



A FRAMEWORK FOR MAJOR EMERGENCY MANAGEMENT



GUIDANCE DOCUMENT 1

A GUIDE TO RISK ASSESSMENT IN
MAJOR EMERGENCY MANAGEMENT
JANUARY 2010



Introduction to A Guide to Risk Assessment



'A Framework for Major Emergency Management' (2006) replaces the *Framework for Co-ordinated Response to Major Emergency*, which has underpinned major emergency preparedness and response capability since 1984.

The Framework sets out the arrangement, by which the principal response agencies will work together in the management of large-scale incidents.

This *Guide to Risk Assessment in Major Emergency Management* is intended to support the Framework text and to provide additional guidance on the risk assessment process.

The guidance document is presented as best practice in the area of Risk Assessment for Major Emergency Management. Guidance documents are administrative instruments not having the force of law and, as such, allow for flexibility in approach. Alternate approaches to the principles and practices described in this guidance described may be acceptable provided they are supported by adequate justification. Alternate approaches should be discussed in advance with the:

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Introduction

The systems approach to Major Emergency Management involves a continuous cycle of activity. The principal elements of the systems approach are:

- Hazard Analysis/ Risk Assessment;
- Mitigation/ Risk Management;
- Planning and Preparedness;
- Co-ordinated Response; and
- Recovery

FIGURE 0.1
Five-Stage Emergency Management Paradigm




Risk Assessment is a process by which the hazards facing a particular community are identified and analysed/assessed in terms of the threat/risk which they pose.

To prepare effectively for dealing with potential emergencies it is necessary to have regard to the specific risks faced by a community. Including formal Risk Assessment as part of emergency planning is increasingly recognised as best practice nationally and internationally. In the Framework the risk assessment process is used as a basis for the decision-making associated with the other elements of the emergency management cycle.

The framework requirement is that:

Each principal response agency should, in association with its partner principal response agencies, carry out a risk assessment in accordance with the procedures set down in Section 2 of the Framework and this Guidance. The initial risk assessment should be reviewed and updated annually, or as circumstances require.





This Guidance sets out a risk assessment procedure that should be applied and documented by the principal response agencies as a basis for major emergency management. The risk assessment procedure underpins work in the later stages of the emergency management cycle. A significant benefit of the risk assessment process is that it can help establish confidence in the Major Emergency Management system, by showing it to be both realistic and logical.

This risk assessment approach is complementary to the principle of an “All-Hazards” approach discussed in Section 1 of the Framework.

Section 2 of the Framework introduced the risk assessment process and defined the following terms (See also Appendix F3):

Hazard: Any phenomenon with the potential to cause direct harm to members of the community, the environment or to physical infrastructure, or being potentially damaging to the economic and social infrastructure.

Impact: The consequences of a hazardous event being realised, expressed in terms of a negative impact on human welfare, damage to the environment or physical infrastructure or other subsequent consequences.

Risk: The combination of the likelihood of a hazardous event and its potential impact.

This guidance is divided into two parts. Part one details the four steps of the risk assessment process while part two provides guidance on how the risk assessment should be employed to inform mitigation and detailed planning. A ‘*Tables and Templates*’ section is included that contains documents designed to support the risk assessment process. It should be noted that tables and templates do not purport to exhaust all potential possibilities but rather should be used as guides to be adapted to Local/Regional circumstances.



