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Federal Office for the Environment FOEN
Hazard Prevention Division

Quantitative evaluation criteria for humans and the environment in Switzerland

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Major accidents Ordinance (MAO)

- Swiss Ordinance on major accidents entered into force in 1991

Aiming at protecting the population & the environment from damage due to major accidents that may occur during the operation of facilities.

Scope

1’200 Chemical establishments

1’700 km railway lines

10’200 km main roads

2’400 km gas and oil pipelines

The MAO; 2 steps process for chemical establishments: step 1

If Establisment uses quant. of chemicals that are above defined threshold quantities:

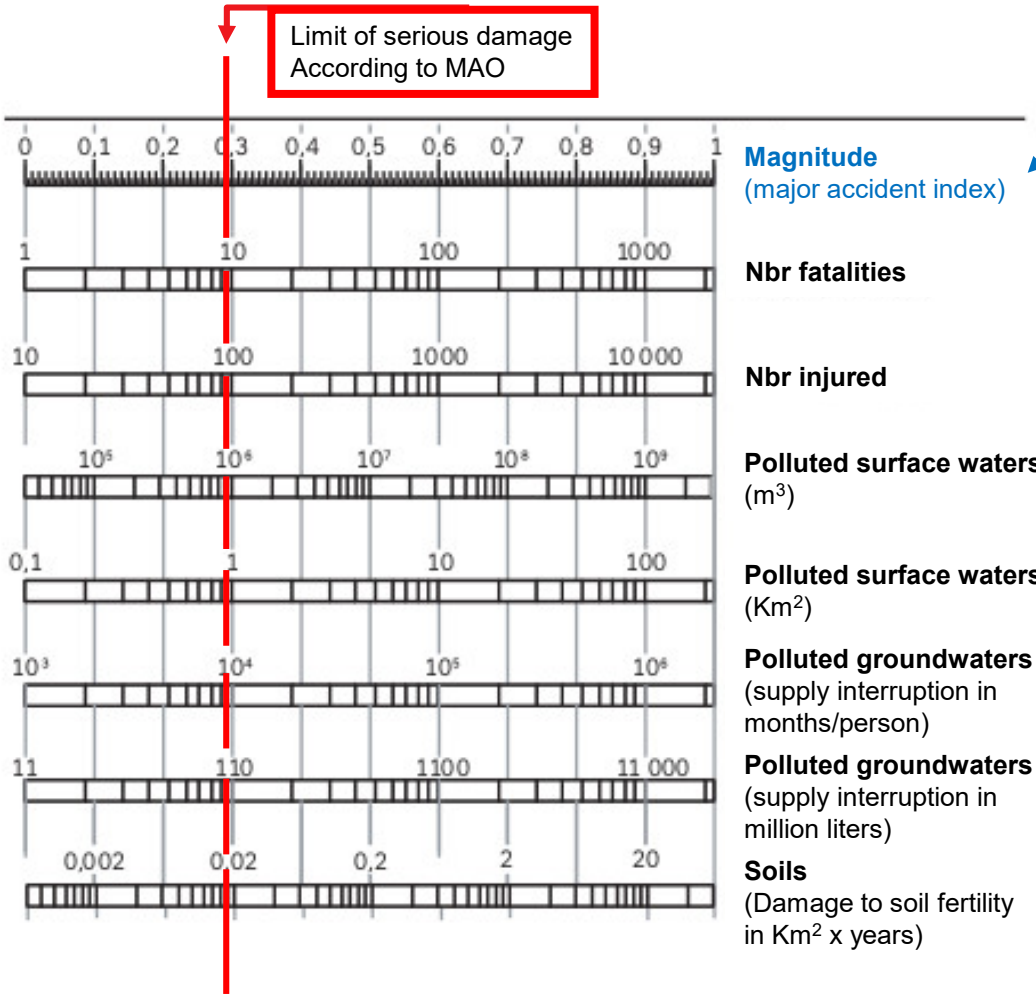
Summary report

- Estimation of magnitude of possible damage to population and / or environment based on worst case scenario

- Evaluation criteria are needed to quantify the damage that could be done to the population or the environment.

