



Rijksinstituut voor Volksgezondheid
en Milieu
*Ministerie van Volksgezondheid,
Welzijn en Sport*



Industrial and environmental safety in the Netherlands

through spatial planning and design

Jeroen Neuvel, Saxion & RIVM

DRM online training series (Coventry University), November 2. 2022



Background

- > PhD in spatial planning (WUR): Geographical dimensions of risk management
- > Teacher
 - Applied Safety and Security Studies Saxion
- > Researcher
 - Involved in research projects on safe urban planning RIVM



- Located in: **Enschede**, Deventer & **Apeldoorn**
- 26.000 students, 2.800 employees
- 11 faculties
- Governance, Law & Urban Development
 - ✓ Safety and Security Management
 - ✓ Urban studies
 - ✓ Real Estate Management
 - ✓ Business Management Studies
 - ✓ Social Legal Services
 - ✓ Law



Exchange at Saxion

- > Check our international semesters at Saxion.edu
 - [Crisis and Disaster Management](#)
 - Information security



Environmental safety

- > Environmental safety policies focus on managing the safety risks at a particular location
- > to protect people and the environment against unacceptable health and safety risks
- > Natural, technological or 'human' hazards

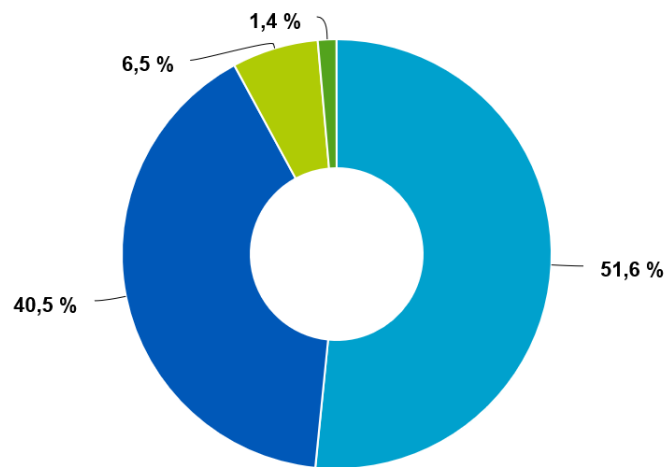


Focus

- > Policies to protect the people in the neighbourhood against risks related to the production, processing, storage, and transport of hazardous materials



Example: Transport of hazardous materials NL, 2017



■ Pipes ■ Ship ■ Road ■ Rail



Source, cbs,2017nl



Derailment Hitrino Bulgaria, december 2016



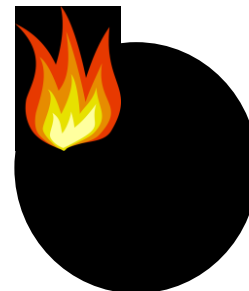
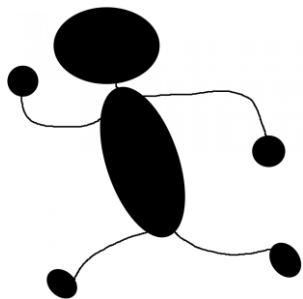


Question

An incident with hazardous materials may affect people in the environment.

At what distance would you expect casualties in case of an explosion as in Bulgaria (a tank wagon with a compressed flammable gas such as LPG)

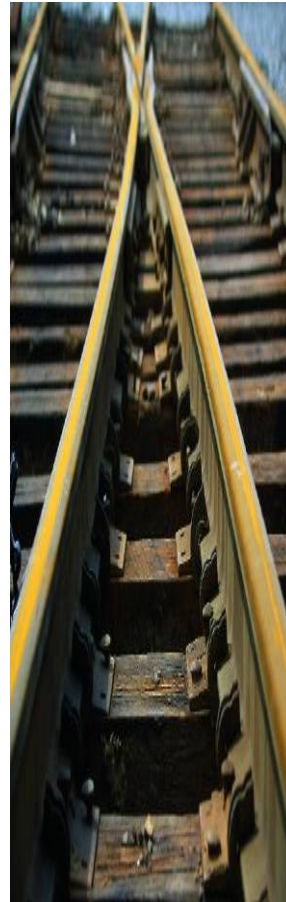
- A. 140 meter
- B. 220 meter
- C. 330 meter
- D. 600 meter





