

As Low As Reasonably Practicable
versus
Globally At Least Equivalent

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Why risk assessment - 1

We change all the time – for instance due to

- Introduction of new tools and methods
- Improvement of available tools and methods
- New processes and procedures
- New jobs that need to be done

Why risk assessment - 2

Any change will affect the future and thus, any change carries some risk.

We can split risk into three groups – they

- Can be removed
- Can be reduced by reducing their
 - Probability of occurrence
 - Consequences
- Have to be accepted as a fact of life

Before we can do anything we need to understand the risk. This is the field of risk assessment.

ALARP and GALE

There are two principles used in the assessment of risk:

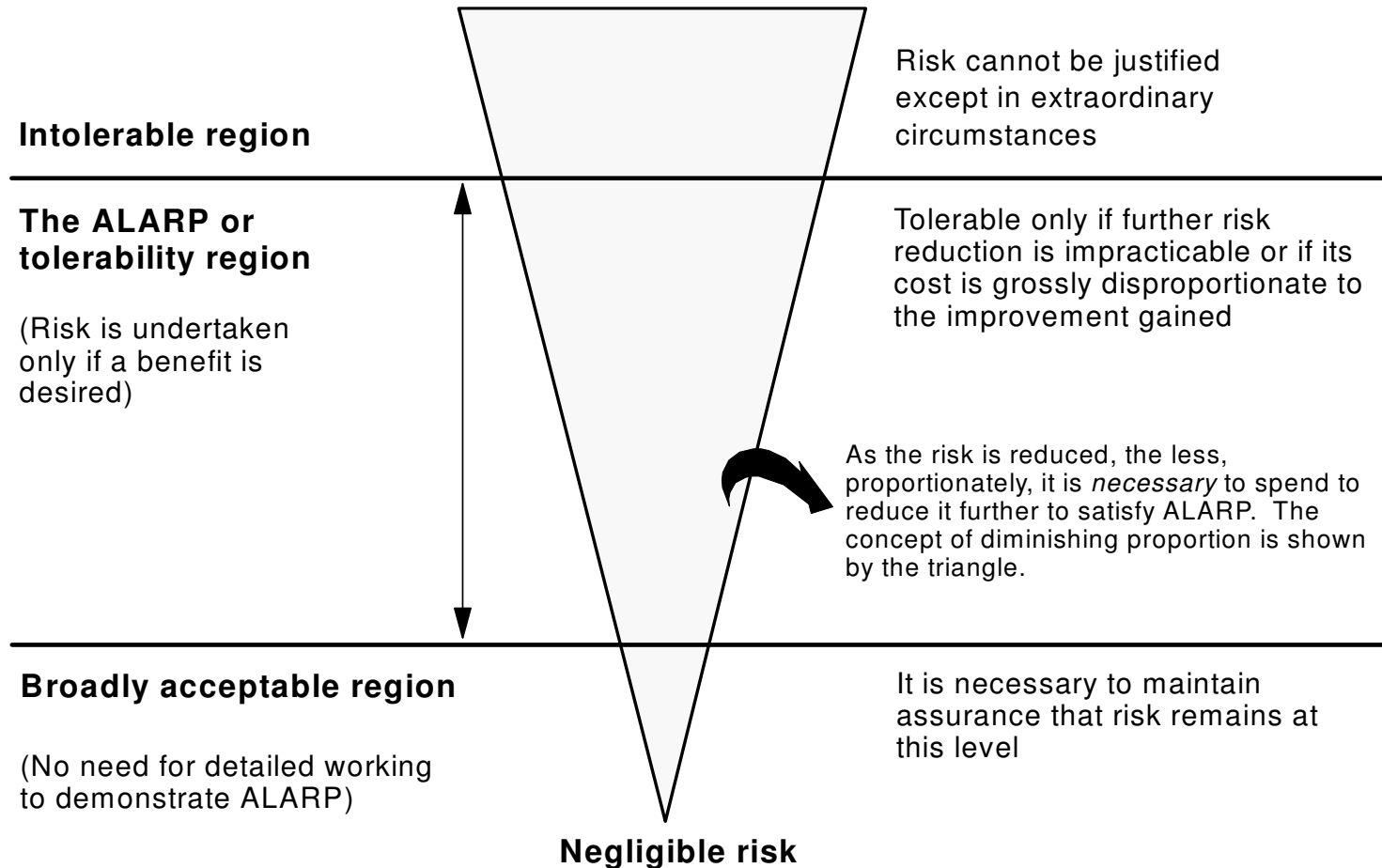
- ALARP – As Low As Reasonably Practicable - We have done all that is reasonable to prevent problems and dangers.
- GALE – Globally At Least Equivalent. E.g. introducing a new process will not increase the total risk compared to what it is today.

ALARP

ALARP requires that we analyze each identified risk separately and then implement mitigation activities.

A reasonable goal for ALARP is to reduce each risk until the extra mitigation costs exceed the value of the risk reduction achieved.

ALARP and risk



GALE

GALE requires us to look at the total risk of a change. We can then start by attacking the cheapest risk or the risk with the largest leverage.

