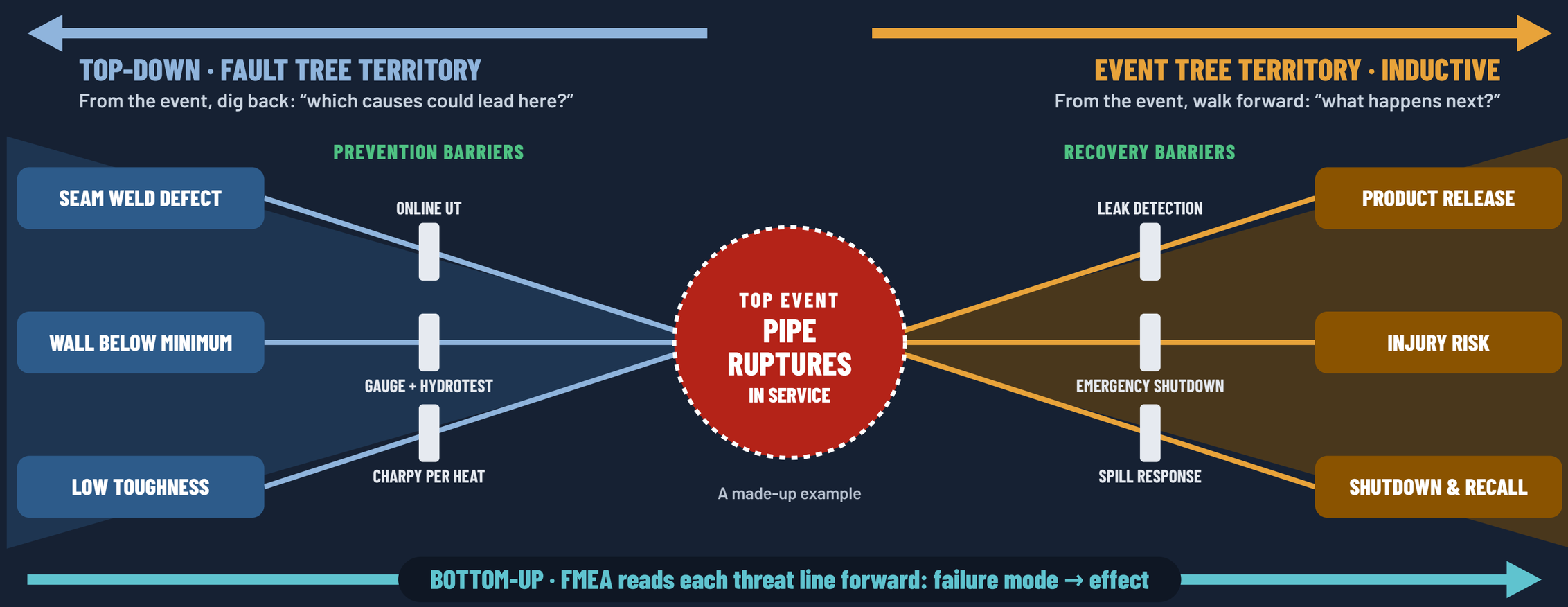
QUICK REFERENCE · RISK ASSESSMENT · CQE · CSSBB · CMBB

ONE EVENT. TWO DIRECTIONS.

Every risk tool either digs **down** from a bad outcome to its causes, or walks **up** from each part to its effects. The bow-tie shows both on one page.

↓ DOWN
↑ UP
WHICH WAY ARE YOU DIGGING?



2 DIRECTIONS
Top-down (deductive) and bottom-up (inductive). Middle-out tools do both.

7 HAZOP GUIDE WORDS
No · More · Less · As well as · Part of · Reverse · Other than

4 QUESTIONS PER DEVIATION
Causes? Consequences? Safeguards? Action needed?

3 STEPS OF RISK ASSESSMENT
ISO 31000: identify, analyze, evaluate. Then treat.

1 TOP EVENT PER FAULT TREE
FTA and bow-tie start from one defined bad outcome.

THE 9 TOOLS + HAZAN

colour = direction · chip = proactive or reactive

TOP-DOWN
FAULT TREE (FTA)
One top event → AND / OR gates → basic causes.
PROACTIVE · REACTIVE

TOP-DOWN
5-WHY · FISHBONE
From the defect you saw back to the root cause.
REACTIVE

MIDDLE-OUT
BOW-TIE
Causes and barriers ← event → consequences and barriers.
PROACTIVE

MIDDLE-OUT
HAZOP
Guide word + parameter = deviation. Back to causes, forward to effects.
PROACTIVE

BOTTOM-UP
FMEA / FMECA
Every failure mode of every step → effect → customer.
PROACTIVE

BOTTOM-UP
HACCP
Hazards step by step, then critical control points.
PROACTIVE

BOTTOM-UP
PHA
Early scan of hazards for each part of a new system.
PROACTIVE

BOTTOM-UP
HAZID
Broad first scan of a layout or concept, and how systems interact.
PROACTIVE

BOTTOM-UP
WHAT-IF / SWIFT
Structured "What if…?" prompts at each step.
PROACTIVE

THEN SIZE IT · MOSTLY TOP-DOWN
HAZAN
Hazard analysis: put numbers on the big hazards and compare with your criteria.
PROACTIVE

BEFORE OR AFTER?

PROACTIVE
Before anything fails.
FMEA · HACCP · PHA · HAZID · SWIFT · HAZOP · BOW-TIE · FTA DESIGN · HAZAN

REACTIVE
After it fails.
5-WHY · FISHBONE · FTA INVESTIGATION · CAPA / 8D

Exam trap: direction ≠ timing. FTA is top-down but is often run at the design stage.

HAZOP IN ONE LOOK

guide word + parameter = deviation

NO No flow	**MORE** Higher flow	**LESS** Lower flow	**AS WELL AS** + contaminant
PART OF Part of the mix	**REVERSE** Backflow	**OTHER THAN** Wrong material	**STEEL FIT** Caster cooling water

HAZID layout → HAZOP P&ID → HAZAN size it

ISO 31000:2018

where the tools plug in

1 · IDENTIFY	HAZID · HAZOP · SWIFT · PHA · FMEA failure modes
2 · ANALYZE	HAZAN · FTA · bow-tie · FMEA S/O/D ratings
3 · EVALUATE	HAZAN · risk matrix · RPN / AP vs criteria
4 · TREAT	FMEA actions · bow-tie barriers · HACCP CCPs
REVIEW	RCA + CAPA feed back. IEC 31010 lists all these techniques.

EXAM TIPS

1. **Known failure? Top-down. Blank page? Bottom-up.**
2. **FTA** is deductive (AND / OR gates). **Event tree** is inductive.
3. **Bow-tie** = fault tree (left) + event tree (right).
4. FMEA's weak spot: **combination failures**. Pair it with FTA.
5. **HAZOP** is filed both ways in the literature: it works out from the deviation.
6. **Use both:** PFMEA across the line + a fault tree for "pipe ruptures".
7. **HAZOP identifies, HAZAN assesses** (Kletz). HAZID comes first.

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