged the reputation of the industry as a whole.

The horrific consequences of disaster remain in the public memory for a long time. Given the size and scale of the industry and many of its operations, the number of major incidents is small, however, although most people would regard even one incident as being too many. Nor is there any basis for suggesting that the mining and metals industry has been the only source of major disasters in recent years (witness Valdez, Bhopal and Seveso, to name but three).

It would be equally wrong to suggest that no progress has been made in the prevention, preparation for and management of disasters. Throughout the 1990s, the mining and metals industry – like others – took on board the need to think ahead in order to anticipate the effects of major incidents.

The Awareness and Preparedness for Emergencies at the Local Level (APELL) programme for mining is just one such step on that pathway. In May 2000 the International Council for Metals in the Environment (ICME), the predecessor of the International Council for Mining & Metals (ICMM), joined with the United Nations Environment Programme (UNEP) to begin the process of providing guidelines for improving the status of emergency preparedness in this industry. ICME and UNEP were particularly concerned with how this preparedness relates to and engages with potentially affected parties who live alongside the industry's operations. The work produced *APELL for Mining*, a set of 10 steps for the successful completion of emergency plans, built on an APELL programme that had already been successfully applied elsewhere.

For communities adjacent to mining operations, the APELL programme was expected to help them better understand those operations, the hazards they present and the risks they generate. Experience has shown that local communities are often inadequately informed of such risks and are unprepared for emergencies. A fast and effective local response to an incident can be the most important factor in limiting injury to people as well as damage to property and the environment. While incidents destroy community confidence, a well-informed, well-prepared community is better able to deal with the aftermath. Given the wide differences in community infrastructure, response capabilities, risks, scale, resources and regulatory frameworks that exist, however, application of APELL would need to be unique to each operation and each community.

A fast and effective local response to an incident can be the most important factor in limiting injury to people as well as damage to property and the environment

[1] World Information Service on Energy, Uranium Project, Chronology of major tailings dam failures (from 1960) http://www.wise-uranium.org/mdaf.html

In 2003, ICMM formed a group to raise the profile of this work among its members and others in the industry. The tasks of this group were to:

- look at the status of emergency planning among its members;
- promote APELL among ICMM member companies;
- help national association members co-ordinate the adoption of APELL by their own members; and
- demonstrate the practical application of APELL by highlighting good practice examples and lessons learnt.

A questionnaire circulated to ICMM members was used to assess the status of emergency planning. The results for the 31 respondent operations are summarised in Table 1.

The overall conclusion of the assessment was that most, if not all, businesses involved in mineral development and the smelting of metals take the provision and practice of emergency plans seriously. In general, plans are prepared, rehearsed on a regular basis, reviewed and modified, and proper arrangements are made for the management of crises should they arise. There are, however, gaps that, if filled, would bring all emergency plans up to the level of best practice.

Most businesses take the provision and practise of emergency plans seriously - there are, however gaps, that if filled, would bring all emergency plans up to the level of best practice

Parameter	%
Annual reviews of plans	100
Back up staff available during a crisis	94
Crisis team trained	94
Periodic testing of plans	94
A corporate culture and policy for emergency preparedness exists	87
External response teams identified	87
Support teams in place (counselling, etc)	84
External involvement in preparation by consultants	64
Information provided to local communities (largely through the environment report)	52
Management involved in plan preparation	48
Neighbouring threats identified	48
Gaps in external response identified	32
Local communities involved in planning and testing (excluding ER teams)	3

Table 1: Summary of Survey of ICMM Members on Emergency Preparedness

The principal gap relates to the involvement of local people in the development of an emergency plan. This is the gap that APELL was meant to address. Many local emergency response organisations have indeed been involved in the planning process and participated in crisis simulation. But the people who might be most affected by an emergency that goes beyond site boundaries – neighbouring communities – were apparently consulted in only one instance.

The principal gap relates to the involvement of local people in the development of an emergency plan - this is the gap that APELL was meant to address

Other gaps lie in the low level of awareness of the risks posed by neighbouring operations and, at the operational level, in reliance on HSE staff for the preparation of the emergency plan. It is evident, too, from the analysis of strengths and weaknesses that the standard of emergency preparedness varies across the industry. For almost every strength reported by any one operation or corporate centre, there was an equal and opposite weakness reported elsewhere.

That 94% of respondents test their plans annually ought to be seen as a source of comfort. The duration of testing was 15 minutes to 72 hours, but 31% of the sample reported a time of less than 1.5 hours. Clearly, appropriate testing is of vital importance, as demonstrated by the response to the London bombings of 7 July 2005. The only good feature of that incident, which claimed more than 50 lives and over 700 casualties, was the outstanding performance of the emergency services. The incident was rapidly bought under control, and information was given regularly to the public. This was only so because of the meticulous preparation and testing for just such an event.

The results of the questionnaire are shown in Appendix 4, along with aspects of the legal requirements for emergency response planning in Appendix 1 and a discussion of the hazards and risks that the industry presents in Appendix 2.

The questionnaire, however, is only part of what informs the need for this report. The experience of ICMM's partner in this project, UNEP, points to four other areas that need to be highlighted: the control of offsite transport, the delivery and on-site management of hazardous chemicals used in substantial quantity, the risk of significantly greater effects from failure as the industry's operations increase in scale, and the latent liabilities that remain, particularly with dormant waste repositories, when operations have closed or will close in the future. These particular points are covered in more detail in the case studies in Chapter 3 (four of these deal with transport) and in Appendix 2.

What is principally addressed in this report is the major gap identified in the questionnaire. The focus of attention has been the operating site and its preparations, particularly in respect of its neighbours. This is not to discount the important, sometimes vital, role that centres of business – their divisions, customer sectors, product groups and other subsections – have to play in preparing for, responding to and recovering from incidents. These are included, but to a lesser degree.

In Chapter 2, the APELL process and other elements of a best practice emergency plan are presented. This is followed by and linked to a series of case studies (Chapter 3) gathered from across the industry that illustrate some of the principles involved and how they might be better applied. Together, these two presentations should help all parts of the industry improve practice in this area.

Preparations for emergencies cannot be left to the last minute. There is a good deal of common sense in the dictum that when you are prepared for the worst, it never happens. This wisdom recognises, of course, that in making preparations, many of the problems and poor practices out of which emergencies arise are dealt with. As United Nations Secretary-General Kofi Annan has observed, emergencies cost money; preventing them costs less. It is hoped that this report will assist all who have plans to prepare and those who have plans to review.

The challenge is to perfect the industry's management in this area. Doing so will diminish the latent fear that exists in the communities surrounding its operations. It will also remove one of the major criticisms of the mining and metals industry.

Chapter 2. A model emergency plan

After outlining the responsibilities of a company, this chapter goes through the 10 steps described in the UNEP Technical Report 41, APELL for Mining. Throughout the chapter, examples are provided from relevant case studies in Chapter 3.

The elements that make up a high-quality emergency preparedness model are shown in Figure 2. It involves the company and the local community, as represented by the neighbours, local emergency response teams, the local government and nongovernmental organisations (NGOs) with specific interests in the area. To have a chance at avoiding emergencies or coping with them with minimum consequences, each party must recognise the other's interest and be prepared to work together to bring about the best solutions possible. This is the intent, for example, of the European Directive on disaster planning (Seveso II), the Awareness and Preparedness for Emergencies at the Local Level (APELL) programme of the United Nations Environment Programme and many other instruments and guidance documents.

After outlining the responsibilities of a company, this chapter goes through the 10 steps described in the UNEP Technical Report 41, the APELL for Mining Technical Report. Throughout the chapter, examples are provided from relevant case studies in Chapter 3.

Company responsibilities

Without in any way diminishing the responsibility of all the parties involved, it is perhaps most evident that the company has the biggest part to play. After all, the potential emergency situations that should be considered would not be present if the company were not in the area. It is also axiomatic that the company should take the lead in the process of engagement needed if emergency preparedness is to be of the highest quality.

The first step for the company is to have policies, procedures and processes in place related to preventing emergencies and dealing with them should they arise in any part of the enterprise. If the company is a major transnational enterprise, then these policies and so on should have common effect across all of the business – through its subdivisions to the operating sites themselves. They should apply not just to individuals and units that the enterprise manages directly but also, if only through influence, to subsidiaries in which there is a share but no management.

The first step for the company is to have policies, procedures and processes in place

An expression of commitment to zero harm to the environment and people is the starting point for many mining and metals companies, as exemplified in BHP Billiton's HSEC policy of December 2002. Behind such policies lie other statements about how this aspiration is to be met. These can be set out as formal standards, guidelines or procedures.

In the case of BHP Billiton (see Case Study 1) there is a relevant management standard on Crisis and Emergency Management (Standard 14), but also standards on Incident Reporting and Investigation (Standard 13) and Communication, Consultation and Participation (Standard 7). The latter two are important because they draw on the APELL principle of relating to the community in all that an operation does, but particularly in the context of emergencies.

Backing up these management standards are other business-based and operational documents. These include an asset protection guideline that sets out when and in what time period each level of the organisation is engaged in an event, depending upon its severity[2]. This upward reporting of an event at the earliest opportunity within a specific time frame is important if it is to be managed in the most effective way.

This enables the appropriate deployment of skilled and specially trained resources when they can be of most assistance. It is easier to save life, protect the environment and minimise damage to property by early intervention. It is difficult to catch up when harm has been done.

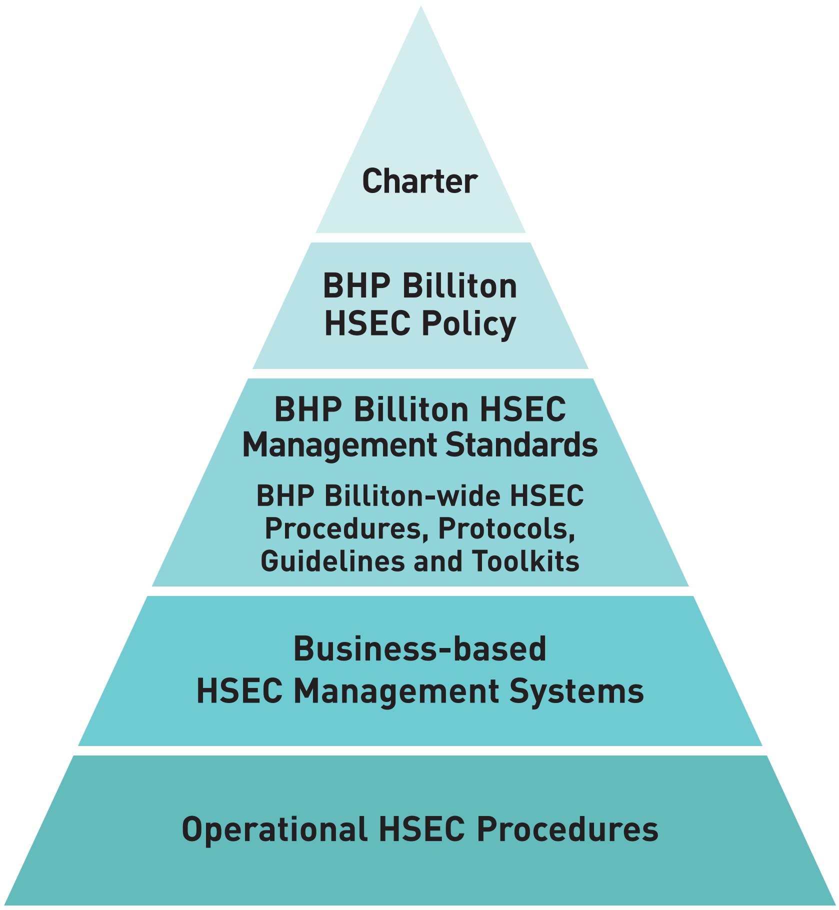

Figure 1 BHP Billiton's Emergency Preparedness Model

The model illustrated in Figure 1 is only one company's approach and reflects the organisational culture of BHP Billiton. Other ways of achieving the same ends do exist. The survey of mining and metals operations reported in Appendix 1 found that 90% of operations had such policies in place.

Working together

The ten-step process described in the UNEP APELL for Mining Technical Report begins with establishment of the Local Emergency Planning Co-ordinating Group (see Figure 2). This Group has a pivotal role to play in developing a community-focussed emergency response and preparedness plan. It should consist of

[2] BHP Billiton Crisis & Emergency Management Organisation, Asset Protection Guideline No. G16, 1 July 2002.

representatives of all parties who are responsible in some way for minimising the effects of emergencies and responding to them. It will obviously include representatives of local industrial facilities and the local emergency response teams. But it must also include members of any communities likely to be affected.

The prime task of this committee is to see that the network of interested parties in emergency prevention and response functions effectively and efficiently and that all the parties involved can and do have an input to the tasks to be achieved. The APELL for Mining report gives details of the preferred membership of this body and its work.

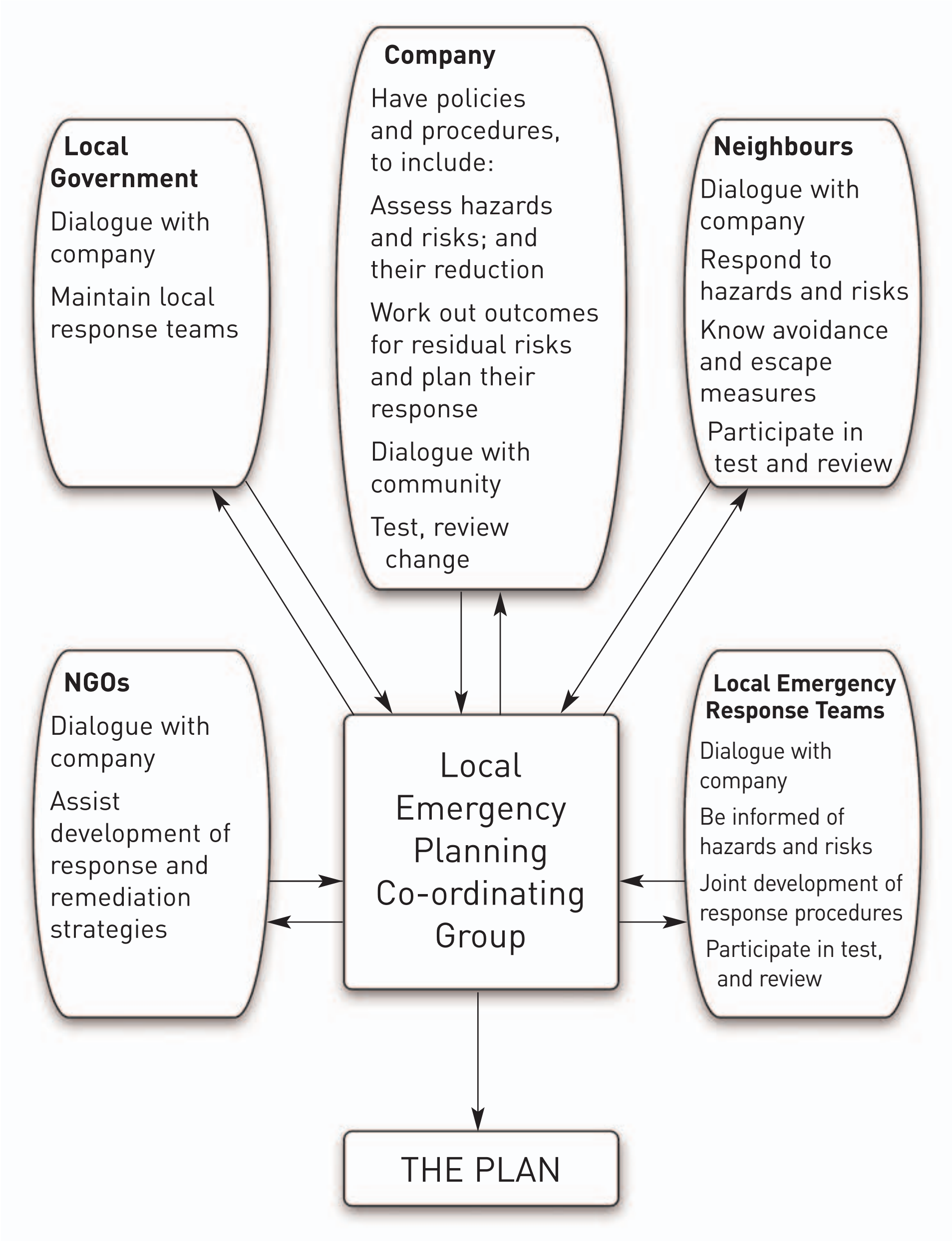

Figure 2 Local Emergency Planning Co-ordinating Group

Step 1 – Identify emergency response participants and establish their roles, resources and concerns

Members of the Co-ordinating Group will be well placed to understand the emergency response agencies and the resources available in the local area or will know where to get the information.
The following tasks are involved in Step 1:

- Compile a list of potential emergency response participants. In addition, Co-ordinating Group members may be aware of specialist groups that could be called on in specific emergency situations. (Another tool is the Community Development Toolkit. Please see box on the following page).
- Obtain copies of existing emergency plans and review these to identify any further emergency response agencies and participants.
- Establish concerns, such as deficiencies in resources or weaknesses in response capabilities. Prepare a brief description (perhaps a spreadsheet) of all emergency participants, their roles and resources, including personnel, equipment, special knowledge, facilities and so on. Pay particular attention to understanding and documenting the boundaries between the different providers, gaps, overlaps and any unclear roles and responsibilities.

Falconbridge use a four-by-four matrix to assist the assessment of identified hazards and probabilities of occurrence. An Excel spreadsheet has been developed to facilitate capture and analysis of relevant data and to assign risk profiles. The information from each facility is recorded corporately, together with appropriate responses, should an emergency occur.

Case Study 2: Identifying and assessing hazards and risks (see page 28).

Many mines and smelters operate in remote areas where government agencies and infrastructure may be extremely limited or, where they do exist, are severely under-resourced. In such cases the mine or smelter will provide virtually all the resources necessary to deal with emergencies. It may already have provided equipment, such as community ambulances, or training to local groups such as volunteer fire-fighters.

In some cases, towns or settlements adjacent to mines and smelters may have grown substantially as a result of the company's presence and have outgrown the capabilities and resources of its emergency response agencies. Volunteer organisations may exist that are capable of fulfilling a role, such as organizing an evacuation.

The Community Development Toolkit (ESMAP, the World Bank Group and ICMM, 2005) provides practical tools intended for use throughout the project cycle which cover the assessment, planning, management and evaluation phases of community development as well as stakeholder relationships. Some of the tools may assist in implementing the APELL process described here, such as:

- Stakeholder identification – a tool for identifying all the people with an interest in a project, or who may be affected by a project;
- Stakeholder analysis – having identified a project's stakeholders, this is a tool to assess their interests in a project and appropriate levels of engagement;
- Consultation matrix – a tool for establishing a comprehensive system for project consultation and communications, to ensure that consultation activities are appropriate to the specific needs of different stakeholder groups.

The Toolkit also contains tools for identifying potential partners and managing, monitoring and evaluating community development activities.

The Community Development Toolkit (available at www.icmm.com)

A checklist of emergency response participants can be developed along the following lines. For mines operating in remote areas, not all of these agencies will be present, and company personnel will fulfil many of these functions:

- Fire department and police;
- Emergency health services such as ambulances, paramedic teams and poisons centres;
- Hospitals, both local and for evacuation for specialist care;
- Public health authorities;
- Environmental agencies, especially those responsible for air, water and waste issues;
- Other industrial facilities in the locality with emergency response facilities;
- Transport companies and suppliers;
- Civil defence teams;
- Welfare services;
- Red Cross/Crescent;
- Public works and highways departments, port and airport authorities; and
- Public information authorities and media organisations.

Some mines are fly-in, fly-out operations remote from towns and from emergency response agencies. Some are in pristine areas with no local community, where the emergency response would be aimed at preventing damage to sensitive ecosystems. Again, the operation may have to provide most of the equipment and facilities to be able to react to an incident. However, there may be agencies responsible for or NGOs concerned with the protected areas that may also be able to mobilize staff and equipment in the case of an accident.

In other cases, facilities are located in highly developed areas with efficient emergency services and environmental agencies present. There is, therefore, a wide variety of situations, and the inventory of potential emergency response providers and available resources will be different in each case.

Step 2 – Evaluate the risks and hazards that may result in emergency situations in the community and define options for risk reduction

Possible accidents should be identified, along with the probability of their occurrence and possible consequences. This enables scenarios to be constructed and priorities to be set for planning purposes. Simultaneously, apparent risk reduction options should be defined and pursued.

The Co-ordinating Group should assess the potential severity of the impact for each possible accident, such as:

- mining accidents that have occurred, including near misses or incidents that similar facilities have experienced;
- the experience of chemical or transport accidents in other industries, since mining operations receive, use and produce many materials that if incorrectly managed present hazards to health and the environment;
- natural disasters such as earthquake, cyclones, floods and forest fires that may cause or compound an emergency at an operation;
- seasonal hazards—freezing may contribute to the occurrence of some accidents, and the spring thaw will contribute to others, while some accidents may be more prone to occur in the dry or wet season in parts of the world; and
- the community's perception of risks and its willingness to accept certain risks but not others – this dimension is important, and risk assessment can usefully be approached as more than an engineering/technical exercise.

> During transport, an unknown quantity of mercury was lost along a 40-kilometer stretch of highway. Villagers collected this on the route because they thought that mercury had a high value or therapeutic properties. Varying degrees of illness developed among some of them. Following the incident, new procedures for ensuring safer transportation were introduced by the mining company. Training sessions for local communities on operational and transport hazards and emergency response procedures were also given.

Case Study 3: Losses in transporting mercury (See page 29).

The Group should assess the potential severity of the impact for each possible accident, such as:

- the size and nature of potential area affected;
- the number of people at risk;
- the type of risk (physical harm, toxic, acute, chronic);
- long-term residual effects;
- impacts on environmentally sensitive areas;
- financial consequences; and
- consequential secondary risks and impacts.