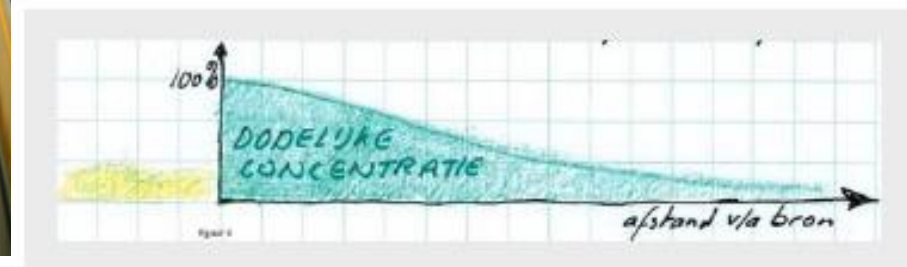
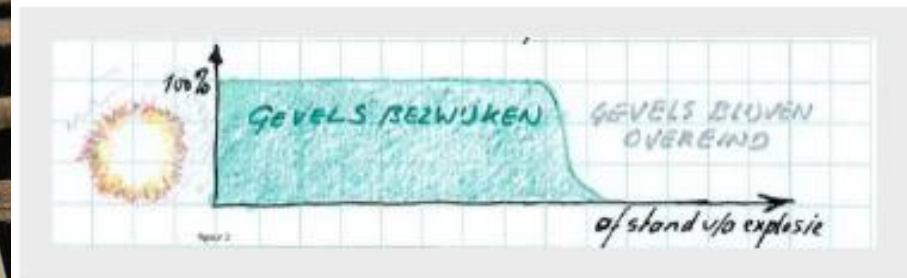
Three types of effects

> Fire



> Explosion

> Toxic cloud





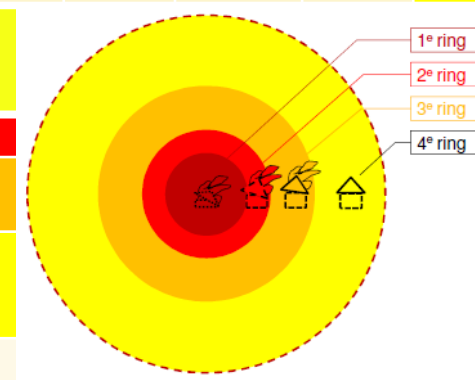
Category	Transport			
	Road	Railway	Water	Pipeline
Nature of the chemical				
Compressed flammable gas	BLEVE with LPG	BLEVE with LPG		
Flammable liquids	Pool fire with gasoline	Pool fire with gasoline	Pool fire with gasoline	Pool fire with oil products
Flammable gas	-	-	-	Jet fire natural gas
Toxic / solid	-	-	-	-
Toxic liquid	Toxic cloud acrylonitrile	Toxic cloud HF	Toxic cloud acrylonitrile	-
Compressed toxic gas	Toxic cloud ammonia	Toxic cloud ammonia	Toxic cloud ammonia	
Toxic gas	-	-	-	Toxic cloud CO ₂



Rail transport Bleve (A, 96 m³)

	Distance (meter)	Heat radiation (kW/m ²)	People outside				People inside				Objects
			†	T1	T2	T3	†	T1	T2	T3	
1 st ring	≤140 meter	≥43 kW/m ²	100%	100%	0%	0%	10%	6%	14%	70%	Irreversible damage and fires
2 nd ring	≤220 meter	≥30 kW/m ²	20%	24%	56%	0%	1%	3%	7%	20%	Heavy damage and secondary fires
3 rd ring	≤330 meter	≥17 kW/m ²	2%	6%	14%	30%	0%	0,6 %	1,4%	5%	Secondary fires
4 th ring	≤600 meter	≥7 kW/m ²	0%	0,6%	1,4 %	15%	0%	0%	0%	1%	Light damage

Distance (meter)	Overpressure (bar)	Objects
≤40 meter	≥ 0,3 bar	Heavy damage
≤85 meter	≥ 0,1 bar 0,03 bar	Average damage
≤ 250 meter	≥ 0,03 bar	Light damage (broken windows)





Exercise





Bleve





Pool fire



Source: scenarioboekexterneveiligheid.nl



Exercise: safety by design

- > Develop a proposal for the redevelopment of the railway area.
- > Think of how your design may contribute to protecting people that will be present in the area in case of an accident with hazardous materials on the railway.
- > Present your proposal on the map
- > What where your design principles?

Houses (1970s)

Appartments (1970s)

Conference centre

Houses

Offices

Railway



Building task

Water 20 squares



Roads (max. width 1)



Green (other)



Houses (new)

Houses (new)

Houses
(new)

Appartments
(new)

Appartments
(new)

Crèche
(new)

Offices
(new)



Exercise: safety by design

- > Develop a proposal for the redevelopment of the railway area.
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- > Present your proposal on the map
- > What where your design principles?

