MODULE 4 :

Event Analysis

2025

ISIC-GSCP
Group of Chemical and Physical Safety

Source: https://fiches-pratiques.chefdentreprise.com/Thematique/gestion-personnel-1099

Introduction: Rumor and facts

What is frequently heard after an accident …

Introduction: What led to the accident?

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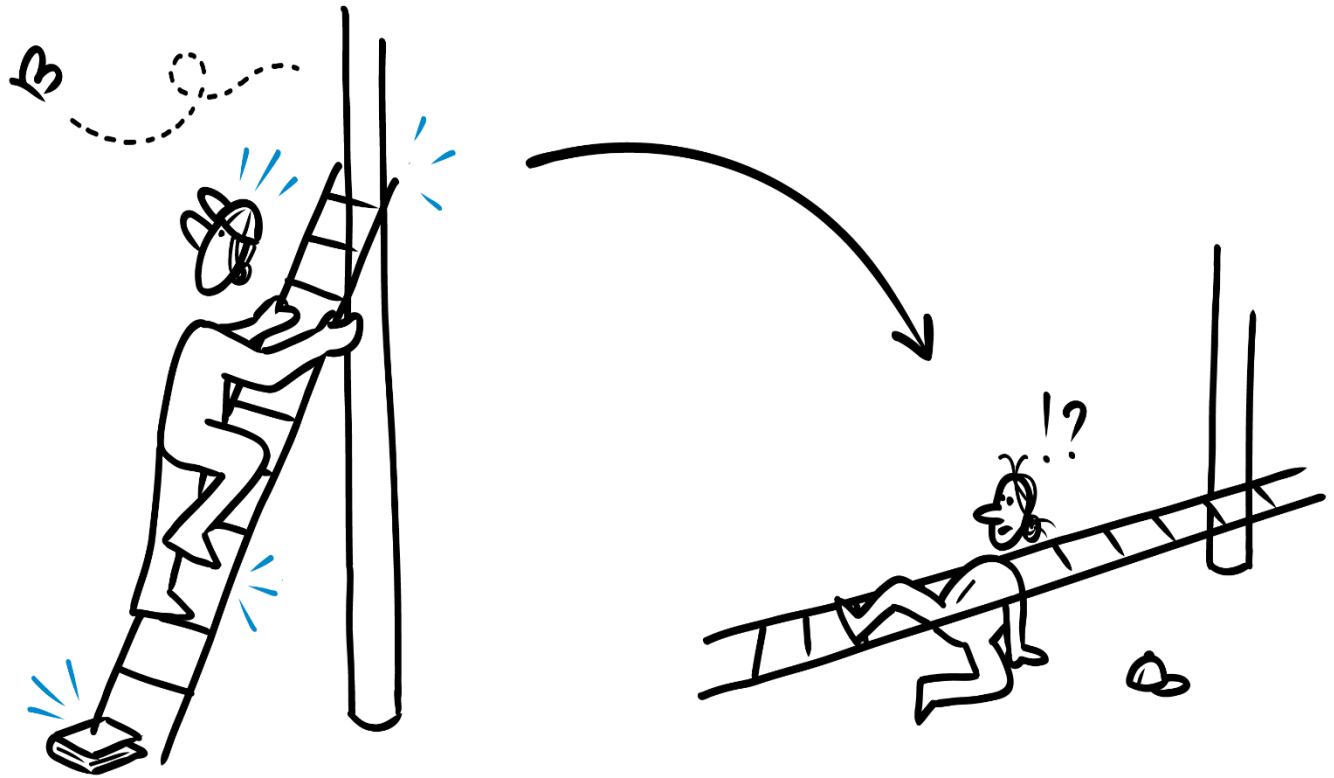
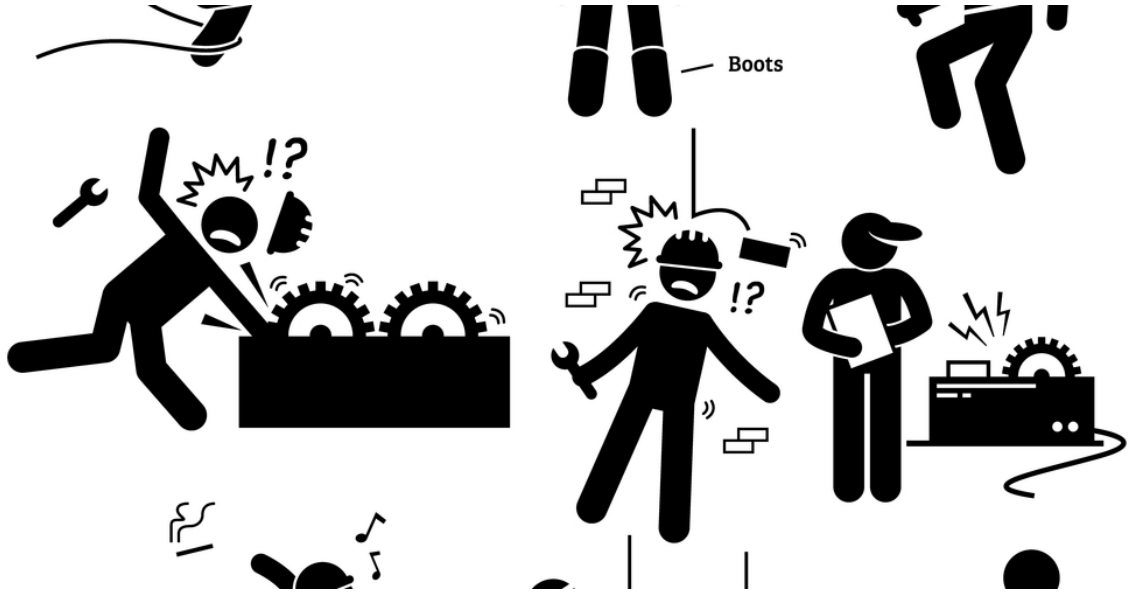