The problem with the GALE principle is that we need to perform arithmetic on risks. E.g. we need to decide how many medium risks we need before we have a large risk

Simple risk assessment

In order to perform a simple risk assessment we need to identify:

- Dangerous events
- Each event's
 - consequence – C
 - probability – p
- Possible barriers – changes or controls
- Person responsible for each risk - Resp.

Simple risk table

Event	C	p	R	Barriers	Resp

Events

We start by identifying dangerous events.
The simple way to do this is to use brainstorming.

The process is simple – just sit down and envisage your worst nightmares related to the activities under consideration.

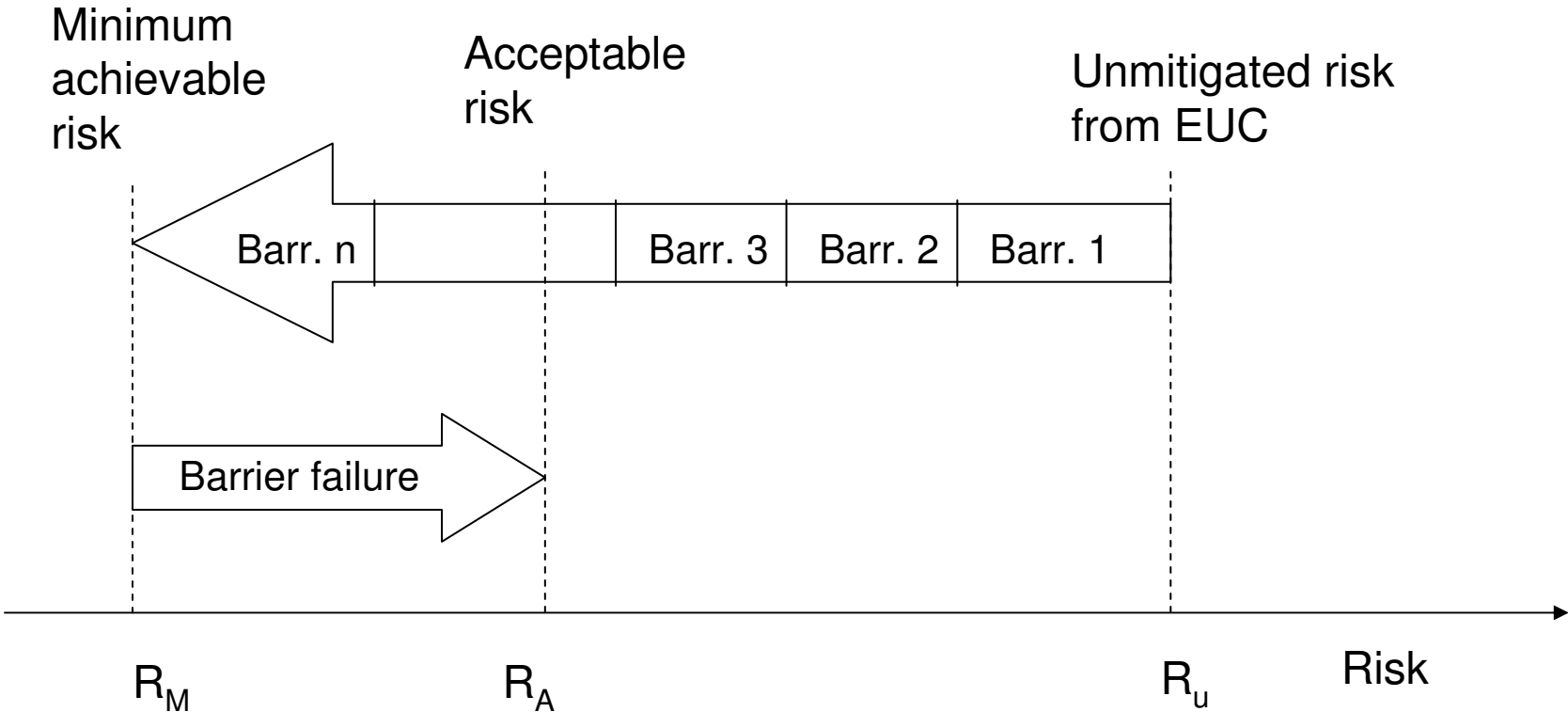
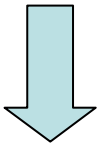
Be realistic – only consider things that you believe *can* happen.

Barriers

Barriers can be realized through:

- Prevention – we change our process so that the event cannot occur.
- Mitigation – we can
 - change the process in order to reduce the event's probability or consequences.
 - define activities that will reduce the problems if the event occurs.

