2.3 Procedure

2.3.1 Basis

The group should begin by deciding on the objectives for the analysis and the level of detail required. An "analysis map" (see figure 2:8) covering the geographical area in question is needed. Only those objects of relevance to the analysis should be included. Use figure 2:1 for the work and to summarize the results

2.3.2 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 2.2). 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.

2.3.3 Identification

Begin with the form for hazard analysis in figure 2 1. **To start, choose an object and area with which all the members of the Co- ordinating group 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 affects 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.

2.3.4 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 see whether consequences are likely. It is not always necessary to estimate in great detail. Risk zones 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.(see annex 3 7).

2.3.5 Classification

Start with the outlines for classification in figure 2.5
Class the estimated consequences from 1 to 5 for:

life (fatalities/injured) -	**in column 7, "L"**
environmental objects -	**in column 8, "E"**
property -	**in column 9, "P"**
speed of development, amount of warning -	**in column 10,"S"**

2.3.6 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 of 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 2.6 (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"). SEE GUIDANCE IN FIGURE 2.7.

See some examples in figures 2.9 -2.15

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".**

2.3.7 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 presented only on a large number of forms. It is therefore advisable to show the most important information on an overall "risk map" (see figure 2.8). 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. See figures 2.9-2.15 for examples.

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.

Figure 2.1

COMMUNITY.....

OBJECT/AREA.... .....

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

① Object	② Operation	③ Hazard (quantity)	④ Risk-type	⑤ Threat-ened object	⑥ Conse-quences	7-10 Seriousness				⑪ Pb	⑫ Pr	⑬ Comments
						L	E	P	S			

Figure 2.2

Examples of risk objects	Common hazards
Docks	Large and variable quantities of many types of dangerous substance (inflammable, explosive, poisonous etc). Cranes, vehicles
Depots, terminals, stores	See docks
Ships	Dangerous goods, oil
Railway marshalling yards	Dangerous goods, oil
Canals	Dangerous goods
Airports	Fuel, dangerous goods
Aircraft	Fuel, dangerous goods
Processing industry Refineries, petrochemical, inorganic chemical, pharmaceutical, paint, steel/metal, cellulose/paper textile, etc	Pressure vessels, tanks,stores, containers, processing equipment with hazardous substances in the form of raw materials, catalysts,products, byproducts, waste and high voltage electricity.
Other industry Plastics, rubber, engineering, saw mills and other wood production industry etc	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, hot water, high voltage electricity
Nuclear power stations	Radioactive and poisonous reactor materials, pressure vessels, high pressure steam, hot water, high voltage electricity.
Natural gas pipelines	Inflammable gas, pressurized pipelines.
Other pipelines	Inflammable, poisonous and enviromentally hazardous substances, pressurized pipelines.
Petrol stations **Oil depots**	Inflammable, poisonous and environmentally hazardous substances
Department stores	Combustible and poisonous substances, aerosol sprays.
Builders merchants	Large quantities of wood
Hardware stores	Explosive and combustible substances.

Saw mills	Combustible substances, wood.
Municipal facilities such as water purification plant, sewage treatment plant, swimming pools.	Hazardous substances.
Hospitals	Hazardous chemicals.
Schools	Hazardous chemicals.
Hotels	Tall buildings
Silos	Combustible dust.
Quarries and other large mountain/underground sites	Unstable rock/soil, gases, drainage water, vehicles.
Areas liable to flooding landslide and building collapse	Geological conditions
Aerial ropeways/cableways	Heights
Tunnels	Risk of collapse, difficult situation for rescue work
Roads	Vehicles, dangerous goods

Figure 2.3

Threatened object	Consequences
People	
Personnel Visitors People living nearby Fire and rescue service and civil defence personnel Children, elderly people	Anything from anxiety, through injury, to many deaths
.....	
.. ..	
....	
Environment	
Sea, lakes, rivers, canals	Boat, ferry and plane crashes, drowning, leakages of hazardous substances (water supply, nature reserves)
Water supply	Pollution, bad taste, sabotage damage
Recreational area	Leakage of hazardous substances, fire
Nature reserve	Leakage of hazardous substances
Agricultural land	Leakage of dangerous and environmentally hazardous substances
Forest	Fire
. . ..	.....
.....	. . ..
Property	
Airport terminal	Any thing from minor damage to complete destruction.
Railway station	As above, plus collisions
Underground railway	As above, plus smoke damage
Docks	As above, plus leakage of dangerous substances
Hospital Care centre Nursery school Hotel Theatre Sports arena	Anything from minor damage to complete destruction

Cinema	
Water supply	Pollution, bad taste, sabotage damage
Water purification plant	As for water supply
Industry	See Figure 2.2

(N.B. the possibility of combination accidents, e g a landslide which then causes a chemical leakage, etc)

. .. .	. .. .
....	.....

Figure 2.4

Factors affecting hazards and risks

The following factors should be considered when assessing risk objects, hazards and, when applicable, threatened objects.

