Zurich Hazard Analysis (ZHA)
Introducing ZHA

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Zurich North America - Risk Engineering

Introducing ZHA

Objectives

After this introduction, you will:

- Know the essence of the Zurich Hazard Analysis (ZHA) Methodology
- Have an overview of which customers already use ZHA
- Appreciate the broad applicability of ZHA
- Have recognized a selection of ZHA proof points
- Know with which standardization organization ZHA does comply
- When to perform a ZHA
- Know the 7 step process of ZHA
- Know the success factors of ZHA (and its derivate, TRP)
- Know how to get ZHA
- Know the answer to some frequently asked questions around ZHA
- Have some additional insight into ZHA

What is a ‘hazard’?

Definition used by Zurich

- Hazard = an unassessed loss potential
- represents a potential threat to people, property, to the environment or business profitability, a source of danger
- represents a known characteristic, inherent property, condition or even intended action
- vulnerability or exposure
- can be continuous, repeating or cyclical in nature

What is a ‘risk’?

The risk equation used by Zurich

Risk = An assessed loss potential

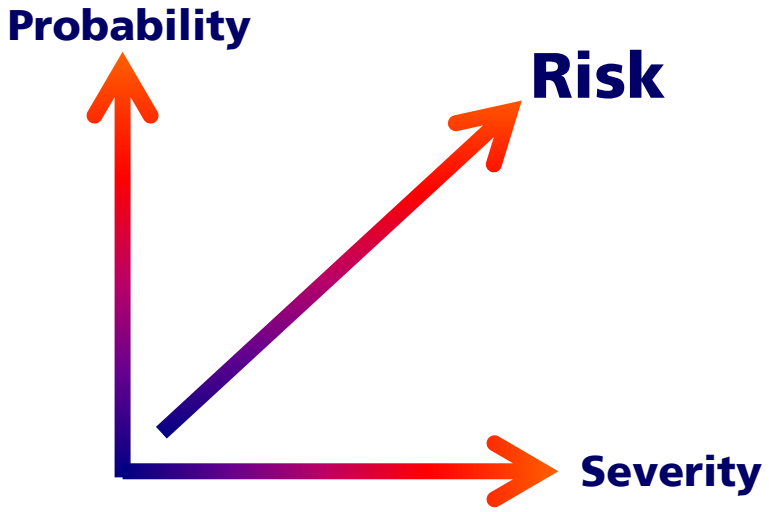
Perfect world: R = P*S

Real world: R = f (P, S)

R = Assessed loss potential or risk

P = Probability of occurrence

S = Severity of the effect



The Risk (R) is a function of Severity (S) and Probability (P)

Zurich Hazard Analysis

To manage your risks, you must first know your risks

- ZHA is a powerful method for identifying risk
- Successfully applied since 1985 in various industries
- Applications: design, plant operations, business continuity, Capital Expenditure (CapEx) projects, product liability, property protection, employee safety, transportation…and more
- ZHA has surprised many customers by revealing catastrophic risks that had gone undetected for years
- Team approach using your experts and conducted at your location
- Focuses the risk improvement actions directly on the cause
- Approved by OSHA and EPA. In line with ISO and NFPA standards.

Zurich Hazard Analysis – What is it?

- ZHA is a robust risk analysis methodology that uses a team to analyze the hazards within a particular scope
- Pathways are used to systematically identify hazard scenarios
- Scenarios are rated in terms of severity and probability to determine the level of risk
- Risks are prioritized graphically and improvement actions developed

Zurich Hazard Analysis

Typical Applications

- ZHA is successfully applied since the 1980ies in:
- Heavy and Manufacturing Industry
- Electronics Industry
- Chemical/ Pharmaceutical/Food/Beverage Industry
- Service Industry (Financial, Insurance, Public)

Zurich Hazard Analysis

Typical objects to conduct a ZHA on

- For systematic analysis of potential hazards of new, planned or existing:
  - Business operations and processes
  - Documentation/procedures
  - Manufacturing sites, facilities, systems or machines
  - Product liability

- Not just for safety
  - Business interruption
  - Construction projects
  - Personnel safety
  - Property damage
  - Financial and emergency planning

Zurich Hazard Analysis

Proof Points

Business Interruption

Identified 20-ton machine that could swing into another - cause a plant shutdown & millions in BI.

Safety

Pipes carrying flammable acetone discovered above office that could be ignited by the lighting fixtures.

Operational efficiency

A pharmaceutical company developed 100 low-cost improvements to a new process line.

Property damage

Water reactive chemical found in sprinklered room

Zurich Hazard Analysis

Compliance

Not only will a ZHA help you manage your company's risks, but it will help them satisfy regulatory requirements. For example, customers who run processes that involve hazardous chemicals and combustible dusts must perform a Process Hazard Analysis on every process and review it every 5 years, as per OSHA 's Process Safety Management standard. ZHA is thus a Process Hazard Analysis that satisfies OSHA's requirements. Plus, it helps provide safer, healthier, and more productive workplaces.

Of course, there are also other Process Hazard Analysis techniques that customers can utilize, but ZHA is recognized as being relatively quick and very robust. ZHA also satisfies the requirements of other regulatory agencies, like the EPA, ISO and NFPA that force certain corporations to complete Process Hazard Analysis.

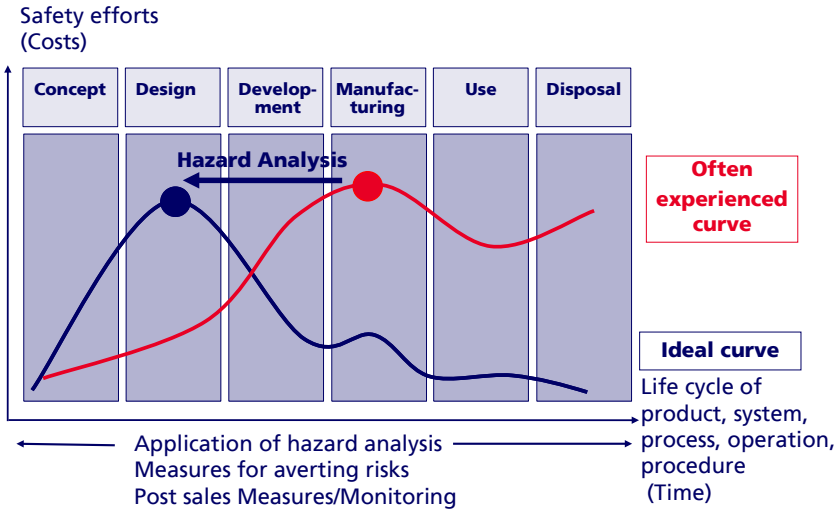
Zurich Hazard Analysis

When to perform

- As required by management or regulators

- Lifecycle events
  - New technologies and equipment
  - Modifications to equipment
  - System level risk assessment (interaction points processes)

- Process stages
  - Concept
  - Design
  - Development
  - Manufacturing
  - Use
  - Disposal



