



United Nations Environment Programme
Industry and Environment

UNEP IE

Management of Industrial Accident Prevention and Preparedness



A Training Resource Package

UNEP

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First Edition • June 1996



UNEP

**UNITED NATIONS ENVIRONMENT PROGRAMME
INDUSTRY AND ENVIRONMENT**

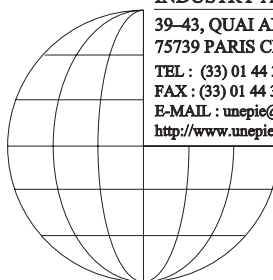
39-43, QUAI ANDRE CITROEN
75739 PARIS CEDEX 15 - FRANCE

TEL : (33) 01 44 37 14 50

FAX : (33) 01 44 37 14 74

E-MAIL : unepie@unep.fr

<http://www.unepie.org/home.html>





Management of Industrial Accident Prevention and Preparedness

A Training Resource Package

This package is one of a series that provides practical support material to teachers and trainers wishing to commence or enrich their curriculum with up-to-date approaches in environmental management.

It is based on extended experience with training workshops by UNEP and other agencies, and is now being made available for wider use in all regions throughout the world.

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Evaluation Form

Management of Industrial Accident Prevention and Preparedness

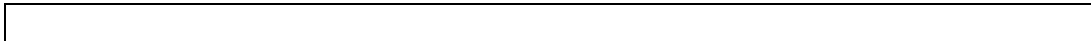
As part of the continuing review of this trainers package, we would appreciate your cooperation in answering the following questions. Please return the completed evaluation form to:

UNEP IE, Tour Mirabeau, 39-43 quai André Citroën, 75739 Paris Cedex 15, France
Fax 33 (1) 44 37 14 74.

- 1 Do you have any suggestions for improvement of the trainers package? How could we improve its readability, contents, practical use, and so on?

- 2 How was the package useful in preparing your own training activity?

- 3 Did the background information and the transparency set in *Parts 3, 4 and 5* provide you with enough information? What was missing?



continued ...

4 What resource information was useful to you? What else should be included?

5 What are your experiences with the exercises in *Part 6*? What worked, and what didn't?

6 Do you have training material which could be incorporated into this workbook?

7 What additional topics related to cleaner production would you want to be included in the final version of this workbook?

*Thank you for taking the time to complete this evaluation form. Please return the completed form to
UNEP IE, Tour Mirabeau, 39-43 quai André Citroën, 75739 Paris Cedex 15, France.*

Users Guide

This is a trainers support package, *not* a reference book. It does not give a systematic, comprehensive overview (there is not enough room to do this); rather, it focuses on some selected aspects that are central to the subject. The structure of the document allows further sections to be easily developed and added as additional modules.

The package is written for trainers to provide them with support material and ideas, rather than as a study book for students. The average trainee will only ever see a few pages or exercises reproduced from this document.

One of the purposes of this package is to provide some case studies and situation scenarios that can be used as a basis for interactive training and simulated decision-making. However, the exercises only explore a small part of the potential of the case studies, and trainers are strongly encouraged to develop further exercises or tasks.

The package is oriented at developing insights and decision-making skills. For teaching the factual knowledge base of the subject, trainers are referred to the reading lists in the bibliography.

Work exercises are predominantly based on interactive groupwork and a team approach to

problem-solving. Such work needs to be guided by a tutor who is a recognized expert in the field. This method allows the full complexity of real decision-making to be explored.

Where calculations are required, the exercises are more oriented towards throwing light on useful approaches or management decisions than simply finding the 'correct' answer. Trainers are strongly urged not to see this package merely as a set of arithmetic exercises.

In some instances, answers are indicated. The 'correct' answer depends on the context of the question. It is here that a tutor or external resource expert is useful.

Many trainers find this disturbing. They should remember that real decision-making depends on the wider circumstances surrounding the problem, and that a numerical answer which is politically or socially unacceptable, or administratively unworkable (even though accurate), is not in effect 'correct'.

The simulation of real life situations and decision-making that is the basis of this package makes it most suitable for senior students and trainees, and especially for professional training (or retraining) courses.

Finally, we must stress again that this package does not cover all aspects of the subject. Its prime purpose is to lead trainers into this field, and to help and encourage them to develop their own material, appropriately tailored to their specific learning situation. UNEP is prepared to work further with trainers who wish to extend this package into new directions, or go into greater depths on some subjects.

How to start a training activity based on this package

1 *Remember that this is a starters kit*, not a complete recipe book. Remember also that the workbook aims to develop insights and decision-making skills, not to convey knowledge or facts.

2 *Understand the needs of your trainees.* What insights or skills do you intend to develop? Define your learning objectives.

3 *Refresh your memory* by reading some of the background papers and studying the overhead transparencies. Write your own notes in the spaces provided.

4 *Identify some expert resource persons* who could be invited as tutors to help you in discussion sessions.

5 *Select some of the exercises* you wish to present to trainees.

6 *Examine carefully the case study or scenario* on which they are based. Be sure that you have at least one solution to the exercise that you can explain and defend.

7 *Develop other exercises* or questions yourself.

8 *Develop your own local case study* if you can, and use this instead of the one in the package.

9 *Prepare some background questions* and preliminary exercises for trainers to carry out before they start the workshop/course.

10 *In session, summarize the issues* for trainees using the overheads given, and others you may have. Discuss the problems and difficulties decision-makers face. Discuss where factual information can be found to help in decision-making.

11 *Commence the work sessions*, preferably in small groups, and preferably guided by a tutor. Discuss and compare results. Be open to ideas and experiences from trainees, and discuss these.

12 *Return to the learning objectives*, and check that they have been achieved.

13 *Consider how to follow up* and reinforce the learning experience by establishing some ongoing projects, or periodic reunions.

Refer also to other packages and workbooks, where useful additional teaching material is found.

To facilitate using this package, the header of odd-numbered pages describes the contents of that particular section. This information is also repeated in the footer of even-numbered pages. You can track your progress through the package by referring to the calibrations on the bar across the bottom of odd-numbered pages:



The shading shows your current position in the text.



Part 1

Introduction

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Introduction

Many teaching institutions and individual trainers have difficulty in following the rapid evolution of environmental issues that are relevant to their courses.

This is particularly true when teaching subjects such as pollution and environmental management. And yet it is important that new graduates have a good knowledge of issues in which they may eventually provide consulting services or policy advice to governments and industry.

The fact that development and environment are interrelated means that it is more vital than ever that:

- *all professionals have a basic environmental literacy that helps them to incorporate environmental priorities into their specialized work, whatever their profession;*
- *specialized environmental courses are relevant to today's environmental agenda.*

In 1993, in response to these findings, UNEP, WHO, and ILO jointly initiated the programme on Training Approaches for Environmental Management in Industry. The programme aims to enhance the capacity of national institutions to offer local training on topics concerned with the prevention of industrial pollution.

In this context, trainers' packages have been prepared on different areas of environmental management. These packages are intended to help educators and trainers to develop their own workshops or curricula, or to integrate some of the ideas and information into already existing teaching programmes.

It is important to keep in mind that these training resource packages merely provide a first orientation to the topic.

In no way does the package constitute a 'course' in its own right.

This package

This package focuses on the situation of industrial risk, especially to neighbouring communities. It builds on and supports the UNEP programme on *Awareness and Preparedness for Emergencies at the Local Level (APELL)*. However, it can also be used as a free-standing trainers package.

Because industrial risk and emergency preparedness is a big subject, only selected issues have been able to be included here. The case

studies and scenarios in the package are, however, able to support training exercises on many other issues that may be added later.

The package is not static.

As feedback is received from users and technical specialists, the material will be modified and enriched.

Users are encouraged to report on their experiences in using this package, and to send in *suggestions for improvements*.

Contents of this package

This package is conceived principally to help trainers prepare a seminar, workshop, or extended course. It is not a course per se.

The package contains:

- suggestions and hints for *effective training*;
- a *short background* to the subject, drawn from other existing publications;
- *overhead transparencies* to introduce and illustrate the main ideas;
- *case studies* and situation reports and scenarios drawn from actual experience;

- supplementary *technical information* to support some work exercises;
- *work exercises* and questions;
- *appendices* with further information about UNEP and its programmes.

Trainers are encouraged to extend the package by adding their own case studies and exercises, and expanding the subject coverage into new topics. For example, trainers in environmental health may wish to add some modules on occupational safety and ecotoxicity by building on the chemical information already presented.

An introduction to the package

Recent accidents around the world have highlighted the potential hazards inherent in many industrial operations. Many accidents, both large and small, are preventable. For accidents that do occur, much can be done to reduce the seriousness of the consequences. In particular, potential victims of large-scale accidents can be informed of the best way to act if an accident should occur so as to minimize the risks to themselves and to property.

APELL is an effective tool to either prevent or to reduce the seriousness of the consequences of accidents. APELL stands for *Awareness and Preparedness for Emergencies at the Local Level*. It is not a risk reduction program per se, although effective hazards communication often stimulates industry to take action to reduce further the degree of hazard. APELL mainly is a hazard communication process which leads to collective action to take preparative measures.

Comprehensive management of field programmes for accident prevention and preparedness depends on systematic integration of technical, administrative, legal and infrastructure considerations.

In addition to this, it is very important to realize that effective public communication at an early

stage is a prerequisite to effective accident preparedness. Indeed, an informed community is the one best defended against risk!

The *APELL Seminar Workshop* is a regular UNEP activity. The workshop is aimed at informing local communities so that they are able to start and lead an APELL process themselves. Effective hazard evaluation, being an essential part of the awareness and preparation process, can be done by local interested parties if they know where to find information and how to interpret it. UNEP has published a short manual on this evaluation process, and national procedures are also available in some countries.

This training resource package is designed to introduce the concepts and methodologies of APELL to professionals who may one day need to participate in it. As the APELL process involves professionals in many sectors of activity as well as members of the public, a better understanding of APELL by professionals is important. The package can be used by non-specialized trainers for the preparation of a short presentation or a workshop about the APELL programme and hazard identification, or to develop a curriculum about APELL and hazard identification for undergraduate students.

Some noteworthy accidents

In order to illustrate the application of the APELL Process, a table of major technological accidents is shown below.

As well as headline nuclear incidents, there are many shocking '*petrochemical headlines*'. Indeed, the list of headline accidents below has led to advances in legislation, and is selected from 180 severe industrial accidents which occurred between 1970 and 1990. Caused mainly

by fires, explosion and escapes of toxic gas, they have killed about 8 000 people, injured more than 200 000, and led to hundreds of evacuations involving thousands of people all around the world.

It should be noted that the APELL process is equally applicable, with suitable modifications, to smaller industrial installations and non-industrial hazards.

Year	Place	Product	Deaths	Injury	Evacuated
1966	Feyzin, France	LPG	17	–	–
1974	Flixborough, UK	Hexane	28	104	3 000
1976	Seveso, Italy	Dioxine	–	200	730
1978	Los Alfaques, Spain	Propylene	216	200	–
1979	Three Mile Island	Nuclear	–	–	200 000
	Mississauga, Canada	Chlorine	–	–	220 000
1984	Bhopal, India	Isocyanate	2 800	50 000	200 000
	Mexico City, Mexico	LPG	500	2 500	200 000
1986	Basel, Switzerland	Insecticide	Pollution across borders		
	Chernobyl, USSR	Nuclear	31?	299	135 000
1987	Pampa, USA	Butane	31	–	–
1988	Piper Alpha, North Sea	Oil Rig	167	–	–
	Tours, France	Chemicals	Pollution	3	200 000
1989	Ufa, USSR	Gas pipe	575	623	–
	Pasadena, USA	Ethylene	23	125	1 300
1990	Sydney, Australia	LPG	–	–	10 000

Source: OECD Selected List



Part 2

Organizing Effective Training Activities

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Organizing Effective Training Activities

Introduction

Communication and organizational skills are just as important as a technical appreciation of the subject. Professional educators already understand this point, but teaching is a very individual matter, and interactive teaching can be very demanding on a busy person.

Here, we recall some of the key aspects of the learning process.

This text contains suggestions about:

- *how to ensure maximum effectiveness as a trainer*
- *how to organize effective training activities and presentations.*

We have provided this advice before consideration of the technical material, so that readers can remind themselves of the importance of the advice when choosing work exercises and training projects, later in this package.

Adults learn best when they are actively engaged. They remember 20% of what they hear, 40% of what they see, and 80% of what they discover for themselves.

Accordingly, this package relies on interactive teaching methods, using working exercises, case studies, and groupwork problem-solving, rather than on lecture format.

Interactive techniques are more complex to organize than simple lecture-giving, but they give better results. In particular, interactive methods are more likely to provide students with practical skills. This is important where skill development rather than factual knowledge is the objective. Lectures are better at providing factual knowledge than at developing skills.

For example, a workshop format is very effective in providing training on the effective use of management tools such as *Environmental Impact Assessment* (EIA), or audits. For high level environmental management, both knowledge and skills are required, so the appropriate mixture of techniques should be used.

The notes in this Part are based on the experiences of UNEP IE and WHO in organizing workshops and other training sessions.

Personal advice on how to be an effective trainer is also given by several experienced trainers, who all use interactive training approaches.

Notes on interactive workshop organization

Workshops

Workshops provide a stimulating learning environment where people with a wide range of experiences and skills can join together to address practical problems beyond the ability of an individual to resolve.

Interactive workshops use a combination of several techniques to bring about a deeper and more pragmatic learning experience than is possible with a lecture-style format.

Workshops also provide excellent opportunities for exchanging personal experiences, problem-solving through panel sessions and direct consultations with experts, and discussing some of the complex situations which surround most environmental problems.

The UNEP/WHO workshop format incorporates the following elements:

- sending out pre-workshop reading material, with some simple exercises

- preparation of a country report by each participant before the workshop
- short introductory or overview lectures on key issues
- practical problem-solving work exercises on case studies
- feedback by experts and discussions on workshop exercises
- panel sessions (that is, question-answer dialogues) with experts
- individual study sessions, computer quizzes, and so on.
- structured oral presentations of country reports leading to a regional overview
- audiovisuals such as videos, films, and slides
- field visits where appropriate
- personal action planning by participants for follow-up activity.

Preparation

Sessions need to be carefully prepared, with participants knowing in advance what they will do or see. A proforma report form for country reports gives a common format to these sessions. Country reports should also try to link the issues with other sessions.

It cannot be overstressed how important it is that participants should be thoroughly prepared for the workshops, and that all the pre-workshop activities have been completed.

Organization

The organization of working group sessions also requires care. Groups should first meet informally, elect their own chairman, and then act as a permanent team in various workshop sessions. They are guided, but not instructed, by technical experts.

It is useful to finish the workshop by preparing personal action plans. Participants should develop and present their proposals for what they can initiate immediately on their return home. Such action includes:

- what they can achieve unassisted, *and*

- what else they could achieve if some assistance were available.

The role of resource experts as advisors is crucial. They should have sufficient experience to assist in all sessions and provide general advice on all subjects in workshops, discussion or panel sessions. They should not, however, dominate the workshops.

The five day format is ideal for covering all these requirements. If less than five days is taken, you can be sure that important issues will be left out. If more time is available, consider including social events and private study sessions, along

with more extensive project work for the students.

Some ideas for more effective communication

If the training is to be successful, effective communication is essential – from recognition of the training need to the final evaluation of the event.

Without good communication, all manner of things can go wrong:

- the training is too early – or too late – to make any impact on performance
- trainees do not know what the training is about or what to expect
- the course is planned for a local public holiday

- trainees who are traditionally used to lectures are suddenly required to take part in discussion groups, which might feel alien to them.

Most of these issues can be anticipated and overcome by good communication between the course designers, writers, and event organizers and presenters on the one side, and the students and their organizations on the other.

Some simple communication considerations will help to improve outputs in training and avoid disasters.

Before the learning event

Find out:

- how the learners have been taught in the past
- the real needs and situation of the learners
- whether the facilities are adequate for the envisaged training
- whether the training has the support of senior people
- how success will be measured.

Make a project plan for the organizers, giving details of how the event will be organized. Send the plan to them, with details of the key dates and needs.

During the learning

- find out how relevant the topics are to the work situation of the participants
- start with the familiar oil can – not a video of an oil spill disaster
- communicate using topics, themes and issues in the local press
- store unanswered questions, and remember to answer them before the end
- keep notes for participants to bullet-point format
- ensure the participants keep notes for future reference – few read essays, or even articles
- if you are working in a foreign language, at least translate the slides.

After the learning event

- always communicate your thanks and best wishes
- inform participants on follow-up study procedures, and how the instructor can help to analyze the evaluations and inform the organizers of the results
- communicate to colleagues the results of the training and what can be learned from these results.

Some personal suggestions for effective training

The following suggestions come from four teachers with long experience in training. They are all different in character, and therefore in teaching approaches. However, they all believe in an enthusiasm for the subject which is critical when teaching students.

To be an effective educator/teacher:

- Provide an enjoyable learning situation that expands all of the participants' network.
- Model courses and teaching styles on examples that you think are outstanding. Ask yourself about the qualities of a good instructor or a good course, and follow the answers you come up with.
- Allow the subject matter to be discussed and discovered by students – not hammered in.
- Make courses relevant and interesting by understanding your audience. Ask them what they already know, and then plan for their needs. Incorporate ideas from the group in the course.
- Remember that no amount of style will substitute for a lack of substance.

Deborah Hanlon, Environmental Scientist
Office of Environmental Engineering
and Technology Demonstration, US EPA

The outstanding educator/teacher:

- Is fully acquainted with, and believes in, the educational merit of the subject matter.
- Utilizes clear and graphic illustrations to inform and motivate the students to learn.
- Utilizes learning approaches including multi-media, projects, interviews, questionnaires, debates, and similar interactive approaches to ensure full involvement of the students.
- Reacts positively to all questions – there are no Stupid Questions, only Stupid Answers.
- Remembers that positive reinforcement is a better motivational approach than criticism.
- Is available for private discussions with individual students or groups of students.

Don Huisigh, Environmental Consultant and Professor at
Erasmus University in Rotterdam
the Netherlands

To be efficient ('doing things right'), and effective ('doing the right things'):

- Think about helping people to learn, rather than teaching them.
- Seek learner feedback, and measure learning achieved with objective tests.
- Set learning time limits.
- Seek conscious and unconscious learning.
- Seek learning that endures, based on understanding and skills.

Bob Boland, Environmental Consultant, France

The best educator/teacher:

- Likes the learners, and has a true understanding of how they learn.
- Has the ability to communicate.
- Will change the training programme and the approach if necessary.
- Is still learning, and has recent applied experience of the subject being taught.
- Has the ability to organise events and to manage things.

Colin Sutherland, Educational Consultant, France

Resource persons guide

As this package relies heavily on interactive groupwork sessions, here are some guidelines on how to be an effective resource person.

In a case study-based training approach, the resource person serves more as a:

- facilitator of the group learning process
- technical adviser as needed,

and a

- catalyst of learning

rather than a:

- lecturer
- story-teller

or

•

instructor.

Here are some guidelines on how to be an effective resource person.

1 Be sure that you have ***read and understood thoroughly*** the participant's notes before you meet your group. There's nothing like being prepared and more familiar with the case study scenario than the participants are!

2 Before every group work session, take time to visit your assigned meeting room and check the:

- ***seating arrangements*** There should be a large enough table surrounded by enough chairs for the participants and yourself
- ***equipment and supplies*** such as flipcharts, flipchart papers, marker pens, white/black board, board eraser, masking tape, transparency sheets, writing pads, ballpen/pencils, calculator, etc.
- ***physical conditions of the room*** There should be sufficient lighting, the room temperature should be comfortable, noise should be as low as possible, etc.

3 During the initial group meeting, it is important to set an ***informal and friendly atmosphere***. It is suggested that you:

- ***introduce yourself***, preferably asking everyone to call you by your first name, and then let everybody introduce himself/herself in a

similar manner. *Do not waste time stating positions and respective organizations, etc.*, which should have been done on the first day anyway.

- then ask if the ***objectives and purpose*** of the exercise, which have been previously discussed in the plenary session, are clear to them.

Sample objectives are:

- identify and understand the options that SMEs can employ in their pollution prevention program
- evaluate the feasibility and suitability of these options in view of technical, environmental, financial, organizational, and social criteria and constraints.

It will be useful to know whether the majority of the group members have actually read the text provided, which states the background and the problem.

If they have not, then you will need to direct them to focus their attention first on what needs to be accomplished by the end of each part.

4 If your group gets involved in diverse issues, try to steer them back on the right track by ***asking relevant questions***, rather than telling them what to do.

5 Give *technical assistance and supplementary information* as needed, without ‘spoon-feeding’ the participants. However, do not lecture or dominate the group discussion process.

6 Although you need not stay with your group for 100% of the time, it is expected that you:

- *spend at least 80% of the time* with them during regular sessions. The crucial times are at the *beginning, middle*, and near the *end* of each groupwork session.

- If they decide to work beyond the prescribed regular time, just make sure that they are on the right track; your presence during overtime is not mandatory, but voluntary.

7 There will be *critical parts* during the identification of options, followed by technical, environmental, and economic evaluation, where your technical advice will be most needed by your group.

The best way to assist the participants is by giving only the advantages and disadvantages of the options in question. Let them weigh these pros and cons and decide for themselves whether to take or drop the option.

8 If you encounter any question about the technical content of the material that you have not been briefed on, discuss it with the Team Leader and *agree on how to tackle the situation*. It may well be that the other resource

persons need to be duly advised on the particular question.

9 See to it that you *compare notes, exchange hints*, and *share strategies* with other resource persons so that you can assist one another, as well as gauge your group’s progress in comparison with the others.

10 If tension or heated argument arises among your group members, try your best (with a sense of humor) to *defuse* it.

11 In the case of *absenteeism*, approach the person/persons in question and encourage them to participate.

12 If one or two group members are dominating the discussions or doing all the work, intervene and *encourage everyone to get involved*. In order to do this effectively, you need to be attuned to your group’s ‘culture’ and trend of discussion.

13 Although *division of labor* is a time saving group work strategy, you must ensure that it is not done to the extent that there is no peer learning and discussion occurring. It is counter-productive for group members to work individually on these exercises.

14 The most productive, meaningful and fulfilling group work is when they get to accomplish what they have to do *as a team* – and have fun in the process!

Suggestions for self study

Although this package was designed to provide resources for trainers, the potential for self-study should not be ignored.

The package does not constitute a complete course on cleaner production in leather tanning, but can be seen as an introduction to be supplemented by further reading and additional training materials listed in the Appendices, and perhaps by site visits and discussions with professionals.

The following approach is suggested for individual study.

- Read the *introduction*, but avoid any sections on organizing training events.
- Seek out the section containing *background papers* or *subject content*. Read through the whole section as narrative.
- Work through the pages offered to the trainer for *overhead projection*, and ensure you can relate the key points of each overhead to the text you have read.
- Look at the section on *exercises*. Identify those which lend themselves to individual work, and tackle them. Those exercises clearly constructed for teamwork, or requiring research, may not be appropriate.
- Refer back to the *narrative* text as and when you need to, to complete the exercises.
- Check your *answers* against those given in this resource pack. Where there are discrepancies, check through your own working to understand why the discrepancies appeared.
- Use the *Appendices* to plan your own further development.



Part 3

Selected Notes on Accident Prevention and Preparedness

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Selected Notes on Accident Prevention and Preparedness

Introduction

This part contains a set of background papers which help you understand why accident prevention and preparedness programmes have to be developed, describing some of the major industrial accidents which have happened in recent years. It also describes what safety means and how hazards in a local community can be identified and evaluated. Finally, it discusses the international response to these accidents and how the APELL programme plays an important role in such response.

This introduction is adapted from *Saving our Planet: Challenges and Hopes UNEP 1972 (Stockholm) to 1992 (Rio)*.

Between 1970 and 1990, about 180 severe industrial accidents occurred worldwide, leading to the release of various chemical compounds into the environment.

These accidents were mainly caused by fires, explosions or collision during transport, and killed about 8 000 people, injured more than 20 000, and led to hundreds of evacuations involving hundreds of thousands of people.

Severe industrial accidents appear to be becoming more common. During 1974-78, there were five major accidents (accidents resulting in at least 100 deaths, 400 injured or 35 000 people evacuated). During 1984-88, there were 16 major accidents.

As long as strict safeguards and standards are not implemented, and as long as industrial installations are located near to dense population centres, serious consequences from major accidents are likely to increase, particularly in developing countries.

The massive explosion at the liquefied petroleum gas storage facility in the crowded San

Juanico neighbourhood of Mexico City in November 1984 killed 452 people, injured 4 248 and displaced 31 000. The blast illustrated the precarious nature of a city where many of the 17 million inhabitants live cheek by jowl with a variety of potentially dangerous installations. The Bhopal accident is another example; most of the Bhopal victims lived in squatter settlements near the plant where the accident occurred.

In order to alert communities to industrial hazards and to help them to develop emergency response plans, in 1988 UNEP launched the *Awareness and Preparedness for Emergencies at Local Level* (APELL) programme. This programme helps countries through the dissemination of information, training, and assistance in case of an emergency. The ILO has recently issued a code of practice to provide guidance in setting up an administrative, legal and technical system for the control of major hazard installations. The Basel accident has made it clear that industrial accidents can have harmful transboundary impacts. This has prompted the Economic Commission for Europe to begin work on formulating a regional convention on the transboundary impacts of industrial accidents.

A number of administrative and technical steps have also been taken. One example is the European Economic Community's directive on the major hazards of certain industrial activities (the 'Seveso' directive). The directive obliges manufacturers within the Community to identify potential danger areas in the manufacturing process and to take all necessary measures to prevent major accidents as well as to limit their consequences – should they occur – for man and the environment.

Three chemical accidents that made headline news (1970-1990)

Seveso

On 10 July 1976, an explosion at the ICMESA chemical factory in the north Italian town of Seveso released a cloud of chemicals into the atmosphere contaminating the surrounding area.

The chemicals contained 2kg of dioxin, a potentially toxic compound. The cause of the accident is believed to be a 'runaway reaction' in the reactor producing sodium trichlorophenolate, a main product.

There were no deaths, but 200 people suffered slight injuries. The main victims were domestic animals. Contamination of the land affected some 37 000 people.

Restrictions were imposed for six years on an area of 1 800 hectares. The worst affected area covered 110 ha.

The estimated direct costs of the accident are about US\$ 250 million.

Bhopal

On the night of 2-3 December 1984, a sudden release of about 30 tonnes of methyl isocyanate (MIC) occurred at the Union Carbide pesticide plant at Bhopal, India. The accident was a result of poor safety management practices, poor early warning systems, and the lack of community preparedness.

The accident led to the death of over 2 800 people living in the vicinity and caused respiratory damage and eye damage to over 20 000 others. At least 200 000 people fled Bhopal during the week after the accident. Estimates of the damage vary widely between US\$350 million to as high as US\$3 billion.

Basel

On 1 November 1986, a fire broke out at a Sandoz storehouse near Basel, Switzerland. The storehouse contained about 1 300 tonnes of at least 90 different chemicals. The majority of these chemicals were destroyed in the fire, but large quantities were introduced into the atmosphere, into the Rhine River through runoff of fire-fighting water (about 10 000 to 15 000 cubic metres), and into the soil and groundwater at the site. The exact mass of

chemicals entering the Rhine has been estimated at somewhere between 13 and 30 tonnes.

Following the accident, the biota in the Rhine was heavily damaged for several hundred kilometres. Most strongly affected were the benthic organisms and the eels, which were completely eradicated for a distance of about 400 km (an estimated 220 tonnes of eels were killed). Several compounds were detected in the sediments of the Rhine after the accident.