The probability of occurrence should be assessed, either qualitatively or using a quantitative assessment. Points to consider include:

- the probability of individual events;
- the probability of simultaneous events (such as an earthquake resulting in rupture of a pipeline); and
- complications from unique environmental considerations, such as severe terrain, location on a major river, frozen conditions and so on.

The Co-ordinating Group should agree on key scenarios that could reasonably be expected to occur or that the community is most concerned about and use these in the planning process.

As the hazards are identified and their probability and consequences are examined, some areas of risk may be identified that can be readily eliminated or cost-effectively pursued. Appropriate action should be taken to reduce or manage those risks through changing operating practices, upgrading equipment, training, changing the chemicals used, and so on. The emergency planning process complements but does not substitute for risk management and risk reduction – action must also be taken on these fronts.

Some areas of risk may be identified that can be readily eliminated or cost-effectively pursued - appropriate action should be taken to reduce or manage those risks

A specialist team or other group may be required to recommend risk reduction options rather than the Co-ordinating Group, but results, plans and progress should be reported back to the Group. It may be possible to eliminate some risks completely. If this is the case, this can be documented, and the next steps in the APELL process can concentrate on the remaining risks.

Two publications that contain valuable information for this section of the process are an analysis of the causes of tailings failures carried out by the International Commission on Large Dams published in 2001 and principles for preventing, preparing for and responding to accidents involving hazardous materials of any kind updated and republished by the Organisation for Economic Co-operation and Development in 2003.[3]

Step 3 – Have participants review their own emergency plan, including communications, for adequacy relative to a co-ordinated response

Emergency plans may exist in various forms for many areas – regional and local plans, for instance, police and fire plans, hospital plans and operator site plans. National Disaster agencies or co-ordinators are one source of information on existing plans. A list of relevant agencies is available from UNEP and from the Office for the Coordination of Humanitarian Affairs.

As an example of a regional plan, the International Commission for the Protection of the River Danube has established an Accident Emergency Warning System. This came in to play with great effect to prevent human health impacts following the tailings release at the Romanian Baia Mare gold mine in 2000. The system was upgraded in 2003 to take advantage of substantial improvements in communications technology.

[3] ICOLD/UNEP Bulletin, Tailings Dams: Risks of Dangerous Occurrences. Lessons Learnt from Practical Experiences, 2001; OECD, OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response. 2003, http://www2.oecd.org/guidingprinciples/index.asp

In some sparsely populated and remote areas, emergency plans may be completely absent. In others there may be unwritten responses that need to be understood in dealing with emergencies such as fire at the local level. The objective of this step is to review plans for adequacy in the context of their contribution to an effective overall response to the emergency scenarios agreed to by the Co-ordinating Group.

Key elements and details that need to be covered in an emergency response plan include:

- established criteria for triggering the plan and alarm signals, with backup;
- clear reporting procedures both internally and upward in the organization, and externally to appropriate authorities;
- communications equipment that can reach all participants, such as mobile phones, pagers, short-wave radios, depending on location;
- media contacts and a media relations strategy, including relevant descriptive material of the operation;
- specialised hazard monitoring and training, such as dealing with chemical fumes or water pollution;
- adequate emergency equipment for spill containment or collection, such as additional supplies of booms and absorbent materials;
- alerting the public and co-ordinating evacuation using sirens or other warnings, with well-rehearsed warnings, evacuation procedures and easily reached shelters;
- clear roles of participants in different areas of response, such as firefighting, community protection;
- alternative drinking water supplies in case usual supplies are contaminated;
- rapid test kits for chemical spills, such as cyanide in the case of gold mines;
- readily available access to information on dealing with chemical hazards; and
- examination of options for cleanup following the accident – both immediate actions to be taken and the approach that would be taken to a longer cleanup programme.

This step involves two principal actions. First, the Co-ordinating Group should contact the participants identified in Step 1, outline the priority emergency scenario(s) and ask them to evaluate their plans against these scenarios. A checklist of plan elements, response tasks and equipment can be developed to assist in this evaluation.

Second, the Group should review the results of the separate evaluations to determine the overall strengths and weaknesses of the current status of a co-ordinated emergency response. The checklist can be developed into a table of information on the various response plans prepared by different agencies, which will help highlight gaps in relation to an integrated emergency response plan.

Step 4 – Identify the required response tasks not covered by existing plans

The reviews carried out in Steps 2 and 3 can help determine whether existing emergency plans address the identified risks and emergency scenarios adequately. Additional tasks that need to be undertaken to complete or improve the plan can be identified. This step requires a thorough definition of what more must be done, with input from emergency response participants and Co-ordinating Group members.

A truck carrying sodium cyanide spilt some of its load into a river after an accident. The company responded effectively, but not before widespread panic had developed among the local population. As a consequence, the mine reviewed, improved and tested its emergency response plans, particularly in relation to hazardous materials transportation. It also participated in a technical cooperation project to facilitate dialogue and information sharing between the company, key community and NGO groups, local and national authorities, international finance institutions and other interested parties.

Case Study 5: Cyanide spill (see page 33).

What needs to be done is:

- identify missing or weak elements or tasks not being covered by any group, in the context of an integrated response;
- determine the importance of these elements to the function of the participant (for example, the fire service may not have the proper equipment to fight some chemical fires or correct antidotes may not be available at nearby hospital); and
- discuss the inter-relationships, responsibilities and communication plans – for an effective integrated response, the importance of establishing a clear command structure cannot be overstated.

In many, but not all, cases, the facility manager or his/her designate will want to take control of the response programme. But there are jurisdictions or scales of incident where this is not permitted by statute, and a designated agency will take overall control in those cases. What is most important in every case is that there is one recognised and authorised person who has overall control of the response programme and to whom all final decisions will be referred.

What is most important in every case is that there is one recognised and authorised person who has overall control of the response programme and to whom all final decisions will be referred

Step 5 – Match tasks to resources available from the identified participants

The Co-ordinating Group must assign each task defined in Step 4 to the participant who can best address that aspect. Assigning the tasks should take into account authority, jurisdiction, expertise or resources.

- Evaluate each of the required extra tasks separately and, using the list of participants from Step 1, determine who is most likely to be able to complete the task. Assess benefits or problems associated with a particular participant completing a particular task.
- Discuss the task with the participant to determine willingness to undertake it and the resources and experiences that will ensure the task is completed, or identify problems that may make it inappropriate or difficult for the participant to accomplish the task.
- Determine if any new tasks, problems or constraints will arise as a consequence of completing those already identified.
- Monitor the successful completion of each task.

Resourcefulness and initiative may be required here. For example, in a sparsely populated area where police are scarce, volunteer fire-fighters could be used for temporary traffic and access control.

Step 6 – Make changes necessary to improve existing emergency plans, integrate them into an overall community plan and gain agreement

By completing Steps 4 and 5, all resource-related problems should be identified and resolved. Integrating the plans will reveal overlapping responsibilities and complex interfaces between agencies.
Tasks in this step are to:

- prepare a draft integrated plan;
- ensure that the newly developed plan is consistent with any regional or national disaster plans;
- ensure its consistency with legislation and any codes that are relevant to emergency planning and community engagement;
- check that the plan is robust in relation to all previously identified risks and emergency scenarios and in relation to response tasks, resources, roles and accountabilities to ensure there are no weak components;
- conduct a role-playing exercise as a preliminary test of the plan, with key participants describing how they would respond to a variety of different emergency scenarios – this should include players from different agencies and so on providing input as the exercise develops to direct the exercise play and hence assess responses to changing circumstances (testing of the plan once it has been developed is covered in Step 9);
- identify any weaknesses in the plan and, if necessary, repeat the two previous steps to resolve these problems;
- revise the plan as often as necessary until all deficiencies are eliminated and the members of the Co-ordinating Group agree it is appropriate and workable; and
- ensure that any individual plans that the various providers and organisations may retain to focus their own particular responses are retrofitted to the integrated plan and that inconsistencies do not creep in.

> The collapse of an underground mine in Austria resulted in 10 deaths and a traumatised community. Following the tragedy a comprehensive crisis management system was devised, including the development of crisis scenarios and the complete revision of the group's emergency response and preparedness procedures, taking on board many of the APELL approaches. This began an extensive process of consultations with local community leaders and their administrations. Local emergency response teams were invited to make detailed inspections of the company's facilities and to suggest ways in which response planning could be improved.

Case Study 7: Changes to plans in respect to communities (See page 38).

Aiming for clear usable plans
Successful plans are often simple, supplemented with appendices of detailed information where necessary.

Many plans include a telephone and contact roster, an action guide/checklist, a list of resources and capabilities that can be shared and an action checklist for field use. Plans that fill thick files are unwieldy and more likely to be ignored or bypassed. Simple, uncluttered flow charts are easy to use, and more people with no special training can be expected to use them in an emergency.

Some or all of this information can be made readily accessible on company websites, but the plan needs to be available in hard copy as well, since computer systems may be disrupted by the accident itself or by other failures.

Post-emergency cleanup as part of the plan
As indicated, cleanup after an emergency should be considered in the planning process to avoid problems later on. Collecting base-line data relevant to the risk scenarios is one important element. Another is to have considered in general terms the logistics, benefits and downsides of alternative cleanup and remediation strategies so that immediate action taken in the course of an emergency does not complicate the longer-term approaches to effective remediation.

Cleanup operations can themselves be dangerous as Case Study 8 shows. The work will not be a part of any normal routine — major truck movements in unfamiliar territory, for example, or working on incompetent ground — and while it may have the appearance of the familiar, it will be characterised by its own particular hazards. Risk assessments are advisable when considering the options.

Detailed cleanup and remediation plans can of course only be prepared after an accident has occurred. Apart from minimizing the environmental and social impacts of the accident itself, the objective would be to enable the facility to return rapidly to safe production, with cleanup to standards acceptable to regulatory authorities, to the community and to the company itself, consistent with good corporate citizenship.

> The flow from the breach of a tailings dam in Spain was massive and extensive. Cleanup was initially hindered by the absence of good-quality baseline data to evaluate the effects of the incident and to determine relevant cleanup standards. During the cleanup there were five fatal accidents on public roads.

Case Study 8: Lessons from a tailings dam failure (see page 42).

Step 7 – Commit the integrated community plan to writing and obtain endorsement for it and relevant approvals

The integrated plan, as agreed by the Co-ordinating Group, needs to be documented in final form and endorsed by the community and the local government or other appropriate agencies.

- Use a small group to write the plan in its final format.
- Prepare a standard presentation to be given to the community, government officials or others who may have a role in its approval or implementation.
- Prepare notices, instructions, posters and so on for use at the site and by other organisations and individuals.
- Make presentations, hold meetings and review sessions and obtain endorsement of community leaders and relevant officials.
- Make arrangements for any written agreements that may be necessary between participants of the APELL process, such as mutual aid, notification formats, use of the media, specialized response personnel and equipment. Agreements are also needed when private companies are to provide particular emergency assistance, such as technical expertise or specialized equipment.

The objective of this step is to take the plan from the development stage, during which the APELL Co-ordinating Group has been the 'owner' of the emerging plan, and transfer ownership and endorsement to the affected communities, relevant agencies and within the company. It could be that some government agencies need to approve the plan officially if it relates to their statutory accountabilities. For example, although individuals from the local council may have been involved via the Co-ordinating Group during the plan development process, to gain official approval and adoption, the plan would probably need to be presented to the council as a whole. If communication has been effective throughout, this step should simply involve formalizing its adoption.

Agencies such as government inspectorates, emergency response providers and company management would be targeted at this stage. Group members, and particularly the leader or leaders of the Co-ordinating Group, can play a central role as communicators of the plan to expedite its endorsement and adoption.

In cases where the government or official groups may be physically or culturally remote from the area where the APELL process is being developed, gaining endorsement may be slow due to distances or the scarce resources within the organisations involved.

Within companies, the Head Office may want to give final endorsement or approval. As discussed earlier, it is likely that corporate management will have a role in certain decisions and actions in the event of an emergency; consequently there must also be sign-off on the plan beyond local management. In other cases, the details would be approved locally, but copies of the plans may have to be sent to the Head Office.

Step 8 – Communicate final version of integrated plan to participating groups and ensure that all emergency responders are trained

Once the plan has been endorsed by those groups whose 'sign off' was appropriate or desirable, the details of it need to be communicated to the members of the emergency provider groups so that they are aware of the format of the plan, of their collective and individual responsibilities and of any training they might require, such as the use of new equipment, new procedures and so on. Operating Procedures covering aspects of the Plan should be available to all staff who may need them.

- Compile a list of participating groups who need to know more about the integrated plan. (See also The Community Development Toolkit on page 12)
- Make presentations to these groups to explain the plan, their roles and the type of training they should institute or receive.
- Update procedures manuals.
- Identify those who must be trained; develop and carry out training sessions where necessary. In cases where the local authorities are not equipped to train key people, the operation may need to undertake this.
- Ensure notices and posters are displayed in appropriate locations.
- Complete field exercises for hands-on training in monitoring, use of communications, traffic control, evacuation procedures and so on.
- Complete comprehensive workshops, including emergency scenarios, to train leaders in co-ordination and communication among participants.
- Focus on communication and media training for principal spokespersons in emergency response agencies and within the company. In some cases the media may be one of the response agencies with an important direct role as one of the emergency channels of communication to reach affected people or response providers in order to trigger plan actions.

These training and presentation sessions may take place as a series of half-day seminars. In some instances, agencies such as the fire services and environmental agencies may 'cross train' to increase the skill levels of each response team. This has the added advantage of raising awareness of the different issues involved, such as the use of breathing apparatus, contaminant monitoring and containment strategies.

The training should include such issues as:

- roles and responsibilities of responders;
- how to use the resources available for a mining or metals-related emergency;
- procedures for contacting relevant people for information or assistance;
- interpretation of UN dangerous goods class, placards and labels;
- emergency cards and response guides – how they are structured and how to use them;
- the location, content and interpretation of documents relating to the contents of a spill; and
- contact with the media and with other key audiences.

Step 9 – Establish procedures for periodic testing, review and updating of the plan

The Co-ordinating Group should ensure that the plan is well tested. Initial testing should take place without involving the public, to uncover deficiencies in co-ordination among groups and in the training that has taken place so far. Nothing can replace a full-scale emergency drill as a means of identifying further areas for improvement. Integrating the drills with other testing procedures on-site may be attractive to management, but the potential involvement of different agencies could make this difficult.

> The Co-ordinating Group should ensure that the plan is well tested

- Form a group to prepare a test drill scenario. The group should not include members of the emergency response group.
- Prepare a written scenario that identifies the objectives of the drill, components of the plan to be tested, sequence of events and simulated hazard levels.

- Designate a group of nonparticipating observers to evaluate the test drill using prepared evaluation checklists.
- Using appropriate local officials, media and other outlets, alert the public and all participants that a test of the plan is scheduled. It is crucial that the public does not confuse the test with the real thing, which could result in panic and a real emergency.
- Conduct the test using the prepared scenario.
- Immediately after the test, the Co-ordinating Group should hold evaluation sessions to consider the results according to the evaluation sheets and the responders' experiences. Interagency and community cooperation should be a particular focus of this evaluation.
- Assign appropriate participants to correct deficiencies and revise the plan accordingly.
- Prepare a guideline to ensure that the plan is regularly reviewed and updated to keep it current. This should address frequency of reviews in the absence of material changes in the operation or the communities, plus a list of triggers that could affect emergency response and hence should, prima facie, lead to a review of the plan.

A different scenario should be tested each time. If there are several scenarios that have very different consequences (such as explosions, tailings dam failure, chemical spill during transport to the operation), more-frequent testing should be considered until they have all been covered. On a large site that has the potential to affect several different communities, a scenario involving each community should be devised and tested.

Weather can raise particular issues or require different responses. Tests should therefore be carried out in different seasons to ensure that plans are as complete as possible. In areas of extreme rainy seasons, for example, access across some rivers may be restricted in times of high flow, so alternative routes may need to be devised. Similarly, in very cold climates, the presence of ice and snow may hamper the plan so that additional resources would be needed to give responders access to all areas that may be affected.

In addition to there being very different sizes of operations, there are also wide differences in the life span of operations – from a few years to many decades. Emergency response preparedness and the APELL process are obviously applicable whatever the length of life of the operation, but the time taken to step through the process may be deliberately telescoped for an operation with a projected life span of five years when compared with one projected to last 30 years. Consideration also needs to be given to post-closure situations and the safety of permanent waste repositories.

Emergency response preparedness and the APELL process are applicable whatever the length of life of the operation

An electrolytic refinery in Europe has undertaken a number of different crisis scenarios, including a chlorine tank leak with gas cloud spread to a nearby school, an iso-propanol leak during unloading, a natural gas leak, and a hydrogen fluoride leak. Each scenario threw up different issues that were addressed more effectively in a revised emergency preparedness and response plan.

Case Study 10: Co-ordination with local services simulation and review (see page 48).

At some operations, the most senior manager may be replaced regularly, so that continuity in the APELL process may become problematic. This is another reason that regular testing and reviews of plans are a good idea. Not only will this highlight any changes that have arisen affecting the execution of a plan since the last test, it will also give new managers and emergency providers experience of their roles. Changed conditions that should require the plan to be reviewed could include such things as an extension to the existing facility, a new area being potentially affected, the development of a new industry in the vicinity of the operation or major new housing or road developments. A substantial change in the capacity or resources of key emergency providers or government agencies may necessitate a review. Other triggers bearing directly on the operation could be:

- a near-miss accident;
- a new open pit development;
- a new waste rock dump;
- a new tailings dam;
- a change in process route such as oxide to sulphide;
- a new heap leach pad;
- other significant changes such as increased mill or smelter throughput; or
- new transport routes or methods.

A review should also be triggered by an event elsewhere in the industry, including sister operations. 'Could the conditions that arose in that case apply to this operation' is a useful question to ask. Such would also apply to incidents in other industries and areas of life. There is a case to be made for more open sharing of the causes of major incidents and how they are handled. In this way, all could benefit and be better protected. An alert eye should also be kept on changes in legislation, both in the region of an operation's domicile and elsewhere.

There is a case to be made for more open sharing of the causes of major incidents and how they are handled

Step 10 – Communicate the integrated plan to the general community

Options for involving the community at large, rather than only community leaders or representatives, should be pursued at every opportunity throughout the APELL process. The ultimate critical step is to ensure that each member of the community who may be affected knows what the warnings will be and what to do during an emergency, how to get additional information and when to evacuate if necessary. Some awareness campaigns are already reasonably commonplace – making people familiar with sirens for blast warnings in the vicinity of open pit or open cast mines, for example, in coastal areas for flood warnings or in buildings and plant to alert people to equipment that is about to move or to order evacuation.

A deactivated tailings pond undergoing remediation stands in a seismic-prone region. The failure of one corner could affect a neighbouring highway and local services and property. An emergency plan and standard operating procedure were developed to cater for this potential incident and used as a tool for public dialogue with the local community. Over a decade, public meetings were held to co-ordinate the response, inform people of the seismic vulnerability and seek their input. A system of message boards that would be automatically triggered in a seismic event were placed at highway intersections to advise traffic of diversions away from hazardous areas along the tailings perimeter.

Case Study 11: Community engagement on potential for seismic failure of tailings pond (See page 50).

- Prepare a standard emergency response brochure for distribution to all residents in areas that may be affected. This must be appropriate to the level of literacy of the local population – use of symbols and pictures may simplify the response actions, although this may need to be backed up by a face-to-face community education programme. The brochure may need to be in two or more languages for some communities. (See also The Community Development Toolkit on page 12).
- Distribute the brochure by the most appropriate means, such as post, door-to-door delivery or community group meetings.
- Prepare a standard media kit that gives emergency contact points in the company and relevant government and other agencies, as well as background information and details on the operation and the emergency response plan.
- Conduct a media briefing session to present the kit and explain what help is needed from the media during an emergency.
- Build other elements of a public awareness campaign, such as organizing a pool of speakers available to address local civic groups, schools and so on, or special workshops on specific chemicals such as cyanide to educate the public about their benefits and risks. Arrange for media coverage of drills, training activities and the like.

A strategy for handling media contacts during an emergency is a necessary and very important part of the response plan and should be developed at the same time as that plan. As noted, the media has an important role as it is a channel of communication that can reach affected people and response providers quickly. It also plays a vital role in providing information on an event and what is happening on the ground.

It is certainly the case that major accidents inevitably generate rapid and extensive coverage by the news media. As most emergencies, at least initially, are characterized by a lack of information, it is easy for them to transmit messages that lead to the spread of unfounded rumours or misconceptions. These can quickly raise anxiety levels unnecessarily and are very hard to correct or quash, even after full investigations have been carried out. Case Study 7 is particularly informative of media behaviour and how, with interactive engagement, it can be changed to advantage.

A strategy for handling media contacts during an emergency is a necessary and very important part of the response plan

Regular communication even in the absence of hard data is vital in maintaining public confidence. If no information is available, the spokesperson must undertake to inform the media when more is likely to be available.

> Through consultation, the Mining Association of Canada established that much needed to be done to improve the effectiveness of communications during a crisis. In this way a great deal of anger, mistrust, frustration and stress would be avoided. They published a comprehensive guide on how the communication process should be embedded within an organisation and be conducted. The steps in the guide are each illustrated in an Appendix, and it comes complete with a worked example.

Case Study 12: Communication plans for crisis management (see page 53).

Proper training of the principal spokesperson, the senior people likely to be involved and any deputies is required if contact with the media is to be positive. (Note, however, that in an emergency only one person should be authorised to provide information.) Such training will contribute to the handling of an emergency, lead to the provision of appropriate information to a community in an emergency and limit the damage to the reputation of the company involved. Press interviews and press conferences can be simulated to give staff practice in handling this aspect of their duties. Building prior contacts with media staff and involving them at various stages of the APELL process will also help. Supplying information packs about the operation will ensure that they have some facts to use in any report that is made.