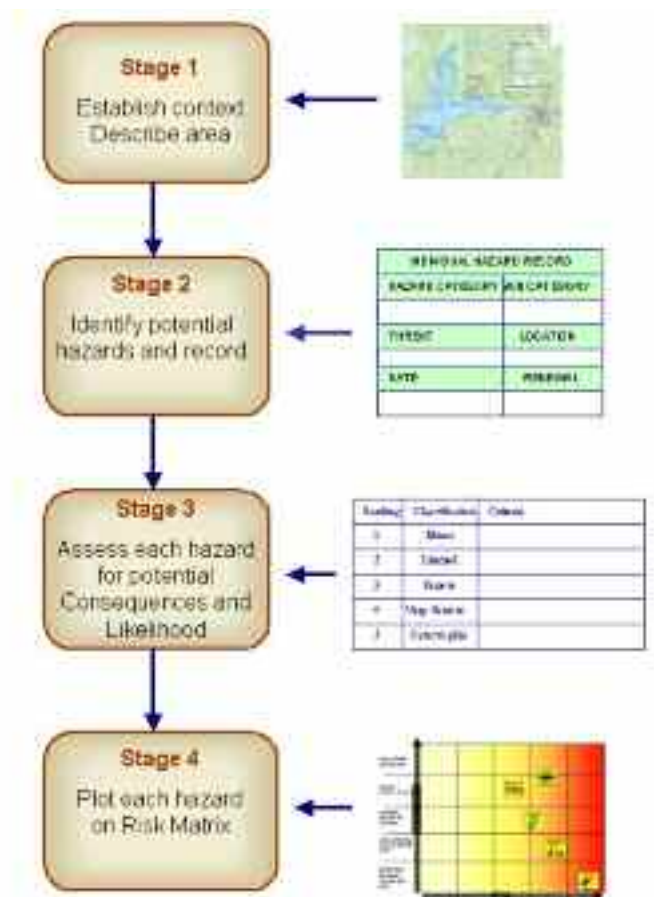
PART 1- The Risk Assessment Process

It is recommended that the risk assessment process should be carried out initially by each principal response agency, before being undertaken and documented by an inter-agency team, working under the aegis of the Regional Steering Group on Major Emergency Management. The relevant outcomes from the regional process should be incorporated into each principal response agency's own major emergency plan.

The risk assessment comprises four stages as illustrated in Figure 1.1 below:

1. Establishing the context
2. Hazard Identification
3. Risk Assessment
4. Recording potential hazards on a risk matrix

FIGURE 1.1
Schematic Risk assessment Process





Risk Assessment Stages

Stage 1 - Establishing the Context

The purpose of this stage is to describe the characteristics of the area for which the risk assessment is being completed, as this will influence both the likelihood and the impact of a major emergency. Establishing the Local/Regional context enables a better understanding of the vulnerability and resilience of the area to emergencies.

Each principal response agency should undertake an initial local risk assessment. The process begins for each agency by establishing the context in which the risk assessment is taking place.

Methodology

The team undertaking the risk assessment exercise should consider the national, regional and local contexts which impact on major emergency management in their area. The outcomes should be recorded in a series of short statements. To assist in this, the team should reflect on the relevant aspects of their area, considering emerging and potential future trends, in addition to the current situation. It will be appropriate also for the team to establish links with bodies that could provide relevant information/input for the risk assessment process. These could include bodies such as the Environmental Protection Agency (EPA), the Health and Safety Authority (HSA), the Food Safety Authority (FSA), Port and Harbour Authorities, and Airport Authorities.

- **Social:** Describe the demographic, ethnic and socio-economic composition of the community. How are the various communities geographically distributed within the area? Are there any particularly vulnerable groups in the community? Are there annual events during which there is an influx of people into the area e.g. Festivals and Concerts? How experienced is the community at coping with different types of emergencies? Is there a strong volunteer/community support ethos?
- **Environment:** Is the area to be assessed urban, rural or mixed? Are there any particular local geographical factors contributing to vulnerabilities? Are there particularly high-density areas? Are there specific environmentally sensitive/amenity areas? What is the history of events in or adjoining the area?
- **Infrastructure:** How is the infrastructure configured in the area - transport (road, rail, air, sea), utilities, business, etc? What are the critical supply networks in the area? Are there any sites in the area that are particularly critical for local, regional or national essential services (e.g.



telecommunications hubs, power generation, fuel /energy supply, medical facilities, educational establishments, head offices of large public or commercial concerns)? What are the drivers of the economy in the area?

- **Hazardous sites:** What potentially hazardous sites exist in the area? Where are they in relation to communities or sensitive environmental areas?

The Regional Context will be established by integrating the statements of all the principal response agencies. Relevant details from the regional process could also be annotated on a suitably scaled map. An example of a generic output from this stage is presented in Table 1 below, this should be used in the preparation of risk assessment.