ZHA Methodology Overview

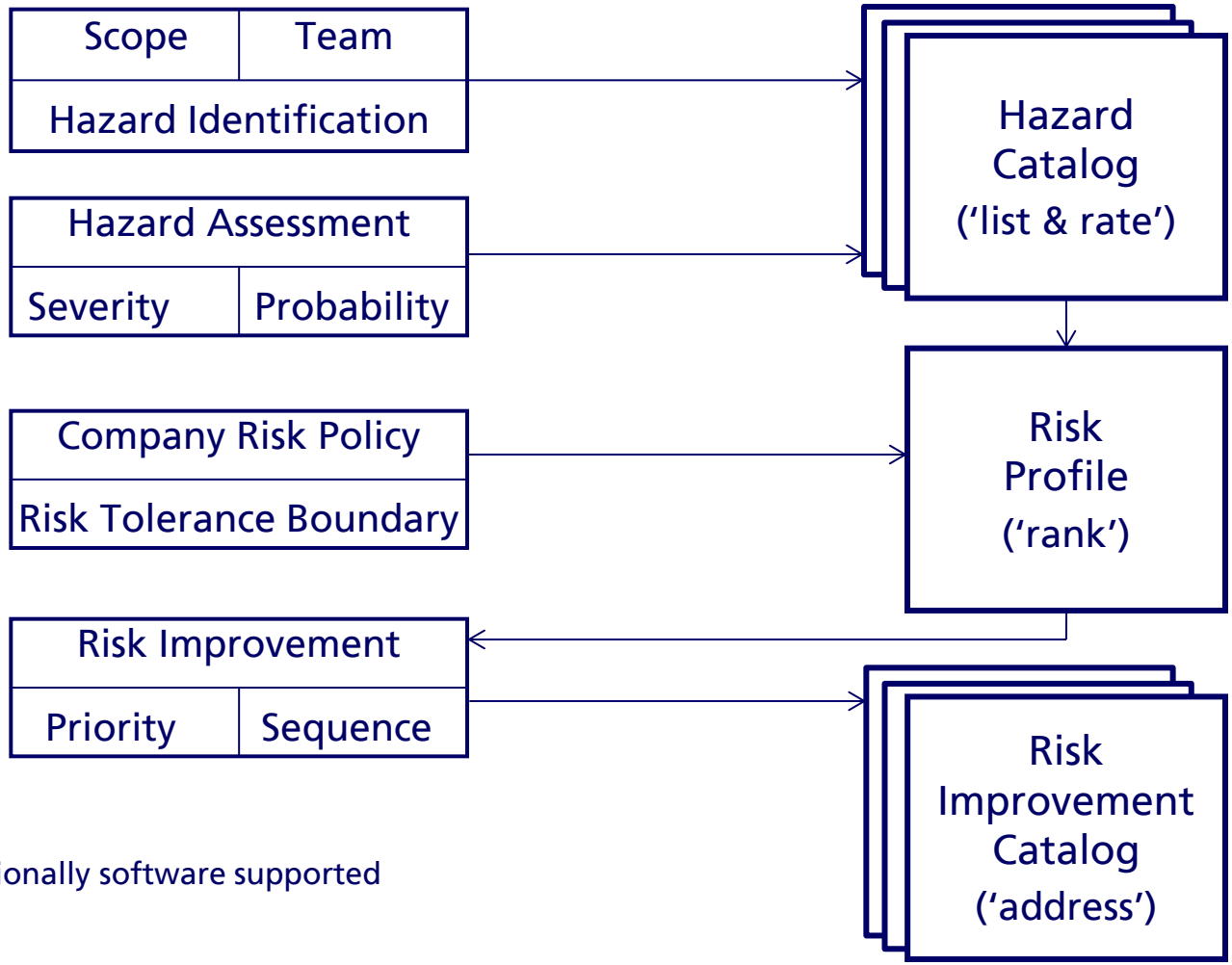
The basic process

1. • Preparation I: Define purpose and the scope
2. • Preparation II: Select the team, gather information
3. • Identify/Assess: Define hazard scenarios, severity & probability
4. • Rank: Build the risk profile, set risk tolerance boundary and plot each risk; quality check the risk profile
5. • Improve I: Develop action plan and plot target risks
6. • Improve II: Implement the action plan
7. • Review the analysis

All of these steps can be supported using Zurich's proprietary ZHA software. This simple tool records all of the ZHA information and creates a high-quality report for the customer.

Zurich Hazard Analysis (ZHA)

Executive Summary (graphic version 2)

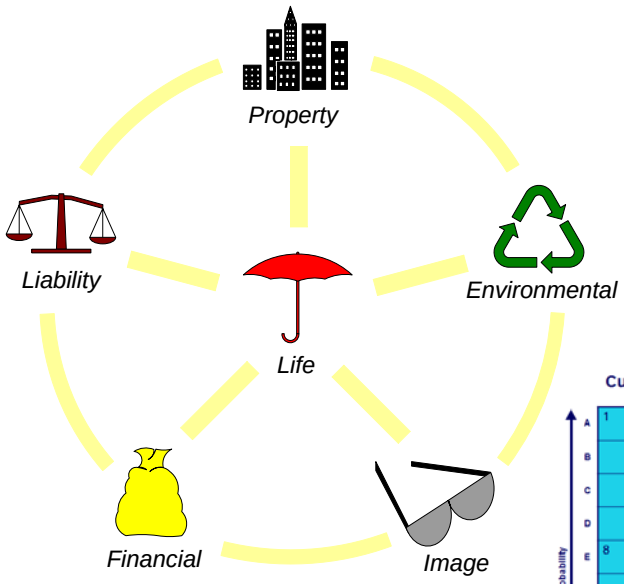


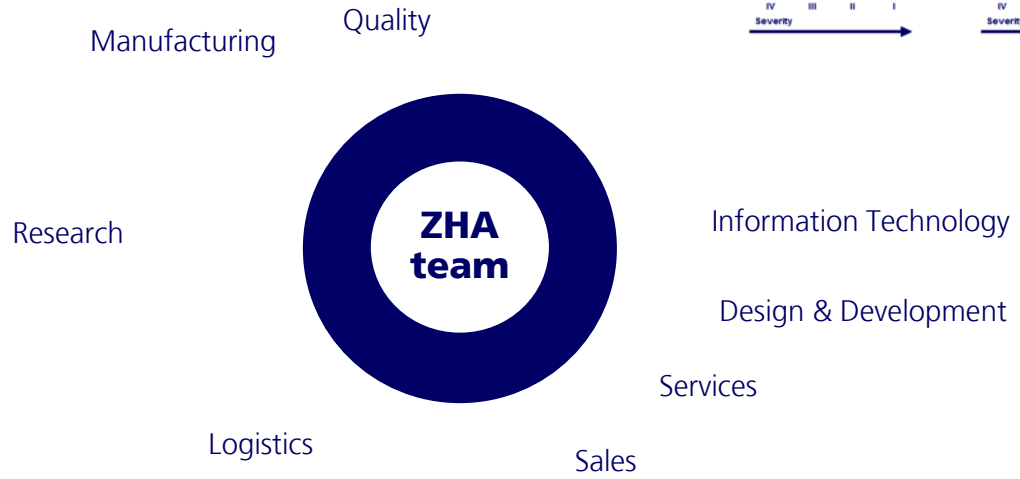
Optionally software supported

Zurich Hazard Analysis

Success factors of ZHA

- **Effectiveness**
- **Simplicity**
- **Efficiency**
- **Visibility**
- **Proficiency**
- **Flexibility**