- > In breakout groups.
 - Download the exercise
 - One design per group
 - Decide which group member shares its screen with the exercise



Exercise

- > Discussion



Exercise: safety by design

- > How does this design contribute to the protection of people against fires, explosions and toxic clouds?
- > What additional measures (in addition to the spatial configuration) can be taken to protect people

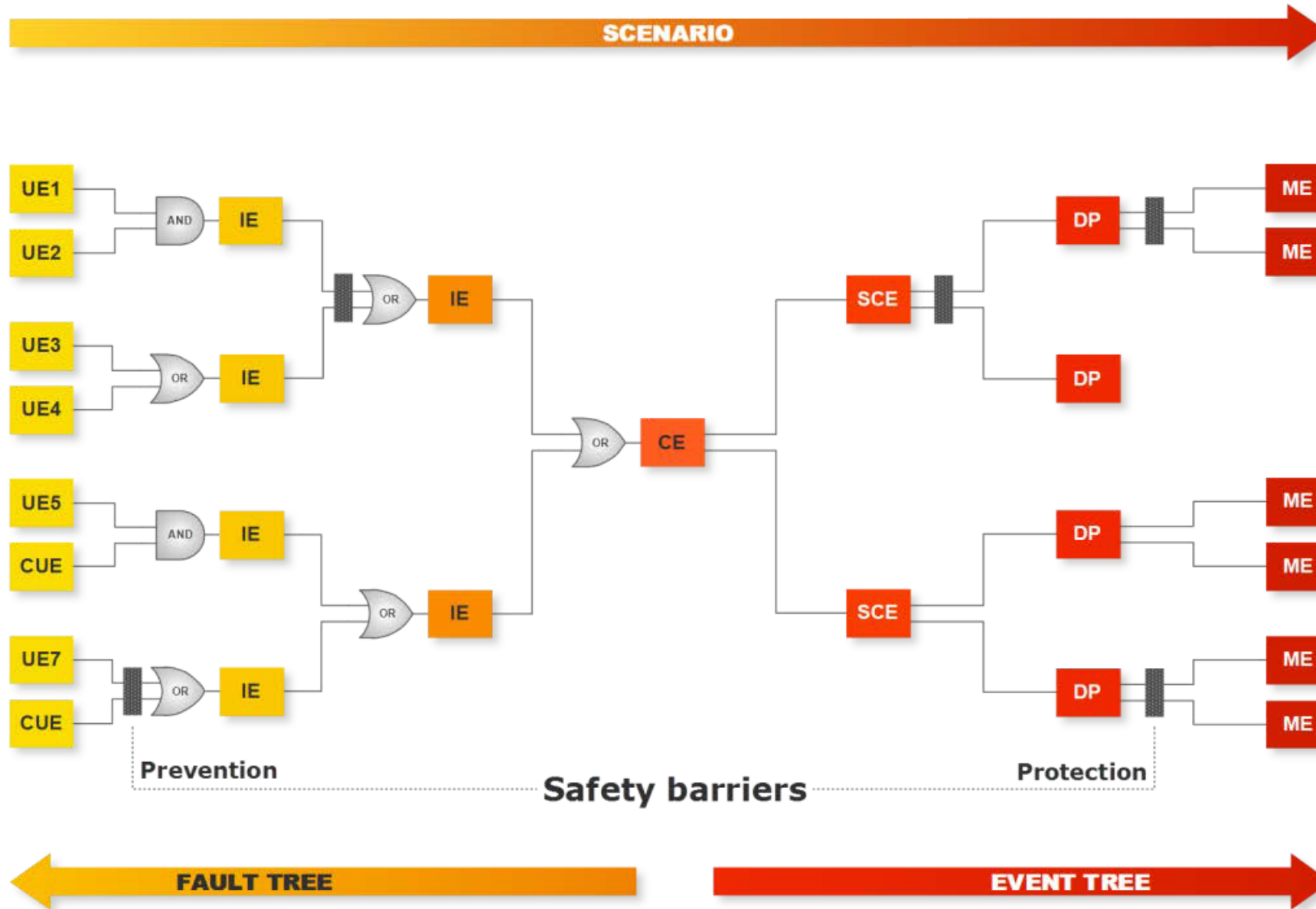


Figure 1 A scenario as depicted in a bow-tie diagramme



Bow-tie

Initiating Event	Critical Event	Dangerous phenomena	Undesirable consequence
Overpressure	Catastrophic vessel failure	Boiling Liquid Expanding Vapour Explosion (BLEVE)	Employees killed or injured, property damage
Corrosion	Hole in vessel wall	Pool fire	Property damage
Loose flange	Pipe leak	Toxic release	Environmental damage