Communication is a critical part of the emergency response procedure and one that the company must approach professionally. There have been cases of representatives appearing on television in the aftermath of an accident who have clearly been ill equipped to present the facts or to convey the attitude of the company in an appropriate and sensitive manner. The designated company spokesperson must not only be trained in handling the media and in communicating key facts and information about the operation. He or she must also be familiar with the emergency response plan before the event.

> Communication is a critical part of the emergency response procedure and one that the company must approach professionally

For some emergencies a spokesperson will not suffice; the chief executive of equivalent must communicate critical information and messages personally. The use of a spokesperson from the Co-ordinating Group on how an emergency situation is being handled could be considered.

During the planning process, it is likely that only local media will be involved, but in the case of a high-profile accident, the facility will have to deal with the international media. As part of the planning process, setting up a website for use in emergencies should be considered. Specific details about the operation and its environs can be included, as well as details of the APELL partners and participants. In the event of an emergency, it will be expected that the company – and in some cases, the industry association – will provide a continuous stream of updated information, as well as background and explanatory material. Placing this information on the website in a timely fashion will give ready access to all media involved. It should be noted that NGOs are particularly adept at managing the Internet to their advantage.

External Affairs, Government Relations and Investor Relations specialists within companies will have their own audiences who want timely and accurate information on the accident, its impacts, the causes and consequences and the response actions taken. They will also be likely to have contact with the media in their roles. Pre-planning, including familiarity with the response plan to be triggered by an accident, will help ensure that consistent and clear accounts are available to the range of stakeholder audiences.

An area worthy of exploration is for the provision of co-ordinated and common media responses as an incident progresses. This would lessen the opportunity for conflicting information being given out, with all the downside that this brings. Such a co-ordinated activity could only be achieved where there was already a good relationship between the various agencies involved. There is opportunity for establishing these relationships during the preceding steps of the APELL programme.

Traditionally, industry associations have tended not to speak in the event of an accident, whether it concerns a member company or not. All but one industry association declined to answer a questionnaire on this subject that was sent to them at the same time it went to companies. The majority did not see engagement with the issue of emergency response and preparedness as an appropriate role for them.

However, the member companies, the media, other stakeholders and the associations themselves are increasingly seeing this silence at best as unsatisfactory. To outsiders, it sometimes seems as though the industry and its associations conspire to protect those who might be guilty of unacceptable behaviour.

Industry associations can usefully play a role that is distinct from the company, which, of course, must always retains primary responsibility for providing accurate and timely information to the various audiences who demand it. An association should never take over the company's role nor pass judgement on an accident's causes, consequences and response measures taken, unless it has been involved in a proper process to review those matters.

Associations can, however, provide prepared and agreed information to help audiences understand the context of an event by, for example, descriptions of the mining process used, of the substances which may have been released, or the circumstances under which the substances might affect human health or the environment. They can point to further sources of information, provide background on the frequency of such accidents and the type and success of remedial actions taken and give out information on any industry codes the company may operate under. Educational packs that the associations might already be producing could include material about what the industry is doing to prevent incidents happening and how they are geared up to handle them if they do.

Associations can provide prepared and agreed information to help audiences understand the context of an event

As part of being prepared for emergencies, industry associations should consider drawing up their own guidelines to define the parameters for their communications before, during and after an accident, to provide spokespeople with media training and to ensure that they, with their members' assistance, have appropriate background information at hand.

Chapter 3. Case studies

This chapter describes 12 case studies that illustrate one or more points of the APELL programme. These have been provided by member companies of ICMM that responded to the questionnaire.

Case Study 1. Community engagement – policy requirements: BHP Billiton

BHP Billiton,[4] in its overarching health, safety and environment (HSE) standards and policies, sets requirements for communication, consultation and participation with local communities; business conduct, human rights and indigenous affairs; incident reporting and investigation; and crisis and emergency management.[5] Relevant sections that relate to parts of emergency response planning are reproduced below.

Communication, consultation and participation

Effective communication and consultation is maintained with stakeholders associated with BHP Billiton activities, and they are encouraged to participate in and commit to health, safety, environment and community (HSEC) performance improvement initiatives.

Systems are in place to identify and work with stakeholders and develop strategies to address their concerns and expectations. Consideration is given to the local context and to social and cultural factors in order to facilitate understanding and informed discussion.

The HSEC Policy, the Standards and relevant information on HSEC matters, risks, plans and performance are communicated to employees, contractors and external stakeholders on a regular basis. Systems provide for consultation and feedback and for tracking of follow-up actions.

Employees and contractors participate in the development, implementation, review and improvement of HSEC initiatives and programmes, the establishment of HSEC goals and targets, and the review and verification of HSEC performance. External stakeholders are encouraged to participate in relevant activities.

Open consultation and communication with governments, authorities and other organisations is maintained in order to contribute to the development of public policy, relevant legislation and educational initiatives.

HSEC information and lessons are shared across BHP Billiton sites and operations and, as appropriate, with external stakeholders.

Concerns, complaints and relevant external communications related to the HSEC aspects of BHP Billiton operations are recorded in a register, acknowledged and investigated as incidents, and outcomes are reported back to relevant stakeholders. Mechanisms are in place to resolve conflicts where they arise, through consultation and participation directly with stakeholders or their intermediaries.

The effectiveness of communication, consultation and participation processes is regularly reviewed with stakeholders.

[4] A dual-listed company consisting of BHP Billiton Limited in Australia and BHP Billiton plc in the UK, operating on a combined basis as BHP Billiton.
[5] BHP Billiton HSEC Management Standards, Issue No. 2, 13 December 2002.

Business conduct, human rights and indigenous affairs
Activities and operations are conducted in an ethical manner that supports fundamental human rights, respects the traditional rights of indigenous peoples and values their cultural heritage.

Paragraph 8.4 of the Standard requires that systems are in place to work with local communities through project development, operational and closure phases to identify needs and set priorities for support of sustainable community development initiatives.

Incident reporting and investigation
Incidents are reported, investigated and analysed. Corrective and preventive actions are taken. Paragraph 13.5 of the Standard requires that information gathered from incident investigations is analysed to identify lessons and monitor trends, and reported to management to improve standards, systems and practices. Lessons learned are shared across the organisation and with other stakeholders as appropriate.

Crisis and emergency management
Procedures and resources are in place to respond effectively to crisis and emergency situations. Systems are in place to identify potential emergency situations and their impacts, including those associated with neighbouring activities.

Plans that define responses (including the mitigation of HSEC impacts) to foreseeable potential emergency scenarios are documented, accessible and communicated. The plans define roles and responsibilities for contractors as well as employees.

Emergency response plans are aligned with the BHP Billiton Crisis and Emergency Management structure and external response organisations, taking into account their response capabilities. Resources required for emergency responses are identified, maintained, tested and available.

Employees, contractors and visitors are trained in and understand the emergency response plans, their roles and responsibilities and the use of emergency response resources. Emergency response drills and exercises are scheduled and conducted regularly, including liaison with and involvement of external response organisations.

Lessons from emergency response drills, exercises and incidents are documented, incorporated into all revisions of plans and resources and shared with other parties as appropriate.

Analysis
A requirement to engage with local communities and emergency response teams is best integrated throughout corporate plans and policies with respect to health, safety and the environment. In this way, the culture is set out for subsidiary operations to engage with local communities in all that they do. Both local communities and company well-being and reputation are safeguarded in this manner.

Employees, contractors and visitors are trained in and understand the emergency response plans

Case Study 2. Identifying and assessing hazards and risks: Falconbridge Inc

One of the first steps in emergency preparedness is to identify and assess hazards and the associated risks within an operation. There are many ways of achieving this, and an illustration of how it may be done can be found at Falconbridge.

Falconbridge is a leading international mining and metals company employing 16,000 people at its operations and offices worldwide. It is one of the world's largest producers of zinc and nickel and a significant producer of copper, primary and fabricated aluminium, lead, silver, gold, sulphuric acid and cobalt. Falconbridge is also a major recycler of secondary copper, nickel and precious metals.

The company has set out a series of sustainable development policy statements. One is that all its operations will meet or surpass applicable environmental, health, hygiene, safety, emergency preparedness and response legislation and other requirements to which the company and its operations subscribe. In order to prepare and be fully capable of responding to emergencies, group companies are expected to conduct a vulnerability assessment to identify and assess their hazards and risks.

Potential crises are identified according to groups of different scenarios (process environmental incidents, environmental, disasters of natural origin, societal and political, financial, and health and safety). How the elements within these groups may affect seven different areas (public health, environmental health, environment, market share, production, facility and equipment and outrage) is then considered.

Potential crises are identified according to groups of different scenarios

This collection of hazard scenarios is then considered under four likelihood possibilities (remote, rare, occasional and frequent) and four severity possibilities (minor, moderate, critical and catastrophic). From the assignments made, a risk level for each of the areas that may be affected is generated. A summation of the risks for each affected area gives a total risk, and from this a priority ranking may be assigned.

Following the exercise, it is up to individual managements to see that the priorities are addressed first within the terms of risk elimination or reduction and then in terms of emergency management strategies to deal with residual risks.

An Excel spreadsheet is used to capture the results of the analysis carried out by individual companies, and these results are fed back to the Falconbridge corporate centre.

Analysis

The list of crisis scenarios is comprehensive. (See Box 1) Potential crises in the plant or mine are included, as are those that may occur outside of the site boundaries. The scenarios include what may happen to employees and also what may happen to the public should a crisis develop. Significantly it allows for public anger and reaction – 'outrage'. The scenarios deal with business in terms of crisis impact on market share and the financial implications of any crisis that develops. The list does not, however, specifically include transport except as it might involve sulphuric acid; for some people, this would be considered a significant omission.

It would be possible to use a different risk matrix to the four-by-four array used by Falconbridge. A simple three-by-three array would be an easy starting point. This does, however, suffer from too sharp a discrimination between the categories, leading possibly to poorer judgements on the actual levels of risk arising.

A matrix of four effects (catastrophic, critical, marginal, negligible) by five likelihoods (frequent, probable, occasional, remote, improbable) has been used elsewhere and has much to commend it. As the categories grow, however, so too must the knowledge required to make the necessary judgements between one level of effect or consequence and another.

Environmental disasters, tailings failure, major external spills, toxic gas release, sulphuric acid release/spill, marine impact

Floods, earthquakes, tornadoes, fires, ice storms
Civil disobedience, strike violence, bomb threats, sabotage, protests/demonstrations, disgruntled employees, acts of terrorism

Stock, financial scam, embezzlement, theft, kidnapping, computer virus, security breach and acquisitions/divestiture

Explosion at Falconbridge facility, employee fatality, mine cave in, plane crash (employees and executives), product safety, worker illness/disease, bioterrorism

Box 1 Scenarios

Case Study 3. Losses in transporting mercury: Minera Yanacocha

Minera Yanacocha SRL[6], a subsidiary of Newmont Mining, operates an open pit gold mine in northern Peru. The operation produces mercury as a by-product. This is sealed in 200-kg metal flasks for transportation from the mine to Lima. In June 2000, a truck left the mine site with a load of 10 empty chlorine cylinders and nine flasks of mercury. Exactly how the incident happened is uncertain, but on the road from Cajamarca to the Pan American Highway one of the chlorine cylinders became dislodged and fell off the truck. As the cylinder was too heavy for the driver to recover on his own he continued on his way for a further 40 kilometres. The following day it was discovered that an unknown quantity of mercury had been spilt all along this 40-kilometres stretch of highway that passed through the villages of San Juan, Choropampa and Magdalena. During the intervening period, residents of the villages and surrounding areas found and collected quantities of the mercury, assuming it had some economic or therapeutic value.

In the following days and weeks, 200–300 villagers were found to have some level of exposure to mercury, with varying degrees of illness. As in many emergencies, initial responses involved a certain amount of confusion and lack of preparation for such an event. Initially efforts were made to recover the mercury, though at this stage (the day after the spill), the health authorities were unaware of the risks posed by the inhalation of mercury fumes, believing that skin contact and ingestion posed the only threats. Methods used to warn people that the mercury was poisonous and asking them to return it to the medical posts in the villages started the day after the incident and included verbal warnings with loudspeakers, meetings and advertisements put in local papers. However, efforts were frustrated because villagers refused to return the mercury. By the end of July, approximately 511 people had been treated for some form of mercury exposure, 134 of them in the hospital.

As in many emergencies, initial responses involved a certain amount of confusion

[6] Minera Yanacocha is owned by Newmont Mining Corporation (51.35%), Compañia des Minas Buenaventura (45.65%) and the International Finance Corporation (5%).

Observations

The following features can be observed from this incident.

- The company's emergency response plan for dealing with incidents off the mine property was untested.
- There was confusion regarding 'ownership' or responsibility for the incident (mine or transport company).
- There was a lack of understanding in the local population as to the health risk from the mercury.
- There was poor initial communication between the mine company and local authorities.
- The remote location of the spill delayed cleanup.

Follow-up action

The Minera Yanacocha shareholders appointed an independent commission under the auspices of IFC's Compliance Advisor/Ombudsman to investigate and provide a report on the incident.[7] This report made a number of recommendations, including:

- reviewing and developing new policies and procedures for the handling and transportation of hazardous materials;
- developing and testing emergency response plans to deal with transportation incidents both on and off mine site and testing the plans with simulation exercises;
- providing additional training to company employees, contractors and subcontractors on policies and procedures for the handling and transportation of hazardous materials and on the Emergency Response Plan;
- establishing a mechanism for communication and information to address the issues revealed through the response to the incident and to augment the company's policies and practices in community relations; and
- providing the community with awareness, risk and education programmes specifically related to the health risk associated with exposure to mercury.

Following this incident, Minera Yanacocha initiated a number of new procedures for ensuring the safer transportation of hazardous materials on public roads. The company also initiated training sessions for the local authorities and communities to explain more about operational activities and hazardous material being used at the site, including the emergency plans and how they can help to reduce risk if needed.

In addition, three mining companies – Minera Antamina, Barrick (Pierina mine) and Newmont (Yanacocha mine) – initiated the promotion of a safe transport initiative that includes APELL implementation (see Case Study 4).

The Ministry of Energy and Mines (MEM) published a resolution ordering mining operators to submit specific emergency response/contingency plans for the handling and transportation of hazardous or toxic substances. An initial list of substances that could present some level of risk or concern to health or the environment for which contingency plans should be developed includes cyanide, mercury, sulphuric acid, fuels and lubricants, lime, sodium hydroxide and hydrogen peroxide. This is in addition to the requirement that all mining operators should submit general emergency response/contingency plans that are audited annually by the MEM.

The IFC issued Hazardous Materials Management Guidelines that specify community involvement.

[7] International Finance Corporation, Investigation into the Mercury Spill of June 2, 2000 in the Vicinity of San Juan, Choropampa and Magdalena, Peru, Report of the Independent Commission to the Office of Compliance Advisor/ Ombudsman of the International Finance Corporation and the Multilateral Investment Guarantee Agency, 2000.

Case Study 4. Security measures and public information for safe transport of chemicals: three mines in Peru

Following the Yanacocha mercury spill, three mines in Peru – Compañia Minera Antamina, Pierina mine (Barrick) and Yancocha (Newmont Mining Corporation and Compañia des Minas Buenaventura) – initiated three programmes aimed at improving emergency response planning and implementation.

Safe Transportation Initiative

The three mining companies have instigated the promotion of a safe transport initiative that includes APELL implementation.[8] (See Box 2.) The idea is to establish a system of auditing and monitoring of hazardous materials transport for the three operations and to establish a co-ordinated spill response programme. An important aspect of the initiative is to standardize common procedures among the three companies. For example, procedures such as signage, training of drivers and escorting of convoys will be the same for the companies and their contractors participating in this project. Standardization is important to make the project more efficient and to cover gaps in existing legislation.

A specialized contractor monitors the transportation units of all companies and provides support if an emergency occurs along the route. Hazardous materials trucks travel in convoy, escorted by vehicles that carry equipment to deal with any incident. All drivers and supervisors are trained to respond to an emergency. The trucks are inspected for tyre tread depth, number times a retread is performed, daily scheduled preventive maintenance, first-aid kits and equipment to control spills. All transporters are certified through audits conducted by a third-party contractor and the three mines, and the route has been evaluated by experts who examine any bridge crossings, proximity of homes and villages, areas with stray animals, sharp turns with steep gradients and so on. Trucks and containers display UN substance codes and hazard identification.

The programme includes outreach to roadside communities based on the international APELL process. Communities receive education in first-aid treatment, how to recognize hazardous materials, and basic actions in case of accident. The communities have a positive attitude towards this training. Incidents along the extended transport route from the coast to mines are decreasing in frequency and gravity. In 2004 there were only four minor incidents, causing neither physical injury nor environmental damage and only minor damage to property.

Box 2 Safe Transportation Initiative

[8] Box 2 is an extract from an article written by S Botts of Minera Antmina and published in the Kobe Times, which can be found in full at http://www.environmenttimes.net/article.cfm?pageID=149.

Promotion of APELL

Over the last several years, the same companies have been trying to promote APELL implementation by the government at both the national and regional level. Specifically, the three companies are promoting a pilot APELL project in their area of operations that could be expanded eventually to include other areas of the country as well as other industrial activities. Other activities designed to promote APELL in Peru have included:

- bringing an international APELL expert to Peru to conduct a survey and prepare a report;
- arranging visits of other experts, along with UN personnel, to visit Peru and meet with industry and government; and
- helping to sponsor an APELL workshop in Lima.

UNEP, the Peruvian Government, NGOs and the industry attended the Lima workshop. The main outcome was the formation of a national committee to promote APELL. This committee is made up of the national environmental agency (CONAM), Civil Defence, Ministry of Energy and Mines, Ministry of Transportation and Communication, the National Industrial Association, the National Mining Association, Antamina, Pierina, Yanacocha, the Catholic University and UNEP.

Formation of a Civil Defence Committee

The companies have also been working with local communities to promote the formation of formal civil defence committees that would be responsible for both planning and reacting to natural and humanmade disasters. This committee structure is described in the Civil Defence plans, but implementation has fallen far short of the expectations in the official documents.

Other initiatives

Antamina has been working with the nearby community of San Marcos regarding local emergency response plans in general and the Antamina emergency response plan for the tailings storage facility. They have also had a meeting with local environmental committees in Aysha, Huarmey, Huallanca and San Marcos to exchange information and discuss a variety of issues, including emergency response. All three companies are working with local authorities to improve the skills of fire-fighters and police in emergency response.

Antamina has carried out meetings with the community of Cajacay, which is located along its concentrate pipeline and transportation route, to explain the emergency response plan associated with the transport of concentrates through the concentrate pipeline. Through its third-party emergency response contractor, Antamina has also promoted the training of local fire-fighters in hazardous materials response.

General response

National authorities are interested in APELL but have struggled to adopt the system or put much into planning for its implementation. Local and regional authorities are also interested in using the APELL framework to improve their emergency response capabilities.

Peru has a civil defence system, but lack of capacity has resulted in a lack of understanding about the benefits of accepting or implementing APELL. The national APELL committee formed after the workshop in Lima is making slow progress due to lack of full buy-in and commitment by the agencies on the committee. However, some progress has been made.

A commitment has been made to hire an APELL co-ordinator, through the United Nations Development Programme, who will work with CONAM and Civil Defence to help implement the programme. Civil defence has prepared and presented a manual based on APELL for expansion of the civil defence system to include industrial emergencies. The National Council of Ministers (the Cabinet) has issued a draft resolution that makes implementation of APELL official within the government. Both CONAM and Civil Defence report to this entity, so the resolution is an official endorsement of their work on APELL.

Analysis

Local environmental committees are a good way to transmit information to the larger public, but they require additional capacity to carry out the work. The three mining companies involved in this project are committed to develop and implement the APELL programme in the area of influence of these operations. But additional experience, expertise and guidance from outside Peru is required to move the programme forward.

The Peruvian government has not yet made the most of APELL. APELL-based programmes are under way in the field and provide coverage where legislative gaps exist, especially in the area of transportation of dangerous materials (see Case Study 5). APELL has been a good way to display mining's commitment to environmental and social responsibility to the benefit of both mining and the communities involved.

Case Study 5. A Cyanide Spill: Kumtor Mine

In 1998 a truck carrying granular sodium cyanide to the Kumtor gold mine in Kyrgyzstan[9] was involved in a road traffic incident on a bridge over the Barskaun River. The truck was carrying 20 one-tonne packages of cyanide, some of which split. Over the next five-and-a-half hours, 1762 kilograms of cyanide entered the river and dissolved in the water, which then flowed downstream past the villages of Barskaun and Tamga. The incident triggered widespread panic, sent several hundred people to hospital and reportedly caused two deaths. Concern was also expressed over the concentration of cyanide in the irrigation canals in the villages.

At the time of the incident, the Kumtor Operating Company (KOC) had an Emergency Response Plan in place with a predetermined set of instructions for management and employees that would allow them to respond quickly and efficiently to an incident both on-site and along the transportation route.

Following the incident, concerns from the affected communities and national and international NGOs lead to direct action against the mine.

Observations

Parts of the existing emergency response plan worked well – the procedures used to notify management, for example, and the effective working of the response teams to keep potential impacts to a minimum. Other parts showed a need for improvement.

[9] The Kumtor Mine is owned by the Kyrgyz Government (67%) and Cameco Corporation (33%).

However, the incident pointed also to the need for greater dialogue between the mine and the local communities.

At the government's request a commission of international experts was formed to determine the short- and long-term effects of the incident and the World Health Organization was asked to carry out an independent assessment. (See Box 3)

KOC provided an apology and paid US$4.6 million in compensation for the delay in notifying the communities of the spill. They also reviewed and improved the Emergency Response Plans, procedures for transportation of hazardous goods and related activities in association with a regional liaison committee. This was in order to facilitate sharing and dissemination of information relating to safety and monitoring issues.