Crédit: Marion Delannoy

Introduction: Why should accidents be analyzed?



Source: https://www.alterpresse68.info/2019/09/18/

- To comprehend through an analysis of the objective causes.
- To avert future recurrences.
- To identify measures that enhance safety.
- To respond by implementing suitable solutions.
- To facilitate communication and resolve any disputes.
- To save costs for businesses.
- To meet regulations.

Introduction: Analysis example

Process safety moment: Lessons from past incidents - Herald of Free Enterprise - 1987

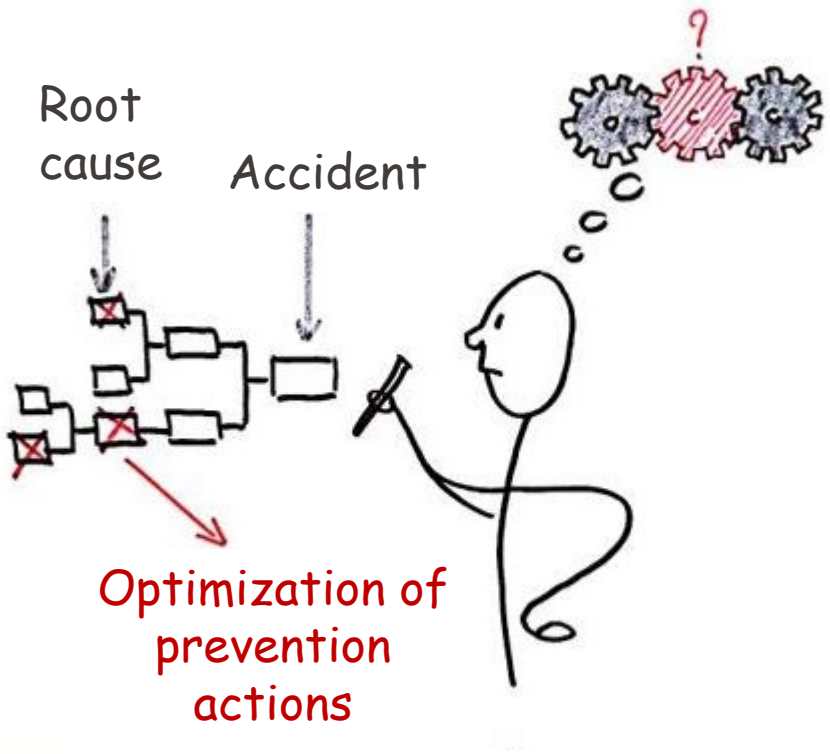
Time 8`00``

Picture credit: MV Herald of Free Enterprise. Report of Court No. 8074 - Formal Investigation, July 29th 1987", Department of Transport (UK),

Introduction: Accident analysis

- Seek solutions, not blame or responsibilities.
- Accidents result from a combination of multiple factors.
- Focus on facts, excluding judgments or interpretations.
- Analysis becomes valuable when it drives solutions.
- Accident analysis is a collaborative effort

Introduction: Causal tree analysis



- Causal Tree Analysis is a Root Cause Analysis technique used for event analysis.
- This method is primarily reactive rather than proactive.
- The accident analysis method using the causal tree, developed by the INRS (Institut National de Recherche et de Sécurité, France), is built upon the foundation laid by the European Coal and Steel Community and was initially tested in the 1970s in the iron mines of Lorraine.
- While the method shares similarities with Fault Tree Analysis (FTA), FTA centers on identifying failures (technical, process), whereas causal tree analysis primarily explores the causes of accidents.

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Causal tree analysis: 4 main steps

I. Search for facts

- Free from judgment or interpretation,
- Handling each fact individually,
- Each fact must be quantifiable and/or visually documented

II. Construct the tree structure

- Begin with the most recent fact,
- Pose the following three inquiries:
  1. What immediate cause triggered this fact?
  2. Was this cause really necessary for this fact to occur?
  3. Was this cause sufficient to prompt the event?

III. Seek solutions

- Initiate with the initial fact,
- Explore measures for every fact,
- Welcome all ideas

IV. Define solutions/measures

- Prioritize efficiency,
- Select measures that avoid displacing or creating new risks,
- Specify straightforward and sustainable solutions,
- Ensure compliance with laws and regulations.

