Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

TSB

Evolving Approaches to Managing Safety and Investigating Accidents

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Transportation Safety Board of Canada

**Eastern Canada Chapter
System Safety Society
November 27, 2008**

BST

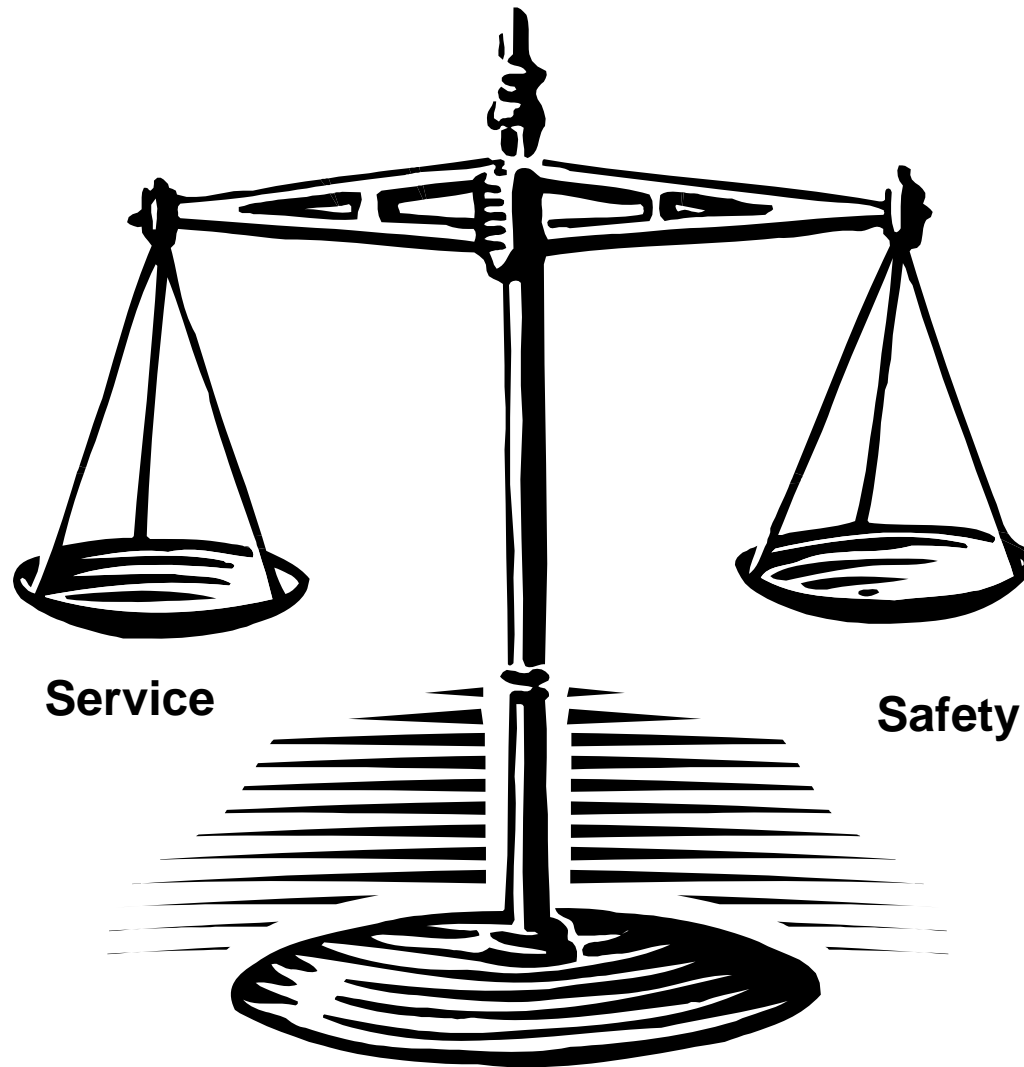Canada

Presentation Outline

- Personal experiences
- Accident causation and prevention - Concepts
- Development of Safety Management Systems (SMS)
  - Hazard identification
  - Incident reporting
  - Safety Measurement
- Role of the Transportation Safety Board (TSB)
- Swissair 111
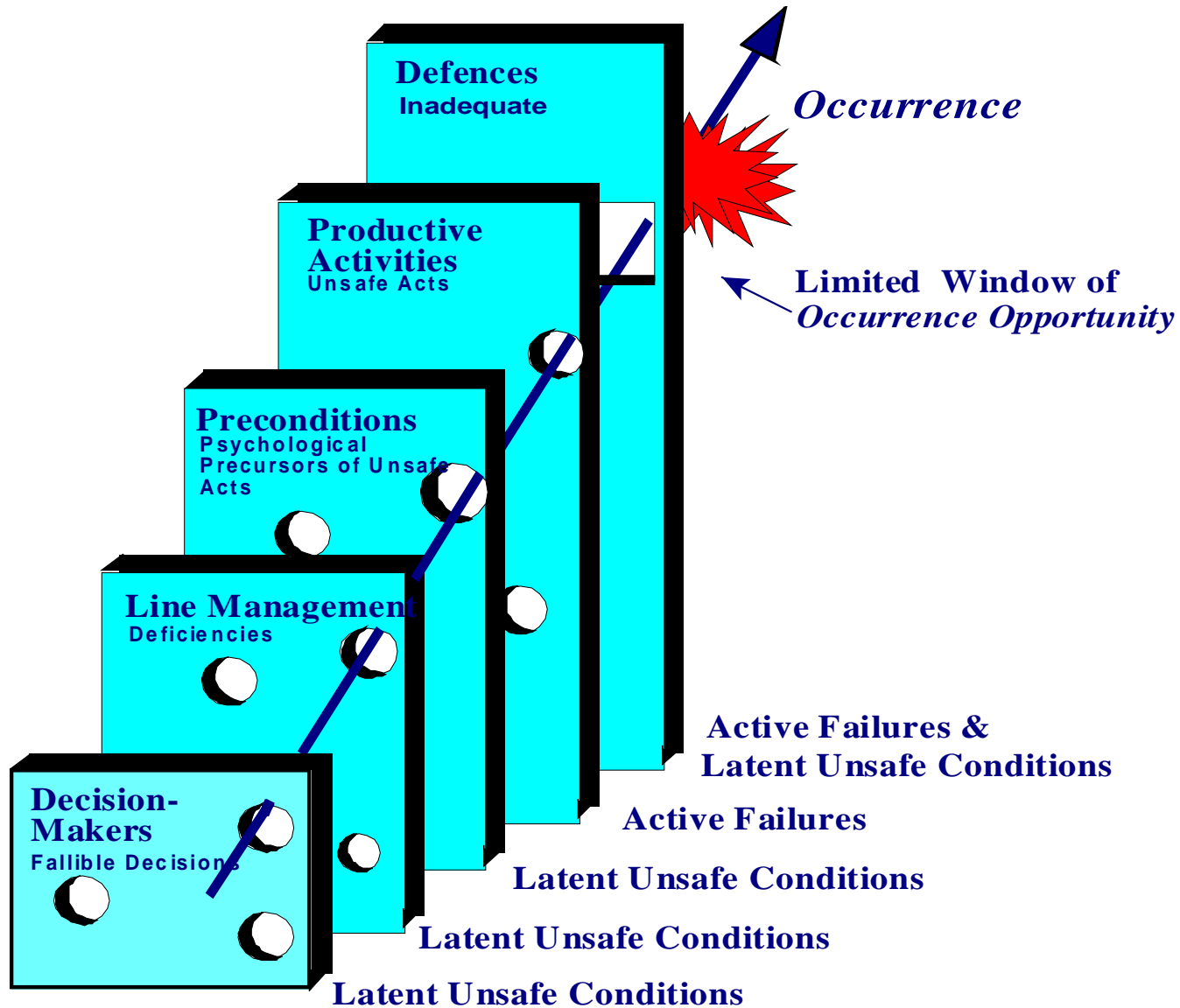
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Early Thoughts on Safety

Standard operating procedures followed +

Attention paid to what's being done +

Mistakes not made and rules not broken +

Equipment does not fail =

Things are safe

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Balancing Competing Priorities

Service   Safety

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Reason's Model

Defences
Inadequate

Occurrence

Productive Activities
Unsafe Acts

Limited Window of
Occurrence Opportunity

Preconditions
Psychological
Precursors of Unsafe
Acts

Line Management
Deficiencies

Active Failures &
Latent Unsafe Conditions

Decision-Makers
Fallible Decisions

Active Failures

Latent Unsafe Conditions

Latent Unsafe Conditions

Latent Unsafe Conditions

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Desirable characteristics of organizations effectively managing safety

