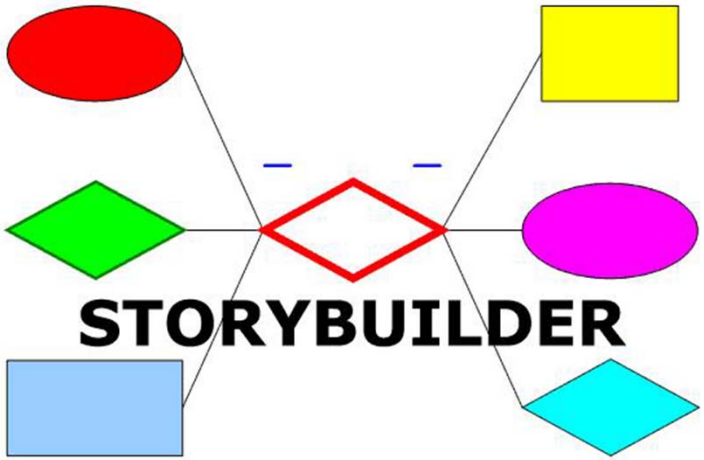

The use of the STORYBUILDER™ database

Linda J. Bellamy, White Queen BV, The Netherlands
linda.bellamy@whitequeen.nl

With thanks to:
Eelke Kooi RIVM (Storybuilder MH model owner) <Eelke.Kooi@rivm.nl>
Joy Oh (Ex. Min SZW, Project initiator, Policy coordinator)

European Commission- Joint Research Centre – Major Accident Hazards Bureau
Accident Analysis Benchmarking Exercise, 12-13 December 2018, Ispra, Italy

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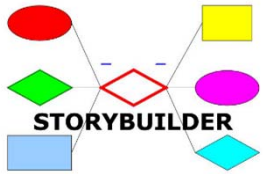
Development background



- 2002 Project start of occupational risk model (webORCA) in The Netherlands for informing policy of *Ministry of Social Affairs and Employment (SZW)*
  - *Accident data*
  - *Exposure data*
- 2003 Storybuilder Occupational accident model & database
- 2008 Storybuilder Major Hazard loss of containment model
- 2018 Storybuilder contains all the Dutch investigated reportable accidents:
  - 30,000+ Occupational accidents (1998-2014)
  - 330 LoC major hazard accidents (2004-2018) of which around 10% MARS reportable
  - 59 MH near misses (one Seveso company) in a success model

The Netherlands

Ministry SZW (Project funding and Chair SC)

Ministry of Social Affairs and Employment

RIVM

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Technical University of Delft, Dept. Safety Science

TU Delft

Consultancies

white queen Safety Strategies

RPS

RIGO Research en Advies BV
Woon- werk- en leefomgeving
www.rigo.nl

veiligheid nl

Greece

NCSR Demokritos

UK

HSE Health & Safety Executive

Denmark

Dept. Management Engineering

DTU Technical University of Denmark

EU

MAHB

European Commission

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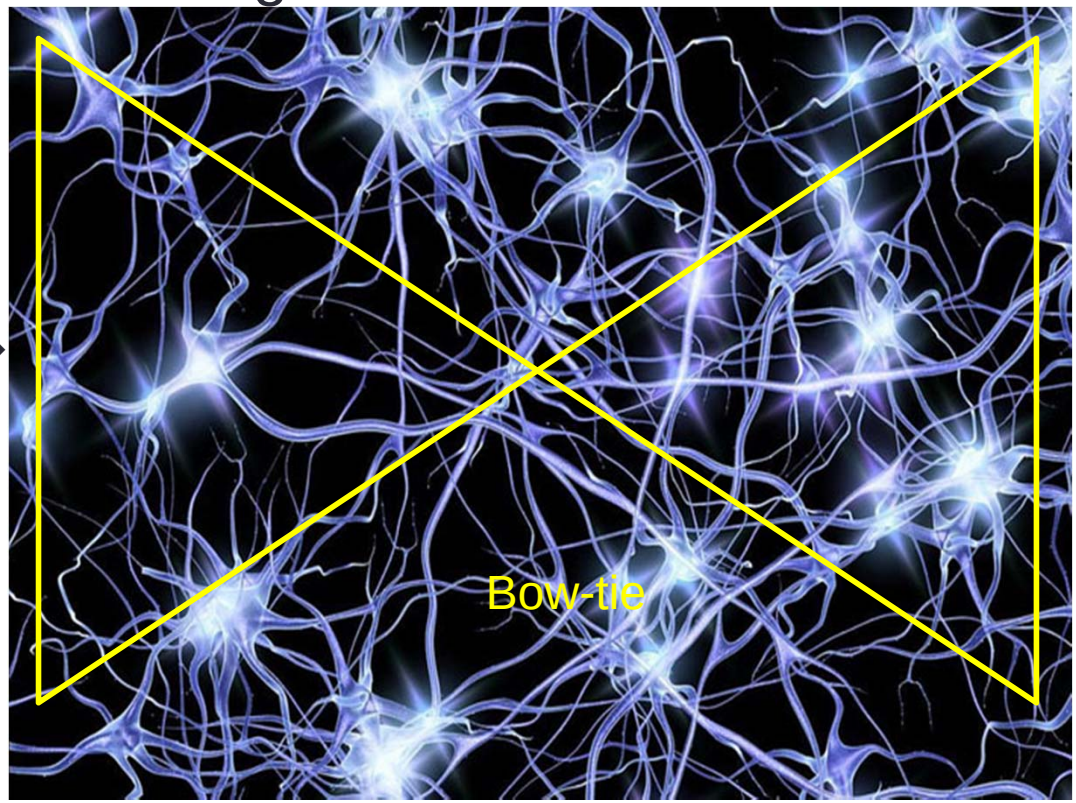
Storybuilder construction