- the presence of hazards (type, quantity and potential)
- extreme conditions, for example when dealing with dangerous substances
- the effects of storing various substances together
- the fact that containers of chemicals might be poorly marked or completely unmarked
- the distance to critical threatened objects and the safe distance to limit knock on effects
- the importance of people acting in a correct manner so that·
    - the risk of damage is avoided
    - the rescue services and threatened objects are warned and kept well-informed
    - rescue work is effective
- the importance of safety equipment and other support services functioning properly
- the effects of natural forces such as rain, snow, wind, avalanche, waves etc
- the likely or possible damage and estimated number of casualties
- the possibility of detecting a dangerous event while it is still in its initial stages
- the probability and possible effects of sabotage

Figure 2.5

Classification (see Matrix in Fig. 2.6) of the consequences of a potential accident, the speed at which the accident would develop and the probability of it occurring - for use in the analysis of threatened objects and/or separate hazards

Consequences for life and health

Class	Characteristics
1. Unimportant	temporary slight discomfort
2. Limited	a few injuries, long-lasting discomfort
3. Serious	a few serious injuries, serious discomfort
4. Very serious	a few (more than 5) deaths, several (20) serious injuries, up to 500 evacuated
5 Catastrophic	several deaths,(more than 20), hundreds of serious injuries, more than 500 evacuated.

Consequences for the environment

Class	Characteristics
1. Unimportant	no contamination, localised effects
2. Limited	simple contamination, localised effects
3. Serious	simple contamination, widespread effects
4. Very Serious	heavy contamination, localised effects
5. Catastrophic	very heavy contamination, widespread effects

Consequences for property

Class	Total cost of damage (M USD, pounds, etc)
1. Unimportant	< 0,5
2. Limited	0,5 - 1
3. Serious	1 - 5
4. Very Serious	5 - 20
5. Catastrophic	> 20

Speed of development

Class	Characteristics
1. Early and clear warning	localised effects/no damage
2.	
3. Medium	some spreading/small damage
4.	
5. No warning	hidden until the effects are fully developed/immediate effects (explosion)

Probability

Class	Rough estimate of frequency
1. Improbable	less than once per 1,000 years
2.	once per 100-1,000 years
3. Quite probable	once per 10-100 years
4	once per 1-10 years
5. Very probable	more than once per year

Figure 2:6

RISK MATRIX

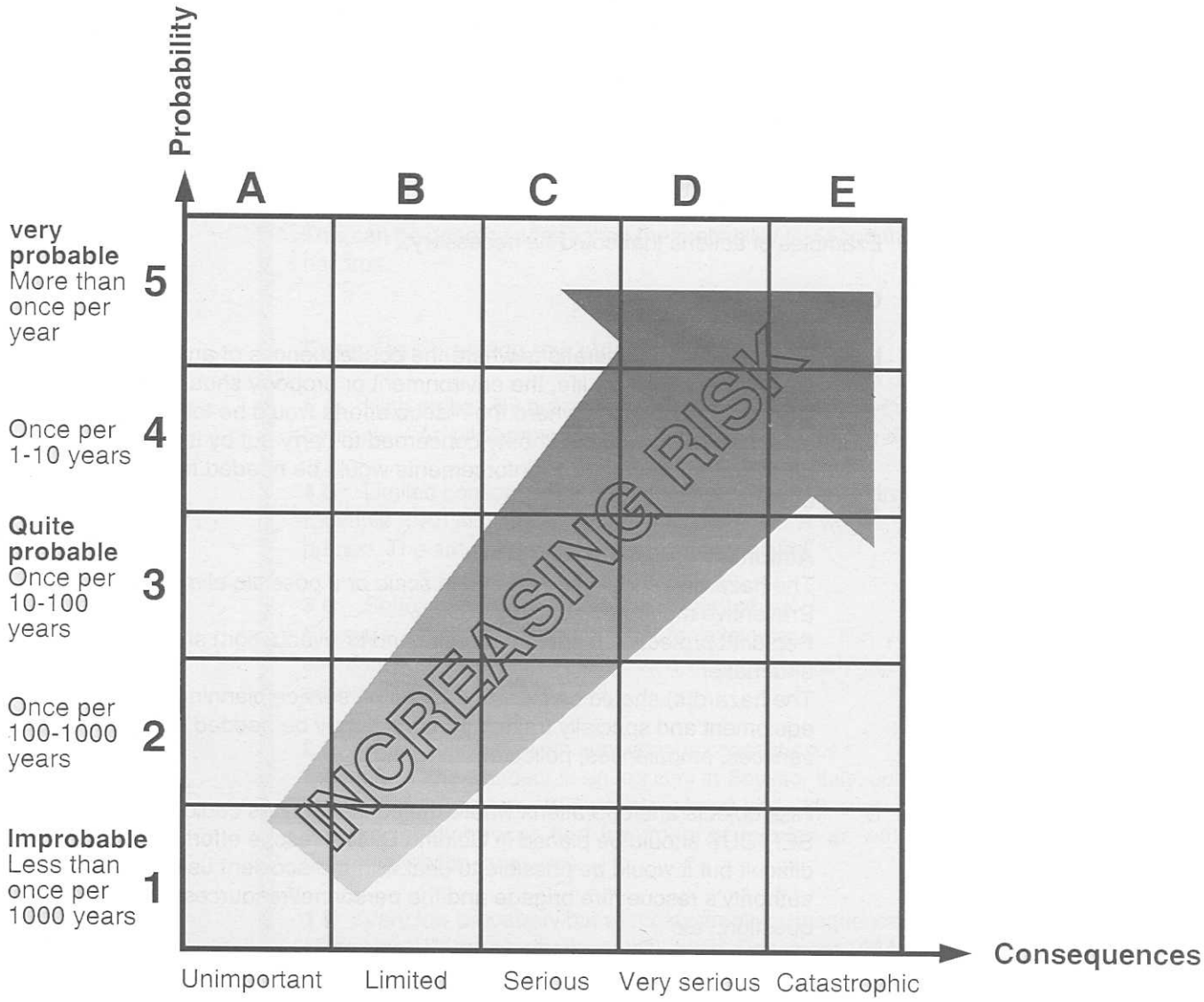


Figure 2:7
Ranking of Risk Objects and Hazards from a Local Viewpoint.
(Comments on the Risk-Matrix in Figure 2.6.)