Zurich Hazard Analysis (ZHA): looks bottom-up at "Hazardous characteristics", "Malfunctions", "Environmental influences", "Use and operation", "Life Cycle"

Zurich Hazard Analysis

At a glance

Features

- Skilled ZHA team leader
- Easy for the team
- Pathways/tickler list
- Wide applicability
- Relative quantification
- Good interface with other methods
- Provides a foundation to prioritize and manage risks

Application

- For systematic analysis of hazards of new, planned or existing:
  - Business operations and processes
  - Documentation/procedures
  - Manufacturing sites, facilities, systems or machines
  - Products and projects

Parameters

- Interdependent factors which determine the value of the ZHA
  - Scope: width and breadth
  - Time: time available
  - Depth: level of detail
  - Team: expertise and knowledge base
  - Data: information available

Zurich Hazard Analysis (ZHA)

Features and Benefits - Overview

Feature	Benefit
• Thorough, systematic coverage with '360 degree' perspective of risk	• Identifies all risks within your specified scope. You will know your risks
• Relative hazard assessment for simplicity and visualization of complex issues	• Easy to learn. Graphic nature of the ZHA simplifies explaining the risks to management
• Risk Profile for prioritization and management of risks	• Focuses your resources on the risks that matter the most
• Efficient front-end screening tool, and immediate results in the hands	• Fast results compared to other tools will help you begin mitigation sooner
• Flexible in scope, duration, depth and application	• ZHA provide great results no matter what your needs

Zurich Hazard Analysis (ZHA)

Conclusion

Overview

- ZHA is a team based methodology which encourages analysis of the 360 degrees of 'Total Risk.' Hazard scenarios are developed and illustrated on a 'Risk Profile', the core of the methodology, which graphically highlights risk priorities in the analysis. The analysis team cover a given scope, applying 'Pathways' and 'Ticklers' to ensure a thorough and systematic assessment is realized.

Success factors

- Systematic cover of hazards (360-degree-perspective)
- Easy integration in already existing Quality and Risk Management systems
- Can be applied to any stage of the product or system lifecycle
- Wide ranging analysis scope from occupational safety to product liability
- Produces risk assessments that are based on your company's risk policy
- Scenario technique and relative risk assessment allow visibility of complex issues
- Qualitative/semi-quantitative tool to produce immediate results
- Risk Profile to prioritize and manage your risks
- Knowledge comes from your team
- It requires an experienced and competent team leader to be efficient
- The results are qualitative and can be less detailed than some other techniques
- Does not need the teams prior knowledge of the methodology

Why Zurich Hazard Analysis?

- To identify hazards in almost any area, including property, liability, employee safety, company image, environmental issues and overall financial performance.

Zurich Hazard Analysis (ZHA)

How to get it

- Zurich Risk Engineering can facilitate a ZHA at your location:
  - Work with you to determine the scope of the analysis
  - Who should be on the team
  - Determine the duration of the analysis– depending on the complexity generally from one half day to 3 days
  - How to prepare - logistics
  - Lead the team through a completed ZHA
  - Provide the report

Zurich Hazard Analysis (ZHA)
ANNEX I: The 7 steps of ZHA in some more detail

March 8, 2019

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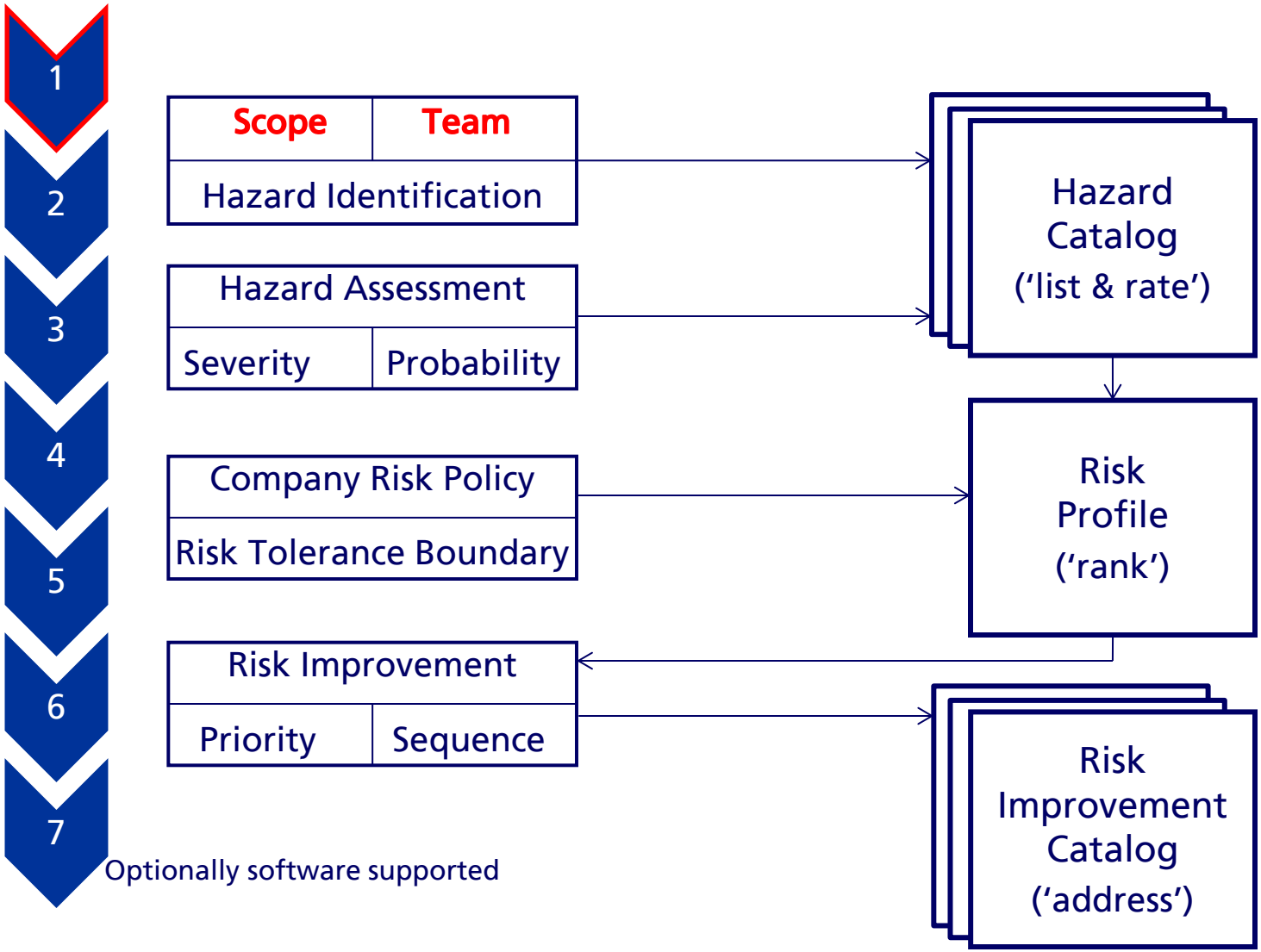
Zurich Hazard Analysis (ZHA)