Table 0.1 Selected examples of major accidents in various countries: 1970-1989*Sources: OECD statistics; Swiss Reinsurance Company*

Year	Place	Cause	Product	Deaths	Injured	Evacuated
1970	Osaka, Japan	Explosion	Gas	92	–	–
1973	Fort Wayne, USA	Rail accident	Vinyl-chloride	0	0	4 500
	Market Tree	Rail accident	LPG	0	0	2 500
	Greensburg	Rail accident	Chlorine	0	0	2 500
1974	Flixborough, UK	Explosion	Cyclohexane	23	104	3 000
	Decatur, USA	Rail accident	Isobutane	7	152	–
1975	Beek, Holland	Explosion	Ethylene	14	1 071	–
	Heimstetten, Germany	Warehouse	Nitrogen	0	0	10 000
1976	Houston, USA	Silo explosion	Wheat	7	0	10 000
	Lapua, Finland	Explosion	Explosives	43	–	–
	Seveso, Italy	Leakage	Dioxin	0	193	730
1978	Los Alfaques, Spain	Road accident	Propylene	216	200	–
1979	Bremen, Germany	Mill explosion	Flour	14	27	–
	Mississauga, Canada	Rail accident	Chlorine/Butane	0	0	200 000
1980	Mandir Asad, India	Industrial accident	Explosives	50	–	–
	Barking, USA	Industrial fire	Cyanide/Sodium	0	12	–
1981	Tocaoa, Venezuela	Explosion	Oil	145	1 000	–
1984	Sao Paulo, Brazil	Pipeline explosion	Petrol	508	–	–
	Bhopal, India	Leakage	MIC	>2 500	>10 000	>300 000
	San Juanico, Mexico	Explosive BLEVE	LPG	600	7 000	–
1986	Chernobyl, USSR	Nuclear accident		direct: 31	500	112 000
	Basel, Switzerland	Warehouse fire		caused severe environmental damage to Rhine		
1987	Harbin, PR of China	Explosion in a flax factory		49	–	–
	Djakakarta, Indonesia	Fire in textile factory		30	–	–
	Pampa, USA	Explosion in a chemical plant		31	severe damage	
	London	Fire in underground station		30	–	–
1988	Paris, France	Train collision in a railway station		59	–	–
	North Sea	Piper Alpha platform		166	–	–
1989	Near Ufa, USSR	Gas leaking out of pipeline exploded because of sparks from two trains		645	–	–
	Pasadena, USA	Gas cloud explosion in a petrochemical plant		23	–	–
	Alaska, USA	EXXON Valdez lost about 40 million litres of crude			cost at least us\$ 2bn	

oil

Table 0.2 Selected examples of smaller accidents at the local level

*Source: Environmental Protection Authority of Victoria, Australia;
Annual Report 1987-1988*

Date of incident	Location	Brief incident report	
1987	July 2	Footscray	Chemical spill from a factory
	3	Melbourne	Gas leak in central business district
	20	Melbourne	Petrol spill in a building
	23	Shepparton	Petrol spill from storage tank
	24	Sunbury	Fire at a dry cleaners
		Boronia	Chemical spill from truck accident
	29	Broadmeadows	Ammonia discharge from factory
	31	Williamstown	Petrol spill from a bowser at a service station
		Williamstown	Petrol spill from overfilling a tank
	August 1	Boronia	Chemical spill in a factory
	2	Ballarat	Diesel spill from truck accident
		Kew	Kerosene spill
	4	Tullamarine	Radioactive spill at airport
	6	Wantima	Petrol spill due to overfilling of tank
31	Geelong	Chemical spill from truck accident	
September	9	Melbourne	Diesel spill in a factory
	10	Port Melbourne	Petrol spill
		Greensborough	Petrol leak from underground tank
	14	Cranbourne	Petrol leak from underground tank
	17	West Footscray	Chemical spill from storage tank
	24	Shepparton	Oil spill from truck accident
	30	North Geelong	Oil leak from transformer
October	1	Fairfield	Chemical in a drum found at roadside
	12	Box Hill	Chemical spill in creek from unknown source
	13	Richmond	Chemical spill in factory
	14	Hawthorn	Chemical spill due to overfilling a tank
	19	Thornbury	Petrol spill from leaking underground tank
		Seymour	Chemical spill from truck accident
	26	Richmond	Spill of malt/grain stock from truck accident
	30	Glenroy	Pesticide spill from truck accident
	31	North Shore	Electrical explosion involving capacitors
November	4	Braeside	Factory fire involving white spirits
	18	Skenes Creek	Petrol spill from overturned tanker
	27	Bayswater	Petrol spill from overfilling of underground tank
December	3	Broadmeadows	Petrol and oil spill from truck accident
	9	Pimpinio	Pesticide drums in local tip

16	<i>Melbourne</i>	Used sump oil spill into drains
	<i>Ballarat</i>	Chemical spill at a transport depot
	<i>Bentleigh</i>	Ammonia leak from storage tank
<i>Continued ...</i>		

1987	<i>December continued ...</i>	
	17	<i>Tullamarine</i> Fire at landfill site
		<i>Spotswood</i> Petrol spill: source unknown
	22	<i>Shepparton</i> Factory fire
	31	<i>Laverton North</i> Leaking drum of neosyntex
1988	January	7 <i>South Melbourne</i> Petrol spill from a leaking drum
		14 <i>Port Melbourne</i> Oil slick on Yarra River
		18 <i>Thomastown</i> Petrol spill from overturned tanker
		29 <i>Tullamarine</i> Fire at landfill site
		30 <i>Collingwood</i> Chloroform bottles found in a derelict factory
		<i>Deer Park</i> Chemical odour and yellow gas discharge
	February	3 <i>Oakleigh</i> Spill of isocyanate from a mixing tank
		4 <i>Ringwood</i> Spill of isocyanate from a leaking drum
		<i>Newmarket</i> Unknown chemicals found in drums at saleyards
		11 <i>Clayton</i> Fire at tip site
		17 <i>West Melbourne</i> Diesel fuel spill from truck accident
		18 <i>Tullamarine</i> Quantity of unknown black powder found
		20 <i>Glen Waverley</i> Anodizing waste spill into Scotchman's Creek
		<i>Newport</i> Major petrol spill at a fuel terminal
		22 <i>Abbotsford</i> Caustic soda spill at a factory
	March	3 <i>Footscray</i> Fire in a waste load on a waste removal truck
		4 <i>Mansfield</i> Paint spill from truck accident
		10 <i>Hallam</i> Diesel spill from truck accident
		19 <i>Doveton</i> Aldrin spill from truck accident
	April	14 <i>Parkville</i> Spill of 200ml of cyanogen bromide
		26 <i>Maribyrnong</i> Diesel fuel on Maribyrnong River
		27 <i>North Melbourne</i> Truck accident spilling 20t of ferric sulphate
		29 <i>Dandenong</i> Chemical fire in a storage hopper
	May	1 <i>Oakleigh</i> Methane gas fire at local tip
		2 <i>Numurkah</i> Spill of petrol and potatoes from truck accident
		<i>Newport</i> Petrol spill during unloading of tanker
		11 <i>South Blackburn</i> Petrol leak from underground tank
		12 <i>Mai Mai</i> Diesel fuel spill from overturned truck
		16 <i>Wangaratta</i> Fire involving petrol leaking from a bowser
		25 <i>Wendouree</i> Roadside spill of drums of PVA
		26 <i>Abbotsford</i> Chemical odour discharge
		<i>Clayton South</i> Warehouse fire
		30 <i>Foster</i> Discovery of dumped drums
	June	3 <i>Carlton</i> Fire at a factory containing polystyrene foam
		6 <i>Heidelberg</i> Spill of petrol from a petrol tanker
		16 <i>East Burwood</i> Spill of petrol from a service station bowser

20	<i>Williamstown</i>	Naphtha leak from underground pipeline
22	<i>Broadford</i>	Spill of acetate from a bulk tanker
30	<i>Geelong</i>	Petrol spill into stormwater drain

Terms used in risk assessment of industrial installations

Source: CEFIC [1988]

Preamble

In April 1986, CEFIC (the European Chemical Industry Federation) published a document *CEFIC Views on the Quantitative Assessment of Risks from Installations in the Chemical Industry*. The document refers to the chemical industry's competence in the use of quantified risk assessment techniques and its interest in using them for 'in-house' assessment applications. It also expresses grave concerns about indiscriminate use of QRA in the regulatory domain: e.g. for licensing or planning purposes.

The paper aroused considerable interest in many circles, both from industry and

governments. However, it revealed a significant lack of consistency in the meaning given to the key terms used in QRA.

Therefore, CEFIC decided to prepare the present nomenclature intended to facilitate the discussion of the 1986 paper, or more generally, any discussion related to the Risk Assessment of Installations and Operations in the Chemical Industry.

Note: The definitions given here are specific to that purpose but some of the same words may have other meanings in other contexts, e.g. the consideration of effects of chronic exposure to toxic agents, insurance, etc.

Introduction

Note: The terms highlighted (in *bold italic* face) are defined individually in the following sections, first in alphabetic order and then in logical order.

The term *risk assessment* is used to describe a variety of procedures. This document defines its meaning, and that of a number of associated terms, as applied to describe a procedure that is used as one aid to risk management in the chemical industry in order to achieve safety.

The definitions apply specifically to the assessment of *risks* to people and the environment from the *effects* that can result from *acute exposure* to the *consequences* of a hazardous *event*.

The risk assessment procedure is applied, to varying extents, to installations and operations in the chemical industry, most particularly to those designated as constituting a *major hazard*.

The procedure involves a *hazard study*, carried out in an appropriate manner – initially to identify hazards which are removed or reduced as far as is reasonably practicable. The remaining hazards are then analysed to determine the events that could cause possible harmful consequences.

The *frequency* or *probability* of events and the extent of their consequences are estimated, in some cases quantitatively, in order to gain an appreciation of the danger involved. This may often be sufficient to decide the course of action necessary for effective control of remaining hazards. Sometimes the procedure may be taken further, and a *risk analysis* may be carried out. This requires, in addition, an estimate of the *acute exposure* of specific targets to the consequences of the event and the harmful dose they might receive in order to evaluate a level of risk, expressed as *individual risk* and/or *societal risk*. A value judgement of the level of *residual risk* is made with reference to appropriate *criteria*, guidelines and other relevant factors.

When quantified estimates of risk are made, the weight attached to them in a risk assessment must take account of the reliability of the methods and data used and the consequent uncertainty of the results.

Definitions of certain key terms used in risk assessment of industrial installations (alphabetical order)

Acute exposure A sudden single exposure.

Chronic exposure A continuous or recurrent exposure over an extended period of time.

Consequence Result of specific event, without consideration of exposure.

Criterion An agreed reference on which a decision or judgement is based.

Danger A popular expression covering the subjective perception of hazard or risk.

Dose Quantity of an agent absorbed over a specified period of time.

Effect Immediately or delayed result of an exposure.

Event The realisation of a hazard.

Exposure State of a specific target being open and vulnerable to the consequence of an event.

Frequency An expression of how often a considered occurrence takes place in a given time.

Hazard An inherent property of a substance, agent, source of energy or situation having the potential of causing undesirable consequences and/or effects.

Hazard study (equivalent terms: *hazard survey*, *hazard analysis*, etc.) Identification of individual hazards of a system, determination of the mechanisms by which they could give rise to undesired events, and evaluation of the consequences of these events.

Individual risk Risk to which an individual person within a specific population is subjected.

Major hazard A hazard having the potential of causing a major accident: i.e. a major emission, a fire or an explosion which leads to considerable social disruption as the result of serious adverse effects on the following targets:
– death, severe intoxication or injuries requiring extended hospitalisation of numbers of people

and/or

– significant damage to property, animals, crops or plants, or significant contamination of water, soil or air, with considerable economic impact.

Probability An expression of the chance that a considered occurrence will take place.

Reliability An expression of the ability of:

– numerical data or assumptions to be a true representation of the required parameter

– methods and procedures to be able to give, for the circumstances of the case, the result that is required of them

– equipment and people to perform the function that is required of them.

Residual risk The risk still remaining after the implementation of risk management.

Risk The combination of a stated effect and its probability of occurring.

Risk analysis The procedure to identify risk by combining the results of a hazard study with the probabilities of the events considered and their effects.

Risk assessment The value judgement of the significance of the risk identified by a risk analysis taking into account any relevant criteria.

Risk management The whole of actions taken to achieve and maintain the safety of an installation and its operation.

Safety A situation without intolerable risks.

Societal risk Risk to which a defined group or number of persons within a specific population is subjected simultaneously.

Uncertainty An expression of the doubt about numerical data, an assumption, or the result of a method.

Definition of certain key terms used in risk assessment of industrial installations (logical order)

1 Hazard Analysis

Hazard An inherent property of a substance, agent, source of energy or situation having the potential of causing undesirable consequences and/or effects.

Major hazard A hazard having the potential of causing a major accident i.e. a major emission, a fire or an explosion which leads to considerable social disruption as the result of serious adverse effects on the following targets:

- death, severe intoxication or injuries requiring extended hospitalisation of numbers of people
and/or
- significant damage to property, animals, crops or plants, or significant contamination of water, soil or air, with considerable economic impact.

Hazard study (equivalent terms: *hazard survey*, *hazard analysis*, etc.) Identification of individual hazards of a system, determination of the mechanisms by which they could give rise to undesired events, and evaluation of the consequences of these events.

Event The realisation of a hazard.

Consequence Result of specific event, without consideration of exposure.

Effect Immediately or delayed result of an exposure.

Exposure State of a specific target being open and vulnerable to the consequence of an event.

Acute exposure A sudden single exposure.

Chronic exposure A continuous or recurrent exposure over an extended period of time.

Dose Quantity of an agent absorbed over a specified period of time.

2 Risk analysis

Risk The combination of a stated effect and its probability of occurring.

Risk analysis The procedure to identify risk by combining the results of a hazard study with the probabilities of the events considered and their effects.

Probability An expression of the chance that a considered occurrence will take place.

Frequency An expression of how often a considered occurrence takes place in a given time.

Individual risk Risk to which an individual person within a specific population is subjected.

Societal risk Risk to which a defined group or number of persons within a specific population is subjected simultaneously.

Uncertainty An expression of the doubt about numerical data, an assumption, or the result of a method.

Reliability An expression of the ability of:

- numerical data or assumptions to be a true representation of the required parameter
- methods and procedures to be able to give, for the circumstances of the case, the result that is required of them
- equipment and people to perform the function that is required of them.

3 Risk assessment and management

Danger A popular expression covering the subjective perception of hazard or risk.

Risk assessment The value judgement of the significance of the risk identified by a risk analysis taking into account any relevant criteria.

Criterion An agreed reference on which a decision or judgement is based.

Risk management The whole of actions taken to achieve and maintain the safety of an installation and its operation.

Safety A situation without intolerable risks.

Residual risk The risk still remaining after the implementation of risk management.

Figure 0.1 Risk assessment: a conceptual model

The risk assessment concept applied to chemicals as most generally accepted.

The concept may slightly vary when applied to other areas (e.g. transport).

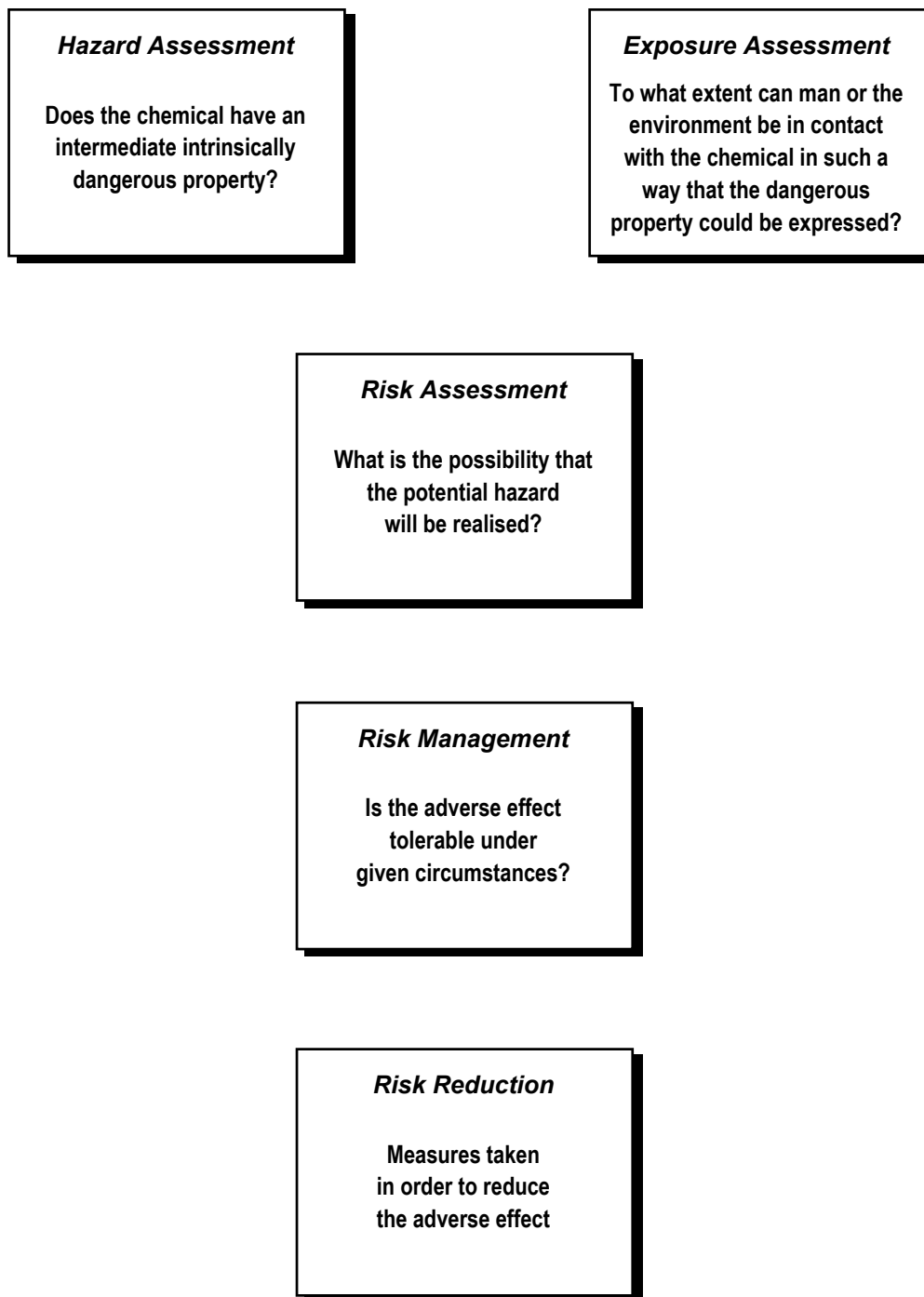


Figure 0.2 Elements of a safety review for an industrial facility

Leadership and administration	Management and training
Planned inspections	Job analysis and procedures
Accident/incident investigation	Planned job observation
Emergency preparedness	Organizational rules and regulations
Accident/incident analysis	Employee training
Personal protective equipment	Health control and services
Programme and evaluation system	Purchasing and engineering controls
Personal communications	Group meetings
General promotion	Hiring and placement
Records and reports	Off-the-job safety

Note to trainer: A key foundation for the Emergency Response Plan is a safety review of facility operations. This safety review, which is central to a company safety plan, examines in detail those items that affect safe operation of the facility. This safety review therefore is a task of the coordinating group and should be done simultaneously with the Local Emergency Preparedness planning.

The three principal hazards

The chemical and processing industries employ many different production processes involving a wide range of different raw materials, intermediates, waste products and final products. The detailed hazard analysis will be unique for each specific plant concerned. However, some broad generalizations can be made.

The three principal types of hazards encountered are **fire**, **explosion**, and **toxic release**, and may expose both people and the environment to risk.

A particular incident may involve one or more of these hazards.

Fire

Fires occur in industry more frequently than explosions and toxic releases. However, the consequences in terms of loss of life are generally less.

The effects of fire on people usually take the form of skin burns caused by exposure to thermal radiation. The severity of burns depends on the length of time exposed and on the intensity of the heat. Heat radiation is inversely proportional to the square of the distance from the source. This means that at twice the distance from the source, the intensity will be reduced to a quarter.

Fires also give off fumes which may include toxic gases. For example, combustion of polyurethane foam gives off cyanides.

Fire can cause severe damage to physical structures either by combustion or by the effects of heat. It may also have an effect on essential services with damage to power and

instrumentation supplies, possibly causing an escalation of the incident.

Fires can take several different forms including:

Jet fires: a long, narrow flame produced, for example, from an ignited gas pipeline leak.

Pool fires: produced, for example, by the ignition of crude oil released from a storage tank into a bund.

Flash fires: rapid, virtually instantaneous, ignition which could occur if an escape of gas reached a source of ignition and rapidly burnt back to the source of the release.

BLEVEs: Boiling Liquid Expanding Vapour Explosions, sometimes called a 'fireball' – a combination of fire and explosion with an intense emission of radiant heat following failure of a pressure vessel due to overheating of the tank wall surrounding the vapour space.

Explosion

Explosions are characterized by a shock-wave which can be heard as a bang. The shock-wave can cause damage to buildings and people can be blown over. Although the effects of over-pressure can be fatal, the indirect effects of collapsing buildings, flying glass and debris cause far more loss of life and severe injuries.

Explosions can be of a number of types:

Gas explosions occur when considerable quantities of flammable gases are released and mix with air to form an explosive vapour cloud before ignition takes place.

Vapour cloud explosions can be either confined such as those which occur within some form of containment (e.g. vessels, pipework), or in less obvious situations (e.g. between buildings), or unconfined occurring within the open air.

Dust explosions occur when flammable solids in the form of very fine powder are intensively mixed with air and subsequently ignited.

It is sometimes difficult to make a distinction between a fire and an explosion. Often an explosion is followed by a fire, with damage and casualties being caused by both.

Probably the greatest danger arises from the sudden massive release of flammable material

producing a large cloud of flammable and possibly explosive vapour. If this cloud were ignited, the effects would depend on a number of factors including wind speed and the degree of dilution of the cloud with air. It could lead to large numbers of casualties and wholesale damage both on site and beyond. However, even in major incidents, the effects are generally limited to a few hundred metres from the site.

Toxic release

Sudden releases of toxic vapours have the potential to cause death and severe injuries at a much greater distance.

In theory, such a release could produce lethal concentrations at several kilometres from the point of release. In practice, the actual number of casualties depends on the weather conditions, the

population density in the path of the cloud, and the effectiveness of the emergency arrangements.

Toxic materials can also be carried considerable distances by water. Their release into the public sewage system, or into rivers, canals and other water courses, either directly or through contaminated water used in fire fighting can result in serious threats to public health.

Extract from APELL Newsletter No. 8 [1993-94]

“Why can’t we manage safety?”

This article has been adapted from *Perspectives*, with the permission of Arther D. Little, Inc.

Our thanks go also to the original authors, David Webb and Dr Gordon Sellers.

Despite the best efforts of government and industry to improve safety, major industry to improve safety, major industrial accidents are as likely to occur today as they were 10 years ago. Since 1982, there has been no reduction in the fatality rates or major accident rates in US industry. But today you are more likely to survive a car accident than you were 10 years ago. So why hasn’t there been a similar improvement in serious industrial accidents?

‘We never had a serious accident before’

We recently interviewed a retired CEO of the speciality chemicals division of a large corporation. On the last day of his more than 30 years with that company, a worker was killed by an exploding vessel. This was the first time anyone in his area of responsibility had died from a process-related accident. In another case, an oil refinery manager with 35 years of experience encountered only one fatality in his career. If these two senior managers relied on experience alone to learn how to prevent major accidents, they would be ill-equipped.

Most companies have significant numbers of minor accidents each year and, after each accident, measures are taken to prevent a recurrence. In this way, minor

injury rates continue to fall. This is not the case when it comes to major accidents. This means most managers don’t have an experience base from which to learn.

'It had operated safely for years, so we thought we didn't need to worry.'

Major accidents generally require the combination of more than one failure or the catastrophic failure of a single component. Because major accidents are rare, it may be very many years before the wrong combination of events arises at a particular facility. Just because it hasn't happened yet doesn't mean that it couldn't happen.

In a recent accident, an operator was killed following a release from a small knockout drum that had been in service for 20 years. The drum was routinely 'shut in' for cleaning of downstream pipework. On the day of the accident it ruptured during cleaning. A slow-building chemical reaction was the cause. For 20 years the drum had never been shut in long enough for the pressure to build up sufficiently to cause a problem. The accident investigation concluded that an effective design safety review would have recognized and addressed the problem.

'It just broke – we could not have anticipated it.'

Some dangerous conditions cannot be seen simply by looking at the equipment or by observing the actions of the operators.

A high-pressure plant in a refinery had operated for 20 years before a pipe suddenly failed, releasing a flammable cloud that ignited and seriously injured three employees. One straight section of welded pipe was the wrong type of steel and over the past 20 years, it had slowly corroded through.

Modern construction checks, which were not available when the plant was built, should now spot such an error. Moreover, thickness checks can be made without dismantling the plant.

Repairing the management systems is the best way to prevent similar accidents in the future.

'It was human error – our operations are inherently safe.'

One railroad company used a series of warning lights to indicate the status of the track ahead. A single red light indicated danger in the next sector, and that the driver must stop. If a driver passed a red light, there was automatic disciplinary action. Indeed, many fatal accidents had occurred as a result of passing a red light. In the past few years, the company decided to undertake a technical investigation of any red light passed more than once. In most cases it found that design faults, such as poor line of sight, rather than driver error, were the cause.

Human error is often an 'easy' explanation: it implies that no further action is required because someone simply made a mistake. However, better design, operating procedures, training or supervision might have prevented the accident. All of these should be part of a comprehensive safety management programme.

'Didn't that happen before?'

Most accidents are the result of failures that are well known and understood, though,

unfortunately, not by the people operating the equipment. Often there have been previous 'near miss' incidents that should have provided a warning.

An operator was killed while opening a high-pressure filter equipped with a quick-release mechanism. This particular mechanism was widely known to be dangerous, and better alternative designs existed. Indeed, at this facility several similar filters had been modified. However, because this particular filter was in the storage area rather than a processing area, the filter was not included in any communication or review regarding the other processing equipment. The direct cause of the death was equipment failure, but the underlying cause was the breakdown in communication.

Communication should be a two-way street, with managers and workers sharing problems with safety issues.

'No one told me we could do that.'

Following two fatalities resulting from falls, a construction project manager unilaterally introduced a rule requiring everyone working at heights more than 1.5 metres to tie off. Unfortunately, because of the design of much of the equipment, this was not always possible. A third fatality followed. Alternative approaches, such as providing guard rails and fall nets, could have prevented that accident, had the project manager and the safety specialists been working together to find the best solution.

'We are continuously reviewing our safety management programmes.'

Safety management programmes are rarely developed in a coherent and structured manner.

They often lack a complete coverage of all the relevant issues. A railroad company, for example, had good standards for the safe operation of trains and track, but no standards for some aspects of workshop safety.

There are a number of assessment techniques available for identifying and assessing hazards. These range from formal, highly structured safety reviews to simple checklists reviews.

High-performance safety management

All of the problems described above can be resolved, providing safety management is addressed alongside other management issues.

In particular, safety must be managed by the operations or business managers, not the specialists, and managed the same way as other business issues.

The following cautions should remind a company to take a broad-based approach to safety management:

- relying on experience alone is insufficient to prevent further accidents;
- just because a major accident has never occurred doesn't mean it won't;
- many fatal accidents are caused by major equipment failure – an effective safety

management programme that includes adequate design reviews, inspections and maintenance programmes can prevent such accidents;

- human error is rarely the key failure underlying an accident;
 - learning from 'near misses' – yours or others – is one of the most powerful approaches to avoiding accidents;
- business managers or project managers must work together with the safety specialists to find the best safety solutions, not always the most obvious ones;
 - a comprehensive safety management strategy is critical to success.

Planning for emergencies

Planning for on-site emergencies

Planning is essential for any successful operation, especially an emergency one. A carefully prepared emergency plan is vital for any plant that handles hazardous chemicals. In a growing number of countries it is a legal requirement.

Aims

The aim of an emergency plan is to enable a swift and effective response to be made to contain or minimize the effects of the incident, and to restore normality as soon as possible.

The plan should be as simple as possible and easy to use. It should be complete in itself and should not entail reference to a number of other documents.

The plan needs to be valid 24 hours a day, every day, and flexible enough to be applicable to any emergency that may arise. It should be structured to allow for the response to be stepped up in the event of escalating circumstances. Above all, it needs to be known and understood by everybody involved.

A person should be designated to draw up the plan in consultation with all those directly involved in its implementation both on and off the site.

The plan should be regularly tested and amended in the light of experience.

Hazard identification

The starting point for all emergency planning is the identification of the hazards present on the site. It is important to establish what could go wrong and where, together with the likelihood and consequences of such problems.

The main hazards that should always be considered are fire, explosion, and toxic release, along with environmental damage, occurring individually or in combination. Consideration should also be given to emergencies caused by natural events such as floods, storms, earthquakes, and by failure of basic utilities.

Assessment of counter measures

This will include development of appropriate tactics together with corresponding training of personnel and provision of equipment.

The following areas should be covered:

- cut-off and isolation systems
- fire fighting (including both extinguishing and controlled burning)
- first aid and the handling of casualties
- staff protection
- reduction of the impact on the environment (e.g. prevention of pollution by contaminated fire-fighting water)
- liaison with off-site emergency services and local civil authorities
- organization of emergency response.

These preparations form the basis on which the actual emergency plan can be drawn up. The plan needs to provide comprehensive instructions for the organization of the response to an incident. In order to be complete, it needs to cover all stages of the incident.

Example of a national law: SARA Title III

The following article is taken from *Hazardous Materials: a citizen's orientation*, a publication from the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), and the Department of Transportation (DOT) of the USA (See references in Part 5).

On October 17, 1986, the Superfund Amendments and Reauthorization Act of 1986, also known as SARA, was signed into law. The third part of SARA is Title III: the Emergency Planning and Community Right-to-know Act.

Prior to this law, citizens had little or no legal backing in their attempts to obtain information about toxic releases from facilities in their own communities. As the public and its Congressional representatives became more aware of the

increasing use of hazardous materials and the corresponding increase in the number of accidents, pressure grew for better information at the local level.

The single incident that is credited with raising the level of concern to the point that such a law could be passed occurred in Bhopal, India, where a release of methyl isocyanate killed at least 1 700 people and injured thousands more. To help reduce the likelihood that such a tragedy would occur in the United States, and simultaneously increase a local government's ability to anticipate and plan for such a major emergency if one were to occur, Title III seeks to provide reliable information to those who would be most affected by an accidental release of this kind: the communities located in the immediate area of industrial plants.



The Department of Transportation (DOT) regulates interstate hazardous materials transport, training carriers and shippers to comply with the law.

As used in SARA, the term 'hazardous materials' refers to substances transported, used, and stored at petroleum refineries and natural gas facilities; hazardous chemicals such as PCBs and trichloro-ethylene (dry cleaning chemicals);

acutely toxic chemicals; and fumes and dust from metal such as arsenic, lead, and cadmium. For the first time, the law even requires the agricultural industry to report production, use storage, or release of certain chemicals. The EPA maintains an updated

list that includes over 300 extremely hazardous substances (EHS), selected on the basis of their ability to pose an *immediate* threat to life and health. These EHS chemicals have been involved in some of the most serious accidents that have occurred in the US to date.