- In order to apply the evaluation criteria, the different elements to be protected must be represented using damage indicators.

Quantitative evaluation criteria



Magnitude
(major accident index)

Nbr fatalities

Nbr injured

Polluted surface waters (m^3)

Polluted surface waters (Km^2)

Polluted groundwaters (supply interruption in months/person)

Polluted groundwaters (supply interruption in million liters)

Soils (Damage to soil fertility in Km^2 x years)

MAI:
Evaluation criteria are transformed into major accident indexes to allow an assessment according to a uniform grid.

Humans

Environment

Quantitative evaluation criteria

Evaluation criteria	Serious damage (MAI ≥ 0.3)
Population *Nbr fatalities*	≥ 10 p.
Population *Nbr injured*	≥ 100 p
Polluted surface waters *Volume of polluted surface waters* *Surface of polluted surface waters*	≥ 10 m^3 ≥ 1 Km^2
Polluted groundwaters supply interruption in months / person *or* in million liters	≥ 10 000 P x M ≥ 110 mio l
Soils Damage to soil fertility in Km^2 x years	0.02 Km^2 x a

The MAO; 2 steps process for chemical establishments: step 1

If Establisment uses quant. of chemicals that are above defined threshold quantities:

Summary report

- Estimation of magnitude of possible harm to population and / or environment based on worst case scenario
- If Major accident index (MAI) < 0.3

→ **Risk acceptable → End of procedure**

If serious damages cannot be excluded (MAI ≥ 0.3)

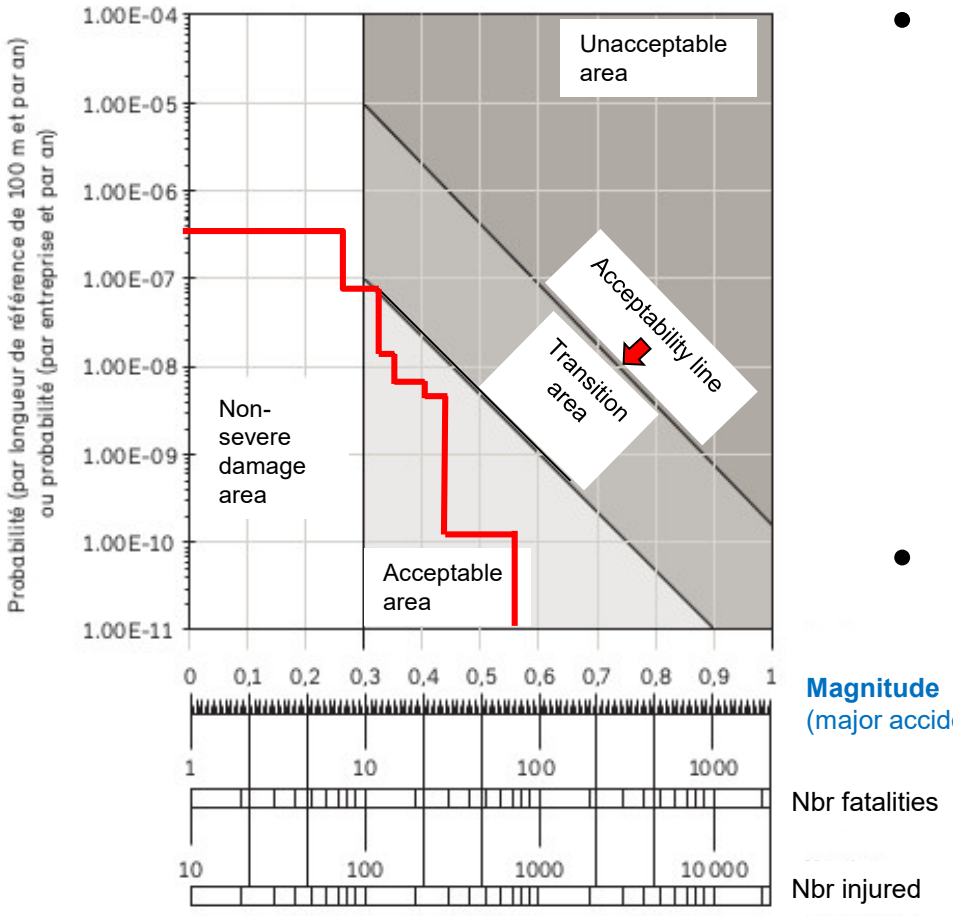
The MAO; 2 steps process for chemical establishments: step 2