- Dedicated software for network building
- Accident stories
- Event sequences through nodal points of a model
- Barrier building blocks

Deviations →



→ Outcomes

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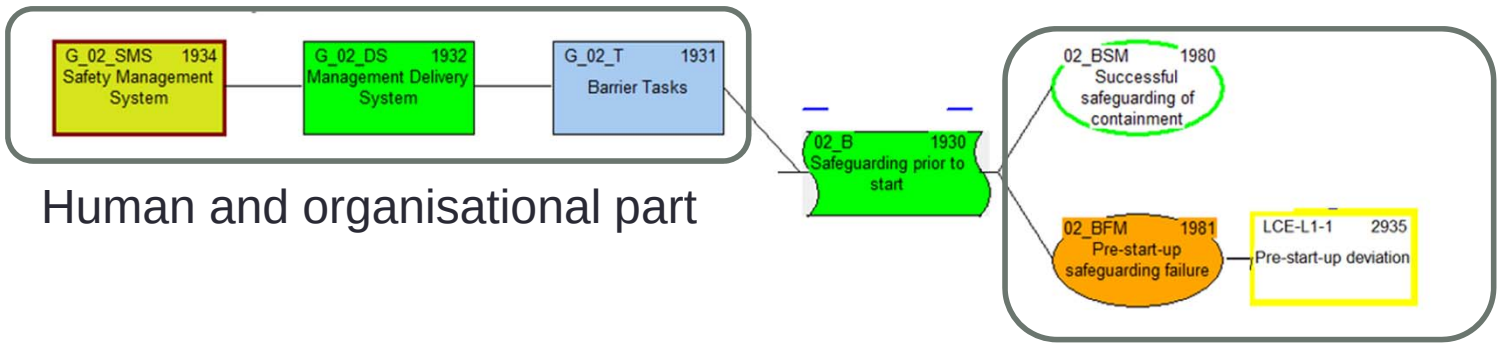
Barrier basic building blocks

