# IDENTIFYING INDIVIDUAL PERFORMANCE FACTORS IN INCIDENT INVESTIGATION

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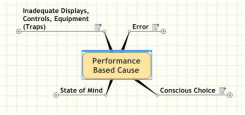




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## Objectives

- Reminder of purpose of incident investigation
- Discuss difficulties in exploring reasons for undesired actions
- Provide an overview of a method and philosophy of identifying human performance influencing factors which contribute to an accident…not only by the person injured/involved
- In order that effective preventative actions can be identified and implemented



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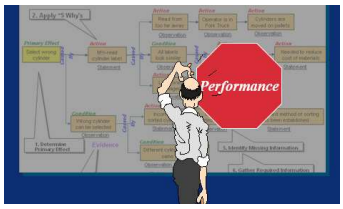
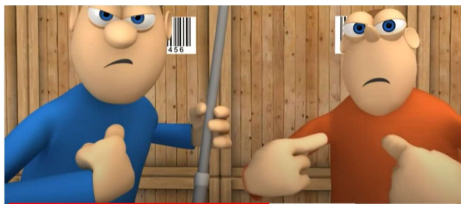
# Investigating human causes

- Traditional approaches tend to stop enquiring “why?” when an undesired human action is identified in incident investigation
- Most investigations stop when enquiry finds an individuals’ action or decision as a cause



- Cross-examining injured or involved person in group investigation meeting is not conducive to hearing all of the real and personal underlying factors



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# Humans cause accidents

- “This accident was the result of human error”
- “...pilot error”



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- “Not following instructions/procedure”




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- “Poor supervision”
- “Not paying attention”
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**It is not usually as simple as that!**


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# Human intent and language

*No-one plans to make an error or mistake…so why do they happen?*

- “Human error" behaviours are the same as "human performance" behaviours; persons acting in the normal range of behaviour
- Only later – with hindsight or during investigation - might that behaviour be defined as **'error'**
- The study of absent-mindedness in everyday life provides ample documentation and categorisation of such behaviour



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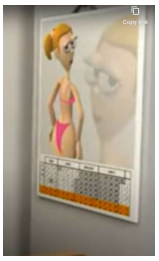
- Only later – with hindsight or during investigation - might that behaviour be defined as **'error'**
- The study of absent-mindedness in everyday life provides ample documentation and categorization of such behaviour
- *AND at work, other workplace factors can increase the likelihood of "unwanted outcomes"…*





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## Human behaviour

Who has done this or knows somebody who has?

- Dialled a wrong phone number/pressed the wrong floor button in a lift?
- Forgotten the item you went to buy from the supermarket?
- Overfilled a bath?
- Used wipers instead of indicators?
- Had the exhaust fall off their car?
- Ignored a fire alarm?
- Set up a new piece of kit without reading the manual?



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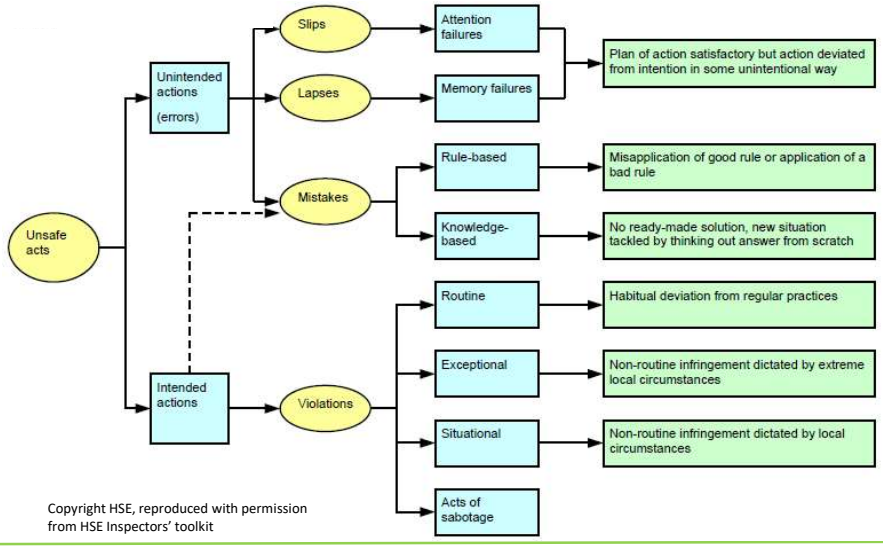
# Types of "human failure"