All barriers work as planned

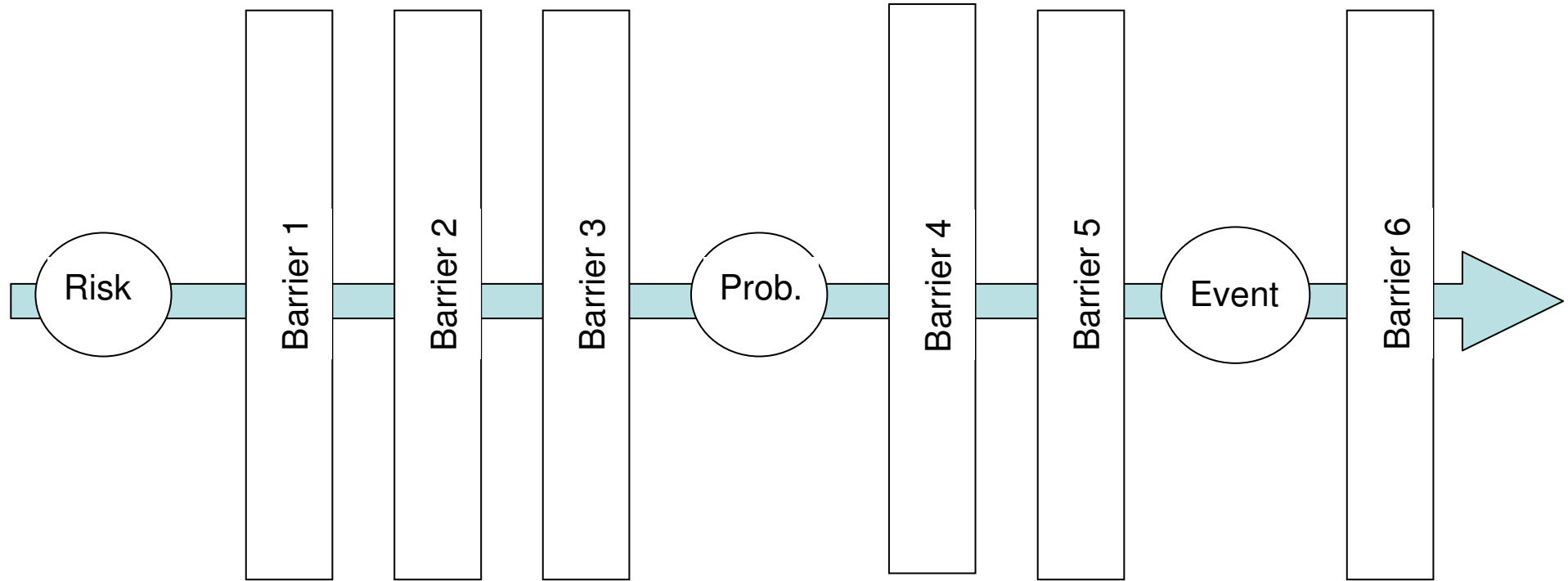


Prevention barriers

Prevent risk from becoming a problem

Handling barriers

Prevent event from having bad consequences



Reduction barriers

Reduce effect of event

Using GALE

ALARP only assesses the new risk – what happens if something is changed. This leads to a defensive attitude towards change.

GALE leads us to look at both our current risk and the risk resulting from the proposed changes.

Risk – status quo vs. change

In many cases, maybe even in most of them, we do risk assessment because we want to compare two or more alternatives, e.g.:

- Status quo – no changes
- One or more changes - improvements

Event identification

- All significant dangerous events must have been identified.
- We must seek
 - minimal overlap between the dangerous events
 - maximum commonality between the dangerous events considered for the status quo and for the system after the proposed changes

The three event sets

The previous rules split dangerous events into three sets – dangerous events that:

- Apply both to the status quo and to the new system.
- Are unique to the status quo
- Are unique to the new system

GALE and risk assessment - 1

GALE uses the following parameters for risk assessment:

- F_E – the event frequency
- P_E – the probability that the event will lead to an accident
- S – the severity score of an event

GALE and risk assessment - 2

We can compute individual and accumulated risk indices:

$$I_E = F_E + P_E + S$$

$$I_{GR} = \log \sum_i (10^{I_i})$$

I_E is the risk index for a hazardous event

I_{GR} is the global risk index

The GALE scoring scheme

The scoring scheme of GALE

- Focuses on deviations from current average. This is reasonable, given that it is mainly concerned with comparing status quo to a new situation.
- Must be tailored to each situation. The next slide shows an example from road safety assessment.

Road safety - frequency score for event

Frequency classification	Occurrences / year on M42 ATM section		F_E
Very frequent	10000	Hourly	6
Frequent	1000	A few times a day	5
Probable	100	Every few days	4
Occasional	10	Monthly	3
Remote	1	Annually	2
Improbable	0.1	Every 10 years	1
Incredible	0.01	Every 100 years	0

Probability score for event

Classification	Interpretation	P_E
Probable	It is probable that this event, if it occurs, will cause a problem	3
Occasional	The event, if it occurs, will occasionally cause a problem	2
Remote	There is a remote chance that this event, if it occurs, will cause a problem	1
Improbable	It is improbable that this event, if it occurs, will cause a problem	0

Severity score for event

Severity class	Interpretation	S
Severe	The portion of occurring problems that have serious consequences is much larger than average	2
Average	The portion of occurring problems that have serious consequences is similar to our average	1
Minor	The portion of occurring problems that have serious consequences is much lower than average	0

Summing up

GALE does not replace ALARP – both methods are important.

GALE makes us aware of and compare current risk *and* new risk

ALARP helps us to focus on risk mitigation, e.g .barriers