A technical cooperation project was developed to facilitate dialogue and information sharing between KOC, key community and NGO groups, local and national authorities, international financial institutions and other interested parties.

- That the concentration of cyanide in the irrigation canals was insufficient to cause human health concerns;
- That the allegations of fatalities associated with the cyanide spill were inconsistent with medical and scientific evidence;
- That the use of inappropriate remedial measures by the authorities may have exacerbated the health problems;
- That the water quality returned to normal within a matter of hours and soil concentrations were never high enough to warrant a cleanup;
- That the design of the bridge contributed to the incident;
- That there was a delay in notifying the authorities and communities; and
- That there was a lack of clear information for those directly affected by the spill.

Box 3 International Commission Findings

Analysis

The incident pointed out the need for greater dialogue and information sharing between the mine and the local communities. This was addressed by the formation of a Community and Business Forum (CBF). The incident prompted KOC to revise the Emergency Response Plan and to carry out simulation exercises to improve the revisions. There were severe inequalities in power among the different interest groups and an institutional culture that determines the participation of particular organisations. Some of the interest groups did not wish to participate in the CBF, and this remains a hindrance to a fully participatory approach. Initiatives such as the CBF would be more effective if planned and integrated from the beginning of the project.

The incident pointed out the need for greater dialogue and information sharing between the mine and the local communities

Community and Business Forum[10]

The Community and Business Forum was established in 1999 with the aim of increasing dialogue between business and community in Kyrgyzstan, to bring about

[10] A. Entwistle, E. O'Keefe and M. Nazari, Developing the Community and Business Forum in Kyrgyzstan: A Case Study of Cross-Sectoral Dialogue in the Mining Industry, Fauna and Flora International and The European Bank for Reconstruction and Development, April 2002.

long-term social and environmental benefits. The CBF has focussed on building relationships between the mining company, government agencies, local communities and NGOs in order to help build trust and encourage information sharing and dialogue.

Within the context of monitoring and advising, the CBF identified specific areas where further scientific investigation was required and collated other sources of information when necessary. It reviewed key documents, including KOC's Annual Report and Emergency Response Plan, and made the findings public. The CBF identified aspects of KOC's activities where the environment or public well-being were potentially at risk and raised these issues with the company. Finally it identified incidents where the environment or public well-being could have been at risk.

In building a collection of useful reports, books and materials, including those produced by KOC, in a resource centre, the CBF aided the dissemination of information to the community. To further this, the group provided regular updates to the public about the company through various forums and a newsletter. It also worked with KOC to make information accessible through provision in an appropriate format. Finally, the CBF set up links to other related sites on the Internet that provide useful information. (See Box 4)

By promoting visits to the mine sites by key groups of concerned individuals, including the steering committee, NGOs based close to the mine and teachers, the process of building relationships was begun. During these visits direct questioning of

Although KOC did have in place routine environmental monitoring and emergency response procedures, these were not easily accessible to local communities. The KOC Annual Environmental Reports had been produced and circulated to local libraries and selected authorities in Russian (which remains an official language) and English since 1997. However, these reports were not considered to be accessible at a local level as they were highly technical and not in the Kyrgyz language. Furthermore, the Emergency Response Plan (ERP) was not in the public domain.

A small spill of granular fertilizers (ammonium nitrate) by a KOC truck on the route to the mine highlighted the need for increased communication and awareness raising for local communities regarding the KOC emergency response procedures. Full disclosure of the ERP became a focal issue for advocacy NGOs, despite counter concerns that critical security and privacy issues prevented the full release of such a document. On the basis of a series of discussions involving the European Bank of Regional Development, KOC, the Community Business Forum (CBF) and NGOs, it was agreed that the CBF and KOC would collaborate to produce a summary of the KOC

Emergency Response Plan. This summary document was produced in simple language and outlined all the key procedures that had been put in place, without disclosing privileged information. This document was made available directly within the communities concerned (through resource centres, NGOs and presentations) and to the international community.

Box 4 Interpretation of technical reports

KOC staff was possible. This relationship building was extended by liaising with communities close to the mine and other concerned individuals and by raising their concerns with the company. The CBF also identified mechanisms for businesses other than KOC to support and assist communities close to the mine, particularly through the small grants programme.

The CBF has helped to build trust with and improved accessibility of information for the local communities and the KOC. This participatory mode of operation could serve as a model for current or future operations. However, a World Bank report (2002) noted that "In spite of this progress, a more comprehensive and understanding programme by the KOC to deal effectively with social issues, in particular public information disclosure and community development, would enhance the contribution of this mine to sustained economic development".

The CBF has helped to build trust with and improved accessibility of information for the local communities and the KOC

Case Study 6. Responding to a distant train derailment: Noranda Inc

In March 2000, an Ontario Northland Railway (ONR) freight train, travelling from Englehart to North Bay, derailed near Temagami, Ontario. The train was carrying sulphuric acid from Noranda's Horne Smelter and Falconbridge's Kidd Creek metallurgical plant. Twenty-five of the derailed tank cars contained sulphuric acid. It was estimated that approximately 700 tonnes of high-strength acid (the equivalent of almost eight full tank cars) was spilt, of which a substantial amount flowed into Martin Creek and Hornet Lake.

The incident happened at about 4.15 pm and Noranda's Emergency Response hotline was notified within 30 minutes. Emergency Response Teams were dispatched from the Horne Smelter and the Kidd Creek plant, both of which are more than 200 kilometres from the incident site, and they arrived on the scene three hours later. ONR installed a security perimeter around the site to control access and established an emergency command post at the Temagami town hall, some 15 kilometres away. By the next day an extensive spill monitoring programme had been instigated at the site and various locations downstream.

An incident command structure was quickly established, headed by ONR with critical support from the operations. Key personnel reporting to the Incident Command team included relevant technical people and a public relations and communications team. Noranda provided resources for incident command, environmental specialists and communications specialists. The provincial authorities informed local residents to refrain from using water from wells and Hornet Lake until the contamination had been neutralized. Alternative water supplies were brought in by truck.

ONR placed crushed limestone in areas where the spilt product had collected in order to contain and neutralize the sulphuric acid. The creek adjacent to the railway track, approximately 1.5 kilometres downstream, was dammed, and a siphon system was installed to prevent more sulphuric acid from entering Hornet Lake. The remaining product from the derailed cars was transferred to other rail cars over several days. Limestone, soda ash and caustic soda were used to neutralize the sulphuric acid that entered the waterways.

The acid eventually acidified a large portion of the lower levels of Hornet Lake. An acid-neutralizing treatment system was designed that pumped water from the bottom of the lake, treated it by adding a slurry of lime and discharged the treated water back to the bottom of the lake. An estimated 40 days of 24-hours-a-day treatment was required to fully neutralize the lake water. All treatment was completed by the end of July 2000.

Temagami is a town with a population of about 1000 with the main industry being tourism and fishing. The region is very scenic, with high environmental and public sensitivities. The incident occurred 8 kilometres south of Temagami, where the only habitation is two cottages with one resident. The incident only affected a small area, but the public perception of it was much worse.

The incident only affected a small area, but the public perception of it was much worse

Emergency systems in place

Responsible Care Programme: As a member of the Canadian Chemical Producers Association, Noranda was certified under its Responsible Care Programme for the safe handling of hazardous chemicals. This is a comprehensive system of principles and codes covering the complete product cycle from research and development through to final disposal. It includes screening of transporters and distributors and establishing Community Advisory Panels for communities most closely affected by operations. Responsible Care also has a mutual aid system for quick response. In the event of an incident, a company has to have a 24-hour emergency centre that is able to respond to an emergency situation within hours. Noranda had established emergency response plans and teams and a business unit Crisis Management Plan to access additional resources quickly in the event of a major emergency. This preparation greatly assisted in the effectiveness of the response.

Corporate Crisis Management Plan: This plan, which was finalized at the end of 2002, contains the procedures for establishing a Noranda Crisis Management Team, a crisis policy and basic definitions. It is closely linked to site emergency plans that are based on ISO 14001. The plans are developed internally and involve some consultation with the board of directors of both companies, major shareholders and the investment community. Simulation training is also carried out internally, every three years, as a desktop exercise. Following the incident, existing management systems were improved to identify more resources for use in the event of a large incident.

Community Advisory Panel: All Noranda plants have a community advisory panel that is established by identifying representative members of the community and local government. Community participants range from teachers to plant neighbours, citizens who are actively engaged in community interests and groups. These panels are lead by the community and review progress and concerns related to the plant/community interface. After the incident, community awareness sessions were conducted along key rail corridors to ease public concern and to train community first responders on what to do in the event of a chemical rail incident.

Ontario Northland Railway: ONR had conducted regular emergency response training, had participated in the region's emergency drills and had initiated contact with various community emergency responders to discuss the transportation of dangerous goods. ONR had also participated actively in sulphuric acid emergency response training conducted by Noranda.

Additional challenges

- ONR is a relatively small rail carrier without the resources of a large major railroad.
- The incident was in a remote area, out of range of mobile phone network with no local road and only access by rail or helicopter.
- Emergency showers were needed for acid cleanup teams before work could start on-site.
- ONR's communications staff were not prepared to deal with a large emergency.
- ONR's original environmental consultant was not experienced in managing large incidents.
- The acidity in Hornet Lake had to be neutralized before the spring thaw set in and melt water extended the area of contamination.

Responses to challenges

- Radio communications with the incident site were established within hours.
- The creek was dammed at the lower end and the acid neutralized with lime to prevent further acidic flow into the lake.
- A temporary road was punched into the area, which took almost a week using heavy equipment.
- Some acid neutralization in the creek was achieved by dropping lime from helicopters while the access road was being built.
- Press conferences were held a week after the incident.

Analysis

Rail maintenance is essential in remote areas; there is a need to work with railroad companies to ensure that this is accomplished.

Dry-run simulations, particularly with technical service providers, are a key element in emergency planning. This means working with transporters before an incident occurs and doing a thorough evaluation of the technical capabilities of contractors.

An appropriate communications strategy and implementation plan should be established immediately.

An appropriate communications strategy and implementation plan should be established immediately

Case Study 7. Making changes to existing plans with respect to communities: Talc de Luzenac

Talc de Luzenac, a subsidiary of Rio Tinto, owns the Lassing talc operation through its wholly owned subsidiary Naintsch Mineralwerke (NMW). It is located in the Province of Steiermark, Austria. Lassing had an emergency procedures manual in accordance with corporate requirements, and a simulated rescue had been tested with assistance from the local emergency response teams.

This underground mine had been worked since 1901 and produced some 25,000 tonnes of talc per year. The operation was situated in a small valley midway between Vienna and Salzburg. Mining was carried out by the underhand cut-and-fill method. At about 10 am on Friday, 17 July 1998, a miner became trapped underground in a rest-room on an upper level following an inrush of water and mud. A crater began to appear on the surface, and houses in close proximity to this began to tilt and move. The entire mining work-force returned to site to assist in the rescue. Company officials came from Graz, the headquarters of Naintsch, and officers from provincial and federal mining authorities arrived from Vienna and Leoben.

By mid-afternoon, some 700 people overwhelmed the site – a number that grew over the next few days. The media, various authorities, fire brigade officers, local community members, police and general onlookers were all there. Some were local, others international. The friends and family of the trapped miner and the rescue miners were also present.

By mid-afternoon, some 700 people overwhelmed the site

Local and Graz management, together with the officers of the mining authority and the rescue team, spent much of the afternoon and early evening underground, planning and effecting one of the rescue plans. Suddenly, at about 9:30 pm, the crater rapidly increased in size and filled with water. Those at the pithead felt a violent rush of air expelled from the shaft. At that point it was realized that a catastrophe had struck and that the nine miners and one technical expert who were still underground as part of the rescue effort were in terrible trouble.

After nine days of frenetic activity, the miner who was first trapped was rescued via a drill hole from the surface. This raised hopes that the others may also have survived and rescue attempts therefore continued until 14 August 1998. Various plans to re-enter the mine to seek and recover the bodies were then worked on. In April 2000 these plans were finally put aside for safety reasons and planning for sealing the mine was commenced.

To put this tragedy in perspective, the nine Lassing miners comprised almost the entire mining work-force. Most lived in and around Lassing village and had relatives and family living within 5 kilometres of the site. Some close relatives also worked in the mill. One house was destroyed and two were so badly damaged that they had to be demolished. Some 12 families had to be relocated. The main local road and a local stream were diverted. This incident therefore deeply affected a very small and tightly knit community.

Investigation of the incident continued throughout 1999 and court action against the mine manager and several members of the Mining Authority took place during 2000. There was therefore almost continual media coverage and exposure of the accident for more than two years after its occurrence.

A tragedy of the scale that occurred at Lassing was a significant event for the country. In addition to the relatives, families, employees and the company management, who were directly affected, other parties or groups became involved. These included Rio Tinto and Luzenac, the media, politicians, the local community and a wide range of technical experts.

A tragedy of the scale that occurred at Lassing was a significant event for the country

The government and NMW provided counselling and caring services, which included group therapy and one-on-one sessions for the relatives, group discussions with employees and psychiatric counselling for the mine manager and the surviving miner.

As with most newsworthy incidents, the media (press, radio and television) played a prominent part in, and had a substantial influence on, how things developed. The situation at Lassing possibly experienced greater exposure because of the large crater that formed (100 metres diameter and 40 metres deep), which, for reasons of investigation and approval by the authorities, was only filled in more than two years after the event. This constant reminder ensured that Lassing would never be far from public attention. It was noticeable that, until and throughout the trial, pictures of the crater usually accompanied news reports.

The media behaved in three different ways. Initially, due to lack of quality information, they were a vehicle to communicate what happened and to promote the recovery of the bodies. Then they became supporters of the relatives when it appeared that investigation, explanation and recovery were progressing slowly. Finally, the media were a voice for the defence at the trial when it appeared that the prosecution was disallowing presentation of some evidence. Their change in attitude as time progressed appeared to result from better management of the information flow. NMW eventually developed a strategy to supply as much information as requested, and in as simple a manner as possible, in contrast to some time after the incident, when there was no concerted, planned effort to keep the media in the picture.

The media behaved in three different ways

Politicians and government departments at the local, provincial and federal levels were deeply involved. The main problem arising from the political involvement at Lassing was a lack of understanding. The mechanisms that led to the catastrophic inundation at Lassing were very complex, and a complete explanation for the tragedy has yet to be found. Yet the politicians understood that the families of the deceased miners wanted to recover their bodies, and they promised that this would happen on the false assumption that this was only a cost issue. Yet it was clear from around November 1998 that recovery of the bodies posed too great a safety risk and was not practicable. But it was not until April 2000 that a statement emerged from the Ministry that this was the case. By then the families and relatives were well aware that the bodies would not be recovered.

Lassing, a small community of about 500 families, was thrust into the limelight by the disaster. Because the community knew or understood very little about the situation, much misinformation circulated within it. Spurious accusations of waste material being dumped in the mine, illegal mining, management arrogance, major settlement of houses over the last 10 years, noise from blasting and so on were all raised. Initially, many, but not all, of those involved in the investigation felt that the technical issues were too complicated for the community and general public to grasp, hence they were excluded from the process. This problem was realized early in 1999, and the Mayor of Lassing was invited to join the weekly progress meetings held between the company, the Mining Authority and government departments. The Mayor thus came to understand that recovery would be difficult and dangerous. It was also noticeable from that moment that the relatives of the deceased no longer directed their frustration and anger at the company, as they had done immediately after the incident.

In handling the Lassing disaster, the management of NMW did many things right. They did have in place an emergency management plan and had tested it. Their care of the bereaved, those who had lost the property and their remaining employees was of a high order. However, nothing had prepared them either for the speed at which events escalated or for the scale of public and political reaction to the disaster. They were equally ill prepared for the intense and long-playing focus received from the Austrian media. Box 5 provides a summary of the critical lessons to be drawn from this sad event.

Following the disaster, Luzenac amended its comprehensive crisis management system to include additional scenarios reflecting these lessons. This led to a complete revision of emergency response/preparedness procedures at each of the group’s sites, including taking on board many of the APELL approaches. This was particularly because of APELL's structured way of building up the connections with the local community and government at various levels.

Luzenac has consciously over many years worked to be a respected member of the local community. They have been very open with local groups and local authorities on their facilities and the potential risks that could affect them. They conduct open days and public meetings and provide their neighbours with printed and electronic information on their activities. The APELL approach seemed the natural way for Luzenac to proceed.

One example is the operations in the north of Italy. Here, there is an underground mine, various exhausted underground operations and a process plant on the banks of the River Chisone, at Porte, in Piedmont. Following the APELL process, Luzenac began consultations with local mayors and their administrations, explaining the company's objectives. In conjunction with this the local emergency services – particularly fire and ambulance – were invited to make detailed inspections of the mine and plant. Together, the emergency preparedness and response arrangements were revised. They made many useful suggestions and provided some training services. Regarding the exhausted underground operations, all three parties have details of their locations and security, for the safety of local people and visitors.

There is a vast difference between a real emergency and a simulation, particularly in the scale of public reaction, response and interest.

The company should provide accurate and up-to-date information proactively and early. For this, a senior credible spokesperson must be appointed.

All affected stakeholders should be included from an early stage in the information and dialogue processes.

Simulating the chaos that develops during an emergency is as critical as simulating the technical aspects.

Emergency plans need to be as strong in dealing with the media, community groups and government bodies as they are in dealing with rescue and recovery.

The cultural context of an operation needs consideration within the emergency plan.

Box 5 Lassing's Critical Lessons

Once the system was finalized and internal training was completed, a full mock emergency drill was carried out with the emergency services and in full communication with the local government authorities. Luzenac took the scenario of a major underground fire and invited local media to cover the practice drill. This was an effective means of communicating to the local population.

The event generated interest throughout the Piedmont region. As part of the preparations for the Winter Olympic Games in 2006, the organisers wanted to simulate a major emergency for the whole valley area and they invited Luzenac to be part of this exercise, due to its previous work. This set a good example to other industries in the area to improve their own emergency preparedness.

Luzenac has strengthened its position as a respected member of this community; the company has brought extra benefits to its customers by reducing business interruption risk and has raised the level of safety for employees. This is being replicated in all Luzenac sites worldwide.

Case Study 8. Lessons from a tailings dam failure: Apirsa Mine in Spain

In 1998, the tailings impoundment at Boliden Apirsa's mine in southern Spain was breached, resulting in the release of a flood of tailings and supernatant water. The tailings flowed down the natural river system, affecting 4634 hectares of land along 40 kilometres of riverbank and farmland, of which 2600 hectares were covered by tailings, with the flow threatening the Doñana National Park 50 kilometres to the south. The impoundment contained 15 million cubic metres of tailings at the time of the incident. Within a few hours of the breach developing in the dam wall, an estimated 5.5 million cubic metres of liquid and 1.7 million cubic metres of solids were released. When the water level fell, the depth of deposited tailings ranged from 4 metres near the tailings impoundment to a few millimetres 40 kilometres downstream.

The flow followed the course of the Rio Agrio and Rio Guadiamar and reached the marshlands on the eastern edge of the Doñana National Park some seven or eight hours later. In the marsh area to the east, a system of dikes and canals were built to reroute the river into the Brazo de la Torre, which then flows into the Rio Guadalquivir. The Rio Guadiamar is in its lower stretch converted into a main irrigation canal, known as the Entremuros, that separates the reclaimed agricultural land to the west from the rice paddies to the east. Here the flow was partially stemmed by a series of dikes that were hastily constructed along the Entremuros by staff from the National Park with the help of rice farmers in the area. The damming up of the Entremuros prevented the contaminated water from reaching the Doñana park area.

The immediate and potential long-term effects were severe. The water and tailings affected more than 50 irrigation wells on the river floodplains, and aquatic life in the rivers was depleted. The spill-affected farmland was used for grazing, agricultural crops and fruit plantations and included important sites for migratory birds. Spanish authorities banned all use of wells and produce in and from the affected land. Boliden Apirsa bought the harvest of fruit for the season to minimize effects on the farmers and to ensure that no contaminated fruit reached the marketplace.

A cleanup plan was presented to the authorities three days after the incident. The company objective was to return the land fully to its previous use. The government, however, wanted to restore the area to an earlier, pre-mining condition and to create a natural park. Following two days of negotiations, responsibilities were divided between the mine and the local authorities. The tailings were mechanically removed and trucked to the old Aznalcóllar open pit for disposal. While haul roads were used alongside the river, public roads also had to be used, and there were five fatal road incidents during the cleanup operation.

Prior to the incident, the relationship between the mine and the authorities (Regional Government of Andalusia, the Guadalquivir River Authorities and the Spanish Geological Survey) were good. One year before the incident the mine operator, with the support of the Aznalcóllar local community and the authorities, completed a significant investment programme that included the building of a new concentrator and the development of a new open pit. (Even after the incident the relationship remained good, in spite of the difficult situation; a joint committee was formed to manage the situation, with Boliden and various relevant authorities represented.) Communication with the administration of the Doñana National Park had not been established before the incident, however. Because of the 50 kilometres distance from the operation, establishing a dialogue had not been identified as necessary.

At the time of the incident, there were no legal requirements for the operation to have an Emergency Plan, and corporate policy was still being developed. In 1997 Boliden had started to develop operation, supervision and maintenance manuals for the company's tailings storage facilities, which included Emergency Plans. When the incident occurred the manual had not been completed for the Apirsa operations, as a recently performed safety audit had not identified this as a priority.

