

How and Why Accidents Happen.



Dr Mike Mackett, DSR workshop, 28th February 2011

What is an Accident?

"An unplanned event which gives rise to ill health or injury; damage to property, plant, products or the environment; production losses, or increased liabilities".

What is an Incident (Near Miss/Close Call)?

"Includes unplanned events with the potential to give rise to ill health or injury; damage to property, plant, products or the environment; production losses, or increased liabilities".



An accident is an unplanned event!
An incident would be if the boulder fell
behind the car and not on it.

Incident v. Accident

" an accident implies the result is outside a person's control. In 97 percent of the cases, what happens - the incident - is easily within someone's control."

"What's the difference between a near miss and a near hit? So why do we call it a near miss?"

Typically we use words like accident and near miss to lessen accountability or minimize the potential consequences."

Safety 24/7 Anderson and Lorber (2006).

Consequences of Accidents

1. Morbidity and occasional mortality. Days off work and possible long term issues for some individuals
2. Personal Costs - e.g. reputation of employer and employee
3. Financial Costs - to employer and employee
4. Increased State supervision - e.g. Labour Department inspections and possibly even legislation as with SARS and Singapore
5. *Significant inconvenience.*

Consequences of accidents can be a loss of life
but more often just minor inconvenience.



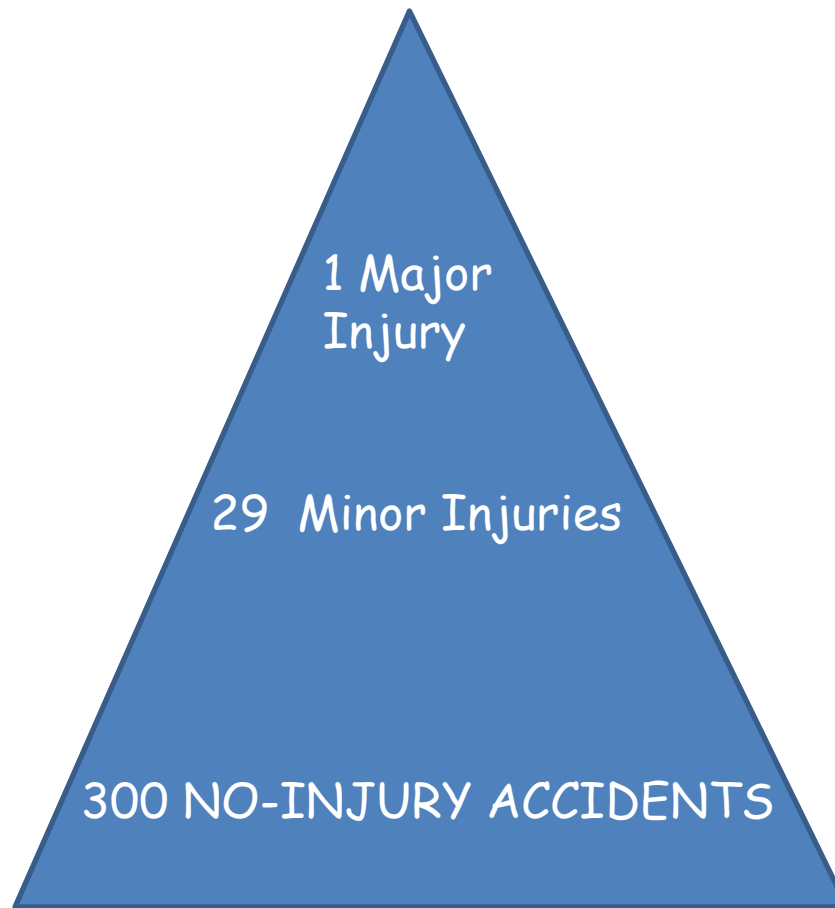
Planning for low frequency high consequence
accidents is problematical.

Consequences of Accidents

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Days off work and possible long term issues
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Loss from Accidents (and Ill Health) (UK study)