- Model built by multi-disciplinary team working closely together

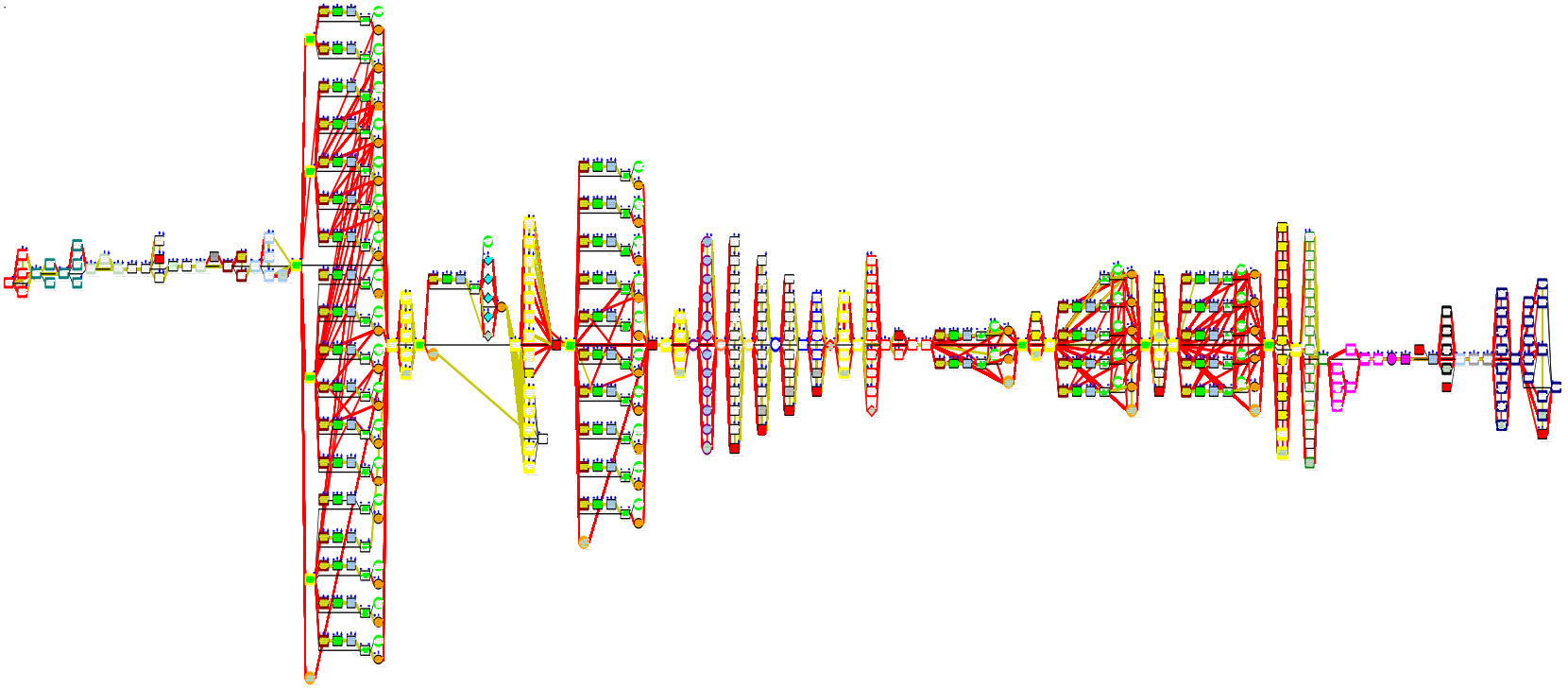


Human and organisational part

Technical part

Big data set

- Many paths through the network
- Counts at the nodes
- Can find patterns
- Answer different questions from different perspectives
- Provides information of interest for different users



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How many accidents, what detail?

- One accident can provide a lot of data
- Unique occurrence or representative?
- To identify patterns you need a certain number of accidents
- Many deviations do not develop to accidents but are the starting point of more serious ones e.g. Buncefield

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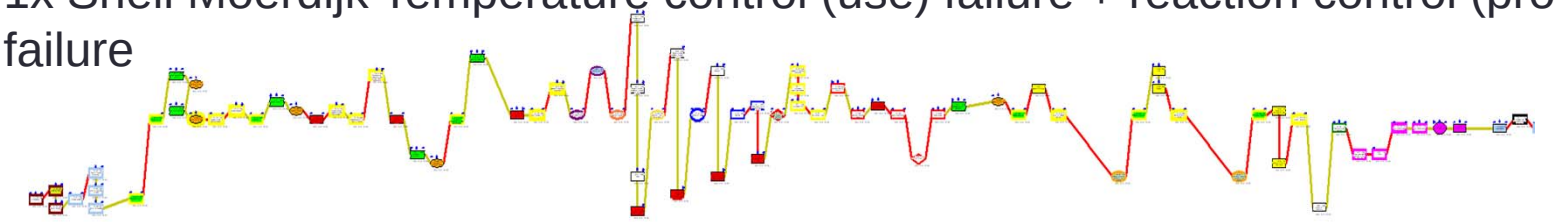
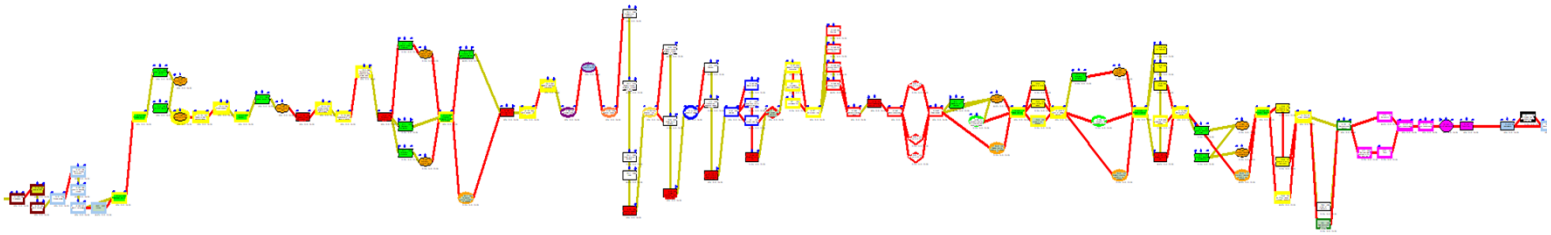
e.g. Lighting up the nodes

