
# Risk management and enforcement of dangerous goods pipelines in Hungary

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**Department for Hazardous Establishments**

TWG2 meeting, 25-27. September 2019.

# Summary



# Outlook on international accidents

Mass movement caused pipeline rupture
Columbia, 2011.
32 fatalities, >80injured

Underground gas pipeline explosions
Taiwan, 2014.
32 fatalities, >320 injured

Gasoline theft
Mexico, 2019.
139 fatalities, >100 injured

# Definitions

**Under tier establishments:**
The location under the control of an operator where dangerous substances are present in quantities equal to or over the 25% of the lower threshold (but below the lower threshold), and furthermore the special establishments listed in the followings:

- establishments related to the **offsite pipeline transport of dangerous substances** and hazardous wastes, including the transport **pipeline**, the **pump-**, **compressor-**, and **distribution stations**, **excluding** the **pipelines** and stations for **distributing gas to the public**, **and** the **collector lines** of the hydrocarbon **mining** under the diameter of 400 mm;
- establishments for incineration of hazardous wastes, if they are not classified as lower or upper-tier establishments;
- establishments, where ammonia or chlorine are present at least in 1000 kg, if they are not classified as lower or upper-tier establishments.

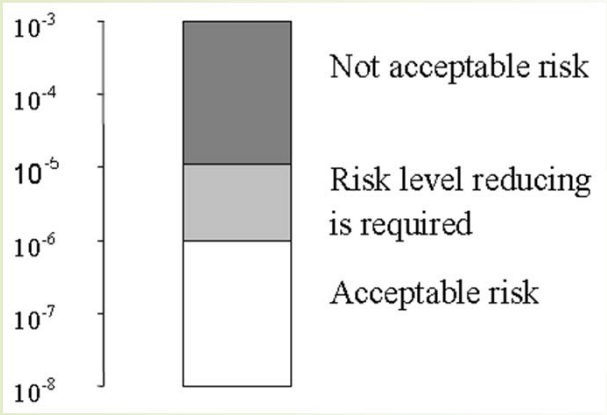
**Serious Accident Prevention Plan (SAPP):**
The operator of an under tier establishment (eg. pipe-network) shall draw up a ***Serious Accident Prevention Plan***, meeting the requirements of content and form determined in national legislation ***to eliminate the consequences of hazards identified***.

The task within the under-tier establishment for limiting the consequences of a major accident involving dangerous substances shall be determined by the operator (all what it could do: like automatic monitoring, early warning, shutting-off, depressurization, flare installation, recovering).

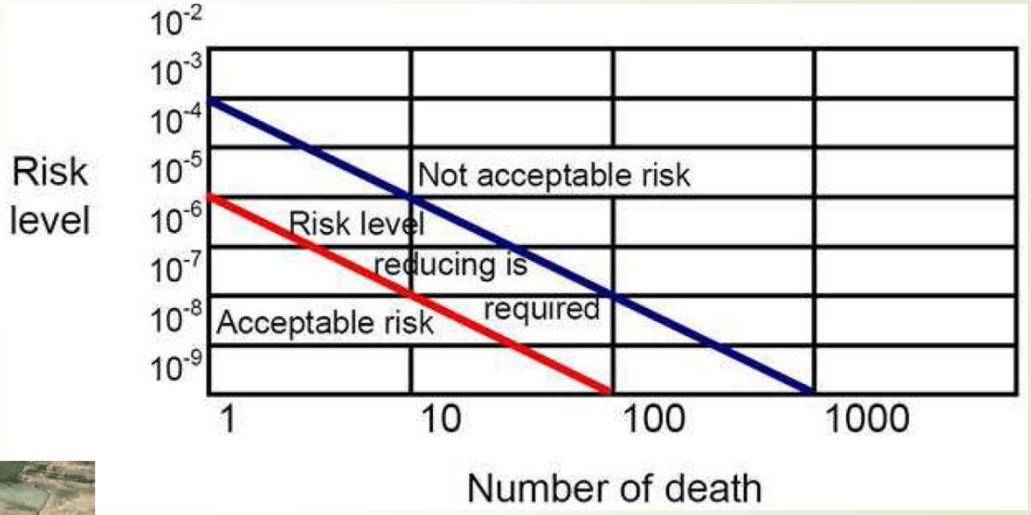
The operator shall provide conditions necessary for the accomplishment of tasks defined in the *SAPP*.

