Risk based External Safety Regulations in the Netherlands

robbert.plarina@ziggo.nl
Personal History

• MSc Technology Policy and Management, system analysis
• 7 years at national directorate External Safety:
  – Seveso regulations at EU & national level
  – National evaluation & improvement program for Seveso enforcement
  – Closing down of 200 LPG filling stations (with compensation €)
  – Reduction of administrative burden for industry
  – Co-ordinated inspectionscheme
• Freelance consultant:
  – External Safety
  – Policy development
  – General project management
Content

• Government response to 2 major accidents
• Risk based External Safety policy
• Risk Modelling
• Unification of the risk model
• QRA vs Fixed safety distances
• Risk based decisions for spatial planning and environmental licences
• Examples of risk reduction
• What is needed for risk based approach?
• Pro’s and Con’s
External Safety in the Netherlands

Over 5000 establishments have hazardous substances:

- 2200 LPG tankfilling stations
- 1000 Chemicals storages
- 500 NH₃ cooling units
- 300 Seveso sites
- 30 Marshalling yards
- … Other sites

+ Transport (rail, water, road)
Bijlmer airplane crash & Enschede Fireworksexplosion
Safety Program financing: 20 million Euro/year

Program Financing External Safety

(million euro's)

Year

2004 2005 2006 2007 2008 2009 2010
How we spend this budget

1. Inventory of risk situations 23 %
2. Actualisation of existing permits 10 %
3. Transportation of hazardous substances: routes 13 %
4. Development of external safety policy 5 %
5. External safety in spatial planning 10 %
6. Development and implementation of societal risk policy 6 %
7. Preparing demolishments 4 %
8. Risk communication 2 %
9. Organisation and professionalisation 27 %
Policy framework External Safety

ES-policy

Policy development
- Chain studies
- Societal Risk
- Council advise

Establishments
- BRZO (Seveso)
- Fireworks regulation
- Regulation on Establishments (Bevi)
- Risk Register

Transport
- Regulation on transport
- Pipelines
- Airports

Specific problems
- Chloride transportation
- LPG- tankstations
- Ammunition storage
- Piazza, Microchemie
- Railyards
- Security

Implementation and enforcement
Program financing
Safety Instruments

Spatial policies

Location of chemical industry and ports

Spatial use near risk source

Safety management companies

Amount of transportation, modality, routes

Base network: RVGS

Convenants

Widening of environment management act

Convenants

Safety in spatial planning

Risk governance

Governmental agreements
Co-ordination in the Netherlands

Ministries: Social Affairs, Internal Affairs, Environment & Spatial planning, Transport & Infrastructure

Occupational Safety, Disaster Preparation, Fire brigades

Inspectorates, Labour, Fire brigade

Seveso company

Horizontal co-ordination

External Safety

Environment authority & Local spatial planning

Traffic and water

Coordinating Frontoffice

Risk based External Safety Regulations in the Netherlands
25 May 2011, Seveso Conference Stockholm
Risk based safety policy

Identify risks

Quantitative assessment

Risk criteria evaluation

Measures / strategies

Monitoring / control

Registration Decree

QRA standardisation

External safety decree

Problem solving

Enforcement
Minimum safety level

- $8.5 \times 10^{-3}$ random Selected person
- $10^{-4}$ persons of age 10 - 15 yrs
- $6 \times 10^{-5}$ deadly traffic accident
- $2.5 \times 10^{-6}$ deadly fire accident

Minimum external safety level in regulations

1/100
Risk modelling

Dispersion of gas cloud
60 weather conditions

Containment failure
10 - 1000 scenario’s

Risk source

Damage
5 - 10 models

Vulnerable objects
Risk Modelling

- **Release scenario**
  - CPR 18 - purple book

- **Source term model**
  - CPR 14 - yellow book

- **Dispersion model**
  - CPR 14 - yellow book

- **Damage model**
  - CPR 16 - green book

- **Risk summation**
  - CPR 18 - purple book
Risk based distances

Are

• Calculated in a Quantitative Risk Analysis, **QRA**
• The results of the weighted summation of small and big effects taking into account their probability

\[
\sum_{\text{installations}} \left[ \sum_{\text{containments}} \left( \text{small effect} \times P_{\text{small effect}} + \text{big effect} \times P_{\text{big effect}} \right) \right]
\]
Risk criteria for External Safety