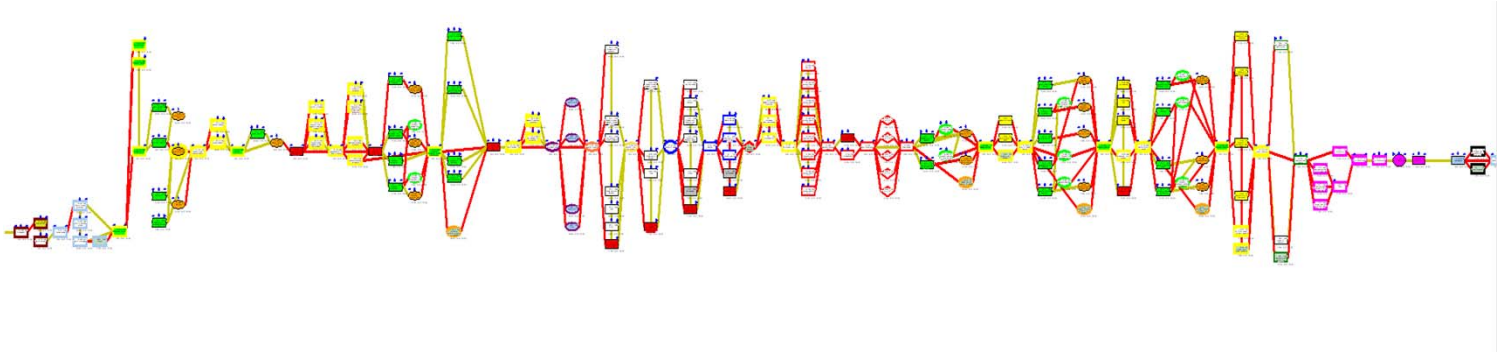
1x Shell Moerdijk Temperature control (use) failure + reaction control (provide) failure



3x Temp control failure + reaction control failure



18x Reaction control failure



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Viewpoint: User needs

- The sort of data required depends on the needs of the user (practitioner, scientist, inspector, policy maker etc.)
- Can one model, one database cover all needs?
- Analyst skills
  - to enter and extract data
  - to know the right questions to ask of a tool/data set
- Conclusion: Tailor made for user

Dutch Labour Inspectorate report

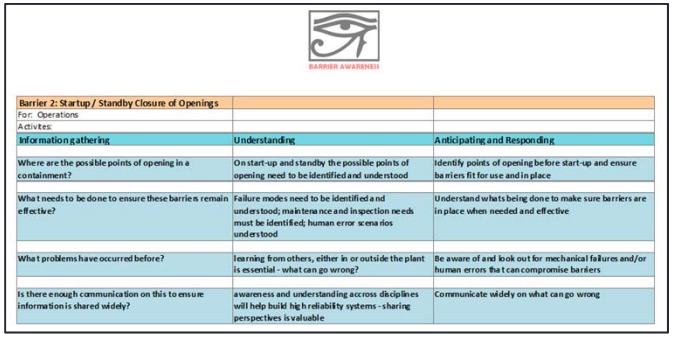
Incidentenanalyse
Arbeidsinspectie
Directie Major Hazard Control

Arbeidsinspectie
Ministerie van Sociale Zaken en Werkgelegenheid

Betreffende de ongevalsonderzoeken
over de periode 1 januari 2008 – 31 december 2010