It is necessary to rank the risk objects in order to allocate resources, to decide where preventive measures should be taken first, to develop emergency plans, etc.

When attempting to rank risk objects systematically it is also necessary to weigh up different kinds of hazards within the risk object. This will be a matter of judgement for the Co-ordinating Group. Both probability and consequences must be considered It is common to concentrate on the risks with the greatest consequences. When attempting to reduce risk levels systematically, however, it may be necessary to weigh an event with low probability but serious consequences against one which is more likely but causes less damage.

The results of the ranking should influence the development of a concrete programme of action necessary to protect and save lives, the environment and property on-site and off-site.

Examples of actions that could be necessary:

Column

E Risk objects and operations where the consequences of an accident could be CATASTROPHIC for life, the environment or property should be shown in Column E. Situations where the rescue efforts would be too difficult or extensive for the local authority concerned to carry out by itself should also be shown in Column E. Reinforcements would be needed from neighbouring authorities and industries, etc.

Actions.
The hazard(s) should be reduced in scale or if possible eliminated.
Preventive measures should be taken.
Personal protection planning (on-site and/or evacuation) should be undertaken.
The hazard(s) should be included in rescue service planning - special equipment and specially trained personnel may be needed by health care services, ambulances, police etc

D Risk objects and operations where the consequences could be VERY SERIOUS should be placed in Column D. The rescue efforts would be difficult but it would be possible to deal with the accident using the local authority's rescue /fire brigade and the personnel/resources of the industry in question, etc

Actions:
Much the same as for Column E.

C Risk objects and operations where the consequences could be SERIOUS should be shown in Column C. The rescue (fire) brigade / industry has the resources to cover the rescue efforts.

Actions:
Preventive measures
Emergency planning

B Risk objects and operations where the possible consequences for life, property or the environment are LIMITED should be given in Column B

Actions:
Preventive measures
Emergency planning

A Risk objects and operations where an accident would have more or less UNIMPORTANT consequences should be shown in Column A.

The risk objects containing hazards with a low probability and limited consequences (1-2/A-B) can be discarded at an early stage of the analysis. However it is important that this selection is done carefully.
It is always useful to know the potential " worst-case" of a hazard. But the " worst-case" event is often considered so improbable that a smaller and more probable event, the "dimensioned damage estimate", is chosen as the basis for safety measures, ranking of the risk object, etc.
It is useful to be able to assign one class to a particular risk object. often based on the "dimensioned damage estimate", taking into account all the different hazards present. This can be done by considering the probability (1-5) and the consequences (A-E) for all hazards

Examples of ranking risk objects:

5 A High probability but more or less unimportant consequences.
Example - An oil depot with minor leakages because of a defective shut-off valve.

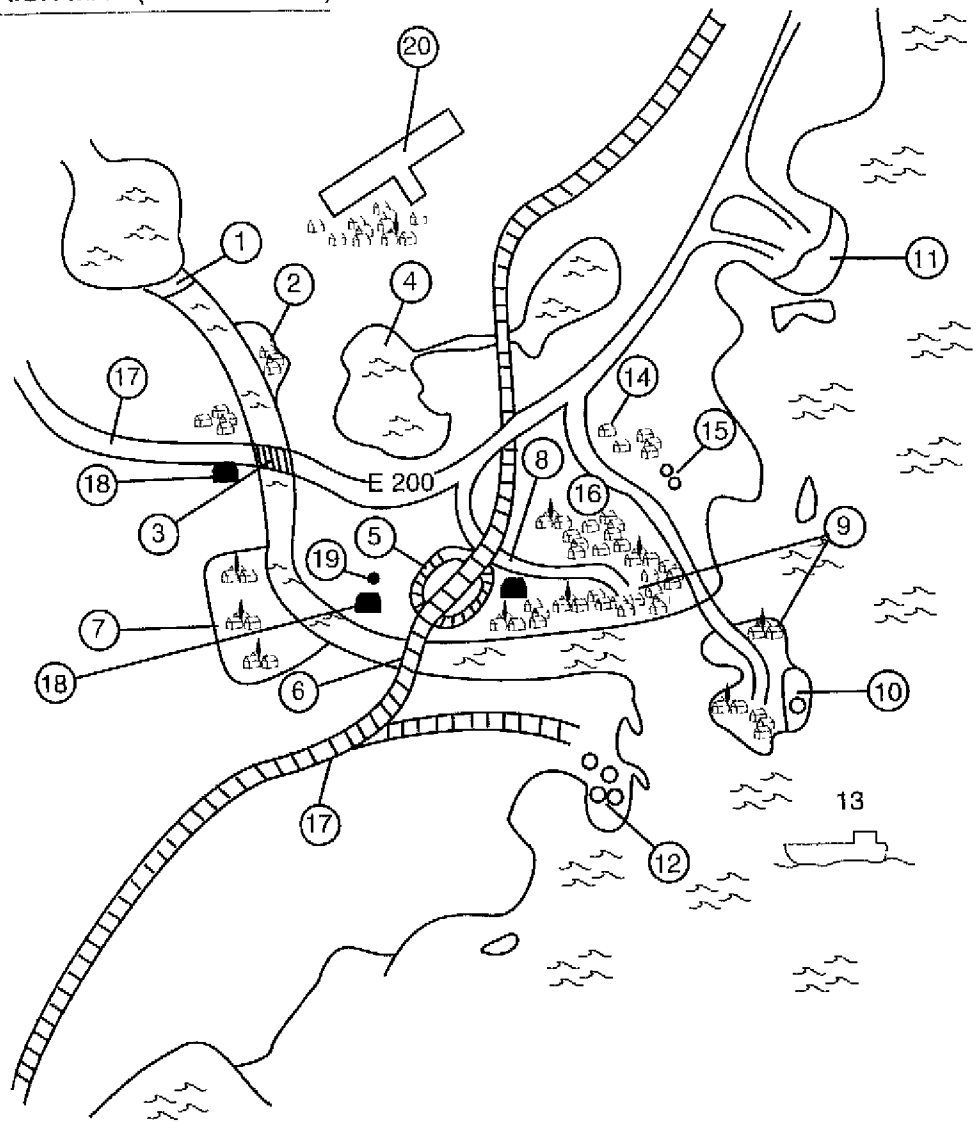
4 B Limited consequences but happens every three years.
Example - An industry with a potential for fires. A worker once got his hands and face burned. The area had to be cleaned and repainted