Table 1- Example to Illustrate Establishing the Context

Social Population-major centres	Region 350,000 City 1 100,000 Town 1 20,000 Town 2 10,000	Demography summary % Elderly % Children % Ethnic minority /immigrant workers
Primary economic drivers	Tourism Industry	Express in Euros/% of local economy List industries with relevant comments
Principal Emergency Services	An Garda Síochána HSE Fire Service	Number and location of stations and relevant comments e.g. station types HSE Ambulance resources and Hospital locations with relevant details Number and location of fire stations and relevant comments e.g. % full time/ % retained
Environment Geographical characteristics	Area over 3,000 square miles Forests Main rivers National Parks	% Urban % Rural % Commercial List-show on map List-show on map % area covered
Adjacent counties	County A County B	
Infrastructure Transport Types	Roads Rail Shipping Airport	Major routes Significant congestion points All land transport of hazardous material takes place by road Mainly passenger traffic International ferry routes Port activity Major international /minor terminal
Water Supply	Local Authority supply schemes Treatment plants	Relevant details
Power Supply	Generating stations	Location and relevant details
Gas Supply	Pressure Stations	Pipeline location
Hazardous Sites		
SEVESO sites	Upper Tier Lower Tier	Details Details
Other Industry		Details



Stage 2 - Hazard Identification

The generic threats that exist in all communities are sometimes taken for granted (e.g. fires, road traffic accidents, accidents involving transport of people, hazardous materials, building collapse). The purpose at this stage is to review and note the generic hazards, including any particular features of these specific to the region, and then to add the hazards that are specific to the local area. Generally speaking, the hazards faced fall into four commonly used categories:

- Natural;
- Transportation;
- Technological;
- Civil.

Methodology

Using the tables provided (see Table 4 in the *Tables and Templates*) each principle response agency should list the hazards that are present in its area. Any hazards that appear on the tables that are not relevant should be deleted and new hazards added to produce a complete list. Tables listing National and International disasters by hazard type are presented to illustrate this process (see Tables 5.1 to 5.4 in *Tables and Templates*).


For each identified hazard, the elements of the community that are at risk should be identified. Both the hazards to the community, and their likely point of impact, should emerge from this stage.

Stage 3 - Risk Assessment

The next stage is to consider the overall risks presented by these hazards. Risk assessment starts with an examination of the impact (severity of consequences to life and health, property and infrastructure, and the environment) of the hazards identified. The likelihood (probability) also has to be considered and the resulting judgement recorded on a risk matrix in the next stage. The basis for making this judgement should be set out on the individual hazard record sheet, and should include sources which influence the judgement (e.g. national/local level intelligence and advice from available centres of expertise, information from risk holder/risk regulator).

A five-point scale is proposed for categorising both impact and likelihood, ranging as shown in the risk matrix in Figure 1.2. In considering the potential impact of a hazard, it is relevant to take two factors into account, - the type or nature of the impact, and the scale. The type or nature of impact may be considered in three fields:



- 
- impact on life, health and residual welfare of a community
 - social/environmental impact. Social impact may be thought of in terms of disruption/displacement of people affected by the event, while environmental impact is the impact on the physical area;
 - economic impact in terms of costs of property/ infrastructure damage as well as recovery costs or loss of economic production.

It is also important to take account of the potential for escalation of an event or the 'domino effect' when combined with other hazards.

A simple approach to assessing likelihood is proposed, expressed in terms of the probability of an event occurring. This is to reflect the judgement of people involved in this field, rather than being a strict mathematical probability.

Methodology

Each principal response agency should complete a Hazard Record Sheet (see *Tables and Templates*) for each hazard identified in Stage 2. The Hazard Record Sheet provides a means of recording information about the hazard and its potential impact and likelihood, with a view to identifying a likely position on the risk matrix. Impact guidance sheets (see Tables 4(a)-4(c) in *Tables and Templates*) for human, environmental, infrastructure can be used to achieve a full understanding of the potential impact of each hazard.

When completing the hazard record sheets, agencies should identify areas of uncertainty where expert technical advice will need to be sought. However, it should be remembered that this assessment does not require detailed technical analysis. An informed estimate, based on experience or existing safety assessment, is all that is required.

The prevention, control and mitigation measures that are already in place should be considered and recorded and, taking these into account, a decision made on the position of the hazard on the risk matrix.