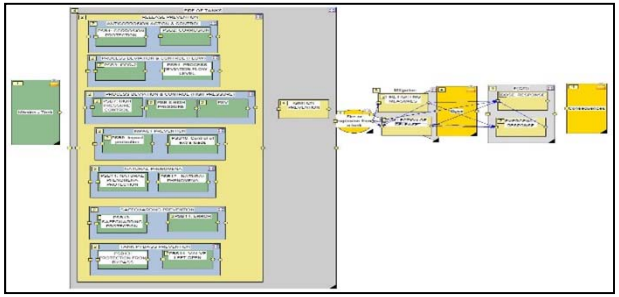
Opdrachtgever	: Ministerie van Sociale Zaken en Werkgelegenheid
Auteurs	: Martijn Mud (RPS), Jörgen van Amen (RPS)
Gecontroleerd door	: Linda Bellamy (WQ), Jos van Liempt (Al-MHC), Bob van Santen (Al-MHC)
Projectleider	: Henkjan Manuel (RIVM)
Report nummer	: RPS - VRM11.8018_R01
Datum	: April 2011

Info-card for barrier awareness training



Barrier 2: Startup / Standby Closure of Openings		
For: Operations		
Activites:		
Information gathering	Understanding	Anticipating and Responding
Where are the possible points of opening in a containment?	On start-up and standby the possible points of opening need to be identified and understood	Identify points of opening before start-up and ensure barriers fit for use and in place
What needs to be done to ensure these barriers remain effective?	Failure modes need to be identified and understood; maintenance and inspection needs must be identified; human error scenarios understood	Understand whats being done to make sure barriers are in place when needed and effective
What problems have occurred before?	learning from others, either in or outside the plant is essential - what can go wrong?	Be aware of and look out for mechanical failures and/or human errors that can compromise barriers
Is there enough communication on this to ensure information is shared widely?	awareness and understanding accross disciplines will help build high reliability systems - sharing perspectives is valuable	Communicate widely on what can go wrong

Logical bow-tie for risk model



Scientific paper

Journal of Loss Prevention in the Process Industries 26 (2013) 1039–1059

Contents lists available at SciVerse ScienceDirect

Journal of Loss Prevention in the Process Industries

journal homepage: www.elsevier.com/locate/jlp

Analysis of underlying causes of investigated loss of containment incidents in Dutch Seveso plants using the Storybuilder method

Linda J. Bellamy [a,*], Martijn Mud [b], Henk Jan Manuel [c], Joy I.H. Oh [d]

[a] White Queen Safety Strategies, PO Box 712, 2130 AS Hoofddorp, The Netherlands
[b] RPS, PO Box 5094, 2600 GB Delft, The Netherlands
[c] Dutch National Institute for Public Health and the Environment (RIVM), PO Box 1, 3720 BA Bilthoven, The Netherlands
[d] Ministry of Social Affairs and Employment (SZW), PO Box 90801, 2509 LV Den Haag, The Netherlands

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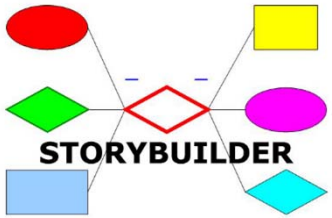
Current Uses



- Prioritising inspection issues
- Reporting to Parliament
- Demonstrating doing the right thing (policy, inspection)
- Providing facts and figures/lessons learned information for companies
- Scientific research
- Answering policy questions, questions from companies, and from inspectors
- Developing new tools