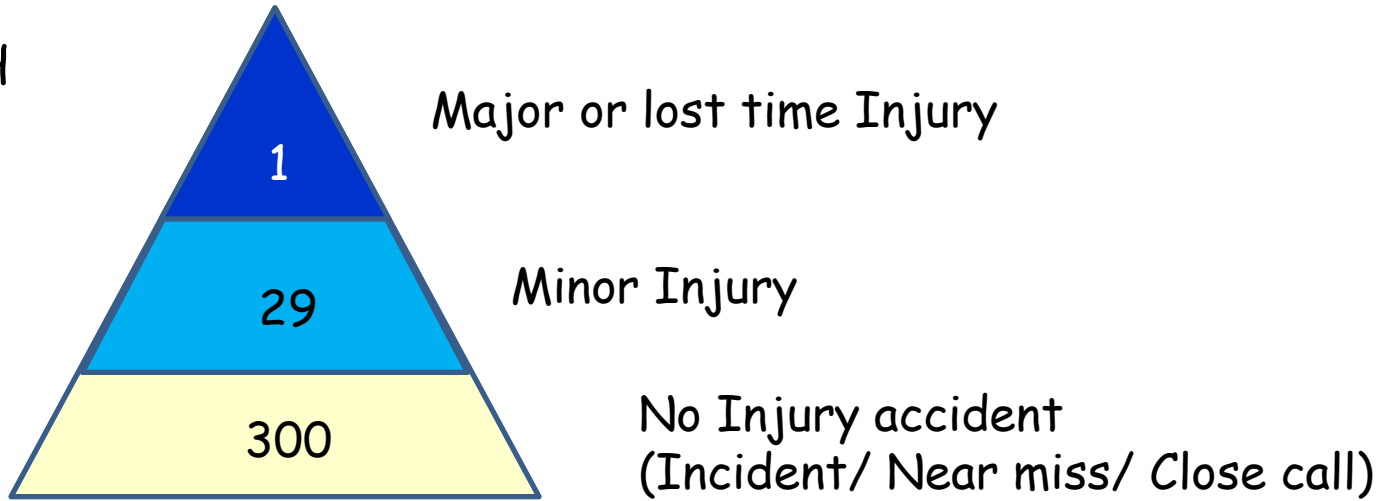
| Organisation | Annualised Loss | Representing |
|---------------------|------------------------|---------------------------|
| Construction Site | £700,000 | 8.5% of tender price |
| Creamery | £975,336 | 1.4% of operating costs |
| Transport Company | £195,712 | 37% of profits |
| Oil Platform | £3,763,684 | 14.2% of potential output |
| Hospital | £397,140 | 5% of running costs |



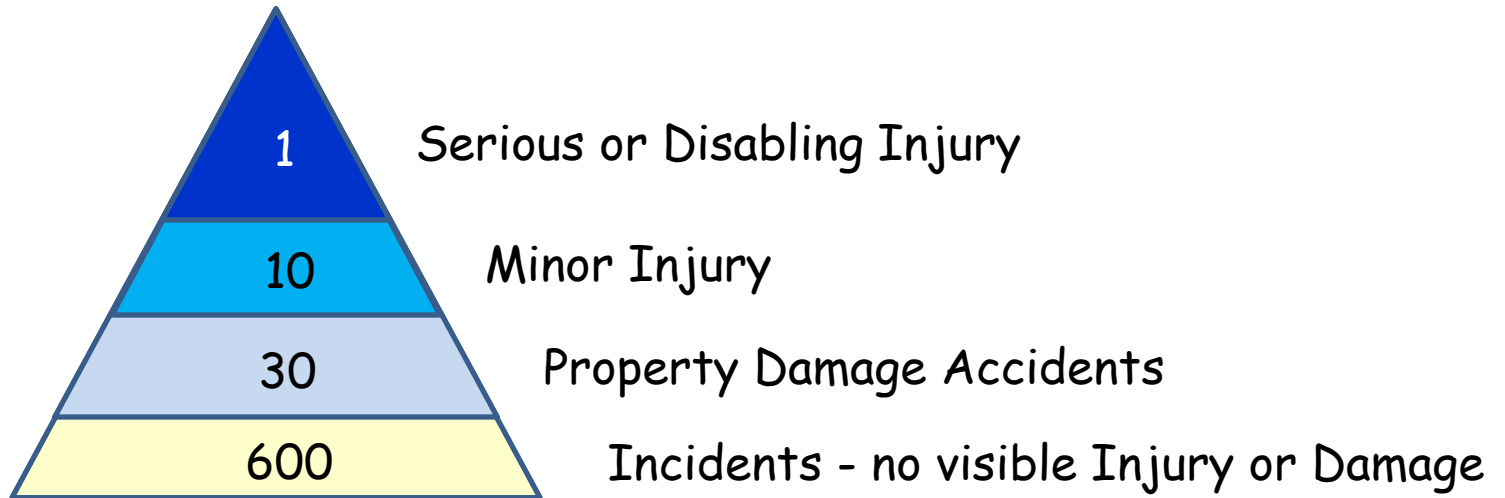
The Foundation of a Major Injury

- 00.3% of all accidents produce major injuries
- 08.8% of all accidents produce minor injuries
- 90.9% of all accidents produce no injuries

ACCIDENT RATIO APPROACH



Heinrich, 1950



Bird, 1969

ACCIDENT RATIO APPROACH



Tye/Pearson 1974/5

CONCLUSIONS

- It is often a matter of chance that near misses are not more serious
- All these events show a failure of control
- Near misses offer preventative opportunities

An understanding of accidents and how they happen can contribute to effective prevention