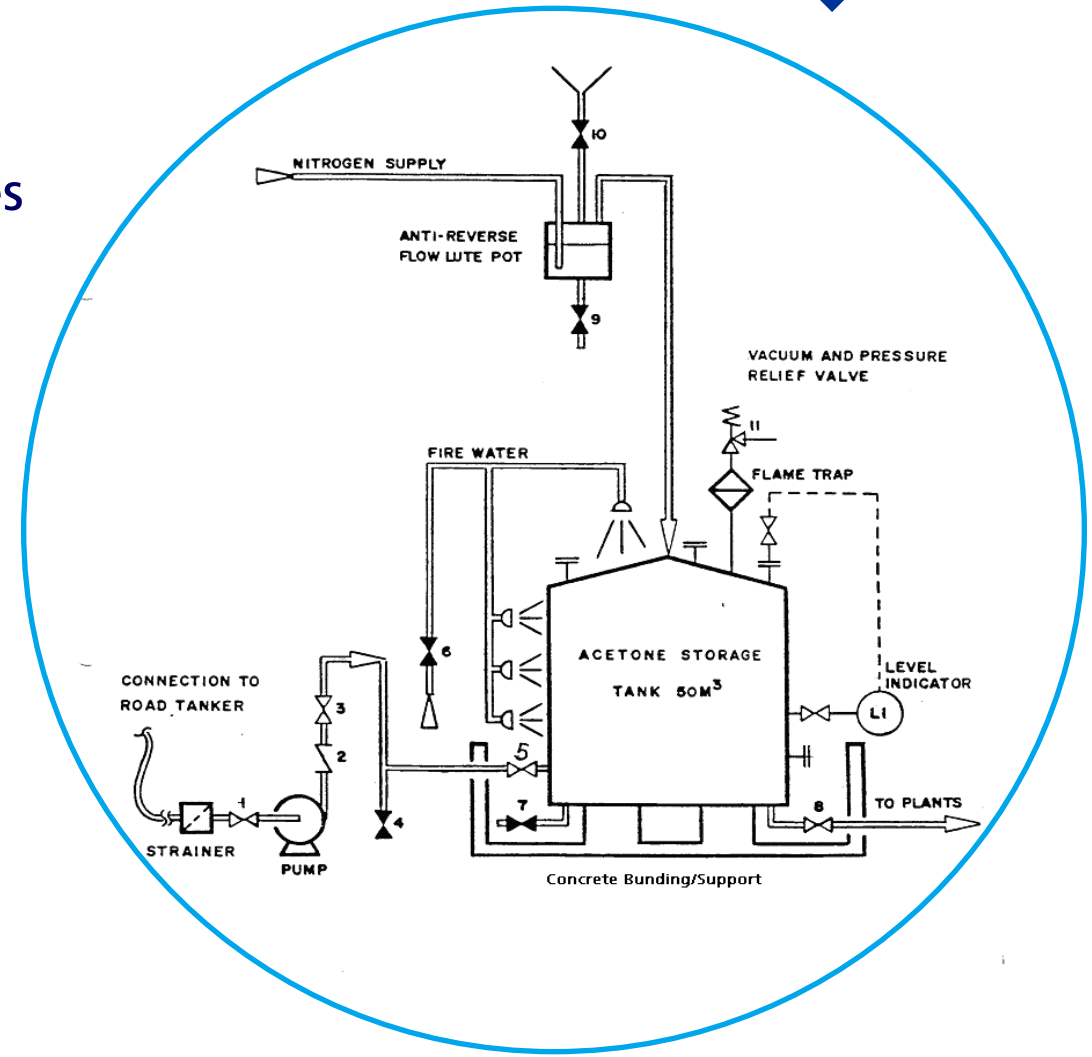
Basic elements of the process



Zurich Hazard Analysis (ZHA)

Step 1 - Define the scope

- Scope describes both the content and the boundaries of the product, facility, process or system to be analyzed
- The scope should be indicated both graphically and descriptively
- 3-D
- As wide, broad or deep as desired



Zurich Hazard Analysis (ZHA)

Step 1: Information to support a ZHA

1

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Examples

- Site/plant layout plans, process flow sheets
- Regulations/GMP regulations for the branch
- Scientific research results
- Statistics of customers complaints
- Manufacturing and operating procedures
- Process and Instrumentation (P & I) diagrams
- Information from key operating personnel
- Business interruption, interdependencies; third party contracts, disaster recovery plans
- Loss information and experience
- Product inventory
- …

Zurich Hazard Analysis (ZHA)

Step 2: Choose Team Leader

2

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The Team Leader must:

- Understand the steps of ZHA
- Possess basic knowledge of the Scope analyzed
- Stimulate risk identification
- Bring team to consensus
- Manage time
- Remain objective
- Challenge the Team
- Manage the Team

- An success factor of a ZHA from a process view-point

Zurich Hazard Analysis (ZHA)