Scenario LPG rail tanker

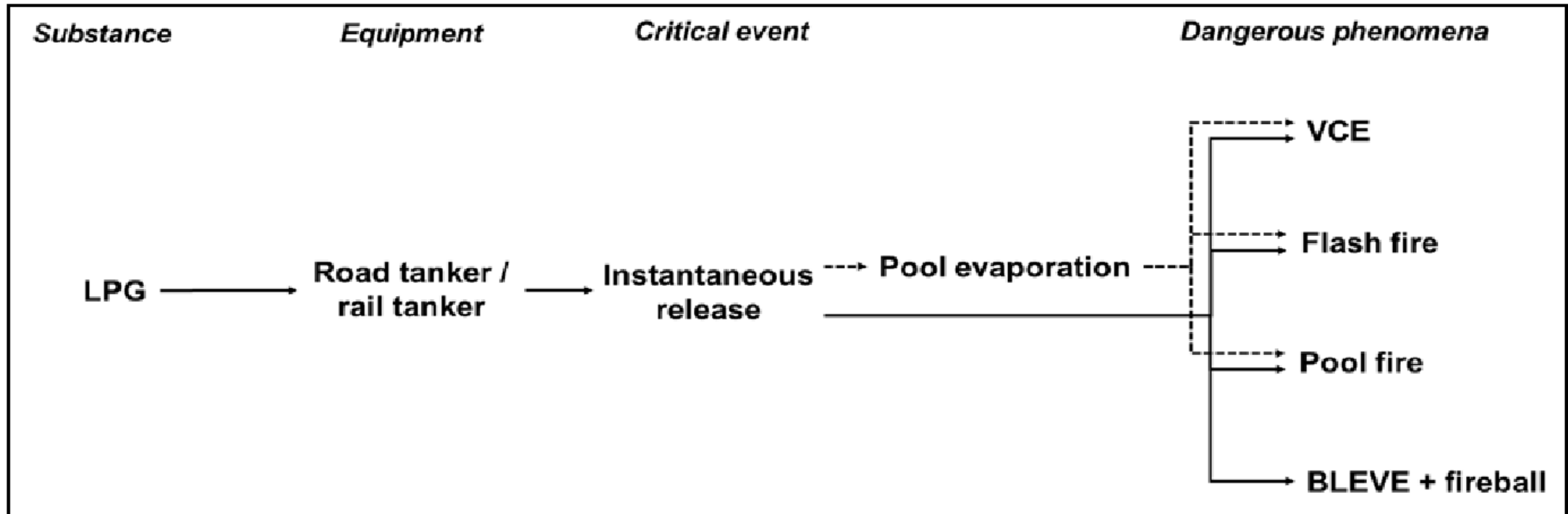


Figure 15 2j LPG instantaneous release road tanker/rail tanker



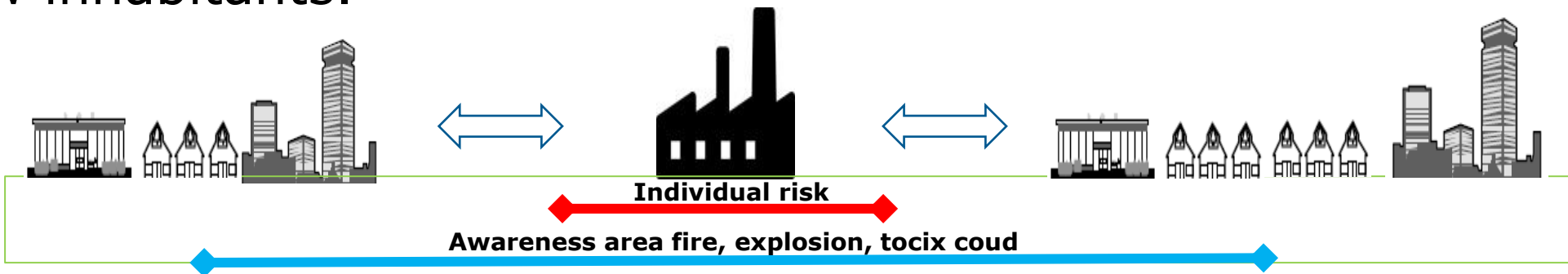
Criteria

- > Permitting developments near activities with hazardous materials



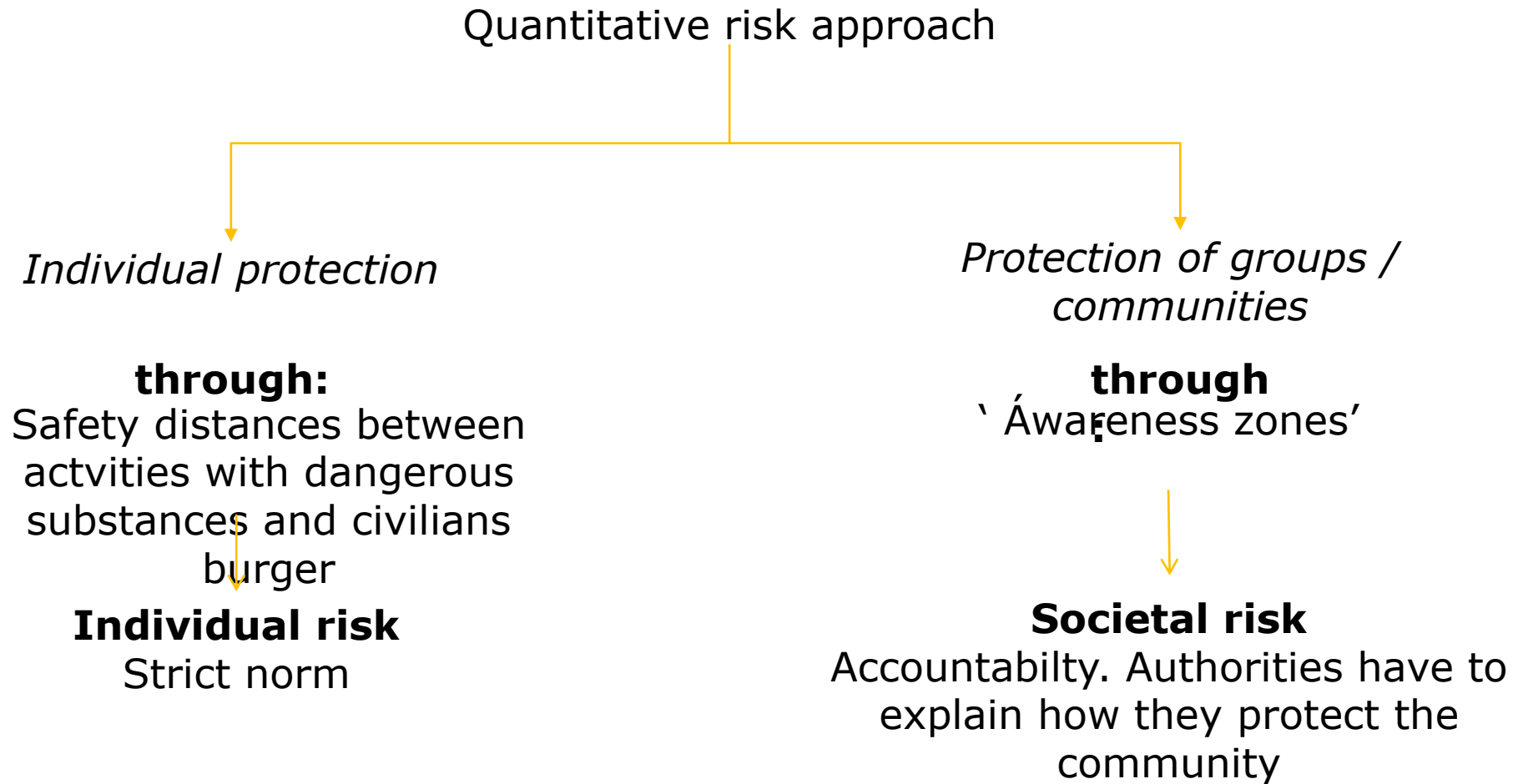
Roles and responsibilities

- > Everyone has a duty of care for the environment
- > Government defines criteria for activities e.g. with hazardous material
- > Municipality defines which new activities are allowed and under which conditions e.g. which level of protection should be given to new inhabitants.





