



Jan Pranger

Industrial Safety Consultant

- Incident Investigation (Tripod Beta)
- Risk Analysis (HAZID, HAZOP, BowTie, QRA)
- Safety Management Systems
- Trainings

Education

- Chemical Technology (1987)
- Management of Safety, Health and Environment (2004)

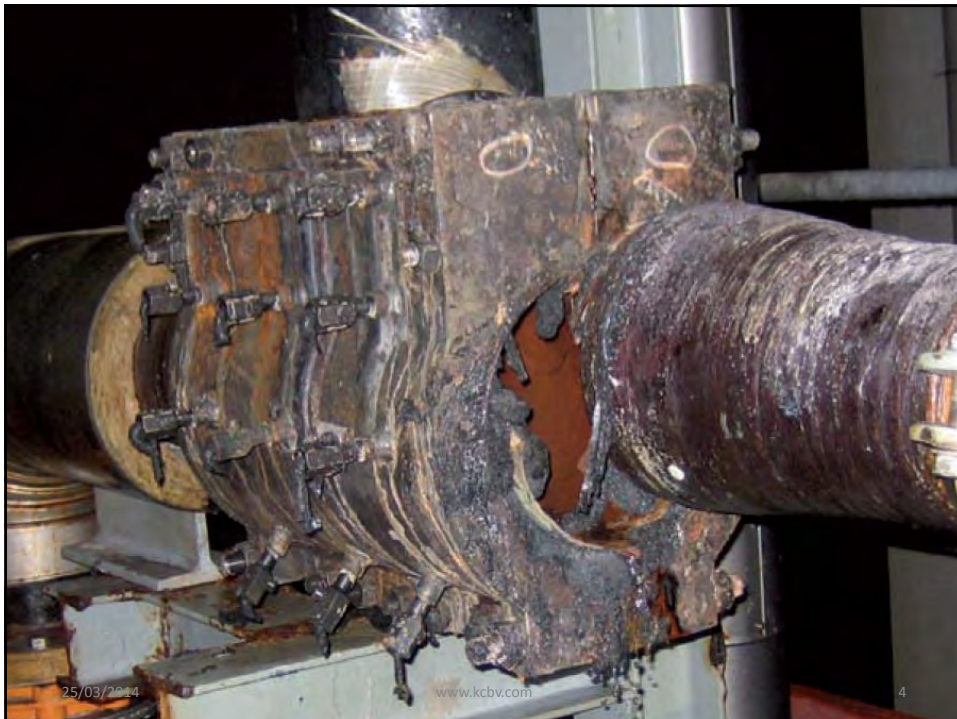
The accident

- An old 8" GRE line was leaking hot brine with ammonia
- Patching didn't work
- Repair during production with steel clamp filled with compound until end of campaign
- Pipe broke off during compound filling,
- Fitter exposed to hot water and hospitalized for 3 weeks

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An Incident investigation was started...

But WHY?

Goals

- What happened?
 - Sequence of events
- How could that happen?
 - Failing or missing barriers
 - Technical issues
 - Human acts, decisions
- Why was the organisation not able to prevent this?
 - Underlying Causes at system level
- Most important: IMPROVE the organisation

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Technical investigation

- Clamp dimensions were correct
- Clamp weight was 100 kg (including compound)
 - Initial estimate: 30 kg
 - More than bearing capacity of old GRE line
- ...New duplex spool piece was ready for installation at end of campaign...

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So – is that it?

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Intermezzo – The Accident Model

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Hazards are parts of our normal business...