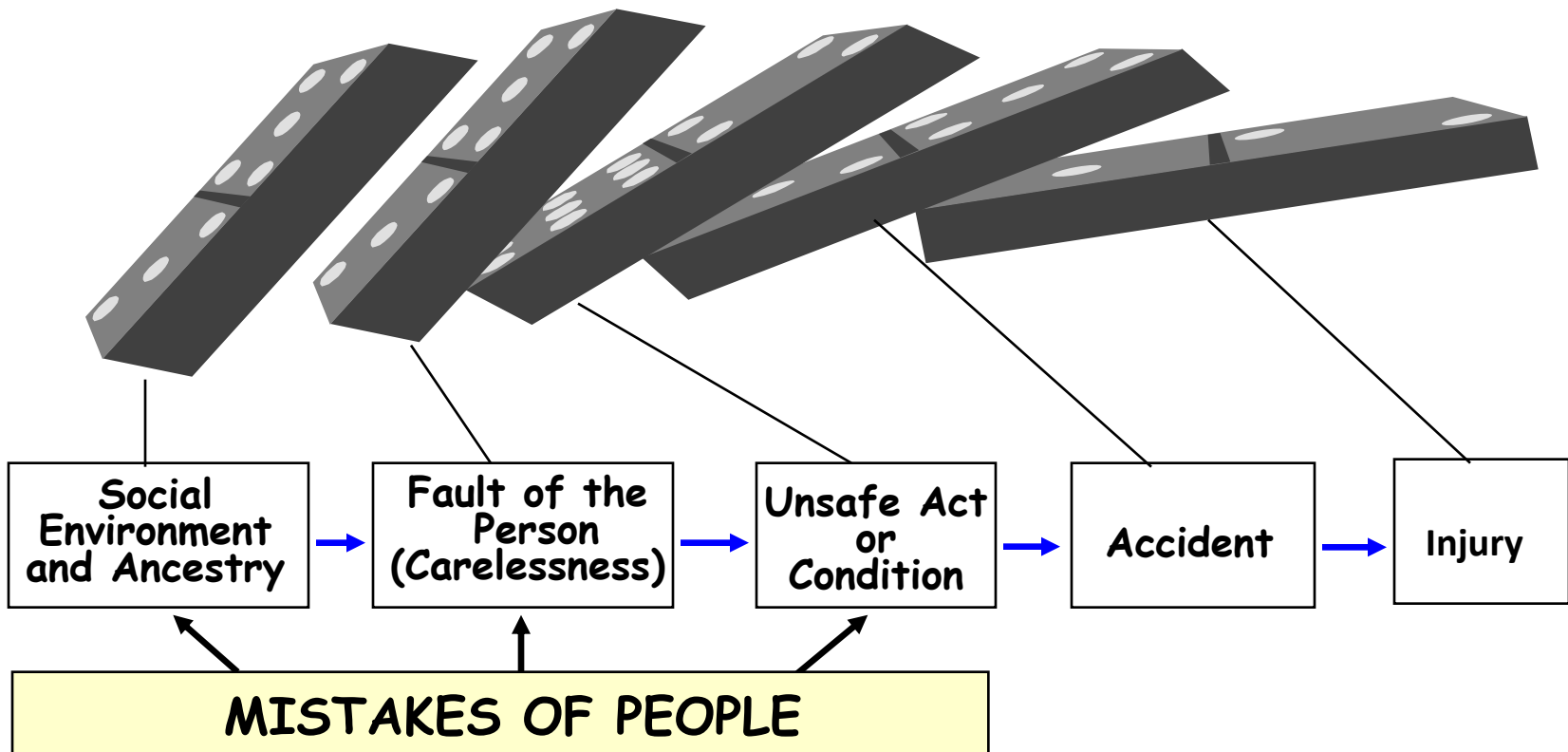
There are many theories including:-

Domino Theory (and modifications)
Human Factors Theory
Peterson's Accident/Incident Theory
Epidemiological Theory
Systems Theory Model
Swiss Cheese Model of Loss
Combination Model

Domino Theory

1932 First Scientific Approach to
Accident/Prevention - H.W. Heinrich

“Industrial Accident Prevention”



Heinrich's Theory

- Corrective Action Sequence
(The three "E"s)

Engineering
Education
Enforcement

INITIAL DOMINO THEORY

Too much emphasis on individual blame

Doesn't deal with organisational and managerial failure

Looks for a single cause where more than one may be present

REFINED DOMINO THEORY

More emphasis on management failure which, accounts for as much as 75% of accidents

