

Risk Assessment Pathways

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Risk Management System? Who needs it??



Course Objectives

- Understand and apply risk assessment and analysis

Contents

- **Definitions**
- **History**
- **Types of risks**
- **Understand the system work processes & work culture**
- **Define Hazards**
- **Analyze Hazards and consequences. Build scenarios**
- **Quantify/Qualify Severity and Probability**
- **Risk Control**

Definitions

- **Hazard:**

A condition of the workplace or an equipment item, or method of carrying out an activity, which has the potential to cause harm

- **Probability:**

The likelihood of a hazard being realized

- **Severity:**

Degree of effect after exposing to a hazard

- **Risk:**

The product of Hazard Probability and severity

- **Risk Matrix:**

Represents the relation between the probability and the severity on a matrix

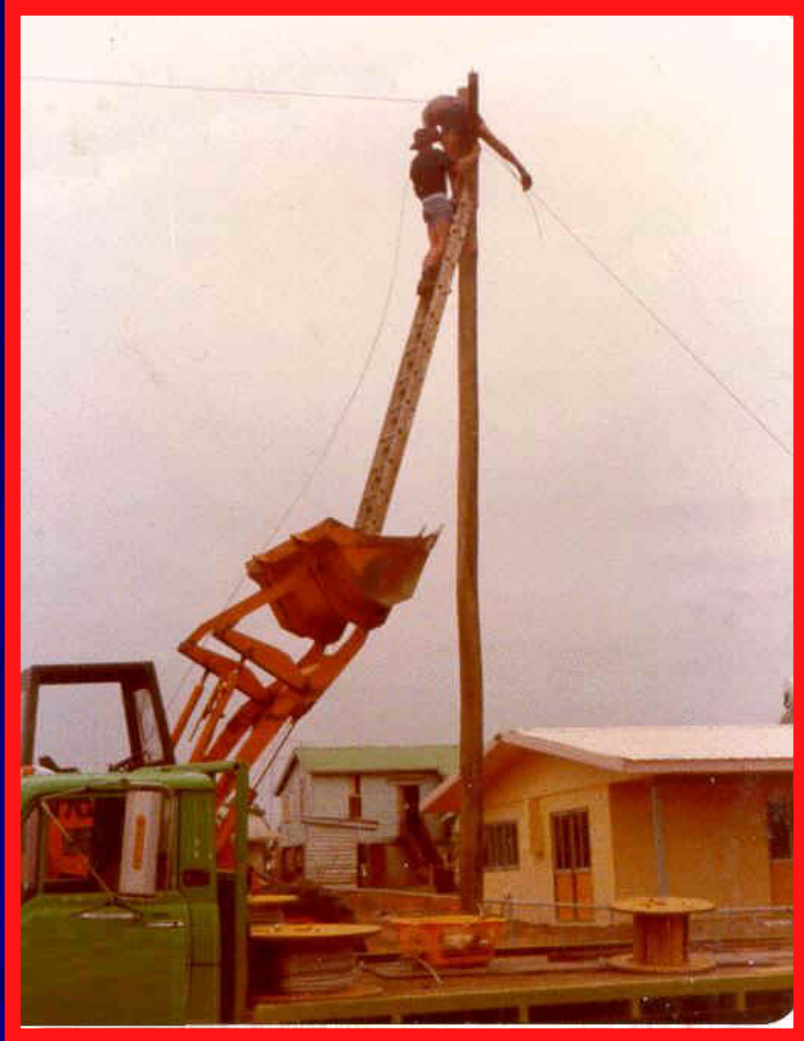
- **Residual Risk:**

The residual risk after applying the method which reduce

**A New Science
(The Science of Dangers)
are Accidents Predictable?**

We Have to Agree on...

- Risk : a complementarity with decision
- Risk : a need for life
- Risk : level zero is an utopia









Development of Danger and Risk Sciences

Prehistoric Times

- **The augur has helped in the decision-making process**
- **The augur was an expiator in case of failure**

Philosophical Age

■ Jean-Jacques Rousseau 1755,
Earthquake in Lisbon, 100 000 death

**“Why have we accumulated 2000
houses with three to five floors in a
notably seismic location?”**

Modern Times

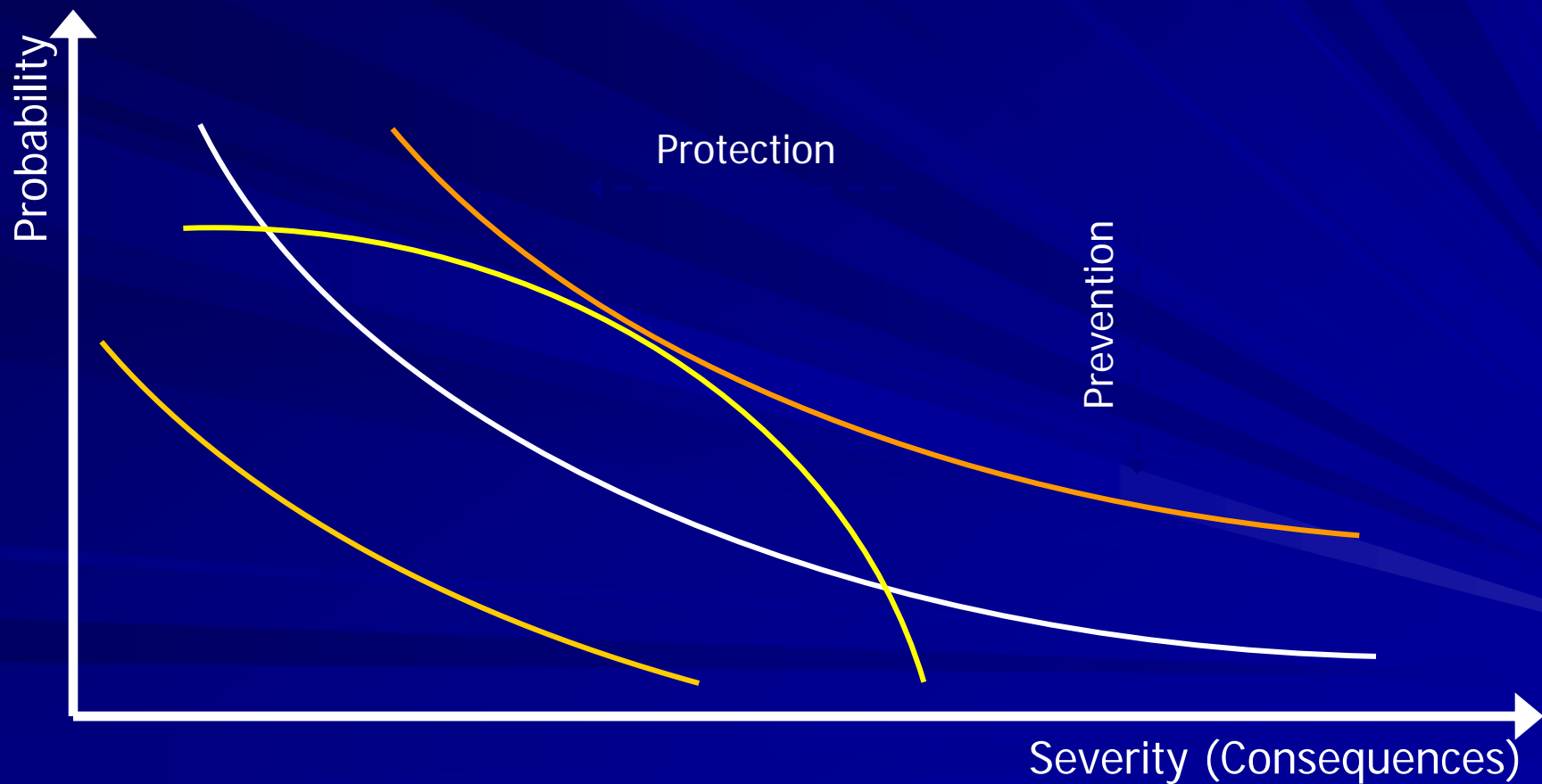
- **Aeronautics (Failure of motors)**
- **World War II (Reliability)**
- **Nuclear Safety**
- **Technological Age**