Dr. Ron Westrum, 1998

- Emphasis on organizational safety
- Collective Efficacy
- Task-Resource Congruence
- Free-Flowing and Effective Communications
- Clear Mapping of Safety Situation
- Organizational Learning
- Clear Lines of Authority and Accountability

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Westrum, R (1998), *Review* commissioned by NAV CANADA

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Desirable characteristics of organizations effectively managing safety (cont.)

Westrum Paper, 1998	SMS requirements (Transport Canada)
Emphasis on organizational safety	Corporate safety policy and goals
Collective Efficacy	Identification of hazards; internal reporting
Task-Resource Congruence	Ensuring personnel are trained and competent
Free-Flowing and Effective Communications	Internal reporting
Clear Mapping of Safety Situation	Identification of hazards and managing the risks; periodic reviews/ audits
Organizational Learning	Identification of hazards and managing the risks; periodic reviews/audits
Clear Lines of Authority and Accountability	Accountable executive; Corporate safety policy; SMS documentation

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Sidney Dekker
Understanding Human Error

- Safety is never the only goal

- People do their best to reconcile different goals simultaneously

- A system isn't automatically safe

- Production pressures influence peoples' trade-offs

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Dekker, S. (2006) *The Field Guide to Understanding Human Error*, Ashgate Publishing Ltd.

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Sidney Dekker
Understanding Human Error (cont.)

- Human Error is systematically connected to features of people's tools, tasks and operating environment

- People operate within an organization
  - Organizations determine the environment, tools, training and resources

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Dekker, S. (2006) *The Field Guide to Understanding Human Error*, Ashgate Publishing Ltd.

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SMS: Hazard identification

Organizations must proactively identify hazards and seek ways to reduce or eliminate risks

Challenges:

- Difficulty in predicting all possible interactions between seemingly unrelated systems – complex interactions [1]

- Inadequate assessment of risks posed by operational changes – drift into failure, limited ability to think of ALL possibilities [2, 3]

- Deviations of procedure reinterpreted as the norm [4]

[1] Perrow, C (1999) *Normal Accidents,* Princeton University Press

[2] Dekker, S (2005) *Ten Questions About Human Error*, Lawrence Erlbaum Associates

[3, 4] Vaughan, D. (1996) *The Challenger Launch Decision*, University of Chicago Press

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SMS: Incident Reporting

Challenges:

- Determining which incidents are reportable

- Analyzing 'near miss' incidents to seek opportunities to make improvements to system

- Voluntary vs. mandatory, confidential vs. anonymous

- Punitive vs. non-punitive systems

- Who receives incident reports

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SMS: Organizational Culture

- SMS is only as effective as the organizational culture that enshrines it

- Work groups create norms, beliefs and procedures unique to their particular task, thus becoming the work group culture [1]

- Undesirable characteristics may develop: lack of effective communication among safety-critical groups, over-reliance on past successes, lack of integrated management across organization [2]

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1 Vaughan, D (1996), *The Challenger Launch Decision*, University of Chicago Press

2 Columbia Accident Investigation Report, Vol. 1, August 2003

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SMS: Accountability

- Recent trends are towards criminalization of human error

- Sidney Dekker, <u>Just Culture</u>
  - Safety suffers when operators punished

  - Organizations invest in being defensive rather than improving safety

  - Safety-critical information flow stifled for fears of reprisals

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Dekker, S (2007) *Just Culture*, Ashgate Publishing Ltd.

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Elements of a "Just Culture"
(Dekker 2007)

- Encourages openness, compliance, fostering safer practices, critical self-evaluation

- Willingly shares information without fear of reprisal

- Seeks out multiple accounts and descriptions of events

- Protects safety data from indiscriminate use

- Protects those who report their honest errors from blame

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Dekker, S (2007) *Just Culture*, Ashgate Publishing Ltd.

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Elements of a "Just Culture"
(Dekker 2007) (cont.)