# Quantitative Risk Assessment

## Acceptability of individual risk (fatal event/year) – residental areas




## Acceptability of societal risk (fatal event/year)



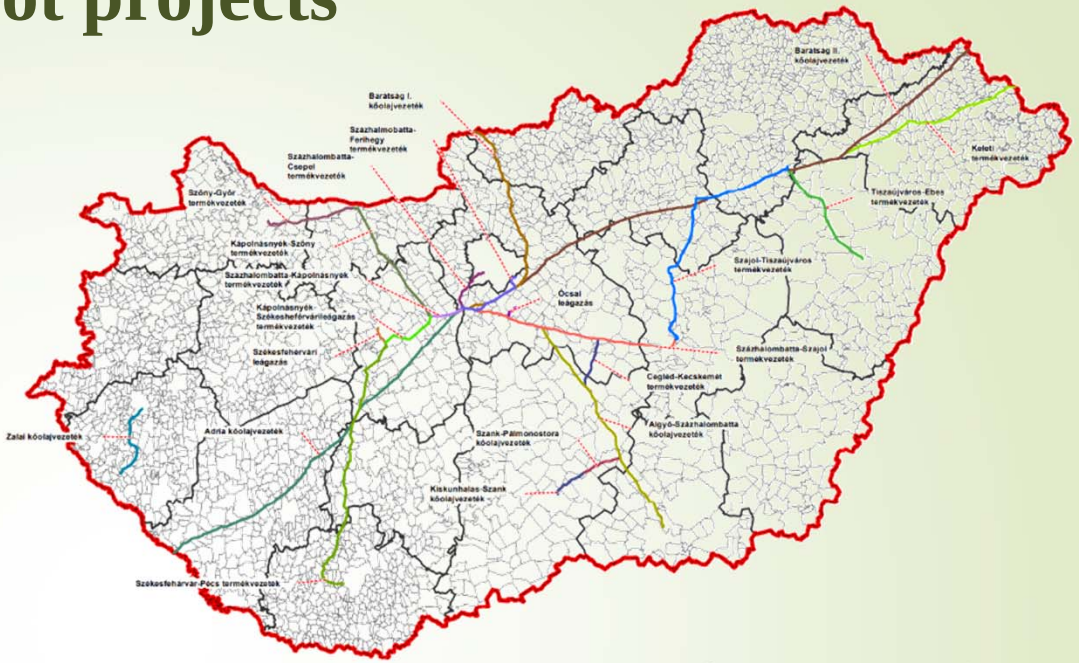


**Residental areas, workplaces, shopping centers, schools, entertaining facilities, hospitals, main transport routes, etc.**

# Pilot projects

Carried through by the NDGDM (the central body of the Seveso competent authority)

1. <u>Petrochemical dangerous substances</u>
   - Crude oil: international transportation (Southern Druzhba, Adria, etc.)
   - Products: diesel, gasoline, JET kerosine, etc.
   - Operated by the MOL Group