3 C Serious consequences but quite probable.
Example - A factory with potential for explosions. Ten years ago the factory had an accident with one person killed and three seriousely injured Property damage was assessed at three million USD.

2 D Not so often but with very serious consequences
Example - The accident in an industry in Seveso, Italy, July 1976. Release of dioxin in an area of 4-5 sq.km. 250 people injured and 600 evacuated. International help was needed for diagnoses and treatment of injuries as well as chemical analysis and decontamination measures

1 E Very low probability but with catastropic consequences.
Examples - Bhopal (poisonous gas), India, December 1984.
- San Juanico (gas cloud explosion), Mexico,1984

RISK-MAP (AN EXAMPLE)



RISK AND THREATENED OBJECTS

1. DAM
2. AREA LIABLE TO LANDSLIDES
3. TUNNEL
4. WATER SUPPLY
5. RAILWAY MARSHALLING YARD
6. RAILWAY BRIDGE
7. INDUSTRIAL AREA
8. CENTRAL STATION
9. TOWN CENTRE
10. INDUSTRIAL AREA
11. RECREATIONAL AREA/ NATURE RESERVE
12. OIL TERMINAL
13. SHIP (WITH DANGEROUS CARGO)
14. PETROL STATION
15. OXYGEN PRODUCTION
16. DISTRICT HEATING POWERPLANT (LIQUIFIED PETROLEUM GAS)
17. TRANSFORMATION OF DANGEROUS GOODS
18. STORAGE OF CHEMICALS
19. FIRE STATION
20. AIRPORT

Map Figure 2:8

Figure 2 9

COMMUNITY.....

OBJECT/AREA... **Hardware store and Timber/Builders' merchant**

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

① Object	② Operation	③ Hazard (quantity)	④ Risk-type	⑤ Threat-ened object	⑥ Conse-quences	7-10 Seriousness L	E	P	S	⑪ Pb	⑫ Pr	⑬ Comments
Hardware store	Selling, storing	Solvents (1000 l)	Fire	Risk objects are situated side-by-side Threatened objects are therefore the same.	The most serious conse-quences are for people and pro-perty as a result of							
		Inflammable paint (3000 l)	Fire									
		Water-based paint (6000 l)	Leakage	Life								
		Liquified petroleum gas bottles for household use (300 x 1 kg)	Explosion	Personnel in own/other companies Customers in own/other companies Local inhabitants School children	• Explosion (caused by fire)	4	2	3	5	3	C	Dimensioned damage estimate
					• Fire/smoke damage	3	2	3	4	4	B	
				Environment								
				Drinking water Drainage water Air Land	• Leakage	-	2	2	5	4	A	
					• Drinking/ Drainage water	-	2	-	-	4	A	
					• Damage to sewage treat -ment plant	-	-	1	-	4	A	
Timber/builder's merchant	Selling, storing	Timber (300m³)	Fire	Property								
		LPG bottles	Explosion	Building beside the square Goods Vehicles on square								
		Welding gas (500 bottles)	Explosion	Sewage treatment plant Upper secondary school								