Step 2: Choose Team Members

2

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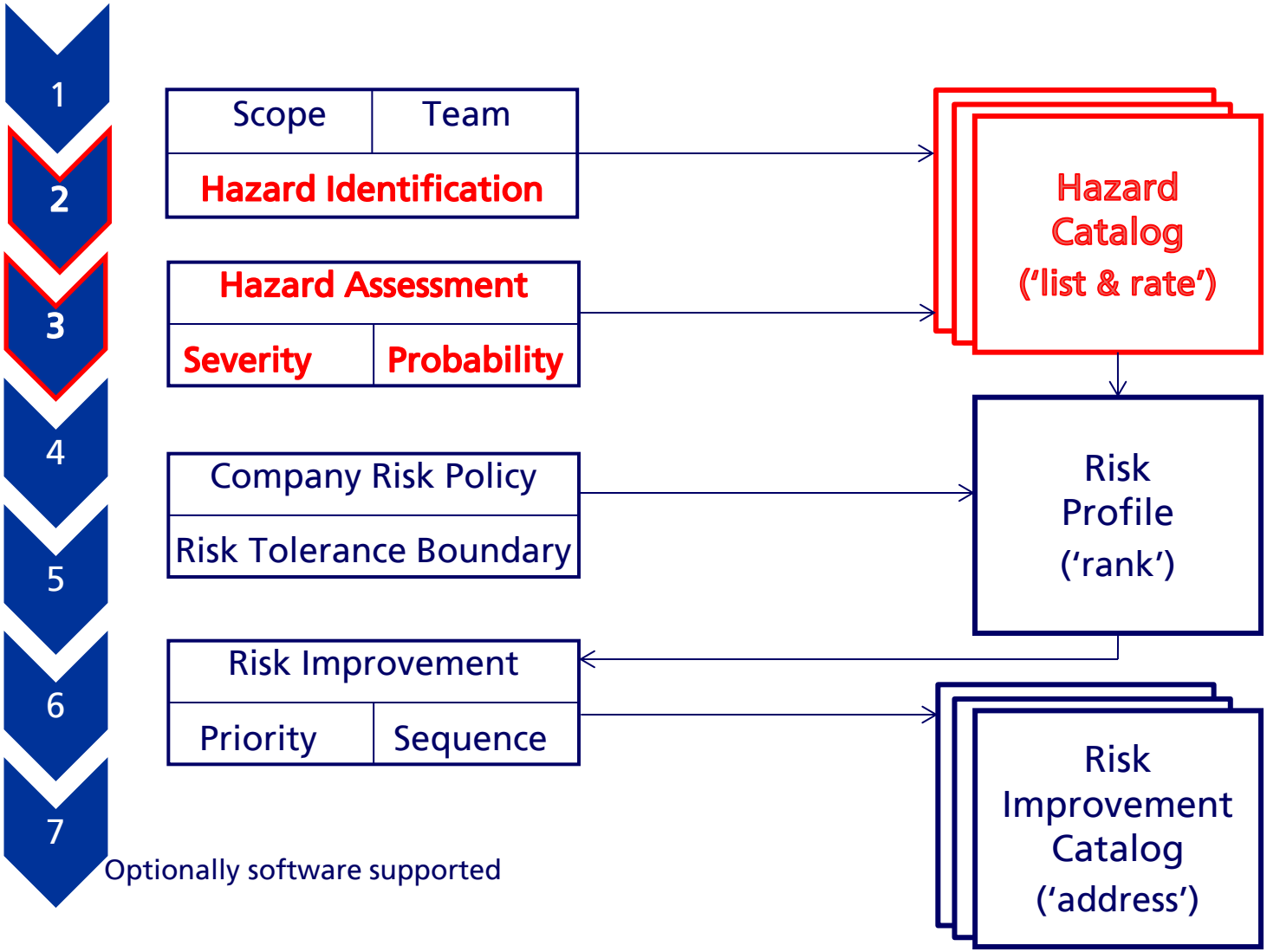
The Team is:

- Composed of 4 to 7 experts with different knowledge and perspective
- Representing several departments and/or disciplines
- Made of full or part time members

- The team is the main success factor, since it represents the knowledge base of the analysis

Zurich Hazard Analysis (ZHA)

Basic elements of the process



Zurich Hazard Analysis (ZHA)

Step 3: The Hazard Catalog - Identify Hazard Scenarios (cont'd)

3

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- Hazard Scenarios are developed as the team brainstorms through a pathway with the tickler list
- Scenarios are listed in the Hazard Catalog
- A Hazard Scenario consists of 3 components:

Hazard → What?
→ Where?
→ Controls

Trigger → How?
→ Why?

Effect → How Big?
→ How Bad?
→ How Much?

Zurich Hazard Analysis (ZHA)

