

## ANNEX 1: RULES FOR SCENARIO MODELLING

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Working definitions and rules for story building:

### Definition 1

An accident path is a sequence of events leading through an undesired centre event. Note, the centre event is always the root box of the storybuild.

### Definition 2:

A loss control event (LCE) of an accident is a necessary event for that accident to occur i.e. lead to the centre event for the left hand side (LHS) LCE and lead to injury for the right hand side (RHS) LCE. So a LHS Loss Control Event is an event that leads to the centre event and a RHS Loss Control Event is an event that contributes to the (severity of the) consequences.

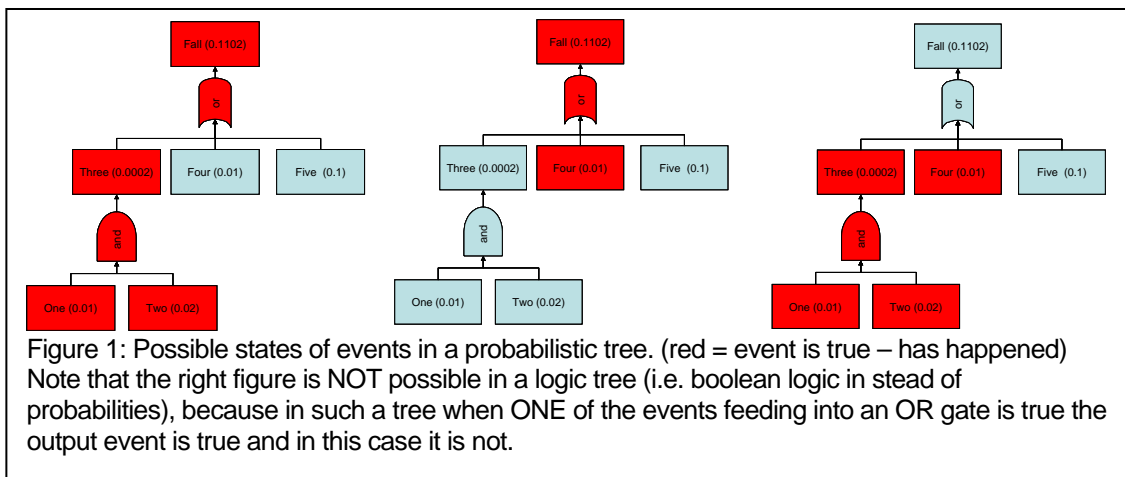
### Definition 3:

A barrier is a physical entity (object, state, or condition) that acts as an obstacle in an accident path. Note that actions cannot be barriers. Actions can create a barrier or restore its functionality.

Typical Barrier Functions are:

- o Prevent presence, build-up, or release of the hazardous agent/ energy
- o Separates hazardous agent/ energy in space (safe distance) or time (safe moment)
- o Prevents the undesired transmission of energy/ hazardous agents
- o Prevents incompatibility of materials
- o Prevents unsafe process conditions (pertains to sequence, temperature, pressure, composition)
- o Prevents unsafe physical conditions (pertains to structural integrity, strength, stability)

LCE's are mapped onto Primary Safety Barrier (PSB) failures. There should be one and only one PSB for each LCE. However there could be more than one LCE for a PSB and these LCEs could happen simultaneously (even if this is unlikely).



LCE's could occur as a consequence of previous LCE's. The barriers associated with the last LHS LCE before the centre event are called Primary Safety Barriers or PSB's. Barriers associated with LCE's further away on the left from the centre event are called Safety Support Barriers or SSB's.

A LCE/barrier failure can be caused by previous LCE's/barrier failures.

When the centre event occurs there should always be at least one LCE and thus one barrier failure. If the centre event occurs only ONE PSB has to be in the failed state.

Although the failure of the barrier is associated with the occurrence of the centre event, the failure of a barrier does not have to lead to the occurrence of the centre event. However the centre event cannot occur without at least one barrier failure.

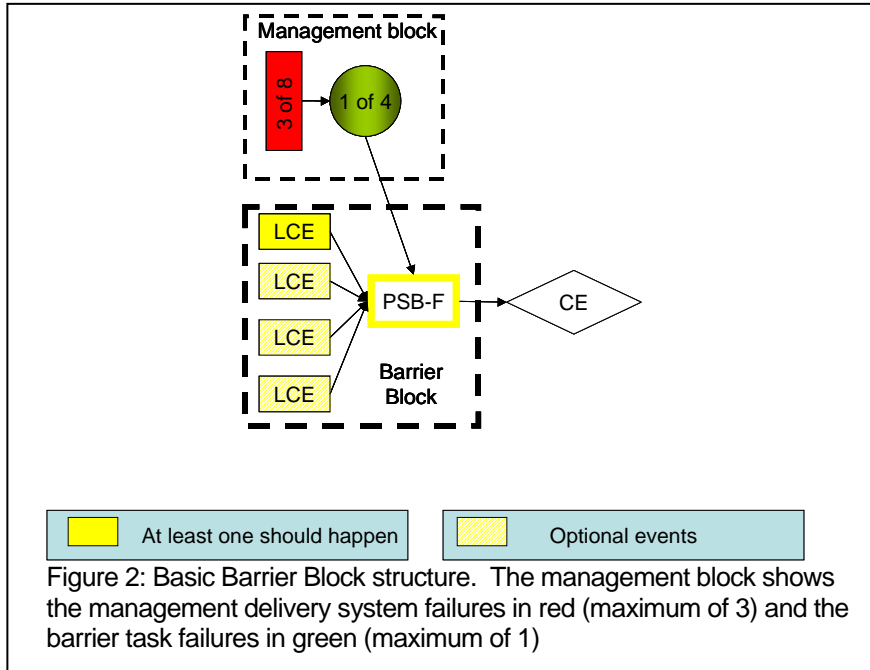
There could be more barriers in the failed state. There could also be barriers in the success state. This is likely since many LCE's did not occur and therefore the associated barriers did not fail.