Today's Definitions

- Accident
- Danger
- Hazard
- Probability of Occurrence
- Risk

Risk Plotting

RISK = Probability of occurrence X Severity



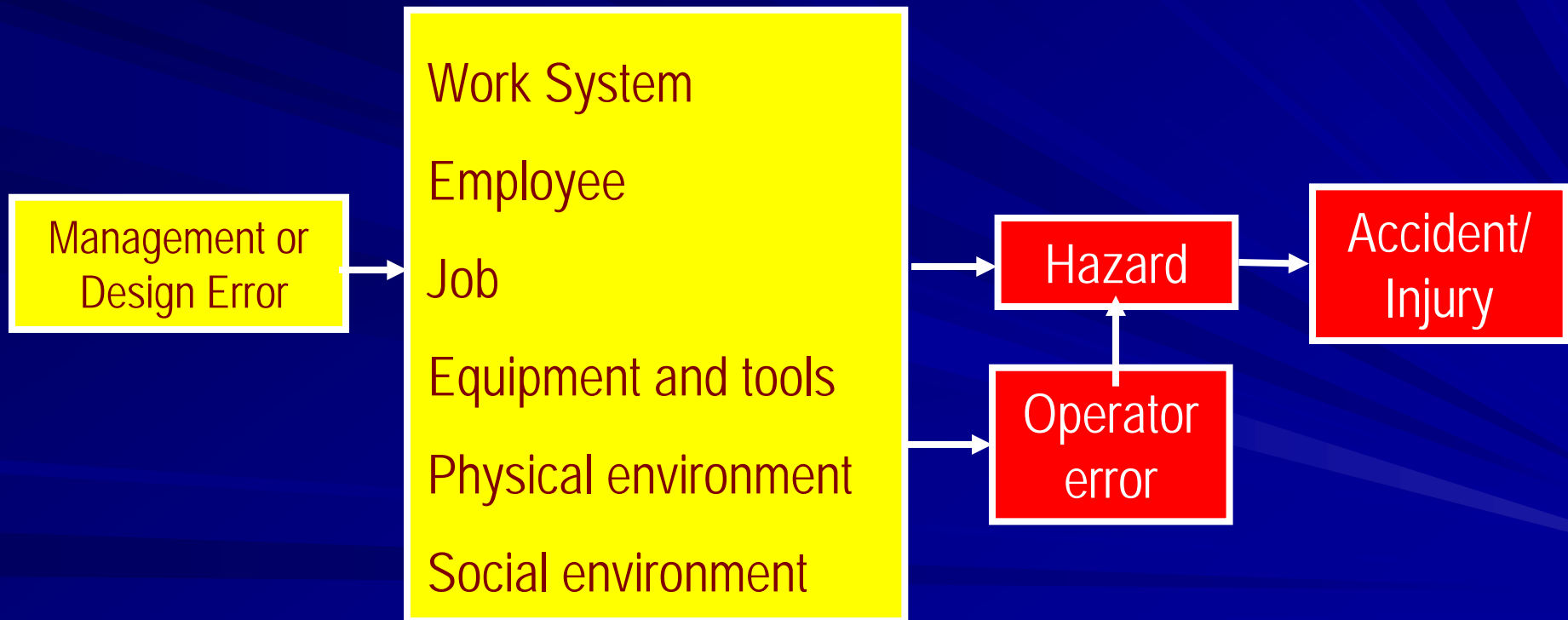
Risk Acceptance

- For a lethal risk :
 - 10^{-6} by year for new plants
 - 10^{-5} by year for an old plant
- For a societal risk :
 - $R \text{ (accept)} = 10^{-3}/N^2$

Human Factors

- **A person makes only one thing at the same time**
- **A person works on mental representation**
- **A person searches information**
- **Persons seek less energetic ways.**

Factors contributing to errors and accidents



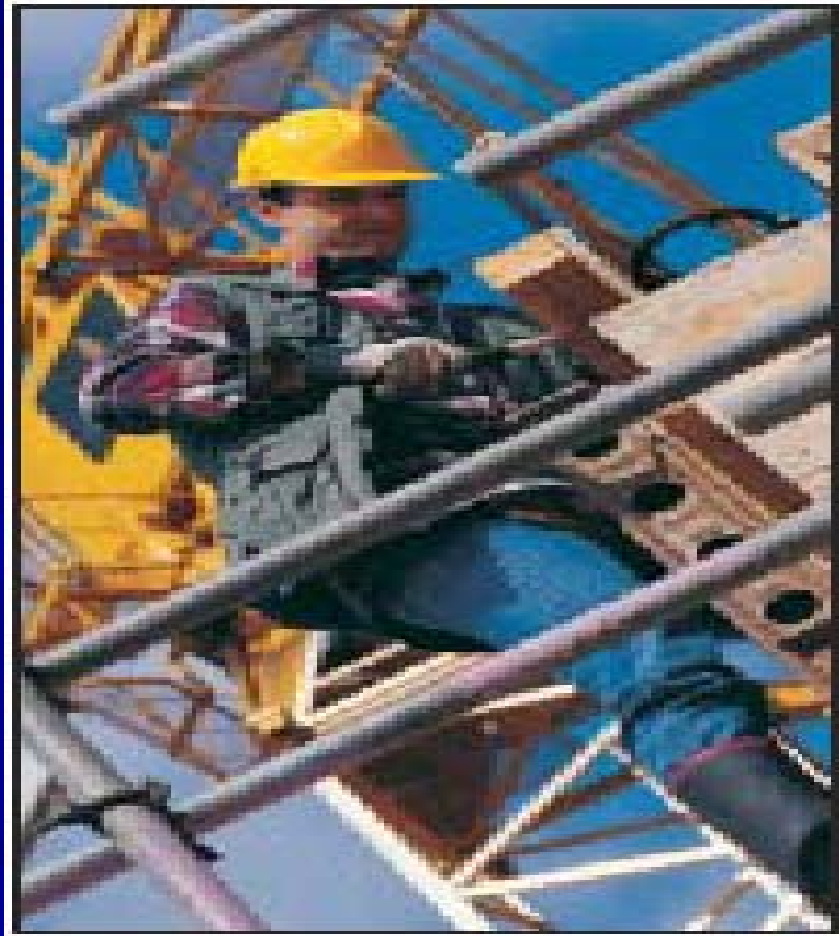
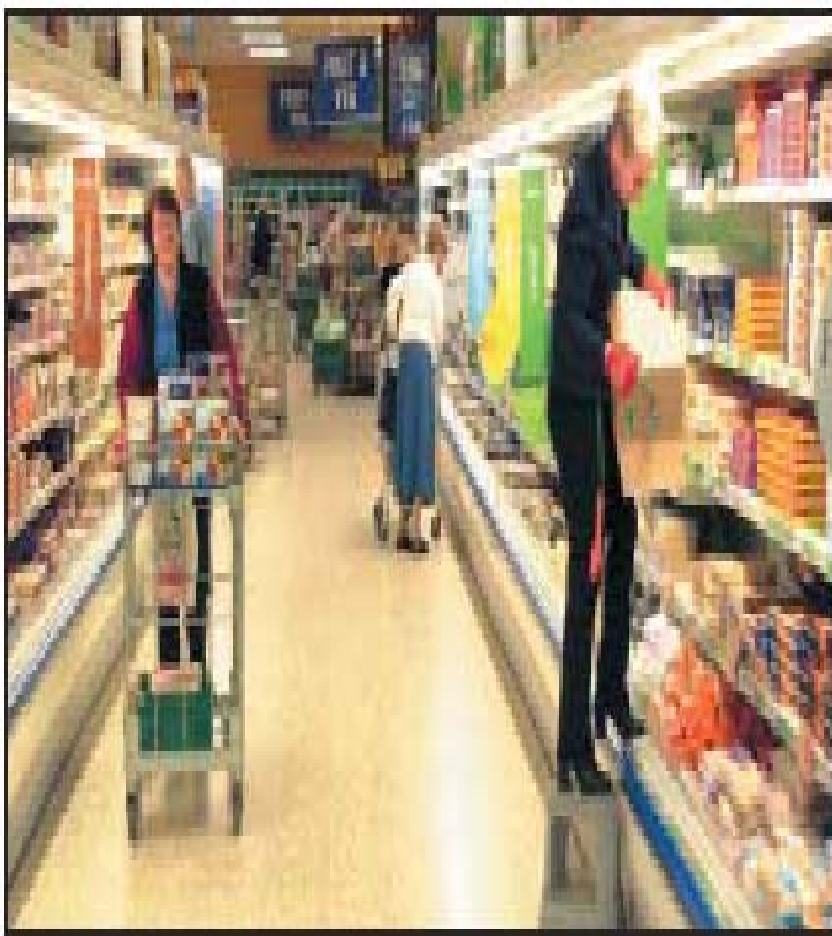
Risk Examples