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# Human factors

- **Individual factors**
  - Persons individual characteristics and attitudes (thoughts, motivations)
- **Organisational factors**
  - The company, team or work group, its management systems and safety culture
- **Job or task**
  - Workplace and equipment design, work environment

EIGA Safety Information, Info HF 01
Human Factors – An Overview




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# Human factors

- Organisational, individual and task specific factors will all influence the likelihood of person performing task successfully (safely)

If there is an incident or accident, does the organisation seem interested in solving the problem rather than finding out whose fault it was?

Are incidents always reported and investigated and given the right level of attention according to how serious they were or could have been?

Does the company learn from incident history, such as through incident reporting and investigation?


EIGA Safety Information, Info HF 11
Organisation - "Safety Culture"

- Unstructured interrogation will focus on individual factors and overlook organisational and environmental (task design) factors which could also have contributed



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# Performance influencers

**Organisation factors**

- Lack of visible safety leadership, in making decisions and setting priorities
- Managers' actions inconsistent with safety communications
- Lack of two-way communication between managers and employees
- Inadequate resource or poor work planning, leading to excessive workload
- Ineffective or missing safety systems and safeguards
- Inadequate or insufficient information, instruction or training
- Procedures not appropriate, accurate or current
- Ineffective change management
- Inadequate responses to lessons learned from previous incidents
- Poor co-ordination and unclear responsibilities including contractor selection and management
- Conflict or negative interactions within and between work teams

**Task factors**

- Illogical design of equipment and instruments
- Constant disturbances and interruptions
- Missing or unclear instructions
- Poorly maintained equipment
- High workload
- Noisy and unpleasant working conditions


EIGA Safety Information, Info HF 03
Human Factors in Incident Investigation



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## Structured investigation

Air Products benchmarked various investigation techniques and then used a combination of the best features from several well tested cause analysis models to develop our inhouse “performance analysis tool”

- Management Oversight Risk Tree
- Tap Root
- ABC Analysis
- Dan Petersen Model
- Personal Safety Experience
- Apollo - ACE: Divergent Cause/Effect



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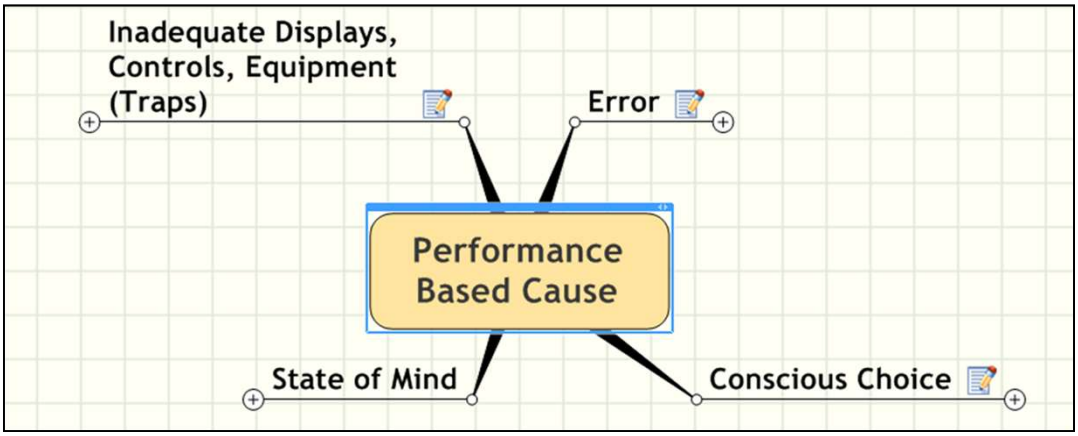
## Performance based causes