Apirsa's response to the incident was to be honest, open and factual and to refrain from speculating when dealing with the authorities, the mass media and the local community. Three weeks after the incident the company opened an information centre in a nearby village, providing information on what had happened and what was happening in the cleanup operations. But the centre failed to attract many visitors. Despite the seemingly poor response, the good work done in providing information had a beneficial return. When rumours later emerged that Boliden was going to pull out of the operation, the local community demonstrated in favour of reopening of the mine, but with renewed and more stringent operating parameters.

Apirsa's response to the incident was to be honest, open and factual

Observations

- The actions of the staff of the Doñana National Park, with the help of the rice farmers, limited the impact of the incident.
- The lack of an Emergency Plan addressing this particular situation meant that cleanup responsibilities and objectives were established after the event and under intense political and media pressure.
- The media had preconceived ideas about the company, which meant that reporting was rarely objective.
- The lack of good-quality baseline data made it difficult to evaluate the effects of the incident and subsequent level of rehabilitation.
- The absence of cleanup criteria and differences in objectives led to uncertainties.
- The most effective information channel with the community was through employees.
- A computerized document register would have saved significant time and effort.

Analysis

The incident highlighted the importance of having relationships in place before something happens, in order to build trust between parties and to establish roles and responsibilities, action plans and so on.

The need for internal and external information cannot be overestimated. Significant resources have to be allocated to dealing with the mass media.

The company's own judgement is that an even more proactive position in providing information to the local community would have been beneficial.

The need to provide employees and the relatives to these directly involved, who are under great stress at such times, with support as well as information must be addressed.

Cleanup operations carry their own risks. The large logistical operation that may be required to deal with the aftermath of major incidents may itself necessitate a degree of risk assessment, emergency planning and community communication.

Case Study 9. Improving community interaction after tailings pipeline failure: Morila Gold Mine

This case study describes a tailings breakout incident at Morila Gold Mine (MGM), the mine's response to it and the engagement with local stakeholders in the process. Out of the lessons learned, a review of the emergency plan was performed using the guidelines from the APELL programme as a basis.

Morila Gold Mine description

The Morila Gold Mine is located approximately 11 kilometres south of Sanso village and 175 kilometres west of Sikasso, the capital of the southern region of Mali. Shareholders are AngloGold Ashanti (40%), Rand Gold Resources (40%) and the Government of Mali (20%).

The mine is located in a rural environment. The nearest four villages are Morila (2 kilometres), Sanso (5 kilometres), Fingola (6 kilometres) and Domba (11 kilometres). The total population of these villages is about 6000. The villages consists of small concentrations of houses, and the main economic activity is subsistence agriculture. The watercourses (Fadia, Diaratou and Koba) around the mine property are seasonal and dry up from January to June.

The oxide and sulphide ore is extracted by surface mining methods. It is processed in a carbon-in-leach (CIL) gold plant. The plant includes two mills (ball & SAG), cyclones and trash screens, a leach regeneration circuit, acid washing and elution circuits, reagent holding tanks, electrowinning process, smelt house/gold recovery room, reagent mixing area, a plant control room, engineering workshop and a chemical laboratory. The barren material (variously referred to as waste rock or mine development rock) is stockpiled in a single waste rock stockpile that is constructed to facilitate concurrent reclamation.

The gold plant is part of the extensive infrastructure that currently supports the Morila Gold Mine. Within the vicinity of the gold mine there is also a diesel-run power station, training centre, bus terminal, main office, security office, a light vehicle workshop, change house with ablution facilities and stores (including fuel storage facilities). Water is pumped from the Bagoe River through a pipeline to a dam (Raw Water Dam) that supplies a secondary storage reservoir (Raw Water Pond) in the vicinity of the gold plant.

Emergency planning at MGM

Emergency planning at MGM has been carried out by first preparing a list of potential events that also details their possible impact on the environment. Potential incidents were identified from experience and knowledge of gold mining operations with conventional CIL plants. Potential impacts were also assessed on the basis of site-specific environment conditions at Morila (air, water, land, geology, vegetation, fauna, land uses, climate and geographic location/available infrastructure).

This list, which is called an Aspects Register or an Impacts Register, is usually kept up to date by ensuring that all planned activities and their associated impacts are adequately characterized.

The list at MGM consists of a number of potential incidents, but the most significant potential major accidents are considered to be:

- tailing storage facility (TSF) main wall rupture (tailing spillage);
- major spill from bulk diesel storage tanks; and
- cyanide and other highly corrosive chemical spillage.

Based on this list, MGM has developed an Emergency Management Plan by combining the Spill Prevention, Control and Countermeasure Plan and the Fire Prevention Plan. This document is aimed at mitigating or overcoming potential major incidents. The involvement of the local administrative and traditional authorities was deemed critical to improve the communication channels between the community and the mine.

All incidents labelled Category 1 automatically trigger the involvement of local stakeholders in the process. Category 1 is defined as follows:

- The impacts have extended onto publicly accessible land and have the potential to adversely affect surrounding communities, livestock or wildlife;
- The event will generate negative public (or media) attention;
- The damage caused or the remediation cost is in excess of US$500,000; and

Case study

Morila experienced a tailings spillage on 16 March 2003 when a weld in the tailings pipeline split open, causing the slime to run off the mine property onto public land. The volume of spilled material has been estimated at 2082 cubic metres, of which more than 96% was contained in catchment paddocks and trenches on mine property. The remaining 69 cubic metres of spillage affected an area of 1.5 hectares outside the mine property.

A factor that contributed to the significant scale of the incident was the control room's inability to immediately identify the pipeline breach and cease pumping. As "open ending" was taking place at the Tailings Storage Facility, no pressure drop was detected in the control room (which would have been detected if cycloning had been taking place). Subsequent investigation showed that the scheduled regular pipeline inspection patrols did not take place, which led to the spillage continuing undetected for an estimated four hours.

A further contributing factor to the extent of impact was that the secondary containment paddocks were not optimally engineered for spill containment, and some tailings overflowed into a perpendicularly adjacent storm water channel instead of into laterally adjacent containment paddocks.

As soon as the incident was reported, the Morila emergency plan was initiated. At the time of the incident, the local authorities – including the Sous Prefet, gendarmes and Mayor – were informed. A delegation from the mine, including the General Manager, went personally to find the Sous Prefet on the evening of the incident in order to explain to him the situation and the measures that had been taken to contain the incident and prevent any further impact on the local people and environment.

During the evening of the incident, a vehicle was sent to Sikasso (the Regional capital) to fetch the Regional Officers in charge of mining and environment. As soon as they arrived the following day, they met the Sanso civil servants involved in the investigations. Then they conducted their own independent investigation of the incident site, with the assistance of the mine personnel when requested.

When that was completed, they met the community leaders and gave them feedback on their findings. They assured them that the mine undertook all the appropriate actions and that there was no persistent danger for people, animals or the environment. In the afternoon, a meeting was organized with the Sous Prefet, the community leaders and the mine. Morila mine management reported openly the cause of the incident and the remedial actions undertaken.

Once again, the Regional Officers confirmed that Morila took all the appropriate actions and that there was no further danger for people and animals. They also said they would report their findings directly to the government.

The community leaders understood the circumstances and expressed their recognition for all the effort Morila undertook to deal with the incident openly and professionally by involving the authorities. In addition to the remedial actions taken to neutralize the incident and prevent any similar occurrence in the future, Morila mine paid compensation to the community for livestock losses.

The incident has been an opportunity for the community and the mine to improve their relationship through open honest dialogue and is a good example of turning a negative incident into a more positive situation.

Lessons learned

Following this incident, MGM has proactively conducted an extensive series of investigations and reviews. Table 2 presents a summary of the lessons learned, as compared to the APELL guidelines.

The 10 steps of APELL	Corrective measures implemented
1.Identify emergency response participants and establish their roles, resources and concerns.	The review process involved input from the environmental, engineering, metallurgical and health & safety discipline departments.
2. Evaluate the risks and hazards that may result in emergency situations in the community and define options for risk reduction.	Aspects Register was confirmed as up to date. Contributing factors have been identified. Areas for improvement in operational controls and response times have been highlighted. Control mechanisms that will prevent or lessen the impact of any similar incidents in the future have been put in place.
3. Have participants review their own emergency plan, including communications, for adequacy relative to a co-ordinated response.	MGM's emergency response and crisis communication plans have been critically reviewed in the light of this incident and have been revised where necessary.
4. Identify the required response tasks not covered by the existing plans.	The pipeline patrol and supervision schedule was reviewed and revised to ensure that the pipeline is inspected regularly on a 24-hour basis.
5. Match these tasks to resources available from the identified participants.	Although MGM has a cyanide and spill response team as well as a fire team, a comprehensive rapid response team was established. This team will also be trained in the relevant communication protocols.
6. Make changes necessary to improve existing plans, integrate them into an overall emergency response and communication plan and gain agreement.	Tailing storage facility operators report to the plant control room on an hourly basis with regard to discharge points and the condition of the pipeline. These data are being recorded. Plant supervisor's night shift visits were increased from two to four per night. Weekend over-inspections were also increased. Asset protection members were trained to be able to identify any TSF spillages and to report them immediately.

The 10 steps of APELL	Corrective measures implemented
7. Commit the integrated community plan to writing and obtain endorsement for it and relevant approvals.	The review process also involved resources from AngloGold Ashanti's East & West Africa Region, Corporate Office and North America Region, as well as involvement from the local community, regional environmental representatives and the Direction Nationale de la Geologie et des Mines.
8. Communicate final version of integrated plan to participating groups and ensure that all emergency responders are trained.	The emergency response and crisis communication plans were revised to expedite the appropriate communication to stakeholders.
9. Establish procedures for periodic testing, review and updating of the plan.	The Issue Register is updated on a continuous basis. The Emergency Plan is revised yearly.
10. Communicate the integrated plan to the general community.	The General Manager has authorized the circulation of the environmental incident report to Environmental Safety and Health staff on other East and West Africa Region operations to serve as a 'learning experience'. This has provided other sites with an opportunity to review their own operational control and emergency response systems and procedures in an effort to prevent similar incidents occurring elsewhere in the future.

Case Study 10. Co-ordination with local emergency services simulation and review: Umicore's Olen plant

This plant is located in North Belgium, in the province of Antwerp. It comprises an electrolytic copper refinery, a cobalt plant, germanium production facilities and a unit reprocessing residues containing nickel and precious metals. The plant is located in a rural environment with a small concentration of houses very close to the plant, including a school 200 metres from the east fence with approximately 150 children between 4 and 12 years old. One kilometre to the northwest there is an amusement park, 'Bobbejaanland', with 10,000–15,000 visitors every day in summer, while 1 kilometre to the west lies the town of Herentals, with a population of 25,000.

Umicore has recently prepared a written corporate policy for emergency preparedness and response. The Olen plant falls under the European Seveso II legislation, and their Seveso Safety Report includes an inventory of potential major incidents (see Box 6), an analysis of mitigating actions and the processes involved.

- Leak of toxic chlorine gas
- Hydrogen gas leak and explosion
- Natural gas leak and fire or explosion
- Iso-propanol leak and fire
- Leak of toxic sulphur dioxide
- Leak of toxic hydrogen fluoride

Box 6 Potential Major Incidents at Olen

The inventory was prepared in co-operation with the public fire brigade in Herentals and the relevant government departments. The company also employed an external consultant to establish the worst-case impact of these incidents. Emergency communication with the community has been done via brochures and handouts that are distributed to every household mailbox as well as being given out during a special event at the local annual market. The company has set up a free phone number that is answered 24 hours a day. Three sirens have been installed at the plant that can also be used to give an audible warning.

Emergency communication with the community has been done via brochures and handouts

As required under the Seveso II legislation, the Olen management holds annual external simulation programmes to test the emergency response plans. These programmes are designed in co-operation with and involve the public fire brigade, public medical emergency team, civil protection units and the local police. A debriefing always follows all exercises, and possible improvements are discussed. The following are examples of these simulations.

Chlorine tank leak and gas cloud spread to local school The first intervention team immediately telephones the company fire service and an alert is sent out to the public fire brigade in Herentals. The brigade commanding officer advises the mayor of Olen for police and operational support in order to close all the roads and to warn the population in the threatened area. The school director is advised to bring all students inside and to close the doors and windows until the rescue team arrives.

As a result of this exercise, it was found that time was very important. The plant must call the school immediately and sirens must be used to alert the local community. In addition, closing roads was found to be time-consuming. To reduce the time involved, the mayor decided that road closure barricades should be kept permanently loaded on their trailer.

Iso-propanol is unloading During unloading, the flexible hose between the delivery tanker and the on-site tank is hit by a forklift truck, injuring the tanker driver and damaging the hose. The spilt iso-propanol is a fire risk and threatens the safety of the two men as well as the truck and the tank. The company fire service, the public fire brigade and the medical emergency team are all called to the scene of the incident.

During the simulation, good co-operation with the external services occurred. But it was found necessary to improve the water supply system so that a complete foam blanket could be spread over the spill and the tanks. In addition, it was shown that the delivery system should include a pressure relief valve so that flow between tanker and tank could be stopped in the event of incident. Finally, because of the potential for many people contacting the mayoral office during an incident, information, transport and access should be provided to the mayor in emergency events.

Natural gas leak The natural gas pipeline entering the plant began to leak, giving rise to a large, potentially explosive cloud. The local fire brigade and the police warned the community to close doors and windows and to stay inside and traffic was stopped on the south side of the plant, closest to the leak.

Following the exercise, it was concluded that a cut-off valve needed to be installed to stop the flow of gas into the plant in the event of a leak. It was also concluded that the drift of a natural gas cloud in different weather conditions should be calculated and that sirens needed to be installed to give an audible warning of an emergency to both the plant and the community.

Hydrogen fluoride pipe leak A fire causes the leak. Dealing with it requires a large quantity of water used by an emergency team equipped with self-contained breathing apparatus. The Herentals fire brigade attends the incident, with the Geel city fire brigade providing additional water supply from the canal. The 'civil protection team' (Ministry of Internal Affairs) also attends. On arrival in the plant, the commanding officer of the public fire brigade is informed by Umicore's fire marshal and takes the command of the operations.

A review of the simulation demonstrated again that cut-off valves should be provided on the outside of buildings for all supply pipes and that a further exercise was required that used breathing apparatus and protective clothing.

Overall

A review of all the simulations concluded that:

- Co-ordination and co-operation with the local emergency services is efficient and effective;
- Generally the public do not read the brochures and handouts and make only limited use of the free phone line; and
- The public appear to prefer to put their faith in the company and the emergency services and not become involved.

Case Study 11. Community engagement on potential for seismic failure of tailings pond: Kennecott Utah Copper Corporation

The Kennecott Utah Copper Tailings Impoundments are located approximately 10 miles west of Salt Lake City, Utah, in the United States, along a major interstate highway and north of the town of Magna. These impoundments store the tailings from the Bingham Canyon Mine about 15 miles to the south. The impoundments include the original south impoundment, which encompasses approximately 5700 acres, and a newer north impoundment, which encompasses about 3400 acres.

The inactive south facility was operated from about 1906 to 2002. It is bounded by a state road to the south and situated immediately to the north of the town of Magna. The perimeter of this impoundment was constructed using a variety of diking methods followed by upstream construction. While upstream construction has historically been used in mining, it is generally considered to exhibit poor seismic performance. The impoundment was also constructed prior to the implementation of regulatory and engineering standards in the design of tailings ponds. In comparison, the active north pond has been constructed using modern, state-of-the-art design and construction practice to be stable under the maximum credible earthquake (MCE) event. The MCE is the maximum earthquake ground motion that could be generated from local fault sources.

In 1987, a geotechnical study of the then-active south pond identified a seismic vulnerability particularly at the southeast corner. The study identified a risk of flow failure that could affect the state roadway, a nearby small housing estate, a neighbouring house, a golf course and some Kennecott facilities. Although the annualized risk of an occurrence was small, the consequences of such a tailings flow failure were considerable. As a result, Kennecott implemented a programme of drainage measures to improve stability and commissioned a number of engineering studies to evaluate methods to upgrade the facility to current design standards.

Technical mitigation measures

Due to the size of the tailings impoundment (the perimeter is 12 miles), it became clear that standardized approaches to upgrading the seismic stability would be costly and, in some cases, technically prohibitive. A number of mitigation methods were tested and employed, along with studies to characterize the tailings embankment. These measures included:

- horizontal drains along the toe of the southeast corner;
- a detailed characterization of the tailings to evaluate the drainage properties and distribution of fine materials;
- a large number of geotechnical instruments, including piezometers and accelerometers;
- vertical dewatering wells;
- wick drains to improve the effectiveness of the horizontal drains and dewatering wells;
- a series of step-back dikes to flatten the crest of the embankment;
- the design and construction of the north tailings facility to include the north embankment of the south pond; and
- plans for the safe closure of the south facility.

After the dewatering methods were implemented on a large scale, additional studies were done to determine when and whether the impoundment would meet current Utah State Engineer design criteria. Although dewatering had upgraded the facility to an OBE standard (Operating Basis Earthquake, an earthquake with a return period of about 200 years), it was found that approximately 20 years would be required to meet the more stringent MCE design criteria. During this interim period while the seismic stability was improving but a risk of failure was still present, several other measures were implemented.

An accelerometer-based warning system was installed. This would divert traffic away from state roads in the event of a seismic shake being measured by the accelerometers. The system consists of seven strong ground motion accelerometers set to activate at an acceleration of approximately one fifth of the anticipated ground shaking caused by a MCE event. Three of the accelerometers are linked to a system of message boards and flashing signs located along all intersections of the state roads in the vicinity of the tailings impoundment.

Berms were constructed around residential buildings at risk in the case of a tailings failure. These were intended to deflect or limit any run-out that occurred. Buffer zones were also established on the east and west sides of the facility.
An emergency action plan (EAP) and standard operating procedures (SOP) were developed to help Kennecott operations in their planning and notification of public agencies.

Community outreach

The EAP/SOP became the document used to engage with the public on the seismic vulnerability issues associated with the south facility. This document contains:

- notification procedures should an earthquake occur;
- a schedule of responsibilities of Kennecott and various public agencies during a seismic event;
- a catalogue of conditions of potential failure;
- the identification of preventative actions and equipment/resources available for emergency response; and
- predictions of the areas that would be subject to impact should a seismic event occur.

As part of the engagement process, the EAP/SOP document was distributed to public agencies with community responsibilities, such as the Fire Department, Emergency Services, Transportation Services, the State office of comprehensive emergency management and Kennecott supervisory and security personnel.

Public meetings were held to co-ordinate the potential emergency response, inform the public of the seismic vulnerability and seek public input. The public involvement programme included articles in local newspapers, a television news report that was later incorporated into a television programme and an educational video regarding seismic preparedness measures. Kennecott also conducted public tours of the tailings facilities to allow interested parties to observe the remedial measures that were being planned, to monitor the progress of reclamation effort and to familiarize themselves with the tailings impoundment. Kennecott representatives also routinely made and continue to make presentations at the local community council meetings to keep the public informed. Internally, Kennecott has independent consultants periodically review the effectiveness of the dewatering/stabilization efforts. As conditions change, the EAP/SOP is updated and redistributed.

Public meetings were held to co-ordinate the potential emergency response, inform the public of the seismic vulnerability and seek public input

Closure planning

The combination of remedial measures to upgrade the south facility, emergency action planning and public involvement demonstrated Kennecott's commitment to long-term sustainability and closure of the facility. Reclamation of the south tailings facility had been initiated in 1991 with the construction of step-back dikes at the southeast corner of the facility. Subsequently, additional dikes were constructed near the west abutment. These dikes were gradually built from west to east as deposition on the south tailings facility was transitioned to the north facility.

The current closure planning for the embankment and impoundment seeks to stabilize the surface against fugitive dust and erosion by establishment of vegetation or maintenance of a wet surface and to stabilize the perimeter of the embankment under seismic (MCE) conditions by combinations of berms, envelopment, dewatering or creation of buffer zones in areas that cannot economically or technically be stabilized using other approaches.

Constructing reclamation dikes across the impoundment and gradually seeding the tailings surface have accomplished revegetation of the embankment surface. Revegetation efforts have been assisted in some areas using lime and organic wastes. Planning is now ongoing to provide long-term usage of the closed tailings facility.

In summary, seismic failure of the Kennecott tailings facilities was identified as a low probability/high consequence event. A series of mitigation efforts were implemented along with public and regulatory information programmes. This approach allowed the entire facility to be upgraded while operations continued. In addition, these efforts led to the transition of operations to the north impoundment and to the long-term closure planning of the facility.

Analysis

Given that Kennecott had become aware of the instability of the southeast corner of the tailings pond in a major seismic event, it was imperative that they first seek to improve the stability of the facility. It was equally imperative to engage with the local community about what would happen if such a large seismic event occurred so that they were aware of the processes and procedures being put in place as safeguards. Over more than a decade, Kennecott has persisted with this engagement through public meetings, newsletters and the media, and there is now a better degree of comfort with the situation in the local community.

Case Study 12. Communication plans for crisis management: Mining Association of Canada

A communications strategy for employees, their dependents, local communities and other relevant stakeholders is an important element in the planning for emergencies. This was the subject of the previous case study. Equally important is a plan for communications at the development of and during a crisis. The information demand from all manner of stakeholders, not least those most affected, grows rapidly as a crisis develops. In the absence of reliable information, there will be a burgeoning growth of views, opinions and 'facts' (see Case Study 7). An emotionally charged chaos can easily ensue, typified by high levels of stress, anger, frustration and mistrust. The consequence of this has a high potential to derail the best of response plans.

> In the absence of reliable information, there will be a burgeoning growth of views, opinions and 'facts'

The Mining Association of Canada (MAC) confirmed this in consultations into emergency planning and response carried out in 2000 among both mining industry leaders and external stakeholders. Among other things, the external stakeholders expressed a grave concern about how the mining industry communicated during and after a crisis. While they were obviously of the opinion that all incidents should be prevented, they also looked to the industry to improve its communication effectiveness and responsiveness when an incident did happen.