- Slipping or tripping at work
- Getting into contact with hazardous material
- Performing work at height
- Handling, transporting or supporting loads while suffering from sprains, strains, or pains
- Having long exposure to computers or other display screen equipment
- Working at a noisy place: causes hearing loss or deafness.
- Predictable or unpredictable, controlled or uncontrolled risk associated with natural or climate phenomena

Risk Examples (Cont'd)

- Being exposed to vibration
- Getting hurt by electricity
- Improper selection of work equipment
- Neglecting maintenance or doing unsafe maintenance work
- Risk associated with pressure systems
- Risks resulting from fire or explosions
- Risks due to radioactive materials
- Feeling stressed by work

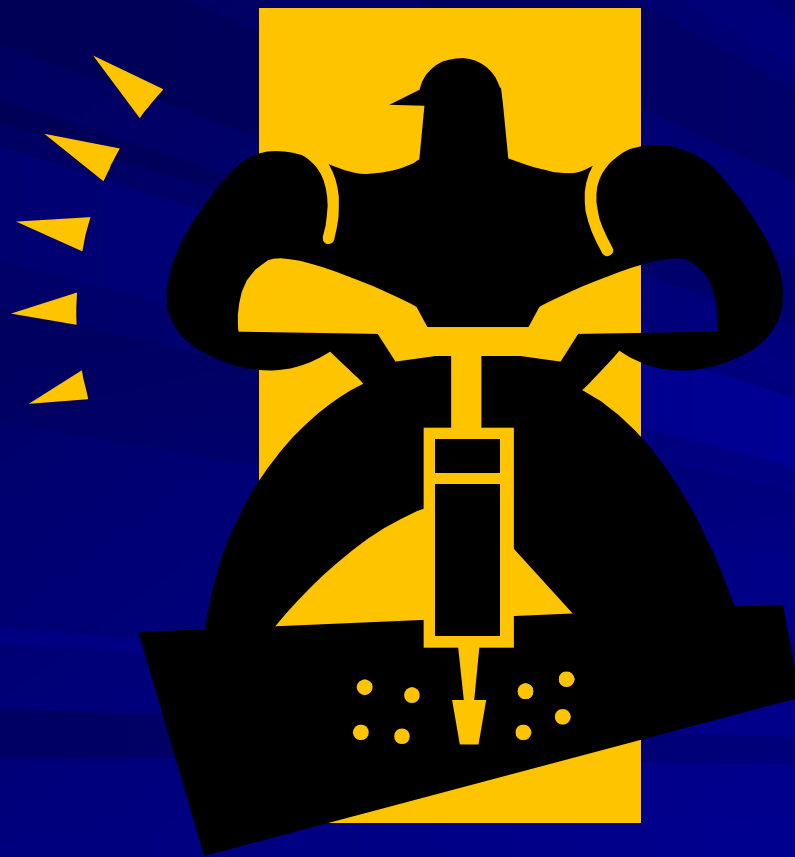
Slip and Working With Height



Getting Into Contact With Hazardous Material



Vibration and Noisy Place



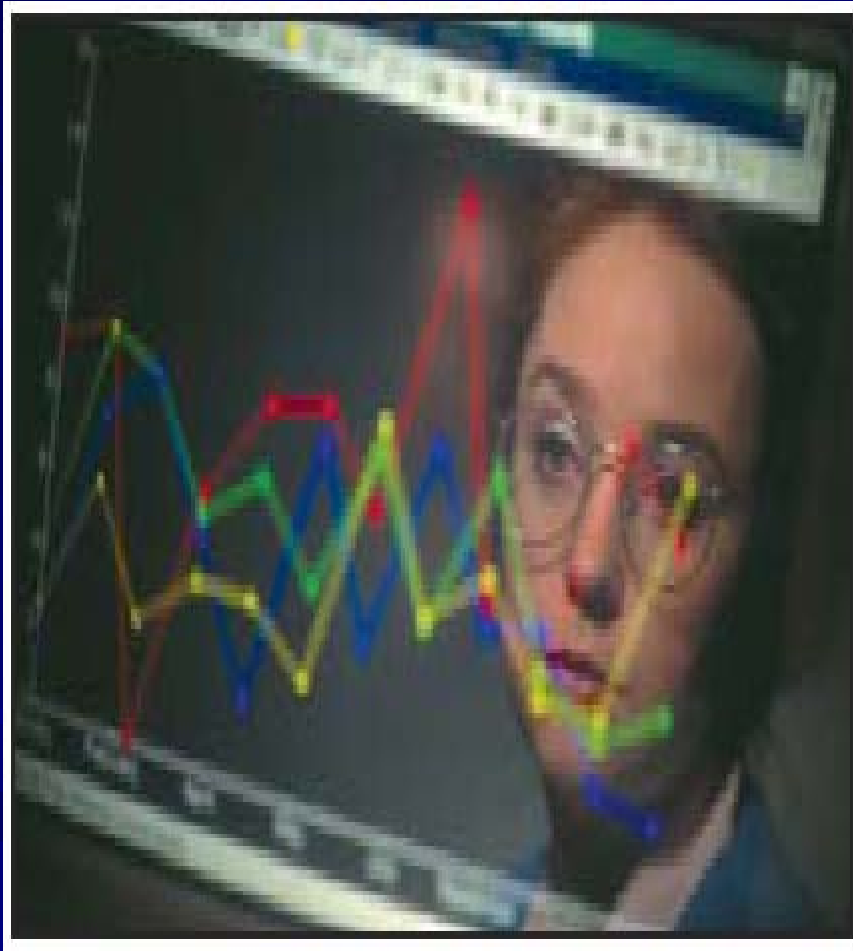
Risk Associated With Pressure Systems



Risks Resulting From Fire or Explosions



VDU and Stress



Maximum Daily Duration for Sound Levels

Duration per Day Hours	Sound Level dB
8	90
6	92
4	95
2	100
1	105
3/4	107
1/2	110
1/4	115

Examples of Sound Levels

Action	Sound level, dB
Leaves rustling	10
Whispers	20
Quiet Radio	40
Conversation	60
Busy Traffic	70
Very Noisy Factory	90
Loud Rock Band	110
Threshold of pain	120
Jet airplane from 30	140