Figure 2.9 Hardware Store

Figure 2.10 **Hardware Store Map**

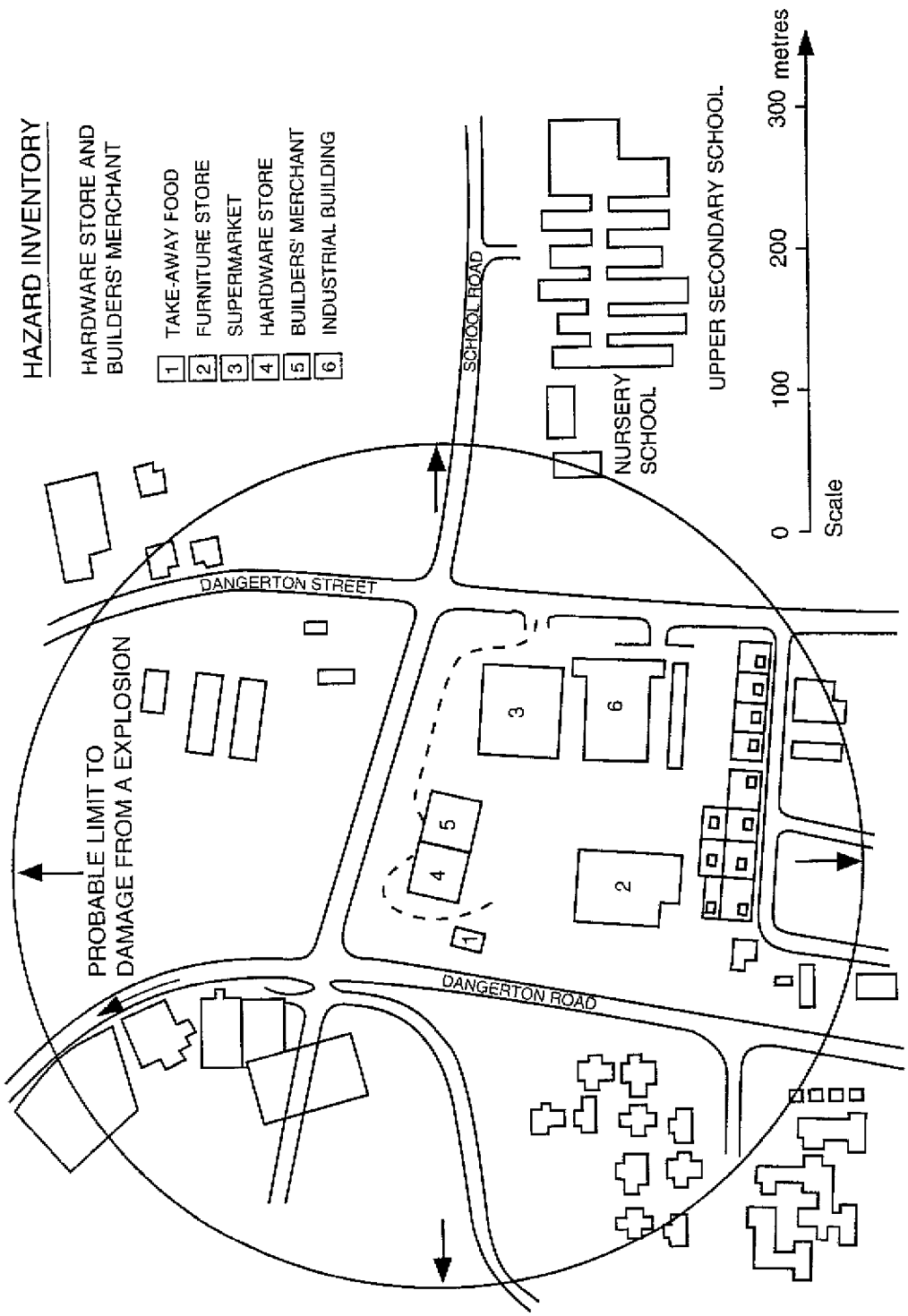


figure 2 10

Notes on figures 2.9 and 2.10

For your first hazard analysis, use the information in figures 2.9-2.15 but start your own work with a smaller object that the Co-ordinating Group members are familiar with.

The following information may be of use when considering the example of the hardware store and the builders' merchant.

The two companies have different owners but share the same building, which is part of a shopping centre.

As illustrated in figure 2.10, the shopping centre also has a kiosk with take-away food, a furniture store and a supermarket as well as an industrial building. It is planned to extend the industrial building towards the supermarket. A petrol station is going to be built between the furniture store and Dangerton Road. A new residential development is planned for the land on the other side of Dangerton Road.

The owners estimate the likely number of personnel and customers at the time of an accident to be:

1 Take-away food kiosk	25 - 50
2 Furniture store	20 - 80
3 Supermarket	150 - 500
4 Hardware store	40 - 120
5 Builders' merchant	20 - 50
6 Industrial buildings	0 - 165

The shopping centre is bounded on three sides by busy roads with the following average number of vehicles per day:

Dangerton Road	7000
School Road	4500
Dangerton Street	5500

There is a residential area next to the shopping centre Blocks of flats house about 500 people. There is also a number of older detached houses.
A secondary school with 1250 pupils and teachers is situated at a distance from the shopping centre.

The shopping centre has parking places for 375 cars. There are two main entrance and exit roads

Deliveries to the back of the hardware store pass between the take-away food kiosk and the store Deliveries to the builders' merchant arrive at the back of the store via a roadway to the rear of the supermarket.