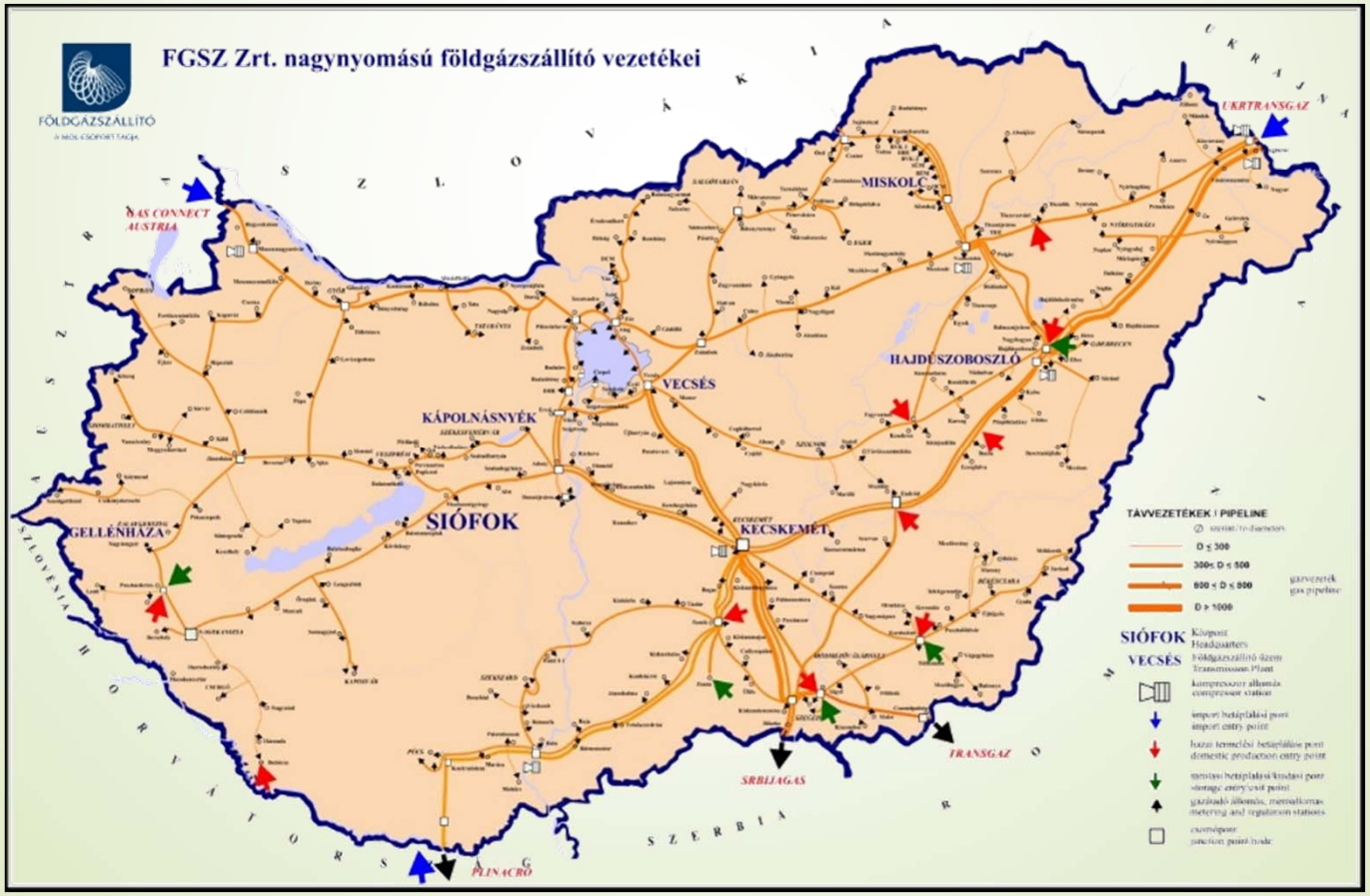



2. <u>Compressed natural gas</u>
   - International transportation (South Stream)
   - The main energy source for heating, both for the public and industrial sectors
   - Operated by FGSZ Ltd.

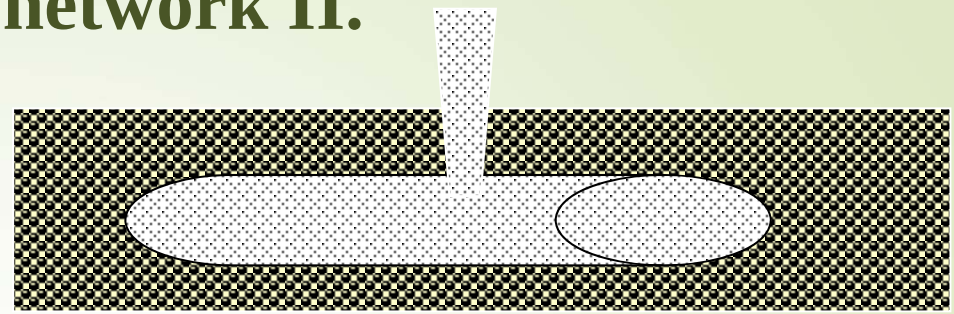

<u>+ smaller companies</u>, shorter pipelines, less complicated projects (eg. direct lines) are evaluated by the regional authorities, individually, BUT following the method of these 2 projects