m

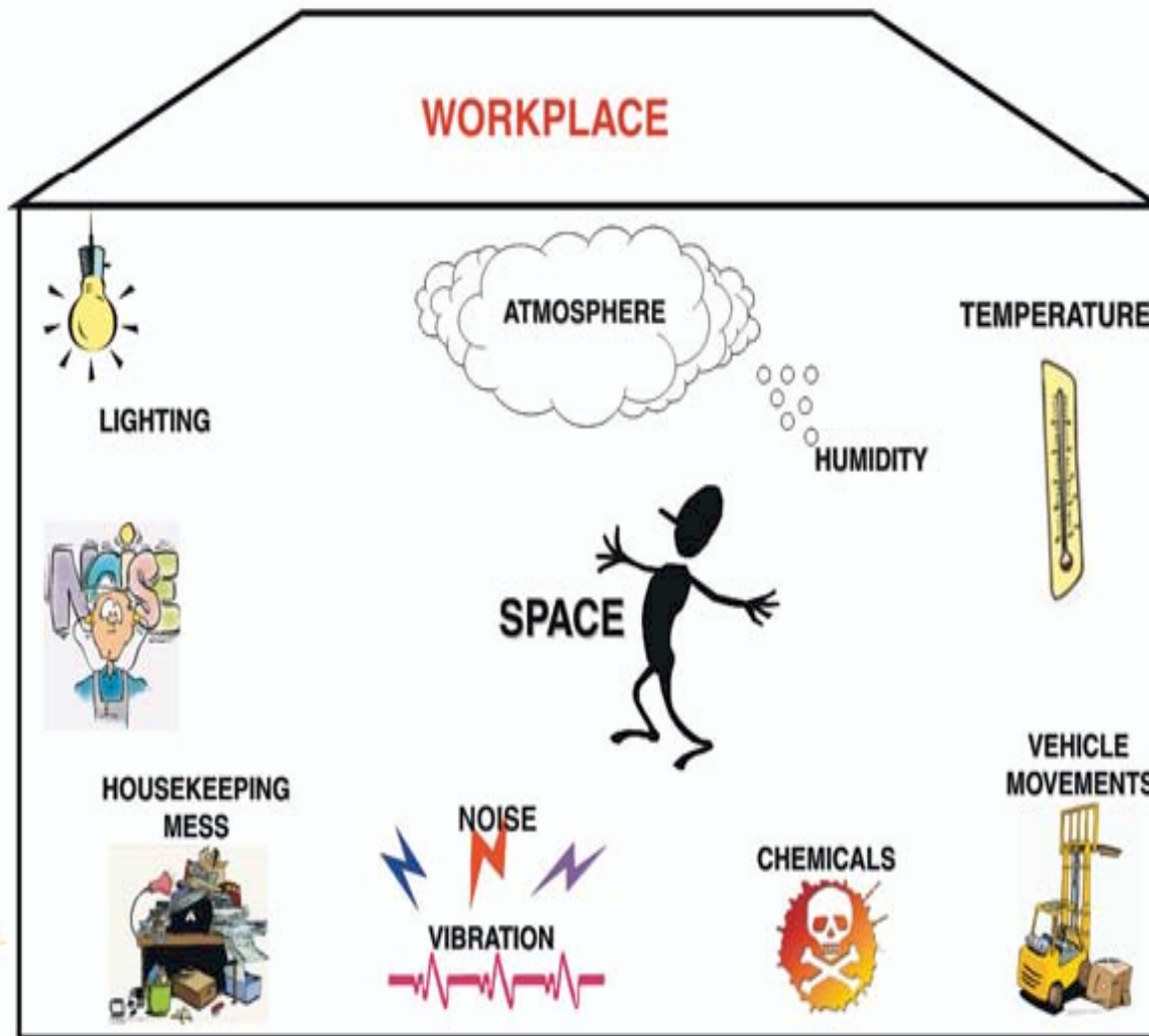


Fig. 2—Hazards in the workplace.

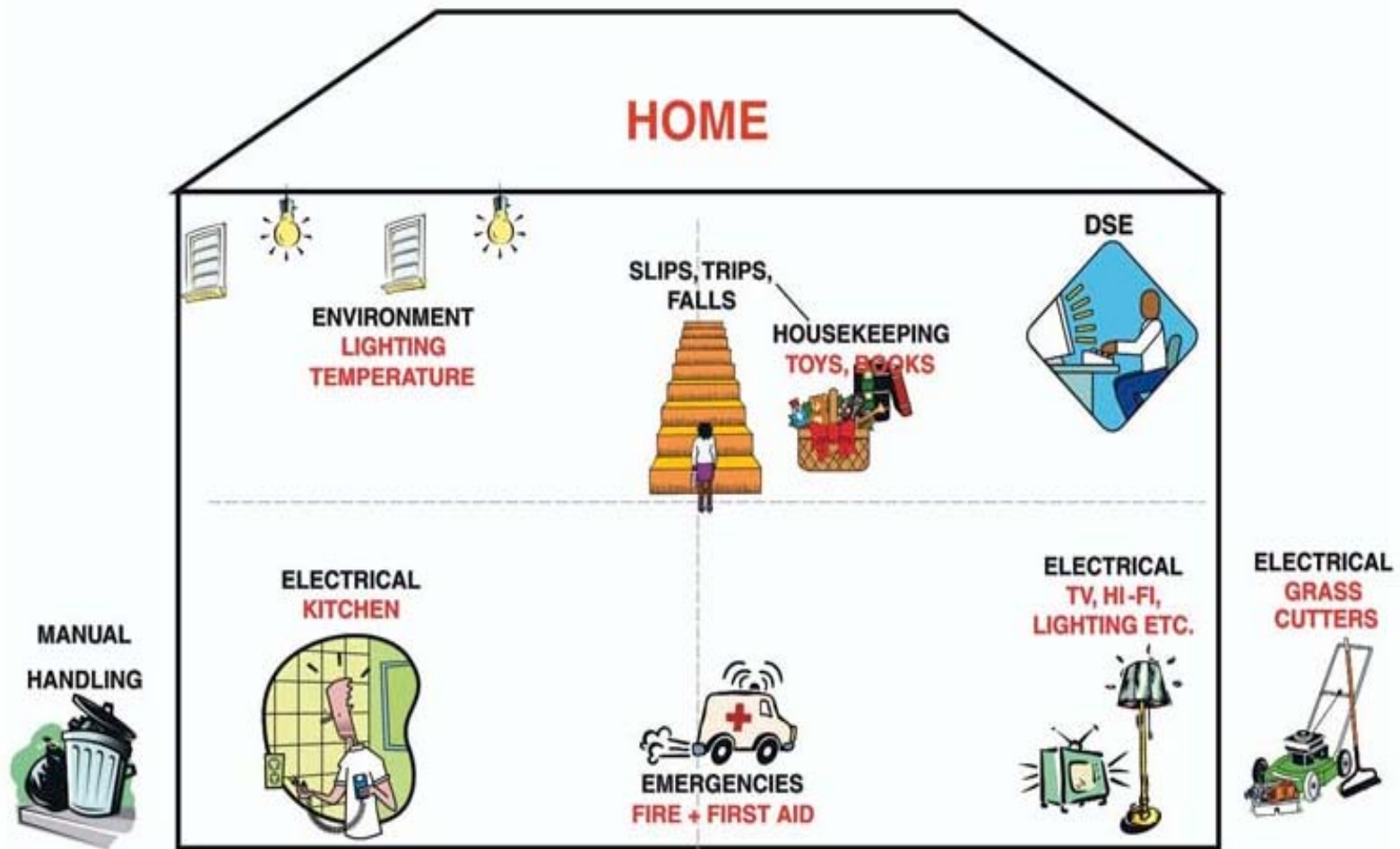
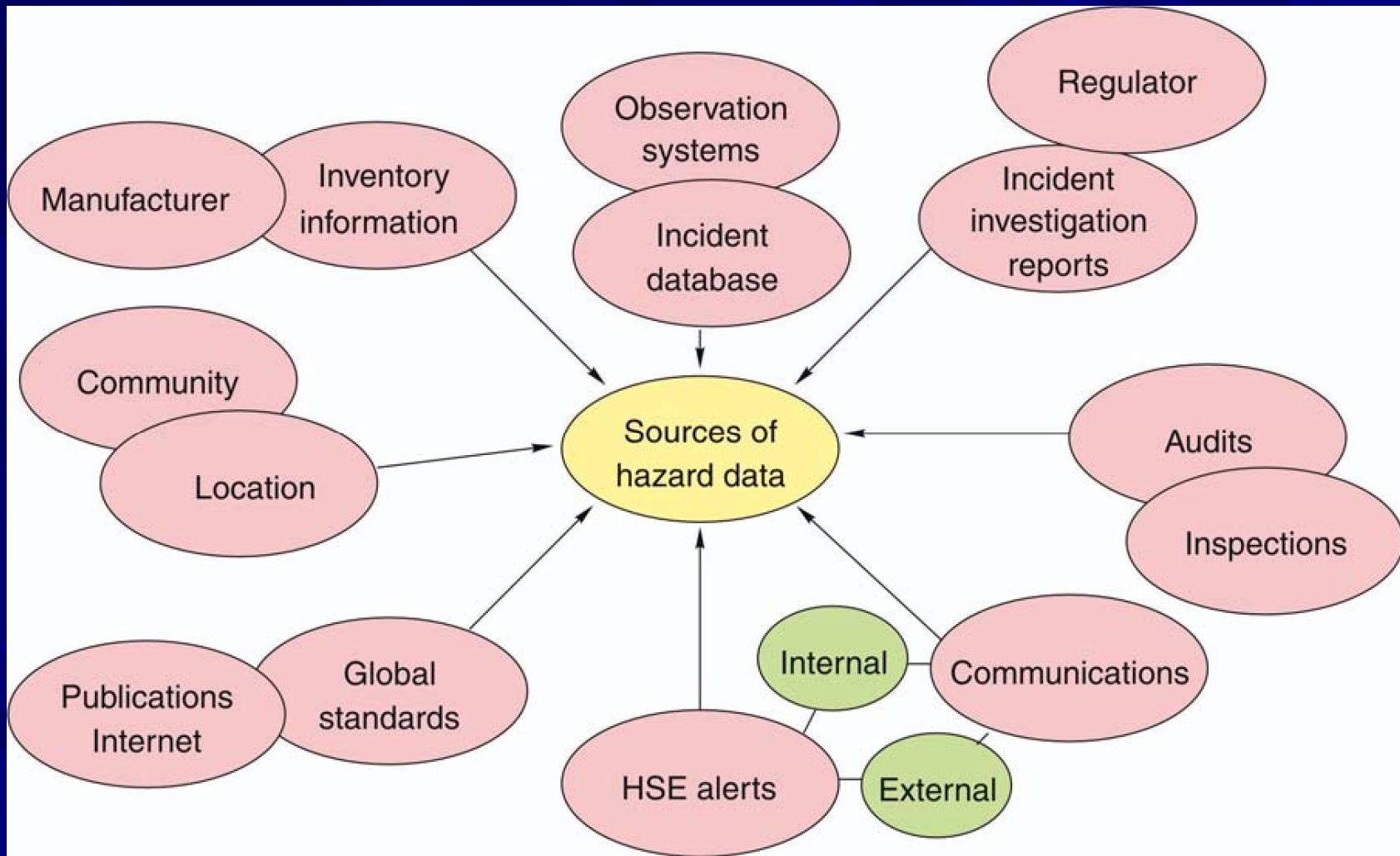