Title III establishes requirements for Federal, State, and local governments and industry regarding local emergency planning and reporting on hazardous materials. It also provides a comprehensive framework within which Federal, State, and local governments can work together with industry to reduce risks.

Title III has four major sections:

- *Emergency planning*
- *Emergency notification*
- *Community right-to-know reporting requirements*
- *Toxic chemicals release and emissions reporting.*

Planning for off-site emergencies

Many incidents can be contained within the boundaries of the site. However, there are those cases where the impact affects the neighborhood, and has consequences affecting life, life-support systems, property or the social fabric. The loss and damage caused by such incidents depends to a large extent on the actions of the first responders to the emergency, and hence their preparedness to act.

Effective response to such situations calls for the efficient integration and coordination of emergency resources. This can only occur if careful advance planning has taken place. In many countries it is now a legal requirement that

emergency plans are in place to cover the eventuality of any type of emergency, including those originating in the chemical industry. The United Nations Environment Programme (UNEP) has, with support of industry, developed

a handbook on Awareness and Preparedness for Emergencies at Local Level (APELL).

It is, of course, essential that all industrial plants ensure that their own on-site emergency plans are incorporated into the wider community plans for responding to emergencies.

The responsibility for drawing up plans to cover emergencies with off-site effects varies from country to country. In many cases it will be the civil authorities. The development of the plan will involve consultation between the following:

- owners/operators of the plant concerned
- civil authorities
- emergency services (police, fire, ambulance, health)
- environmental monitoring agencies
- voluntary bodies (e.g. Red Cross)
- local community.

The function of all emergency planning is to consider what emergencies might arise, and what action needs to be taken to mitigate the effects.

Figure 0.3 Emergency response plan evaluation matrix

Source: APELL – A Process for Responding to Technological Accidents. UNEP IE [1988]

	Regional				Local Governments <i>(country, city, town)</i>				Other <i>(industrial, educational)</i>			
Plans evaluated												
Planning elements												
Organizational responsibilities												
Risk evaluation												
Notification procedures and communications systems												
Core elements in place and emergency equipment and facilities readiness												
Assessment capabilities												
Protective action procedures												
Public education and information												
Post-emergency procedures												
Training and drills												
Programme maintenance												

KEY

- A - Acceptable
- B - Minimal work needed
- C - Substantial work needed
- N - Not applicable

Note to trainer: The evaluation of an Emergency Response Plan is, among others, a helpful tool for the coordinating group in selecting the issues that are critical to their particular situations as they apply to the APELL process.

Procedure for hazard identification and evaluation in a local community

The risks associated with the activities of a particular site may be identified and evaluated using the procedure which is described here. The procedure is part of the APELL process, which will be discussed later in this package. The aims of this procedure are to show how risk objects can be identified, evaluated and ranked by a basic ‘rough-analysis’ method. Based on this ranking, emergency plans can be developed or reviewed.

An example of an application of this procedure for an oil depot is given at the end of this section.

For a more detailed description of the procedure outlined in the section, refer to UNEP IE Technical Report No. 12 *Hazard Identification and Evaluation in a Local Community*.

1. Basis

The group should begin by deciding on the objectives for the analysis and the level of detail required. An ‘analysis map’ covering the geographical area in question is needed. Only those objects of relevance to the analysis should be included. Use **Figure 0.4 Analysis map** for the work and to summarize the results.

2. Inventory

A list should be made of the objects to be included in the analysis. Examples of risk objects and hazards are given in **Figure 0.5**. The analysis map provides a starting point. A visit to the location of the risk object should always be made, especially for the objects that are predicted to be major threats.

3. Identification

Begin with the form for hazard analysis in **Figure 0.4 Analysis map**.

To start, choose an object and area with which all the members of the APELL Coordinating Group (see **Figure 0.11 The ‘responsibility bridge’** page III:75) are familiar.

The other hazardous installations and risk objects in the municipality can be studied subsequently.

The parts of an installation or risk object which contain hazards should be listed in *Column 1*.

The operation taking place at that part of the installation should be shown in *Column 2* – for example:

- manufacturing, purification, mixing, packing

- storing, loading
- transport
- selling
- energy production, energy distribution, transformer equipment
- maintenance, repairs
- market gardening, meat production
- hospitals, schools, entertainment facilities, sports amenities.

List the substance or energy forms which create the accident risk in *Column 3*. Show the quantities of hazardous chemicals, together with other relevant information, e.g. degree of toxicity, which affect the potential scale of an accident.

The types of accident that could be caused by each hazard should be shown in *Column 4*.

These could include: landslide, building collapse, flooding, release of a dangerous chemical, fire, explosion, collision or something similar. List also the combination accidents that could be caused.

Threatened objects are shown in *Column 5*. If the hazards present are not serious threats to people, the environment or to property, then the risk object(s) under consideration can be omitted from the rest of the exercise.

4. Evaluation

In many cases, it is sufficient to estimate the scale of the consequences. These should be shown in *Column 6*. It is important to determine whether consequences are likely; however, it is

not always necessary to estimate the scale in great detail. Risk zones both on-site and off-site should be considered.

It may be necessary to seek expert advice when the consequences are hard to predict. Models for estimating the spread of gases and their effects are available for use on personal computers.

5. Classification

Classify the estimated consequences from **1** to **5** for:

	Column	Code
life (fatalities/injured)	7	L
environmental objects	8	E
property	9	P
speed of development, amount of warning	10	S

6. Ranking

Estimate the probability from **1** to **5** and write this in *Column 11: Pb*.

Weigh up the various consequence classes, arriving at a classification for each hazard. Show the priority of each of them, from **A** to **E**, in *Column 12: Pr*.

It is very important to know about the ‘worst-case scenario’, but it is not necessarily the decisive factor in emergency planning. The priority for the work should be to find risk objects and hazards and to classify the threats in the following order:

- people
- environment
- property.

Give the risk object an overall class based on the matrix in **Figure 0.6** (1C, 2D, etc.), according to your judgement of the probability of an accident arising from the hazard(s) and the seriousness of

its consequences (the ‘dimensioned damage estimate’ and the ‘worst case’).

The risk objects have now been ranked. You may want to go back and change your ranking for some objects when you have learned more.

The use (if any) of a dimensioned damage estimate, any other facts worth noting, and any recommendations – e.g. for safety zones or emergency plans – should be written in *Column 13: Comments*.

7. Presenting the results of the analysis

The exercise will produce a number of forms containing the information shown above.

These forms will in themselves be of great value to various local authorities. However, it is difficult to get an overall picture of the risk objects if the information is present only on a large number of forms. It is therefore advisable to show the most important information on an overall ‘risk map’. Risk objects can be marked by symbols showing their ranking, together with associated threatened objects of various kinds. It is also important to have a detailed map for the location of each important risk object. This should also show the predicted zones in which the hazard could cause deaths, injuries and damage.

Now you know where the most potential risk objects and hazards are in the community. You have defined the hazards, evaluated their potential to harm or kill people, to damage the environment and to destroy or damage property. Last but not least you have ranked the risk objects and documented your findings.

Now it is time to communicate your results and to take the next step (3) in the APELL process: ‘Develop or review emergency plans and identify weaknesses’; together with actions to prevent accidents.

Example: application of the procedure for an oil depot

The example of hazard identification and evaluation in an oil depot explains how the procedure outlined above can be applied.

Notes on Figures 3.7 to 3.9

Figure 0.7 is a map of a fictitious oil depot and its surroundings. It is not uncommon for housing, oil depots, industries, etc., to be situated too close together. As also shown in *Figure 0.7*, consideration is not usually given to meteorological conditions when the siting of industries, oil depots and houses is being planned.

In this fictitious case, the prevailing wind comes from the sea. If there is a fire in the depot, the smoke (or a gas cloud) is probably going to affect the people living in the nearby housing.

Figure 0.8 and *Figure 0.9* show how to use the rough analysis method step by step.

Of course you have to study all the hazards present in order to get to know the risk object and its potential for accidents. (This is not done in this example.)

To start with, it would be of interest to get an overall view of the risk object, especially if it is as big as shown in *Figure 0.7*. Such a view is shown in *Figure 0.8*. It is clear from this that there are several different kinds of hazards and possible risk types in this risk object. It is not possible here to give examples of every kind of

accident that might occur. Some accidents are obvious, e.g. fires giving off huge plumes of black smoke or leakages of oil damaging the environment. Other possible accidents and threats are less overt. The Coordinating Group and the owner(s) of the oil depot should therefore do the analysis work together.

With the results of the analysis in hand, it is possible to review or to develop emergency plans and to start work on preventive measures and on the allocation of resources on-site and off-site. (For a more 'in-depth' study, the risk analysis methods shown in *Annex 3.6* of the UNEP Technical Report No. 12 are normally used, together with information stored in computerized databases and other tools.)

As you can see in *Figure 0.9*, the storage tanks area – especially the LPG store – is probably where the 'worst-case' scenario of a BLEVE (Boiling Liquid Expanding Vapour Explosion) could happen. As a dimensioned damage estimate, you might choose another event, like a fire or a leakage of oil or a minor explosion.

The risk object is given an overall ranking of 2D, with 1E possible.

Figure 0.5 Inventory

Examples of risk objects	Common hazards
Docks	Dangerous substances (inflammable, explosive, poisonous etc.). Cranes, vehicles.
Depots, terminals, stores	See <i>Docks</i> .
Ships	Dangerous goods, oil.
Railway marshalling yards	Dangerous goods, oil.
Airports	Fuel, dangerous goods.
Aircraft	Fuel, dangerous goods.
Processing industry <i>Refineries, petrochemical, inorganic chemical, pharmaceutical, paint, steel/metal</i>	Pressure vessels, tanks, stores, containers, processing equipment with hazardous substances in the form of raw materials, catalysts, products, by-products, waste and high voltage electricity.
Other industry <i>Plastics, rubber, engineering, saw mills, etc.</i>	Pressure vessels, stores, storage tanks with poisonous/inflammable substances, etc.
Hydro-electric power stations	Dammed water, high voltage electricity.
Thermal power stations	Inflammable substances, pressure vessels, high pressure steam, high voltage electricity
Nuclear power stations	Radioactive and poisonous reactor materials, pressure vessels, high pressure steam, hot water, high voltage electricity.
Pipelines	Inflammable gas, pressured pipelines. Environmentally hazardous substances.
Petrol stations, oil depots	Inflammable, poisonous and environmentally hazardous substances.
Department stores	Combustible and poisonous substances, aerosols.
Builders merchants	Large quantities of wood.
Hardware stores	Explosive and combustible substances.
Municipal facilities <i>such as water purification plant, sewage treatment plant, swimming pools</i>	Hazardous substances (chlorine).
Hospitals, schools	Hazardous substances.
Hotels	Tall buildings.
Silos	Combustible dust.
Quarries <i>and other large mountain/underground sites</i>	Unstable rock/soil, gases, drainage water, vehicles.

Figure 0.6 Risk matrix

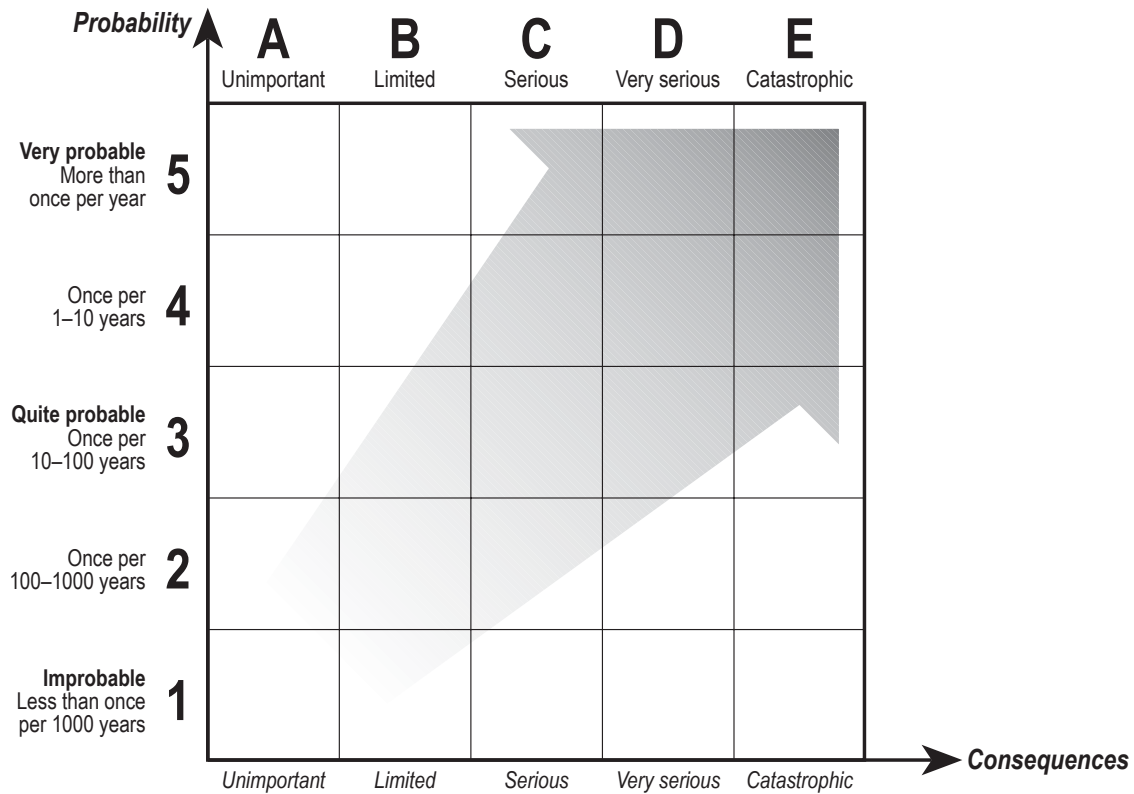


Figure 0.7 Map of oil depot
Example of hazard analysis for an oil depot

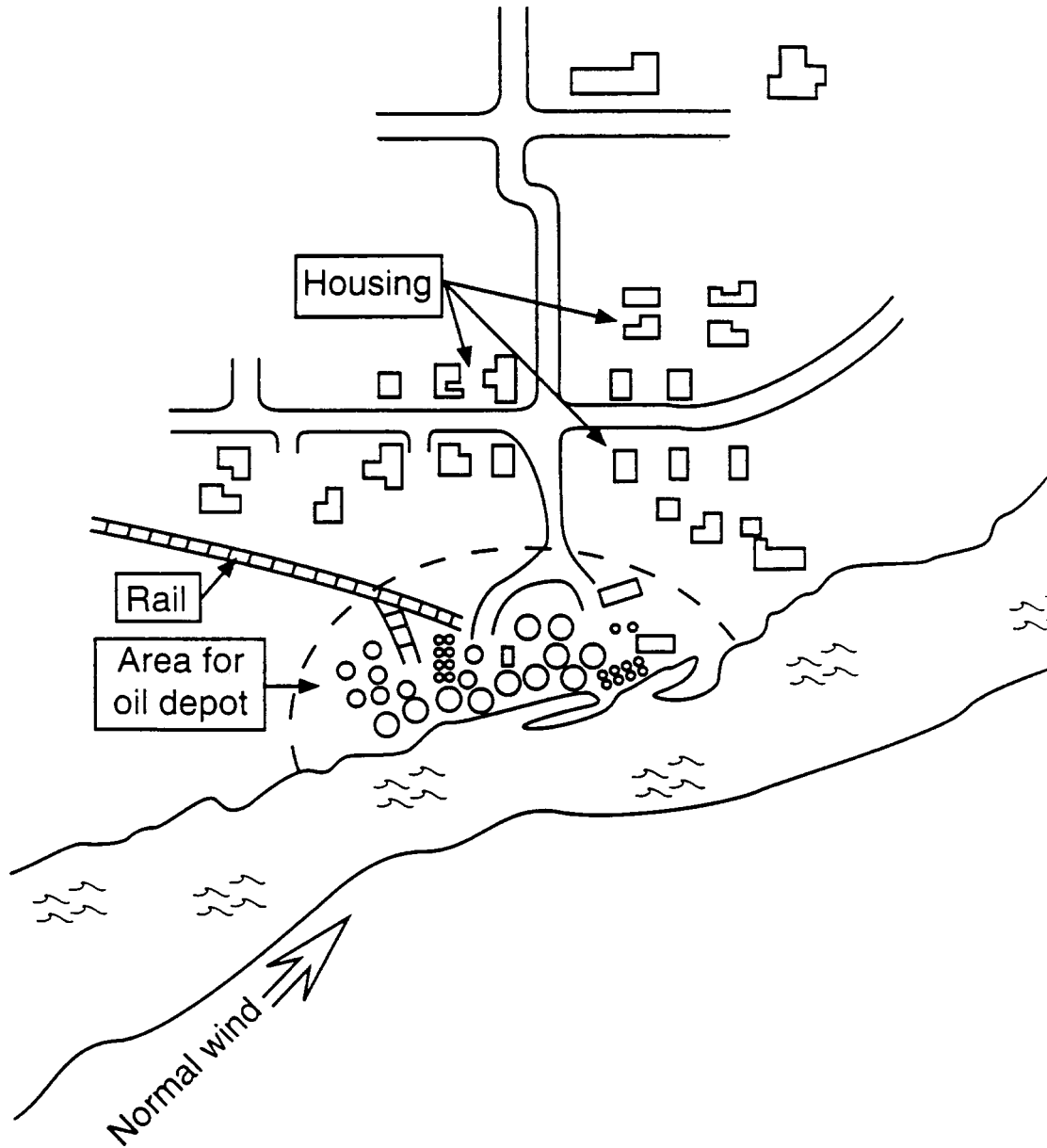


Figure 0.8 Oil depot (overall view)

Community:		Object / Area:										
1	2	3	4	5	6	Seriousness			11	12	13	
Object	Operation	Hazard (quantity)	Risk type	Threatened object	Consequences	7	8	9	10	Pb	Pr	Comments
						L	E	P	S			
Storage tanks - crude oil - gasoline - liquid petroleum gas (LPG) - NO ₂ fuel oil (furnace, diesel stove) - NO ₄ fuel oil (plant heating) Storage of LPG bottles Filling station Oil/LPG - pipeline - rail - trucks - ships Roads Railways Harbour	Refinery Storage Loading Unloading Transport Storage Transport Storage Transport Loading Unloading Transport Transport Transport Loading Unloading	Crude oil 100,000m ³ Flammable Gasoline 500,000m ³ Flammable LPG 10,000m ³ Explosive Flammable NO₂ and NO₄ 600,000m ³ Flammable Stored LPG 20,000m ³ Explosive Flammable	Fire/leakage Fire/leakage Fire/explosion Fire/leakage Collisions	Depot as a whole Life - workers - drivers - crews - fire and rescue - the public Environment - shores - water - air Property - tanks - vehicles - oil products - houses - ships - equipment	Depot as a whole Life - anything from a few burns to many deaths Environment Contamination in water and on shores; severe burns of woodland Property - smoke damage - building collapses, fire damage, destruction of oil products						D	Risk object that has to be studied in depth

L = Life
 E = Environment
 P = Property
 S = Speed
 Pb = Probability
 Pr = Priority

Figure 0.9 Oil depot (in depth)

Community:		Object / Area:													
1	Object	2	3	4	5	6	7			8			11	12	13
							L	E	P	S	L	E			
Area storage tanks	- LPG - gasoline - crude oil - fuel oils	Refinery Storage Loading Unloading Transport	LPG 10,000m ³	Explosion (Primary)	Life - workers - drivers - crews - fire and rescue serv. - the public	Life Deaths/ injuries -" -" -" -" Environment Contamination and destruction of air, land	4-	-	-	-	5	2	D	Dimensioned damage estimate	
							5	-	-	-	5	2	D		
Storage of LPG bottles etc.	Storage Transport etc.	Storage Transport etc.	LPG 10,000m ³	Explosion (Primary)	Life - workers - drivers - crews - fire and rescue serv. - the public	Life Deaths/ injuries -" -" -" -" Environment Contamination and destruction of air, land	2	-	-	-	5	2	C	To consider	
							-	3-4	-	-	5	3	D		
Filling station Oil/LPG	- pipeline - rail - trucks - ships	Transport Loading Unloading etc.	Gasoline 500,000m ³ etc.	Boiling Liquid Exp. Vapour Exp. (BLEVE) (Secondary) Fire Leakage etc.	Property - tanks - vehicles - houses - oil products	Property Destruction Collapses -" Destruction	-	-	-	-	5	2	D	To consider	
							-	-	-	-	5	2	C		
Roads etc.	Transport etc.	Transport etc.	Gasoline 500,000m ³ etc.	Boiling Liquid Exp. Vapour Exp. (BLEVE) (Secondary)	- oil products	Destruction	-	-	-	5	2	D	"Worst-Case"		
Railways Harbour etc.	Transport Loading Unloading etc.	Transport Loading Unloading etc.					5	5	5	5	1	E			

L = Life P = Property
E = Environment S = Speed
Pb = Probability
Pr = Priority

Some reflections on risk communication

Introduction

There is a vital need for people to be aware of the hazards to which they are exposed, and how to protect themselves. They should know where these hazards are and what the effects might be. This is critical to the APELL process, which is concerned with making the public aware of certain risks, and preparing them for a possible accident.

In order to estimate the hazards that people are exposed to, an analysis can be made of risk objects and hazards. A risk estimation can be derived from the probability of an accident arising as a result of the hazard(s) and the seriousness of its consequences as regards the risk object.

If an accident actually happens, the public has to be informed about its seriousness, and the threats it imposes on the local community. This also is an essential part of the emergency response plan in the APELL process.

However accurate the risk estimation of a possible or actual accident may be, it may still be viewed in a variety of ways by the public. This note will briefly discuss the ways individuals perceive risks. Risk communication, as an important tool to minimize the discrepancy between public perceptions of risk and expert judgement, will be covered as well.

Risk perception at the individual level

Individuals react differently to different kinds of risks. Where there is a relatively low probability of a potentially severe loss, they often act as if they are immune to disaster. For instance, when it comes to protective activities, such as wearing a seat belt, people often reason as follows: "Why buckle up if an automobile accident won't happen to me?"

Other risks, such as nuclear power plant mishaps, provoke the opposite reaction. Emotional responses such as fear and dread may lead to intense preoccupation with the possibility of a catastrophic disaster, even when experts claim that the facility is extremely safe. In contrast to the earlier case of protective action, the public often cries for 'zero risk' when it comes to regulating technology, without appreciating that it is practically impossible to achieve such a goal.

The response of the public towards a risk once the accident has actually happened is often unpredictable. Depending on the way the information about an accident is presented to the public, dramatic and overreactive responses may occur. The response towards an accident can affect the general public's attitude towards

industry. The pressure of public opinion can even force a company to close down.

These reactions have their origins in the way individual persons perceive risk. When talking about risks, an important distinction has to be made between 'voluntary risks' and 'involuntary risks'. Smoking, for instance, is a risk to personal health. People often take surprisingly high risks as long as there is choice, and some sort of control over the risk which they are undergoing. **Table 0.3** shows a few of the daily risks we are exposed to. 'Involuntary risks' are those which individuals (or communities) cannot fully choose to avoid and are generally regarded with much more fear and aversion. This is especially so when the individual has the feeling that there is no effective emergency plan for the community which is undergoing the 'involuntary risk'.

Another important distinction which has to be made is the distinction between a 'known' and an 'unknown' risk. The risk a nuclear power plant imposes on the local community is often 'unknown'. It is hard to give an exact estimate of the risk, and for the local community to understand the risk which is being imposed on them. One tends to be intolerant of risks that are not understood or which are unfamiliar. In this

sense, the consequences of high risks are better understood and hence (curiously) better tolerated than many low risks (see **Table 0.3 Risks**). When talking about the risk a nuclear power plant imposes on the local community, another very important factor in shaping risk perception can be discovered. These days, many risks are

‘invisible’. Radiation – be it nuclear, electrostatic or magnetic, scentless carcinogenic materials in the air, etc. – is ‘invisible’, but poses a serious threat to personal health. The fact that a risk is ‘invisible’ makes it impossible for a person to know if he or she is exposed to danger, and in that way the risk is ‘unknown’.

Table 0.3 Risks

Voluntary risks (average to those who take the risk)		
Smoking (all effects)	5×10^{-3}	5000 in one million
Riding a motorcycle	1×10^{-3}	1000 in one million
Drinking alcohol	4×10^{-4}	400 in one million
Driving a car	1.5×10^{-4}	150 in one million
Travelling by train	3×10^{-5}	30 in one million
Travelling by plane	1×10^{-5}	10 in one million

Risks averaged over the whole population		
Cancers (all causes)	2×10^{-3}	2000 in one million
Accidents at home	1×10^{-4}	100 in one million
Walking	3×10^{-5}	30 in one million
Storms and floods	2×10^{-7}	0.2 in one million
Lightning	1×10^{-7}	0.1 in one million

The way in which a person responds to a certain risk imposed on him, be it ‘voluntary’ or ‘involuntary’, ‘known’ or ‘unknown’, ‘visible’ or ‘invisible’ depends on the person’s attitude towards the risk. For example, a decision by an individual concerning the siting of a noxious facility is determined by one’s perception of the possible outcomes associated with the hazard in question. Each outcome is characterized by a number of attributes, including psychological impacts such as fear and dread, economic effects of property damage, and health and safety consequences affecting the individual or the surrounding environment. Attributes such as probability, emotional impacts or economic consequences determine the individual choice.

These, in turn, are contingent on the way information is presented to an individual.

Contingent weighing of risks may distort what the individual will tolerate. If individuals perceive the probability of an accident to be below a given personal threshold level, then the entire weight may be placed on the probability dimension, with no attention paid to the consequences. If on the other hand, the information is presented so that a person perceives the probability to be above their threshold level, then the entire weight would now be placed on the outcome dimension (see **Table 0.3** again). This is often the case with hazards imposed on the public by industry. These are the kind of risks at the center of attention in the APELL process.

Risk communication

How a person perceives a risk depends heavily on the way the information is presented to him or her. In practice, there is a large discrepancy between public perception of

risk and expert judgement of the same risk. In order to reduce the discrepancy between public perceptions and expert judgements, the risk communication process has to be improved.

It is important to distinguish between the

A firm that wants to inform the local community about a certain risk it imposes on the community will try to present the risk in a realistic way, to reassure, or try to present the risk as smaller than it actually is. The media, on the other hand, are often out to find sensational stories, and will try to exaggerate or dramatize the risk a firm imposes on the local community. Accident victims make good television or good copy. Scientists, academics, and consultants who calculate the risks will try to present the risk in an objective, 'scientifically responsible' way. Environmentalists, however, may want to interpret the outcomes of the risk estimation altogether differently from the consultants, the firm and the media.

In the APELL process, the Coordinating Group has to be well aware of these different motives for interpreting risk and how these interpretations are communicated to the local community.

It is the responsibility of the Coordinating Group – i.e. the technical, scientific, corporate, regulatory and community news sources involved with environmental issues – to inform the public regarding environmental risk, but they often cannot do so directly. The mass media – local, national or international – provides information about a situation and the risk it imposes on the local community. Since, as mentioned above, mass media and companies often have conflicting motives for addressing the local community, the process of communicating information on risk is generally complex. For the Coordinating Group, risk communication must either be direct – between the firm and the local community, e.g. through letters or open days at the firm – or indirect, through the media.

Risk communication involves public participation. Public participation implies that the general public becomes a party in the decision-taking processes. This is different from a 'public-relations' exercise, which is usually a one-way process in which a company or an authority tries to 'sell' an activity or a message. Therefore, in a decision-taking process, it is important to involve/inform the public in the beginning of the chain of decisions, rather than at the end. The Coordinating Group has the responsibility to

different motives for communications on risk. safeguard the progress of the APELL process. During this process, it is important to inform the public regularly about proceedings. Essentially, it means that the Coordinating Group has to keep contact with the media and/or seek other means of communication channels, such as letters and open days, and to address the local community. In general, considerable differences in philosophy, approach and interpretation regarding risks, exist between industry and authority on one side and the public on the other. Risk communication cannot be successful as long as this situation is not properly dealt with.

Once a member of the community believes that a significant risk has been imposed on him or her by a business, the question of the social legitimacy of firms in the community and their credibility become of paramount importance. Legitimacy and credibility are therefore critical issues the Coordinating Group must address.

The firm, trying to establish 'social' legitimacy, must also address other negative impacts that might be associated with its operations in addition to the risks from its hazardous operations. Problems such as traffic, aesthetics, the effect of its presence on property value, etc. may all need to be addressed.

Competence, honesty, openness and performance against promise are the elements that establish credibility. The firm that is not credible with reference to items such as employment and aesthetics cannot expect credibility regarding statements about imposed risks.

The theory and research of risk communication has focused thus far on the perceptions and reactions of audiences to information about risk. The communication process is acknowledged – the source and the message – but the primary concern is the receiver, the individual citizens who use, or fail to use risk information. When the communication process is discussed, risk experts (government officials, industry representatives, scientists, academics and activists) are often viewed as the source, and the mass media are often treated as the medium or channel of communication, when they are considered at all.

It is equally important to focus on the role of the mass media in the communication of risk information, opinions and attitudes. From mass communication it is known that the medium is the source (the reporters and editors), not the government, industry or scientific experts who attempt to provide their own messages to the mass media.