Causal tree analysis: Collecting facts

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- A fact is an actual action or event that occurred !
- **From**: a set of pertinent circumstances and additional details.
- Compile a **fact list**: directly tied to the accident, confirmed by team members.
- **Objectives:** enable identification and establishment of the factors leading to an event.
- **Requirements**: an immediate report post-accident, with all team members present at the scene.
- **Qualifications**: curious, meticulous, precise and accurate in word choice.
- Rules to follow:

  - No judgment
  - Avoid evaluation,
  - Identify facts exclusively
  - Document one discrete fact at a time,
  - Facts are quantifiable and/or visually verifiable, put simply
  - Describe the facts
  - The facts must be unambiguous
  - Avoid mentioning feelings unless they are spontaneously expressed by the injured person
  - Do not use adjectives (beautiful, dangerous, much, little, etc..)

Causal tree analysis: Collecting facts – example (1)

Car body repairer John Bely arrives at the garage via Geneva Street. In the yard, a worker vigorously gesticulates and shouts in German while looking skyward. Subsequently, he enters the workshop and starts tire replacement on a red car. In close proximity to the entrance, a bearded young man converses warmly with an individual dress in jeans and long hair.

Causal tree analysis: Collecting facts – example (2)

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Proposals	Answers		
	True	False	?
1. John Bely works as a car mechanic			
2. The courtyard has only four individuals			
3. John Bely is located on Geneva Street			
4. The contractor heard a worker shouting			
5. One of John Bely's employees was changing tires			
6. A German worker was present in the courtyard			
7. The worker who was shouting in the courtyard had a conversation with a colleague on an upper floor			
8. He shouted to inform his colleagues about John's arrival			
9. A bearded man and a woman were engaged in a conversation.			

Causal tree analysis: Building the tree (1) - 3 types of connectors

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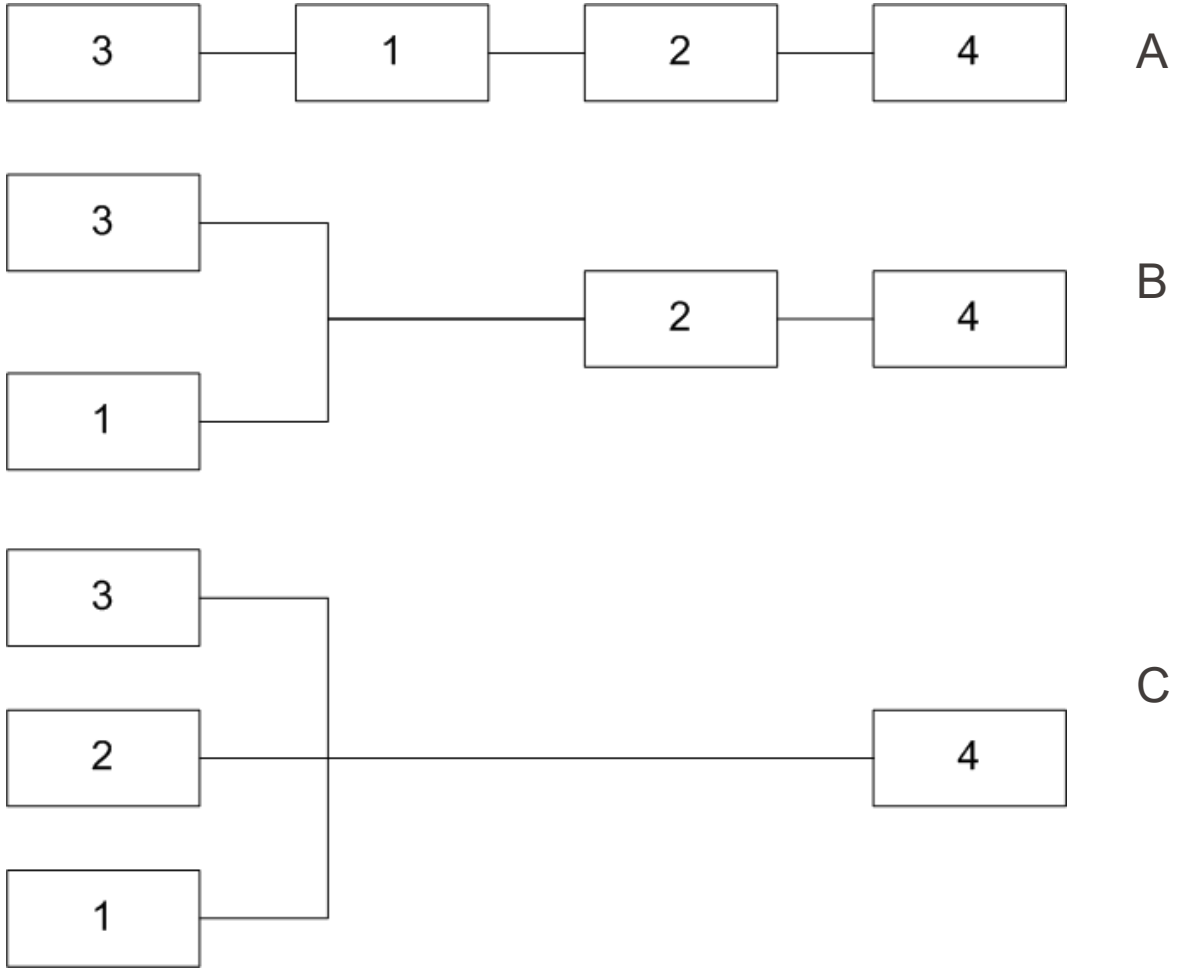
	X	Y
The sequence X was both necessary and sufficient for Y to occur	Slipping	Fall
Disjunction X was both necessary and sufficient for both Y1 and Y2 to take place	Storm	Broken tree branch Phone line torn off
Conjunction Both X1 and X2 were individually necessary for Y to happen, and their combined efforts were required for Y to occur	Slope of the road 10% Used brakes	Cannot stop