Risk report

- Detailed risk analysis with estimation of magnitude of possible harm to population and / or environment based on multiple scenarios.
- Probability / Consequence diagrammes (plot of societal risk).
- Identification of safety measures to minimize risk.
- Evaluation of risk acceptability upon MAO evaluation risk criteria.

- Evaluation criteria are used to determine risk acceptability according to MAO.

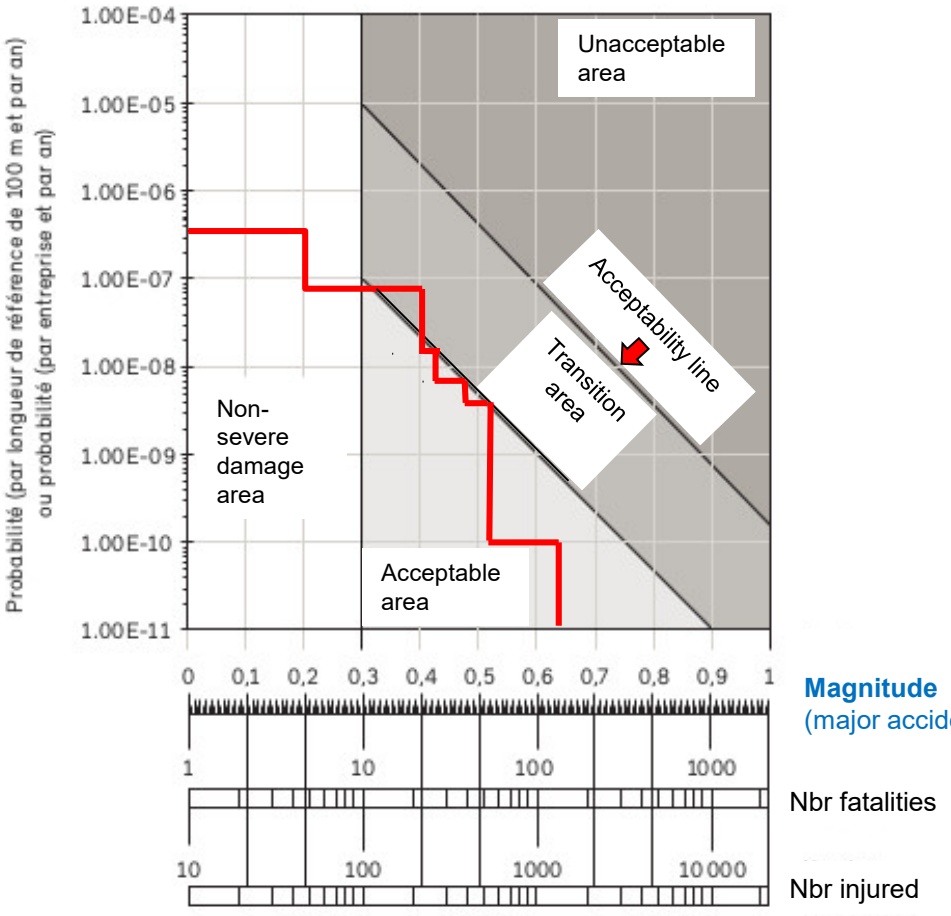
Societal risk representation in P-C diagrams



- Risks represented by cumulative curves expressing multiple possible scenarios with estimation of damage and probability associated.
- 4 areas defined to determine risk acceptability