# CNG pipe network I.

- up to 63 bar overpressure
- almost 6000 km long pipe network
- pilot-project in 2012 (QRA evaluation criteria) – authorities, operators, consultants
- 2 main characters of the equipment:
    - Underground pipeline
    - Aboveground facilities (compressors, pressure reducers, junctions, etc.)

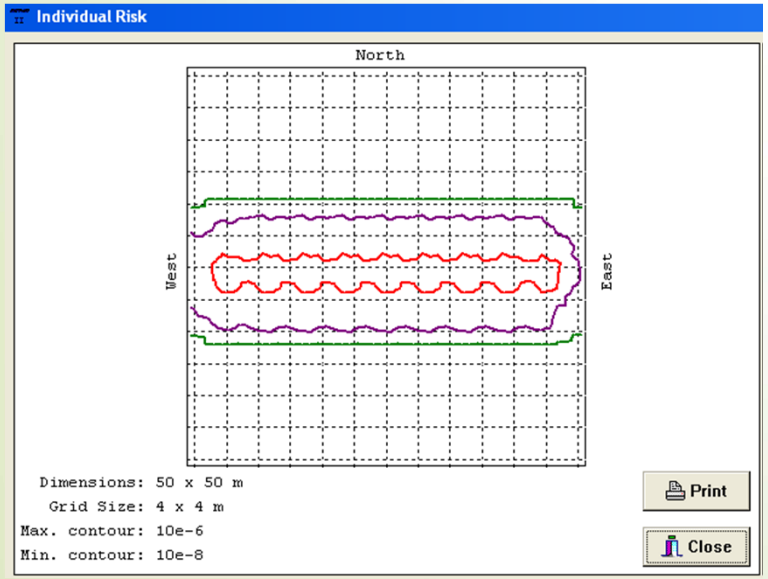


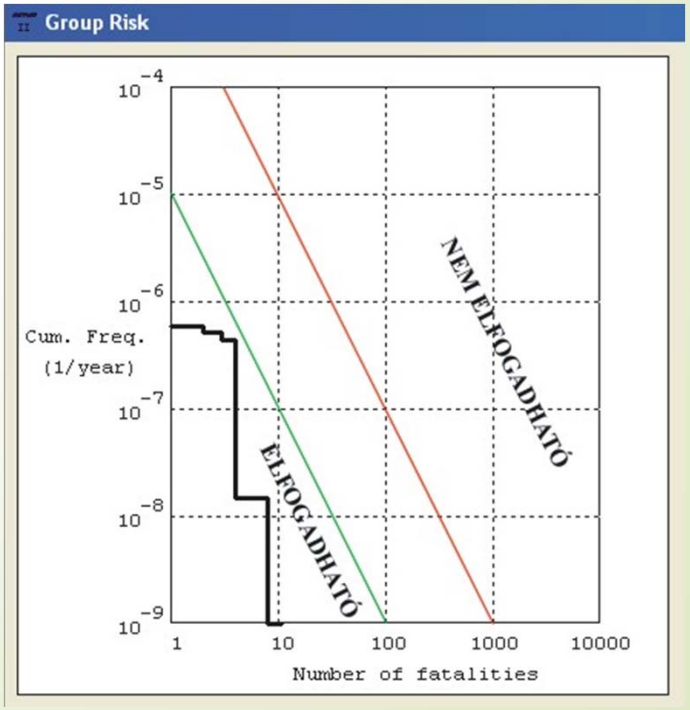
# CNG pipe network II.