The template starts with the 4 main groups of factors that *could be* the direct causes of the performance issue



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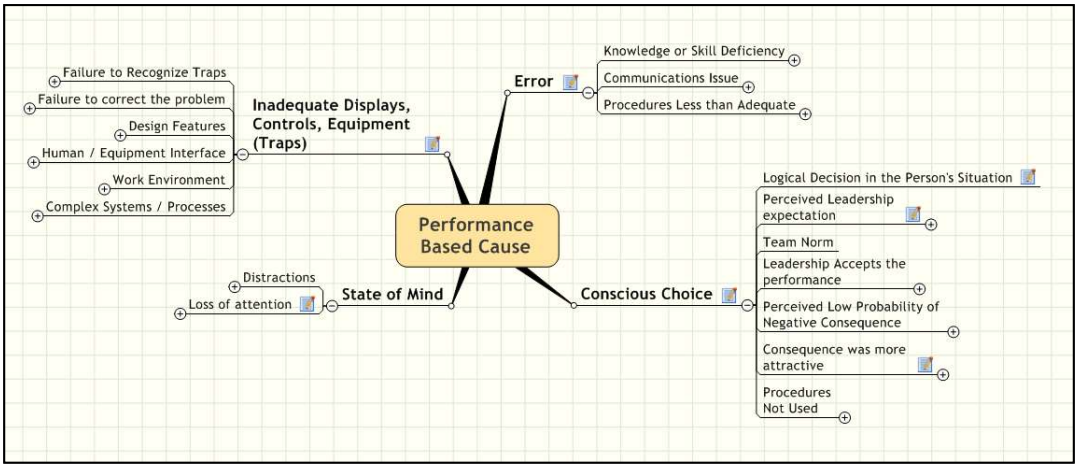
# Performance based causes




And expands to guide you to the contributing factors



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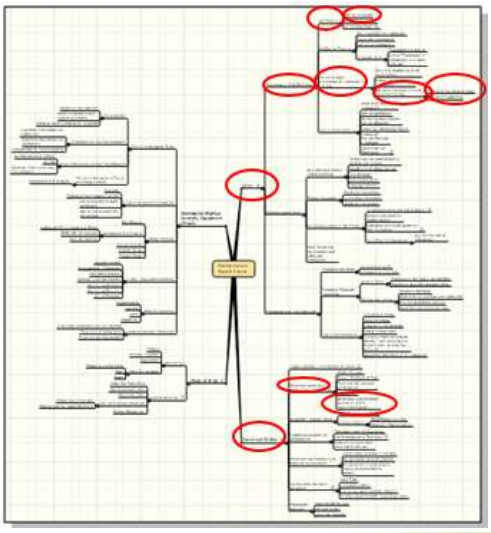
# Identify relevant causes



- The investigation team will review all possible performance causes and eliminate (~~strikethrough~~) those that do not apply
- The relevant factors (usually several) are highlighted and the team challenged to identify effective prevention measures



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## Humans cause accidents

- As well as resulting in injury accidents, our actions and decisions influence major accidents
- In reference (printed) slides there are list of significant national/international incidents (Piper Alpha, Bhopal, etc.)
  - and what was shared about WHY individuals, teams and organisations behaved as they did



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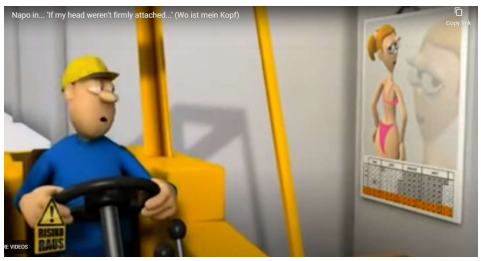
## Conclusion

- We must remove **blame** from the investigation process in order to understand why humans, (individuals and teams) behave as they do
- An impartial process eliminating not-relevant factors is less accusative/emotive and can uncover **unexpected** contributory causes