Fig. 3—Hazards in the home environment.

Source of Hazard Information

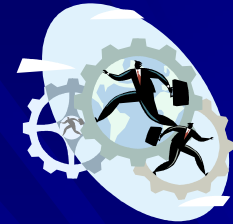


Sample List of Project Risks

■ Staff Risks



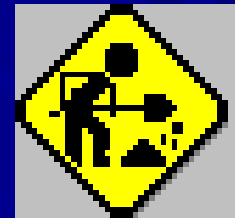
■ Delivery Risks



■ Equipment Risks



■ Physical Risks



■ Client Risks



■ Political Risk

■ Scope Risks



■ Financial Risk



■ Technology Risks



■ Environmental Risk



Some of Physical Risks

Process Types	Contaminant Type	Contaminant Examples
<p>Hot operations Welding Chemical reactions Soldering, Melting Burning</p>	<p>Gases (g) Particulates (p) (dusts, fumes, mists)</p>	<p>Chromates (p) Zinc, Manganese and compounds (p) Carbon monoxide (g) Fluorides (p) Vinyl chloride (g)</p>
<p>Liquid operations Painting, Degreasing Cleaning</p>	<p>Vapors (v) Gases (g) Mists (m)</p>	<p>Benzene (v) Sulfuric acid (m) Hydrogen chloride (g)</p>
<p>Shaping operations Cutting, Grinding Drilling</p>	<p>Dusts (d)</p>	<p>Asbestos, Zinc Uranium</p>

General Commercial Risks

- Liability exposure for death, injury or damage
- Liability to the state, fines and imprisonment
- Building and other property loss and damage includes:
 - Fire
 - Theft
 - Earthquake
 - Deliberate damage
 - During transportation damage
 - Loss of profit following property damage
 - Explosion
 - Windstorm
 - War

General Commercial Risks

- Criminal risks
 - Fidelity (financial loss due to untrustworthy employee)
 - Terrorism
 - Malicious contamination (cost of recalling product and market share)
- Hazard depend on others
 - Poor or nonperformance by suppliers
 - Poor or nonperformance by subcontractors
 - Poor or nonperformance by joint venture partner

General Commercial Risks

- **Overseas locations**
 - Volatile exchange rates
 - Political climate risks
 - Instability, war, terrorism
 - Different statutory obligations
 - Local insurance requirements
- **Financial hazards**
 - Un-viability of new products
 - Tender miscalculations
 - Inflation
 - Statutory pay rise
 - Loss of rental income

General Commercial Risks

- Labor hazard (strikes)
- Internal management hazard
 - Poor recruitment, job allocation, training
 - Dangerous materials
 - Poor production line
 - Substandard quality of product
 - Duplications, bottlenecks and dependencies
 - Lack of contingency planning and disaster measures
 - Negligent design
 - Staff health and safety
 - Lack of data security backup

General Commercial Risks

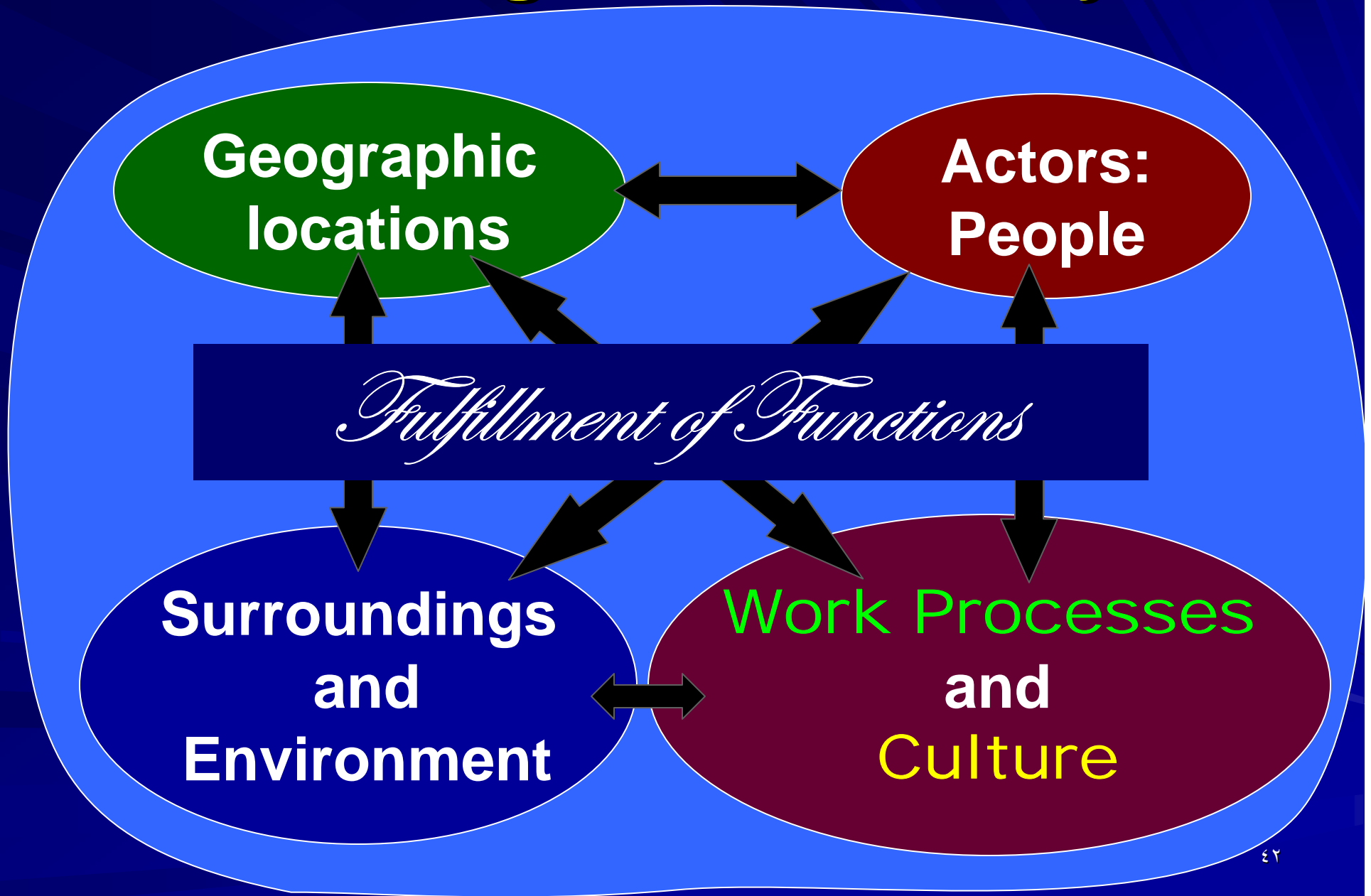
- Other hazards
 - Loss of public goodwill, reputation, image
 - Loss of key staff
 - Loss of intellectual property
- Action of competitors

Concept of System

A System is a set of elements, human, hardware, software, information organized in an interaction to realize a mission in defined environment

**1. Understand
the system
work processes
&
work culture**

The building as a macro system



Parameters of the system

- Type of Public.
- Function of the System.
- Equipment of the System.
- Frequency of the Operation of the System.
- Type of Construction.
- Geographical Location.
- Meteorological Location.
- Natural Activity of the Ground.
- Culture and History

The building as a micro system: A mental model for collecting information

Consider relationships between all parameters helps find innovative ideas and obviate missing important thoughts.