Step 3: The Hazard Catalog – Using the ZHA WORKS software

3

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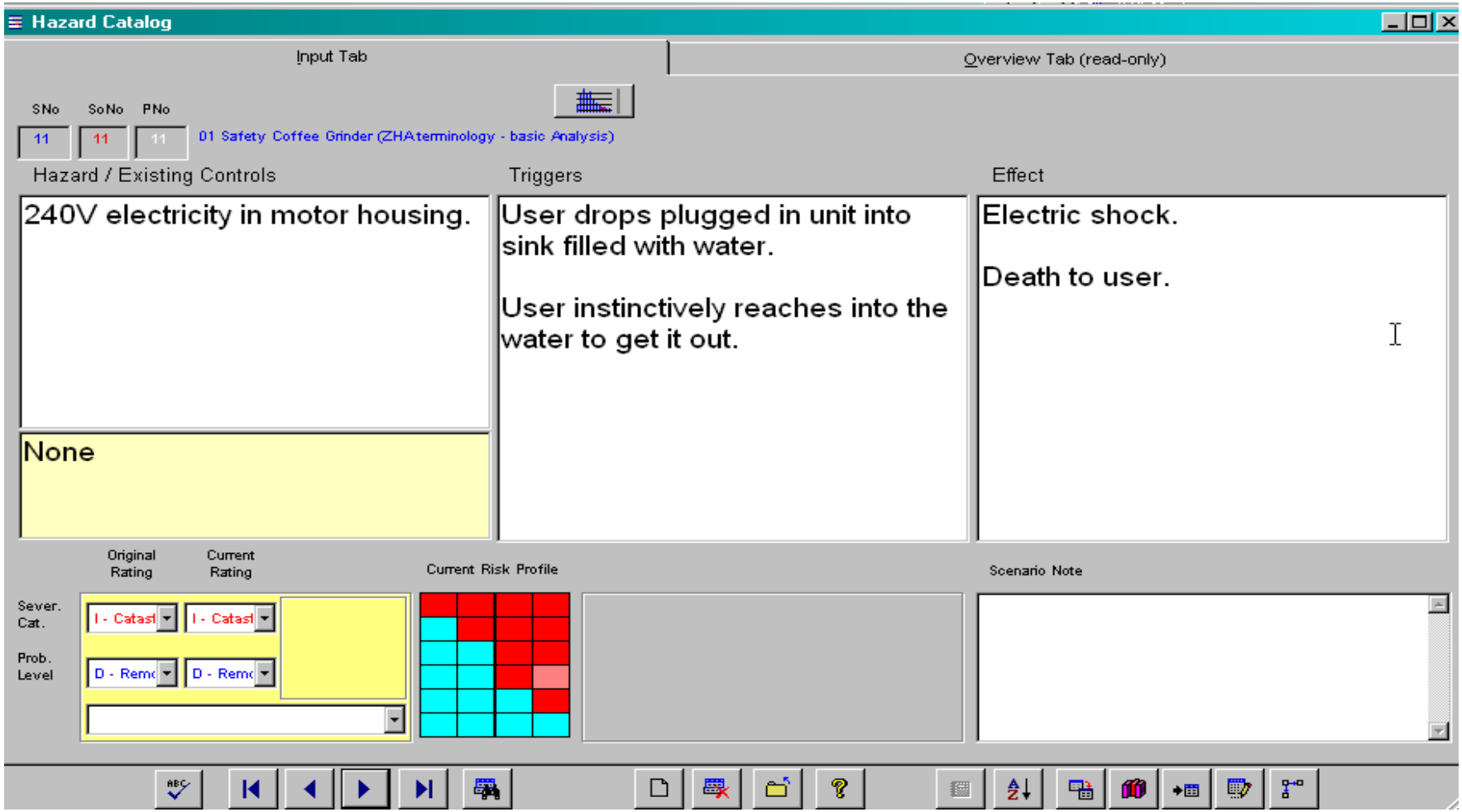
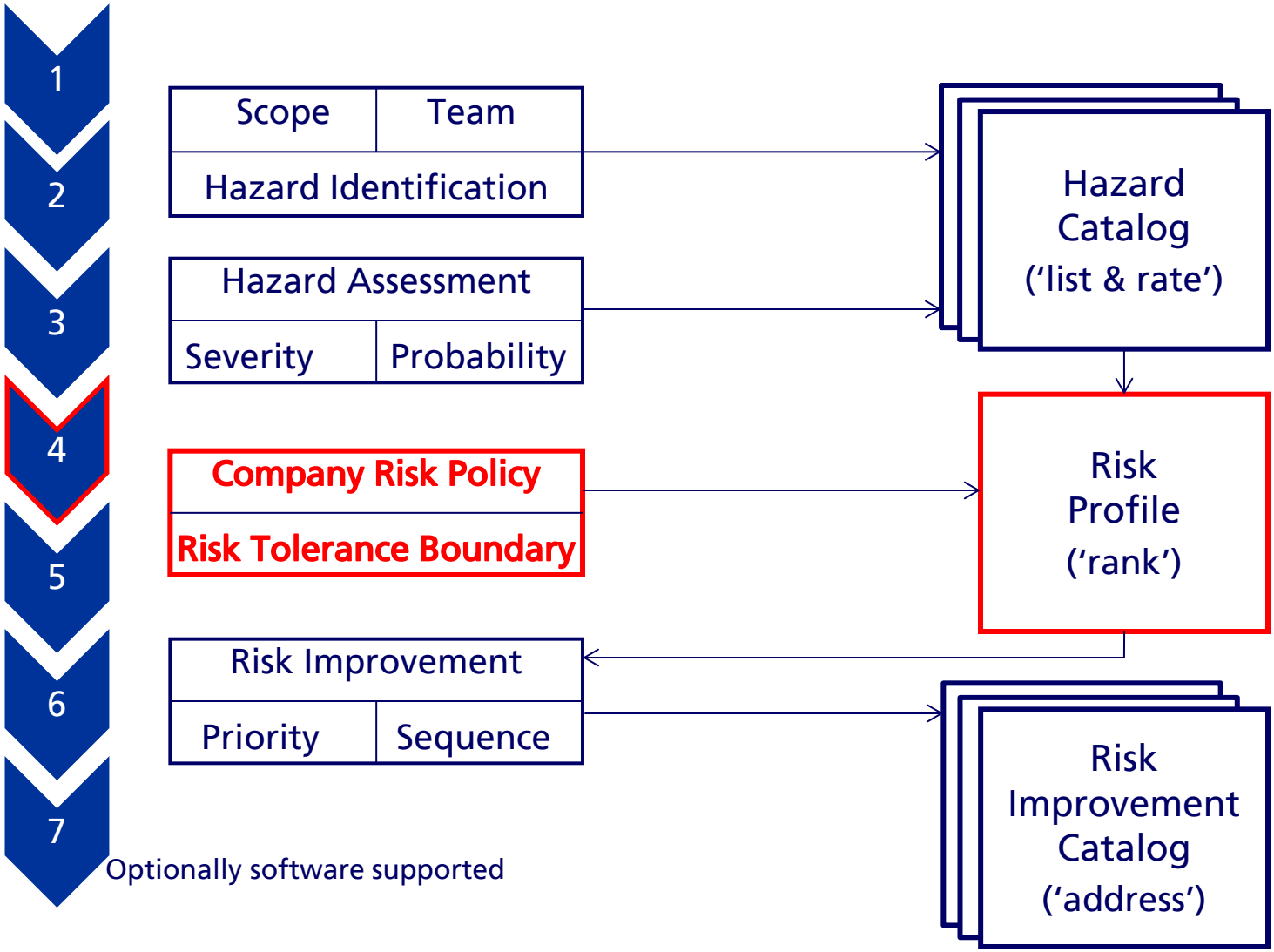


Zurich Hazard Analysis (ZHA)

Basic elements of the process



Zurich Hazard Analysis (ZHA)

Step 4: Build the Risk Profile - the Risk Tolerance Boundary

4

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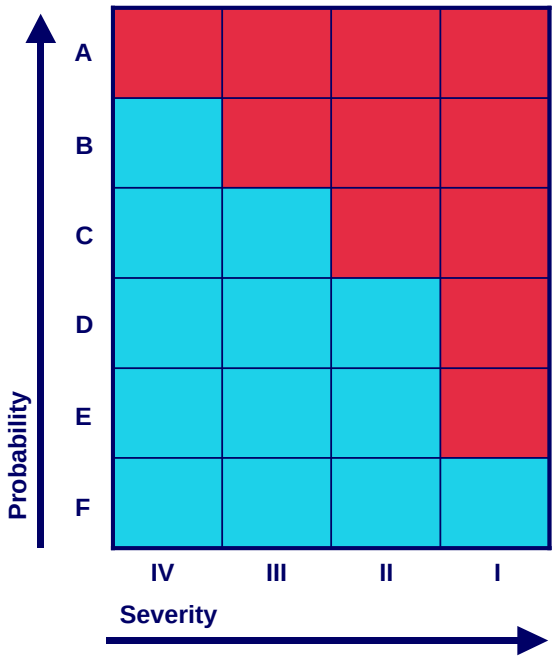
1. Set the Risk Tolerance Boundary

- The Risk Tolerance Boundary:
  - is set by the team as a stepped 'line' across the empty Risk Profile
  - Risks above the Boundary line are not tolerable
- Risk tolerance is seen in the eyes of the team
- **Team consensus** needed on tolerability of risk



Zurich Hazard Analysis (ZHA)

Step 4: Build the Risk Profile – plot the risks

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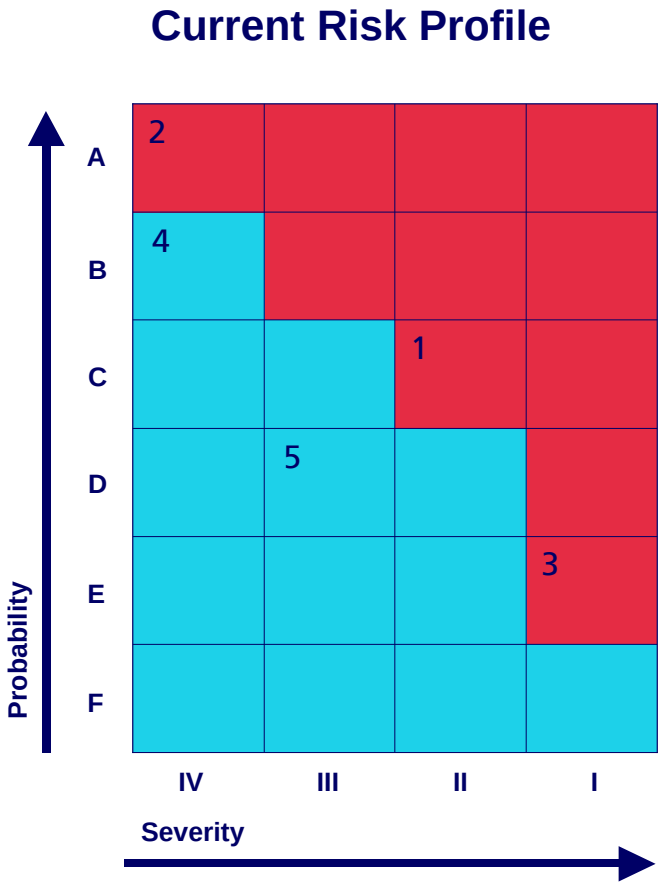
2. Plot the risks