**UNDERGROUND PIPELINE**

- vertical JET→ spread/fire/explosion
- frequencies: based on *Guidelines for quantitative risk assessment („Purple Book"), Haag, 1999., Volume 2., Chapter 3.5.*
  - Modified (1): no rupture, but 50 mm hole (based on the 250.000 km.yr own experience)
  - Modified (2): 1 mm leakage (3-4 times/year)
- main consequence: the designing criteria (5m defended zone, no buildings) was proper

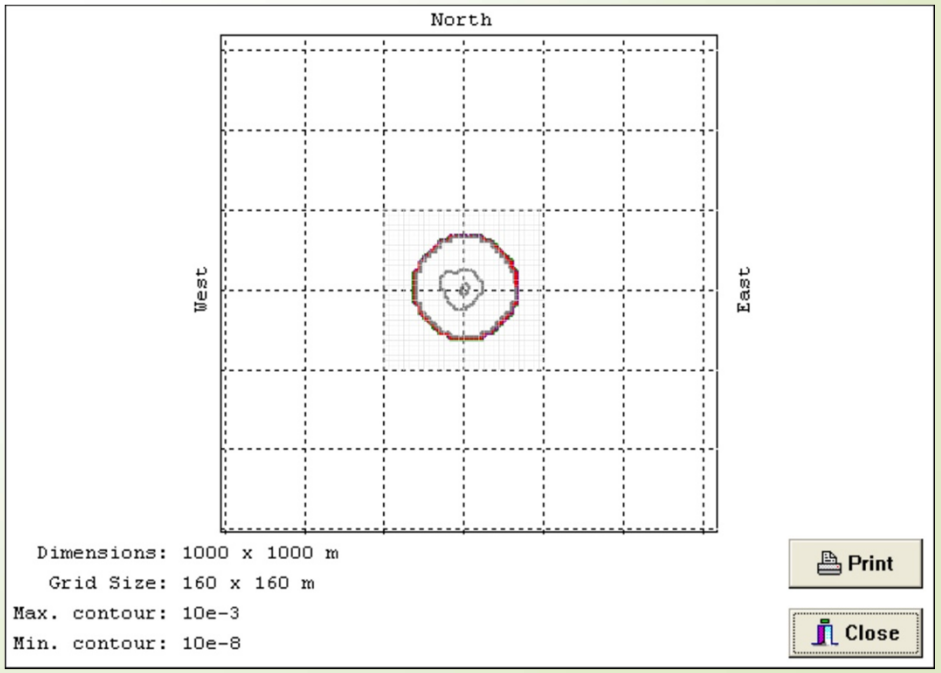


# CNG pipe network III.

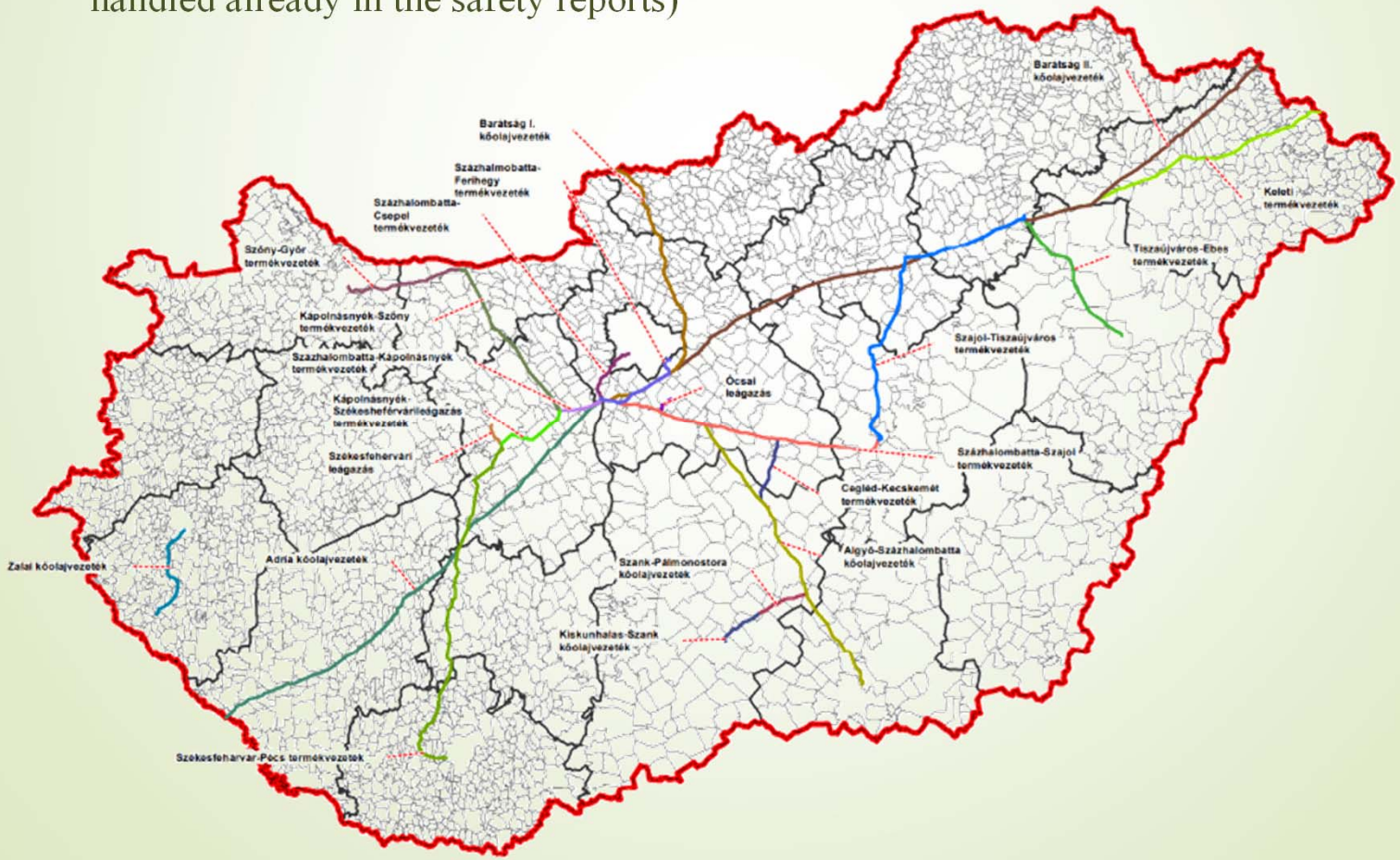
**ABOVEGROUND FACILITIES**

- Equipments involved in the QRA:
  - heat-exchangers
  - tanks (condensate)
  - aboveground pipelines (length up to 2000 m /facility)
- main consequence: risk level reducing is required if there are habitual buildings within 110 m
