RETOMOD

Dispersion modelling of accidental toxic gas releases – a model comparison study

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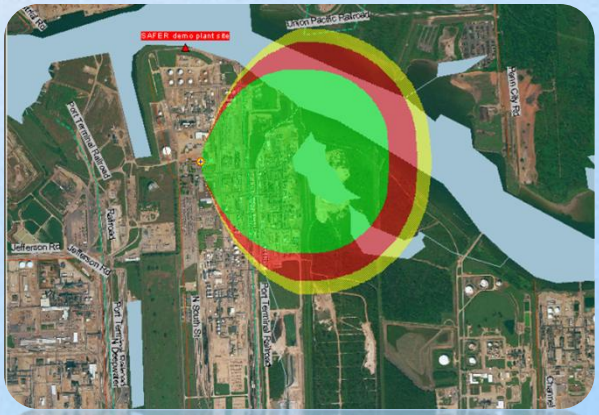
Why modelling the accidental release of toxic gases?

Prediction of the threat zones by accidental released toxic gases

- Accidents in establishments (chemical plants)
- Transport accidents

Calculation of the Maximal concentration / Dose

- for the next 1 hour after the accident
- from the first few meters up to 20 km



Application:

- Training
- Planing (Emergency plans)
- Support for the emergency responders

Explosion in the rail station Viareggio, Italy

30. June 2009
Railcar with fluid gas
22 dead, ~50 injured
Damages up to 300m

Modelling of accidental released toxic gases

- Dispersion models calculate averaged concentrations:

  - short time peaks in the concentrations can be higher or smaller depending on the wind fluctuations.

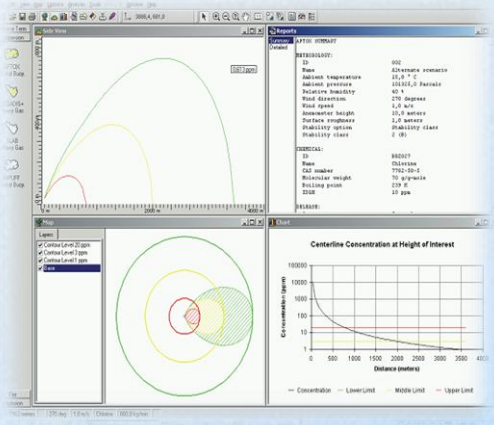
- Estimation of the threat zones with comparison to threshold values.

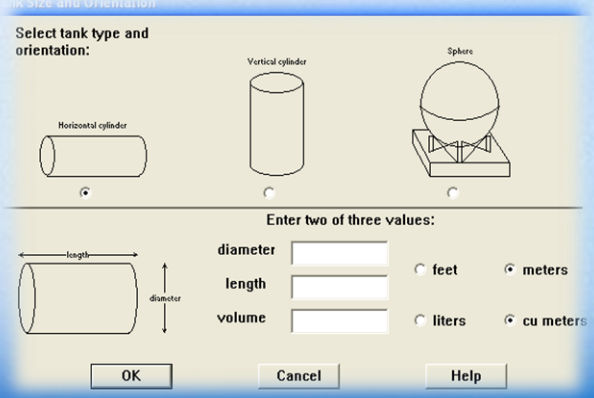
- Release terms are complex, mostly unknown and insufficient.