Little emphasis on individual failure

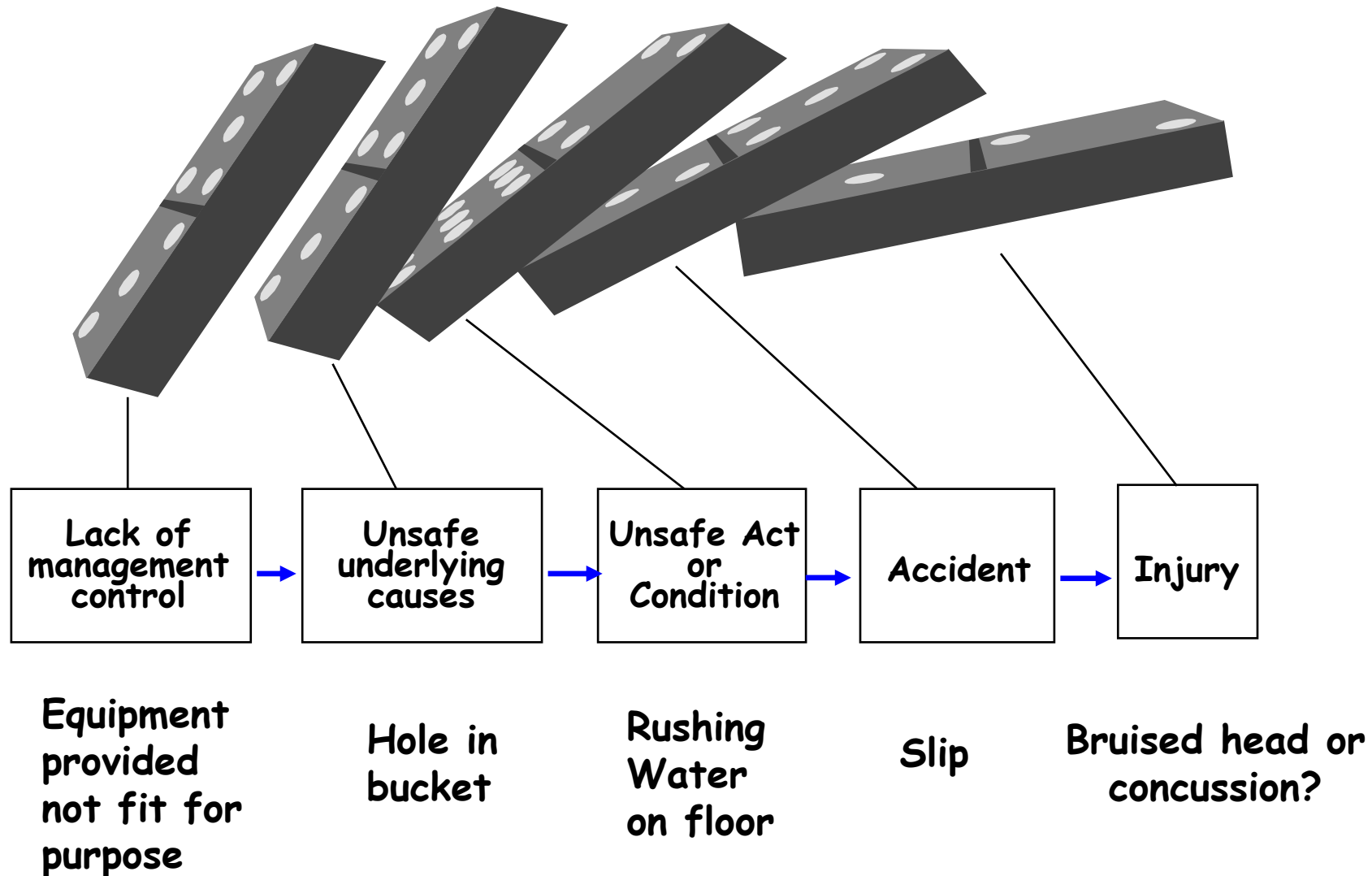
Still a single causation approach

A typical accident



- A cleaner has a hole in his bucket.
- As a result he spills water onto the floor.
- An second employee is rushing and fails to spot the water.
- As a result he slips and bangs his head on the floor.

Refined Domino Theory



Human Factors Theory

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graph TD; A[Human Factors Theory] --> B[Overload]; A --> C[Inappropriate Response]; A --> D[Inappropriate Activities];
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Overload

- Environmental Factors (noise, distractions)
- Internal Factors (personal problems, emotional stress)
- Situational Factors (unclear instructions, risk level)