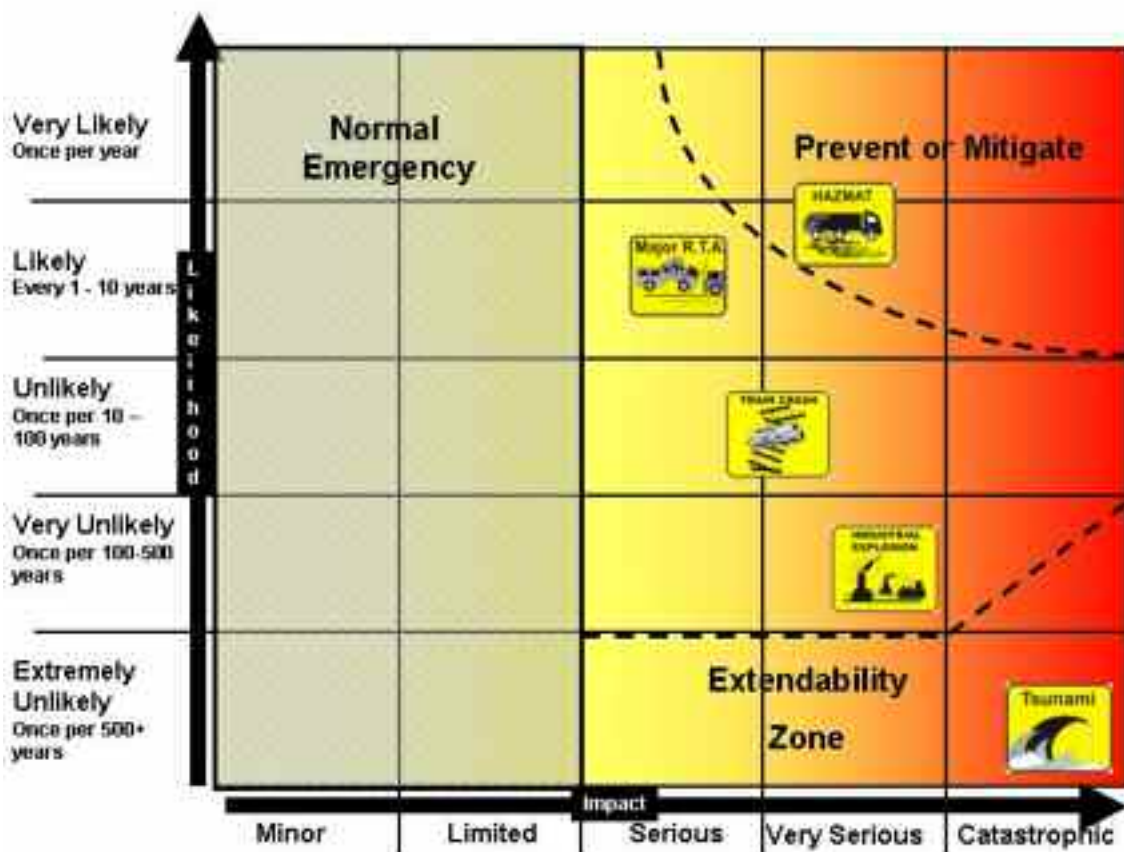
This process is initially undertaken at individual agency level and then repeated at regional level in a small multi-agency team/s, typically 3 or 4 persons. The hazard record sheets produced at inter-agency level should include as much detail as is available in relation to the hazard. Where quantitative data is available, it should be used in support of the risk assessment.



Stage 4 - Recording Potential Hazards on a Risk Matrix

The process proposed for recording the risk assessment is considered in this stage. A five by five matrix (see Figure 1.2), using the scales for impact and likelihood presented in Tables 13 and 14 below, is used to present the results of the risk assessment. The process requires the outcome from the risk assessment to be recorded and inserted in the box judged to be most appropriate for the functional area under consideration. Multi-agency perspectives can help bring balance to this task. The risk assessment exercise records, in a readily presentable format, the combined judgement of the principal response agencies in regard to the identified hazards in the area.

FIGURE 1.2



The Risk Matrix

Methodology

The impact and likelihood criteria as outlined in Tables 2 and 3 below are used to position all the identified hazards on the risk matrix.

Table 2 - Classification of Likelihood

Ranking	Classification	Likelihood
1	Extremely Unlikely	May occur only in exceptional circumstances; Once every 500 or more years
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communicates; and / or little opportunity, reason or means to occur; May occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisations worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Table 3 - Classification of Impact

Ranking	Classification	Impact	Description
1	Minor	Life, Health, Welfare Environment Infrastructure Social	Small number of people affected; no fatalities and small number of minor injuries with first-aid treatment. No contamination, localised effects <0.5M Euros Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare Environment Infrastructure Social	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements. Simple contamination, localised effects of short duration 0.5-3M Euros Normal community functioning with some inconvenience.
3	Serious	Life, Health, Welfare Environment Infrastructure Social	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support. Simple contamination, widespread effects or extended duration 3-10M Euros Community only partially functioning, some services available.
4	Very serious	Life, Health, Welfare Environment Infrastructure Social	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated Heavy contamination, localised effects or extended duration 10-25M Euros Community functioning poorly, minimal services available
5	Catastrophic	Life, Health, Welfare Environment Infrastructure Social	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated. Very heavy contamination, widespread effects of extended duration. >25M Euros Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