In response to this finding, the MAC established a crisis management team to study best practice in the industry and to make recommendations on how to proceed. This resulted in the publication in November 2001 of a Crisis Communications Guide. The Guide was reviewed and republished in 2004.

This guide was designed to assist companies in developing or improving their plans for responding to and communicating during a crisis. It deals solely with communication issues and reflects best practices drawn from many industrial sectors. The guide comes in two parts; the first reviews the key components of a corporate crisis management plan (CCMP) and the second provides a sample of such a plan.[11] This section describes only some of the important aspects in the preparation of a communications plan.

The guide defines a crisis as a sudden event or set of circumstances that could significantly affect the company's ability to carry out its business, damage its reputation or threaten the environment, health, safety and well-being of employees, neighbouring communities or the public at large. It defines the first critical step in the development of the crisis management plan as securing the endorsement and support of the most senior company officials. Such endorsement ensures that the CCMP becomes a priority in the organisation during its development.

The second critical step is to ensure that a member of the senior management team is responsible for the plan's development. His or her first responsibility is to establish a multidisciplinary crisis management committee, thus ensuring across-the-organisation understanding and buy-in. Such a committee would consist of representatives from corporate affairs, environment, human resources, operations, finance, legal and other relevant departments or functions. The committee should also have representatives from the operations to ensure that the corporate and operations' plans are integrated and seamless.

This committee should determine at the outset what the organisation's top priority is during a crisis, because this will set the tone and focus of the CCMP as it emerges. From there the work of developing a CCMP should involve an assessment of the potential risks and threats facing a company and the evaluation of the company's crisis preparedness both at the corporate and operations level (see Box 7 and also Case Study 2).

Operational

- Industrial emergencies, such as accidents resulting in a critical injury or property damage
- Natural disasters that threaten employee safety or jeopardize operations
- Accidental releases of materials, such as tailings dam failure or a major chemical spill that could threaten people and the environment

Non-operational

- Medical emergencies in jurisdictions where quality medical care is either remote or entirely lacking
- Corporate/business-related threats such as litigation, white collar crime, market issues and other matters with a material impact on the company
- Workplace issues such as sexual harassment, workplace violence, allegations of an unethical behaviour and so on
- Missing persons incidents related to criminal or non-criminal circumstances
- Political and security risks such as kidnapping, extortion, bomb threats, sabotage, political or civil unrest, disgruntled employees, illegal detention by authorities and insurgent or guerrilla activity
- Any other event that threatens the health and safety of employees or the communities in which the company operates

Box 7 Organisational Vulnerabilities

[11] The Mining Association of Canada, Guidelines for Corporate Crisis Management Planning (2004) http://www.mining.ca/english/tsm/crisisguide-eng.pdf.

The next step is to establish a crisis management team organisation with a clearly defined structure, roles and accountability. Again, like the committee, this team should draw in people who represent all facets of the corporate centre and the operations. Specifications for the roles and examples of a team are given in the Crisis Communications Guide.

That task having been completed, the development of activation protocols extending into the key components of managing a crisis follows. The core of the CCMP – the who, what, when of the communication process – is then addressed in detail. This part of the guide has sections on the important elements of debriefing, training and review.

Analysis

The MAC has produced a comprehensive document (81 pages) about the development of a corporate crisis management plan that includes an extensive worked example. It is about how a corporate centre should communicate during and after a crisis has developed, but not how it should respond to it. As such, the document gives due attention to communities likely to be affected by local operations and, indeed, recommends the UNEP Technical Report, APELL for Mining. It emphasises that while professional communication with the media is vital in an emergency, so too is communication with local communities and the work-force.

Apart from the vulnerability assessment, however, the document does not cover what should be done in preparation for a crisis ahead of its development, and this is equally an important issue for communication with local communities and employees. It is conceivable, too, that some who read it will be at odds with some of its apparent business orientation. This view, however, should not reduce the value of this guide for those who wish to improve their communication practices in a crisis.

Appendix 1. Charters, codes and regulation

This appendix sets out some of the voluntary and compulsory instruments that cover emergency preparedness and that may be applicable to the mining and metals production industry.

Charters and codes

Various voluntary codes of practice and association policies in the industry include provisions for emergency preparedness and response. The Sustainable Development Principles of the International Council on Mining and Metals[12] require members to inform potentially affected parties of significant risks from mining, minerals and metals operations and of the measures that will be taken to manage the potential risks effectively, and to 'develop, maintain and test effective emergency response procedures in collaboration with potentially affected parties'.

The Mining Association of Canada

The Environmental Policy of the Mining Association of Canada (MAC)[13] has commitments to:

- risk management – an organisation must identify, assess and manage environmental risks;
- incident management – an organisation must develop, maintain and test emergency preparedness plans to ensure protection of the environment, workers and the public; and
- communications – an organisation must encourage dialogue on environmental issues with employees and the public and be responsive to concerns.

MAC, along with other national associations, requires these national commitments to be met wherever its members conduct their business.

The MAC also publishes guidelines on the planning and management of a corporate crisis.[14] Before the development of the sustainable mining initiative in 2000, MAC consulted widely inside and outside of the industry. Concern was expressed about the negative image of the industry due to incidents such as tailings failures and explosions, among others. There was obvious concern that the industry should do all it could to prevent any incidents. If emergencies do occur, however, then the industry must improve its communication effectiveness and responsiveness. The guidelines were drawn up as a response to this heartfelt need.

The MAC guidelines come in two parts (See also case study 12 on page 54). The first discusses the requirements for preparation of a crisis management plan – including a vulnerability assessment, a statement of objectives, team organisation, how the plan is activated, communicating in a crisis, debriefing, training and review – and the second illustrates what such a plan may look like. There is also a comprehensive set of appendices covering the many challenges in avoiding and, as a last resort, managing a crisis. While the title and some of the foreword would suggest that the document is all about protecting and restoring an organisation's and the industry's reputation, The guidelines confirm that the primary objective in any crisis is to protect the safety and well-being of employees (permanent or contract), to remediate any negative effects on nearby communities and the environment and to return the plant to safe operating conditions as soon as possible.

[12] International Council on Mining and Metals, Sustainable Development Principles (2003), http://www.icmm.com/icmm_principles.php

[13] Mining Association of Canada, Environmental Policy (1995), http://www.mining.ca/english/initiatives/environm.html

[14] MAC, Guidelines for Corporate Crisis Management, 2004.

APELL for Mining
The technology, industry and economics division of the United Nations Environment Programme based in Paris has developed a set of practical guidelines in association with chemical manufacturers to help local communities, governments, response agencies and industry prepare for emergencies. This programme is called APELL for Awareness and Preparedness for Emergencies at a Local Level. In 2001, UNEP extended this work when it published APELL guidance specifically for the mining industry.

The APELL for Mining Technical Report provides a framework for the preparation of emergency response plans that can be used by all the parties involved with a mining operation. It introduces the generic objectives and organisational framework of the APELL programme, covers risk factors specific to the mining industry and describes how APELL can be applied to the industry. The guidance is illustrated by case studies. The title refers only to one section of the process of mineral resource development, but it was anticipated that it would be useful also to smelters and refineries, although the original basic APELL programme would perhaps be more relevant. As indicated in Chapter 2, APELL for mining is a 10-step process, which, if followed diligently and logically, would result in a safer industry and reassured communities.

It was expected that APELL for Mining would be of assistance to the industry and its local communities in two ways. First, against the backdrop of major incidents and inherent risks, it would help raise awareness of the importance of preparedness for emergencies at the local level within both companies and communities. Second, it would help companies, communities and emergency response agencies to become thoroughly prepared for the work required in dealing with all aspects of a major incident should one arise.

This technical report uses examples or lists factors most relevant to mining operations and accidents, with a particular focus on tailings dam spills because of their frequency and the potential severity of the consequences. The guidelines also suggest that other APELL programmes – like that for transport, TransAPELL, and for Ports, APELL for Port Areas – are also relevant for the mining industry in some instances.

Responsible Care
The year 2005 is the twenty-fifth anniversary of the Canadian chemical industry's Responsible Care programme. Born out of such disasters as Bhopal, Love Canal and the sinking of the Torrey Canyon, this voluntary but strongly administered programme seeks to change the behaviour of the chemical industry worldwide. Member organisations in national chemical associations commit at the most senior level to six guiding principles and six codes of practice. Some members of the mining and metals industry have made commitments to the code (see Case Study 6).

In particular, the Community Awareness and Emergency Response code requires Responsible Care practitioners to design and implement extensive community outreach programmes. These are based on openness and cooperation. They require the provision of candid information about risks and the integration of company emergency plans with local emergency plans. Extensive outreach may mean door-to-door visits by company representatives, plant visits, community advisory panels, group meetings or dinners for community members. It is expected to mean a two-way dialogue in which the industry does as much listening, if not more, as it does talking.

A second code of relevance, since the industry moves and receives many tonnes of materials, is that covering transportation. This aims to reduce the risks that people and communities face along transportation corridors, including storage and transfer facilities, used by the industry to ship chemicals. Under this code, hundreds of transportation routes and chemical carriers are subject to regular Responsible Care assessments that examine key safety factors. The assessments enable members to choose only the safest routes and carriers who comply with the Responsible Care code.[15]

Finally, focussing on pragmatic preparation for emergencies in the event that they may happen should not detract from the pre-eminent goal of accident prevention. Disasters cannot be totally eliminated, and preparing for them and reducing their impacts is also a moral imperative.

International Cyanide Management Code

In February 2000 there was a significant uncontrolled discharge of tailings at the Baia Mare gold plant alongside the River Danube in Romania. The tailings had a high level of cyanide within them that seriously affected the environment for many kilometres along this international river and led to the application of emergency response measures by many downstream communities to prevent serious human health effects. As part of its response to this incident, gold producers, through their associations, worked with UNEP, ICMM and other stakeholders to produce an International Cyanide Management Code.[16]

The Code is intended to cover the manufacture, transport and use of cyanide in the production of gold. It focuses exclusively on the safe management of cyanide and cyanidation waste materials and leach solutions. Its intent is to improve the management of cyanide in gold production and to assist in the protection of human health and the reduction of environmental impacts.

The Code addresses emergency response in three of its nine standards of practice. Standard 7 deals with the protection of communities and the environment through the development of emergency response strategies and capabilities. The eighth standard covers the training of workers and response personnel to manage cyanide in a safe and environmentally protective manner, while Standard 9 deals with the issue of public engagement through consultation and disclosure.

Guiding Principles for Chemical Accidents

There are many hazards that are well recognised as particular features of the mining and smelting industry, such as rock falls, tailings dams and explosions. But the industry also produces and uses significant quantities of chemicals that have hazardous properties of their own and that need specific attention if they are not to be the cause of a major incident, such as sulphuric acid, oxides of arsenic, cyanides and so on. The Programme on Chemical Accidents prepared by the Organisation for Economic Co-operation and Development (OECD) is therefore a relevant body of work to guide the development of emergency preparedness within this industry.

[15] Canadian Chemical Producers Association, Responsible Care ® (2004). http://www.ccpa.ca/ResponsibleCare/
[16] International Cyanide Management Code for the Gold Mining Industry, (2003) http://www.cyanidecode.org.

The Guiding Principles for Chemical Accidents[17] is a multiagency work. Its objective is to set out general guidance for safe performance throughout every aspect (from planning to operation) of the production, handling, storing and disposal of hazardous chemicals. It is not confined to production sites but includes any place where hazardous substances are handled or stored with a potential for fire, explosions, spills or other accidents. It is not limited by size, location and ownership of the facilities in question, nor is it restricted in application to OECD countries.

It does not, however, address radioactive materials or transport, recognising that there are other instruments available for these categories. But it does include facilities where hazardous substances are transferred, loaded or unloaded.

Legislation and conventions

Most countries have legislation that caters for preparedness and response to emergency situations within an industrial setting. Some countries (Canada, for example) do not deal with this nationally or federally but leave such matters to a provincial or state legislature.

South Africa
In South Africa, the primary legislation for prevention of mining accidents is the Mine Health and Safety Act. Emergency planning based on ISO 14000 concepts is included in the Mineral and Petroleum Resources Development Act, 2002 through the Environmental Management Principles section. A Chamber of Mines of South Africa work group was giving consideration in 2003 to regulations, guidelines (requiring employers to draft codes of practice) and national standards on the topic of emergency preparedness and response in mining operations. Work on this is ongoing.

United States
The Emergency Planning Community Right to Know Act is the main requirement for emergency planning for industry in the United States. Most other requirements are embedded in state permits governing emissions to air and water. The Occupational Safety and Health Administration regulations also contain specific requirements for emergency response plans linked with process safety. These regulations are, of course, primarily concerned with employee well-being. Emergency Action Plans are also required by some states for permitted dams.

Seveso Directive
Countries within the European Union have a strong framework for emergency prevention and response that is also being followed elsewhere in the world. The directive was first drawn up following the catastrophic emission of dioxin at Seveso in Italy in 1976. It also reflects the concerns for the effects of an industrial incident being felt by a neighbouring country.

The directive was revised and strengthened in 1989 (the Seveso II Directive)[18] and then strengthened again in 2003 following the Enschede fireworks and Toulouse chemical plant incidents. This strengthening related to areas such as the information to be made available to the public about the hazards and precautions that a plant had and was taking, the level of training for emergencies that is required and the involvement of subcontracted personnel. The strengthened Directive also

[17] OECD, OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response. 2003.
[18] European Seveso II Directive[03/XX/E C], April2003.

obliges industries that fall within its scope to provide risk maps showing areas that might be affected by a major incident. In 2003, the Directive was also extended to include mining as a consequence of the Baia Mare (Romania) tailings incident in 2000.

Seveso II makes provisions that apply to all establishments where listed dangerous substances are present in sufficiently large quantities to create a major accident hazard. It acknowledges that most major accidents are a result of managerial or organisational shortcomings that make it necessary to lay down basic principles suitable for preventing and controlling major hazards and limiting the consequences of them should things go wrong.

Under the Directive, operators are required to draw up documentation setting out their major accident prevention policy (MAPP) and safety management system (SMS) and to ensure that these are properly implemented through an internal emergency plan. Operators must then share these with their competent local authorities through a safety report so that these authorities can generate a complete community emergency plan. Safety reports are subject to audit. Consultation on the emergency plans is built into the process, with engagement with employees inside the plant and the public around it.

The Directive covers new and existing plants and anticipates changes in the MAPP and SMS when facilities have been modified. The emergency plans so formed have to be reviewed, tested and, depending on the result, modified at least every three years. This is an obligation for both operators and the authorities.

Annex III of the Directive contains specific details of an emergency plan. Together with the APELL Programme, the Seveso Directive is a considerable help to those drawing up an emergency response plan for the first time.

Transboundary effects
The United Nations Economic Commission for Europe's Convention on Transboundary Effects of Industrial Accidents (TEIA) was signed in 1992 and came into force in 2000 when it was ratified by 26 of the parties to the Convention. It lays down a set of measures to protect human beings and the environment against the transboundary effects of industrial accidents and to promote active international co-operation between the Contracting Parties before, during and after such accidents. The convention applies to most industrial activity but specifically excludes, among others, dam failures and land-based transport accidents. It is built around the generally accepted framework of prevention, preparedness and response but includes also the concept of civil liability across national borders.

TEIA measures include efforts to:

- induce action by operators to reduce the risk of industrial accidents;
- establish policies on the siting of new hazardous activities and on significant modifications to existing hazardous activities, with the objective of minimising the risk to the population and the environment;
- prepare for emergencies caused by industrial accidents, introducing the necessary measures, including contingency plans to prevent and minimise transboundary effects;

- provide adequate information to the public and allow a process of consultation; and
- endeavour to make the plans of the various parties compatible.

The contracting parties must identify hazardous activities within their jurisdiction and must inform the affected parties of any such proposed or existing activity. At the initiative of any one of them, the parties must enter into discussions on the identification of activities capable of causing transboundary effects. It is noteworthy that the Convention requires there to be a process of public engagement so that neighbours on both sides of a border may know what they are living with and how they are to be protected. This engagement goes as far as local people having a part in the decision-making about the arrangements in any given facility.

Standards and Guidelines

ISO 14001
The International Standard for Environmental Management (ISO 14001)[19], which many businesses in the industry seek to comply with, includes requirements for emergency preparedness and response (section 4.4.7). The requirements of this part of the standard are further expanded in the guidance notes issued as Annex A to the standard (section A 4.7). These are reproduced in full in the Annexe to this Technical Report.

Basically, the ISO 14000 requirements for an organisation are to:

- establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them;
- respond to actual emergency situations and accidents and prevent or mitigate associated adverse environmental impacts;
- periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations; and
- periodically test such procedures where practicable.

Although this section does not deal directly with relationships with people outside an operation, there are other parts of the guidance that do (A 4.3 - Communication). The guidance notes suggest that internal communication is important and offer several methods to achieve that: regular work group meetings, newsletters, bulletin boards and Intranet sites. They also suggest that organisations should implement a procedure for responding to relevant communications from interested parties, giving relevant information about the environmental aspects and impacts associated with the organisation's operations. It is presumed that these aspects should include emergency planning, but that is not explicit. Also note that this is a response to an enquiry by an external stakeholder rather than involving the stakeholder in the exercise of planning, as required by the APELL process.

However, the guidance notes do suggest that the communication procedures should also address necessary communication with public authorities regarding emergency planning and other relevant issues. Methods for external communication can include annual reports, newsletters, websites and community meetings.

[19] International Organization for Standardisation, Environmental Management System, EN ISO 14001:2004.

The guidance notes also cover the need to document emergency plans (A 4.4) and to maintain records of any tests that are conducted (A 4.5).

Global Reporting Initiative
In February 2005, the Global Reporting Initiative (GRI) and ICMM released the pilot version of the Mining and Metals Sector Supplement.[20] Developed through GRI's multi-stakeholder process in partnership with the ICMM, this Supplement provides specific guidance on reporting against the GRI Guidelines for companies in this industry. Included within the parameters to be reported by the industry are new indicators on emergency preparedness (MM12) and significant incidents affecting communities around the industry's facilities.

MM12 asks reporters to 'describe approach to identifying, preparing for, and responding to emergency situations affecting employees, communities, or the environment. Include a description of the nature of existing skills, teams who respond to emergency situations, training, drills, review processes and community involvement.'

The guidelines comment that the reporting organisation should provide a description of any significant incidents, which should include spillage of tailings, slimes or other significant process materials.

[20] Global Reporting Initiative, Mining and Metals Sector Supplement (2005) http://www.globalreporting.org/guidelines/sectors/Mining_Pilot1.pdf

Appendix 2. Major risks that may give rise to an emergency

High-volume materials management

Both minerals and metals production can give rise to high volumes of waste and product material. In the case of mines, waste can come as large-sized material known as waste rock. In the case of minerals and metals, it comes as fine material known by such terms as tailings, slimes or slag. Where these two types of material have no other use, they have to be stored safely.

High stripping ratios in open pits mean that very large quantities of waste rock are generated to produce a small quantity of metal or concentrate. Some waste rock from underground mines is fed back into the mine and some is occasionally used in the construction of embankments, roads and other infrastructure. Most, however, is stored above ground in major free form structures. Along with dumps of fine materials, these are the characteristically visible features of mining's presence. Dumps can stand high above the surrounding terrain and generally have very long slopes.

Waste dumps do fail if not designed and managed properly. Sometimes this is because the design is compromised by increased activity at or near the crest. Sometimes it is because of water buildup in the interstices in the dump, causing slippage, or because weathering or chemical reaction has changed the angle of repose at which the material will sit.

In Cornwall in the United Kingdom a slip occurred in the 1990s in a relatively new china clay waste dump. The slip crossed a road and engulfed a house opposite. Fortunately, the road had no traffic and the residents were not at home at the time. At a different time of day, the accident could have been fatal. In 2000, part of a 400-metre high waste rock dump failed at the Grasberg mine in West Papua, slipping into a lake and generating a water wave that killed four contractors. The wave stopped just short of a downstream village.

Incidents with fine waste material have been much more frequent and always potentially more severe. The 1966 accident in Aberfan, Wales, is described in Chapter 1. In 1972 at Buffalo Creek, West Virginia, in the United States 125 people lost their lives and 4000 were rendered homeless when a coal slurry depository failed. Hardly surprisingly, the catastrophic failure of a tailings dam or fine waste dump draws particular attention from the media, often internationally, and generates considerable anger among communities and those who oppose mining activity.

In 2001, the International Commission on Large Dams (ICOLD) and UNEP produced a bulletin that surveyed the causes, lessons learned and remedial actions taken from failures in tailings impoundments.[21] The bulletin noted that these structures could be large and significant works of engineering, some of which rank alongside the world's major water dams. Failure of such huge structures can release large volumes of liquefied minerals that will travel a long way. Because of their greater weight than water, they have the potential to destroy everything in their path. Failure then is likely to have serious consequences for public safety, the environment, the owner and the operator (see Case Study 8).

[21] ICOLD/UNEP Bulletin, Tailings Dams: Risks of DangerousOccurences. Lessons Learnt from Practical Experiences, 2001.

The bulletin contained a compilation and analysis of 221 cases of known tailings dam incidents over almost 50 years. Since this analysis was completed (Baia Mare, January 2000), a further 11 failures have been recorded. The bulletin also showed that the risk of failure was significantly reduced if:

- the quality and competence of the foundation was assured before it was constructed;
- an adequate drainage system was provided;
- the tailings were actively managed and not treated as orphan properties, often out of sight and mind;
- the status of surface and pore water was monitored and controlled within safe design limits; and
- there was true appreciation of failure trigger mechanisms.

Studies in mining companies have highlighted the imperative of managing water effectively for tailings impoundment security. Usually this is in the context of ensuring that there is no excess water.[22] However, too little water can result in dry beaches giving dust problems for nearby communities. Blowing dust can have impacts on health through inhalation, as well as on agriculture through metals uptake by plants. These are some of the chronic effects of poor tailings management, and significant community unrest can result.