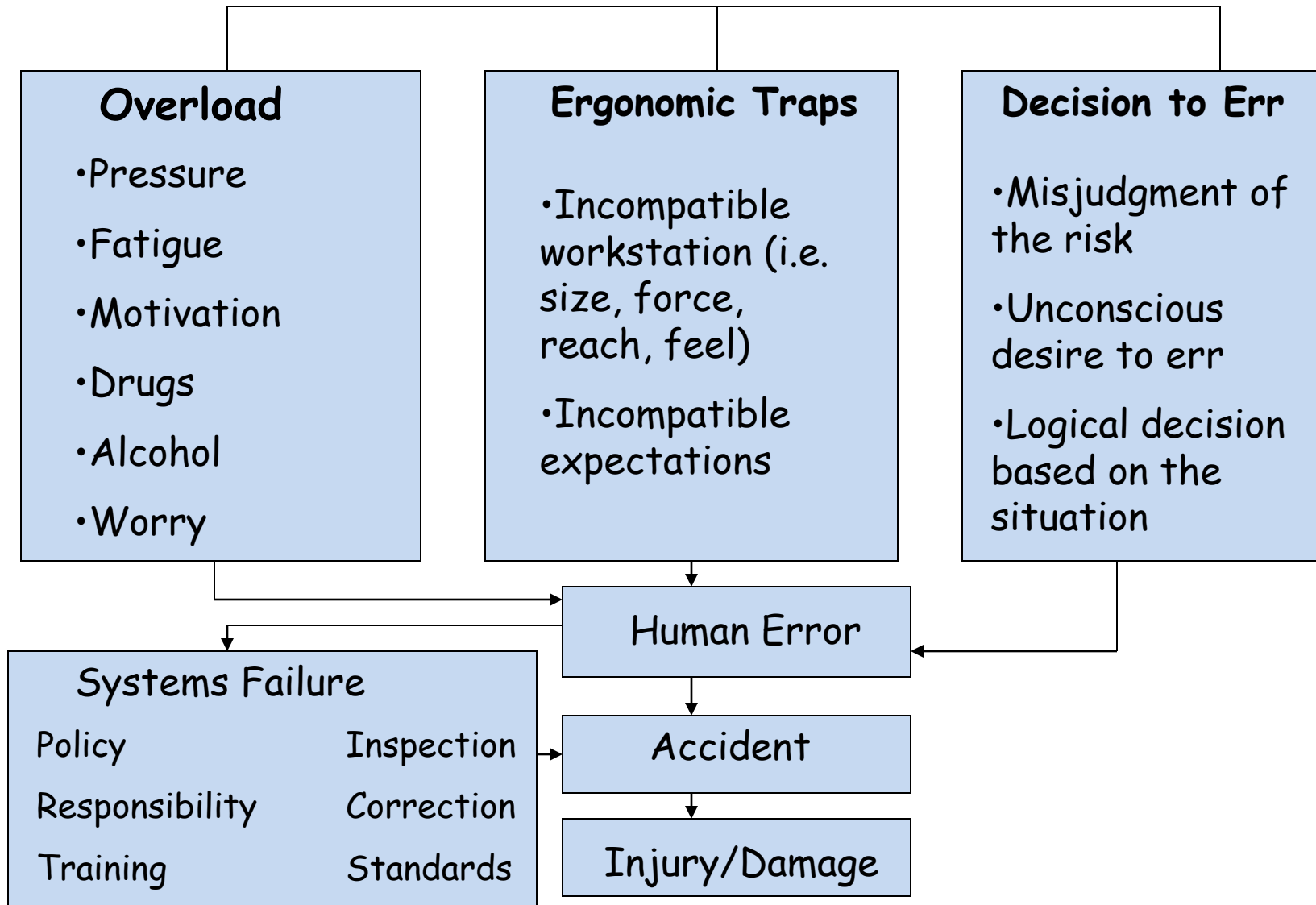
Inappropriate Response

- Detecting a hazard but not correcting it
- Removing safeguards from machines and equipment
- Ignoring safety