PART 2 - Using the Risk Assessment

While being an intrinsically useful exercise in itself, the risk assessment also provides a sound basis for determining a range of steps at later stages of the emergency management cycle - especially in the Mitigation and the Planning and Preparedness stages. As outlined in section 2 of the Frameworks the risk matrix may be overlaid by a template, as shown in Figure 2.1(a) and 2.1(b) below, which shows how the risk assessment can place a potential hazard into either:

- the “normal” emergency zone;
- the major emergency zone, at the extremities of which are delineated two specific areas;
 - o A Prevent or Mitigate area, where prevention/mitigation of hazards is required
 - o A Disaster/Extendibility area, where hazards are extremely/ very unlikely and do not therefore warrant specific preparedness, but can be responded to by extending the inter-agency arrangements of the major emergency regime

FIGURE 2.1(a)
The Risk Matrix Zones

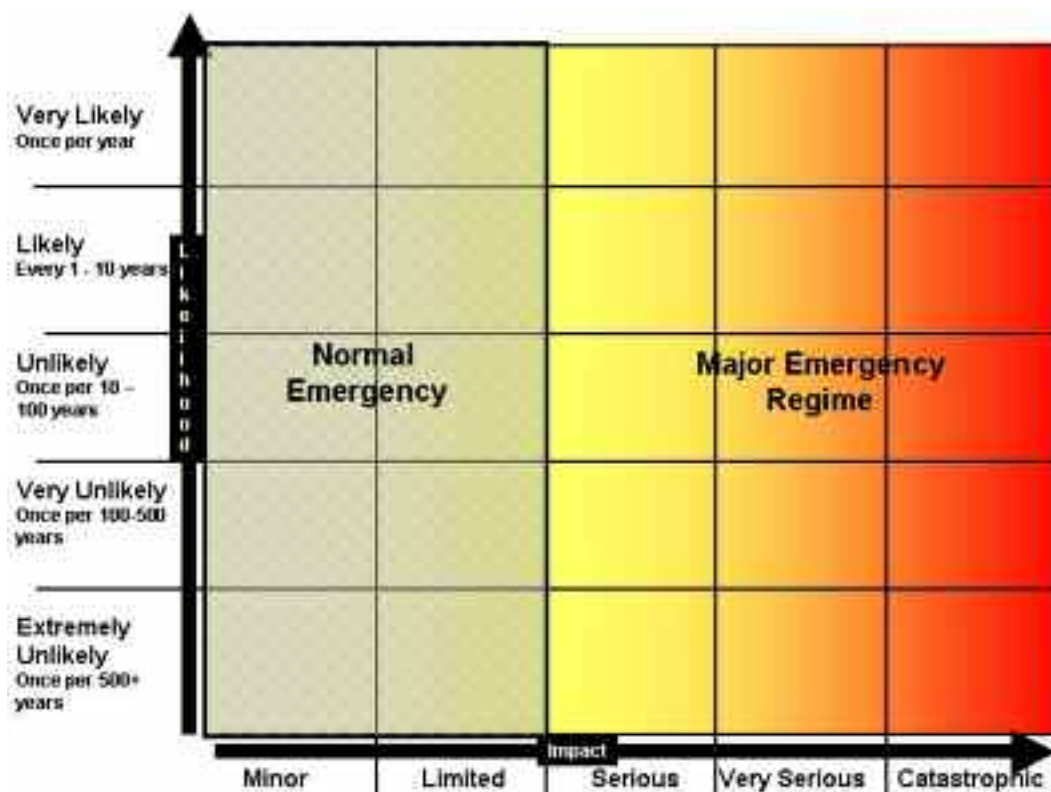
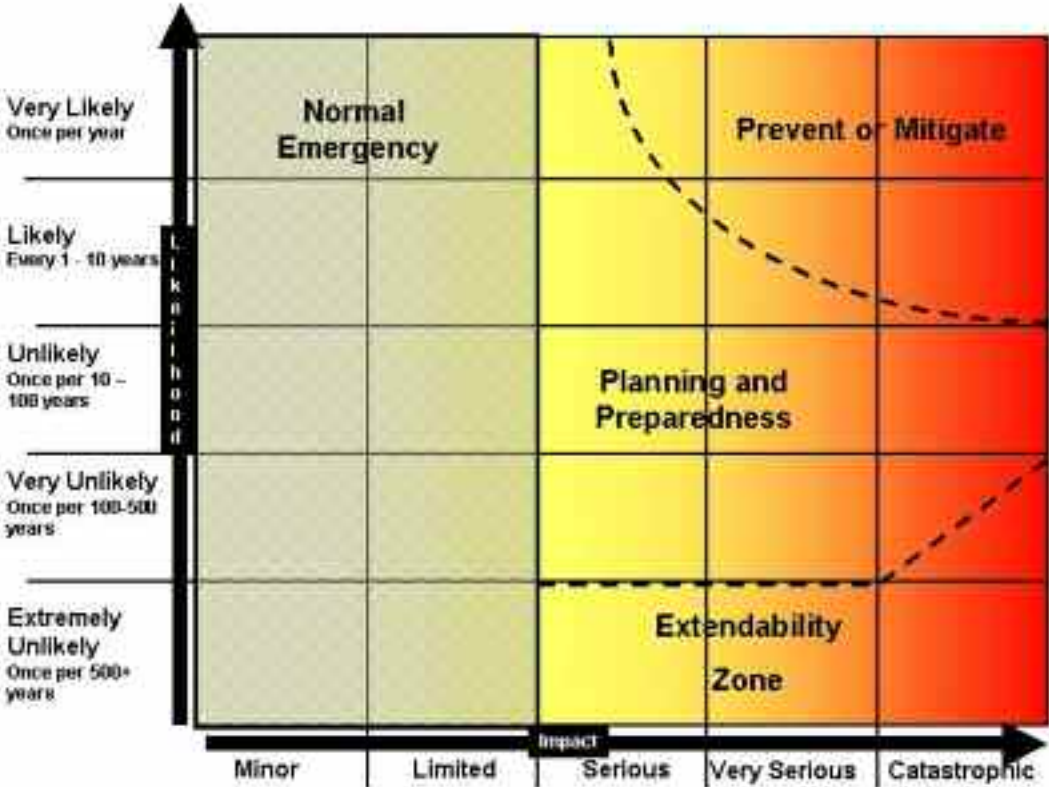