Definition 4:

A storybuild is a representation of an accident report according to the storybuilding procedures

## GROUND RULE

No assumptions shall be made with respect to any barrier state or LCE. ONLY WHAT IS SPECIFIED IN THE ACCIDENT REPORT SHOULD BE SPECIFIED IN THE ACCIDENT STORYBUILDS.



### Rule 1

The Centre event should be the root box

### Rule 2:

The barrier name should be chosen such that it gives a concise description of the barrier function. Each barrier should be unambiguously defined. Barrier functions are mutually exclusive. Barrier failures however are not mutually exclusive,

### Rule 3

Human behavior alone cannot be a barrier. However human behaviour may influence or directly cause a barrier to fail.

### Rule 4:

Barrier failure events or failure modes (BFMs) and barrier success events or success modes (BSMs) are entered into the accident path when and if the specifications in the accident report warrant it. Note that the coding process in principle allows the last event before the centre event (CE) to be a barrier success event, but this is not allowed. The last sequence before the centre event should be LCE -> (PSB<sup>1</sup>) ->CE. There could be more than one LCE feeding into a PSB and more than one PSB feeding into the CE (but for any one accident this is unlikely)

### Rule 5

Management deliveries and barrier tasks are put as input to a barrier if and only if the state of the barrier is specified.

### Rule 6

If the LCE occurs the associated barrier is in the failed state. If a barrier is given in the failed state one of the associated LCE's has to occur.

### Rule 7:

<sup>1</sup> In practice PSBs were mostly identified in the logical bowties which were developed from the Storybuilds.  
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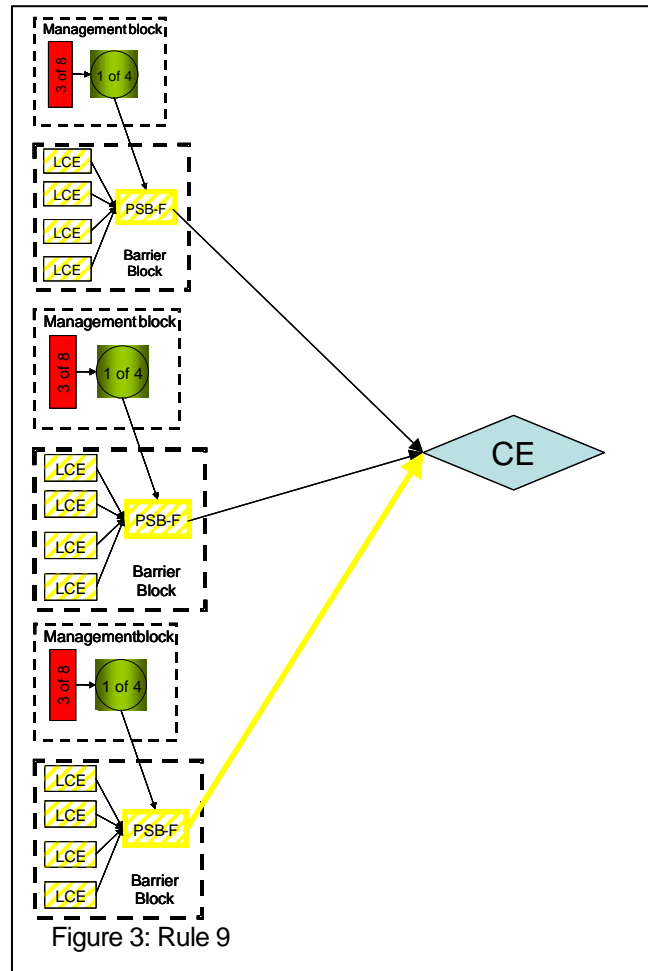
All storybuild scenarios have to go through the centre event. Scenarios that stop before the CE is reached do not constitute an accident. These are marked as such and deleted from the storybuilds. No scenario can pass from LHS to RHS without passing through the CE.

Rule 8

Cyclic paths are not possible and therefore not allowed in the storybuilds.

Rule 9:

There can be only ONE PSB for any LCE but there could be multiple LCEs for one PSB.



Rule 10

An accident path can only go through one mode of a specific barrier (not the success and the failure mode at the same time) -> barrier modes of the same barrier are mutually exclusive.

Rule 11

The sum of the deaths, the permanently injured, the non permanently injured and the unknowns should be equal to the number of victims.

Rule 12

An accident path can only be split into children when there are multiple casualties.