- almost 20% of the aboveground facilities needed a detailed, personalized QRA after the pilot project



# Petrochemical pipe network I.

- 5 different **petrochemical product** transporting „establishments”
- 2 different **crude oil** transporting „establishments”
- 1 pilot project for each type (QRA evaluation criteria) – authorities, operators, consultants
- 2 main characters of the equipment:
    - Underground pipeline
    - Aboveground pipeline (pump stations are usually in the territory of upper-tier establishments, handled already in the safety reports)



# Petrochemical pipe network II.

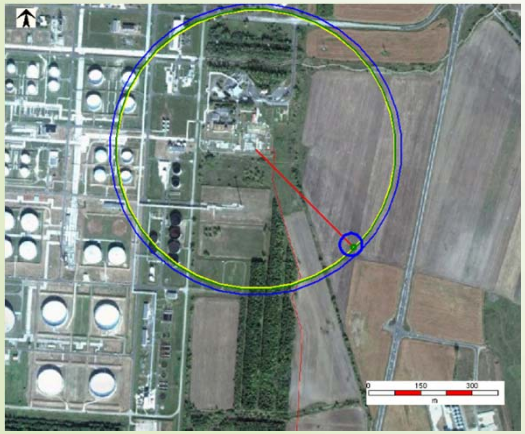
**Frequencies**: oversight of 6 different methods

| Scenario | Probability(%) |
|---|---|
| D=6 mm leakage | 78,7 |
| D=50 mm leakage | 16,0 |
| Catastophic rupture | 5,3 |