FIGURE 2.1(b)
The Risk Matrix Zones



Methodology

An inter-agency group, comprising representatives of An Garda Síochána, the Health Service Executive and the Local Authorities, should select a range of approximately six major emergency scenarios, which will provide a good basis for development of a robust, All-Hazards major emergency plan. One scenario in the extendibility zone (catastrophic impact, very unlikely) should be included as part of this process. It is recommended that an extreme version of a more likely event is chosen for this purpose, rather than a potential “freak” or “bizarre” incident.

Consideration should be given to a range of factors in the selection of an appropriate list of scenarios. Scenarios should be chosen that test the response dimensions and resource requirements towards the limits of those required within the major emergency regime. This could mean choosing a particular scenario as a vehicle for testing the local requirements for a specific type of response, such as specialist fire-fighting capability, specialist health-care, e.g. multiple burns or paediatric casualties, or specialist community care provision. Consideration should also be given to the rate of development and escalation of the chosen scenarios. This in turn allows the determination of reasonable resource requirements in terms of quantity, quality and timing.





Defining Local Response Dimensions

Each principal response agency should use the chosen scenarios as a basis for determining a range of essential response requirements for major emergencies. Response dimensions are qualitative or quantitative statement of the performance required of a system or resource to deliver an appropriate response to mitigate the impact of the emergency.

These responses could cover topics such as:

- Provision of resources or specialist equipment
- Number and quality of local responders
- Situations where plans or 'Standard Operating Procedures' are required for specific risks
- Areas where training and exercising should be focussed
- Situations/sites/events where specific protocols need to be established with third parties such as utility companies
- Situations/sites/events where specific arrangements need to be established with the private sector.

Once established, the relevant response dimensions should be used to inform the planning and preparedness stage for the individual agencies. If gaps are identified, part of the preparedness cycle should involve identifying where additional resources may be obtained in an emergency, and ensuring that arrangements are in place to mobilise them and use them effectively.