Zurich Hazard Analysis (ZHA)

Step 4: Build the Risk Profile – perform a quality check

4

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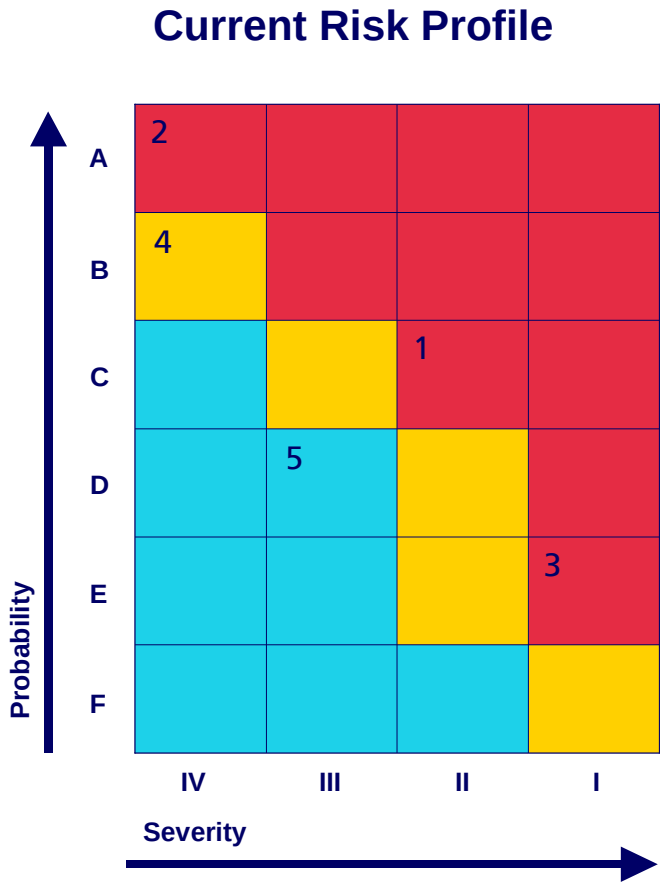
3. Perform a quality check of rating consistency and boundary position*)

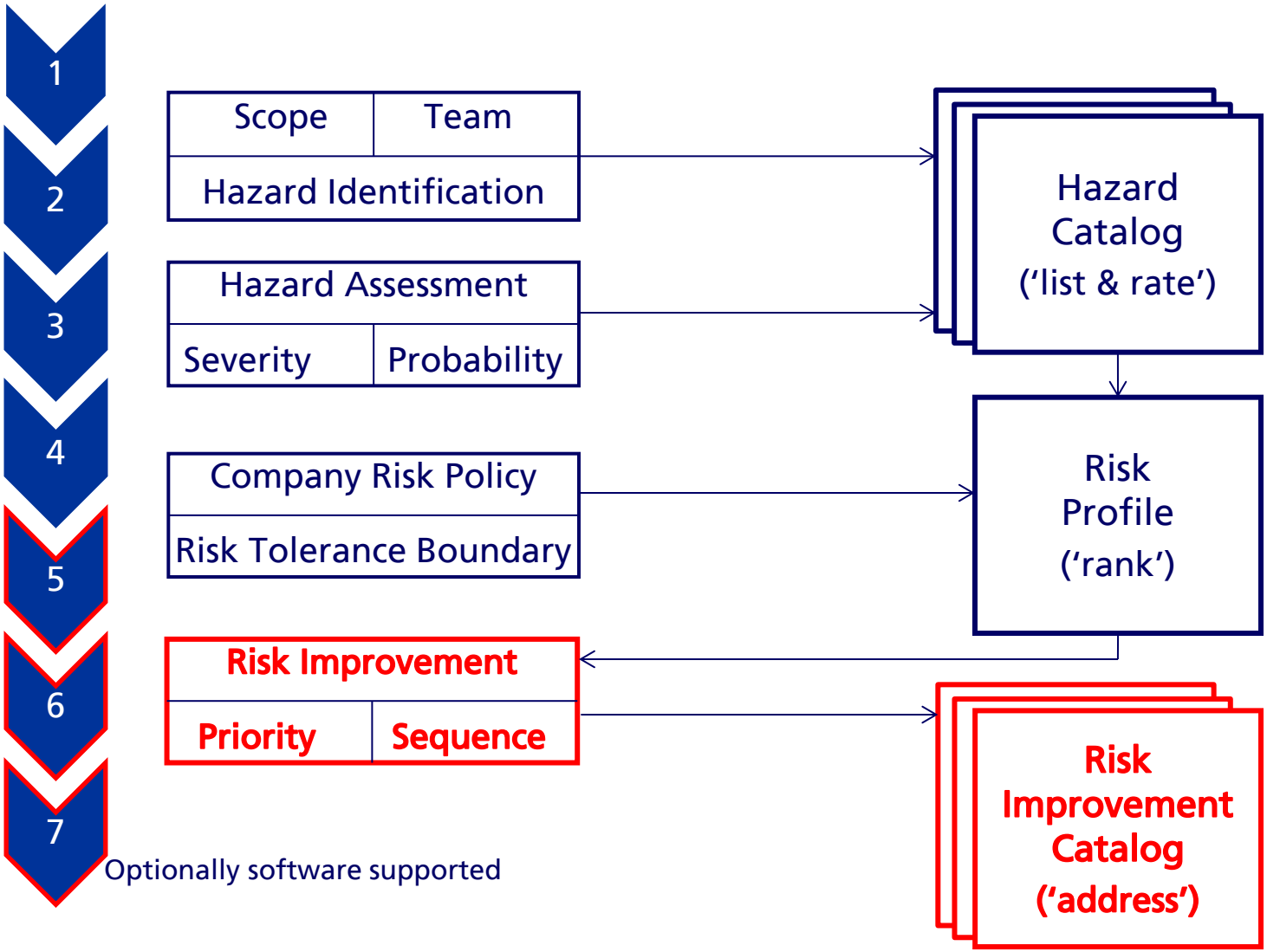
- **Team consensus** needed on rating and tolerability of risk

*) Lowering the risk tolerance boundary is not permitted!