The hardware store was built at the beginning of the 70s. It has a corrugated iron facade on a steel framework. On the ground floor there is a large hall, as in a supermarket. On the upper floor there is a smaller selling area with offices round the outside Fire alarms and smoke vents have been installed. The builders' merchant's premises consists of a large hall. The dividing wall between the two stores is not sufficiently fire-proof

Liquified petroleum gas cylinders are stored in the middle of the hardware store (300 x 1kg). Paints and solvents are also stocked in the store. The smaller containers are kept along the outer wall opposite the take-away food kiosk. Larger containers for professional decorators are kept beside the wall dividing the two stores, that is to say in the middle of the building as a whole. There are 1000 l solvents, 3000 l inflammable paints and 6000 l water-based paints, giving a combined total of 10 000 l. The actual size of the stock varies during the year, being topped up at the beginning of every summer.

The builders merchant has a large stock of wood - on average about 300 cubic metres, including impregnated wood This is stored both indoors and outdoors. There are stocks of roofing felt and cellular plastic. There is also a depot for LPG (about 300 cylinders of 6-11 kg) and gas for welding (about 500 cylinders of 20-40 l)

There is a drain in the floor of the hardware store leading to a sewer. The builders' merchant has two drains in the floor. These are connected to the normal drains which flow out in a nearby river. The ground at the shopping centre was covered with asphalt when the supermarket and furniture store were built. Drains from this surface also lead to the river, but flow into it at a different point to those from within the builders' merchant's premises. Water used to extinguish a fire in these two stores would therefore enter the river at two other points, as well as via the sewers.

Because of the possibility of explosions and because many people are at risk, the risk object is given the classification 3C

Figure 2.1

COMMUNITY.....