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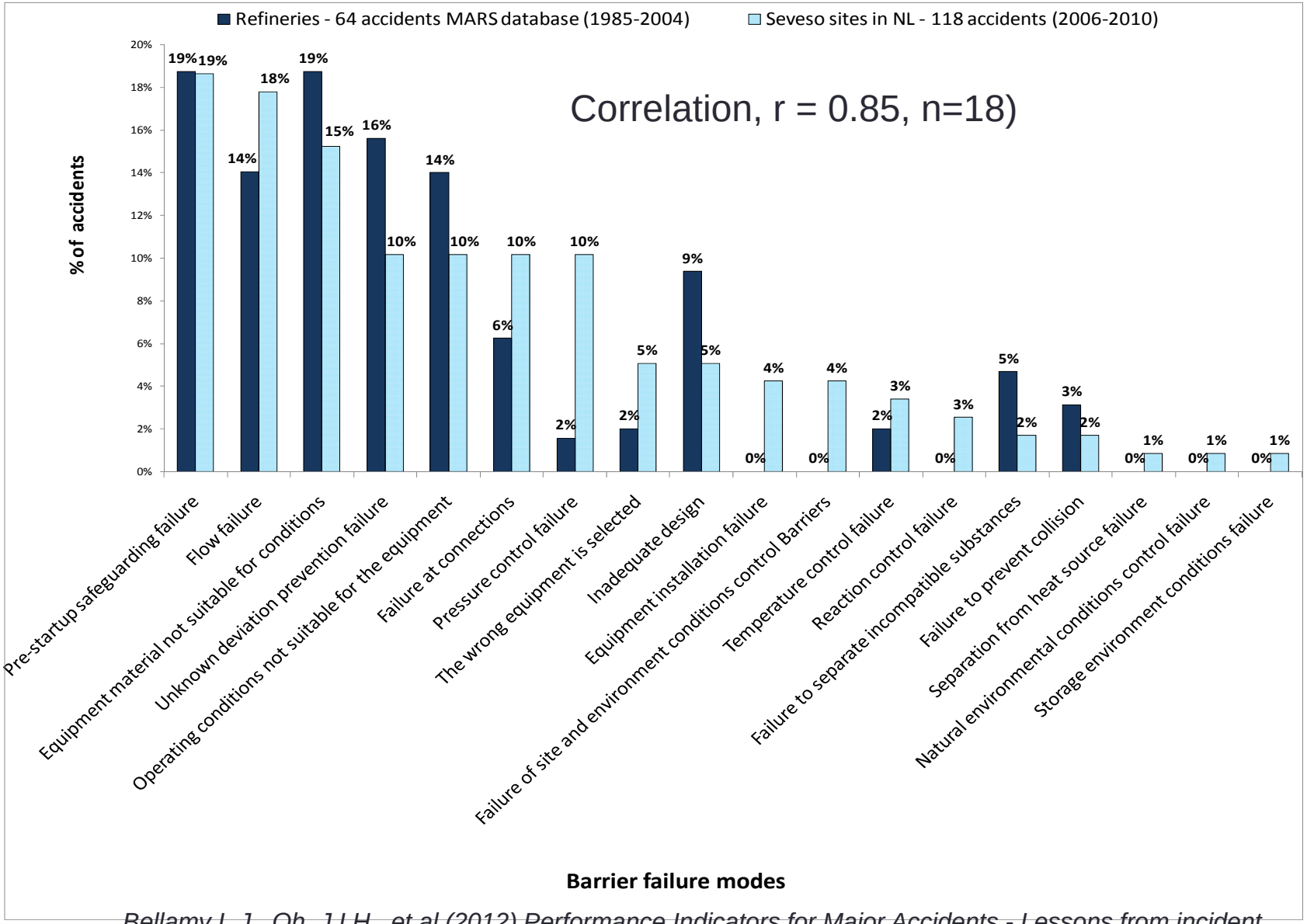
Common direct causes NL versus Europe (1st LOD)



Bellamy L.J., Oh, J.I.H., et al (2012) Performance Indicators for Major Accidents - Lessons from incident analysis. HAZARDS xxiii, 12-15 November 2012, Southport, UK. IChemE

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HSL model, UK data (1817 barrier failures)