Risk acceptability criteria

Cumulative curves partially located in transition area

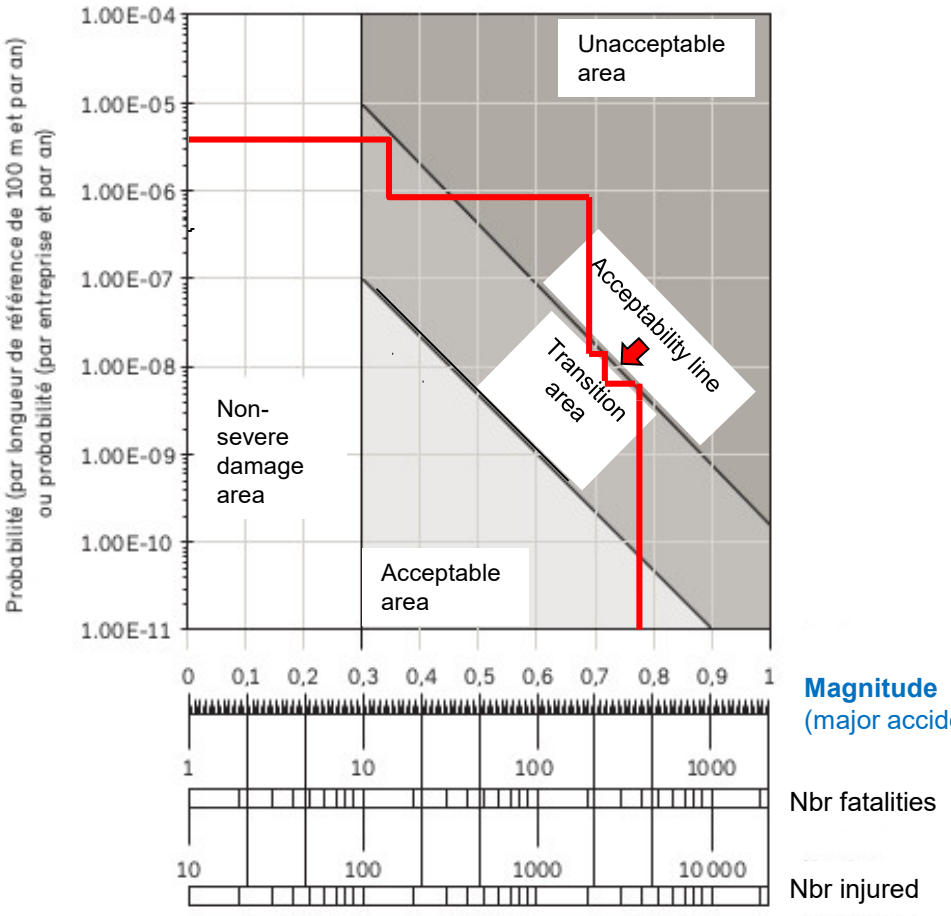


→ Carrying out of an interest weighing (public-private vs needs for protection)

→ Require additional safety measures to minimize risk.

Risk acceptability criteria

Cumulative curves partially located in unacceptable area



→ Carrying out of an interest weighing (public-private vs needs for protection) to determine the level at which the risk should be reduced.

→ Require additional safety measures to minimize risk.

Quantitative evaluation criteria

- First published in 1996 (stationary installations) in an enforcement aid document (new revision released in Nov. 2018).
- Developed jointly by experts (industry & research institutes) and enforcement authorities at national level.
- Intended to owners of installations and enforcement authorities.

Main goal:

- Encourage a consistent approach to assessing summary reports and risk reports for establishments handling substances, preparations or hazardous wastes.
- Provide clear criteria to determine the level of acceptable risks.

Conclusion

20+ years experience implementing quantitative evaluation criteria show that these criteria:

- Are applicable and well implemented;
- Facilitate the discussion about risk between concerned stakeholders;
- Have harmonized risk evaluation throughout the country (establishments are evaluated the same way).

Thank you