1. *CPR18E („Purple Book"), Volume 2., Chapter 3.5.*
2. *British Standards PD 8010-3 and IGEM TD/2*
3. *Guide méthodologique (Rapport n° 2008/01 Révision 2012 - version du 21.09.2012)*
4. *OGP – International Association of Oil and Gas producers method*
5. *CONCAWE method*
6. *AMINAL (Guidebook on Probability Numbers for Safety Reports, Version 2.0, 01/10/2004) method*

We chose the method of the *British Standards*, based on the frequency data of UKOPA database analyze, in addition with earthquake probability. (average failure frequency ~2,22x10$^{-4}$/km)

**Scenarios**:
fault trees and event trees were built for the possible scenarios

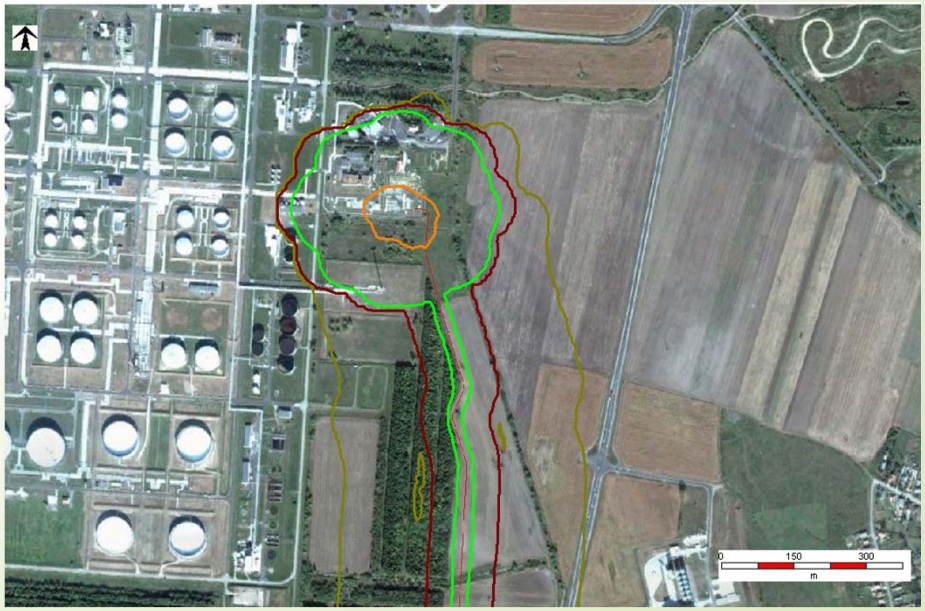


| Initating event | Immediate ignition | Late ignition | JET fire / VCE / Flash fire / pool fire | Consequence | Frequency [year$^{-1}$] |
|---|---|---|---|---|---|
| 8,70E-06 | Y | | | JET fire + pool fire | 5,66E-07 |
| | 0,065 | | | | |
| | N | Y | | Flash fire + late pool fire | 9,76E-07 |
| | 0,935 | 0,4 | 0,3 | Vapor Cloud Explosion | 6,51E-07 |
| | | | 0,2 | | |
| | | | 0,5 | Late pool fire | 1,63E-06 |
| | | N | | Toxic dispersion / pollution | 4,88E-06 |
| | | 0,6 | | | |

# Petrochemical pipe network III.

**PROTECTION LAYERS**

- protective coating
- cathodic protection
- Double-wall tube where crossing rivers
- automated, remote-controlled disconnecting stations (every 5-10 km)
- overpressure protection (automated pressure control)
- 24/7 service, online human supervision, dispatcher center with SCADA
- sensor foil, 60 cm above the pipeline (identifies immediately the location of damage with great accuracy)
- leakage detection system (pressure-difference based, counting automatically with flow rates)
- regular pipeline pigging
- smart pigging (GPS, corrosion detection, etc.)
- regular visual checks (by airplane)