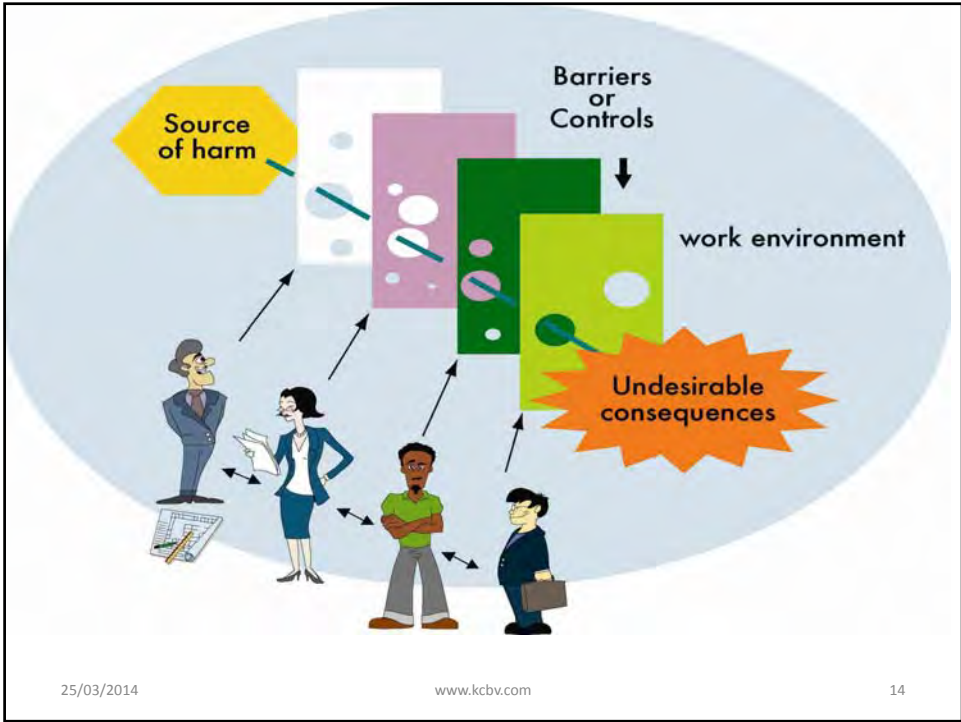
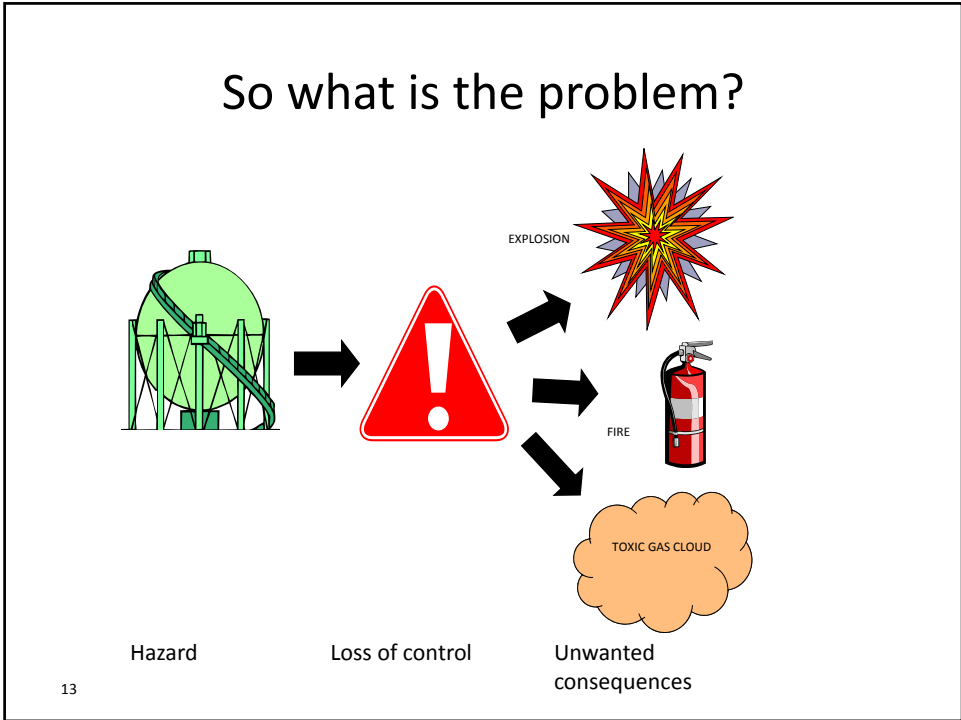


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...but can have unwanted consequences...



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- We cannot influence the potential to do harm
 - This is nature
- But we can manage the barriers!
 - This is done by our people

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- Accidents happen because barriers fail
- People make barriers fail
- But: does that mean that people are
 - Stupid
 - Inattentive
 - Complacent
 - Not safety-minded

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So, why do people fail?