ICOLD has published a series of guidelines for the design, construction and closure of safe tailings dams. Many other guidelines exist, including management frameworks such as the Mining Association of Canada's, A Guide to the Management of Tailings Facilities. They cover sound management throughout the active life cycle of a tailings facility. These guidelines include emergency response plans (with communications plans) for the various phases of a dam's life prior to and including closure.

In some operations, high-volume product material is stored on the ground for processing purposes. Heap leaching for gold or copper is an illustration of this. One critical element for such a facility is the shear strength of the interface between the liner and the overlying or underlying material. If this is misunderstood or compromised, then the material on the heap will become unstable and slide. Drainage may then be compromised or leaks formed in the heap liner, allowing chemicals to escape into the environment.

Ground subsidence

Underground mining can result in ground-level subsidence over time. Sometimes this can occur suddenly and rapidly, as at Mufulira, Zambia, in 1970, when 1 million tonnes of tailings dropped into the underground workings through a sink hole, killing 89 employees. At the Lassing Talc mine in Austria in 1998 (see Case Study 7), an equally sudden and violent collapse at the surface led to the death of a 10-man rescue party and destruction of people's homes.

Mine subsidence is more often a gradual process. It can occur over relatively large areas, particularly over shallow extensive mining operations, such as coal mines under incompetent ground. In the Ferniehill district of Edinburgh, Scotland, some 250 homes were lost recently over 24 months as 200-year-old coal workings beneath them failed. In other areas, subsidence can occur above historic mining sites as structural supports age and deteriorate; in France, in 2004, this derailed a TGV

[22] *Breaking New Ground* The Report of the Mining, Minerals and Sustainable Development Project, Earthscan Publications Limited, 2002 pp 240-241.

travelling at 300 kilometres per hour. Most often it is the mining communities themselves or subsequent developments on top of old mining fields that are exposed to this risk.

Chemical emissions

Fuels and chemicals used at mining and metallurgical sites are often hazardous substances. They may be toxic to humans and animals or plant life. Virtually all of them are also in common use in other industries. A relatively small number of chemicals are widely used in the mining and metals industry in large quantities, and the risks associated with the delivery, handling and storage of these are well known. In most cases these hazardous materials are well controlled. Occasionally, though, they escape the site through leakage, directly or through contaminated watercourses or gaseous emissions.

Cyanide use has become associated with gold mining, although it is reasonably common in other industries also. The public is uncomfortable with its use, and any incident involving cyanide can be expected to attract strong media attention. Sound emergency preparedness and communication for operations handling cyanide should be an obvious priority. A voluntary Code for Cyanide Management in the gold industry has been developed (see Appendix 1) and contains a strong emergency preparedness component.

For other fuels and chemicals, such as sulphuric acid, lime and sodium hypochlorite, the industry needs to be aware of the experience of other industries in relation to transport, transfer, storage, handling, risk reduction and emergency response measures directed at spills. Even chemicals used in water treatment, a seemingly innocuous process, may be hazardous and need careful management.[23] The OECD Guiding Principles for Chemical Accidents referred to in Appendix 1 are relevant here.

Explosives are one particular form of chemical that is widely stored and used at mine sites. ANFO is normally mixed at the drill hole. It is shipped as two components – ammonium nitrate (fertilizer) and fuel oil (diesel) – both of which are significantly less hazardous than the mixture. Explosives are normally well controlled and stored in safe conditions in licensed magazines that are operated by the company or a contractor.

As noted earlier, other flammable substances such as fuel (diesel, petrol and kerosene) and, sometimes, liquefied petroleum gas are also transported and stored in large quantities, as are chemicals such as solvents, ammonia, sulphur and relatively smaller quantities of process reagents. Large operations may have acetylene plants for use in the workshops, while small operations will also store and use acetylene. Some mines and many smelters also have oxygen plants, others use raw sulphur to produce sulphuric acid, while still others may use high temperature and pressure together with acid leaches to extract metals from ore. The proper management of all of these is important if incidents are to be avoided, and procedures need to be in place if they do arise.

Loss of chemicals during processing can be equally a significant hazard, as noted earlier. Another critical element for heap leach operations is the integrity of the liner and drainage system. If either of these fails, then cyanide or acidic, metal-rich liquors can escape the site and contaminate surrounding areas.

[23] *Mining Environmental Management*, September 2003.

The production of some metals involves also the co-production of sulphuric acid or by-products containing arsenic or cadmium. The escape of sulphur dioxide fumes into the neighbourhood has been the cause of many community complaints in the course of the industry's history. While the application of double contact and double adsorption with tail gas scrubbing has reduced incidents considerably, the potential for uncontrolled escapes of sulphur dioxide still requires the development of plans to prevent situations reaching emergency proportions.

On some sites, oxides of arsenic have been stored because there is no end use market. Dust and leach containment are hence important.

In the United States, the Emergency Planning and Community Right-to-Know Act passed in 1986 requires businesses to report to their states and local governments the locations and quantities of chemicals, hazardous or otherwise, that are stored on-site. This drawing up of an inventory is the first step in the proper management and reduction of risk in having hazardous materials. In 1997 Environment Australia produced a best practice guide for the mining industry, which provided the following guidance on managing hazardous materials to minimize the risk of damage from accidental releases:

- knowing which hazardous materials are on-site;
- allocating clear responsibility for managing hazardous materials;
- understanding the actual or potential hazard and environmental impacts in transporting, storing, using and disposing of these materials;
- minimizing the use or generation of hazardous materials;
- constructing storage facilities that contain the materials in all foreseeable circumstances;
- disposing of waste materials in a way that eliminates or minimizes environmental impacts;
- implementing physical controls and procedural measures to ensure that no materials escape during normal or abnormal operations;
- having emergency response plans in place to ensure immediate action to minimize the environmental effects should accidental or unplanned releases occur;
- monitoring any discharges and also the environment to detect any escapes of the materials and measure any subsequent impacts; and
- keeping adequate records and reviewing them regularly so future environmental problems are anticipated and avoided.

Transportation
The mining and metals industry moves a great deal of material often over large distances. This may be product, by-product or waste leaving a site or supplies coming in. All forms of transport are used – from pipelines, roads, rail and sea to air, both fixed wing and helicopter.

Supplies of hazardous chemicals such as cyanide or sulphuric acid may be brought in and transferred between different transport modes in the process—from ship to port to truck to barge to helicopter, providing many opportunities for incidents that have a damaging effect on communities and the environment. Some serious transport incidents have occurred involving cyanide. It has been spilt into rivers from trucks, dropped from helicopters and lost from barges. Wastes and by-products, such as mercury, may be transported from sites – sometimes over poor roads and through local communities. A transport incident involving mercury had serious consequences for health in the affected community (see Case Study 3, page 29). Other transport accidents have occurred in remote areas (see Case Study 6, page 36), posing environmental and community threats but often going unreported.

It is important for miners and smelters to give as much attention to the management of an emergency arising out of a transport incident as it is for one arising out of, for example, a sudden ground collapse. Perhaps there should be even more attention, because such an incident may well be far from an operating site, thus making effective and timely responses much more difficult.

Such preparation applies whether or not the operating company is itself involved in the transport. In the event of an emergency, the company's reputation is on the line, and the company is likely to be involved in cleanup and remedial activities. It is therefore incumbent on the company to satisfy itself that the transport contractor or supplier has sound emergency procedures in place along the handling chain.

Pipelines

Pipelines are a frequent means of carrying tailings or concentrate away from sites or fuel and chemicals into them. Frequently they cover long distances, sometimes across public land and over difficult terrain. Facilities such as processing plants or heap leach pads may be several kilometres from the mine itself, and waste disposal facilities such as tailings dams may be further away – particularly in mountainous terrain. This may mean that the mine site is extensive or consists of several small areas with pipelines, as well as haul roads, between them. Pipeline rupture is a relatively frequent event, rapidly spilling large quantities of materials. This may go undetected for some time and, as secondary retention structures are not always provided, may release hazardous substances into the environment (see Case Study 9, page 44).

Natural hazards

Seismic events, cyclones, electric storms, flash floods and ice, to name but a few, are natural hazards that are encountered by many operations across the world. In planning a facility, account should have been taken in the environmental impact assessment of such risks and appropriate engineering measures should have been taken to reduce them. Yet there are some situations where difficulties may result in triggering emergency management plans. Ships carrying mining and metal products do sink, with loss of life and sometimes the spilling of cargo in sensitive environments. Incidents such as these reach the media and need a response from the companies involved. Two other factors need to be considered.

First, some operations are situated in places where they may well be the only competent agency to deal with emergencies of natural origin. Being able to assist local communities to manage the impact of natural events is a role that the minerals industry must sometimes play. Second, there is a growing appreciation, not least among insurers, that some natural events related to climate are on the increase and becoming more severe. A watchful eye on this trend should be kept and, where necessary, should trigger a review of emergency preparedness and response plans.

Non-operational facilities

Closed mines can be the source of emergency incidents. Catastrophic releases of contaminated water can occur, such as the release of acidic, metal-rich waters from the closed Wheal Jane tin mine in Cornwall, England, in 1991. The event was the result of flooding in the old workings, which were rich in oxidation products from many years of weathering, and the failure of a plug in an adit that released some of the water into a nearby estuary.

In the ICOLD/UNEP Bulletin, there are relatively few records associated with inactive dams. The Bulletin notes, however, that such facilities are not immune to failures, and those that have occurred have usually been as a result of an increase in pool water resulting in overtopping such as at Merriespruit, South Africa, in 1994, where failure occurred in an inactive dam on an operating site that was being used to store water. The potential for seismic failure must also be taken into consideration during operation and when dams are closed out (see Case Study 11, page 50).

As mentioned elsewhere in this Report, mine stability and safety need to be addressed in the decommissioning and post-closure phases. Contingency planning and emergency response plans need to be tailored to the different situations that will exist. In particular, the mine, and possibly the community, will no longer have the resources or the personnel to deal with local emergencies (see Case Study 7, page 38). Planning must address the ongoing capacity and roles of the community and government agencies in emergency preparedness for the long term. It should be borne in mind that the number of closed mines and therefore the potential for incidents will only increase with time as more and more ore bodies reach the end of their economic life.

Long-term events

This report is about planning for accident prevention and being prepared for and responding to events when they do occur. However, much will still apply to other situations where community and environmental impacts over the long term have been experienced.

As mentioned earlier, chronic impacts can result from soil and water pollution due to the migration of contaminants from the site through the physical dispersion of particles by erosion and weathering or from chemical dispersion such as acid rock drainage or leachate from mine wastes. Long-term seepage of fluids from underground storage tanks, tailings dams and pipelines can affect groundwater and surface water. Small-scale 'garimpeiro' mining activities can cause long-term effects on local communities, particularly through the use of mercury in gold mining. In areas where rivers are being disturbed, high sediment loads in the river can have longer-term effects on fish populations that in turn can have an impact on local communities downstream. High levels of lead have sometimes been found in houses located near lead smelters, and in some places high levels of lead in blood have been measured in the neighbouring community.

The approaches described in this Report can also be applied in post-incident consultative processes. Here the objective is essentially the same – to use community consultation and planning involving many parties, in pursuit of integrated, effective action which is well understood and supported by all.

Social unrest and other hazards

This Appendix has described emergency situations arising out of process operations in the mine or metals facility. Some will lead to community unrest of varying degrees. There are also other hazards and associated risks that businesses in this industry face that are not induced by technical failure. A significant number of mining operations exist in places where the potential for social unrest triggered by the operation's presence is high. And today all mines and smelters must treat the global terrorist threat seriously and be prepared for any eventuality. Most especially this would apply to those that produce high-value products or that are material players in a national economy.

At the extreme, a mine may be closed for a long period by the actions of local people at odds with the political system that exists (as in Bougainville copper mine in 1989). Mine managers and expatriate staff in some parts of the world are exposed to the possibility of kidnapping or, in extremis, death. In other parts of the world, travel to and between operations is significantly dangerous. These and other similar circumstances are just as much emergencies that need managing as are those arising out of a tailings failure or chemical leak. The processes described in this Report can be applied to them. In the case of social situations, the very fact of engagement with the local community in preparation for emergencies may in itself lead to the reduction in the potential for social unrest.

Appendix 3. Emergency preparedness – a guide to self-assessment

This guide indicates how an emergency plan might be assessed when a plan has first been prepared and, at subsequent annual intervals, after it is tested, reviewed and kept up to date.

The emergency preparedness plan is considered in sections: being ready for and responding to an emergency, managing it and its aftermath and communication before, during and after it has occurred.

The self-assessment guide is intended for use by stand-alone entities. Operating sites or corporate centres can follow it. Corporate entities could use the completed guides to establish the extent of emergency preparedness in the whole corporation.

The questions in the self-assessment draw on the APELL model established in the Towards Good Practice in Emergency Preparedness and Response report published by ICMM and UNEP and described in the rest of this document.

It is not intended that this guide should be complete. Individual sites will have to establish for themselves the gaps that might exist that pertain to their own operations. Space is allowed on page 77 (for Part 1) and 79 (for Part 2) for this to be done.

SITE DETAILS

Name of site/facility:

Location:

Sub Group Reporting:

Location:

Head Office of Corporation:

Location:

Use Part 1 for the initial assessment of the status of the emergency plan and Part 2 for successive annual assessments.

PART 1: INITIAL ASSESSMENT

Use this part of the self-assessment guide for a plan that has just been drawn up or one that is in existence but has not been assessed before. The questions reflect what should be in the plan, not what may have been done during the year.

A: Basic Plan Information

1. Is there an emergency response plan? Yes/No
2. When was it prepared? Date: ____________
3. Who has signed the plan? Name: ____________

   Title: ____________
4. Where is the plan located? Place: ____________
5. Is there an abridged version for easy access in an emergency? Yes/No
6. Is there an electronic/web-based version for similar use? Yes/No
7. Have clear notification protocols (including maximum time elapses) been established? Yes/No
   a. Internally?
   b. Corporately
   c. Externally
8. Is there an up-to-date 24/7 contact list for these protocols? Yes/No

B: Preparation of the Plan

9. Who was involved in the preparation of the plan?

Use the following checklist as a guide. Complete the checklist for special conditions or groups that were involved in the preparation of the plan. Where appropriate, name the organisations that were involved (such as consultants) at the end of the self-assessment questionnaire (page 77).

		Involved		Consulted		Not Available
		Yes	No	Yes	No	
Operations	Senior managers					
	HSE advisers					
	Operating staff					
	On-site clinic					
	On-site rescue teams					
Other company staff	Communications advisers					
	Legal advisers					
	Corporate managers					
Other industrial facilities	Senior managers					
	Search and rescue teams					
Potential local community responders	Police and similar agencies (such as Coast Guard)					
	Fire brigades					
	Emergency health services (paramedic services)					
	Local hospitals					
	Specialist hospitals (such as burns units)					
	Public health authorities					
	Environmental agencies					
	Civil defence teams					
	Welfare services					
	Red Cross/Crescent or similar aid agencies					
	Public works authorities (roads, ports, airports)					
	Media centres					
The local community	Community leaders and representatives and others					

C: Contents of the Plan

10. What emergency situations does the plan cover?

Use the following checklist as a guide. Complete the checklist for special conditions that exist in your operation so that it is a reference for the future. Note any special circumstances that exist or seasonal variations that may affect the checklist (page 77).

	Situation	Included			Response Planned	
		Yes	No	Not Relevant	Yes	No
Operations	Rock falls/slides/ mine collapse					
	Explosions					
	Fire					
	Hazardous chemicals release					
	Toxic gas release					
	Structural collapse					
	Tailings transport failure					
	Tailings storage failure					
	Waste rock storage failure					
	Product safety					
	Marine incident					
	On-site transport					
	Off-site transport (product)					
	Off site transport (deliveries)					
	Employee action					
	Occupational health and safety					
	Personnel transport (boat/bus/plane)					
	Remote facility operation					
	Other					
Other nearby businesses	The risks they pose					
Natural	Seismic event					
	Forest or prairie fire					
	Cyclones and tornadoes					
	Ice storms					
	Water inundation					
	Other					
Social	Civil action					
	Strike violence					
	Terrorist threats/action					
	Kidnapping/hostage taking					
	Disease epidemic					
	Conflict/war					

	Collapse of government					
	Other					
Business	IT security					
	Site security					
	Communications failure					
	Financial irregularity					
	Hostile bids					
	Debtor failures					
	Other					

11. Does the plan include:

    a. Selection of on-site emergency response teams? Yes/No
    (Indicate the size and scope of teams on page 6)

    b. Is there back up for absent and off-duty workers? Yes/No

    c. Training of those teams?
    (Indicate the number of person hours involved on page 77)

    d. Assessment of the standard of training achieved? Yes/No

12. Does the plan include testing provisions?

    a. At least annually? Yes/No

    b. Involving a significant proportion of the ER team? Yes/No

    c. Involving local ER teams? Yes/No

    d. Involving the local community? Yes/No

    e. With review and communication of the results? Yes/No

    f. Modification to the plan as a result? Yes/No

13. Does the plan include for periodic review? Yes/No
    (The Seveso Directive suggests every three years)

14. Does the plan cover control during and emergency? Yes/No

    a. Has a crisis control room been set up? Yes/No

    b. Is an alternative identified (off-site preferably) Yes/No

c. Has an overall crisis manager been nominated Yes/No

Name: ______________________

Title: ______________________

d. Has the crisis management team been identified? Yes/No
(List these people separately on page 77)

e. Is crisis communications covered in the plan (see 15)? Yes/No

f. Does this involve the Divisional and Corporate centre Yes/No

g. Are there clear boundaries for upward referral Yes/No

15. Has a media communication plan been set up?

a. Has a spokesperson been nominated? Yes/No

b. Is there an up to date list of media contacts? Yes/No

c. Are there information packs on the operation/business? Yes/No

d. Are there templates for responses to specific crises? Yes/No

16. Is there a Personnel response plan? Yes/No

a. Does it provide for dealing with staff and relatives? Yes/No

b. Are appropriate counselling facilities identified? Yes/No

D: Communicating the Plan

17. Has the plan been seen/approved by the Division? Yes/No
(Division is used as a short form for the next upward layer in the Corporation)

18. Is a copy of the plan held there? Yes/No

19. Where is it held? Place: ______________________

20. Who holds the plan? Name: ______________________

Title: ______________________

21. Has the plan been seen/approved by the Holding Company? (This is the ultimate owner or designated managing company of the facility) Yes/No

22. Is a copy of the plan held there? Yes/No

23. Who holds the plan? Name ____________

Title: ____________

24. Has the plan been shared with other local businesses? Yes/No

25. Has the plan been shared with local emergency responders? (Note separately on page 77 the organisations with which the plan has been shared) Yes/No

26. Has the plan been shared with local communities? (Indicate on page 77 how this was done) Yes/No

Assessed by: ____________

Title: ____________

Signed: ____________

Date: ____________

ADDITIONAL INFORMATION

Use this page to capture the additional information suggested in the questions.

PART 2: ANNUAL ASSESSMENT

Use this part of the self-assessment guide to determine annually if testing and reviewing have taken place and that the plan has been kept up to-date:

1. Are all 24/7 contact numbers and personnel details correct? Yes/No
    a. Internally
    b. Corporately
    c. Externally
2. Has the plan been tested in the last 12 months? Yes/No
   (If not, add an explanation on page 79 and go to question 3)
    a. Which item of the plan?
    b. How long did the test last?
    c. How many people were involved?
        i. On-site
        ii. Local emergency response teams

iii. Local community people/neighbours

d. Was a report of the test prepared? Yes/No

e. With whom has it been shared?

i. On-site

ii. Among local emergency response teams

iii. Among local community people/neighbours

f. What plans exist for making amendments in the light of the test? (Include details of these on page 79)

g. With whom will the amendments be shared?

i. On-site

ii. Local emergency response teams

iii. Local community people/neighbours

3. Has the plan been reviewed in the last 12 months? Yes/No
(If not, add an explanation and go to question 4)

a. Did you conclude that no changes were necessary? Yes/No
(If yes, go to question 4)

b. Have you modified the plan in the light of the review? Yes/No
(If not, add an explanation on page 79 and go to question 4)

c. Have the modifications been communicated?

i. On-Site

ii. Local emergency response teams

iii. Local community people/neighbours

iv. Divisional and corporate offices

4. What changes in plant/process/business/global context have occurred in the last 12 months (list on page 79)?

5. Have you allowed for these changes in the plan? Yes/No
(If not, add an explanation and go to end:
If yes, identify the changes. All on page 79)

6. Have these changes been communicated?
   i. On-site
   ii. Local emergency response teams
   iii. Local community people/neighbours
   iv. Corporate offices

Assessed by: ______________________

Title: ______________________

Signed: ______________________

Date: ______________________

ADDITIONAL INFORMATION

Use this page to capture the additional information suggested in the questions.

Appendix 4. Questionnaire analysis

The first task of the International Council on Mining and Metals (ICMM) working group was to establish the status of emergency planning among its members. In order to achieve this, a questionnaire was sent out to corporate centres and operations and associate members. (The questionnaire can be found on page 85 of this appendix). Appendix 5 lists the companies that received the questionnaire.

The questionnaire sought information on the legislative requirements for emergency preparedness and response plans; identification of the emergency preparedness and response systems; the degree of stakeholder involvement; and the extent to which existing plans were audited and reviewed. An analysis of the responses to these questionnaires is presented in this appendix. For ease of comparison, the responses have been summarised in simple terms of yes and no for both the corporate and the operational categories.