Risk assessment



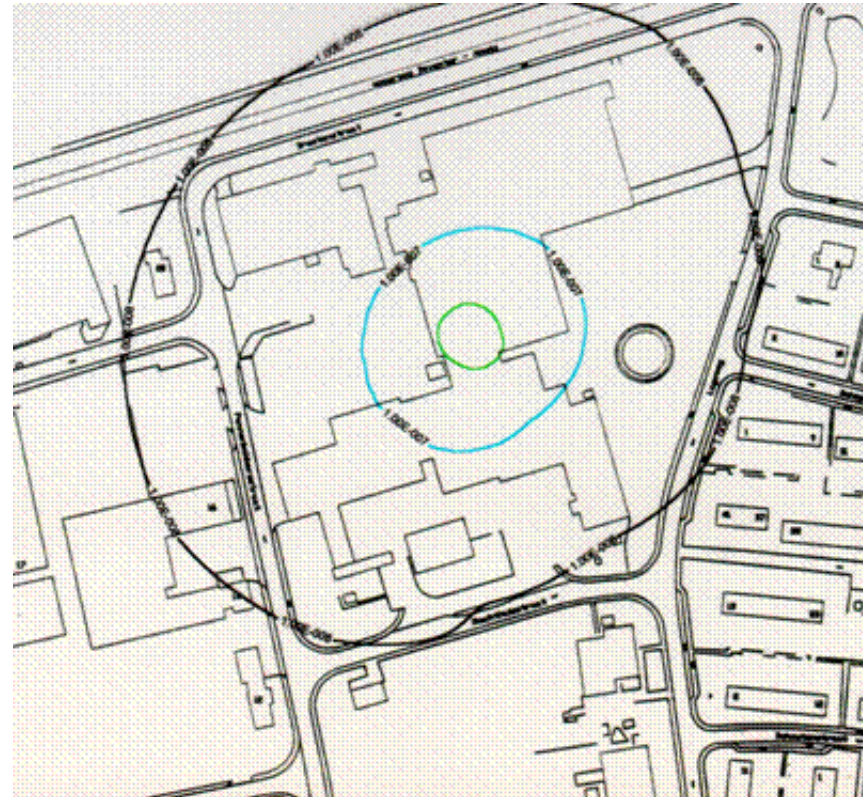


Individual risk

- > The probability that a person permanently residing at a location in the vicinity of a hazardous activity will be killed due to an incident involving that activity



Risk contours





Risk acceptability criteria in the NL

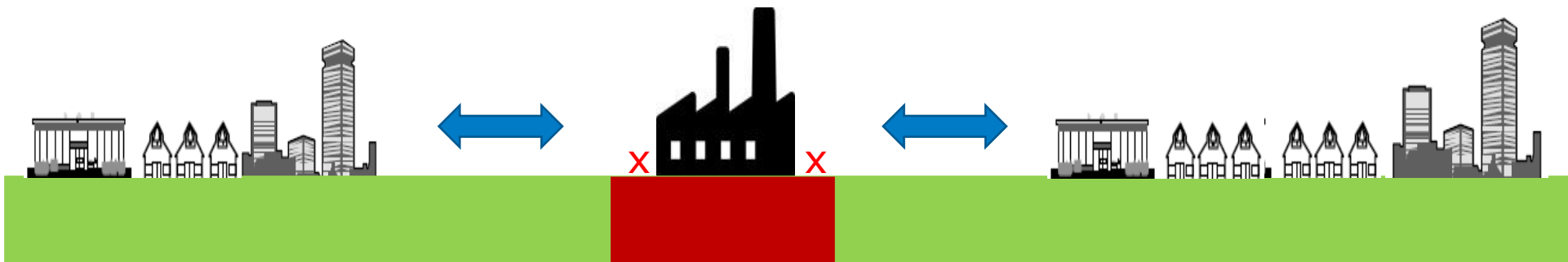
Object activity /	Risk acceptability criteria
(Very) Vulnerable	Limit value PR 10^{-6}
Less vulnerable	Guide value PR 10^{-6}



Individual risk criteria

Instrument for spatial planning

- > Vulnerable activities are not allowed within the 10^{-6} contour



Houses (1970s)

Appartments (1970s)

Conference centre

Houses

Offices



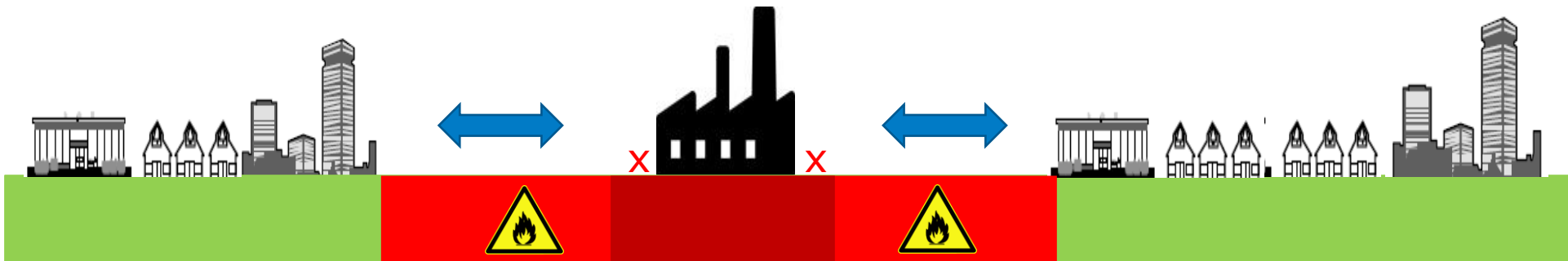
Railway



Awareness areas (aandachtsgebieden)