- Amphitheaters
 - Labs
 - Offices
 - Library
- Classrooms
- Coffee room
- Electric box
- Control Room (for exams)
- Control rooms (for electricity)
 - Lift, , Stores
 - WC's
- Prayer's area
- Cafeterias

➤ Employees
➤ Students
➤ Staff
➤ Visitors

➤ Nearby Buildings
➤ Environment

- ✓ Function
- ✓ Boundaries
- ✓ Organization
- ✓ History
- ✓ Rules
- ✓ Culture & Values

Lab Subsystem

- ✓ **Chemicals**
- ✓ **Equipment**
- ✓ **Gas**
- ✓ **Radioactive materials**
- ✓ **People: supervisors, students, technicians, visitors, others**
- ✓ **Electricity**
- ✓ **Ventilation**
- ✓ **Safety rules**

2. Define Hazards

Hazards Undesired Events

Fire,
Accidents
incidents
...

Consequences

Damages

Losses

Loss of image

Electrical

Mechanical

Radioactive

Chemical

Infrastructural

Economical

Biological

Environmental

Social

Human

Managerial

System components & associated feared events

- 1. Amphi's
- 2. Labs
- 3. Offices ...
- 4. Classrooms
- 5. Installations
- 6. Stores
- 7. Library
- 8. WC

1. Fire	X	x	x		x	x	x	
2. Explosions		x				x		
3. Property damage	x	x	x	x	x	x	x	x
4. Environment damage		x						
5. Loss of reputation	x	x	x		x		x	x
6. Loss of business								
....	x			x				

3. Analyze Hazards and consequences. Build scenarios.

Build Scenarios for FE

A scenario is a sequence of related succession of events leading to an undesired event.

Initiator → initial/enabling events
→ succession of events → **the undesirable/top event** →
consequences (losses, damages)

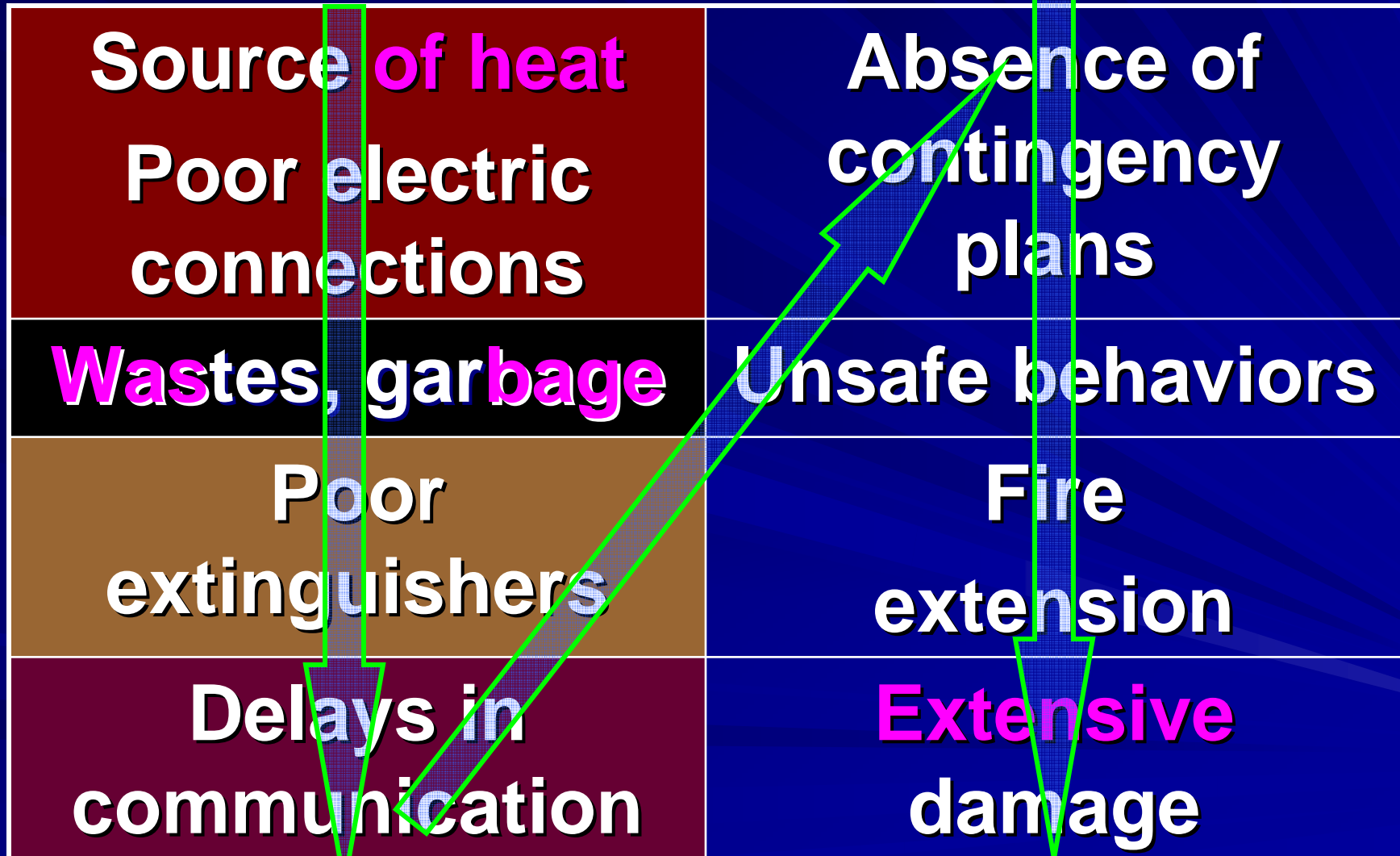
Why Scenarios?