Overall conclusion
The overall conclusion is that most, if not all, businesses involved in mineral development and the smelting of metals take the provision and practice of emergency plans seriously. There are, however, gaps that if they were filled would bring all emergency plans up to the level of best practice. The principal gap relates to the involvement of local people who might be most seriously affected by an emergency that goes beyond an operation's boundary. Other gaps lie in the level of awareness of the risks posed by neighbouring operations and, at the operational level, the apparent lack of senior management involvement in preparation of emergency plans, as indicated by the heavy reliance on health, safety and environment (HSE) staff for this work. To some extent also, the time devoted to testing of plans (31% of the total sample have a test time of less than 1.5 hours) is also a potential gap.

It is evident from the analysis of strengths and weaknesses that the standard of emergency preparedness varies across the industry. For almost all the strengths that were reported by any one operation or corporate centre, there was an equal and opposite weakness reported elsewhere. These overall conclusions are expanded on below.

Corporate analysis
The total number of responses to the questionnaire from corporate centres was 12. Several organisations did not submit a separate corporate response but combined it with an operational one. In these cases, the corporate response has been extracted from the operational response and recorded in this section.

In response to some questions, such as what kind of emergency situation has your company identified and planned for, more detail was provided and this also was recorded. Summaries of the responses that are important from a corporate perspective are presented in Table A and discussed here.

Eight organisations (67%) have national/regional legislation in the country in which they are based that requires them to have an emergency response system. Only three countries require auditing of the system.

Nine organisations (75%) report a corporate culture and policy concerning emergency preparedness and response. Three report that they did not have one. There is a wide range of emergency situations catered for within the plans of each of 11 organisations (92%), although some are more inclusive than others. In nine organisations (75%), these emergency situations include matters that are outside the expected safety and environment brief. They also cover natural disasters, operational events, finance, procurement, markets, aviation, transportation and kidnapping.

It is difficult to determine the degree of formality in the emergency response plans because organisations use different words to describe their system.

However, nine organisations describe their system as a standard, procedure or plan, with five being in considerable detail. In one other organisation the corporate system is in preparation and in another, highly decentralised organisation, only guidance is provided to its divisions. At least nine organisations have some form of crisis command centre, although the terminology differs on a case-by-case basis.

In only four organisations (33%) have senior managers been involved in the preparation of emergency response plans. In one of these the crisis command centre personnel were also involved. In another five organisations the corporate HSE Department and risk or audit managers prepared the corporate emergency responses. Eight organisations (67%) had backup procedures in place for people who may be unavailable at the time of the crisis.

Five organisations (42%) review their emergency response plans regularly, with at least three doing so on an annual basis. One additional organisation (making six in total, 50%) tests its emergency response plans on at least an annual basis. The test duration ranges, however, from less than one hour to three days. A post-simulation report is prepared in five instances (42%). However, in only three cases (25%) are external stakeholders involved in the simulation or given the report. Four organisations (33%) note that they had tested their emergency response plans in a real situation.

The remaining responses to the corporate part of the questionnaire are better related to operations than to the corporate centre and will be considered in that section of the report.

Operational analysis
In all, 31 operations responded to the questionnaire, as listed in Appendix 5. The responses are shown in Table B. Care has to be taken in interpreting responses, since in some cases a person in the corporate centre was responsible for making them. However, the following general conclusions can be drawn.

For almost all operations (27, or 87%), an emergency plan is legally required but only for 14 (45%) is there a requirement to audit that plan. There would appear to be no legal requirement for an emergency plan in West Africa or federally in Canada. One Japanese operation reports no legal requirement, but this is not confirmed by the other operations in the same group. These results generally confirm the corporate responses.

Almost all operations (27, 87%) also confirm the existence of a corporate policy or culture in planning for emergencies. In one organisation, three operations reported the existence of a corporate policy, whereas the corporate centre admitted that this was only in preparation.

Personnel in one or all of the HSE functions are involved in preparation of emergency plans in 23 operations. In only 15 operations (48%) are managers involved. In 20 operations (64%) there is some form of external involvement in the development of emergency plans. In most cases this is through consultants with specialist knowledge, although local regulators and emergency services are also evident in some responses.

Again in almost all operations (26, or 84%), mobilisation guidelines for operational staff exist. There is also backup at 29 operations (94%) for those who would be involved in dealing with an emergency in the event of absence through holidays or business reasons. There are 29 training programmes for those people with designated responsibilities during an emergency. In 23 operations (74%), there is some form of assessment of the effectiveness of these training programmes. In 26 operations (84%), support teams to take care of human resource issues, media relations, counselling and other matters have also been identified and trained.

All operations report that emergency plans are reviewed annually and are improved in the light of deficiencies identified during the reviews. Almost all (29, or 94%) test their plans annually and 26 of these provide a report afterwards. In 28 operations (90%), the emergency plans have been used in a real situation, although thankfully few of these had been catastrophic incidents seriously affecting local communities.

Many plans and planning processes appear to lack knowledge and understanding of what is going on beyond site boundaries and involving people who live there.

On a positive note, 27 (81%) operations have identified the existence of other emergency response facilities in their neighbourhood. However, gaps in these facilities have not been identified in most cases (21, or 68%). In fewer than half the operations (15, or 48%) have the risks posed by neighbouring facilities been identified. These last two can, of course, become linked to serious effect.

The number of operations engaging with external stakeholders is limited. Although 16 operations report positively on the provision of feedback on their emergency plans to these groups, some of this was only through the annual environment report (this term is used generically to include all types of sustainable development reports), and some of the stakeholders that are involved included, for example, insurance companies, corporate head offices, local emergency response providers and local regulators.

As noted earlier, while 20 operations report external involvement in the development of emergency plans, in only one case does this engagement appear to include the people in local communities. Furthermore, while 14 operations do have systems in place to communicate emergency plans to their communities, the effectiveness of these communications needs further exploration. When it comes to testing the effectiveness of emergency plans, there is even less engagement with external stakeholders (nine operations). Again, those external stakeholders who are involved may well be the local emergency response facilities (a positive engagement) rather than the people who may be most affected by an emergency that develops beyond site boundaries. In no case does it appear that the results of such a test are shared with local communities.

Analysis of strengths and weaknesses

The questionnaire asked the respondents to list three strengths and three weaknesses in their planning for emergency situations. These responses have been tabulated and then organised into categories that the responses themselves suggest. A list of the numbers of responses in each category of strength is shown in Table C.

The largest number of strengths and weaknesses are reported in the planning category. Several operations note the quality of planning and documentation that has been prepared for emergency response management. Included here are a number of references to risk identification and management strategies. This is an important factor if emergencies are in the end to be avoided. However, a significant number of other operations believe the emergency plans are incomplete or too wordy, are difficult to keep up to date and display too much thinking inside of the box.

Almost equal in importance is personnel. The commitment, competence, experience, continuity, quality and numbers of people available to attend to emergencies are clear strengths in many operations. However, these strengths are countered in almost equal numbers by weaknesses. There is concern about high staff turnover, an ageing work-force, insufficient knowledge and an inability to maintain sufficient numbers – particularly on a 24/7 basis.

A number of operations believe that the effectiveness of the headquarters is a strength. This is characterised, among others, as establishing a strong culture, transference of best practice around a group and ownership shared at the group level. There are few weaknesses highlighted here except perhaps the function of the crisis control centres.

Like other categories, local involvement demonstrates both strengths and weaknesses, with weaknesses just outnumbering strengths. One operation maintains that community trust has been established while another believes there is no clear strategy regarding local people.

The weaknesses with testing and practice of emergency responses outnumber the strengths by more than two to one. Regular practice is seen as a strength in several operations. On the other hand, some maintain that there are not enough practices, that real situations are difficult to simulate and that there is too little attention to off-site emergencies. In one sense heartening in this category are the four references to lack of real emergencies to test the plans that have been made. But in another sense there are references to complacency and a lack of preparedness.

Several operations witness good visible support by managers, particularly corporately. There are no reported weaknesses in this category, which affirms the general commitment of the industry's leaders to responsible preparation for emergency management.

Three operations claim that training is their strength, whereas six say that training is a weakness. There are clear strengths in equipment and resources, with fewer weaknesses in these areas.

Among the strengths that do not fall into any particular category, the use of the company intranet is interesting, as is the improvement in travel safety resulting from the preparation for emergencies. The latter demonstrates the breadth of coverage given by some of these plans.

Analysis of plans and standards

Only a few examples of emergency plans were submitted in sufficient detail to enable some form of analysis to be made. They came in many guises and contained different and varying amounts of information. In this examination, specific references were looked for that related to how the community in surrounding areas to a plant was considered, involved, recognised or dealt with before, during and after emergencies. Because the data were limited, it is not possible to draw hard conclusions from the examination. On the evidence, however, despite one or two good responses there would appear still to be room for further attention to communities in preparation for, response to and management of emergencies.

Table A: Summary of results from the corporate section of the questionnaire

Annotated Question	Yes	No	No response
A1 Is a plan legally required in your jurisdiction?	8	2	2
A2 And is there an audit requirement?	3	7	2
B3 Is there a corporate policy/culture of EP?	9	3	-
B5 Is there a standard – (and a CCC)[a]?	9 (9)	2 (2)	1 (1)
B7 Have neighbouring risks been identified?	2	3	7
B8 Have other ER facilities been identified?	5	-	7
B9 Have gaps in response facilities been identified?	1	4	7
B10 Are there mobilisation guidelines?	5	-	7
B11 Is there an EP report to external stakeholders?	2	1	9
B12 Is the EP endorsed by local government?	-	6	6
C13 Who is involved in preparing the plan?		-	2
All or part of HSE	9		
Senior Managers	4		
C14 Is there back up?	8	1	3
C15 Was there external involvement in EP development?[b]	5	5	2
C16 Have support teams been identified/trained?	5	1	6
C17 Are key groups missing in development teams?	1	10	1
C18 Are there training programmes?	4	2	6
C19 Are these assessed?	3	3	6
C20 What procedures are there for educating the community in the EP?	2	2	8
C21 How is the EP communicated to the community?	3	1	8
D22 Is the plan reviewed annually and improved?	5	1	6
D23 Is the plan tested?	6	-	6
D23 Does the test involve external stakeholders?	3	3	6
D24 What are the mobilisation procedures for test?	-	-	-
D25 Is there a post-test report?	5	1	6
D25 Is it shared with stakeholders?[c]	3	3	6
D26 Has the EP been used for real?	4	1	7

[a] The words standard, plan or procedure have been taken to express some formality to the corporate engagement with Emergency Preparedness. CCC is Crisis Command Centre, although other acronyms have also been used.

[b] All external involvement was consultants with occasional use of other functions, such as law and media.

[c] Stakeholders are given as the corporate centre, insurers, emergency responders.

Table B: Summary of Operations' Responses to the Questionnaire

Annotated Question	Yes	No	No response
A1 Is a plan legally required in your jurisdiction?	27	4	-
A2 And is there an audit requirement?	14	17	-
B3 Is there a corporate policy/culture of EP?	27	3	1
B5 Is there a standard – (and a CCC)[a]?	26	2	3
B7 Have neighbouring risks been identified?	15	16	-
B8 Have other ER facilities been identified?	27	4	-
B9 Have gaps in response facilities been identified?	10	21	-
B10 Are there mobilisation guidelines?	26	5	-
B11 Is there a EP report to external stakeholders?	16	11	4
B12 Is the EP endorsed by local government?	7	24	-
C13 Who prepared the plan?			
HSE	23		
Senior Managers	15		
C14 Is there backup?	29	-	2
C15 Was there external involvement in EP development?[b]	20	11	
C16 Have support teams been identified/trained?	26	4	1
C17 Are key groups missing in development teams?	3	27	1
C18 Are there training programmes?	29	2	-
C19 Are these assessed?	23	6	2
C20 Are there procedures for educating the community in the EP?	14	17	-
C21 How is the EP communicated to the community?	14	16	1
D22 Is the plan reviewed annually and improved?	31	-	-
D23 Is the plan tested annually?	29	2	-
D23 Does the test involve external stakeholders?	9	21	1
D24 What are the mobilisation procedures for test?	-	-	-
D25 Is there a post-test report?	26	4	1
D25 Is it shared with stakeholders?[c]	14	16	1
D26 Has the EP been used for real?	28	3	

[a] The words standard, plan or procedure have been taken to express some formality to the corporate engagement with Emergency Preparedness. CCC is Crisis Command Centre, although other acronyms have also been used.

[b] In most cases, consultants are involved and in some local regulators, legal or local emergency response providers. In only one case is the local community involved.

[c] Stakeholders are given as the corporate centre, insurers, and emergency responders.

Table C: Strengths and Weaknesses in Categories

Category	Strengths	Weaknesses
Audits and reviews	4	1
Centre/operations relationship	9	3
Contractors	1	1
People	15	16
Plans, procedures and standards	16	10
Testing and practices	7	16
Training	3	6
Management involvement	6	0
Local involvement	7	9
Equipment	5	4
Internal emergency resources	7	0
Other	14	8

Appendix 5. Organisations That Responded to the Questionnaire

Company	Plant	Product	Location
Alcoa World Alumina	Port Comfort	Alumina	Texas, United States
	Portland Aluminium	Aluminium	Victoria, Australia
	Point Henry	Aluminium	Victoria, Australia
	San Ciprián	Aluminium	Spain
Anglo American Coal	Bank Colliery	Steam and Met Coal	Middleburg, South Africa
AA Base Metals	Codemin	Ferronickel Alloy	Rodovia, Brazil
AA Platinum	Rustenburg	Base and Precious Metals	Rustenburg, South Africa
AngloGold Ashanti	Tao Lekoa	Gold Mine	Orkney, South Africa
	Sunrise Dam	Gold Mine	Western Australia, Australia
	Morila	Gold Mine	Mali, West Africa
BHP-Billiton	Mount Arthur	Coal Mine	Hunter Valley, New South Wales, Australia
	La Escondida	Copper Mine	Antofagasta, Chile
	Worsley Alumina	Alumina	Western Australia, Australia
Mitsubishi Materials	Naoshima	Copper Smelter	Naoshima, Japan
	Onahama	Copper Smelter	Nagisa, Japan
Newmont Mining	Minera Yancocha	Copper Mine	Peru
	Golden Giant	Gold Mine	Ontario, Canada
Nippon Mining and Metals	Sagan-Oseki	Copper Smelter	Oita, Japan
	Hitachi	Copper Smelter	Ibaraki, Japan
Noranda/Falconbridge	Brunswick Mine	Lead/Zinc Mine	Bathurst, Canada
	Brunswick Smelter	Lead Smelter	Belledune, Canada

Company	Plant	Product	Location
Rio Tinto	Richards Bay	Mineral Sands	KwaZulu Natal, South Africa
Sumitomo Metal Mining	Hishikari	Gold Mine	Kagoshima, Japan
	Toyo	Copper Smelter	Ehime, Japan
	Harima	Zinc/Lead Smelter	Japan
Umicore	Olen	Copper Smelter	Olen, Belgium
	Pirdop	Precious Metals	Pirdop, Bulgaria
	Hoboken	Copper Smelter	Hoboken, Belgium
WMC	Monument Mine	Ammonium Phosphate	Queensland, Australia
	Olympic Dam	Uranium and Copper	South Australia, Australia
	Kwinana	Nickel Refinery	Western Australia, Australia

Acknowledgments

This report was prepared by Alan Emery. He is currently a private consultant, and was formerly Head of Health, Safety and Environment at Rio Tinto, and chaired the ICME-UNEP Liaison Committee which oversaw preparation of APELL for Mining (2001).

UNEP's Fritz Balkau co-ordinated their input before he retired in June 2005. We are very grateful for his contribution to this report and his ongoing counsel.

This project was overseen by a working group comprising Chris Anderson (Newmont), Joe Norton (Alcoa), Dave Rodier (Falconbridge) and Andrew Parsons (ICMM), under ICMM's Community and Social Development Task Force chaired by Ian Wood (BHP Billiton). We appreciate their guidance and support and the many hours they put into reviewing drafts.

It is important that management guidance be based on real experience. We thank the many contributors and authors who provided factual input for incorporation into this report.

References

1. World Information Service on Energy, Uranium Project, Chronology of major tailings dam failures (from 1960) http://www.wiseuranium.org/mdaf.html
2. BHP Billiton, Crisis & Emergency Management Organisation, Asset Protection Guideline No. G16, 1 July 2002.
3. ICOLD/UNEP Bulletin, Tailings Dams: Risks of Dangerous Occurrences. Lessons Learnt from Practical Experiences, 2001; OECD, OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response. 2003, http://www2.oecd.org/guidingprinciples/index.asp
4. BHP Billiton HSEC Management Standards, Issue No. 2, 13 December 2002.
5. International Finance Corporation, Investigation into the Mercury Spill of June 2, 2000 in the Vicinity of San Juan, Choropampa and Magdalena, Peru, Report of the Independent Commission to the Office of Compliance Advisor/Ombudsman of the International Finance Corporation and the Multilateral Investment Guarantee Agency, 2000.
6. Box 2 is an extract from an article written by S Botts of Minera Antmina and published in the Kobe Times, which can be found in full at http://www.environmenttimes.net/article.cfm?pageID=149.
7. A. Entwistle, E. O'Keefe and M. Nazari, Developing the Community and Business Forum in Kyrgyzstan: A Case Study of Cross-Sectoral Dialogue in the Mining Industry, Fauna and Flora International and The European Bank for Reconstruction and Development, April 2002.
8. The Mining Association of Canada, Guidelines for Corporate Crisis Management Planning. 2004 http://www.mining.ca/english/tsm/crisisguide-eng.pdf.
9. International Council on Mining and Metals, Sustainable Development Principles. 2003 http://www.icmm.com/icmm_principles.php.
10. The Mining Association of Canada, Environmental Policy.1995. http://www.mining.ca/english/initiatives/environm.html
11. Canadian Chemical Producers Association, Responsible Care ® 2004. http://www.ccpa.ca/responsiblecare
12. International Cyanide Management Code for the Gold Mining Industry. 2003. http://www.cyanidecode.org.
13. OECD, OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response. 2003.
14. European Seveso II Directive [03/XX/E C], April 2003.
15. International Organization for Standardisation, Environmental Management System. EN ISO 14001:2004.
16. Global Reporting Initiative, Mining and Metals Sector Supplement (2005) http://www.globalreporting.org/guidelines/sectors/Mining_Pilot1.pdf
17. ICOLD/UNEP Bulletin, Tailings Dams: Risks of Dangerous Occurrences. Lessons Learnt from Practical Experiences, 2001.
18. Breaking New Ground: The Report of the Mining, Minerals and Sustainable Development Project, Earthscan Publications Limited, 2002 pp 240-241.
19. Mining Environmental Management, September 2003.

Photo credits

Front cover photos courtesy of: New Boliden, AngloGold Ashanti Limited, Antamina, Anglo American, and Umicore. Clockwise from top left: Tailings dam failure, Spain; Meeting with Sanso Sous Prefet, Mayor and delegates, Mali; Tailings pipeline failure, Mali; Alcohol test, Peru; Scaw's old waste disposal site, South Africa; Emergency services simulation and review, Belgium.

p. 31 Hazardous materials trucks travel in convoy, Antamina
p. 36 Noranda pile-up, Noranda
p. 42 Tailings dam failure, New Boliden
p. 45 Tailings pipeline failure, AngloGold Ashanti Limited
p. 48 Umicore plant location, Umicore

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the International Council on Mining and Metals or the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the International Council on Mining and Metals or the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

Published by International Council on Mining and Metals (ICMM), London, UK and United Nations Environment Programme

© 2005 International Council on Mining and Metals and United Nations Environment Programme

Reproduction of this publication for educational or other non-commercial purposes is authorised without prior written permission from ICMM and UNEP provided the source is fully acknowledged. Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission from ICMM and UNEP.

International Council on Mining and Metals and United Nations Environment Programme (2005). Good practice in emergency preparedness and response

ISBN: 0-9549954-2-2

Edited by: Linda Starke
Design: ICMM and Magenta
Print: Print+

Available from: ICMM, www.icmm.com, info@icmm.com and United Nations Environment Programme

This book is printed on Challenger Offset 120gsm and 250gsm paper. A great proportion of the raw material used is the by-product from other processes i.e. saw mill waste and waste which results from forest thinning. The mill holds not only ISO 2002 but also ISO 14001 accreditation for their environmental management systems, which include an active policy on sustainable forestry management.

UNEP – United Nations Environment Programme

The United Nations Environment Programme Division for Technology, Industry and Economics (UNEP DTIE) encourages decision makers in Governments, local authorities, industry and civil society to develop and implement policies, strategies and practices that are cleaner, safer, make more efficient use of natural resources, reduce pollution and risks for humans and the environment. UNEP DTIE works in partnership with other international organisations, governmental authorities, business and industry, and non-governmental organisations to build capacity in developing countries and to support implementation of conventions.

Division of Technology, Industry and Economics (DTIE), United Nations Environment Programme (UNEP)

Tour Mirabeau
39-43, quai André Citroën,
75739 Paris, Cedex 15, France

Tel: +33 1 44 37 14 40
Fax: +33 1 44 37 14 74

Email: unep.tie@unep.fr
Web: www.uneptie.org

ICMM – International Council on Mining and Metals

The International Council on Mining and Metals (ICMM) is a CEO-led organisation dedicated to sustainable development. ICMM comprises many of the world's leading mining and metals companies as well as regional, national and commodity associations, all of which are committed to improving their sustainable development performance and to the responsible production of the mineral and metal resources society needs.

ICMM's vision is a viable mining, minerals and metals industry that is widely recognised as essential for modern living and a key contributor to sustainable development.

As part of its commitment to improving industry performance, ICMM hosts an online library at www.goodpracticemining.org where you can find more case studies and other key materials exemplifying leading sustainable development practices globally.

19 Stratford Place
London W1C 1BQ
United Kingdom

Tel: +44 (0) 20 7290 4920
Fax: +44 (0) 20 7290 4921

Email: info@icmm.com
Web: www.icmm.com

Reference: 03-05