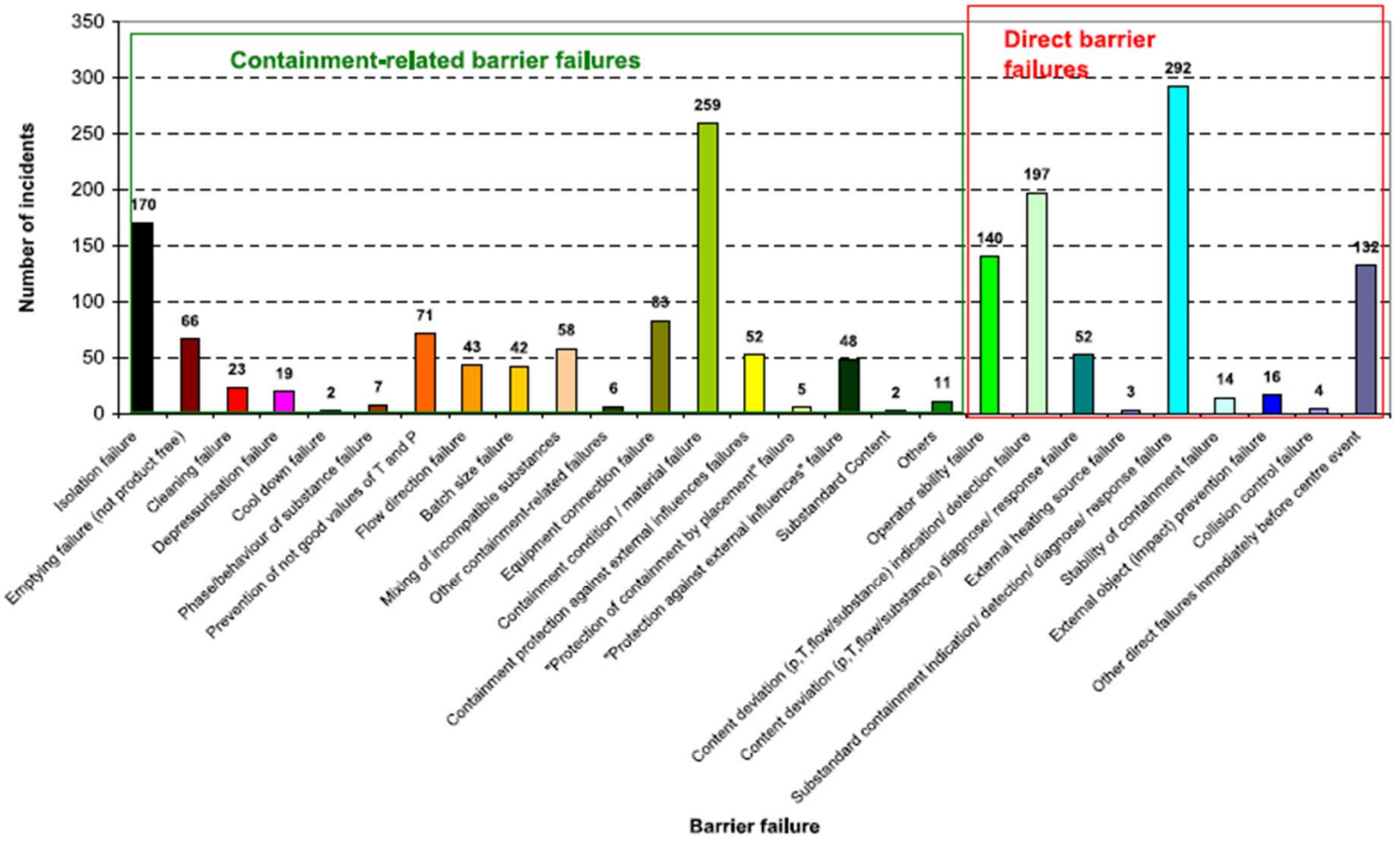

Fig. 7. Number of containment-related barrier failures and direct barrier failures in the loss of containment incident dataset (containment-related and direct barriers not mutually exclusive; total number of barrier failures is 1817).

"Analysis of a loss of containment incident dataset for major hazards intelligence using Storybuilder"

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Conclusions

- Accident investigation reports can fill Storybuilder's sociotechnical model
- Rich data source that can serve many uses but not all needs
- Must have a skilled (tailor made) analyst for tailor-made questions & answers
- Dutch Storybuilder data could be used Europe wide because correlates with other databases

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Dutch data set (332 accidents)

Name	% Centre Event Paths
Normal operation	59.50%
Maintenance and inspection	19.00%
Commissioning	13.08%
Start-up after maintenance	10.28%
Shut-down	3.12%
Normal start/start-up	3.74%
Not in operation	2.49%
Unknown process stage	2.80%
Commissioning	0.93%
Normal stop	1.56%
Decommissioning	0.93%
Fixing disturbance (during operations)	0.31%
Start after disturbance/interruption	0.31%
Trial or testing of installation	0.31%
Closed or switched-off	0.31%
Emergency stop	0.31%
Fixing disturbances (operation interrupted)	0.00%

Nancy Leveson CAST analysis “The operators’ knowledge and skill is most challenged during off-nominal phases, and most accidents occur during such phases”

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Model for Inspection & Auditing