Scenarios help define

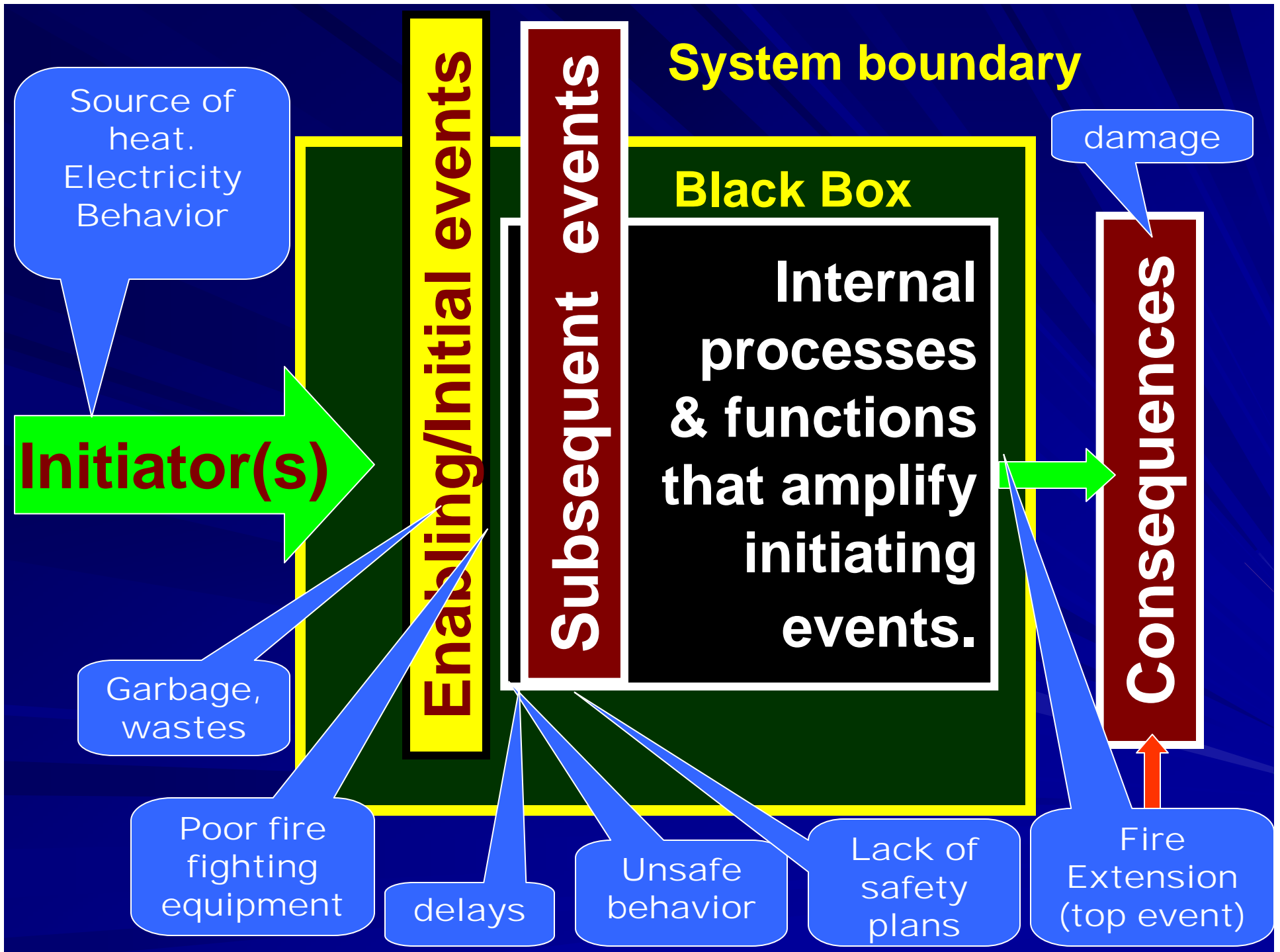
- **Consequences**
- **Deficiencies**
- **Corrective and preventive measures**
- **Probability: probability of a feared event is the resultant of all probabilities of events in the scenario**
- **Severity of consequences**

Scenario for Fire

Start



Finish



Sequence of events for fire



4. Quantify/Qualify Severity and Probability

For evaluation of severity and probability

- **Adopt scenario-based approach**
- **Discuss with employees, specialists & management**
- **Search historical data and statistics**
- **Use risk analysis tools**

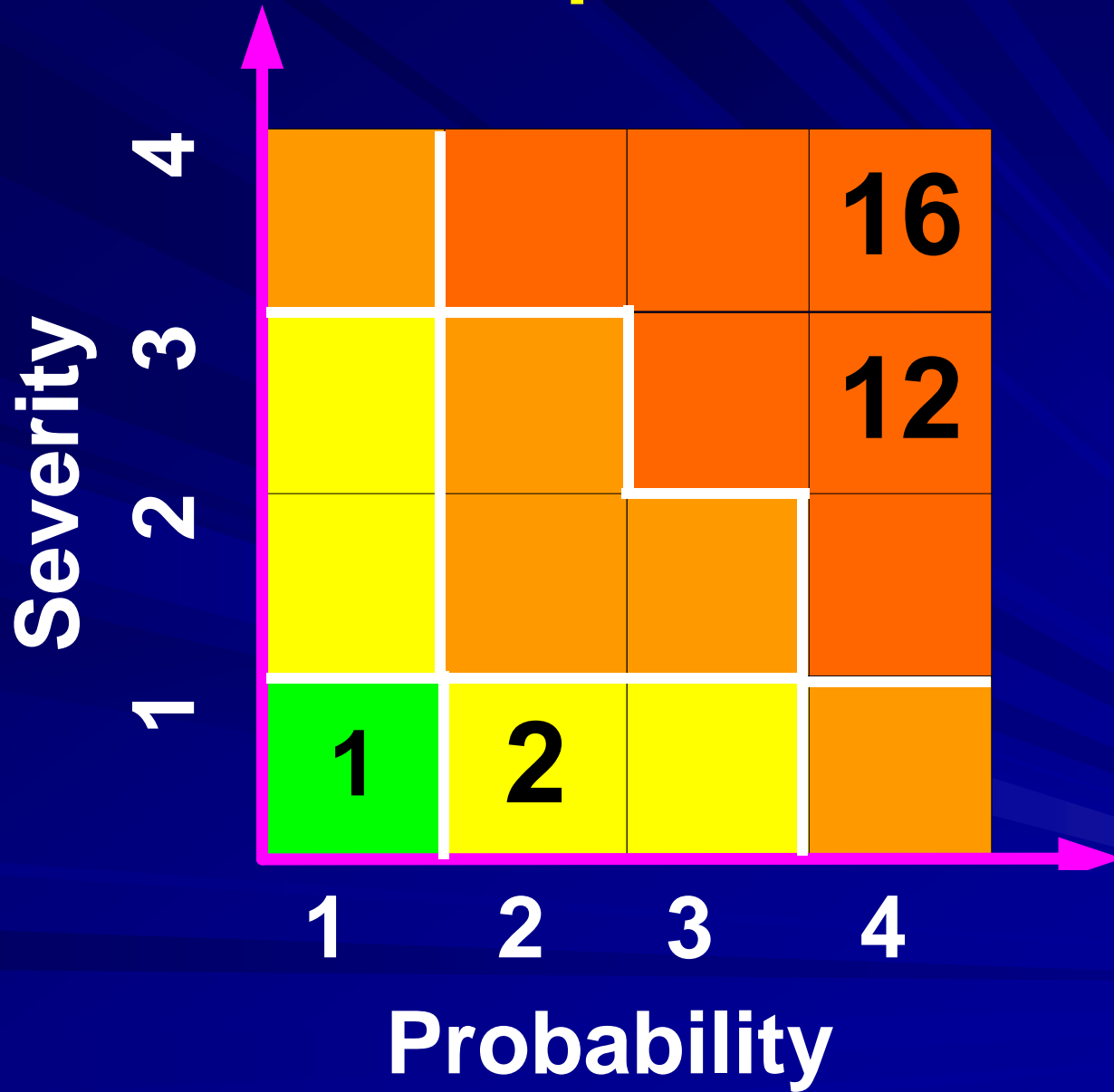
A Scale for Severity Rating

Consequences			Rating
Personnel	Property Damage	Environmental Damage	
Fatalities	Extensive	Massive	4
Serious	Major	Beyond regulations	3
Minor	Minor	No lasting effect	2
Slight	Slight	Contained locally	1

A Scale for Probability (Likelihood)

Description	Likelihood
Certain	4
Likely	3
May Happen	2
Unlikely	1

Risk Representation



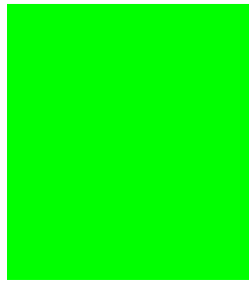
Color codes for different scales of P & S

1-12	1-2	1	1
13-25	3-6	2-4	2
30-59	7-10	5-7	3
60-100	11-25	8-16	4

Risk could be

Risk
color

Trivial, Tolerable: No action necessary. Control measure and risk management are maintained