> *"Rather than being the main instigators of an accident, operators tend to be the inheritors of system defects created by poor design, incorrect installation, faulty maintenance and bad management decisions. Their part is usually that of adding the final garnish to a lethal brew whose ingredients have already been long in the cooking"*
>
> (Reason, *Human Error*, 1990)

- So that **organisations** can identify and implement effective solutions

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# Documents referenced

| EIGA Ref. | Document title | Link |
|---|---|---|
| Info HF 01 | Human Factors Overview | www.eiga.eu |
| Info HF 03 | Human Factors in incident investigation | www.eiga.eu |
| Info HF 11 | Human Factors – safety culture | www.eiga.eu |
| TP series | Recent Incident in the Industrial and Medical Gas Industry | www.eiga.eu |
| | **Inspectors Toolkit: Human Factors in Major Hazards Oct 2005** | http://www.hse.gov.uk/humanfactors/topics/toolkit.pdf |
| **HSG48** | Reducing Error and Influencing Behaviour | www.hsebooks.co.uk |
| | Reason, James, **"Human Error"** 1990 Cambridge University Press ISBN 0 521 314194 | |
| **NAPO films** | Napo - What is near miss, incident, accident?<br>Napo Wo ist mein Kopf (Napo in... 'If my head weren't firmly attached...') | NAPO (napofilm.net) |



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# Significant accidents (from HSG48)

| Accident, industry and date | Consequences | Human contribution and other causes |
|---|---|---|
| **Three Mile Island**<br>*Nuclear industry*<br>*1979* | Serious damage to core of nuclear reactor. | Operators failed to diagnose a stuck open valve due to poor design of control panel, distraction of 100 alarms activating, inadequate operator training. Maintenance failures had occurred before but no steps had been taken to prevent them recurring. |
| **King's Cross Fire**<br>*Transport sector*<br>*1987* | A fire at this underground station in London killed 31 people. | A discarded cigarette probably set fire to grease and rubbish underneath one of the escalators. Organisational changes had resulted in poor escalator cleaning. The fire took hold because of the wooden escalator, the failure of water fog equipment and inadequate fire and emergency training of staff. There was a culture which viewed fires as inevitable. |
| **Clapham Junction**<br>*Transport sector*<br>*1988* | 35 people died and 500 were injured in a triple train crash. | Immediate cause was a signal failure caused by a technician failing to isolate and remove a wire. Contributory causes included degradation of working practices, problems with training, testing quality and communications standards, poor supervision. Lessons not learnt from past incidents. No effective system for monitoring or limiting excessive working hours. |





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# Significant accidents (from HSG48)

| Accident, industry and date | Consequences | Human contribution and other causes |
|---|---|---|
| **Herald of Free Enterprise**<br>*Transport sector*<br>*1987* | This roll-on roll-off ferry sank in shallow water off Zeebrugge killing 189 passengers and crew. | Immediate cause was the failure to close the bow doors before leaving port. No effective reporting system to check the bow doors. Formal inquiry reported that the company was 'infected with the disease of sloppiness'. Commercial pressures and friction between ship and shore management had led to safety lessons not being learnt. |
| **Union Carbide Bhopal, India**<br>*Chemical processing*<br>*1984* | The plant released a cloud of toxic methyl isocynate. Death toll was 2500 and over one quarter of the city's population was affected by the gas. | The leak was caused by a discharge of water into a storage tank. This was the result of a combination of operator error, poor maintenance, failed safety systems and poor safety management. |
| **Space Shuttle *Challenger***<br>*Aerospace*<br>*1986* | An explosion shortly after lift-off killed all seven astronauts on board. | An O-ring seal on one of the solid rocket boosters split after take-off releasing a jet of ignited fuel. Inadequate response to internal warnings about the faulty seal design. Decision taken to go for launch in very cold temperature despite faulty seal. Decision-making result of conflicting scheduling/safety goals, mindset, and effects of fatigue. |