Reporters and editors evaluate events on the basis of traditional determinants of news (timeliness, proximity, prominence, consequence

and human interest), rather than in terms of the scientific degree of risk. Environmental news sources who empathize with journalists and are willing to teach reporters about their specific fields can help make mass media coverage of environmental risk as accurate and professional as the public deserves. But equally they must understand the media process, and provide information in a form that is interesting and useful to media agencies.

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This article is written by J.W. Scheijgrond, based on the references below and on interviews with Mr. D. Thwaites, Senior Industry Consultant to UNEP (1992-93).

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International action

Example of the Seveso Directive

In addition to individual national initiatives, a number of international organizations have attempted to also provide a framework for industrial accident prevention. Regional organizations have also contributed to this.

The OECD has prepared *Guiding Principles for Chemical Accident Prevention, Preparedness and Response: guidance for public authorities,*

industry, labour and others. One of the best known (but not necessarily best understood) instruments has been the European ‘**Seveso Directive**’, decreed in 1982 by the European Commission. The instrument is binding on member governments. In view of its high public profile, we provide below a summary of this Directive.

HAZARD LEGISLATION: THE ‘SEVESO’ DIRECTIVE

(Directive 82/501/EEC, 24 June 1982)

Introduction

In 1976, a chemical accident at the village of Seveso near Milan in Italy highlighted the dangers inherent in some industrial processes for the environment, including man.

The 1982 Council Directive, also known as the *Seveso Directive*, establishes a system for:

- identifying those industrial activities capable of creating a major accident,
- ensuring managers of plants take all the necessary measures to prevent major accidents,
- limiting the consequences on the environment, including man.

How is this achieved?

Identification of hazardous installations

The directive defines two kinds of hazardous industrial installations. The first, more numerous, have to comply with the general requirements within *Articles 3 and 4*, whilst the second, most hazardous installations, are required to:

- submit a detailed notification, or safety report, to the national competent authority;
- prepare an on-site emergency plan to deal with major accidents on site;
- provide information to the competent authorities to enable them to prepare an off-site emergency plan;
- update the information provided to the competent authorities periodically, or in the event of a significant modification.

Thus the Directive establishes criteria and procedures that require industrial managers to

identify, assess, and take steps to prevent major accidents in their operations. But what does it do to prepare the public and authorities for an accident if one occurs?

Emergency preparedness

Apart from requiring the manager of a hazardous installation to prepare an on-site emergency plan, the directive places a duty on competent authorities to prepare an off-site emergency plan and to inform the public, including people likely to be affected across the border in another Member State, of what they should do in the event of an accident.

The information to the public and the general improvement in the flow of information among interested parties (openness or transparency) is an important aspect of the Directive.

The competent authorities must also organize inspections of the hazardous installations, examine the information provided in the safety

¹ Based on Report EUR 13258 EN.

report, and ascertain that the hazardous installation takes the most appropriate measures to prevent major accidents and to limit their consequences. To achieve this the manager is obliged to prove that, apart from the technical measures to prevent major accidents, he has provided the people on site with information, training and equipment to ensure their safety.

Emergency response

If a major accident occurs the manager is obliged to notify the competent authority, who in turn is obliged to notify the Commission of the European Community. The Commission maintains a register of accidents which have occurred within the Community (MARS).

The purpose of such a reporting procedure is to analyze causes of the accidents, and to use the experience gained and measures taken for prevention purposes.

Application system

The Directive applies to hazardous activities which are defined by the use of annexes giving both the activities concerned and the threshold of dangerous substances held on site before the installation is deemed to be capable of creating a major accident hazard. The current system of application differentiates between the isolated storage, and manufacture or associated storage. Each particular type of activity is covered under the relevant annex.

The future

The Directive has, over the years since its adoption, been amended twice, particularly following the Sandoz warehouse fire in 1987 which caused tonnes of highly toxic chemicals to be washed into the Rhine River. Now, however, the Commission is proposing to strengthen the present approach by collaborating with the Member States to incorporate a number of newer ideas into a Fundamental Review of the Directive.

The harmonization of safety reports and the inclusion of human factors into their preparation is to be considered, and trials using a scale to determine the gravity of industrial accidents are under way. The Commission is also working on a practical guide to public information, to emphasize the importance of this aspect of the Directive.

Following the accident at Bhopal, the dangers to dense populations around major industrial installations became apparent. The European Commission proposed to introduce some form of Land Use Planning Controls around the sites to prevent the creation of new housing adjacent to major hazards and, in the long term, to encourage the general separation of major hazards from residential developments or areas of particular environmental sensitivity.

In this way, the success of the Directive can be maintained into the next century.

Summary of the main requirements of the Directive

- **Application (Articles 1 & 2):** the Directive is concerned with the prevention of major accidents which might result from certain industrial activities, including the storage and use of dangerous substances. The Directive does not apply to nuclear installations, military installations, explosives, mining or, with certain provisos, to the disposal of waste.
- **General Provisions (Articles 3 & 4)** include the obligation on the manufacturer to take all measures necessary to prevent major accidents and to limit their consequences for people and the environment. The manufacturers are also required to prove to the authorities that they have identified existing major hazards, adopted appropriate safety measures and provided workers with information, training and equipment in order to ensure their safety. These general provisions apply to all industrial activities covered by the Directive.
- **Notification Requirements (Articles 5 & 6)** include the basic requirement to inform the authorities of the existence of a major accident hazard and to prepare and forward a detailed report relating to both an and off-site safety. The safety report, which should be kept up to date, includes details relating to:
 - the dangerous substances;

- the installation where the industrial activity is located;
 - possible major accident situations;
 - information sufficient for the authorities to prepare an external emergency plan.
 - **Implementation and Monitoring** (*Articles 7 & 9*) achieved using competent authorities within the Member States. These competent authorities are responsible for:
 - receiving and examining the notification and information provided by the manufacturer;
 - ensuring that an emergency plan is drawn up for action outside the establishment;
 - ascertaining the manufacturer has taken the most appropriate measures to prevent major accidents;
 - organizing inspections or other measures of control for the type of activity concerned.
 - **Public Information and Transparency** (*Articles 8, 13 & 18*) provides:
 - information on safety measures and what to do in the case of an accident to the public around major accident hazards, without their having to request it;
 - other Member States with the equivalent information to that provided for the public;
- for confidentiality to protect industrial information, where necessary;
 - an exchange of information between Member States and the Commission to provide for the development and proper functioning of the Directive.
 - **Response to Major Accidents and Record Keeping** (*Articles 10, 11 & 12*), provided for by:
 - a requirement for manufacturers to report major accidents to the competent authorities in the Member States and for those authorities to report to the Commission;
 - a register, run by the Commission, containing a summary of all major accidents within the Community, including an analysis of the causes, the experience gained and the measures taken to allow Member States to use the information for prevention purposes;
 - a system of information exchange and maintenance of a Community Documentation Centre which allows for the free exchange of information relating to major accidents whether inside or outside the Community.

Example of the World Conference on Natural Disaster Reduction

United Nations

World Conference on Natural Disaster Reduction

Distr.
LIMITED

Yokohama, Japan

A/CONF.172/L.7

23-27 May 1994

26 May 1994
Original: English

Agenda Item 11

OUTCOME OF THE CONFERENCE, INCLUDING A PLAN OF ACTION FOR NATURAL DISASTER REDUCTION

Draft Yokohama Message

submitted by the Chairman of the Open-Ended Drafting Group of
the Main Committee, Mr. Daniel D. C. Don Nanjira (Kenya)

We, the States Members of the United Nations and other States, having met at the World Conference on Natural Disaster Reduction, in the city of Yokohama, Japan, from 23 May to 27 May 1994, in partnership with non-governmental organizations, and with the participation of international organizations, the scientific community, business, industry and the media, deliberating within the framework of the International Decade for Natural Disaster Reduction, expressing our deep concern for the continuing human suffering and disruption of development caused by natural disasters, and inspired by the Yokohama Strategy and Plan of Action for a Safer World.

Affirm that:

1. The impact of natural disasters in terms of human and economic losses has risen in recent years, and society in general has become more vulnerable to natural disasters. Those usually most affected by natural and other disasters are the poor and socially disadvantaged groups in developing countries as they are least equipped to cope with them.

2. Disaster prevention, mitigation, preparedness and relief are four elements which contribute to and gain from the implementation of sustainable development policies. These elements, along with environmental protection and

sustainable development, are closely interrelated. Therefore, nations should incorporate them in their development plans and ensure efficient follow-up measures at the community, national, subregional, regional and international levels.

3. Disaster prevention, mitigation, preparedness and relief are better than disaster response in achieving the goals and objectives of the Decade. Disaster response alone is not sufficient, as it yields only temporary results at a very high cost. We have followed this limited approach for too long. This has been further demonstrated by the recent focus on response to complex emergencies which, although compelling, should not divert from pursuing a comprehensive approach. Prevention contributes to lasting improvement in safety and is essential to integrated disaster management.

4. The world is increasingly interdependent. All countries shall act in a new spirit of partnership to build a safer world based on common interests and shared responsibility to save human lives, since natural disasters do not respect borders. Regional and international cooperation will significantly enhance our ability to achieve real progress in mitigating disasters through the transfer of

technology and the sharing of information and joint disaster prevention and mitigation activities. Bilateral and multilateral assistance and financial resources should be mobilized to support these efforts.

5. The information, knowledge and some of the technology necessary to reduce the effects of natural disasters can be available in many cases at low cost and should be applied. Appropriate technology and data, with the corresponding training, should be made available to all freely and in a timely manner, particularly to developing countries.

6. Community involvement and their active participation should be encouraged in order to gain greater insight into the individual and collective perception of development and risk, and to have a clear understanding of the cultural and organizational characteristics of each society as well as of its behaviour and interactions with the physical and natural environment. This knowledge is of the utmost importance to determine those things which favour and hinder prevention and mitigation or encourage or limit the preservation of the environment for the development of future generations, and in order to find effective and efficient means to reduce the impact of disasters.

7. The adopted Yokohama Strategy and related Plan of Action for the rest of the Decade and beyond:

(a) Will note that each country has the sovereign responsibility to protect its citizens from natural disasters;

(b) Will give priority attention to the developing countries, in particular the least developed, land-locked countries and the small island developing States;

(c) Will develop and strengthen national capacities and capabilities and, where appropriate, national legislation for natural and other

disaster prevention, mitigation and preparedness, including the mobilization of non-governmental organizations and participation of local communities;

(d) Will promote and strengthen subregional, regional and international cooperation in activities to prevent, reduce and mitigate natural and other disasters, with particular emphasis on:

(i) Human and institutional capacity building and strengthening;

(ii) Technology sharing, the collection, the dissemination and the utilization of information;

(iii) Mobilization of resources.

8. The framework of action of the International Decade for Natural Disaster Reduction provides all vulnerable countries, in particular the developing countries, with the opportunity to achieve a safer world by the end of this century and beyond. In this regard, the international community and the United Nations system in particular must provide adequate support to the International Decade for Natural Disaster Reduction, and its mechanisms, especially the secretariat of the Decade to enable them to carry out their mandate.

9. The Yokohama Conference is at a crossroad in human progress. In one direction lie the meagre results of an extraordinary opportunity given to the United Nations and its Member States. In the other direction, the United Nations and the world community can change the course of events by reducing the suffering from natural disasters. Action is urgently needed.

10. Nations should view the Yokohama Strategy for a Safer World as a call to action, individually and in concert with other nations to implement policies and goals reaffirmed in Yokohama, and to use the International Decade for Natural Disaster Reduction as a catalyst for change.

Guiding Principles for Chemical Accident Prevention, Preparedness and Response

(OECD, 1992)

GUIDING PRINCIPLES FOR

CHEMICAL ACCIDENT

PREVENTION, PREPAREDNESS AND RESPONSE

GUIDANCE FOR PUBLIC AUTHORITIES, INDUSTRY, LABOUR AND OTHERS

SECTION A

Executive Summary

The *OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response* deal with the roles and responsibilities of all interested parties including public authorities at all levels, management, and other employees of enterprises operating hazardous installations.

The Guiding Principles address the various issues which may affect safety at a hazardous installation. These include prevention-related issues such as those concerning the establishment of a corporate Safety Policy, the planning, design, siting, construction and operation of the installation, and the review of safety performance as well as the establishment of safety objectives and a control frame work by public authorities. In addition, the Guiding Principles address the issues of emergency planning and response in order to mitigate the adverse consequences of any accident that might occur. Other issues

covered are land-use planning, community awareness, research and development, and aid and investments related to installations in non-OECD countries.

While the main text is laid out issue-by-issue, this Executive Summary provides an overview of the roles and responsibilities of each of the parties under three main headings: *Public Authorities*; *Management of Hazardous Installations*; and *Employees*. In addition, the Summary includes certain items which are critical to effective accident prevention, preparedness and response but which do not fit neatly under one of the first three headings.

These have been included under the headings: *Industry in General*; *Other General Principles* and *Investments, Technology Transfer, and Aid Programmes Related to Installations in Non-OECD Countries*.

1: Public Authorities

(a) Public authorities should motivate all sectors of society to recognise the need for accident prevention, preparedness and response and to take the measures which are required of each of them.

(b) Public authorities should establish safety objectives and ensure that these objectives are being met. To do this, they should, among other things, establish a clear and coherent control framework. The control framework should set out binding requirements, define which installations are covered, establish notification and information requirements, and provide for enforcement actions for non-compliance with the requirements. Public authorities should also provide guidance to industry and others to help them understand how to fulfil these requirements. A co-ordinating mechanism should be established where more than one competent authority exists.

(c) Public authorities should establish appropriate arrangements for monitoring the safety of hazardous installations by means of both a planned sequence of inspections and visits in response to accidents, complaints, and other indicators that management control may be inadequate.

(d) Public authorities should require the investigation and reporting by management of accidents. Public authorities should also investigate significant accidents. Public authorities should publish accident information as widely as possible, including any conclusions arising from the analysis or investigation of accident data.

(e) Public authorities should establish appropriate procedures, including planning, siting, licensing and other means for giving permission for a hazardous installation to operate in a given location under certain conditions, and for limiting inappropriate developments in the vicinity of hazardous installations.

(f) Public authorities should ensure that the potentially affected public have the appropriate

information concerning hazardous installations and concerning what to do in the event of an accident with off-site effects. Communication with the public should be the joint responsibility of public authorities and industry.

(g) Public authorities, at all levels, should establish emergency preparedness programmes concerning accidents involving hazardous substances. Transport accidents involving hazardous substances should be integrated in these programmes.

(h) Public authorities should ensure the development, implementation, testing and updating of adequate on-site and off-site emergency plans in conjunction with management of hazardous installations and, as appropriate, with the participation of employees and of neighbouring communities. They should ensure that adequate manpower, equipment and financial and other resources necessary to carry out emergency plans are readily available for immediate activation in the event, or imminent threat of, an accident. Emergency response personnel should be educated and trained, on a continuing basis, to ensure that a state of readiness is maintained.

(i) Public authorities should ensure that accident warning systems are available to warn the potentially affected public when an accident has occurred.

(j) Public authorities should facilitate and promote the sharing of information and experience related to accident prevention, preparedness and response among countries and with industry.

(k) Public authorities should actively promote and support research and development related to accident prevention, preparedness and response.

(l) Public authorities should be provided with adequate staff and resources, and the staff should be appropriately educated and trained, in order to carry out their roles and responsibilities.

2: Management of Hazardous Installations

(a) Management of hazardous installations has the prime responsibility for designing, constructing and operating a hazardous installation in a safe manner and for developing the means to do so. Therefore, safety – which incorporates protection of health and the environment – should be an integral part of the business activities of an enterprise. This includes the development of a corporate safety culture, as well as appropriate corporate safety policies and procedures, and ensuring their application by employees at all levels.

(b) All enterprises operating hazardous installations should aim to reach the ultimate goal of ‘zero incidents’, and resources should be targeted to this goal.

(c) The day-to-day management of safety should be the responsibility of local line management at each installation in an enterprise.

(d) Producers of hazardous substances have a responsibility to promote the safe management of any hazardous substance they produce throughout the total life cycle of the substance, consistent with the principle of ‘product stewardship’.

(e) When planning, designing and modifying hazardous installations and processes, management should ensure that hazards are identified and ranked and that the most suitable means of reducing or eliminating the hazards are instituted. Similar analyses should be undertaken for proposed acquisitions and for existing installations that were not subject to a critical safety examination.

(f) Management should ensure that every hazardous installation has written operating procedures necessary for its safe operation.

(g) Management should ensure that the staffing of a hazardous installation is done in a manner which allows for the safe operation of the installation at all times. Management should take all reasonable measures to ensure that everyone

employed at a hazardous installation, including temporary employees and contractors, receives appropriate education and training and is competent to perform their duties in the operation of the installation under both normal and abnormal conditions.

(h) Safety measures should be incorporated in the engineering design of a hazardous installation to enhance the intrinsic safety of the installation wherever practicable. This should take into account the fact that safety may be enhanced by: avoiding or minimising, to the extent reasonably practicable, the use of hazardous substances; substituting less hazardous substances for hazardous substances; reducing inventories of hazardous substances; simplifying processes; reducing process temperatures and pressures; and separating people from hazardous substances to the extent possible.

(i) Management should pay particular attention to quality assurance during construction of a hazardous installation.

(j) Management should not engage contractors to perform jobs if this would compromise safety. Management should do business with only those contractors who are able to satisfy the management that the services will be carried out in compliance with all applicable laws and regulations as well as the relevant safety policies of the enterprise. Management should monitor and control safety compliance by contractors.

(k) Management should ensure that effective two-way channels for the transfer of safety information between management and other employees are established at hazardous installations. The regular channels of communication should be reinforced by the establishment of a Safety Committee structure to provide a formal mechanism for consultation on safety matters.

(l) Management should ensure that arrangements exist for the safety assurance of

hazardous installations, including provision for the regular maintenance, inspection and testing of equipment so that the equipment is fit at all times for the purpose for which it was designed.

(m) Management should establish formal procedures to ensure that no repair work or modifications to plant, equipment, processes, facilities or procedures compromise safety.

(n) Management should satisfy itself as to the suitability of storage facilities for its hazardous substances, as well as the competence of the warehousekeeper to undertake the storage required.

(o) Management should establish arrangements for the regular and comprehensive monitoring of safety of all its hazardous installations including those of subsidiary and, to the extent possible, affiliate enterprises.

(p) Management should, in co-operation with appropriate public authorities, provide relevant information to the public concerning the hazardous installation and actions to be taken in the event of an accident.

(q) Management should be responsible for the development implementation, testing and updating of on-site emergency plans, and for ensuring that appropriate manpower, equipment, financial and other resources are available for immediate

activation of the plans, as necessary. Management should provide to those responsible for off-site emergency plans the information they have which is necessary to assess hazards and to develop the off-site plans. There should be close co-operation between those responsible for off-site and on-site emergency planning, and all related on-site and off-site plans should be consistent and integrated.

(r) To form a basis for both off-site and on-site emergency planning, management should identify and assess the types of accidents which could arise at the installation and their likely consequences.

(s) Management should ensure that employees, contractors and visitors are made aware of the relevant provisions of the on-site emergency plans, and of what they should do in the event of an accident.

(t) Management should ensure that systems are in place for the rapid detection of an accident or imminent threat of an accident, and for the immediate notification of emergency response personnel.

(u) Management should investigate all significant incidents in order to identify causes and to undertake remedial actions to correct any deficiencies in technology or procedures.

3: Employees

(a) All employees should carry out their jobs in a safe manner and contribute actively to the development of safety policies and practices.

(b) Each employee should be responsible for following established procedures, and for taking reasonable care for his or her personal safety and for the safety of others who may be affected by the employee's acts or omissions at work.

(c) An employee should have the right to refuse to do any task which he/she believes may create an unwarranted risk of an accident involving

hazardous substances. The employee should immediately report to management the reason for refusing to perform these tasks, or any situation which could develop into such an accident.

(d) No measures prejudicial to an employee should be taken if, in good faith, the employee complains to other employees with responsibilities for safety of what he/she considers an inadequacy in the measures taken with respect to safety.

4: Industry in General

(a) Larger enterprises and trade associations should, as appropriate, offer assistance to small and medium-sized enterprises in meeting safety objectives.

(b) Process or other safety-related technology should not be transferred unless the supplier is satisfied that the technology receiver can apply the technology in a safe manner.

(c) Industry, including manufacturers and processors of hazardous substances and equipment

designers, have the primary responsibility for carrying out safety-related research.

5: Other General Principles

(a) The Polluter-Pays Principle, with respect to accidents involving hazardous substances, should be applied in accordance with the OECD Council Recommendation [C(89)88(Final)].

(b) The media should be provided with appropriate information concerning hazardous installations and should be involved in the

emergency planning process in order that they can provide an effective means of communication in the event of an accident. In this function, they should be given access to officials during an emergency so that they can provide essential and accurate information to the public.

6: Investments, Technology Transfer, and Aid Programmes related to Installations in Non-OECD Countries

(a) Industry and public authorities should support the principle that hazardous installations in non-OECD countries should be sited, designed, operated, managed, maintained and monitored so as to meet a level of safety at least equivalent to installations in OECD countries.

(b) The degree of safety of installations which result from an investment by an OECD-based enterprise or which incorporate process or other safety-related technology transferred from an OECD country, should be the highest level of safety reasonably practicable according to the current state of knowledge.

(c) Transfer of technology from an OECD country to a non-OECD country, or investment by an OECD-based enterprise in a new hazardous installation in a non-OECD country, should only take place once there is reasonable assurance that safe operating conditions can be achieved taking into account local factors.

(d) Transfer of technology related to hazardous installations should only take place if accompanied by appropriate safety technology and information.

(e) The prevention of accidents should be one of the fundamental business considerations taken into account by OECD-based enterprises, as well as by international service organisations and financial institutions, in any investment related to a hazardous installation in a non-OECD country.

(f) Bilateral and multilateral aid agencies should help reduce the likelihood of accidents involving hazardous substances in aid-recipient countries by providing technical assistance, education and training to build institutional infrastructures.

(g) Aid agencies should screen relevant aid proposals to minimise the possibility that aid projects will help create sustain or increase an unreasonable risk of an accident involving hazardous substances, and should include in any aid projects involving hazardous substances adequate monitoring and follow-up to ensure that essential safety requirements are being met.

(h) Multilateral financial institutions should develop policies and procedures for minimising the risks of accidents at hazardous installations they help to finance.

The APELL process²

In 1988, the UNEP Industry and Environment Centre (IE) developed, in cooperation with industry and other international organizations, a *Handbook on Awareness and Preparedness for Emergencies at Local Level* (APELL). This handbook is designed to assist decision-makers and technical personnel in improving 'community awareness' of hazardous installations, and in preparing 'Emergency Response' plans should unexpected events endanger life, property or the environment.

APELL addresses all emergencies related to any industrial or commercial operation which have a potential for fire, explosion, spills or releases of hazardous materials. How to determine which industrial and commercial operations should be concerned by the APELL Process is in principle the result of a risk assessment. In many cases, simple judgement and common sense may identify the facilities which present a potential for a major accident. The following article explains the most important aspects of the APELL process. The UNEP publication *Hazard Identification and Evaluation in the Local Community* gives some general guidance (UNEP, 1992).

Prepared by **John E. Hay** Coordinator
 Network for Environmental Training at Tertiary Level in Asia and the Pacific (NETTLAP)
 UNEP Regional Office for Asia and the Pacific, Bangkok, Thailand

I. Introduction

The APELL process is designed to build on all emergency plans already in existence and produce a coordinated single plan that will operate effectively at the local level where first response efforts are so critical.

There are several reasons why it is appropriate to focus on the local level. These include:

- the extent of an accident's impact depends heavily on the immediate response to an emergency at the plant site and at the local level;
- in addition to being responsible for safety and accident prevention in their own operations, industrial plant managers and their staff are in the best position to provide information on how the facility operates and on how it could affect its environment and to help prepare appropriate community response plans in the event of an emergency;
- community members and organisations are the principal stakeholders in public safety and health and environmental quality and they are therefore highly motivated to express concerns

and participate in planning for and responding to emergencies.

II. The Two Aspects of APELL

There are two principal components in a strategy for awareness and preparedness for emergencies at the local level. These are:

- the enhancement of *community awareness* of the possible hazards involved in the manufacture, handling, and use of hazardous materials or the use of hazardous processes and the steps taken by authorities and industry to protect the community and environment from the possible effects;
- in the manufacture, handling, and use of hazardous materials or the use of hazardous processes and the steps taken by authorities and industry to protect the community and environment from the possible effects;
- development of *emergency response plans* which involve the whole community in reacting to an emergency endangering its safety and welfare, in terms of effects on persons, property or the environment.

² This paper is based on the UNEP publication *APELL: Awareness and Preparedness for Emergencies at Local Level*. The Annexes referred to in the present paper may be found in that report.

III: APELL is a Collective Responsibility

Awareness and preparedness for emergencies is a collective responsibility, involving more than just the local level. The various parties and their roles are as follows.

National Level

- involves ministries, departments, agencies, boards etc responsible for national planning, industry, the environment, public services, safety and health;
- these agencies will set national goals, priorities and standards; establish regulations; provide support and resources to foster cooperation at the local level and allow participants to achieve better preparedness.

Local Authorities

- involves state, province, district, city and town officials responsible for providing the public with services related to public and environmental health and safety;
- these officials will facilitate the preparation and implementation of response plans and programmes to increase public awareness; ensure cooperative participation of, and adequate training and appropriate resources for, public service functions such as police and fire departments; approve emergency response plans and monitor their performance.

Local Community and Interest Groups

- includes leaders of the community, such as leaders of NGOs and other groups involved in community services, environmental protection and conservation, religious activities, health and lay care, education, business and communications;
- these people and groups will bring to the attention of government and industry the concerns of the community and inform the community as to what is being done to address their concerns; assist with training the public on hazards that may exist and the emergency response steps that are necessary.

Industry

- involves owners and plant managers of industrial facilities where hazardous materials are used or manufactured or where hazardous processes occur; the work force of such establishments; members of the transportation industry involved in conveying or controlling hazardous materials;

- their roles are to ensure that the best possible accident prevention and emergency preparedness procedures are in place within the industrial facility; participate in programmes that will result in a well-informed community capable of effective participation in emergency response programmes without harbouring unfounded fears of hazards; establish close and good working relations with the emergency response agencies in the local community and with local community officials and leaders.

International Organisations

- includes both governmental and non-governmental organisations at the regional and global levels such as industry, manufacturing and trade associations, consumers associations, workers associations, social welfare, conservation and environmental organisations and technical organisations;
- these organisations and their members will assist in coordination of information, expertise, resources and concerns; promoting and supporting the implementation of emergency response plans and programmes to increase public awareness. The relationships between these partners are shown in

Figure 0.10.

Development of awareness and preparedness for emergencies requires the close and effective cooperation between local authorities, local leaders and representatives of the industrial facilities to which the local area plays host. The 'bridge' can be provided by a 'Coordinating Group' (**Figure 3.11**). Members of this group must be able to command the respect of their various constituencies and be willing to act cooperatively in the interest of local well-being, safety and property.

Industry is primarily responsible for protective actions within the boundaries of the industrial plant. All industrial facilities have a responsibility to establish and implement a facility emergency response plan. A key foundation for such a plan is a safety review – a list of items which affect the safe operation of a facility, and which should therefore be included in such a review, is given in *Annex 1*. One part of this in-depth review is the preparation of an

emergency response plan. Typical components of such a plan are listed in *Annex 2*.

On the other hand, local government is responsible for the safety of the general public and the protection of the environment. The role of the Coordinating Group is to provide the bridge between industry and local government, with the cooperation of community leaders, and to develop a unified and coordinated approach to emergency

response planning and communication with the community. *Annex 3* contains a list of people or organisations who should be included in the Coordinating Group.

Note that the Coordinating Committee does not have a direct operational role during an emergency; rather it is preparing the various parties involved to be ready and to know their tasks should an emergency occur.