Zurich Hazard Analysis (ZHA)

Basic elements of the process



Zurich Hazard Analysis (ZHA)

Step 5: Develop Risk Improvement Actions (cont'd)

5

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- Devised for risks above the RTB
- Follow priority order
  - ➢ Start with those hazards which represent the highest level of risk

- Follow a logical sequence
  - ➢ Eliminate the hazard, if not possible:
  - ➢ Reduce the probability and/or severity of an event:
    - – Control systems against the event (automatic/manual control, alarms, human-machine-interface, preventive maintenance),
    - – Protection systems against the event (interlocks, alarms, relief devices, redundant components, guards, human/machine-interface)
    - – External systems against the event (drains, fire walls, bunding, human-machine-interface, quality control, emergency response)
- Re-rate the scenario considering all proposed improvements (Target Profile)

Zurich Hazard Analysis (ZHA)

Step 5: Revealing it all (another example)

5

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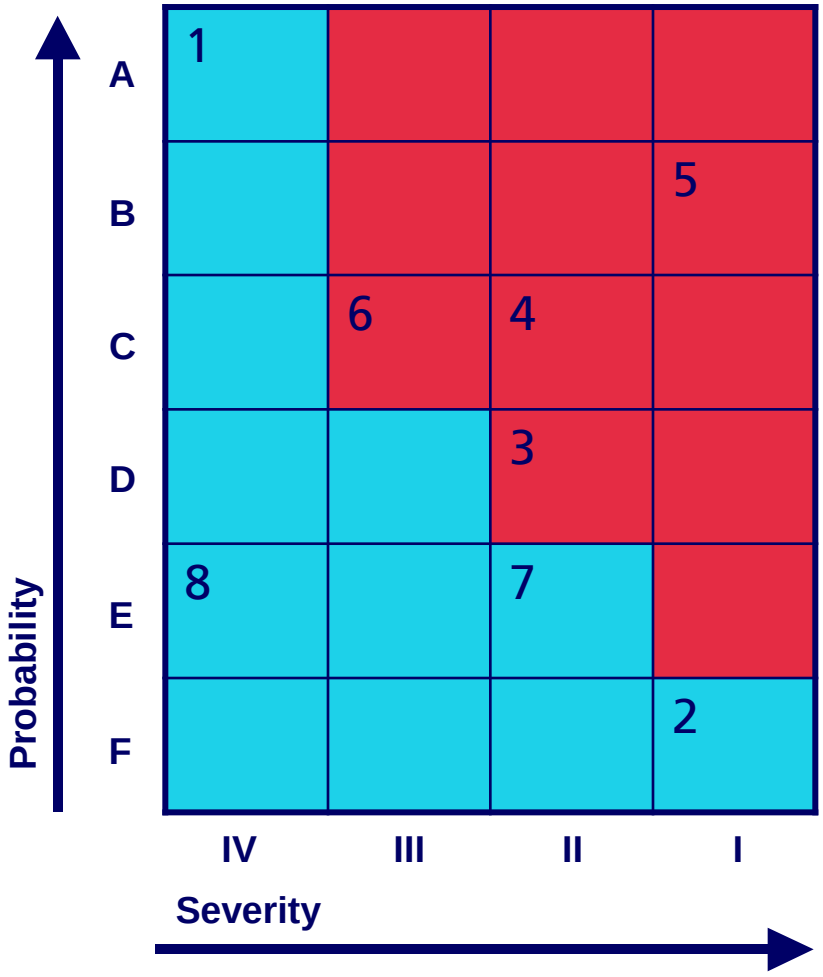
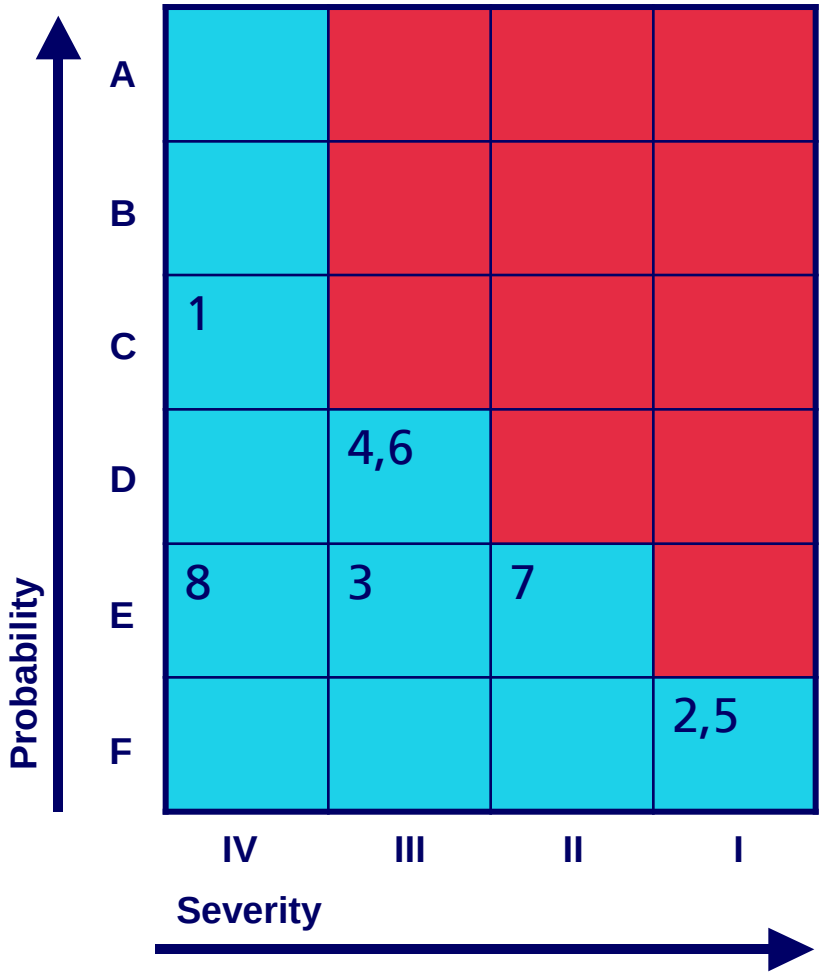
Current Risk Profile



Target Risk Profile



Zurich Hazard Analysis (ZHA)

Step 6: Implement Risk Improvements

6

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Occurs after the analysis

The risks are improved & managed by:

- Verifying the implementation of Risk Improvement Actions
  - Action responsible
  - Due dates
  - Action status
- Verifying Risk Reduction
- Documenting the Actions

Note: in case one of the risk improvement actions was a Control, this Control, once fully implemented (i.e. its action status = “completed”), will be added to the list of existing Controls as defined in the Hazard during Review Step 7.

Zurich Hazard Analysis (ZHA)

Step 7: Review the ZHA

7

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Many aspects of the analysis can change. Review triggers are changes in:

- Scope
- Legal requirements
- Progress Control on improvements
- State-of-the-art
- Scope or Process changed or assess need for Process change
- Check on continuing realism of the scenarios and identify any new risks
- Industrial Standards
- Consumer expectations
- Materials
- Environment
- Emerging risks
- Technology
- Workforce
- Risk Tolerance

Thank you