TABLES AND TEMPLATES

It should be noted that these templates are not exhaustive of all possibilities. They should be used to stimulate discussions about the functional area where they are to be used. Tables should be edited as appropriate.



Table 4 Hazard Identification Template

Natural Hazards			
Category	Type	Sub-type	Local Hazard
Meteorological			
Hydrological			
Geological			
Other			
Transportation Hazards			
Aviation			
Rail			
Road			
Water			
Technological Hazards			
Industrial Accidents			
Explosions			
Fires			
Building Collapse			
Hazardous Substance			
Pollution/ Contamination			



Table 4 Hazard Identification Template (cont..)

Civil Hazards			
Category	Type	Sub-type	Local Hazard
Civil Disorder/ Disturbance			
Major Crowd Safety			
Mass Shooting			
Loss of Critical Infrastructure			
Food Situation Crisis			
Water Supply			
Epidemics and Pandemic			
Animal Disease			
Missing Persons			



Table 5.1 National and International Examples - Natural Hazards

Category	Type	Sub-type	Irish Examples	International Examples
Meteorological	Storm/ Severe Gales	Hurricane/ Cyclone	Storm on Christmas Eve 1997	
		Tornado (local)		
	Heavy Snow	Blizzards	Jan 1982	
	Severe Cold/ Frost	Icy Roads Hypothermia		
	Thunder and Lightning Storms			
	Dense/persistent fog			
	Heat Wave/ Drought			Heat Wave France 2003
Hydrological	Flooding	Coastal/Tidal	SE Coast Nov 2004 Dublin Nov 2002	UK/ NL 1953
	Heavy Rain	Inland	Clonmel Nov 2004	Prague 2002
Geological	Earthquake			Kobe 1995 Turkey 1999 Bam, Iran 2003
	Tsunami		Ireland 1750s	SE Asia Dec 04
	Volcano			Krakatoa 1887 Mount St Helens
Other	Landslide		Polathomais 2003 Derrybrien 2003	Aberfan 1967
	Land Cave in			
	Reservoir/ Dam-burst			
	Forest/ Wilderness fire		Donegal Easter 2003	Portugal/France 2003
	Space debris/ meteor etc			

Table 5.2 National and International Examples - Transportation Hazards

Category	Type	Illustrative Example	Irish Examples	International Examples
Aviation	Aircraft collision/ loss	Mid-air	Air-India 1985	Lockerbie 1997
		Low-speed (near Airport)	Shannon 1953	British Midland 1989
		Airport incident		Frankfurt 1998 Paris CdeG 2003
	Aviation security	Hijacking		
Rail	Mainline		Cherryville 1983 Buttevant 1982 Roscommon 2001	December 2000
	DART/ Suburban			
	Tram		Luas/Bus Crash Sept 2009	
	Haz Mat/ Goods			
	Tunnel / Bridge			Mont Blanc, Kaprun etc. tunnel fires; Germany, Austria, Switzerland.
Road	Multiple vehicle RTA			
		Bus		
		Motorway	M7 Pileup March 2007	
		Tunnel		
	Hazmat			
	Bridge		Rathcoole 2004	
Water	Marine	Ferry	Rosslare Ferry Feb 2003	Swedish Ferry 2007 Zeebrugge March 1987
		Port	Dublin Bay collision	
	Inland Waterways	Pleasure craft/ cruises		Marchioness London 1987
		Pollution	Kowloon Bridge 1986 Princess Eva Feb 2003	Braer January 1993 Spanish Coast Feb 2003

Table 5.3 National and International Examples - Technological Hazards

Category	Type	Illustrative Example	Irish Examples	International Examples
Industrial Accidents	Explosions		Hicksons 1994	Toulouse 2004 Flixboro 1974 Seveso 1976
	Petrochemical Fires			Wales Brucefield 2005
	Industrial Fires	LPG tank fire	Belmullet 1999 Edgeworthstown 1995	
	Gas Emission			Bhopal 1984
	Fluid Emission	Pipeline leak Fire-water run-off		Sandoz 1986
Explosions	Domestic	Natural gas explosion	Raglan House 1984	Belgium 2004
	Bomb		Omagh 1998 Dublin 1974	Madrid 2004
	LPG			BLEVEs
	Pipelines/Platforms			Piper Alpha 1988
Fires			Stardust 1981 Bundoran 1980 Whiddy 1979	Gothenberg 1998 Netherlands 2000
Building Collapse			Raglan House 1984	
Chemical		Accident at site		
		Transportation accident		
		Weapons		
	Biological	Leak/ Weapons	Anthrax scares 2001	
	Nuclear Accident			Chernobyl 1986 Three Mile Island 1990
	Radiological	Fire at storage site/ dirty bomb		
Pollution/ Contamination	Air/Water Pollution		Hicksons 1994	Basil Fire 1986
	Space Debris			
	Mining			