Figure 0.10 APELL information and organization flow chart

(from UNEP, 1988)

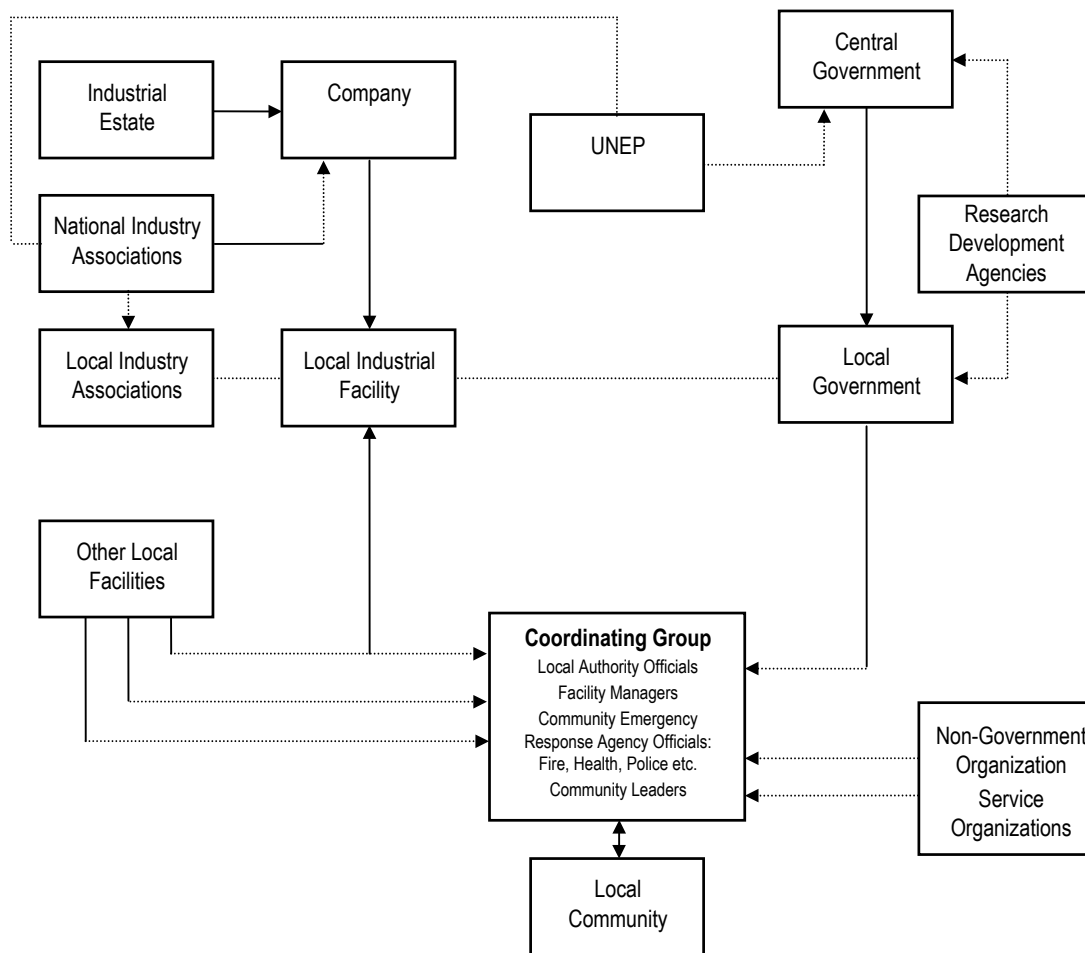
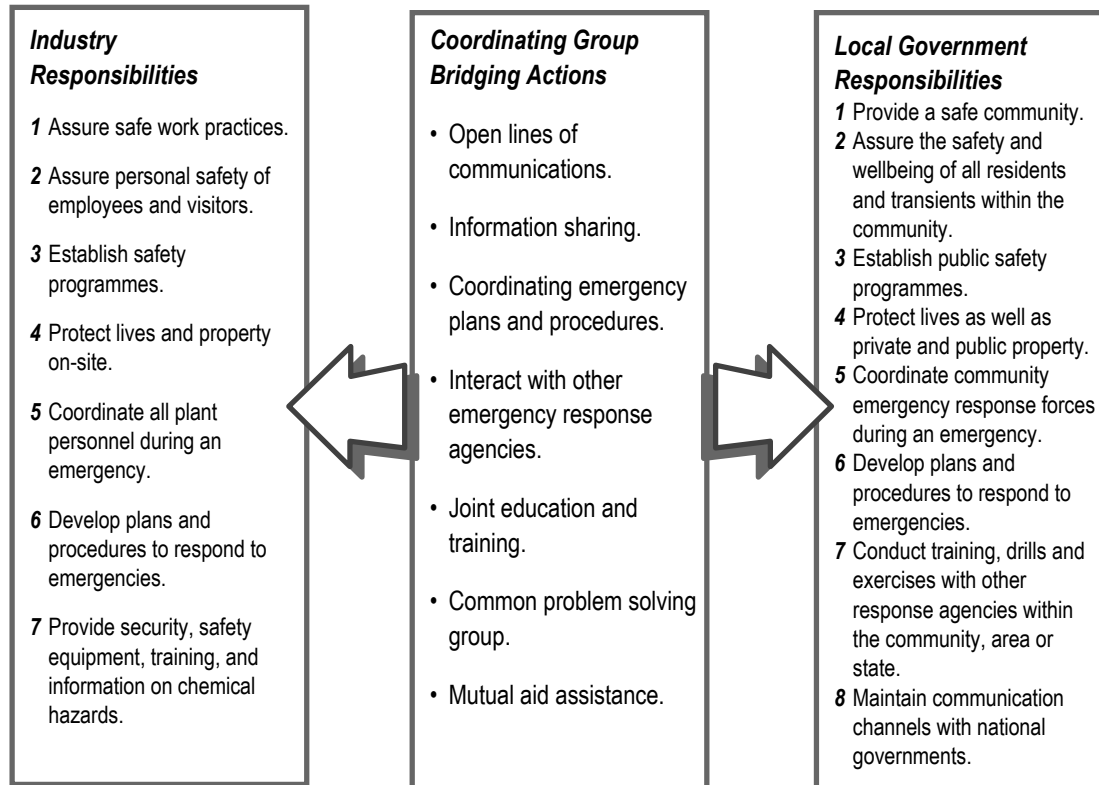


Figure 0.11 The 'responsibility bridge'

(from UNEP, 1988)



IV: Assessing the current situation

The steps involved in this facet of APELL are:

- identify local agencies making up the potential local awareness and response preparedness network (e.g. emergency health services, civil defence, NGOs such as Red Cross/Crescent, schools, public utilities, religious organisations);
- identify the hazards that may produce an emergency situation (see Annex 3); include operations such as water treatment plants, hospitals, transport and warehousing in addition to chemical manufacturing and potentially hazardous operations; include natural hazards in addition to human-induced hazards;
- establish the current status of community planning and coordination for hazardous materials emergency preparedness and assure that potential overlaps in planning are avoided; assess authority and responsibility, information bases, training programmes and effectiveness of the plan under test conditions;
- identify the specific community points of contact and their responsibilities in an emergency; identify individuals or organisations in the community which have specific chemical or toxicological expertise;
- list the kinds and amounts of equipment and materials which are available at the local level in response to emergencies;
- identify the organisation structure for handling emergencies; identify the single person who would be in charge and the chain-of-command;

- determine if the community has specialized emergency response teams to respond to hazardous materials releases – the teams may be government, industry or community based;
- define the community emergency transportation network (e.g. evacuation routes and access routes for emergency services);
- establish the community procedures for protecting citizens during emergencies; and
- establish a mechanism which enables responders to exchange information and ideas during an emergency.

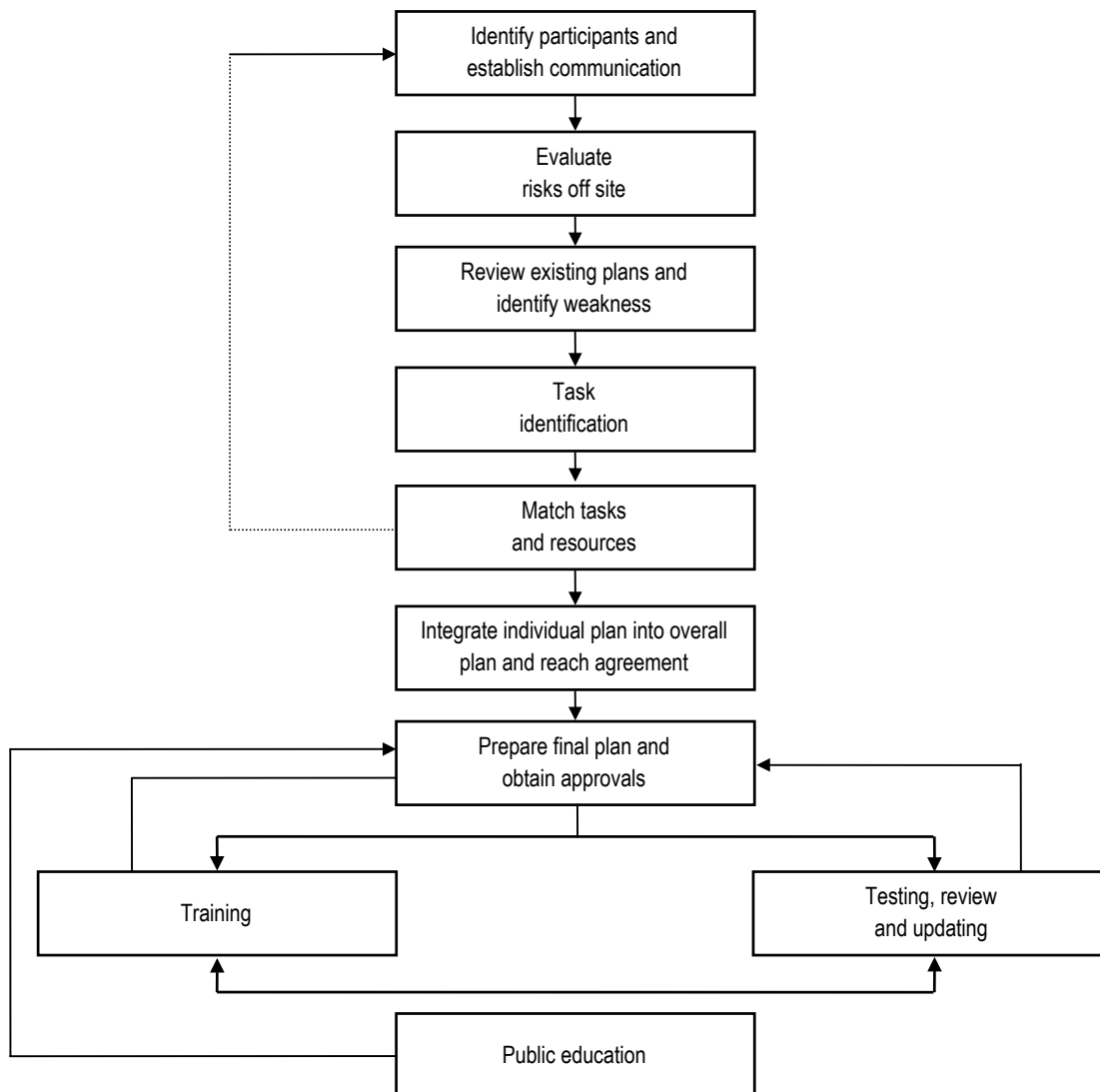
Responses to these tasks should show how well the local area can deal with an emergency which could cause injury to life and health and/or damage to property and/or the environment. The assessment show the need to enhance the existing or produce a new emergency response plan. The following section outlines an appropriate approach.

V: Preparing an emergency response plan

Based on experience, a ten-step approach has been developed for preparing a useful and effective integrated community emergency response plan (*Figure 0.12*).

Figure 0.12 Community emergency plan implementation flow chart

(from UNEP, 1988)



- 1 **Identify the emergency response participants** and establish their roles, resources and concerns (*Annex 10* identifies possible participants).
- 2 **Evaluate the risks and hazards** that may result in emergency situations in the community – compile a list of potential hazards, both natural and human-related; define the magnitude of the risk and the potential seriousness of the impact; to determine the probability of occurrence, decide if a qualitative approach is sufficient or whether a quantitative risk assessment is necessary. Factors to consider include the probability of individual events and of simultaneous events complications from special environmental considerations. Prepare a list of scenarios reasonably expected to occur for use throughout the planning process.
- 3 **Have participants review their own emergency plan** for adequacy relative to a coordinated response (*Annexes 4* and *6* would assist this review).
- 4 **Identify the required response tasks** not covered by an integration of existing plans.
- 5 **Match these tasks to the resources available** from the participants and assess willingness and ability to contribute and participate.
- 6 **Make the changes necessary** to improve existing plans, integrate them into an overall community plan and gain agreement. Review the draft plan and subsequent modifications against the planning elements in *Annex 4* to ensure completeness. Assess and modify the plan using a tabletop role-playing exercise. Assure the integrated community plan is compatible with any regional or national disaster preparedness plan and industry/utility/transportation emergency plans.
- 7 **Prepare full documentation** for the integrated community plan and obtain the necessary approvals from government and other authorities.
- 8 **Educate participating groups** about the integrated plan and ensure that all emergency responders are appropriately trained.
- 9 **Establish procedures** for periodic testing, review and updating of the plan.
- 10 **Educate the wider community** about the integrated plan. Prepare and distribute an explanatory brochure. Prepare a media briefing kit and conduct a briefing. Implement a broad-based public education programme (see below).

VI: Facilitating community awareness, involvement and preparedness

The important points to consider in community awareness, involvement and preparedness are:

- defining the local community concerned;
- preparing an inventory of local community contacts;
- contacting other industrial facilities to coordinate community affairs activities;
- developing fact sheets or kits on each industrial operation;
- developing fact sheets on community preparedness;
- assigning responsibilities for community tasks;
- looking for communications opportunities;

- selecting methods of communication appropriate for local circumstances (e.g. slide/speech presentations, community newsletters, plant tours, visiting schools);
- using appropriate outside help (e.g. Chamber of Commerce, public relations firms, community and religious leaders);
- involving employees in the industrial facility, transport company etc, explaining the APELL process and the roles of the company and employees in it.

VII: Keeping the public informed

All parties to the APELL process have a duty to keep the public informed in a timely, sensitive and appropriate manner and to ensure that conflicting or confusing information is not passed to the public. Media relations efforts, like

local level cooperation programmes, cannot be started after an emergency has occurred.

Considerations for media relations should include:

- **preparation:** decide who will serve as spokesperson in all contacts with the media, not only in an emergency. Determine what media and which reporters really count, and under what circumstances. Prepare a kit of basic facts and graphic materials, using readily understood language, for use in subsequent interactions with the media.
- **getting acquainted:** get to know local and regional media personnel, and determine what they tend to emphasise. Involve local leaders and industry managers in the 'getting acquainted' process.
- **cultivating and maintaining good relations:** ensure that local media are receiving the information they require. Seek opportunities to bring 'good news' to the attention of the media.
- **developing a public information plan before an emergency arises:** plan for the spokesperson to receive current and accurate information about the emergency as it progresses. Select a location to act as a media centre and assess access and resources. Industry managers should develop a general policy on media access in an emergency situation.
- **adhering to the plan in an emergency:** the media spokesperson should be included in the first call out of emergency personnel and should be fully briefed. Log all enquiries and note name and affiliation, questions and answers. Follow up on questions that cannot be answered immediately.

VIII: Media relations

The following are important to note in the context of media relations.

- Do not expect reporters to be trained in the intricacies of industrial processes and human and environmental toxicology. Keep all explanations factual and simple; analogies are useful.
- Never speculate or answer hypothetical questions.
- Don't be afraid to admit that you 'don't know', but provide an answer later if you can.
- Be sensitive to relatives etc in cases of death or injury. For example, do not release names before relatives have definitely been notified.

- Do not comment on the seriousness of injuries; leave this to the professionals.
- Be open and cooperative with reporters, but recognise that there is no need to go beyond factual outlines of the situation, even when pressured.

IX: Termination of an emergency

The termination stage of an emergency is frequently overlooked. But often, it is as important as the initiation of an emergency. There needs to be an explicit system whereby personnel understand that the emergency is terminated. It is important that all personnel are aware of who has the authority to terminate an emergency status and what the procedure will be. Verbal methods are potentially dangerous; audio, visual or written methods are preferred.

If public emergency services have been involved, it is likely that the public emergency service commander will first terminate his/her status by handing control back to the company commander or coordinator.

X: Further assistance

Sources of additional information and assistance with emergency planning include:

- *APELL: Awareness and Preparedness for Emergencies at Local Level*. Industry and Environment Office, United Nations Environment Programme, Paris, France, 63pp;
- *The APELL Newsletter*. Industry and Environment Office, United Nations Environment Programme, Paris, France;
- List of references in *Annex 11*; and
- *CAMEO: Computer-Assisted Management of Emergency Operations*. A computer programme that assists local planners in managing information about chemicals in the community and in conducting a hazards analysis and developing integrated emergency response plans for industrial accidents. The computer package includes an extensive data base for over 3000 chemicals.

Further information available from Industry and Environment Office, United Nations Environment Programme, Paris, France.

XI: Reference

UNEP [1988] *APELL: Awareness and Preparedness for Emergencies at Local Level*.

Paris, France: Industry and Environment Office, | United Nations Environment Programme. 63pp.

How APELL can be introduced to a community

The APELL Handbook provides the elements for local communities to prepare emergency response plans in co-operation with industry and other leading groups. This Handbook has been translated into many languages by local groups.

It is often useful to bring into the community someone who already has direct experience of starting such a programme. Such an outsider is also more easily seen as 'neutral' by local interest groups. The exchange of information and guidance based on experience elsewhere is generally arranged through national or regional APELL seminars and workshops. It is important that these seminars and workshops be locally generated, using the outside experience as and when requested.

Workshops and seminars bring local partners together to discuss how the process described in the handbook will allow them to start addressing their common problems and hazards.

Objectives of Seminars and Workshops

The main objective is not just to offer management knowledge of APELL to key decision-makers, but also to develop their ideas into a co-operative programme which becomes their own. This encourages local implementation and follow-up.

Organization of the Seminar and Workshop

APELL seminar/workshops are arranged by local host organizations, usually an association of government and industry. They arrange the venue and conference facilities and invite 50 to 60 senior individuals from industry, government and the local community. UNEP may

arrange the international experts/speakers for the APELL seminar presentation during the workshop.

Typically, a four-day programme integrates the seminar discussions with the participative workshop.

The first part of the seminar presents the APELL programme. Speakers from industry, government and local authorities/community present their views on their complementary roles in promoting technological safety, health, environmental protection, accident prevention and response programmes. The second part of the seminar focuses on specific elements and issues related to the implementation of APELL. This session is complemented by the presentation of APELL-like case studies and special topics.

The workshop sessions broaden the discussions of the previous two days. Working groups identify needs, priorities and possible actions which should be pursued for the implementation of APELL. The working groups present their findings in a final presentation to a panel of national/local decision-makers. Such recommendations and conclusions are summarized in a final report, and serve as a basis for follow-up action.

Further information on organizing APELL meetings can be obtained by writing to UNEP IE in Paris.



Part 4

Resource Package on APELL

<i>0</i> Introduction.....	IV:5
<i>0</i> Overview of APELL.....	IV:6
<i>0</i> Transparencies on the APELL Programme.....	IV:11

Resource Package on APELL

Introduction

This Part provides useful additional information to trainers who are concerned with explaining the APELL to national or international audiences who are interested in this concept.

Users should also refer to the background paper in *Section 3.9*.

This package is *not* sufficient for the actual implementation of an APELL Programme. Much

additional information of a more technical nature is needed for this. The material in this Part consists largely of tables and diagrams taken from various APELL documents. It summarizes the key elements of the APELL process, without, however, giving any explanations. For this, the original references should be consulted.

Most of the material is in the form of overhead transparencies.

Overview of APELL

APELL partners include:

At national level

- Ministry of Interior
- Ministry of Industry
- Ministry of Environmental Protection
- Ministry of Defense
- Public services/works
- Department of Occupational Health
- National Safety Council
- Association of Chemical Manufacturers
- Chambers of Industry/Commerce.

At local level

- Province or district authorities
- Mayor’s office
- Local authorities:
 - *public services* –
 - *police*
 - *fire department/civil defense*
 - *first aid/hospitals* – *social health services*
- Industry within the area:
 - *manufacturing or processing companies*
 - *transport/storage companies*
 - *industrial mutuals and societies*
- Local community and interest groups:
 - *community services* –
 - *news/media*
 - *business community* –
 - *environmental groups*
 - *schools/educational groups.*

Note to trainer: After having stated the objectives of APELL, it is important to identify the partners in the APELL process.

What are APELL partner responsibilities?

At national level

- prepare government framework for accident prevention, emergency response and preparedness at all levels
- enable local/district authorities to acquire and provide resources needed to respond effectively to accidents or emergencies.

Industry

- make company management responsible for safety, human health and ecology within and outside the fence, including emergency response and preparedness
- develop and implement accident prevention and preparedness programmes

- develop outreach programmes in response to demands for information from authorities, health care organizations, fire brigade, police, etc.
- acquire and provide the necessary resources to respond effectively as soon as accidents or emergencies occur involving products of the industry.

Local Authorities

- raise public awareness of local hazards and risks
- coordinate cooperative programmes
- acquire and mobilize resources needed
- respond effectively in case of accidents or emergencies

Note to trainer: After having identified the APELL partners, it is important to outline the partners’ responsibilities.

Awareness building

APELL partners, either individually or through the coordinating committee, should:

- **identify in industrial areas:**
 - factories or storage depots and their management
 - local, industrial area, state or multinational companies
 - the nature and extent of industrial hazards.
- **identify important authorities, such as:**
 - governing bodies and officials
 - civil defense – fire brigades
 - police – educational agencies
- environmental protection agencies
- occupational/human health agencies
- **define the community background, including:**
 - size of population affected – geography
 - influential organizations
 - media organizations
 - chambers of commerce
 - concerns of the population.

See APELL handbook pages 26-28

Note to trainer: Industry managers local authorities or community leaders who participate wholeheartedly in establishing and implementing the APELL process should consider these points in building community awareness.

N.B. This is not only a task of the coordinating group!

Information/communication

- Get acquainted with other APELL partners.
- Cultivate and maintain good relations.
- Preparation
 - i.e. How do you organize the communication?*
 - Do you have fact sheets?*
- Express thoughts and proposals in understandable language.
- Develop a communication plan before there is trouble.
- Follow up on the plan when trouble comes.

See APELL handbook pages 28-29

Note to trainer: All APELL partners, as listed in the table on page 62 of the APELL handbook, have a duty to keep the public informed on progress. All partners should ensure the public does not receive conflicting or confusing messages; confusing or contradictory information can undermine the entire operative effort.

Local Emergency Preparedness Planning: I

Identify	hazards that may produce an emergency situation.
Establish	the current status of community planning and coordination for hazardous materials emergency preparedness, and assure that potential overlaps in planning are avoided.
Identify	the organizational structure for handling emergencies.
Identify	the local agencies that make up the community's potential awareness and response preparedness network.
Identify	the specific community points of contact and their responsibilities in an emergency.
Check	if the local authorities and/or industry have a specialized emergency response capability to respond to hazardous materials releases.
List	the emergency fighting equipment and materials available to respond to emergencies.
Define	the community emergency transportation network.
Set up	a mechanism that enables responders to exchange information or ideas with other entities before, during and after an emergency.
Establish	the current status of community procedures for protecting citizens during emergencies.

See APELL handbook pages 31-33

Note to trainer: These points only cover some of the major considerations or issues that should be resolved within or by the coordinating group.

N.B. this data should be collected before the ten-step plan in the APELL Process is started.

Local Emergency Preparedness Planning: II

Ten-Step Plan

This plan leads to a useful and effective integrated community emergency response plan. Significant effort will be required to complete each step.

1	Identify	emergency response participants, roles, resources, concerns
2	Evaluate	risks and hazards
3	Review	current emergency response plans for adequacy and coordinated response
4	Identify	the required response tasks not covered by the current plans
5	Match	tasks to available resources from identified participants
6	Make	changes necessary to improve existing plans, gain agreement
7	Present	integrated community plan in writing to local authorities
8	Educate	participating groups
9	Establish	procedures for periodic testing and updating
10	Educate	the general community about the integrated plan

See APELL handbook pages 35-42

Note to trainer: The ten-step plan can be initiated after:

- *the APELL partners and their responsibilities have been identified*
- *preparation/preliminary research has been done by the co-ordinating group.*

Partners' responsibilities include:

- *ways to build awareness*
- *disseminating information*
- *monitoring good communication.*

This ten-step plan should lead to a useful and effective community response plan.

Components of an emergency response plan for an industrial facility

- Plant emergency organization.
 - Plant risk evaluation.
 - Area risk evaluation.
 - Accident notification procedures and communication systems.
 - Emergency equipment and facilities.
 - Procedures for returning to normal operations.
- Training and drills.
 - Regular tests of emergency organization and procedures.
 - Plan updates.
 - Emergency response procedures and operating manual.

Note to trainer: The APELL process, conducted by the coordinating group, is designed to assist in preparation for response to an emergency. This is called the Emergency Response Plan. A short summary of the components is given here. A more detailed list of components can be found in Annex 2 of the APELL Handbook. (See “Preparing an Emergency Response Plan”, Part III, Fig. 3.)

Evaluating an emergency response plan

- Identification of levels of vulnerability and probable locations of hazardous products.
 - Identification of areas of public health concern.
 - Identification of sensitive environmental areas.
 - Information on chemical and physical properties (e.g. MSDS).
 - Involvement of all groups in development and approval.
- Providing a review mechanism during a response or exercise so as to correct shortfalls.
 - Communication system for dissemination of information to responders, affected public, etc.
 - Identification of trained and equipped incident commanders.

Note to trainer: This is to evaluate the plan rather than the preparedness of those who developed the plan. It is not sufficient to ask if there is a plan, but rather to determine if the plan that does exist adequately addresses the needs of the community or entity for which the plan was developed.

Transparencies on the APELL Programme

This set of transparencies can be used to explain the APELL Programme and the APELL process. The set follows a logical order, but does not necessarily have to be used as a whole. The trainer may want to add certain transparencies or leave some out.

Space has been left under each transparency for the trainer to make personal notes and add key information for discussion.

This is a selection from transparencies which are available from UNEP IE. If this section doesn't provide you with enough transparencies on the APELL Programme, or if you would like to obtain some transparencies covering other environment related issues, please contact UNEP IE.

APELL

***Awareness and
Preparedness for
Emergencies at
Local
Level***

Why APELL?

Major accidents occur:

- *universally, diverse circumstances*
- *human and environmental damage*

Exposure beyond fence:

- *prevention not a guarantee*
- *raises issue of awareness*

Response capability before accident:

- *devise and practise*
- *test and develop*

1/2

Why APELL?

Emergency plans require coordination:

- *industry and authorities*
- *services and community*

Coordination requires APELL:

- *social and technological systems*
- *planning/communication vital*

2/2

Well Known Accidents

	Place	Product	Deaths	Injury	Evacuated
1966	Feyzin, France	LPG	17	-	-
1974	Flixborough, UK	Hexane	28	104	3 000
1976	Seveso, Italy	Dioxine	-	200	730
1978	Los Alfaques, Spain	Propylene	216	200	-
1979	Three Mile Island, USA	Nuclear	-	-	200 000
	Mississauga, Canada	Chlorine	-	-	220 000
1984	Bhopal, India	Isocyanate	2 800	50 000	200 000
	Mexico City, Mexico	LPG	500	2 500	200 000
1986	Basle, Switzerland	Insecticide	River pollution		
	Chernobyl, USSR	Nuclear	31?	299	135 000
1987	Pampa, USA	Butane	31	-	-
1988	Piper Alpha, North Sea	Oil Rig	167	-	-
	Tours, France	Chemicals	-	3	200 000
1989	Ufa, USSR	Gas pipe	575	623	-
	Passadena, USA	Ethylene	23	125	1 300
1990	Sydney, Australia	LPG	-	-	10 000

Source: OECD Selected List

Sources of Major Accidents

Frequently released chemicals:

- *large volume industry*
- *chlorine, ammonia, acids, alkalis*

Source of release:

- *manufacturing facilities*
- *chemical producers and users*

Quantities released:

- *wide range: 25 kg - 25 tonnes*

1/2

Sources of Major Accidents

Cause of release:

- *commonly more than one*
- *equipment failure and operator error*

Where from?

- *storage, piping, process vessels*
- *valves, mechanical equipment*

Which operations?

- *routine processing*
- *(un)loading and maintenance*

2/2

What is APELL?

APELL is a programme designed to:

- *create, or increase community awareness of local potential hazards*
- *develop a co-operation plan to respond to emergencies caused by these hazards*

It addresses all *emergencies* related to any industrial or commercial operation in a community (with the exception of nuclear industry).

It addresses all countries:

- *by providing the basic concepts for the development of a local action plan*
- *by allowing flexibility to adapt them to local conditions*

1/2

What is APELL?

It is not:

- *a model*
- *a detailed technical manual on risk management*

*APELL was developed by
UNEP IE in cooperation
with CMA and CEFIC*

2/2

What are the objectives of APELL?

- **To provide community members with information on:**
 - *the hazards in its neighborhood*
 - *the measures to be taken to reduce their risks.*
- **To review, update, or establish emergency response plans in the area.**
- **To increase local community involvement.**
- **To integrate industry emergency plans with local emergency plans in one overall plan.**
- **To involve members of the local community in the development, testing and implementation of the overall emergency response plan.**

APELL

How APELL works

- *Partner roles*

Seminars and workshops programme

Who are the APELL partners?

At the local level:

Local authorities

Industry

(state-owned or private):

- *plant managers*
- *workers*

**Local community and
interest groups**

1/3

Who are the APELL partners?

At the national level:

- **Governments**
- **Industry associations**
- **NGOs**

2/3

Who are the APELL partners?