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# Significant accidents (from HSG48)

| Accident, industry and date | Consequences | Human contribution and other causes |
|---|---|---|
| **Piper Alpha**<br>*Offshore*<br>*1988* | 167 workers died in the North Sea after a major explosion and fire on an offshore platform. | Formal inquiry found a number of technical and organisational failures. Maintenance error that eventually led to the leak was the result of inexperience, poor maintenance procedures and poor learning by the organisation. There was a breakdown in communications and the permit-to-work system at shift changeover and safety procedures were not practised sufficiently. |
| **Chernobyl**<br>*Nuclear industry*<br>*1986* | 1000 MW Reactor exploded releasing radioactivity over much of Europe. Environmental and human cost. | Causes are much debated but Soviet investigative team admitted 'deliberate, systematic and numerous violations' of safety procedures by operators. |
| **Texaco Refinery, Milford Haven**<br>*Chemical processing*<br>*1994* | An explosion on the site was followed by a major hydrocarbon fire and a number of secondary fires. There was severe damage to process plant, buildings and storage tanks. 26 people sustained injuries, none serious. | The incident was caused by flammable hydrocarbon liquid being continuously pumped into a process vessel that had its outlet closed. This was the result of a combination of: an erroneous control system reading of a valve state, modifications which had not been fully assessed, failure to provide operators with the necessary process overviews and attempts to keep the unit running when it should have been shut down. |





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# Powerful “people” solutions

| Power | Method | Description | Examples |
|---|---|---|---|
| 5 | • Improve Leadership Norms and Values<br>• Develo | • Work Teams, Peers, Leadership work together to set expectations and actively monitor how | • Mentoring |
| 4 | • Individ<br>Improv | | |
| 3 | • Improv<br>• Elimina<br>• Engage<br>Team | | work practices<br>effectiveness<br>ntributed to the |
| 2 | • Active<br>• Engage<br>• Success | | ions |
| 1 | • Enforce<br>• Retrain | | andards and |
| 0 | • Share<br>• Consid<br>options<br>• Conduc<br>investig | | in safety |

In order of DECREASING effectiveness

5. **Active** monitoring by management
4. **Involve team** in active use of new method
3. Engage team in performing assessment/review
2. Re-train, repair
1. Communicate, consult
0. Review



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# Powerful “people” solutions

- Examine your proposed actions
- Compare the action to the appropriate power scale
- If you have low power solutions, challenge yourselves to identify ways to move up on the scale
- It is ok to have some lower power solutions, in combination with higher power solution(s)
- Exercise caution if all your solutions are low power… you probably are not implementing **long term, sustainable solutions**



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# Less powerful solutions

| Power | Method | Description | Examples |
|---|---|---|---|
| 0 | • **Share** information<br>• **Consider or evaluate** different options<br>• Conduct a more detailed **investigation** | • Identify incident information then communicate to all necessary individuals<br>• Instruct/council individual<br>• Consider a certain action/evaluate an idea | • Communicate with team. Council employee(s). Cover in safety meeting or group contacts<br>• Issue safety flash<br>• Consider making more frequent observations<br>• Evaluate the need for improving work instructions<br>• Conduct a root cause analysis |



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# More powerful solutions

| Power | Method | Description | Examples |
|---|---|---|---|
| 5 | • Improve **leadership norms and values**<br>• Develop **team norms** and values | • Work teams, peers, leadership work together to **set expectations** and **actively monitor** how well the entire work team applies the requirements | • Mentoring<br>• **Team observations** (safety sampling/quick safety observations with peers)<br>• Peer contacts<br>• Peer task safety observations |
| 4 | • Individual or **team performance i**mprovement plan | • Individuals and leadership develop a specific individual or team improvement plan and measures effectiveness. Progress is monitored until there is agreement the improvement is engrained | • Improvement project directly related to the incident<br>• Assign a **peer mentor** |



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# Hierarchy of controls

In order of decreasing “effectiveness”

- **Eliminate** the hazard completely wherever practical
- **Reduce** hazard - by dilution or substituting
- **Isolate** people from hazard (for example technical separation such as barriers to protect from sound or chemical spray)
- **Controls** for example software trips to close valves and avoid hazard or alarms to make operators aware of situation
- **Procedures** – clear operating instructions intended to avoid hazardous operating conditions
- **Discipline** – reprimand person after accident