Instrument for spatial planning

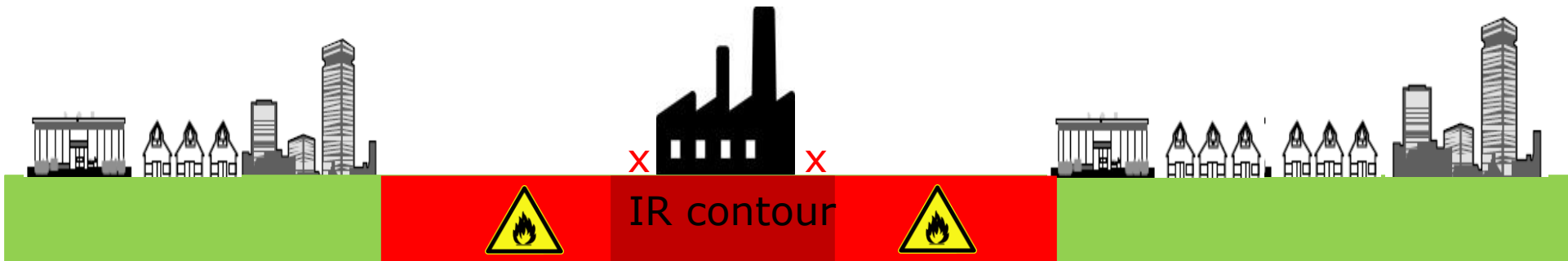
- > Starting point for a discussion about appropriate protection
- > Areas that need extra attention for protection





Awareness area

- > Where is taking shelter in regular buildings with closed windows and doors insufficient?
- > Where is extra attention needed to protect people against the effect of a fire, explosion or toxic cloud?
- > Deliberate choice between room for development and protection levels





Awareness areas

Areas where regular buildings, emergency services and risk communication do not guarantee protection of people in buildings

Based on scenario's:

- Heat radiation: 10 kW/m²
- Overpressure: 100 mbar * Excepstion BLEVE: 35 kW/m²
- Concentration: Life Treating Concentration for people insite

Houses (1970s)

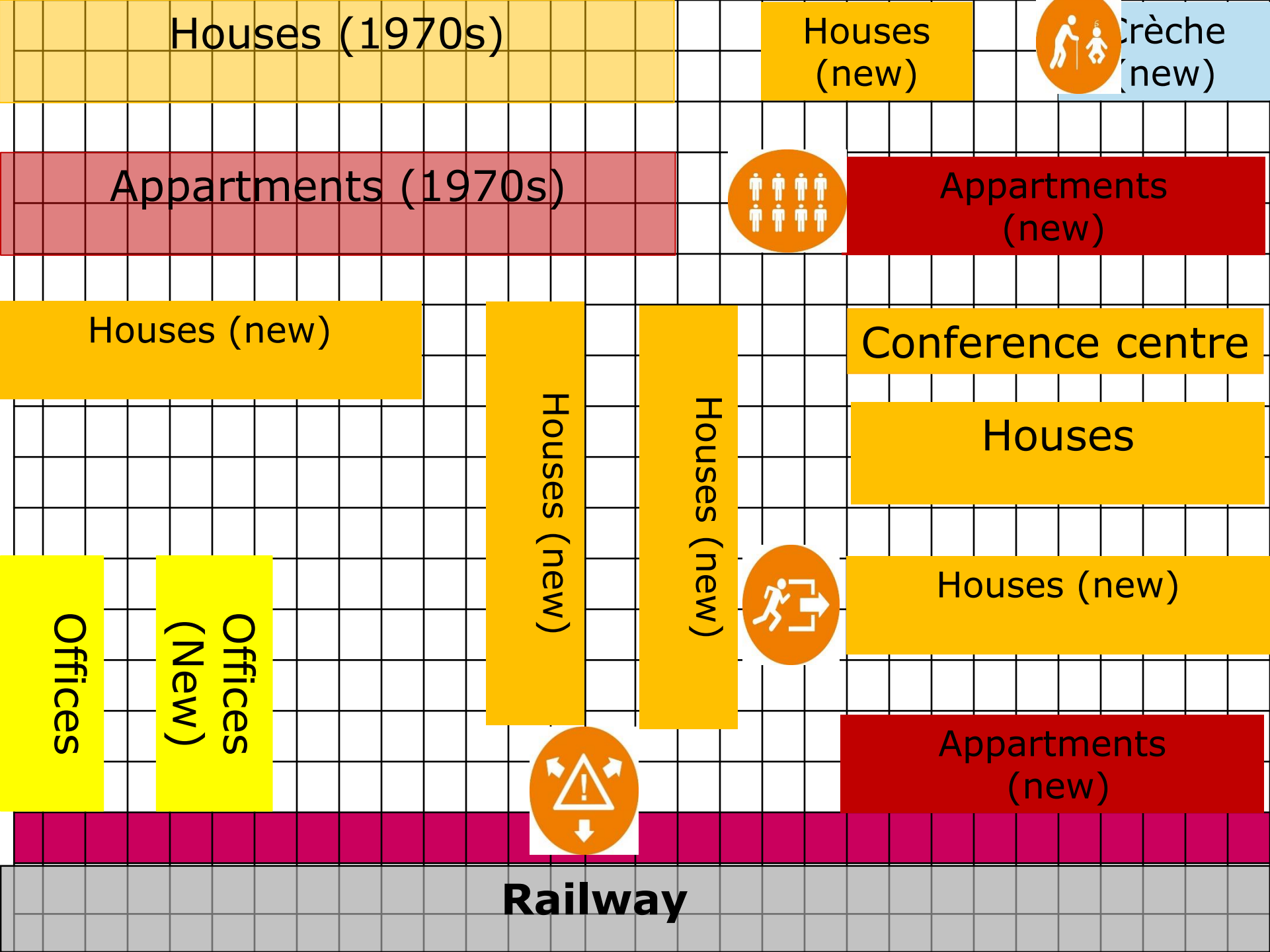
Appartments (1970s)