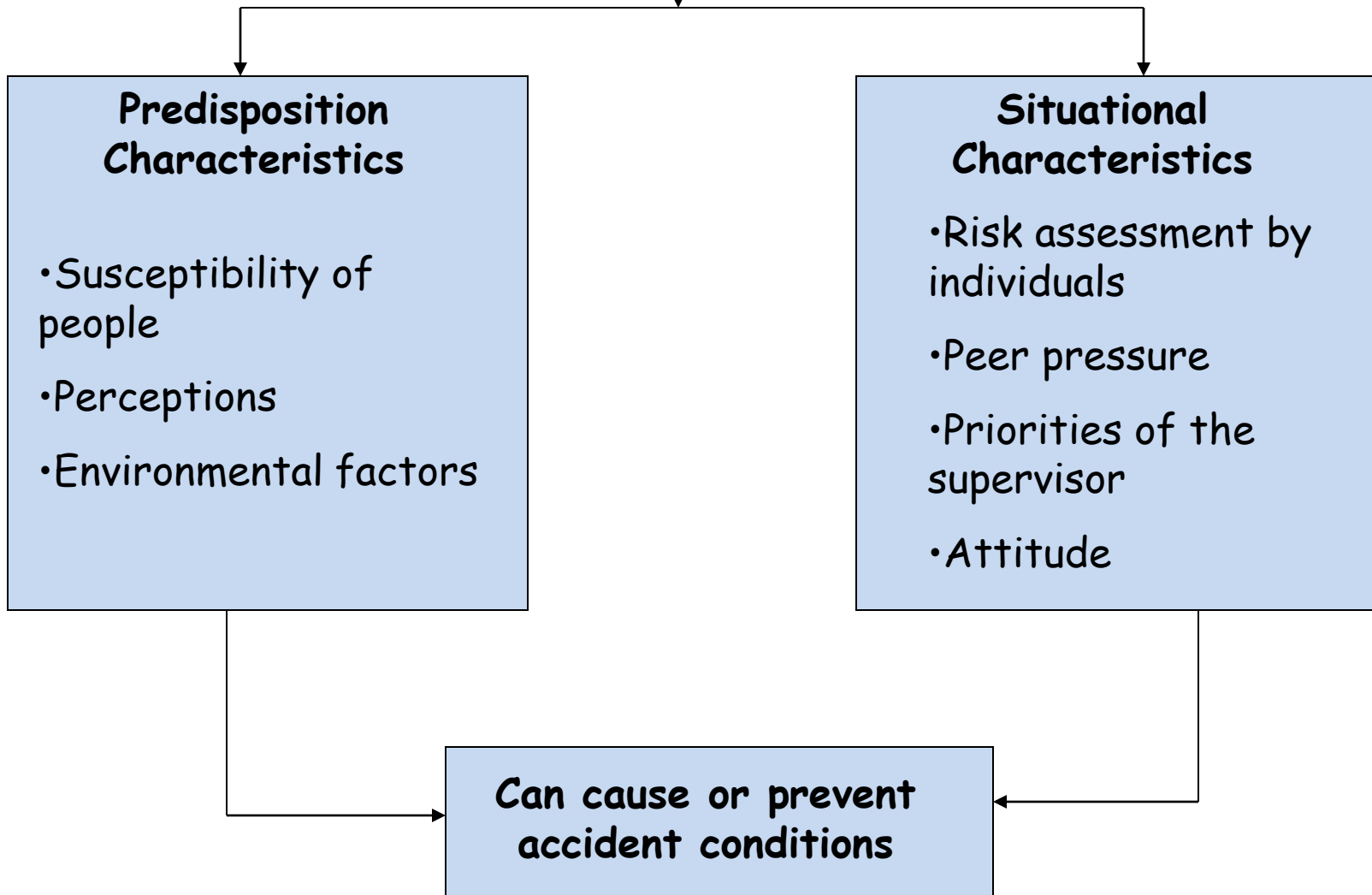
Inappropriate Activities

- Performing tasks without the requisite training
- Misjudging the degree of risk involved with a given task