**Location-specific risk (LR)**
(Individual risk)

- $10^{-8}$
- $10^{-7}$
- $10^{-6}$

**Societal risk**

- $10^{-8}$
- $10^{-7}$
- $10^{-6}$

---

**Risk based External Safety Regulations in the Netherlands**

25 May 2011, Seveso Conference Stockholm
Risk contours - calculated from QRA

Iso-risk contours

Location-dependent risk
Societal Risk: FN-curve & area specific map
Legislation structure:

- Environment Management Act
- Spatial Planning Act
- Risk criteria Decree
- License per establishment
- Min. Regulation
- Spatial planning decision

Provincial council and local council roles are indicated in the diagram.
2 sides of External Safety Decree (Bevi)

Environmental Permits

Spatial Plans

10^{-6}
Spatial Planning: new situations
Action on existing situations

- 2007
- 2010
- 10^{-5}
- 10^{-6}
- FINANCIAL COMPENSATION
- LC_{01}
Example of problem solving: Ammonia

Production site Yara Sluiskil

Processing all ammonia on the site instead of transporting the surplus

-Negotiations still running-
Example of problem solving: Chlorine

Deal Akzo Nobel

Agreement to stop chlorine transportation by rail by

- Stopping chlorine production in Hengelo
- Setting up a modern chlorine plant in Delfzijl, so transport is no longer needed.
Example of problem solving: LPG filling stations

• Underground storage tanks
• Tests show that failure frequencies were too high (filling hose) -> lower safety distances
• Relocation of filling points
• Coating of LPG tank trucks (Bleve-scenario)
• Closing down the station (200) with compensation
Quality of QRA is critical

- External safety is the part of safety that focuses particularly on Land Use Planning
- Land Use Planning ⇒ at the end **YES OR NO**
  - LUP needs **robust and accepted** (codified) end-point (LR)
- Probabilistic approach
  + Makes it possible to quantify a wider range of modifications
    ⇒ reduction of zones
  - Needs additional data (failure frequencies), which is not readily available
Benchmark before QRA unification:

URL: http://www.rivm.nl/bibliotheek/rapporten/610066015.html
Response: QRA unification

• MODELS:
  • Establishments: SAFETI-NL
  • Transportroutes: RBM-II

• Reference manual (replaces the old CPR-books’)

• Expert Panel: Government, Institutes, Industry
Two types of establishments

establishment categories: safety distances
LPG tankfilling stations,
Chemicals storages,
Ammonia cooling installations

risk assessment and evaluation by risk criteria
for: 300 Seveso companies,
+ Railroad marshalling yards,
+ ...
Fixed safety distances vs QRA