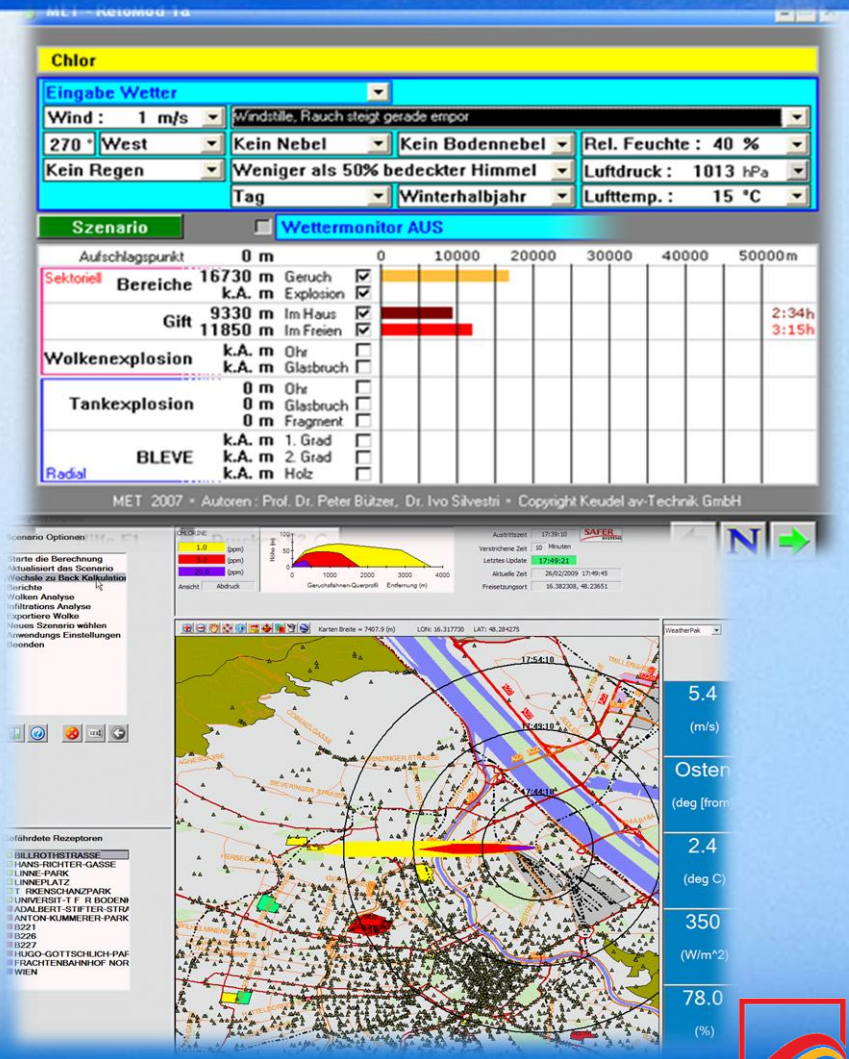
- Chemical features of the substances can influence the dispersion.