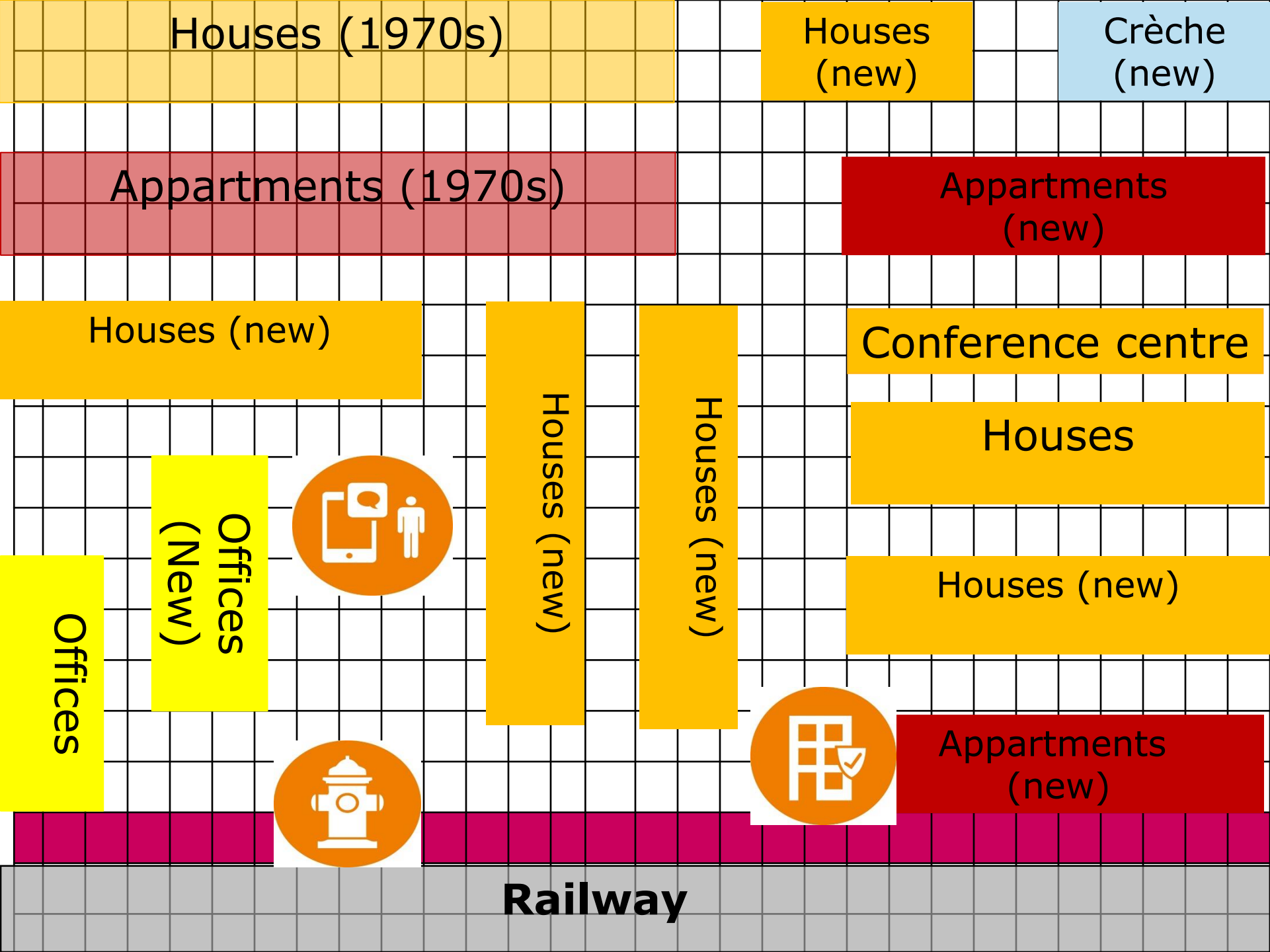
Conference centre

Houses

Offices

Railway







Thanks for your attention

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