Causal tree analysis: Building the tree (1) - Example

4 facts, 3 potential combinations... which one represents the correct solution?

Facts

1. The faucet is left open
2. The bathtub overflows
3. The drain is blocked
4. The bathroom carpet is completely wet



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Causal tree analysis: Selecting Remedial Measures

Source: https://www.design1st.com/5-innovative-flood-prevention-products-replace-sandbags/

The selection of measures is based on the following criteria:

- No risk of displacement.
- Legal and regulatory compliance.
- Effectiveness as a solution.
- Simplicity (high acceptance by individuals).
- Elimination of the root causes of the event

The chosen measures should counteract all factors in the causal tree.

The farther they are from the facts, the more effective they become.

Accident: Is sugar hazardous ?

On February 7, 2008, a huge explosion and fire occurred at the Imperial Sugar refinery northwest of Savannah, Georgia, causing 14 deaths and injuring 38 others, including 14 with serious and life-threatening burns. The explosion was fueled by massive accumulations of combustible sugar dust throughout the packaging building.

Time 7`54``

Source: http://www.csb.gov

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Causal tree analysis: Example A (1)

Not covered in class: for your reference

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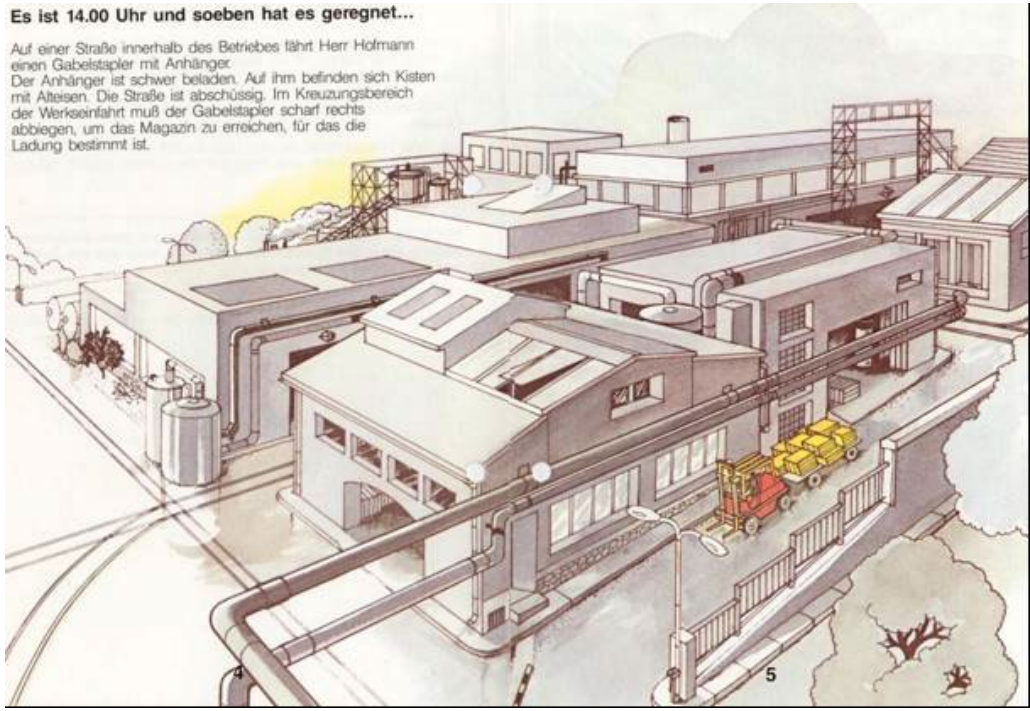
It's 2 PM, and the rain has recently ceased. Mr. Martin is operating a forklift, towing a heavily loaded trailer filled with old materials, along a construction road.

The road has a noticeable slope.