- Distinguishes between technical and normative errors based on context

- Strives to avoid letting hindsight bias influence the determination of culpability, but rather tries to see why people's actions made sense to them at the time

- Recognizes there is no fixed line between culpable and blameless error

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Dekker, S (2007) *Just Culture*, Ashgate Publishing Ltd.

About the TSB

- Independent organization investigating marine, pipeline, rail and air occurrences

- Finds out what happened and why

- Makes recommendations to address safety deficiencies

- Not a regulator or a court

- Does not assign fault or determine civil or criminal liability

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About the TSB (cont.)

- Reason's Model adopted in early 90s
  - Multicausality
  - Human error within broader organizational context

- Integrated Safety Investigation Methodology (ISIM)
  - Determining if full investigations are warranted based on potential to advance safety
  - Use of various human and organizational factors frameworks (Westrum, Snook, Vaughan, Dekker)

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Swissair Flight 111
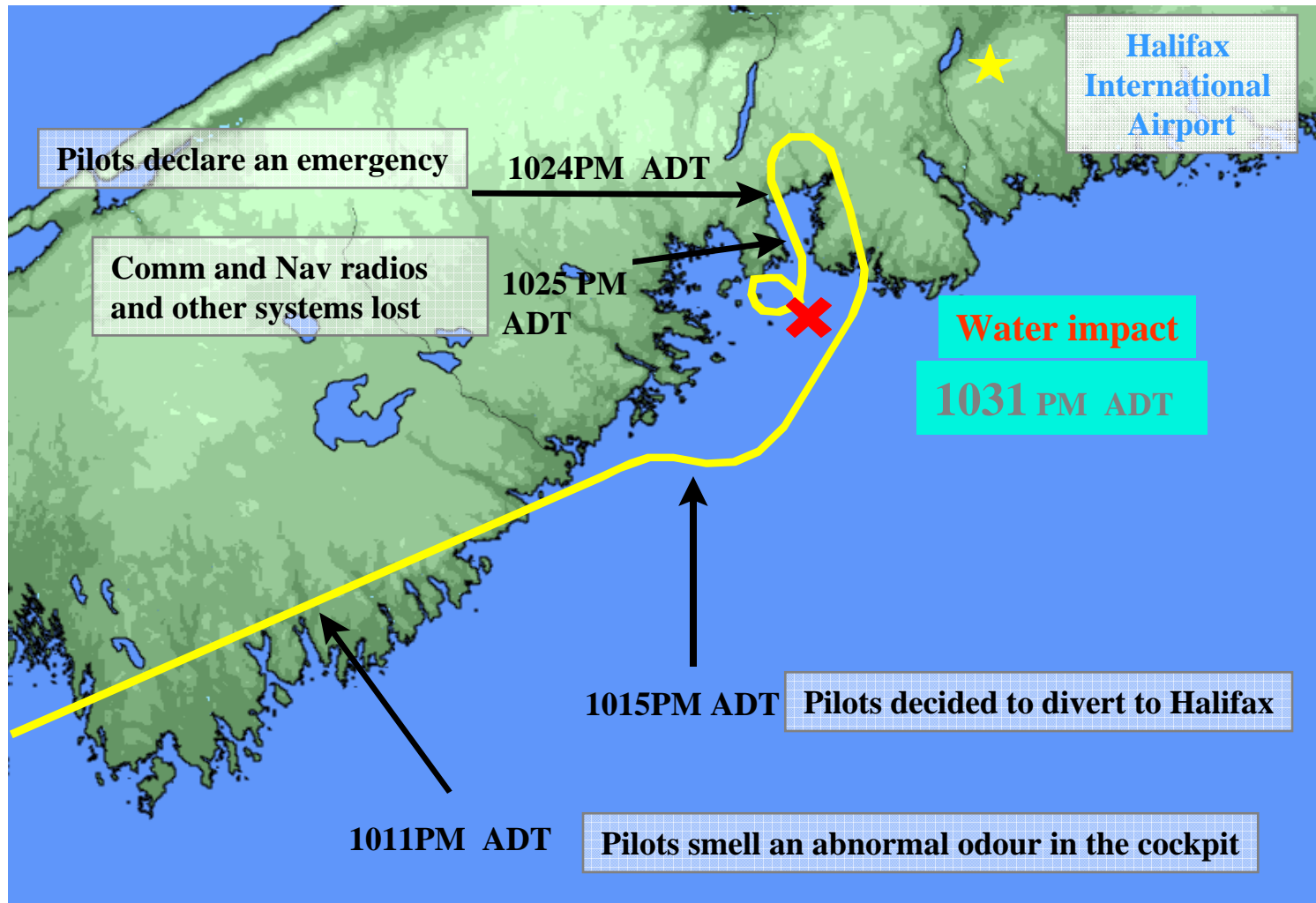
Swissair Flight 111
In-Flight Fire Leading to Collision with Water
September 2, 1998, near Peggy's Cove, NS