Other partners

- **International governmental organizations**
- **International/regional/national industry and trade associations**
- **Regional governmental organizations**
- **International NGOs**

3/3

APELL partners' role

Industry/CMA

Top commitment prevention

Government

Legislation guidelines

Community

Right/need to know

Plant management

Outreach

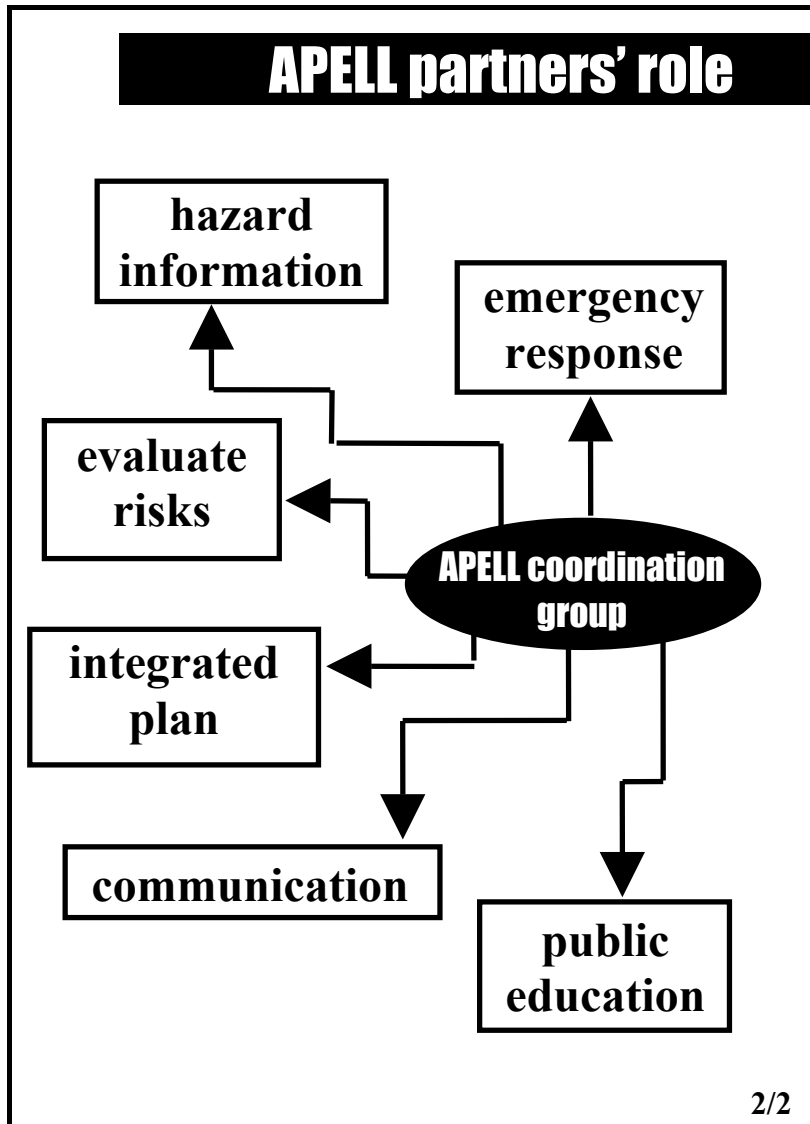
Local authority

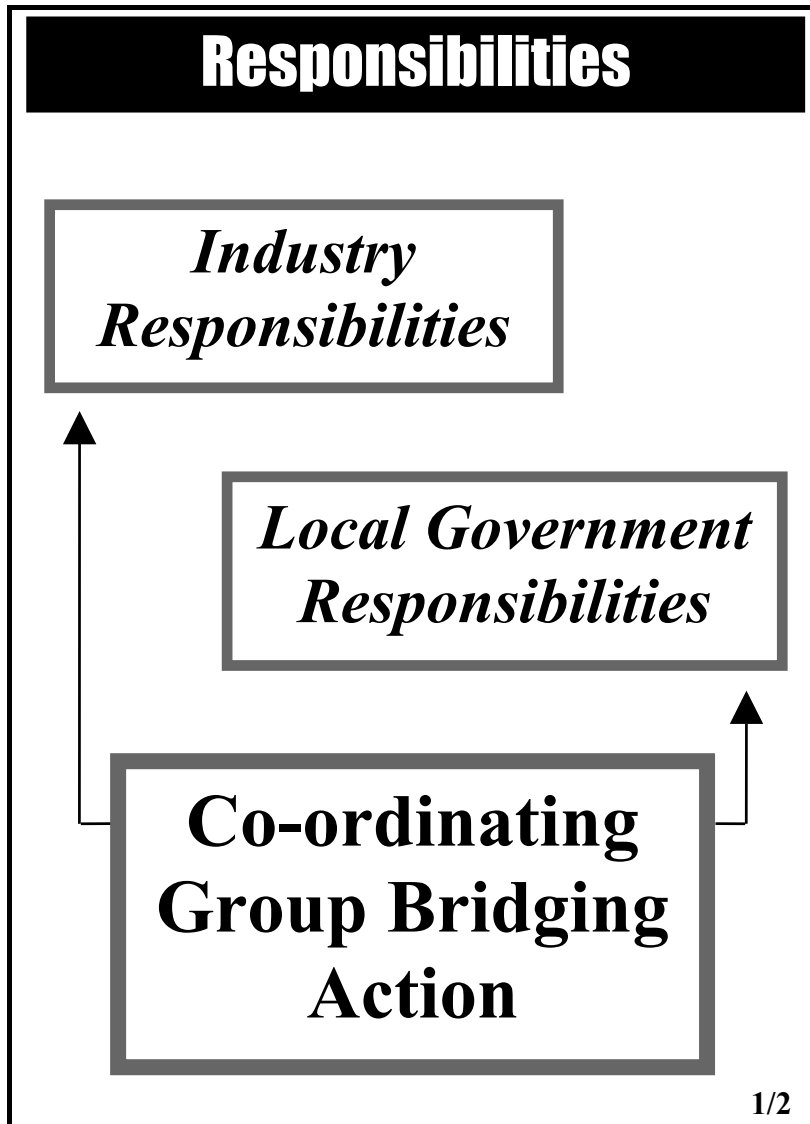
Awareness

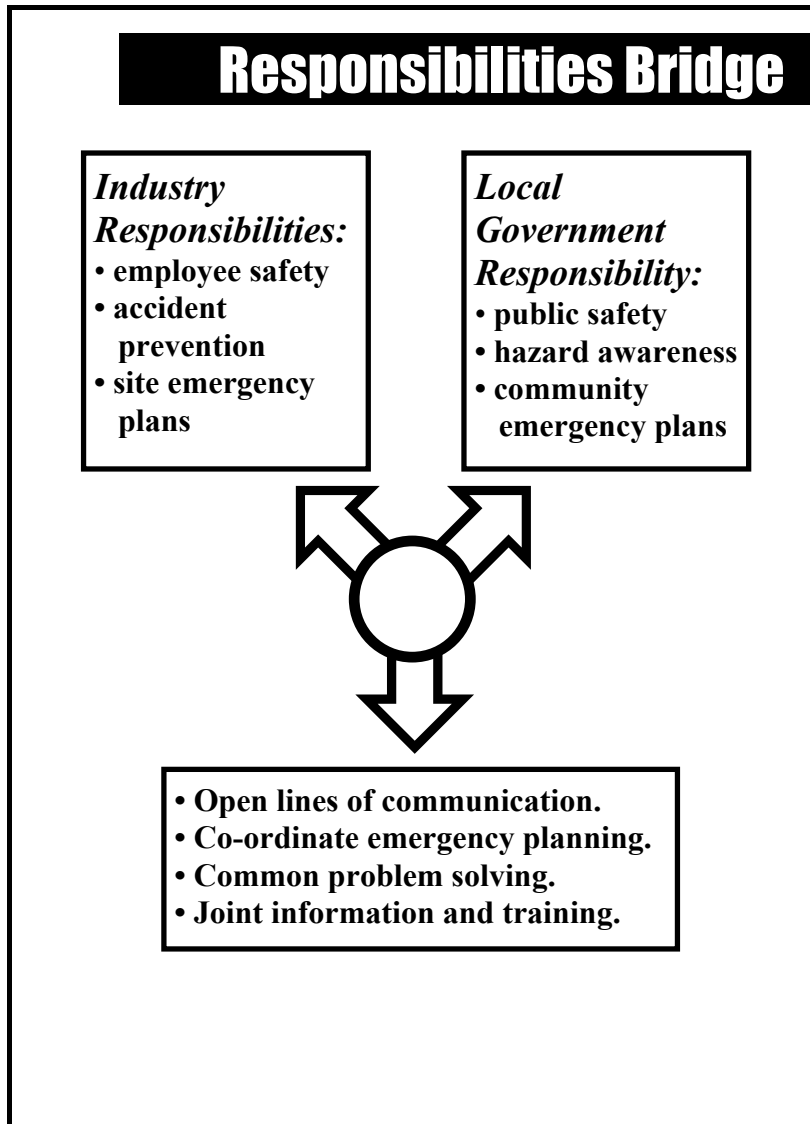
Interest groups

Issues

1/2







10 steps to implement APELL

1 Identify participants in Response Planning

- • *their roles, resources and concerns*

2 Evaluate offsite risks

- • *probable accidents with high consequences*

3 Review existing plans

- • *potential contribution to coordinated response*

1/3

10 steps to implement APELL

4 Examine joint plan deficiencies

- *tasks needing better coordination*

5 Match existing resources to needs

- *how each problem can best be handled*

6 Upgrade and integrate existing plans

- *to be effective for whole community*

7 Formalize and approve overall joint plan

- *written agreement to satisfaction of authorities*

2/3

10 steps to implement APELL

8 Educate groups

– train responders

- *make presentations and conduct drills*

9 Plan – test – critique –

update – test again

- *periodically resolve deficiencies in co-ordination*

10 Educate community

- *explain emergency plan and everyone's role*

3/3

Awareness and Communication

Identification of hazards

- *What hazards?*
- *Where?*

Definition of risks

- *To whom?*
- *What effect?*

Planned prevention and response

- *Plant measures*
- *Emergency services*

1/2

Awareness and communication

Emergency alert

- *Signal system*
- *Initial precautions*

Emergency response plans

- *Co-ordination / clear roles*
- *Further actions*

Clean-up and mutual aid

2/2

In-plant activities

**Establish and maintain
plant plan**

*Continually improve
employee awareness of
emergency response
planning*

Regular plant tests

Outside plant activities

- **Define the local community**
- – *D*
- **Prepare a list of initial contacts**
- – *Meet with key officials*
- **Establish or identify a co-ordinating group**
- – *Prepare and implement community outreach programme*

Building Community Awareness

How should we communicate?

- **Define the local community**
- – *Draw up inventory of existing local community contacts*
- **Contact other industrial facilities to co-ordinate community activities**
- • *Plan an initial meeting of a “coordinating group”*
- **Look for communication opportunities**
- – *Select methods of communication appropriate for local conditions*
- **Seek outside help**
- – *Inform employees and personnel*
- **Assign responsibility for communication tasks**

1/2

Building community awareness

What should we communicate?

- **Develop fact sheets or kits on each industrial operation**
- – *Develop fact sheets on community preparedness*

2/2

**Benefits of an
involved and informed
community:**

- **Reduces fear of the unknown**
- – *participation offers a control element*
- **Emergency planning and response enhancement**

Some *do's* and *don'ts* when handling information

All parties active in APELL have:

- *A duty to keep the public informed*
- *The responsibility to insure that no conflicting or confusing messages reach the public*

Developing working relations with the media:

- *is not a magical process*
- *needs time and effort from all members of the “coordinating group”*

Developing media relations cannot start after an emergency has arisen

APELL programme results

- **Accident prevention**
- **Improved co-ordinated emergency response**
- **Accident impact reduction**
- **Increased peace of mind in the community**
- **Improved working relationships between industry and local community**

Local APELL programme schedule

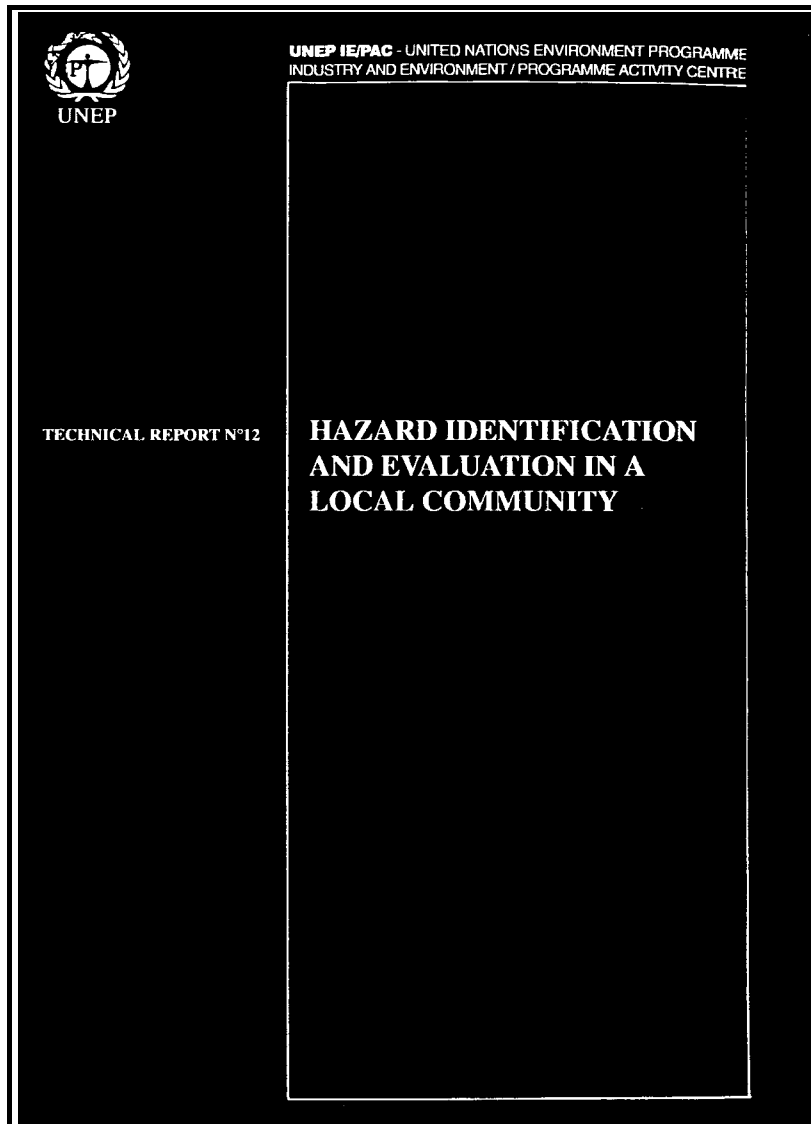
- **Discuss initiation of coordinating group**
- **Achieve general agreement between key groups**
 - – *government/industry/community*
- **Form co-ordinating group**
- **Produce draft of plan**
- **Practise draft plan**
- **Formalize plan**
- **Review, revise and test programme**

APELL programme results

The UNEP APELL programme provides:

- **Publications**
- **Training**
- **Networking**
- **Technical assistance**

*Trainer's note: for publications, see slide 32
for training, see slide 35*



The cover of UNEP Technical Report No. 12 *Hazard Identification and Evaluation in a Local Community*.

APELL seminars/workshops

	Regional	National	Local
1989		<i>Bahrain</i>	
1990	Latin America (Mexico)	<i>Philippines Columbia</i>	Cubatao (Brazil) Gabès (Tunisia)
1991	USSR (Moscow)	<i>Tunisia</i>	Izmit (Turkey)
1992		<i>Yemen Hungary Czechoslovakia</i>	Alexandria (Egypt) Madras (India) Seminars in Bombay & New Delhi Maceio (Brazil)
1993	Arab States (Cairo, Egypt) China (Shanghai)		Monterrey (Mexico) Quatzacoalcos (Mexico)
1994	Baltic States (Riga, Latvia)	<i>Indonesia (Lhokseumawe)</i>	Cilegong/Bandung (Indonesia) Tula (Russia) Kanpur (India) Cochin(India)
1995	International Disaster Workshop (Santiago, Chile)	<i>Chile (Santiago) Venezuela (Caracas)</i>	Baroda (India) Haldia (India) Concepcion (Chile) Moron-Puerto Cabello (Venezuela) Poza Rica (Mexico) Orizaba (Mexico) Puerto La Cruz (Venezuela) Maceio (Brazil) post-APELL Daugaphils (Latvia) Valpariso (Chile) Kristenhamm (Sweden)



Part 5

Information Sources and Background Material

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<i>0</i>	Some reference sources regularly used by chemical response centres.....	V:8
<i>0</i>	Bibliographies.....	V:9
<i>0</i>	Audiovisuals.....	V:11
<i>0</i>	Some background documents on the environment.....	V:14

Information Sources and Background Material

Introduction

The references below are recommended as a basis for defining the local and national elements of an accident prevention and preparedness programme. They also provide a useful set of resource documents for trainers who wish to build up their curricula in industrial safety and accident preparedness and response.

This section is not complete. Further information about training courses, data banks, training manuals, journals and magazines and other relevant information sources will be added as the development of this package continues.

References for accident prevention and preparedness

- APELL: Awareness and Preparedness for Emergencies at Local Level** – a process for responding to technological accidents [1988] Issued by UNEP IE, Paris, France.
- APELL Worldwide** [1995] Paris, France: UNEP IE.
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- Health Aspects of Chemical Accidents** [1994] Environment Monograph No. 81; Technical Report No. 19. Paris, France: UNEP IE.
- International Directory of Emergency Response Centers** [1991] Technical Report No. 8. Issued by UNEP IE, Paris, France. OECD Environment Monograph No. 43.
- Manual for the Classification and Prioritization of Risks due to major Accidents in Process and Related Industries** [1993] Inter-agency programme on the assessment and management of health and environmental risks from energy and other complex industrial systems. Vienna, Austria: International Atomic Energy Agency (IAEA).
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- Techniques for Assessing Industrial Hazards: A Manual** [1990] World Bank Technical Paper No. 55. Second edition. Washington, D.C. 20433, USA: The World Bank.
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- Users' Guide to Information Systems Useful to Emergency Planners and Responders Available in OECD Member Countries (GD/91/103)** [1991] Paris: OECD.

Some reference sources regularly used by chemical response centres

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ISBN 0-948404-01-9.

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and Dutch Chemical Industry Association.
ISBN 0-7923-1258-9.

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- Sax's Dangerous Properties of Industrial Materials** [1992] 8th ed. 3 volumes. New York, USA: Van Nostrand Reinhold.
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- Dictionary of Substances and their Effects** [1992] Richardson, Gangoli. Five volumes. London, UK: Royal Society of Chemistry.

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- International Register of Potentially Toxic Chemicals** (UNEP IRPTC). Palais des Nations, CH1211 Geneva, Switzerland.
Tel 41 (22) 979 9111; Fax 41 (22) 797 3460.
- Registry of Toxic Effects of Chemicals Substances** (RTECS) National Institute for Occupational

- Safety and Health, USA. 100,500 products (300,000 names).
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Tver, D.F., Bolz, R.W.

New York: Chapman and Hall.

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[1986] Meyers, R.A. New York: McGraw-Hill.

Chemical Technology Handbook: *guidebook for industrial chemical technologists and technicians.*

Pecsk, R.L., Chapman, W.H.

Washington: American Chemical Society.

Three pages of references.

Audiovisuals

A number of videos are available concerning accident prevention and preparedness. Most of them have been produced for specific national programmes. Their use in general programmes on accident prevention and preparedness must take these national origins in account.

The Day the Sky Caught Fire

Language: English

Year: 1984

Length: 25'00"

Summary: The BLEVE (Boiling Liquid Expanding Vapour Explosion) which happened in Mexico 1984 is shown. The causes and consequences are analyzed and an introduction is given to how to prevent such accidents in the future. Good for a general audience as an introduction to APELL.

Community Awareness Emergency Response

Language: English

Year: 1989

Length: 9'00"

Produced by: Imperial Oil Ltd.

Distributed by: Dow Chemical Canada Inc.,
Modeland Road, Sarnia, Ontario N7T7K7.

Summary: This video is an initiative of the North American petro-chemical industries. It explains what the petrochemical industry does about Community Awareness Emergency Response (CAER). It shows some examples of

emergency response drills and explains what you should do in case of an emergency. Good for a general audience.

APELL Process: An Introduction

Language: English

Year: 1994

Length: 14'00"

Produced by: Scientific Research and Development Organization, Industrial Risk, Kurchatov Square, 1, Moscow, 123182, Russia.
Phone: 7 095 196 7379/ 196 7482.
Fax: 7 095 943 4121/ 196 5973.

APELL Process: System and Implementation

Language: English

Year: 1994

Length: 20'00"

Produced by: Scientific Research and Development Organization, Industrial Risk, Moscow, Russia. Kurchatov Square, 1, Moscow, 123182, Russia.
Phone: 7 095 196 7379/ 196 7482.
Fax: 7 095 943 4121/ 196 5973.

For copies of the above, readers should contact the producers/distributors. UNEP does *not* have copies for distribution.



IChemE has an international reputation for providing high quality, effective safety and environmental training solutions using video, slide, open learning and computer-based techniques. We draw on experts throughout industry, the regulatory bodies, the legal profession and academia to ensure that our training packages are both high quality and relevant.

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Understanding is the key to effective environmental improvements - both through certified standards and effective policy implementation. This package gives a thorough grounding in environmental awareness. The case studies cover: environmental law; global issues; corporate issues; and waste minimization.

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Package E01

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Volume 2: measurement and monitoring

Package E013

Trainees learn how to measure and monitor effluents, ensuring compliance and reducing treatment costs.

AIR EMISSIONS

Volume 1: key issues

Package E03

This package provides comprehensive coverage of generic air pollution issues and technologies, backed up with detailed sections on sources and types of emissions, atmospheric chemistry, standards and legislation (UK and European).

Volume 2: monitoring and control

Package E012

This package follows on from AE Vol. 1: key issues, and provides detailed information on measurement and monitoring and control techniques, illustrated with comprehensive case studies. Sections on ambient monitoring, meteorology and air dispersion modelling help to provide a thorough grounding in the technical issues associated with air emissions.

ENERGY MANAGEMENT

Package E011

Energy efficiency affects the bottom line. Trainees learn the basic tools and techniques for effective energy management.

ENVIRONMENTAL AUDITING

Package E04

Trainees learn how to make audits more effective. In clearly defined sections, the package explains how to go about auditing a site, from defining the scope and objectives through on-site activities to reporting and follow-up work. Thirteen case studies and exercises, supported by over 120 slides, include: setting up an EMS; auditing for waste disposal, due diligence and effluence compliance; reporting audit findings; and discussion of photographs of bad practice.

ENVIRONMENTAL MANAGEMENT SYSTEMS

Package E05

If you already have an environmental management system, this package will help you gain commitment from your staff. If you are just developing a system, not only will you benefit from the training, but also benchmarking from the detailed case studies will save you time. And if you have still not decided which system to go for (if any), this package will help you make an informed decision.

ENVIRONMENTAL IMPACT ASSESSMENT

Package E06

This training package gives you a thorough grounding in the EIA process and techniques. Produced in conjunction with the Institute of Environmental Assessment, the package provides an effective means of training all staff concerned with EIAs. There are nine case studies provided by leading environmental consultancies. These introduce the practical aspects of the EIA process by examining projects involving a food processing plant, a sewage treatment works, a coastal defence scheme, a pipeline proposal, an oil refinery and a power station.

WASTE MINIMIZATION

Package E07

Approaches in the package vary from good housekeeping to complex techniques such as life cycle analysis. This training package shows how to go about it, from defining a strategy through to making sure it happens.

CONTAMINATED LAND

Package E08

Trainees learn why contaminated land is important, how and why a company should avoid contamination, and the pros and cons of the key remediation techniques. You will also learn how to use this knowledge to get the most out of the consultants you use.

continued ...



Continued ...

SAFETY PACKAGES

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002	Hazards of plant modification
003	Fires and explosions: revised in 1995
004	Preparation for maintenance
005	Furnace fires and explosions
006	Preventing emergencies in the process industries
007	Work permit systems
008	Human error
009	Inherent safety
010	Handling emergencies
011**	Safe handling of LPG: Volume 1
012	Safer piping
013**	Safe handling of LPG: Volume 2
014	Practical risk assessment
015	Hazop and hazan
016	Controlling electrostatic hazards
017	Managing for safety
018	Safer use of chemical additives
019	Offshore practical risk assessment
020	Learning from accidents
021	Flammable liquid fire ... don't be a victim
022	Dust explosion hazards
023	Control of exothermic chemical reactions
025	Modifications: the management of change Modifications: the management of change - OHP set
026	Incident reporting Incident reporting - OHP set
027	Inherently safer process design Inherently safer process design - OHP set
028	Safer work permits Safer work permits - OHP set Safety and environmental index

ENVIRONMENTAL PACKAGES

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E02	Environmental awareness Environmental awareness - OHP set Environmental awareness - legal annexes Environmental awareness - legal annexes OHP set
E03	Air emissions: Volume 1 Air emissions - OHP set
E04	Environmental auditing
E05	Environmental management systems Environmental management systems - OHP set
E06	Environmental impact assessment Environmental impact assessment - OHP set
E07	Waste minimization Waste minimization - OHP set
E08(a)	Contaminated land with slides
E08(b)	Contaminated land with paper overheads)
E09	Environmental investment appraisal Environmental investment appraisal - OHP set
E010	Environmental law in the UK Environmental law in the UK - OHP set
E011	Energy management Energy management - OHP set
E012	Air emissions: Volume 2 Air emissions - OHP set

For order form contact:

Mark Smith
Safety Health and Environment Department • Institution of Chemical Engineers
165-189 Railway Terrace • Rugby CV21 3HQ, UK

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Some background documents on the environment

Saving Our Planet: challenges and hopes [1992]
M.K. Tolba (Executive Director of UNEP).
ISBN 0 412 47370 4.

This book analyses the changes that have occurred in the environment in the past two decades. It focuses not only on the state of the environment, but also on the interactions between development activities and the environment. It highlights the main responses since 1972 to protect the environment.

Published by: Chapman & Hall,
2-6 Boundary Row, London SE1 8HN, UK.

Environmental Data Report 1993-1994 [1993]
United Nations Environment Programme.
ISBN 0 631 19043 0.

This report is updated biennially and provides the best available data and information on a wide range of environmental topics, including pollution, health, natural resources, population and settlements, energy, wastes and disasters.

Published by: Blackwell Publishers,
108 Cowley Road, Oxford OX4 1JF, UK.

Chemical Pollution: a global overview [1992]
United Nations Environment Programme.

This book overviews the origins and impacts of pollution around the world, caused by selected chemical pollutants and wastes.

Published by: UNEP, Nairobi.

The Earth Summit's Agenda for Change: a plain language version of Agenda 21 and the other Rio Agreements [1993] M. Keating. ISBN 2 940070 00 8.

This publication is aimed at facilitating access to the very important material contained in Agenda 21.

Published by:
The Centre for Our Common Future,
52 rue des Paquis, 1201 Geneva, Switzerland.

Beyond the Limits: global collapse or a sustainable future? [1992] D.H. Meadows; D.L. Meadows; J. Randers. ISBN 1 85383 131 X.

Using World 3, a computer model, to project the future, and by varying the basic global policy assumptions, a range of possible outcomes is described. It is shown that a sustainable society is technically and economically feasible, if growth

if material consumption and population are ceased down and there is an increase in the efficiency of our use of materials and energy.

Published by: Earthscan Publications Ltd.,
120 Pentonville Road, London N1 9JN, UK.

Changing Course: a global business perspective on development and the environment [1992]
S. Schmidheiny. ISBN 0 262 69153 1.

This book provides an analysis of how the business community can adapt and contribute to the crucial goal of sustainable development, combining the objectives of environmental protection and economic growth.

Published by:
Massachusetts Institute of Technology (MIT)
Press, Cambridge, Massachusetts 02142, USA.

Blueprint for Green Management: creating your company's own environmental action plan [1995]
G. Winter. ISBN 0 07 709015 2.

This book is a handbook of industrial ecology with numerous checklists for practical use and a concrete example of the Integrated System of Environmental Business Management (the so-called Winter Model), supported by the Commission of the European Communities.

Published by:
McGraw-Hill Book Company (UK) Ltd.

Life Cycle Assessment: what it is and how to do it [1996] UNEP IE

This report is in two parts. The first, *Life Cycle Assessment: what it is*, is concerned with the concept of LCA, how it is currently practised and how it is expected to develop. It also places LCA in the broader perspective of other tools for environmental analysis such as environmental impact assessment, risk analysis and technology assessment.

The second part of the volume, *Life Cycle Assessment: how to use it*, examines the several steps involved in making an LCA in a simplified but systematic manner. It illustrates the problems involved and the kind of results that can be produced by working through a real LCA that has been used to assess the environmental impact of different low fat spreads.

Further information: UNEP IE, Paris, France.



Part 6

Training Material

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Training Material

Introduction

This part contains material to support work exercises on various aspects of accident prevention and preparedness. In order to make the exercises more realistic, we have based them on two case study scenarios that simulate common national situations. There is a case study on the imaginary country *Apellania*, and a case study on a plastics factory in *Apellania*.

The exercises are divided into *preliminary* exercises and *work* exercises. The preliminary

exercises can function as homework for trainees before they attend a workshop or a course, but can also be done during actual sessions.

Every exercise contains a paragraph describing what the objective of the exercise is.

The purpose of these exercises is to stimulate a positive way of thinking among trainees which makes them see the challenges and the opportunities which are available when applying accident prevention and preparedness concepts.

Trainers are encouraged to adapt the given exercises to suit the target audiences, and to develop additional exercises to extend the learning experience.

Case studies

This section includes a case study on the imaginary country of *Apellania*, and on a hypothetical plastics factory, *Apellastics*. The case-studies allow a realistic simulation of real life situations of industrial risk, and practise decision making on the basic concepts of the APELL process. Although they are relatively simple, and may even seem trivial, they form a good introduction to the basic situations and concepts of industrial risk management.

The case study on *Apellania* gives a country report and is suitable for use when examining the role of national authorities and national organisations in the implementation of the APELL process.

The case study on *Apellastics* is developed to help teach the concepts of the APELL process in the local community. Because of its simplicity, it forms a very useful case study to explain the APELL process during a workshop or course. The concepts learned from the case study of *Apellastics* can thus be translated to a more complex plant, which poses higher risks on its local community.

Some of the exercises in **Section 6.3** refer to the case study of *Apellania*, or the plastics factory *Apellastics*. The trainer is encouraged to

Case study on Apellania

use the case studies also for other purposes, and develop his/her own exercises around the case studies.