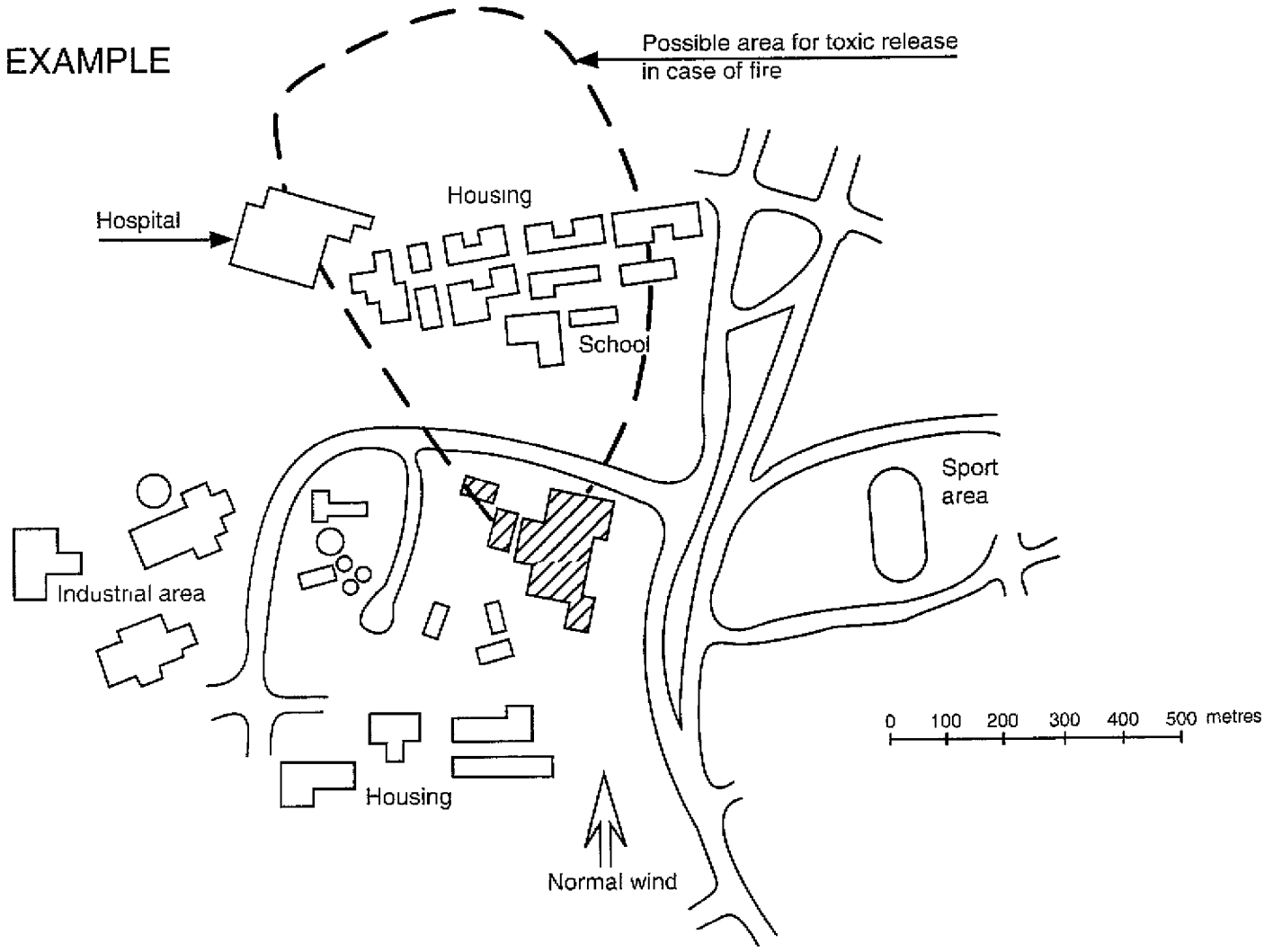
OBJECT/AREA... **Plastics Factory**

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

① Object	② Operation	③ Hazard (quantity)	④ Risk-type	⑤ Threat-ened object	⑥ Conse-quences	7-10 Seriousness L	E	P	S	⑪ Pb	⑫ Pr	⑬ Comments
Foam Area	Foam Production	TDI 50 tons Polyol 100 tons Amines 2 tons	Leakage " Fire Hydrogen Cyanide Nitrous gases	Personnel " Personnel People living near factory	Poisoning (inhalation) Poisoning Burns	2 2 3	2 2 1	1 1 3	4 4 2	3 3 2	B B C	
Area for Hardening	Hardening	Polyurethane 100 tons	Self ignition	"	Poisoning (inhalation)	2	1	4	4	4	C	
Area for Cutting	Cutting	Polyurethane 100 tons	Fire giving off TDI and Hydrogen Cyanide	Personnel People living near 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 3	2 2 1	1 1 3	4 4 4	2 2 2	B B C	

Figure 2.12 Plastics Factory Map

figure 2.12



Notes on Figures 2.11 and 2.12.

In this example, a Plastics Factory, you will find various chemicals (hazards), which are threats to workers, local inhabitants, etc.; either by giving off toxic gas in case of fire or by being poisonous themselves.

As you can see in figure 2.11 the risk object consists of different areas.

The area considered most hazardous is the one where the plastics are cut. People as well as property are in danger here. This information is important for safety measures and allocation of resources as well as for rescue tactics.

In working with this " rough analysis" method, it is important to remember that the main thing at this stage is not to produce a mathemathically exact value for all the hazards or all their possible risk zones. This is anyway most unlikely to be possible It is much more important to get an overall view of the problems, rank the risk objects and do something about the threats to people, property or the environment.

In case of fire in the factory, people living near by are at risk from toxic gas, as you can see in Figure 2.12. This type of problem is quite common in developed as well as developing countries.

Risk-consiousness is important in physical planning (industry and housing, hospitals, etc., should not be located too close together) and in considering the social impacts of economic development.

It is also important to communicate the risks to people living near the industrial area, in this case in order to protect them from the effects of a toxic release.

Because of the possibility of toxic gas emission in case of fire and the potential effects on the people living nearby. the risk object is given the overall ranking 3D.

Here, as in most cases, it is not possible give an exact value for the probability. But since there have been several fires giving off toxic gas in recent years, an accident of the type shown in this example is quite probable.