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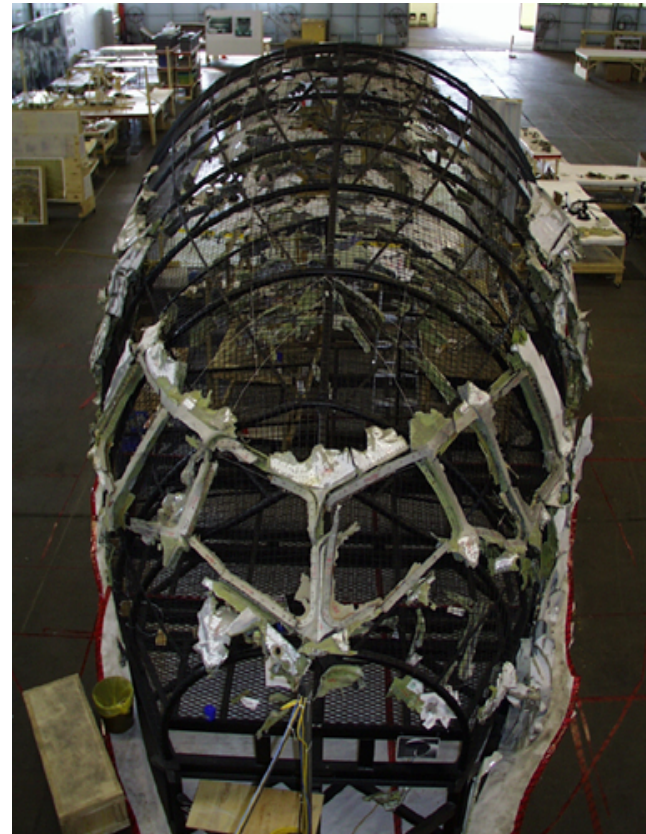
Material Flammability

- Material used for insulation was found to be flammable, despite meeting regulatory requirements

- Flammability standards themselves not stringent enough and did not represent realistic operating environments

- Standards focused primarily on materials in the cabin - lower standards for materials used elsewhere in aircraft

- Manufacturer stopped using MPET insulation and issued service bulletin recommending its removal, but no action mandated to remove it by FAA

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8 Flammability Recommendations

- More rigorous flammability testing standards
- Removing materials failing standards from service
- Improving certification requirements to better represent realistic operating conditions and systems interactions

Action Taken

- Directives mandated removal of MPET insulation

- New flammability test criteria established

- Guidance material developed for more accurate and consistent interpretation of test standards

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Flammability – Outstanding Action

- Comprehensive review of remaining types of insulation

- Quantification and mitigation of risks associated with all materials that failed new flammability standards

- Establishment of test regime to evaluate aircraft electrical wire failure characteristics

- Evaluation of how aircraft systems and their components could exacerbate existing fire

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Summary

- Adverse outcomes from complex interactions of factors difficult to predict

- People at all levels in an organization create safety

- 'Near-misses' must be viewed as "free opportunities" for organizational learning[1]

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1 Dekker, S. & Laursen, T. (2007) *From Punitive Action to Confidential Reporting* Patient Safety and Quality Healthcare September/October 2007

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Summary

- Accident investigators must focus on what made sense at the time, not be judgmental, avoid hindsight bias[2]

- Accountability requires organizations and professionals to take full responsibility to fix problems[3, 4]

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2 Dekker, S. (2006) *The Field Guide to Understanding Human Error* Ashgate Publishing Ltd.

3 Sharpe, V.A. (2004) *Accountability Patient Safety and Policy Reform* Georgetown University Press

4 Dekker, S. (2007) *Just Culture* Ashgate Publishing Ltd.

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