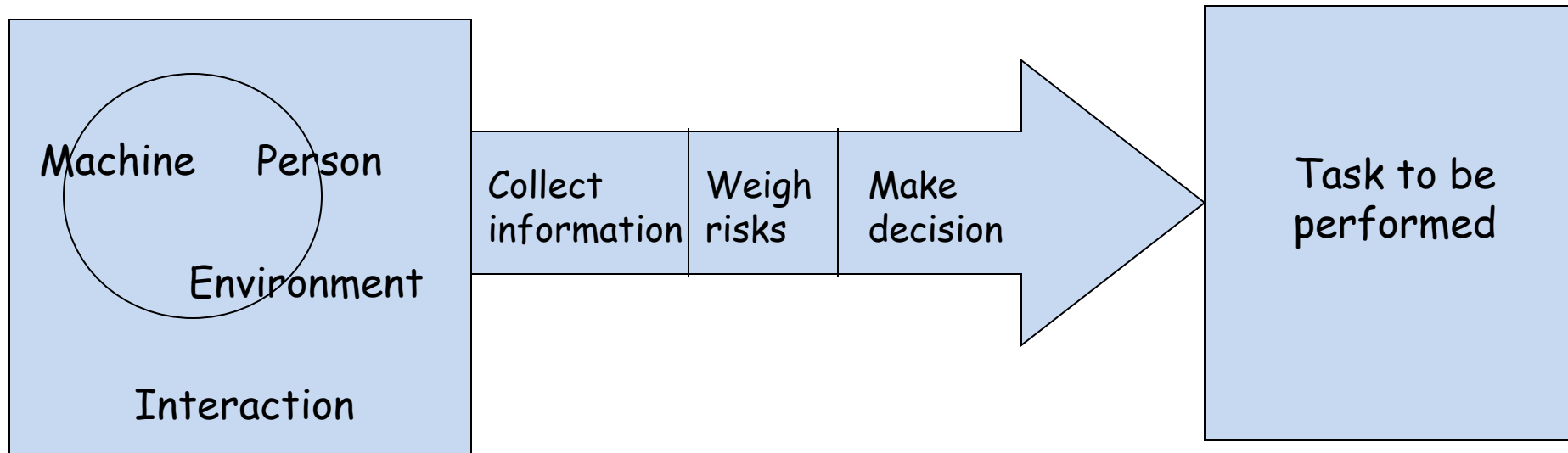
Petersen's Accident/Incident Theory

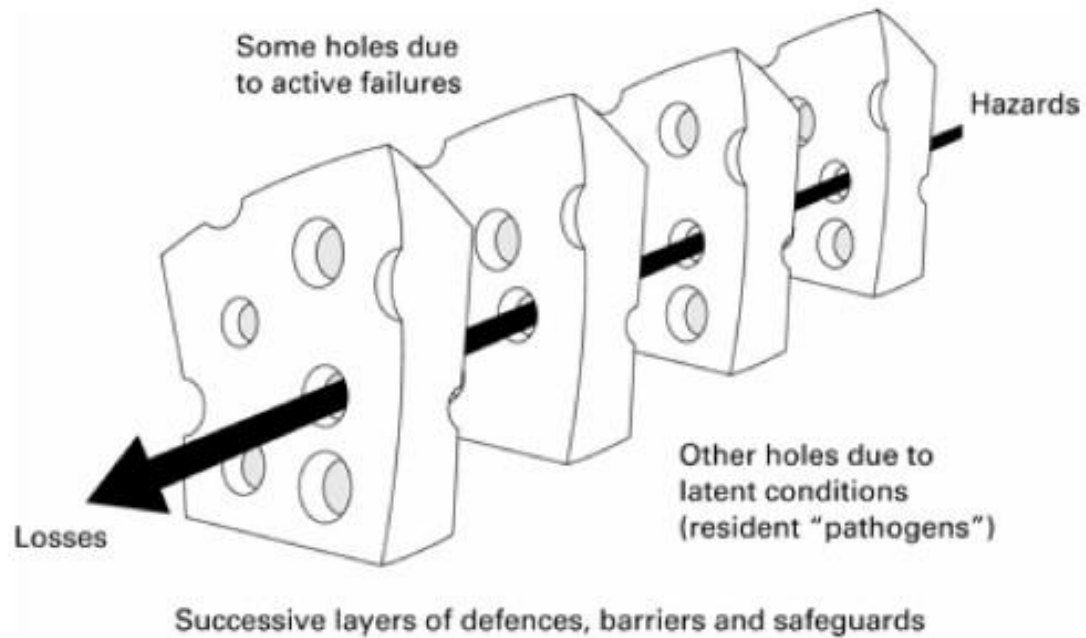


Epidemiological Theory



Systems Theory Model





Swiss cheese model of losses (Reason, 1990 -2001)

A Day in Your Life

You have an important decision meeting in central.

Your spouse has already left for work taking the kids to school on the way. Unfortunately he/she left the glass coffee pot on a lit burner and it cracked.

You desperately need coffee in the morning so you rummage around for an old drip coffee pot.

You pace back and forth waiting for the water to boil and after a quick cup you dash out the door.

You get to your car only to realize that you left your car and apartment keys inside the house.

That's okay. You keep a spare house key hidden outside for just such emergencies.



Not a Good Day



Then you remember that you gave your spare key to a friend. *(failed redundant pathway)*

There's always the neighbour's car. He doesn't drive much. You ask to borrow his car. He says his generator went out a week earlier. *(failed backup system)*

Well, there is always the bus. But, the neighbour informs you that the bus drivers are on strike. *(unavailable work around)*

You call a cab but none can be had because of the bus strike. *(tightly coupled events)*

You give up and call in saying you can't make the meeting.

Your input is not effectively argued by your representative and the wrong decision is made.

A Quiz

What was the primary cause of this mission failure?

1. Human error (*leaving heat under the pot or forgetting the keys*)
2. Mechanical failure (*neighbor's car generator*)
3. The environment (*bus strike and taxi overload*)
4. Design of the system (*a door that allows you to lock yourself out or lack of taxi surge capability*)
5. Procedures used (*warming coffee in a glass pot; allowing only normal time to leave the house*)
6. Schedule expectations (*meeting at set time and place*)

What is the correct answer?

The Answer

All of the above



Life is a complex system. Accidents can have complex causes.

Combination Theory

- For some accidents, a given model may be very accurate, for others less so
- Often the cause of an accident cannot be adequately explained by just one model/theory
- Actual cause may combine parts of several different models

Accidents /Incidents

-individual

- knowledge
- skills
- training
- experience
- personality
- attitude
- risk perception

- job

- task
- workload
- equipment
- controls
- procedures
- environment

- organisation

- culture
- leadership
- resources
- work patterns
- communications

Common Unhelpful Comments?

- accidents just happen it's an Act of God - "force majeure", just in the wrong place at the wrong time (implying - we can't do anything about them)
- we don't have many accidents (implying - it won't happen to us)
- safety is expensive (we cant afford it)
- the insurance will pay
- safety is just common sense

So what does this mean for us?