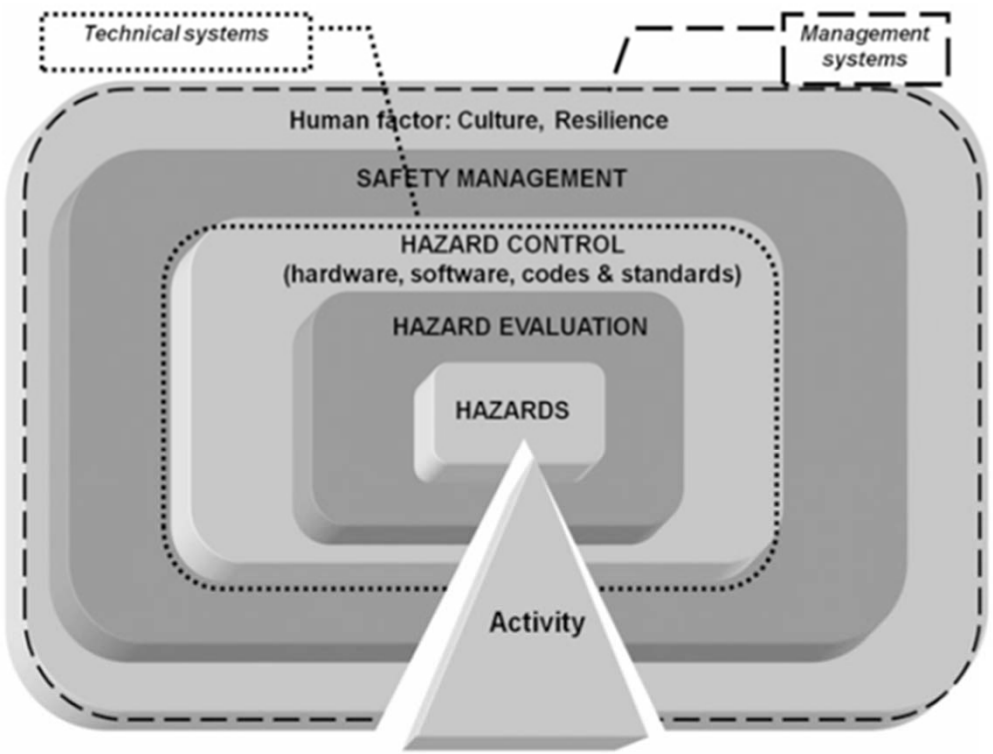

Fig. 9.1 A "piece of cake": an activity associated with a hazardous technology contains the ingredients of the socio-technical system as understood and regulated

Bellamy L.J. (2018) Doing What Is Right or Doing What Is Safe. In: Bieder C., Gilbert C., Journé B., Laroche H. (eds) *Beyond Safety Training*. SpringerBriefs in Applied Sciences and Technology. Springer, Cham

Oh, J.I.H. & Bellamy L.J. (2000). AVRIM2: A holistic assessment tool for use within the context of the EU Seveso II directive. Seveso 2000 conference, 22–23 June, Bordeaux, France.

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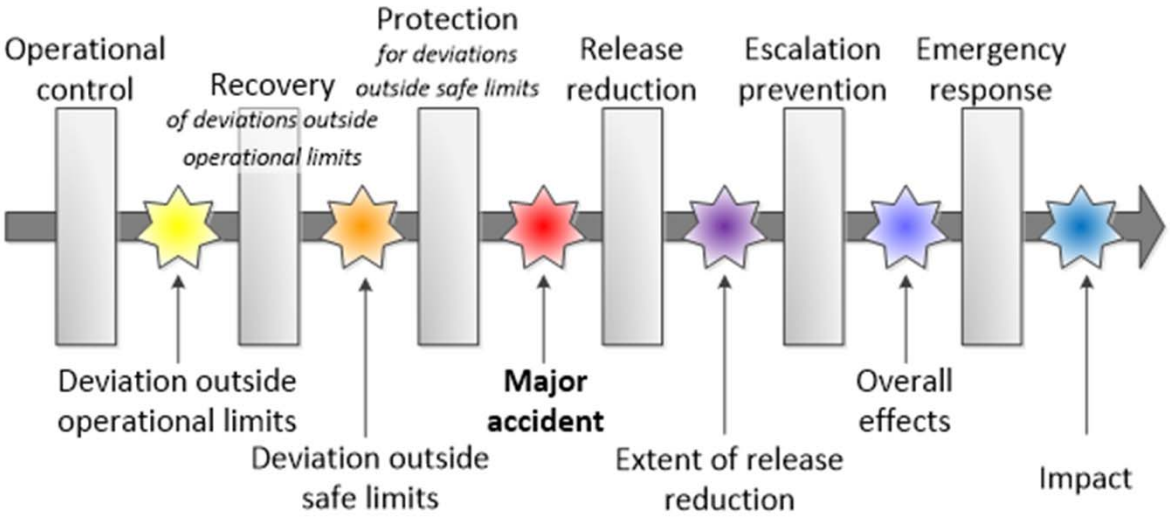
Lines of defence model



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