Adequately controlled. Risk is tolerable when controlled



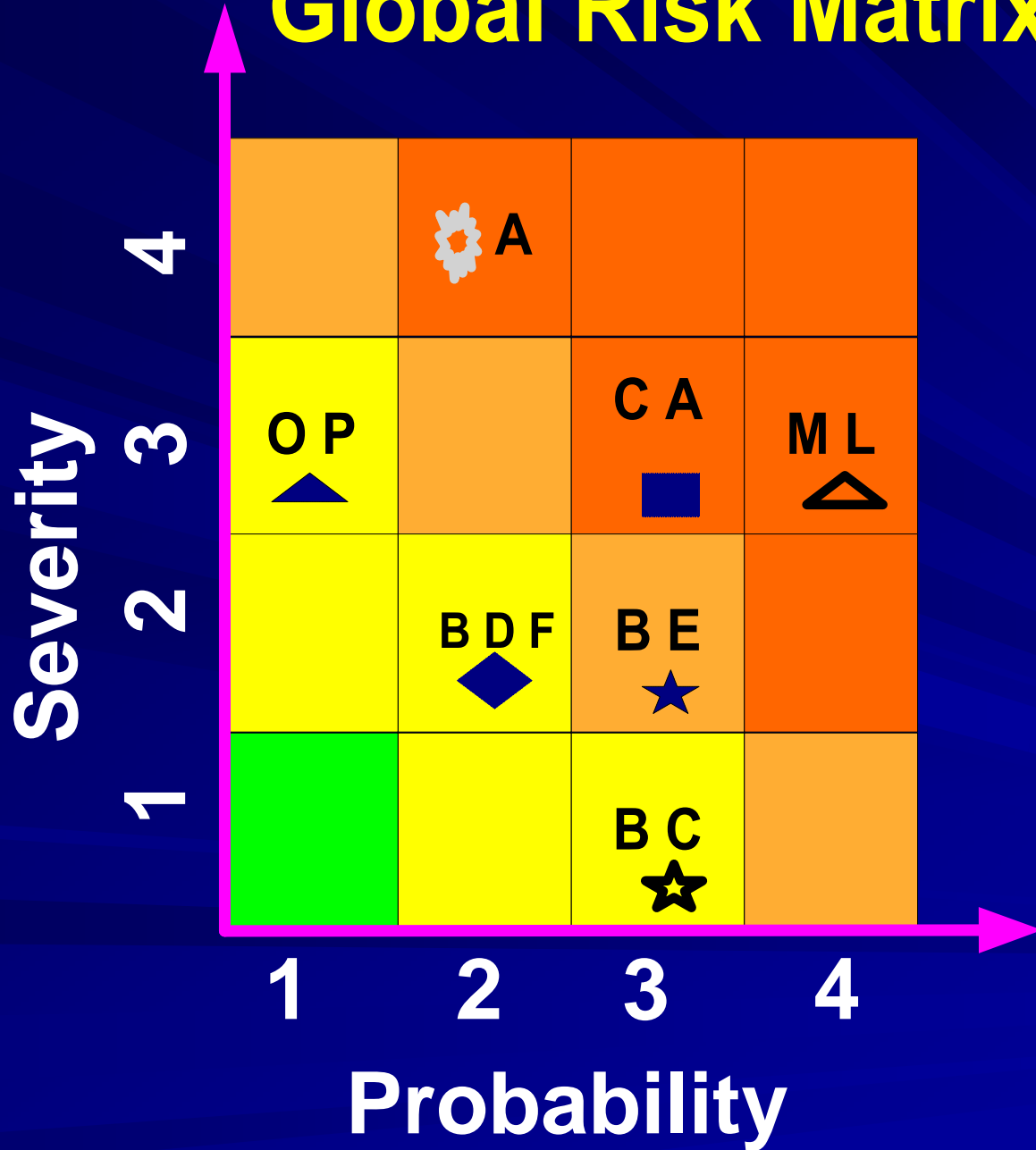
Moderately controlled. Further risk reduction must be considered





Intolerable (I). Risk unacceptable. Activity needs specialist input.



Global Risk Matrix



	FE1	A	Place 1
	FE2	C	Place 2
	FE3	D	Place 3
	FE4	E	Place 4
	FE5	F	Place 5
	FE6	G	Place 6
	FE7	H	Place 7

5. Risk Control

Risk Control

Risk control involves 3 strategies:

1. Risk Prevention/Avoidance

Reorganizing for not having FE's.

2. Risk Transfer

Sharing consequences of hazards with others.

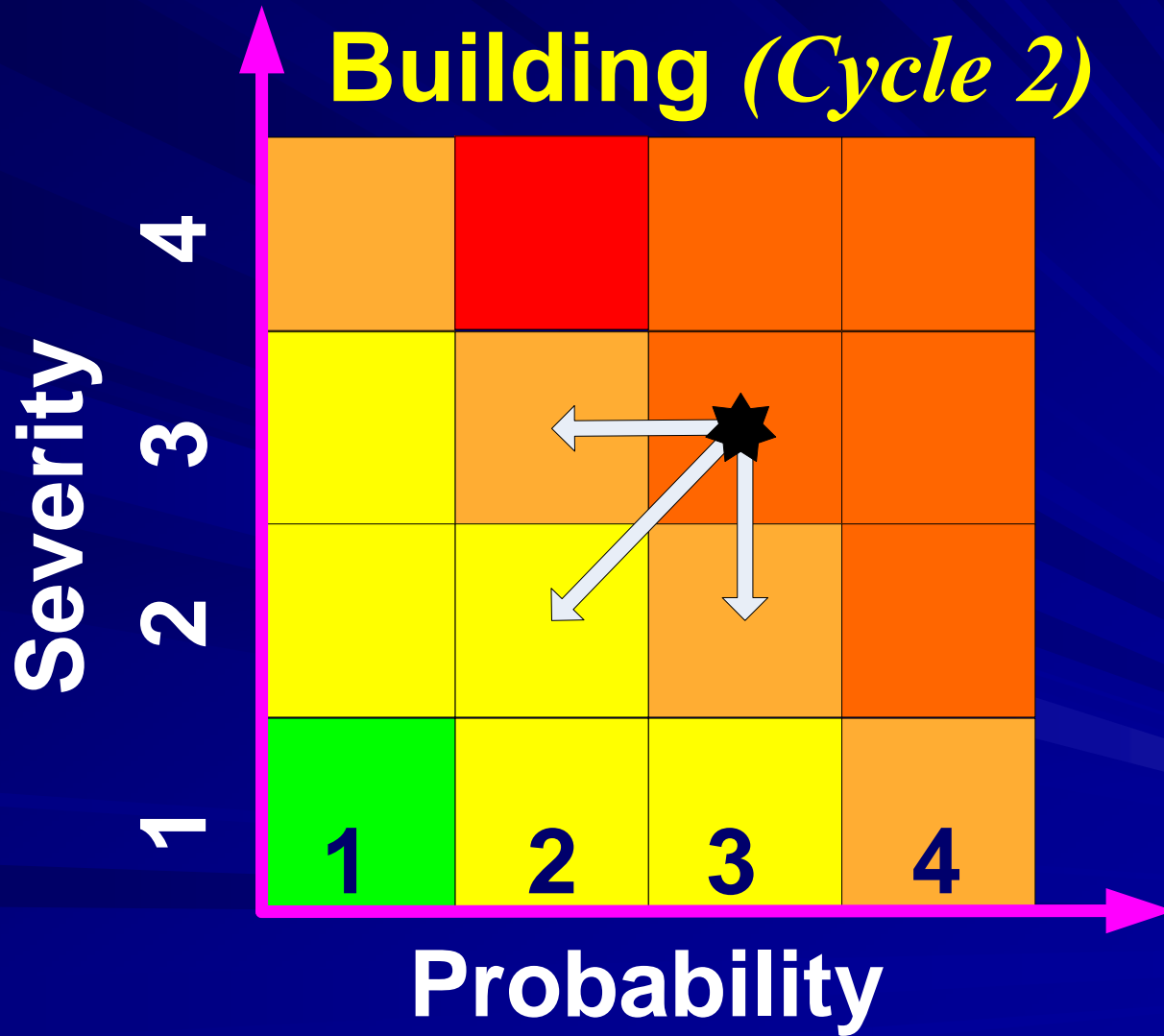
3. Risk Acceptance

Deciding to live with hazards and build contingency in the planning process.

Accident Control/Prevention for Scenario SC1

- ✓ **Control of consequences**
 - Probability control
 - Severity control
- ✓ **Prevention measures**

Global Risk Matrix: Building (Cycle 2)



Risk Assessment Exercise