We need to learn from incidents and accidents
Safety Office website - Safety Matters

Don't wait for accidents to happen - be proactive - look for where your department is most vulnerable. Solicit views from all staff.

Ensure all available control measures are used

- safety procedures/work instructions
- adequate training
- effective communications
- good housekeeping
- guards/safety devices/warning signs adequate
- working environment
- regular safety inspections
- risk assessment

Organisations don't always learn from accidents



"UK firm fined (January 2011) after three men fell through skylights in the same industrial unit on three separate occasions in less than a month"

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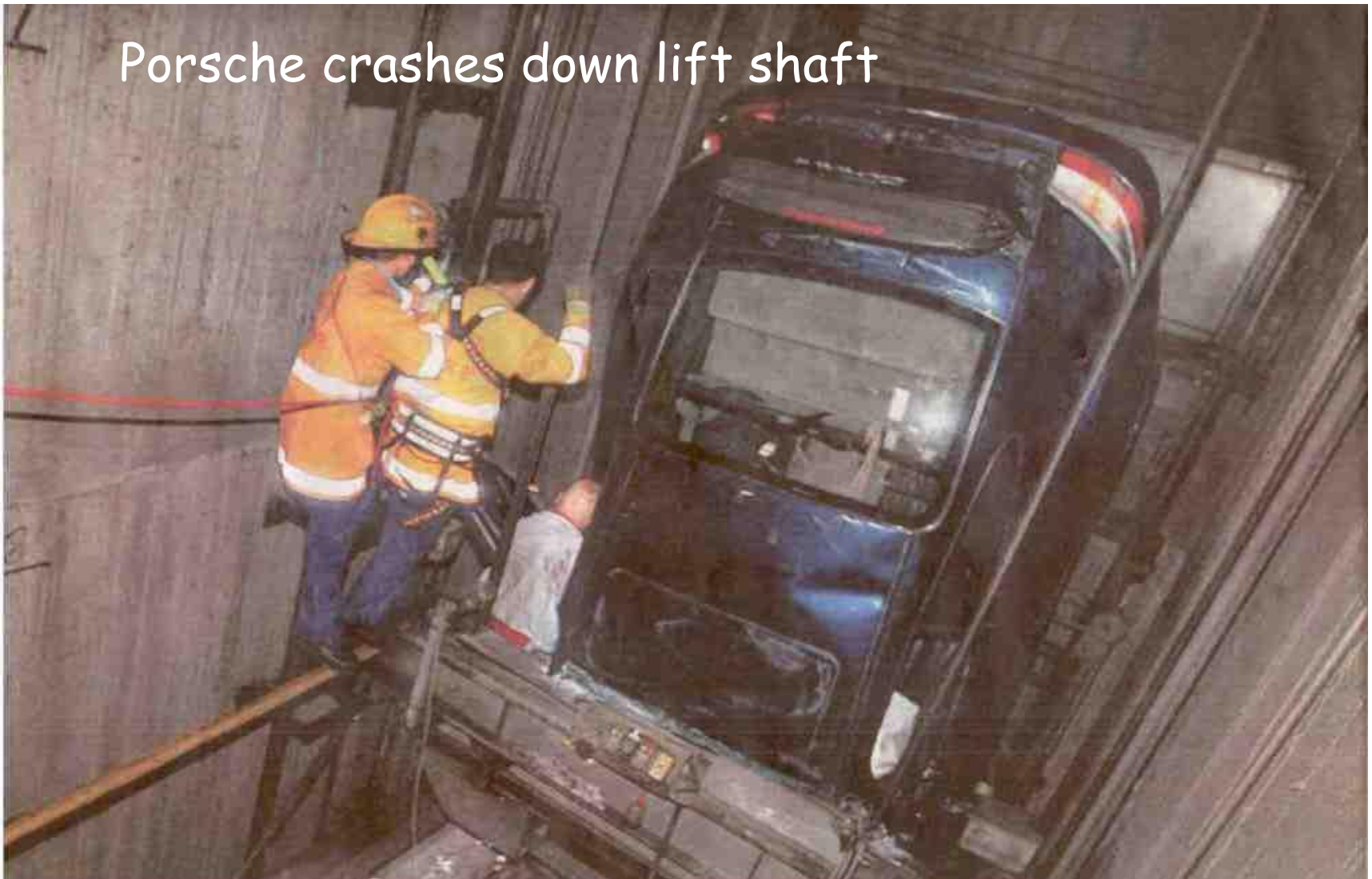
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Porsche crashes down lift shaft



Even very unlikely accidents can happen - can all contingencies be planned for? Probably not. Accident statistics point to where most effort needs to be focused - i.e. where to deploy effort/time and finances. Risk assessment also informs priorities.