Standardized risk - distance modelling

Standard installation

Risk distance table

Risk distances $10^{-5}$ and $10^{-6}$
+ max. pop. density

4000 sites

Complex site or Seveso site

Standardized risk modelling

Risk contours $10^{-5}$ to $10^{-8}$ + Soc Risk

500 sites
Example of fixed safety distances: Ammonia

### Koelsystemen en warmtepompen met ammoniak als koudemiddel

<table>
<thead>
<tr>
<th>Type installatie</th>
<th>Hoewelheid ammoniak</th>
<th>Opstelling uitvoering</th>
<th>Afstand (m) vanaf machinekamer</th>
<th>Afstand (m) vanaf vl</th>
</tr>
</thead>
<tbody>
<tr>
<td>installaties met een maximale werktemperatuur° lager dan −25 °C</td>
<td>&lt; 1500 kg</td>
<td>1</td>
<td>n.v.t.⁵</td>
<td>n.v.t.⁵</td>
</tr>
<tr>
<td>en</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>3</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&gt;= 1500 kg</td>
<td>1</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&lt; 3500 kg</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&gt;= 3500 kg</td>
<td>3</td>
<td>35</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>2</td>
<td>30</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>&lt; 6000 kg</td>
<td>3</td>
<td>65</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>&gt;= 6000 kg</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>1</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>&lt; 8000 kg</td>
<td>3</td>
<td>75</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>&gt;= 8000 kg</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>1</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>&lt; 10,000 kg</td>
<td>3</td>
<td>85</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>installaties met een maximale werktemperatuur° tussen −25 °C en −5 °C</td>
<td>&lt; 1500 kg</td>
<td>1</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
</tr>
<tr>
<td>en</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>3</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&gt;= 1500 kg</td>
<td>1</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&lt; 3500 kg</td>
<td>2</td>
<td>n.v.t.</td>
<td>n.v.t.</td>
<td></td>
</tr>
<tr>
<td>&gt;= 3500 kg</td>
<td>3</td>
<td>45</td>
<td>n.v.t.</td>
<td></td>
</tr>
</tbody>
</table>
What do we need?

Risk based approach demands expertise
- Fault tree's, corresponding frequencies and calculation of the effects
- International cooperation research institutes and industry

Expertise has to be applicable for LUP decisions (YES OR NO)
- Translation of expertise into applicable protocols
  - Dilemma: detail or reproducability
  - Difficult to quantify additional efforts to increase safety

Capability of decision makers to accomplish the intended evaluation and to effectuate their decision
- Experience of the local organisation (critical mass)
- Commitment of the local organisation (decentralized decisions)
- Provide the necessary legislation

Maintenance to keep the system up-to-date
- MoC procedures
Maintenance & Management of Changes

Requests for improvement
expert panel
(DORA)

Publication of Recommendations + investigation of impact

Decision by the departments involved

Last check by representative bodies
(Competent authorities + industry)

Publication of adapted Regulations
Recent Activities

• Introduction of the presented structure for LUP and environmental permits concerning Seveso sites
• Introduction of the presented structure for additional (industrial) activities with hazardous goods:
  • LPG filling stations
  • warehouses (PGS 15)
• Introduction of the presented structure for establishing probit functions (modelling acute toxicity in QRA's)
• Evaluation of lessons from Buncefield regarding our standardized LUP-QRA's
Current activities

• Introducing the presented structure for additional industrial activities. e.g.:
  – stevedoring companies
  – ammonia cooling installations
  – Mining activities (gas)
    » adaptation of the QRA protocol to the dimensions (high pressure, large volumes)
• Establishing additional probit functions
• Introducing an adapted version of the presented system (legislation) for transport routes
  – Transport and stationary establishments share the QRA expert panel and the presented maintenance structure
• Evaluating our existing implementation of the Societal Risk
• Introducing insulation on road tankers delivering LPG to Dutch LPG filling stations
• Stimulating a more structural exchange of experience and the cooperation (critical mass)
Maintenance

• Evaluation of the regulated protocol and software

• Improving the system, based on e.g.:
  – list of priorities compiled by the QRA expert panel

• ...
Some thoughts on risk based policy

PRO’s:
• Minimum safety level for the public
• Uniformity (1 model)
• Efforts can be directed to biggest risks
• Tool to force safety awareness in spatial planning

CON’s:
• Limited incentive to go beyond minimum safety level (ALARA)
• Difficulty to explain to decision makers (Politicians)
• Not all safety measures part of QRA outcome (SMS)
• Requires a lot of expertise and maintenance
• Thinking does not stop at outcome of QRA
More information?

• PGS (Dutch)
  - http://publicatiereeksgevaarlijkgestoffen.nl/publicaties

• Probits (English)
  - http://www.rivm.nl/rvs/normen/ramp/prob/index.jsp

• Reference Manual Bevi Risk Assessments, the successor of the "Purple Book" (Dutch + English)
  - http://www.rivm.nl

• QRA expert panel (Dutch)

• SEVESO (DUTCH)
  - www.brzo99.nl