Some of the preliminary exercises can be adapted to form an introduction to the case studies. For instance, the case study on *Apellania* can be sent to trainees as an example of the type of information they have to collect on their own country.

A preliminary exercise can be used to ask international participants to make an inventory of plastics producing factories in their country. In this way, the participants are introduced to the case study on *Apellastics* before they start working on the group assignments during a workshop or during a course.

National Profile

Geographical

Area 500 000 km²; 600 km of coastline with adjacent lowland; mountains far inland; two large rivers crossing the country, one of which is accessible for small carriers up to 200 km inland.

Climate Temperate warm to hot; rainfall 600 mm/year lowland; 750 mm/year highland. 90% of all the rain falls in the rainy season from December until February.

Population 16 million inhabitants; five cities with a population of over 250 000. Apellcity, the capital, has 1.5 million inhabitants. 25% of the population is Christian, and 47% is Moslem. The rest of the population follows traditional ancestral worship. Christians and Moslems generally live in cities, while the ethnic groups live in the country. The two religious groups don't often live in the same town districts, but

do work in the same places. The official languages are English and Arabic. In the country and smaller cities, most people only speak Arabic. In the five biggest cities, many people also speak English. 40% of the population is literate. 6% of the population has had some form of higher education, such as attendance at University or College.

The unemployed make up 40% of the population. Unemployment is highest in the cities, but there is still an increasing migration towards the cities. Housing, especially in the five largest cities, is a major problem.

Administration

Government Republic with a constitutionally chosen President, Prime Minister and Parliament. There are five provinces, each with a local government and parliament. There are

40 local authorities. After an unstable period, the Socialist Party and the Moslem Labor Party won the election seven years ago, and has formed the government ever since. There is a strong parliamentary opposition, however, from the Moslem Democrats, the Christian Front, and the Apeal-la Native Front. There will be new parliamentary elections next year, for both the national and the provincial parliaments. Women and men are officially regarded as equal when it comes to politics, so they can both vote and be voted for. In practice, only 2% of the parliament and government members is female. It is expected that the elections will lead to demonstrations, but that the demonstrations will not lead to violence.

Administration There are National Ministries for the Interior, Foreign Affairs, Finance, Urban and Rural Planning, Defense, Industry and Economic Development, Public Health, Energy and Transport, Research and Environmental Affairs, Agriculture and Fisheries, and for Education and Science.

Civil defense falls under the jurisdiction of both the Ministry of Interior and the police. The fire brigade falls under the jurisdiction the Ministry of Defense. Occupational health falls under the jurisdiction of the Ministry of Public Health. Telecommunication falls under the jurisdiction of the Ministry of Industry and Economic Development. Sport and youth affairs are taken care of by the Ministry of Interior.

The provinces have a Ministry for Town and Regional Planning. The provinces are responsible for lower education and hospitals.

Currency 10 riskle = 1 US dollar. The annual inflation rate is currently 25%.

Semi-official services There are three universities in Apellania. There is an agricultural University in Inzyth. In Apellcity, there is a University of Social Sciences and a University of Natural Sciences, with very weak links to industry via the Faculty of Science. The advanced courses are given in English and the local language. There are chambers of commerce in the industrialized areas, with strong links to the banks. There are trade associations (e.g. the chemical industry, transport, etc.), and labor organizations for mining, the petrochemical

industry, and for employees from the public sector. There are no labor organizations for employees of the chemical industry and employees of the public services.

Several engineering consultants have offices in the country. They have mostly been involved in plant design and operation. A few non-governmental organizations, like Greenpeace and the International Red Cross, have offices in different cities. Most of these NGOs are working in the field of public health, environmental pollution, ecology, and rural development.

There are two project centres of European Universities located in a small town called Hapell, working in the fields of ecology, irrigation, anthropology and archaeology.

Infrastructure Apellcity has an international airport, situated along the coast, just two kilometres from the industrial area of Apellcity. Normally, the wind is west to north west, so airplanes have to fly in over the industrial area and the centre of Apellcity. Some small regional airports are located in different parts of the country. Only small passengers planes and helicopters can land at these airports.

Apellania has one major port responsible for 80% of the exports. Major and medium size industries are located near this main port. The main roads in the centres of the five largest cities and the industrial areas are paved. There are a few expressways leading through the country and connecting the five major cities. Other roads are mainly unpaved. Some medium sized industries are located in the highlands in the proximity of the aluminum mines, and are accessible by paved roads and a rail line leading from Apellcity. These industries are mainly cement, plastic and pesticides, located in the proximity of cities. The railroad is used for transportation of goods and for passenger transport. Small industries are scattered over the country and are only connected by road. Production of these industries mainly consists of handicraft, textile, tannery, cottage industry, etc. The telecommunication system is developed in the five largest cities.

The river Toksika flows through Apellania for 400 km, but is only accessible to small carriers for the last 200 km before the

estuarium. Hazarda and Hapell are situated along the navigable part of the river and both have a small harbour.

Industry profile

Types of industry and approximate output

	Production (10%/month)	Employees (1000)	Export (%)	Import (%)
Petroleum refining	85	70	70	12.3
Industrial chemicals	75	35	7	3.4
Plastics	146	95	23	17.9
Aluminium	37	8	56	0.7
Cement	129	28	2	1.4
Construction	21	6	–	5.1
Electricity, gas, water	15	2	–	6.6
Transport	93	10	20	10.6
Agriculture and fishery	201	185	60	2.4
Services	190	97	6	20.9

* Currency: riskle (10 riskle = 1 US\$)

Data supplied by the Ministry of Industry and Development, September 1993

Media information on accidents

The information about industrial accidents in 1993 is provided by the Ministry of Industry and Economic Development, the *Apellania Telegraph* (the daily newspaper of Apellania), the Greenpeace office in Apellcity, and the annual report of the Apellcity fire brigade.

Date	Place	Accident description
Information on industrial accidents, provided by the Ministry of Industry and Economic Development		
03.06.93	Apellcity	Lightning struck the electrostatic precipitator of the cement factory in Apellcity and destroyed it completely. As a consequence, enormous amounts of dust were emitted in the area. The canned fish factory next to the cement factory had to stop its production, because the canned fish contained serious amounts of lime dust.
25.11.93	Hapell	A defect in the process of a dyes company led to an emission of hydrogen chloride. Fifty people, with irritation to the eyes and skin, needed hospital treatment.
Information on industrial accidents, provided by the <i>Apellania Telegraph</i>		
01.01.93	Apellcity	A firecracker, thrown in a storage container of polyurethane foam by two boys, caused a fire. Three children had to be taken to the hospital with respiratory problems after inhaling the toxic fumes.
04.05.93	Apellcity	An oil tanker and a fish boat collided in the harbour of Apellcity. The oil tanker lost 50m ³ of oil, leading to pollution on Apellbeach over a distance of five kilometres. Pelicans and other seabirds died, and it was impossible to swim in the

		sea for a period of two weeks.
04.09.93	<i>Hazarda</i>	A fire in a storage building at a Hazarda Pesticides company led to the spill of an unknown amount of water polluted with endosulfan, and possibly other contaminants. The polluted water ran into the River Slodo. Two people were poisoned. Fish were killed over a distance of 30 kilometres; a village, normally using the water for cooking, had to be supplied with drinking water from Hazarda.

Information on industrial accidents, provided by Greenpeace

16.02.93	<i>Importa</i>	A train collided with a truck at the Importa oil refinery. The truck, carrying 100 gas cylinders of 50 litres each, caught fire. The cylinders started to explode one after the other. Three people were killed, and seven were injured.
02.05.93	<i>River Toksika</i>	Due to a process error, 2000 litres of chemical ran into a sewer leading to the River Toksika. Fish were killed over a distance of 25 kilometres, and fifteen people who were swimming in the river near the factory were poisoned.
07.10.93	<i>Inzynth</i>	There was an explosion in a mineshaft of the National Crown mines in Inzynth, which killed five people and injured seven others. It is believed that the cause of the accident was mine gas.
07.10.93	<i>Apelcity</i>	A leakage in one of the five old chlorine cylinders at the water purification company of Apelcity intoxicated two employees, who were working within 15 meters from the cylinders.

Information on other industrial accidents in Apellania, provided by Greenpeace

02.03.93	<i>Town Square</i>	Chemical spill from truck accident.
15.04.93	<i>Industry Road</i>	Ammonia leak from storage tank.
04.05.93	<i>Daup Road</i>	Unknown chemicals found in drums at salesyards.
16.06.93	<i>Stuwpit Road</i>	Fire at a factory containing polystyrene foam.
06.08.93	<i>Skyline Square</i>	Methane gas fire at local tip.
27.10.93	<i>Artist Area</i>	Paint spill from truck accident.
16.11.93	<i>Tresj Quai</i>	Fire in a load on a waste removal truck.

Current state of accident handling capacity

The fire brigade of Apelcity has five divisions, and employs 25 firemen. One unit of four men is specifically trained in handling chemical accidents and spills. They have at their disposal the following equipment:

- *personal protective gear (8 persons);*
- *overdrums;*
- *one container (5MT, 10 bar);*
- *hoses, connections and some types of pumps;*
- *one dedicated trailer.*

The port authorities of the main port have the following equipment at their disposal:

- *oilbooms (600 meter);*
- *some chemicals for dispersion;*
- *a dedicated vessel.*

The following industrial facilities have an emergency response organization and equipment:

- *the petroleum refinery near the main port;*
- *two of the five major chemical producers.*

Because there are no agreements between industry and the authorities, industry acts solely on its own premises in the event of accidents/incidents.

Administrative responsibilities

On environmental, public health, public and industrial safety, the following acts and agencies are in place:

	Responsible ministry/agency
Police	Ministry of Interior
Fire brigade affairs	Ministry of Interior
Public Health Act	Ministry of Public Health
Occupational Safety and Health Act	Ministry of Industry and Development
Environmental Affairs Agency	Ministry of Environmental Protection
Notification of Hazardous Substances Regulation	Ministry of Industry and Development
Office of Disaster Preparedness	Ministry of Interior
Military Facilities	Ministry of Defense
IMO/ADR/RID Transport Regulations	Ministry of Energy and Transport
Water Pollution Act	Ministry of Research and Environmental Affairs
Marine Pollution Act	Ministry of Agriculture and Fishery
Waste Substances Act	Provincial Ministry of Public Health, Ministry of Research and Environmental Affairs

Case study of a plastics factory

Introduction

Figure 0.1 shows the location of *Apellastics*, a factory producing polyurethane foam in the town of Hapell, in Apellania. The factory uses Toluene Diisocyanate (TDI) as a starting material to produce both rigid and flexible foams for a variety of customers.

At any one time, there are around 150 tonnes of TDI, 200 tonnes of polyol, two tonnes of amines, and one tonne of silicone agent on the site. Up to 300 tonnes of finished foam may be stored on-site pending despatch to clients. A copy of a Materials Safety Data Sheet (MSDS) for TDI is attached. A total of 63 employees work on the site, which is situated close to an urban community. Many workers live in this community.

TDIs are synthetic organic chemicals with a molecular formula of $C_9H_6N_2O_2$. TDI-based polyurethane foams are widely used in the automotive and furniture industries, and in packaging and insulation.

Besides Toluene Diisocyanate (TDI), polyols, various amines (catalysts), and silicone copolymers are used in the production process. Although it uses potentially hazardous chemicals, the operation is relatively simple. Many factories around the world have been built in urban areas and small industrial estates to supply foam for local manufacturing industries. In most cases, the chemicals are imported.

Process

A simplified reaction equation of the overall process is given as:



where TDI = Toluene Diisocyanate
 Polyol = Polyether Polyol
 Catalyst = Triethylamine
 Stabilizer = Silicone copolymer
 Blowing agent = Water

The raw materials are injected under pressure with precision dosing pumps into a mixing chamber, and then enter the mould. The resulting active mixture expands rapidly with the

simultaneous generation of considerable heat. At the end of the reaction, the foam solidifies and hardens. The blocks are released from their molds and subsequently cut and stored pending delivery.

Hazards and environmental effects

TDI is a toxic compound, and it should be treated as both a potential human carcinogen and as a known animal carcinogen. Exposure can lead to adverse effects on the respiratory tract, skin, eyes, and gastrointestinal tract. See also MSDS in **Figure 0.2** on page VI:12.

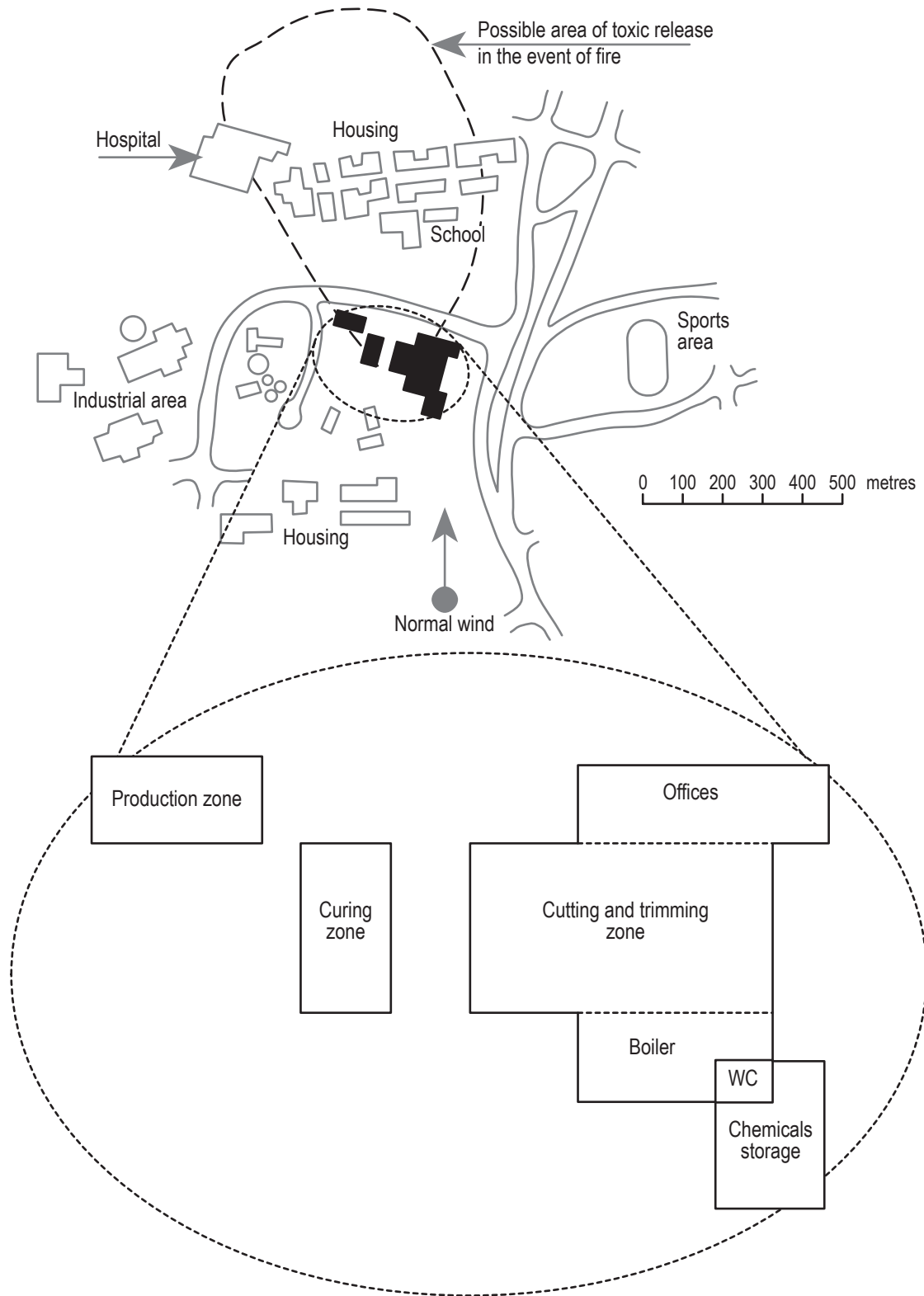
The polyols are stable to high temperature, and relatively inoffensive.

Triethylamine is irritant and corrosive to skin. Prolonged exposure may affect the cornea.

Some of the reagents can react under conditions that lead to some danger. In particular, TDI may react violently with water or alcohols, amines, bases, acids and polymerization activators. The reaction may liberate gases and cause the liquids to splash onto nearby objects or people.

Many of the chemicals used in foam production are not easily biodegraded and thus persist in the soil, or are washed out into the watertable.

Figure 0.1 Location and plan of *Apellastics*



Safety measures

The factory is equipped with comprehensive safety measures for the storage of chemicals,

including proper containers and enclosed storage

sites with hermetically sealed floors. Reactive products are stored away from each other.

Foam is stored away from sources of heat, in a site equipped with sprinklers and other fire precautions. Storage is in a separate building to that used for fabrication of foam.

There is some risk of auto-ignition of the freshly formed foam immediately after

production. Accordingly, there should be an initial storage in a well ventilated place and away from other products.

Caloric value of foam is around 10 000 Kcal/kg, sufficient to allow rapid propagation of a fire.

In case of fire

Burning foam releases a wide range of fumes, containing a number of highly toxic components. The main toxic gas produced by plastics in a fire is carbon monoxide. Other toxic agents which

may be present include hydrogen cyanide and hydrogen chloride, which are likely to be emitted by any substance containing nitrogen and chlorine, respectively.

Emergency measures

Individual precautions include safety clothing, glasses, gloves and boots.

It is important to avoid run-off of spills into drains or watercourses.

In case of spill, the liquid should be contained and adsorbed onto suitable adsorbents. TDI can be neutralized by an alkaline solution of ammonia and detergent.

Figure 0.2 MSDS Form of 2,4-Toluene Diisocyanate

2,4 – Toluene Diisocyanate

ICSC : 0339

CAS #	584-84-9	Benzene 2,4-diisocyanate	Hazard symbols: <i>consult national legislation</i>
RTECS #	CZ6300000	2,4-Diisocyanatetoluene	
ICSC #	0339	4-Methyl- <i>meta</i> -phenylenediisocyanate	
UN #	2078	C ₉ H ₆ N ₂ O ₂	
EC #	615-006-00-4	Molecular mass: 174.2	

Types of Hazard/ Exposure	Acute Hazards/Symptoms	Prevention	First aid /Fire fighting
FIRE	Combustible under specific conditions	NO open flames. NO contact with alcohols, water and amines. NO contact with hot surfaces.	Powder, alcohol-resistant foam, water spray, carbon dioxide.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• Inhalation	Abdominal pain, burning sensation of the nose and throat, cough, nausea, shortness of breath, vomiting	Closed system and ventilation.	Fresh air, rest, artificial respiration if indicated, and refer for medical attention.
• Skin	Redness, burning sensation	Protective gloves	Rinse and then wash skin with water and soap
• Eyes	Redness, blurred vision	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• Ingestion	Abdominal cramps, diarrhoea, vomiting	Do not eat, drink, or smoke during work.	Rinse mouth, give a slurry of activated charcoal in water to drink, do NOT induce vomiting, and refer for medical attention.
Spillage disposal		Storage	Packaging and labelling
Evacuate danger area, consult an expert, ventilation, collect spilled liquid in open containers and neutralize with a mixture of ammonia (4-8%), detergent (2%), and water or absorb remaining liquid in sand or inert absorbent and remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).			UN Haz Class: 6.1 UN Pack Group: II Further information on labelling: Consult national legislation.

Additional Information

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See important information on back

ICSC: 0339 V1.0
Important legal notice on back

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continued ...

Preliminary exercises

Some ideas for preliminary exercises

Before attending a training activity, trainees should be given some preliminary information to read, some exercises to perform, and some information to search out. In order to make the experience as relevant as possible, these exercises can be based around a preliminary search for key information in their country or company.

These activities can thus familiarize trainees with the major considerations of accident prevention and preparedness before formal activities commence. After an attempt to search out preliminary information, trainees will appreciate better the purpose behind some of the exercises.

In all cases, trainers are encouraged to develop additional exercises to suit their particular needs.

1 You can ask the participants to collect newspaper articles or articles from journals which are related to the issues that will be at the centre of attention during the training activity.

For instance, you can ask the participants to gather articles on recent industrial accidents. During the training activity, these articles can function as case-studies for discussion purposes. Ask how these accidents could have been prevented, or how the response to the accidents could have been better.

2 Ask the participants to make an inventory of major industrial accidents which happened in their country within the last five years. This inventory should focus on more severe accidents than the inventory in Exercise 1.

Apart from newspapers and magazines, other possible information sources are civil defense (or equivalent), fire brigades in the industrial area, relevant government reports (if available), and interviews with unions.

3 Participants from industry can be asked to make a global inventory of the risks from their industrial activities.

At the end of the training activity, you can ask the participants if they would be able to identify more risks within their company, and if they would be able to find ways to:

- prevent accidents related to these risks
- organize an appropriate programme in preparation for an accident.

The inventory made by the participants may serve as a starting point for the development of an APELL programme, or the organization of a more in-depth APELL workshop.

Preliminary Exercise A: national industry profile

In this exercise, trainees are asked to prepare a national or regional industrial profile. They are also asked to make an inventory of the hazardous chemicals which are associated with these industries. This information can be used or referred to when teaching about the need for and the concepts of accident prevention and preparedness.

In advance of the workshop, please list the following information on manufacturing facilities in your country:

Industries	No. of locations	No. of major plants	Output in tonnes	No. of people employed
Petroleum refining				
Agricultural chemicals				
Fertilizers				
Explosives				
Plastics				
Aluminum				
Steel				
Other major metals				

** For national sources of information, please check with the Ministry of Industry, the Ministry of Economy, Chambers of Commerce, local industry associations, etc.*

If possible, also try to add the following information about major chemicals in storage:

Associated Hazardous Chemicals

Substance	Location	Quantity
LPG		
Petroleum		
Chlorine		
Ammonia		
Acids		

Preliminary Exercise B: national regulatory / legislative situation

This preliminary exercise is useful in developing an understanding of the regulatory and legislative framework in which an APELL process can be developed. This inventory is part of the first step in the APELL process, where participants in the APELL process have to be identified.

- Question 1** | Which authorities in your country are responsible for:
- public safety and health?
 - occupational safety and health?
 - industrial safety?
 - safety in transportation and storage?
 - public emergencies like fires, explosions, gas emissions, etc.?
 - the environment?
 - clean-up of spills on land, and in harbours?
- Question 2** | Which regulations, laws, acts, etc., with respect to the responses from *Question 1*, are in effect in your country?

Preliminary Exercise C: fire brigade accident handling capability³

This exercise will give the trainee more insight in how the fire brigade is able to respond adequately to an accident. This information plays an important role when drawing up an accident preparedness plan.

- Question 1** | What type of training with respect to hazardous material accident handling does the fire brigade of a typical industrial area in your country receive?
- Please mention if :
- they have a manual.
 - they follow courses.
 - they receive instructions. Where and how do they receive these instructions?
- Question 2** | What type of accident handling equipment does the fire brigade use?
- Question 3** | What type of personal protection gear shown in the list below does that fire brigade use?
- Emergency Response Equipment***
- vehicle
 - equipment:
 - personal protection gear
 - measuring equipment
 - first aid kit
 - communication equipment
 - emergency handling equipment (containment, absorption, pumps, etc.)
 - isolation and blocking material
 - small hand tools
 - documentation and manuals

³ Possible sources of information are the Department of Civil Defense, the Ministry of the Interior, the Ministry of Industry, fire brigades in the capital, and major industrial areas.

Preliminary Exercise D: hazard information

Step Two of the APELL process is to evaluate risks off-site. In order to estimate (or calculate) the risks of a particular plant, trainees could collect scientific information on the hazards posed by substances, products, and processes. This exercise helps to identify information sources which can be useful in answering other questions later on in the process.

Question 1

Where would you find information on:

- hazards of chemical substances?
- safety in handling chemical substances?
- hazardous industrial processes generally?

Question 2

- Where would you find information on the location of factories making polyurethane foam?
- How many such factories are there?
- Do they have a national association?
- Where can you find information about the manufacture of polyurethane foam?
- What chemicals are commonly used? What are their hazards?
- What are the main risks to the surrounding communities from these factories?

Work exercises

The following work exercises allow trainees to explore various aspects of emergencies by simulating real life situations as described in the case studies, or through similar situations chosen by the trainer.

The exercises should not be regarded as a complete set; they simply indicate to the trainer how such exercises can function, and encourage the development of further exercises to explore other elements of the emergency situation.

Because we are often dealing with value judgements, these exercises are particularly well suited to group work, discussion sessions, or problem solving by syndicates. Nevertheless, some insights are still possible for individual readers.

Answers are best explored by discussion with an appropriate expert from one of the sectors involved. However, beware – there may not be a single correct answer, and the most appropriate answer in one country may not necessarily be the best in another.

Working Group: assignments on Apellania

This exercise is developed around the case study of *Apellania*. A country report on *Apellania* is given in Section 6.2. The following questions are best considered and answered in small groups of between three and five trainees, using an experienced resource person as a facilitator.



- 1 You are working for the Ministry of the Interior in Apellania. You have been assigned to form a working group which has to develop signs for vehicles which warn people that those vehicles transport hazardous materials. The decision to develop these signs has been made after several accidents involving the transportation of hazardous materials.

(i) Which are the partners you will ask to join you in your working group? Why?

continued ...



Question 1 continued ...

(ii) Refer to the industry profile of Apellania. Each industrial sector transports different hazardous materials. What different signs will you develop for the different hazardous materials which are transported by the vehicles?

(iii) Make a draft of one of the signs you want to use for vehicles. Make sure that the signs are simple enough so everybody understands what they mean.

(iv) How will you make the people aware of the introduction of this new sign? How will you inform the whole population of *Apellania*?



- 2 Each industrial sector poses a different potential threat to the local community. Each of these sectors needs a tailor-made emergency preparedness and response plan. The national government has the responsibility of organizing and maintaining an adequate level of preparedness for facing emergencies throughout the country and, as such, has a role and responsibilities in the implementation of the APELL process. This exercise focuses on the general role which national authorities play in implementing the APELL process.

(i) Which industries in *Apellania* pose a serious threat to local communities if an accident occurs in their sector?

(ii) Each industrial sector has other partners at the national level which play a role in the implementation of the APELL process. Make a list of partners at the national level (government, agencies, universities, etc.) which play a role in the implementation of the APELL process for each of the industrial sectors identified above, in Question 2(i):

(iii) Choose one of the industrial sectors identified in Question 2(i). Assume that the selected industry sector has several plants in *Apellcity*. Refer to Section 4 of the case study on *Apellania*, '*Current state of accident handling capability*'. Apart from the APELL partners identified there, identify other APELL partners within *Apellcity* which could help to set up an emergency response plan for the selected industrial sector. For each partner, indicate how they can contribute:

(iv) Refer to the information on accidents in *Apellania* and select four accidents randomly. What measures can the national government take to prevent these accidents in the future?

APELL at a plastics factory

This exercise is designed around the case study of the plastics factory *Apellastics*. After reading the case study, the questions should be answered by a group of trainees acting as a team. This exercise will familiarize the participants with the APELL process. It is not a substitute for a full APELL workshop, which requires considerably more time to produce results that can be implemented in actual situations. The exercise can be done in combination with the case study of Apellania. Reference can be made to the *Apellania country report* when answering the questions in this exercise.

Working group assignments

The working groups should keep a record of their discussion. A one-page summary should be prepared and submitted to the organizer/trainer. Ideally, the summary should include a list of

main conclusions and issues that were identified by the group. The group's verbal report to a plenary session, if required, can also be based on this one-page summary.



- 3 (i) Refer to the scenario of *Apellastics*. Which partners are important here? List each partner, and give reasons:

- (ii) Who can most effectively start a Coordinating Group? How?

- (iii) How could information on risks from the plastics factory installation best be provided to the local community:

- by industry?

- by local government?

*continued ...**Question 3 continued ...*

(iv) How can/should information on emergency preparedness planning (or emergency measures) be included in this information?

4 (i) Who from *Apellastics* should respond to questions from the local community about hazards? Sketch out a public query arrangement that should be in place.

(ii) Where can a member of the public find information about:

- the chemicals used in the processes in the factory?

- the factory operations which are the most hazardous?

- the consequences of an accident?

Hazard identification and evaluation in the plastics factory Apellastics

This exercise focuses on hazard identification and evaluation. The exercise can either be performed by working groups, or individually.



- 5 (i) Consider **Table 0.1** (taken from the UNEP report *Hazard Identification and Evaluation in a Local Community* p41). List the most important information sources that would help you to complete the entries in each of the columns. (Include sources such as bibliographic references, data bases, direct observation, interviews with experts, interview with factory personnel, and others.)

--

- (ii) From the above table of the hazard evaluation manual, which are the operations with the highest risk for:

- the locality?

--

- the environment?

--

Which of the risks are the most likely?

--

Which would you address first? Why?