Table 5.4 National and International Examples - Civil Hazards

Category	Type	Illustrative Example	Irish Examples	International Examples
Civil Disorder / Disturbance			Lansdowne Road Intl Soccer 1995	G8 summits
Major Crowd Safety	(movement, crushing etc)	Pop Concerts Sports events Fireworks displays Airshows	Lansdowne Road 2005	Ibrox 1971 Heysel Stadium 29 May 1985
Terrorism	Bombs	Car-bombs	Dublin/Monaghan 1974	
		Bombs in buildings		
		Fire-bombing		
	CBRN as weapons			
	Disruption	Bomb scares		
Mass shooting				Dunblane 1996 Columbine 1999
Loss of Critical Infrastructure	Energy and Power Supply	Electricity		Canada Italy London
		Natural Gas		
		Fuel Oil		
		Communications	PSTN: Mobiles: Web	
Food Situation Crisis		Food Contamination		
Water Supply		Shortage Contamination		
Epidemics and pandemic		Communicable diseases	Swineflu 2009	Flu pandemics
Animal Disease		Foot & Mouth 2001		Avian Influenza





INDIVIDUAL HAZARD RECORD SHEET TEMPLATE





INDIVIDUAL HAZARD RECORD SHEET TEMPLATE



INDIVIDUAL HAZARD RECORD SHEET

HAZARD CATEGORY

SUB-CATEGORY

Hazard Description

Hazard Location

Date:

Review Date:

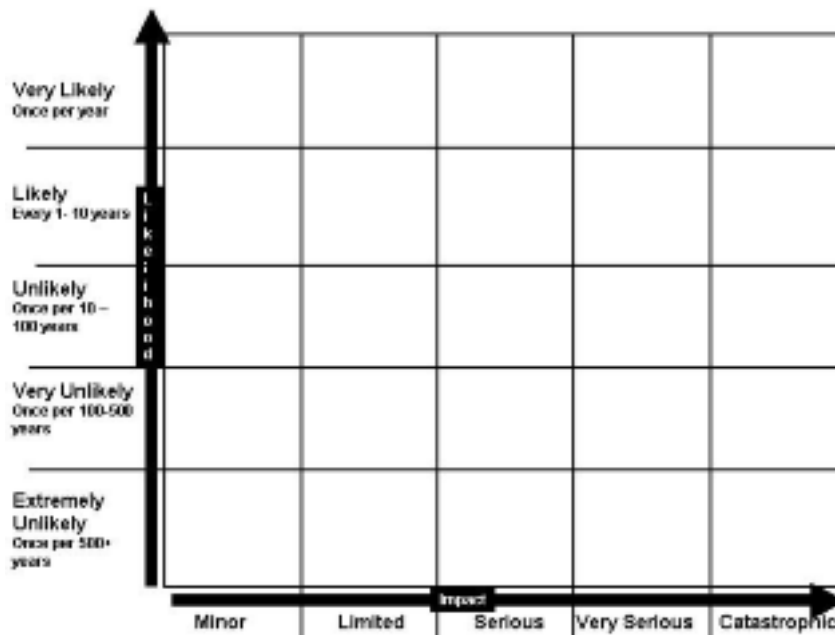
1. Overview of Hazard

2. Key Historical Evidence

3. Assessment of Impact and Likelihood

Hazard	Impact				Likelihood
	Human Welfare	Environment	Physical Infrastructure	Speed of Development/ Escalation	
	Minor	Minor	Minor	Minor	Very Likely
	Limited	Limited	Limited	Limited	Likely
	Serious	Serious	Serious	Serious	Unlikely
	Very Serious	Very Serious	Very Serious	Very Serious	Very Likely
	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Extremely Unlikely

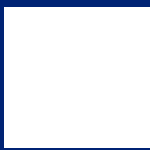
4. Position on Risk Matrix



5. Prevention/Control/Mitigation Measures in Place

6. Risk Management Approach: Prevention/Control/Mitigation Measures Required





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