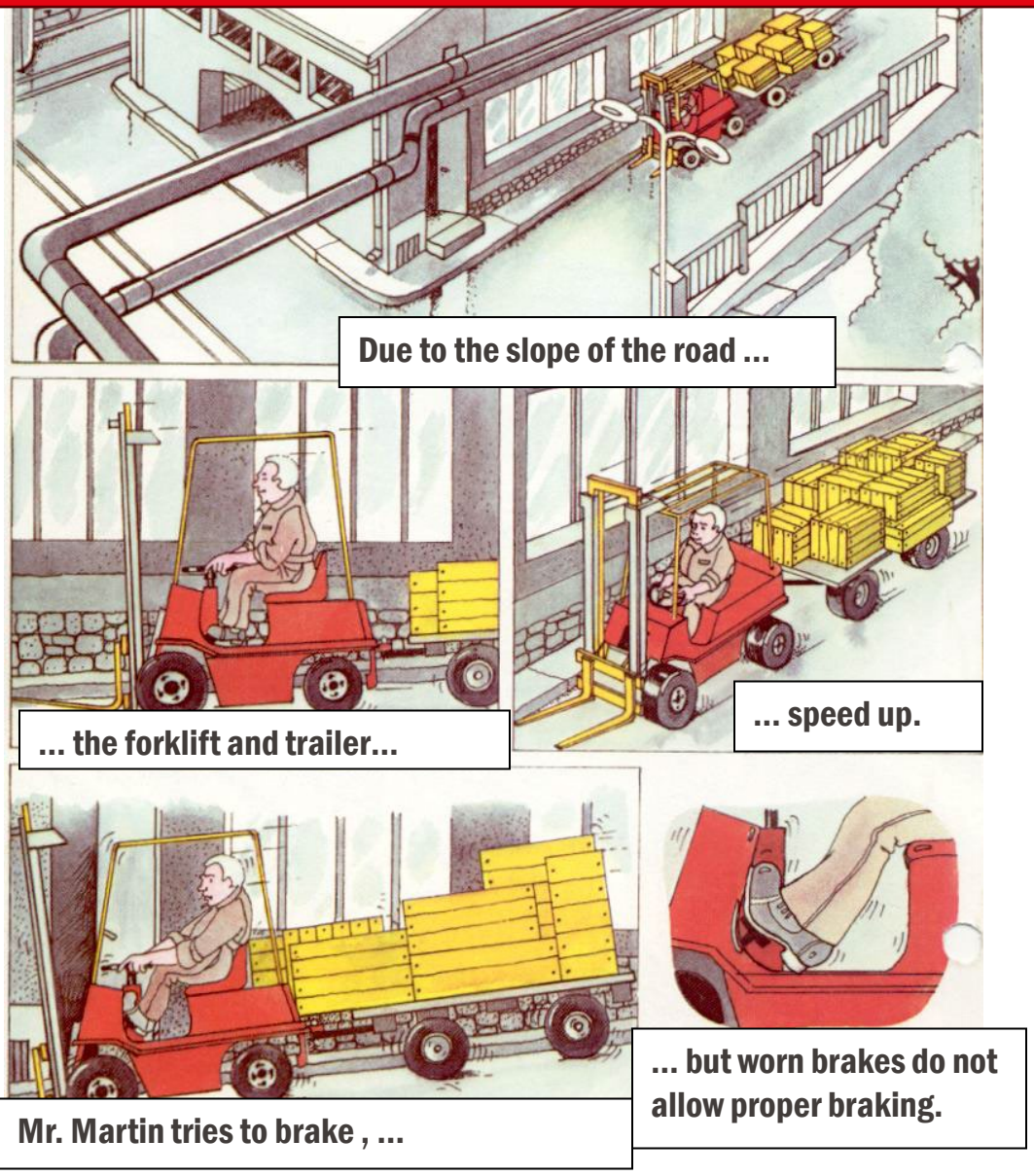
The forklift must make a sharp right turn near the plant entrance to reach the warehouse.



SUVA is acknowledged for the documentation

Causal tree analysis: Example A (2)

Not covered in class: for your reference



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Causal tree analysis: Example A (3)