--

Table 0.1 Risk table

Taken from the UNEP report *Hazard Identification and Evaluation in a Local Community*

1		2		3		4		5		6		7-10				11	12	13
												Seriousness						
Object	Operation	Hazard (quantity)	Risk type	Threatened object	Consequences	L	E	P	S	Pb	Pr	Comments						
Foam area	Foam production	TDI: 50 tons Polyol: 100 tons Amines: 2 tons	Leakage "-"	Personnel "-"	Poisoning (inhalation) Poisoning Burns	2	2	1	4	3	3	B						
Area for hardening	Hardening	Polyurethane 100 tons	Self ignition		Poisoning (inhalation)	2	1	4	4	4	4	C						
Area for cutting	Cutting	Polyurethane 100 tons	Fire giving off TDI and hydrogen cyanide	Personnel People living near the factory Rescue personnel	Poisoning Breathing difficulties Pneumonia	4	1	5	4	3	D	Dimensioned damage estimate						
Area - roads	Transport	TDI: 25 tons Polyol: 25 tons Amines: 1 ton	Leakage Loading/unloading Collision	Drivers Personnel Rescue personnel	Poisoning Breathing difficulties	2	2	1	4	2	B							

L = Life
E = Environment
P = Property
S = Speed
Pb = Probability
Pr = Priority

Community: Apellania

Object / Area: Apellastics



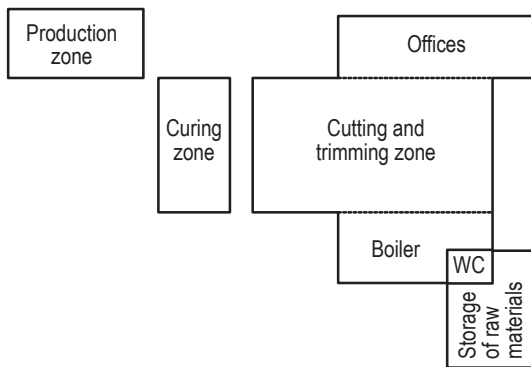
6 Consider the attached possible layouts of Apellastics in **Figure 0.3**. Which is the safest in your view? Give reasons for your answer. Enumerate the good and bad points of each layout option:



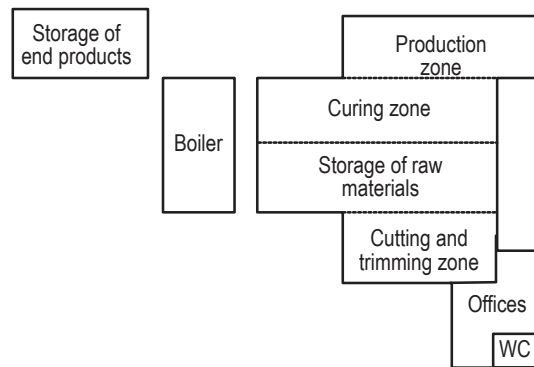
Figure 0.3 Layout of Apellastics

Which plan seems to be less hazardous?

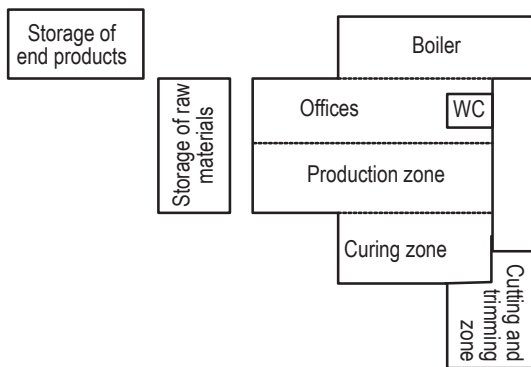
i) Current plan of the plant



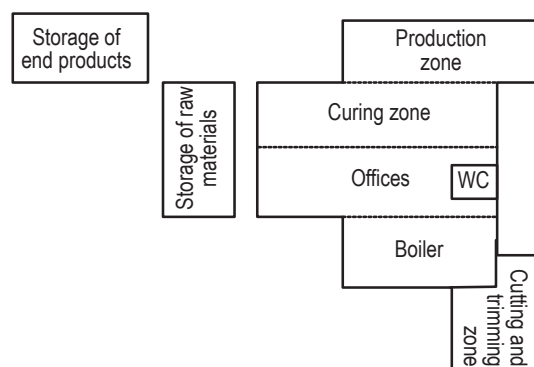
iii) Possible factory plan



ii) Possible factory plan



iv) Possible factory plan





7 (i) We know from the MSDS that TDI reacts violently with water. What recommendations do you have for combating:

- a spill?

- a small fire of TDI?

(ii) Can water be used in any way?

(iii) What first aid measures are appropriate for a worker who has TDI splashed in his face?

(iv) Assume you are a resident close to the factory. You are at home, and you have heard that there has been a spill of five tonnes of toxic chemicals, including TDI, nearby. What do you do?



8 (i) As the plant manager, through what means would you inform the employees of the factory about what to do in case of a TDI spill?

(ii) What devices and aids would you need at the plant which can facilitate the response to a spill?

(iii) What information about what risks would you disseminate among the local community to prepare them for, and make them aware of, a possible accident?

(iv) What means would you use to disseminate this information among the local community?

Working Groups on APELL

In this session, several groups of trainees will each work on the key issues in accident preparedness. The conclusions of each group will be discussed in plenary session afterwards.

Introduction

These working sessions are designed to make participants familiar with the APELL process. They are not substitutes for a full APELL workshop, which requires considerably more time to produce results that can be implemented in actual situations.

The working sessions are, however, well suited to general teachers who want to familiarize graduates and professional audiences with the APELL process. They may also be used as introduction to longer APELL workshops in order to prepare national participants for the subsequent detailed sessions.

Workshop procedure

The discussion should take into account the situation in the participants' own countries, as well as of the general issues surrounding industrial hazards. Discussions will be assisted by an expert resource person, who can advise the participants on particular points. The resource person is not there, however, to solve the problems on behalf of the working groups.

The groups have only limited time to discuss the questions, and must keep to the central issues. The group elects its own chairman and rapporteur.

Some tables to assist the discussion are attached. The background papers in *Parts 3* and *4* can also be consulted. If discussions become very detailed, the *APELL Handbook* and other references can be consulted.

Background for working group discussions

To prompt discussions in the Working Groups, we present here a short synopsis of the recommendations drawn from the APELL process (see *APELL Handbook*).

The APELL process advocates that central government should create a *framework* which will promote co-operation between local government and the industry within their authority. This includes preparedness at local level to handle accidents which might arise from

industrial hazards. A programme to reduce these hazards to an acceptable level is also required. This should utilize industry expertise to the maximum and be supported by adequate local services.

At the *local level*, the lead should be taken by senior industrial managers, local authority officials and community leaders to form an APELL Coordinating Group. The necessary coordination requires authority/support from the top of their respective organizations. Technical expertise will subsequently come automatically, according to the need.

To consider the issues of which they and the local community should be aware, the APELL Coordinating Group should *commission a survey* to be made of significant local hazard situations and what can be done about them. Clear identification and evaluation of hazards, both those liable to arise from industry and within the community, are essential to communicate to those who may be affected. Clarity, agreement and commitment are the corner stones of good communication of such hazard information.

In an industrial community there is a balance between the remaining risks, (after preventive measures have been taken), and the benefits of the industry to the local economy. In particular, where the danger is severe due to encroachment of industry on the community (or the community on the industry), then all the partners in APELL have a responsibility to formulate plans and actively implement them.

In discussing all of the above, it should be recognized that risk managers, the media and the public often have only a limited picture of the risks that are involved, and this may not be based on the most thorough information.

As a renewed effort to overcome existing limitations, the maxim that "*an informed public community is the best defence against risk*" needs to be adopted by industry and government regulators alike.

This, and the coordination of action, are the | essence of APELL.

Working group assignments

- 9 Refer to the list of APELL partners in **Table 0.2** *Who are the APELL partners?*. Why are these partners important at the national level? List one or more reasons for each partner:

- 10 Who can most effectively start a Coordinating Group? How?

- 11 Which APELL elements in **Table 0.3** *Awareness building* have the highest priority? (Number them from 1 to 16). Where would you find information on each?



12 In what form can information on general industrial hazards be provided to the public? What type of information should be included? Who should prepare it?

13 Who should respond to questions from the local community about hazards from *Apellastics*? Sketch out a public query arrangement that should be in place:

14 Describe how local hazards from industry in individual communities can easily be identified and evaluated. Who can do this identification?

15 Where would you try to find technical information about (i) industrial and (ii) chemical hazards? Can the same sources provide information about safety measures?

Table 0.2 Who are the APELL partners?

At national level	At local level
<ul style="list-style-type: none"> • Ministry of the Interior • Ministry for Industry • Ministry of Environmental Protection • Ministry of Defense • Public services/works • Department of Occupational Health • National Safety Council • Association of Chemical Manufacturers • Chambers of Industry/Commerce 	<ul style="list-style-type: none"> • Province or district authorities • Mayor's office • Local authorities: <ul style="list-style-type: none"> – <i>public services</i> – <i>fire department/civil defense</i> – <i>police</i> – <i>first aid/hospitals</i> – <i>social health services</i> • Industry within the area: <ul style="list-style-type: none"> – <i>manufacturing or processing companies</i> – <i>transport/storage companies</i> – <i>industrial mutuals and societies</i> • Local community and interest groups: <ul style="list-style-type: none"> – <i>community services</i> – <i>news/media</i> – <i>business community</i> – <i>environmental groups</i> – <i>schools/educational groups</i>

Table 0.3 Awareness building

APELL partners, either individually or through the coordinating committee, should:

<ul style="list-style-type: none"> • identify in industrial areas: <ul style="list-style-type: none"> – <i>factories or storage depots and their management</i> – <i>local, industrial area, state or multinational companies</i> – <i>the nature and extent of industrial hazards</i> 	<ul style="list-style-type: none"> • identify important authorities such as: <ul style="list-style-type: none"> – <i>governing bodies and officials</i> – <i>civil defense</i> – <i>fire brigades</i> – <i>police</i> – <i>environmental protection agencies</i> – <i>occupational/human health agencies</i> – <i>educational agencies</i>
--	--

Another APELL scenario

This exercise asks you to develop an emergency preparedness plan. The development of this emergency preparedness plan is urgent considering the fact that great possible danger is imposed on the local community. The emergency response plan has to be developed, based on the concepts of the APELL process.

1 The Office of Disaster Preparedness of the Ministry of the Interior in Apellania has received a letter from the local Water Board, asking for advice about an abandoned stockpile of chlorine cylinders.

2 300 old cylinders of various sizes are stored in a disused and unguarded warehouse in an industrial estate near the water treatment plant. When new, they contained 40 tonnes of chlorine. Salt air has badly corroded the cylinders. Derelict equipment and rubbish is lying about, and local youths play on the site. It is not known how many cylinders are still full, but a faint smell of chlorine gas can be detected inside the warehouse. The cylinders are all at least 12 years old. Since then, the Board has changed to bulk chlorine for disinfection.

3 In the past few years, a high-rise housing estate has been constructed nearby. A school and hospital are within 300 meters of the warehouse. The road from the warehouse passes

through this area on narrow, congested streets.

The fence around the warehouse is in bad repair.

4 The original supplier of the cylinders is not known. The current supplier of bulk chlorine is a trading company in Asia.

5 There are no experts specialized in handling chlorine in the country. The port fire services have two sets of breathing apparatus, but they have never been used.

6 The letter from the Water Board has asked the Office of Disaster Preparedness to take charge of the problem, as it seems to be a situation where air pollution may arise. The Board has asked for advice about what the Office intends to do. The letter has been circulating the Office for three months, trying to find someone who can decide what to do.

7 Someone proposes that the public be informed of this situation. The Office is uncertain of how to do this.

You are called in to advise.

Answer the questions on pages VI:37 and VI:38, using the attached background notes and MSDSs.

Figure 0.4 MSDS for chlorine

Chlorine

ICSC : 0126

CAS # 7782-50-5 (cylinder)
 RTECS # FO2100000 Cl₂
 ICSC # 0126 Molecular mass: 71
 UN # 1017
 EC # 017-001-00-7

Hazard symbols:
consult national legislation

Types of Hazard/ Exposure	Acute Hazards/Symptoms	Prevention	First aid /Fire fighting
FIRE	Not combustible but enhances combustion of other substances.	NO contact with combustible substances, acetylene, ammonia and dispersed metals.	Preferably no water.
EXPLOSION	Risk of fire and explosion as a result of decomposition.	Do NOT expose to friction or shock.	In case of fire keep cylinder cool by spraying with water, but NO direct contact with water.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• Inhalation	Burning sensation: nose, mouth and eyes. Cough. Lachrymation. Tachycardia. Laboured breathing, shortness of breath (see Notes).	Breathing protection. Closed system and ventilation.	Fresh air, rest, half-upright position, artificial respiration if indicated, and refer for medical attention.
• Skin	Serious skin burns, pain, corrosive.	Protective gloves, protective clothing.	Remove contaminated clothes, rinse and then wash skin with water and soap, and refer for medical attention.
• Eyes	Pain, blurred vision, severe deep burns.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• Ingestion			
Spillage disposal		Storage	Packaging and labelling
Evacuate danger area, consult an expert, ventilation, NEVER direct water jet on liquid, remove chlorine cloud with fine water spray (extra personal protection: complete protective clothing including self-contained breathing apparatus).		Separated from combustible and reducing substances, cool, keep in a well-ventilated area.	Special insulated cylinder. UN Haz Class: 2 UN Subsidiary Risks: 6.1 Further information on labelling: Consult national legislation.

Additional Information

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See important information on back

ICSC: 0126 V1.0
 Important legal notice on back

Important data

Physical State Appearance:

Green-yellow gas with pungent odour.

Physical Dangers:

The gas is heavier than air and may travel along the ground.

Chemical Dangers:

Reacts violently with many organic compounds and finely dispersed metals causing fire and explosion hazard. On contact with air it emits HCl. Attacks metals in presence of water. Attacks plastics, rubber and coatings.

Occupational Exposure Limits:

TLV: 1 ppm; 3 mg/m³ (ACGIH 1988-1989).

Routes of Exposure:

Inhalation Risk:

A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

Effects of Short-Term Exposure:

Tear drawing. The substance is corrosive to the eyes, skin, and the respiratory tract. Inhalation of gas may cause lung oedema (see Notes). Rapid evaporation of the liquid may cause frostbite. Exposure for above the OEL may result in death. The effects may be delayed.

Effects of Long-Term or Repeated Exposure:

The substance may have effects on

Figure 0.5 Information on caustic soda

Sodium Hydroxide (NaOH)			
<i>White solid, flakes or powder; clear aqueous solution with no odour.</i>			
SYNONYMS			
Caustic soda, Lye, Sodium Hydrate, Soda Lye, White Caustic, Hydroxyde de Sodium (Fr.), Sodium (Hydroxide de) (Fr.).			
IDENTIFICATION NUMBERS			
UN No.	1823 (solid) 1824 (solution)	CAS No.	1210-73-2
STCC No.	4935235 (dry) 4935240 (liquid) 4935243 (52% solution)		
GRADES AND PURITIES			
<i>Rayon and regular grades</i>	Aqueous solutions	50 and 73 percent nominal concentrations.	
	Anhydrous	98.5 percent minimum (purity varies from supplier to supplier, generally from 96 to 99 percent).	
IMMEDIATE CONCERNS			
Fire	Noncombustible. Anhydrous form in contact with water may generate sufficient heat to ignite combustible materials		
Human health	Corrosive to all tissues upon contact.		
Environment	Harmful to aquatic life at high concentrations		
PHYSICAL PROPERTY DATA			
	Anhydrous	50% solution	73% solution
State (15°C 1atm)	solid	liquid	liquid

Background technical note for APELL scenario

Following your urgent request to IRPTC and UNEP IE for advice on the dangers of chlorine, you learn that:

- chlorine is a very toxic gas, and as it is heavier than air it does not easily disperse (see MSDS in *Figure 0.4*)
- chlorine cylinders can in theory be weighed to see if they are empty or full. Larger cylinders often have a pressure gauge built in
- for abandoned equipment, the risk of accidents is highest when the equipment is disturbed, handled or moved
- chlorine can be detoxified by passing it slowly, at a controlled rate, through a bath of concentrated caustic soda (see MSDS in *Figure 0.5*)
- caustic soda is itself a hazardous chemical that must be very carefully handled to avoid burns and skin damage

- the best way of disposing of hazardous chemicals is to use them for the purpose for which they were originally intended.



16 What are some of the first things you would advise the Office of Disaster Preparedness?

17 What other departments or outside persons should be involved?

18 How do you recommend the problem of the cylinders be resolved?



19 (i) What public announcements do you make?

(ii) How and what do you communicate with the adjacent community?

20 How could this situation be avoided in future in other cities?

21 How do you prepare an emergency preparedness plan in case of future incidents such as this?

Note: You may wish to use additional pages to give a complete answer.

Prioritizing the actions in an APELL process

This exercise aims to develop more insight in the importance that all APELL partners play in different stages of the APELL process.

The exercise is made available in two versions.

The *first version* is general, and helps the participants to get an insight in to the different stages of the APELL process.

The *second version* has the same purpose as the first, but uses the case study of the plastics factory *Apellastics*, and therefore works best after the exercises in the case study have been done.

Prioritizing the actions in an APELL process

Version I

The APELL process can only be successful when several partners are involved in each stage of the process. Actions by a single partner are seldom sufficient.

Table 6.4 lists the partners who should be involved in or relevant to the APELL process. There may be several partners in each action, or partners may be involved in several actions.

Table 6.5 gives a list of actions to be taken before, during, or after the implementation of the APELL process.

For each of the actions given in **Table 6.5**, find the responsible partner(s) in **Table 6.4** and fill in the partners in *Column 3* of **Table 6.5**. After completing **Table 6.5**, rank the actions in chronological order in **Table 0.6**.

Table 0.4 APELL partners and interest groups

UNEP	A
National Government	B
Industry	C
Local authority	D
Local community	E
Coordinating Group	F
Press	G

Table 0.5 Some APELL related actions

No.	Actions	Partners
1	Identify local agencies making up the community's potential local awareness and response preparedness network.	
2	Create a Coordinating Group.	
3	Comply with national and local legislation regarding on-site and off-site emergency plans.	
4	Publish an article about the risks and benefits of the plant in a local newspaper.	
5	Evaluate the risks and hazards which may result in emergency situations in the community.	
6	Establish a sequence of events and a timetable for accomplishing the APELL process.	
7	Drill the Emergency Action Plan.	
8	Develop and implement accident prevention and preparedness programs.	
9	Raise public awareness of local hazards and risks.	
10	Define the community background including concerns of the population, size of population affected, etc.	
11	Cultivate and maintain good relations.	
12	Review existing plans and identify weaknesses.	
13	Disseminate information about the APELL process and make the Handbook and other relevant material available on a wide scale.	
14	Provide the strongest possible support and resources to the plant managers so that the best accident prevention and emergency preparedness procedures are in place in the industrial facility.	
15	Seek support which is essential to successful planning of the emergency response from the executive and legislative branches.	
16	Inform public how the Emergency Response Plan works and what they should do in case of emergency.	
17	Mobilize local support and participation in the APELL process.	
18	Provide assistance to initiate the APELL process.	

Table 0.6 Answers (to be completed in chronological order)

	Action	Participants		Action	Participants
1			10		
2			11		
3			12		
4			13		
5			14		
6			15		
7			16		
8			17		
9			18		

Suggested answers for the trainer

Table 0.7 Responsibility of APELL partners and interest groups for specific actions

Partner		Action
UNEP	A	18
National government	B	11, 13, 18
Industry	C	2, 3, 5, 7, 9, 11, 14
Local authority	D	2, 7, 9, 11, 15, 16
Local community	E	2, 3, 7, 10, 11, 17
Coordinating group	F	1, 4, 5, 6, 11, 12
Press	G	4, 7, 11

Table 0.8 Chronological order of actions

Action	Partners	
1 8	<i>C</i>	Develop and implement accident prevention and preparedness programs.
2 18	<i>A, B</i>	Provide assistance to initiate the APELL process.
3 13	<i>B</i>	Disseminate information about APELL process and make the Handbook and other relevant material available on a wide scale.
4 14	<i>C</i>	Provide the strongest possible support and resources to the plant managers so that the best accident prevention and emergency preparedness procedures are in place in the industrial facility.
5 2	<i>C, D, E</i>	Create a Coordinating Group.
6 11	<i>ALL</i>	Cultivate and maintain good relations.
7 6	<i>F</i>	Establish a sequence of events and a timetable for accomplishing the APELL process.
8 1	<i>F</i>	Identify local agencies making up the community's potential local awareness and response preparedness network.
9 5	<i>F</i>	Evaluate the risks and hazards which may result in emergency situations in the community.
10 3	<i>C</i>	Complying with national and local legislation regarding on-site and off-site emergency plans.
11 10	<i>E</i>	Define the community background, including the concerns of the population, the size of the population affected, etc.
12 9	<i>D</i>	Raise public awareness of local hazards and risks.
13 4	<i>F, G</i>	Publish an article about the risks and benefits of the plant in a local newspaper.
14 12	<i>F</i>	Review existing plans and identify weaknesses.
15 15	<i>D</i>	Seek the support which is essential to successful planning of the emergency response from the executive and legislative branches.
16 17	<i>E</i>	Mobilize local support and participation in the APELL process.
17 16	<i>D</i>	Inform the public how the Emergency Response Plan works and what the public should do in case of the emergency.
18 7	<i>C, D, E, G</i>	Drill the Emergency Action Plan.

Prioritizing the actions in an APELL process**Version II**

This exercise is aimed at recapitulating the concepts in the APELL process. The exercise can easily be adapted to a more practical situation. The case on *Apellastics* can be taken as an example. In Table 6.10, some actions are given in

chronological order, related to the specific APELL partners in the case of the plastics factory.

In this case, the trainer asks the questions to which these are the answers.

Table 0.9 Interest groups in the Apellastics case study

Apellastics	A
Other industrial companies	B
Coordinating team	C
Local authority	D
Moslem community	E
Christian community	F
School	G
Hospital	H

Table 0.10 APELL related actions (*in chronological order*)

No.	Actions	Partners
1	Call a meeting about the safety of <i>Apellastics</i> with all relevant institutions.	A, B, D, E, F
2	Attend the weekly coordinating group meeting, as an APELL partner.	A, B, D, E, F
3	Calculate the probability and the consequences for the local community in the event of a fire at <i>Apellastics</i> .	C
4	Compare the different emergency preparedness and emergency response plans of the industrial companies in Hapell.	C
5	Train the fire brigade on chemical accidents.	D
6	Meet with the local radio station and the provincial daily newspaper.	C
7	Publish an article about the reasons for starting the APELL process and disclose information about previous accidents.	C
8	Locate possible places to receive evacuated people.	D, E, F, G, H
9	Organize an informative evening in the local school about the emergency response plan of <i>Apellastics</i> .	C, D, E, F, H
10	Make a review of the fears and concerns which play an important role within the Moslem community. Identify possible non-compliance areas.	E
11	Repair and widen the roads leading through the industrial area.	D
12	Play a football match in the 'Plastics Cup' tournament.	A, B, D, E, F
13	Organize a drill on-site.	A
14	Distribute a brochure among the population with instructions on what to do in case of an emergency.	E, F
15	Organize a drill on-site and off-site.	A, B, C, D, E, F, G, H



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Appendix I

Supporting Documents for this Package

The following documents are available to support further work using this package:

APELL: Awareness and Preparedness for Emergencies at Local Level – a process for responding to technological accidents [1988] Paris, France: UNEP IE.

Guiding Principles for Accident Prevention, Preparedness and Response [1992]
Paris, France: OECD/Environment Directorate.
Guidance for public authorities, industry, labour and others.

Hazard Identification and Evaluation in a Local Community [1992]
Technical Report No. 12. Paris, France: UNEP IE.

Storage of Hazardous Materials: a technical guide for safe warehousing of hazardous materials [1990] Paris, France: UNEP IE.

Techniques for Assessing Industrial Hazards: a manual [1990]
World Bank Technical Paper No. 55. Second edition.
Washington DC 20433, USA: The World Bank.

Appendix II

List of Training Resource Packages available from UNEP IE

The following training resource packages have been developed by UNEP IE. They all use interactive training methodologies to explain the subject, and are aimed at educators who, although technically skilled, may not have specialized knowledge in this particular area. The packages are available from UNEP IE.

Some trainers' packages are still under development, and users are encouraged to assist UNEP to bring these to a final stage of publication.

Due to the cost of printing of the packages (between 100 and 400 pages), the completed documents are offered for sale to most users. However, a limited number of draft packages are free of charge to users prepared to contribute to their further development through review, field testing and adding material. Assistance with translation would also be welcome.

Cleaner Production: a Training Resource Package [1996] First Edition. Contains

background reading, transparencies, bibliography, and work exercises. 110 pages. Price \$120 (English, Spanish). This package can be used with the workbooks below.

Trainer's Workbook on Cleaner Production in Leather Tanning [1996] First Edition.

Contains background reading, case studies, work exercises and answers. 120 pages. Price \$120.

Trainer's Workbook on Cleaner Production in the Brewing Industry [1996] First Edition.

Contains background reading, case studies, work exercises and answers. 75 pages. Price \$100.

Trainer's Workbook on Cleaner Production in Textile Wet Processing [August 1995] First Edition.

Contains background reading, case studies, work exercises, answers, references. 140 pages. Price \$120.

Management of Industrial Accident Prevention and Preparedness: a Training Resource Package [1996] First Edition. Contains

background reading, case studies and work exercises. 110 pages. Price \$120. This package also helps to explain the APELL programme.

Risk Management of Contaminated Industrial Land: a Training Resource Package [1996] First Edition. Contains background reading,

case studies and work exercises. 110 pages. Price \$120. English, Spanish.

case studies and work exercises. 110 pages. Price \$120. English, Spanish.

Hazardous Waste, Policies and Strategies: a Training Manual [December 1991] TR10.

Contains background reading, case studies, work exercises, reference tables and bibliography. 250 pages. Price \$120. English, French, Spanish.

Landfill of Hazardous Industrial Wastes: a Training Resource Package [March 1994] TR17.

Contains background reading, case studies, work exercises, reference tables and bibliography. 315 pages. Price \$120.

Environmental and Technological Issues related to Lead-Acid Battery Recycling: Trainers Workbook [1996] First Edition.

Contains background reading, transparencies, bibliography and work exercises. 130 pages. Price \$120.

Environmental Management of Mining Sites: a Training Manual [1995] UNEP/DDSMS.

Contains background reading, transparencies, case studies, work exercises and answers. 200 pages. Price \$160.

Environmental Management Systems: Training Resource Kit [1995] UNEP/ICC/FIDIC.

Contains background reading, transparencies, case studies, work exercises, bibliography. 492 pages. Price \$190.

Aerosol Conversion Technology Handbook [1994]

Price FF225/US\$45 for developed countries.

Training Manual on Chillers and Refrigerant Management [1994] Price FF425/US\$85 for developed countries.

Training Manual on Good Practices in Refrigeration [1994] Price FF400/US\$80 for developed countries.

Environmental Impact Assessment: a training resource manual [1996] Preliminary version. Available from UNEP Environment and Economics Department, UNEP, Nairobi.

Enquiries UNEP IE

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

Tel 33 (1) 44 37 14 50

Fax 33 (1) 44 37 14 74

Email unepie@unep.fr

<http://www.unepie.org/home.html>

Appendix III

About UNEP Industry and Environment

Industry and Environment was established by UNEP in 1975 to bring industry and government together to promote environmentally sound industrial development.

UNEP IE is located in Paris and its goals are to:

- 1 encourage the incorporation of environmental criteria in industrial and development plans;
- 2 facilitate the implementation of procedures and principles for the protection of the environment;
- 3 promote the use of safe and clean technologies;
- 4 stimulate the exchange of information and experience throughout the world.

UNEP IE provides access to practical information and develops co-operative on-site action and information exchange backed by regular follow-up and assessment. To promote

the transfer of information and the sharing of knowledge and experience, UNEP IE has developed three complementary tools:

- technical reviews and guidelines;
- *Industry and Environment*: a quarterly review;
- a technical query-response service.

In keeping with its emphasis on technical cooperation, UNEP IE facilitates technology transfer and the implementation of practices to safeguard the environment through promoting awareness and interaction, training and diagnostic studies.

Some relevant UNEP IE publications

Refer to **Appendix II** for trainers' packages. For complete list, refer to publications catalogue.

Industry and Environment [quarterly] deals with issues relevant to industrial development, such as auditing, waste management, industry-specific problems, and environmental news.

Government Strategies and Policies for Cleaner Production [1994] 32pp.

Cleaner Production Worldwide Vol. I and II [1995] 48pp.

Life Cycle Assessment: what it is and how to do it [1996] 92pp.

Audit and Reduction of Industrial Emissions and Wastes: Technical Report No. 7 [1991] UNEP/UNIDO. 127pp.

Monitoring of Industrial Emissions and Wastes: Technical Report No. 27 [1996] UNEP/UNIDO. 188pp.

Energy, Efficiency and Climate Change [1991] UNEP/IPIECA. 95pp.

Hazard Identification and Evaluation in a Local Community: Technical Report No. 12 [1992] 86pp.

Health Aspects of Chemical Accidents: guidance on chemical accident awareness, preparedness and response for health professionals and emergency responders

Technical Report No. 19 [1994] A joint IPCS/OECD/UNEP/WHO publication: OECD Environment Monograph No. 81. 47pp.

Environmental Aspects of Industrial Wood Preservation: a technical guide *Technical Report No. 20* [1994] 105pp.

The Textile Industry and the Environment *Technical Report No. 16* [1994] 120pp.

Environmental Management in the Brewing Industry *Technical Report No. 33* [1995] 120pps.

Storage of Hazardous Materials *Technical Report No. 3* [1990]

Companies Organization and Public Communication on Environmental Issues *Technical Report No. 6* [1991] 130pp.

Company Environmental Reporting *Technical Report No. 24* [1994] 118pp.

*From Regulations to Industry Compliance:
Building Institutional Capabilities Technical
Report No. 11 [1992] 62pp.*