Because we put them in an **imperfect** working environment

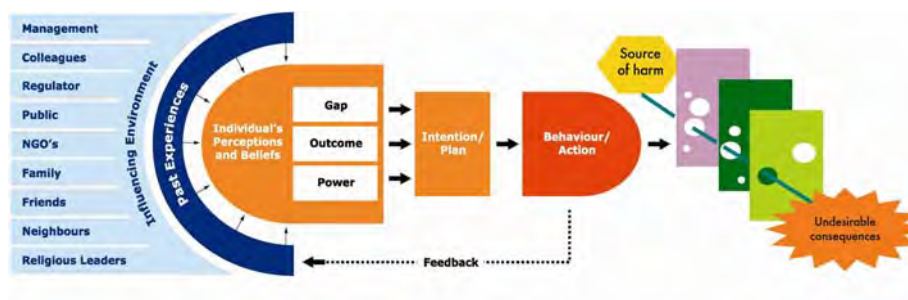


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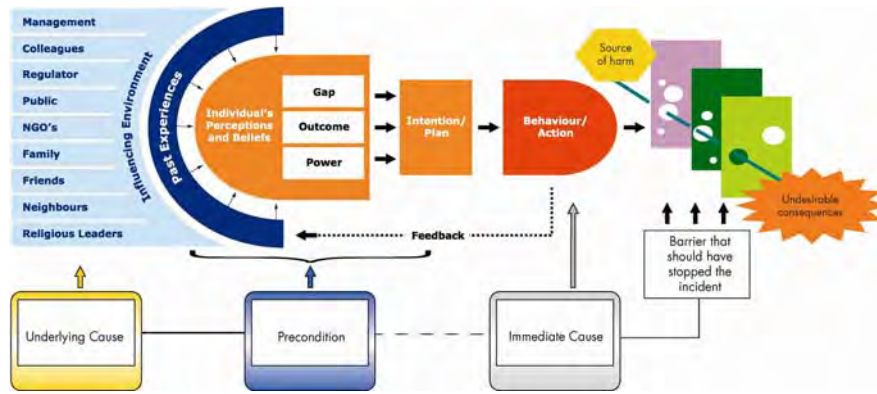
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The Human Behaviour Model



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Human Behaviour and Tripod Beta



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The Asia Barge

For each failed barrier we must find:

- Immediate cause (one!)
 - That made the barrier fail directly
 - Usually a human act, omission or decision
- Preconditions
 - Environmental factor that makes immediate cause for the individual logical or even commendable
- Underlying causes
 - Factors at organisational level that shape preconditions