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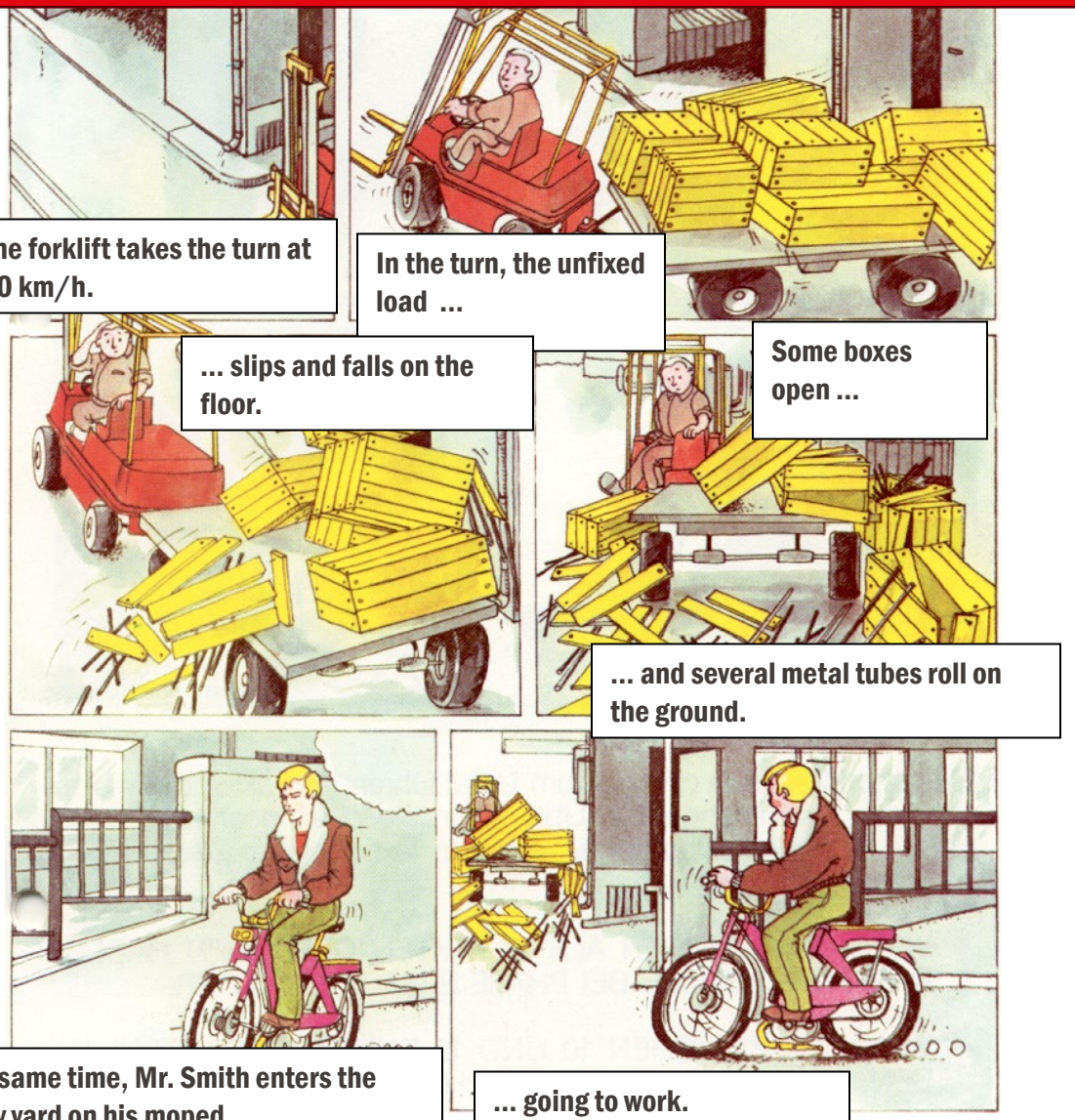
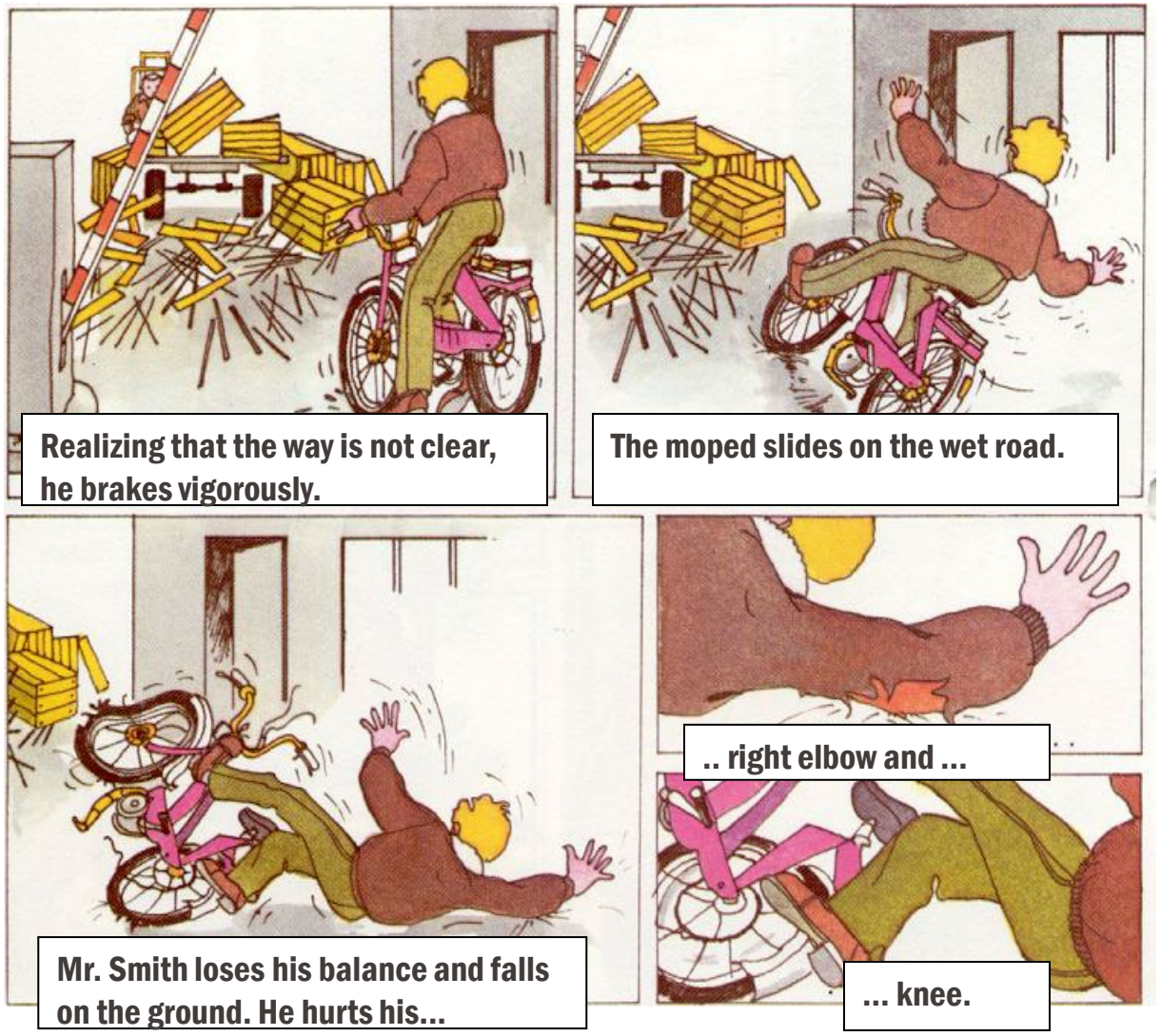
Not covered in class: for your reference