Figure 2.13 Map of Oil Depot

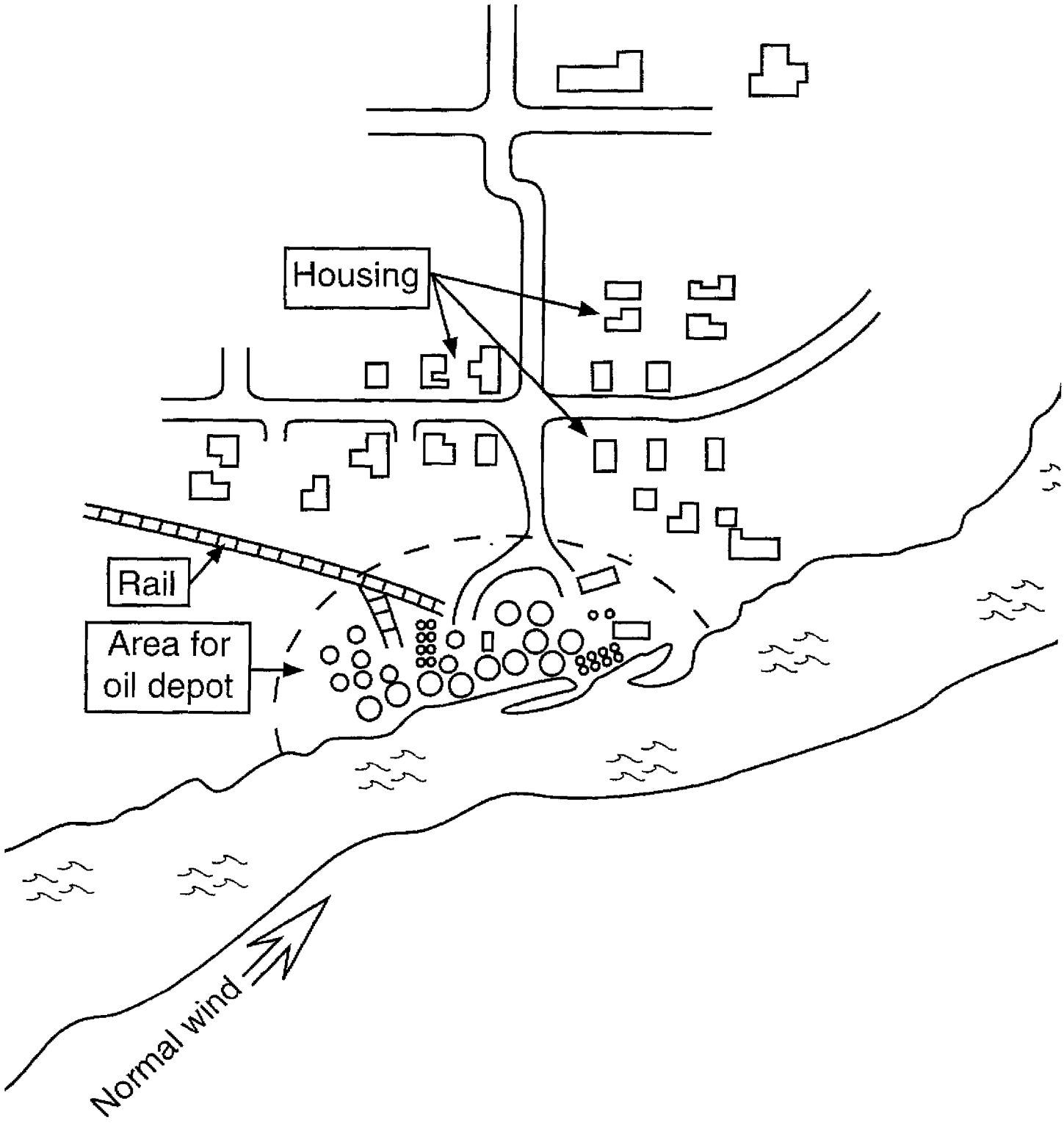


Figure 2.1

COMMUNITY.....

OBJECT/AREA.....**Depot of oil and oil products (overall view)**.....

L = Life
E = Environment
P = Property

S = Speed
Pb = Probability
Pr = Priority

① Object	② Operation	③ Hazard (quantity)	④ Risk-type	⑤ Threat-ned object	⑥ Conse-quences	7-10 Seriousness L	E	P	S	⑪ Pb	⑫ Pr	⑬ Comments
Storage Tanks - crude oil - gasoline - liquid petro-leum gas (LPG) - NO2 fuel oil (furnace, diesel stove) - NO4 Fuel oil (plant heating)	Refinery Storage Loading unloading Transport	**Crude oil** 100.000 m3 Flammable **Gasoline** 500.000 m3 Flammable **LPG** 10.000 m3 Explosive Flammable **NO2 and NO4**	Fire/leakage Fire/leakage Fire/explosion Fire/leakage	Depot as a whole **Life** - workers - drivers - crews - fire and rescue serv. - the public **Environment** - shores - water - air	Depot as a whole **Life** - anything from a few burns to many deaths **Environment** Contamination in water and on shores, severe burns of woodland						**D**	Risk object that has to be studied in depth
Storage of LPG-bottles **Filling station** **Oil/LPG** -pipeline - rail - trucks - ships	Storage Transport Storage Transport Loading unloading	600 000 m3 Flammable **Stored LPG** 20.000 m3 Explosive Flammable	Fire/explosion	**Property** - tanks - vehicles - oil products - houses - ships - equipment	**Property** - smoke damage - building collapses, fire damage, destruction of oil products							
Roads **Railways** **Harbour**	Transport Transport Transport Loading unloading	Vehicles Ships Trains etc	Collisions									

Figure 2.1

COMMUNITY.....

OBJECT/AREA... **Depot of oil and oil products (in depth)**

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

① Object	② Operation	③ Hazard (quantity)	④ Risk-type	⑤ Threat-ned object	⑥ Conse-quences	7-10 Seriousness L	E	P	S	⑪ Pb	⑫ Pr	⑬ Comments
Area												
Storage Tanks												Dimensioned damage estimate
- LPG	Refinery	LPG 10.000 m3	Explosion	Life	Life	4-						
- gasoline	Storage		(Primary)	Workers	Deaths/injuries	5	-	-	5	2	D	
	Loading			Drivers	" / "	4	-	-	5	2	D	
- crude oil	Unloading			Crews	" / "	4	-	-	5	2	D	
- fuel oils	Transport			Fire and Rescue serv	/ "	3	-	-	5	2	D	
Storage of LPG bottles	Storage Transport			Public	/ "	2	-	-	5	2	C	
				Environment	Environment							
				Air	Contamination	-		-				To consider
etc.	etc.			Land Water	and destruction of air, land	-	3-4	-	5	3	D	
Filling station oil/LFG	Storage			Property	Property							
	Transport											
- trucks	Loading			Tanks	Destruction	-	-	3	5	2	D	
- ships	unloading			Vehicles	"	-	-	4	5	2	C	
- rail	etc.			Houses	Collapses	-	-	4	5	2	D	To consider
- pipelines, etc				Oil products	Destruction	-	-	5	5	2	D	
Roads	Transport		Boiling Liquid									
etc	etc		Exp. Vapour									"Worst-case"
			Exp.			5	5	5	5	1	E	
Railway	Transport		(BLEVE)									
HARBOUR	Loading		(Secondary)									
etc	unloading	Gasoline	**Fire**									
	etc	500.000 m3	**Leakage**									
		etc	etc									

Figure 2.15 Oil Depot (In Depth)

Notes on Figures 2.13-2.15

In figure 2.13 you see 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 2.13, 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 2.14-2.15 shows 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 2.13. Such a view is shown in Figure 2.14. 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 Co-ordinating 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 are normally used, together with information stored in computerised databases and other tools)

As you can see in figure 2.15, the storage tanks area, especially the LPG store, is probably where the "worst-case" scenario could happen - a BLEVE (Boiling Liquid Expanding Vapour Explosion). 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, with1E possible.