# Advantages I.

**Awareness-raising**


Annual seminars for operators, safety consultants, other experts

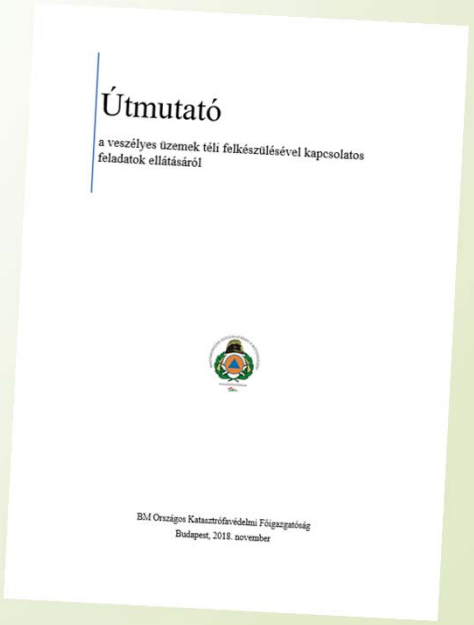
- since 2015
- 4x2 days
- 100-200 participants
- actual topics (maintenance, ageing, lessons learned from international accidents, safety subcontracting, etc.)

Special training for the Seveso contact persons and operational and HSE management of MOL Group (operator of the petrochemical transportation) in 2015.

Other trainings, workshops organized by regional directorates

Guidelines:

- Identification of hazardous activity (2017)
- Safety management systems (2016)
- Accident investigation (2018)
- SPIs in practice (2019)
- NaTech (2016)
- Winterization (2018)
- Logistics sites (temporary storage) (2015)
- National inspection plans (annual)
- Good practices on maintenance (ongoing)
- Subcontracting (ongoing)


Útmutató

a veszélyes üzemek téli felkészülésével kapcsolatos feladatok ellátásáról

BM Országos Katasztrófavédelmi Főigazgatóság
Budapest, 2018. november

# Advantages II.

**Regular inspection**

The central body of the Seveso competent authority (NDGDM) makes the national inspection plan.

It covers all types of inspections:

- regular
- joint (with other authorities)
- spot checks (to identify illegal hazardous activity)

In order to:

- have well-scheduled inspections
- inspections at the time of the peak production period of each sector
- attention to the regional inspection's experience (highlighted topics)

Highlighted topics:

- Register of dangerous materials present on site (2016)
- Investigation of near misses carried out by the operator (2016) *
- Personal protective equipements (2017) *
- Training of personnel covered by the SMS (2017) *
- Maintenance procedures for SCEs (2018) *
- Refrigeration systems (2018)
- Inspecting the logbooks (2019) *
- New technologies in the site (2019) *

# Advantages III.

**Practices, cooperation**

The serious damage protection plan (SKET) must be practiced every year.

Even if the company operates more establishments, just one training day is required, if it extends to all relevant personnel.

Changing the location (county, district) and the type of modeled scenario is required.

The geographically competent authority (regional directorate) take part of the practices.

At the end of the exercise, both the operator and the authority qualify that.

It must be repeated in the following cases:

- not exercises at least one of the worst-case scenarios (too easy situation)
- not following the necessarry steps, specified in the SKET
- there is circumstance which could lead to a negative outcome in the case of an assumed accident

# Advantages IV.

**Accidents, incidents, near-misses**

I. Prompt alert to the Disaster Management's operation duty services (rescue)
II. Detailed information within 24 hours (information to the public)
III. Investigation (usually within 2 months)

The operator must investigate the (root)causes of every accident, incident and near-miss, which is showing the signs of SMS malfunction.

<u>Detailed information - about the root causes, and countermeasures - for the Disaster Management is required in the following cases:</u>

1. Unexpected event (during normal operation/in the technological process of an establishment)
2. Requires immediate intervention
3. And has one of the following consequences:
   a) fire involving dangerous substances,
   b) explosion involving a dangerous substance,
   c) the release of toxic or carcinogenic substances (without threshold),
   d) release at least 1000 kg of liquid, which is flammable, dangerous for the environment, or oxidizing,
   e) release of other hazardous substances, in an amount of at least 0.1% of the upper threshold.

# Thank you for your attendance!