Causal tree analysis: Example A (4)

Not covered in class: for your reference



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Causal tree analysis: Example A (5)

Not covered in class: for your reference

List of facts

Fact	Description	Fact	Description
1	Mr. Smith is hurt at his elbow and knee	11	Mr. Smith goes to work
2	Mr. Smith falls	12	The factory gate is open
3	Mr. Smith loses his balance	13	The load falls from the trailer
4	The moped slips	14	The load is not fastened
5	The road is wet	15	The forklift drives at 20 km/h
6	Mr. Smith brakes vigorously	16	The forklift has to take a tight right turn
7	It had rained	17	The load is heavy
8	The road is cluttered	18	The forklift descends an important slope
9	Mr. Smith enters the factory yard	19	The forklift's brakes are worn
10	The load falls on the floor		

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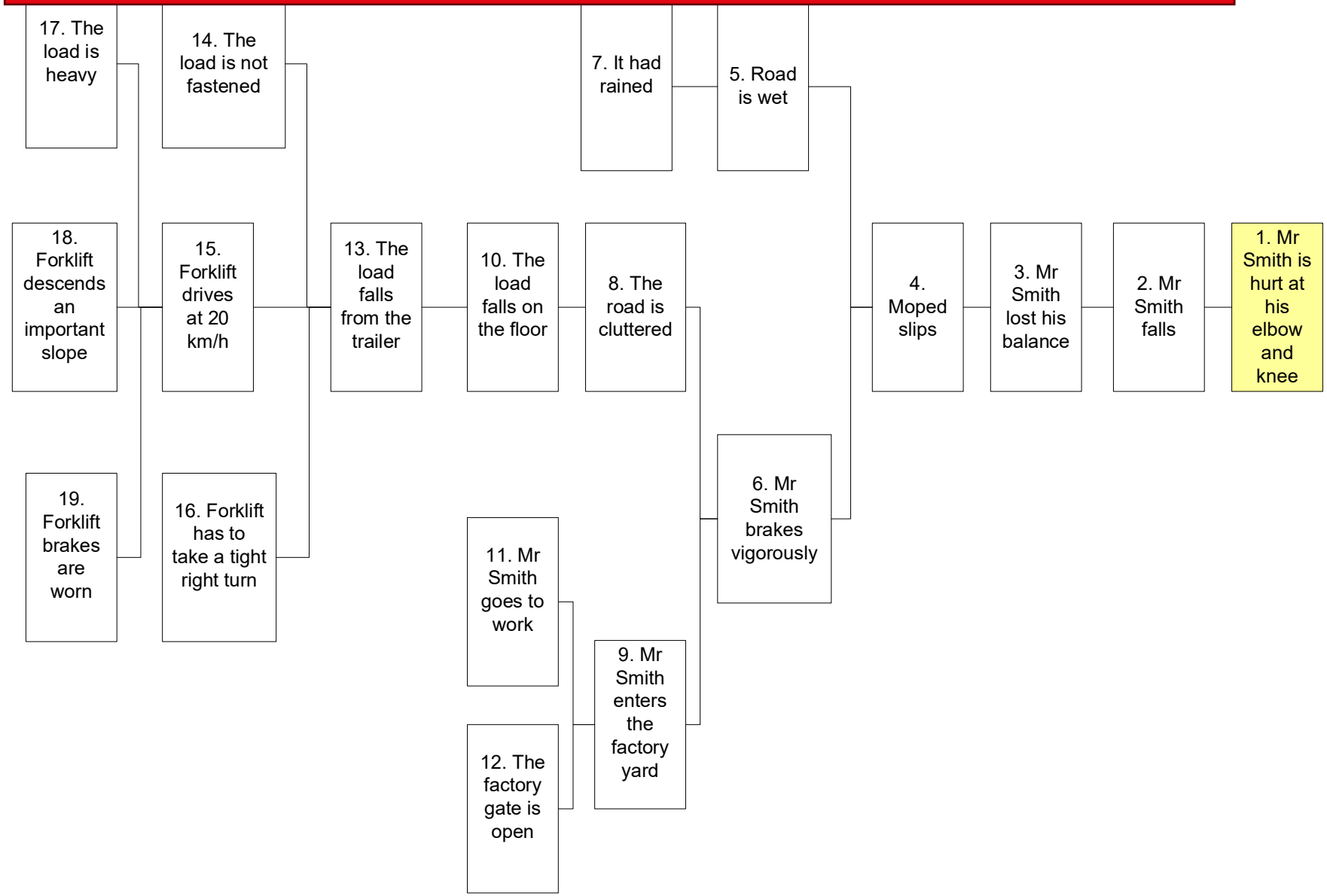
Causal tree analysis: Example A (6)