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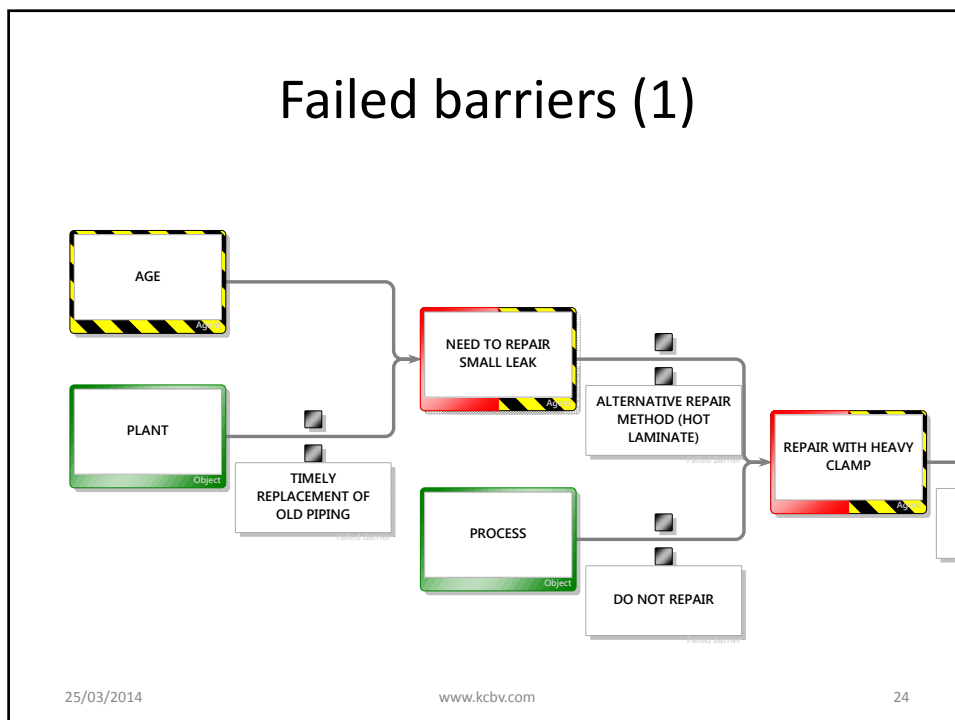
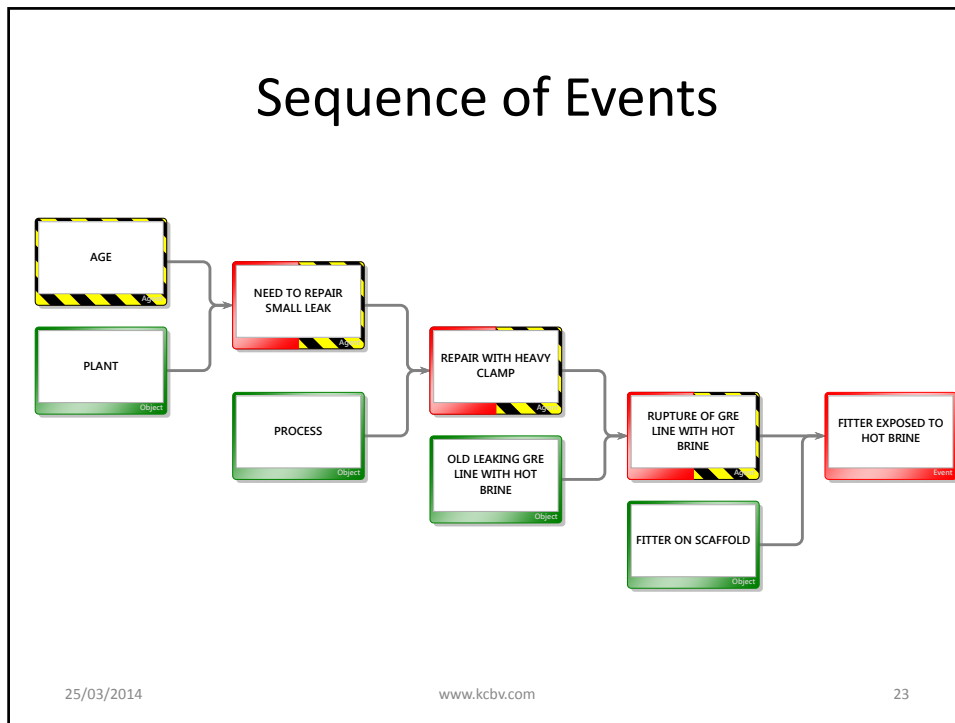
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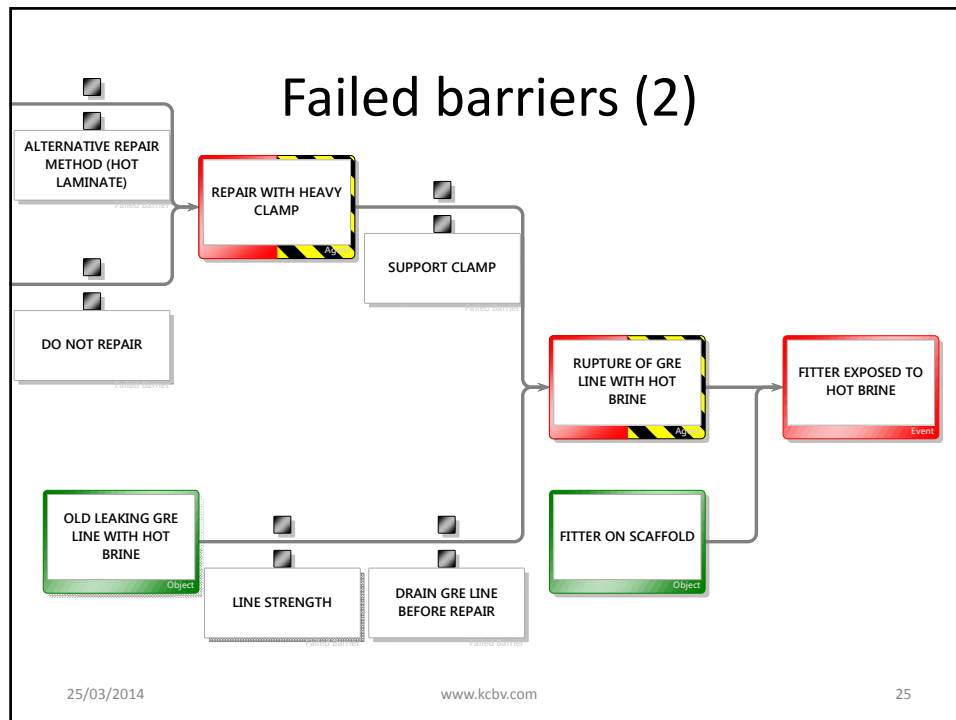
Back to the brine incident

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Immediate Causes

- Piping NOT replaced with duplex
- Alternative repair method NOT considered
- Decision to repair
- Clamp NOT supported
- Line NOT strong enough (due to ageing)
- Line NOT drained before repair

Preconditions

- Alternative repair method not considered
- No stress calculations done
- Clamp considered to be “light” (30 kg) and GRE piping to be strong enough
- No Task Risk Analysis done

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Underlying Causes

- Ineffective communication with contractor
 - Repair method, limitations
 - Expectations and responsibilities
- Lack of knowledge about:
 - GRE, allowable stress
 - Repair methods, suitability of clamps for GRE
- Ineffective TRA procedure:
 - TRA's only done for jobs that require system opening
- **Priorities: hot repair versus shutdown**
- **Bad financial situation of company**

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Follow-up

- Fix Barriers (short-term)
- Fix Underlying Causes (long-term)

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Conclusion

- *“Control the Controllable”* (Jop Groeneweg 2002)
- People are involved, but you cannot change people
- However you CAN control their **environment**

- So to prevent accidents, you must optimize the environment
 - Physical
 - Psychological
 - Organisational

- An incident reveals Underlying Causes that shape an environment that make people fail

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Thank You!

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