Not covered in class: for your reference



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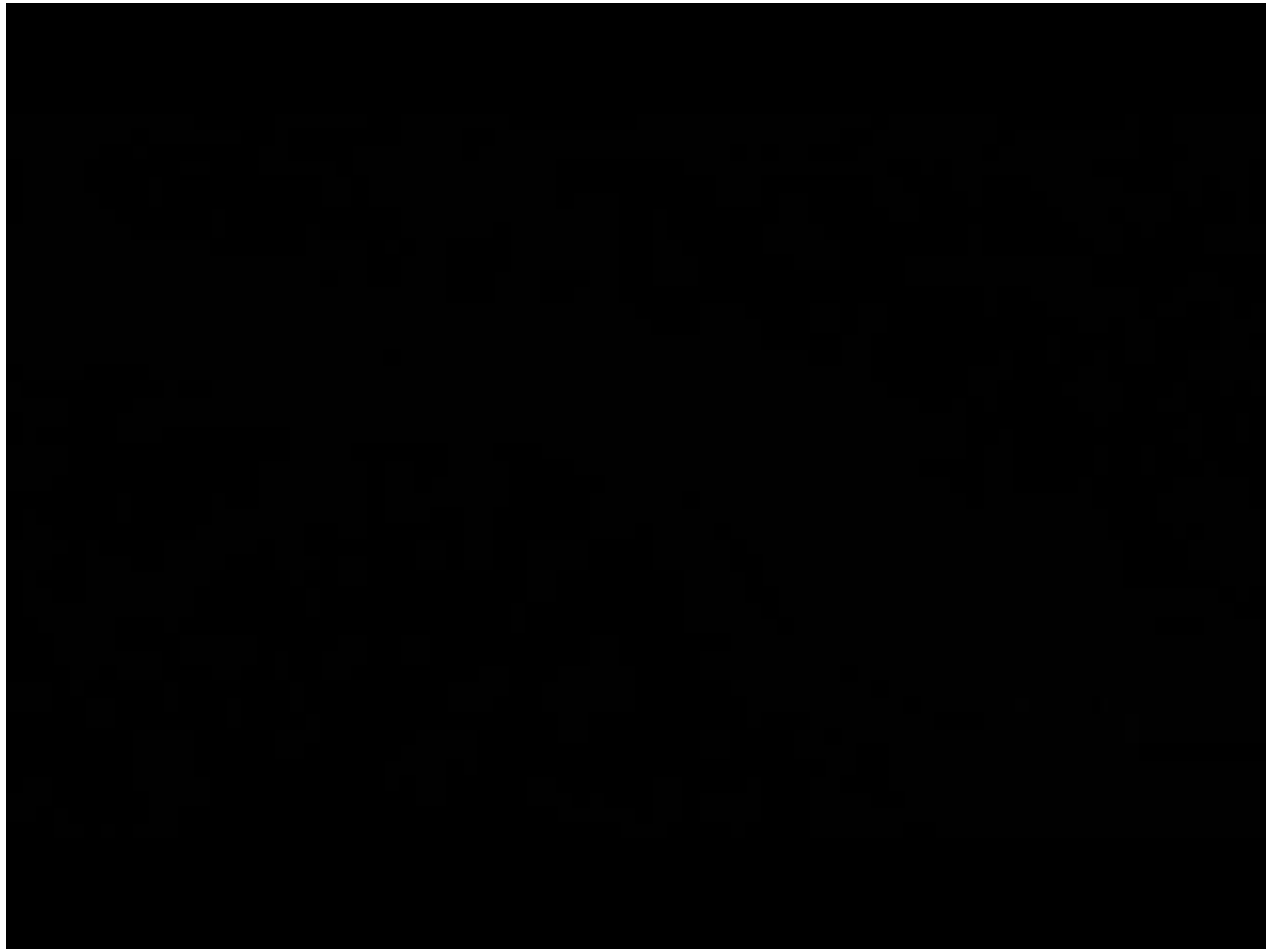
Causal tree analysis: Conclusions

- Reliable method with consistent results.
- Ideal for finding preventive measures and engaging stakeholders.
- Focus on fact-based accident analysis, not blame.
- Identify multiple accident causes and develop solutions.
- Effective for safety training and awareness.

Are we really learning ?

August 28, 2008; Two workers were fatally injured when a waste tank containing the pesticide methomyl violently exploded, damaging a process unit at the Bayer CropScience chemical plant in Institute, West Virginia.



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Source: http://www.csb.gov