Modelling of accidental released toxic gases

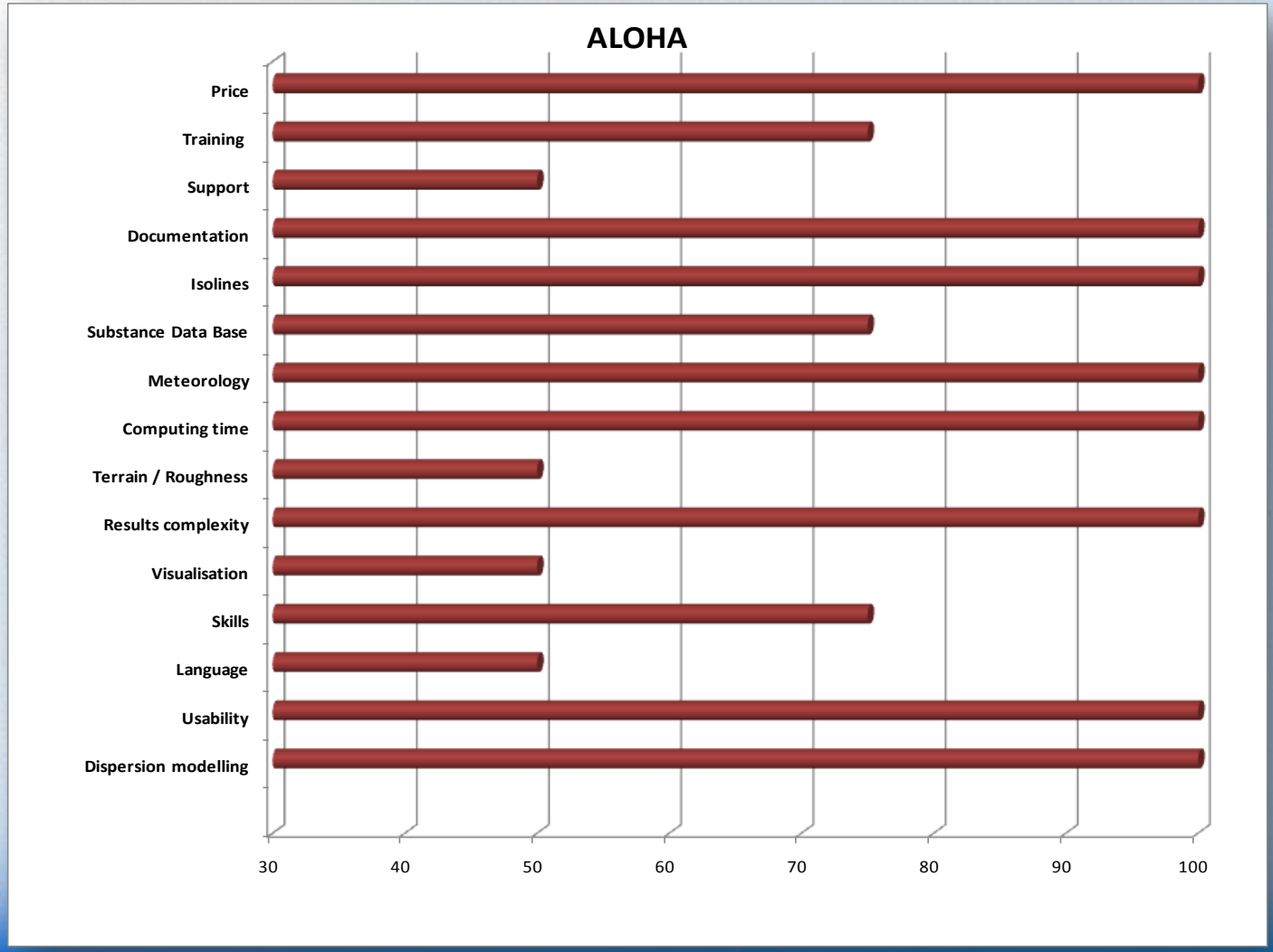
- ALOHA (CAMEO)
- HAZMAT RESPONDER
- TRACE
- MEMPLEX MET
- BREEZE HAZ
- SAM-S







Assessment of the model utility for the fire brigades



Interpretation of the results

Estimation of the threat zones – threshold values

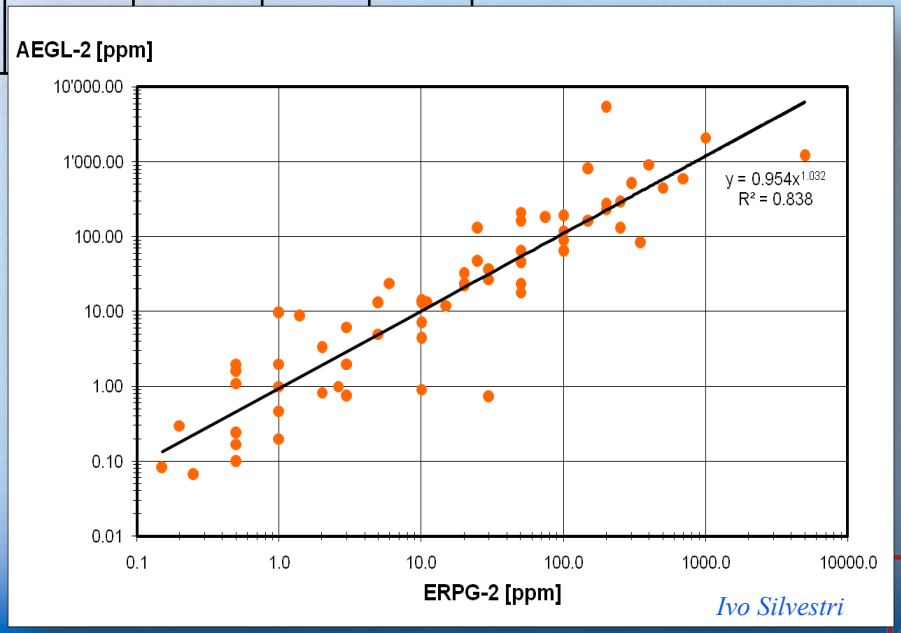
Substance	IDLH (30min)	ERPG-1 (60min)	ERPG-2 (60min)	ERPG-3 (60min)	AEGL-1 (30min)	AEGL-2 (30min)	AEGL-3 (30min)	MAK TmW	MAK Kzw
Ammoniac [ppm]	300	*25*	150	750	30	160	1 600	20	50
Chlorine [ppm]	10	1	3	20	0,5	2,8	28	2	4
Conversion factor to IDLH		10- 12	2 – 3,5	0,4–0,5					

IDLH = Immediate Dangerous to Life and Health,

ERPG = Emergency Response Planning Guide,

American Industrial Hygiene Association

AEGL = Acute Exposure Guideline Levels, EPA



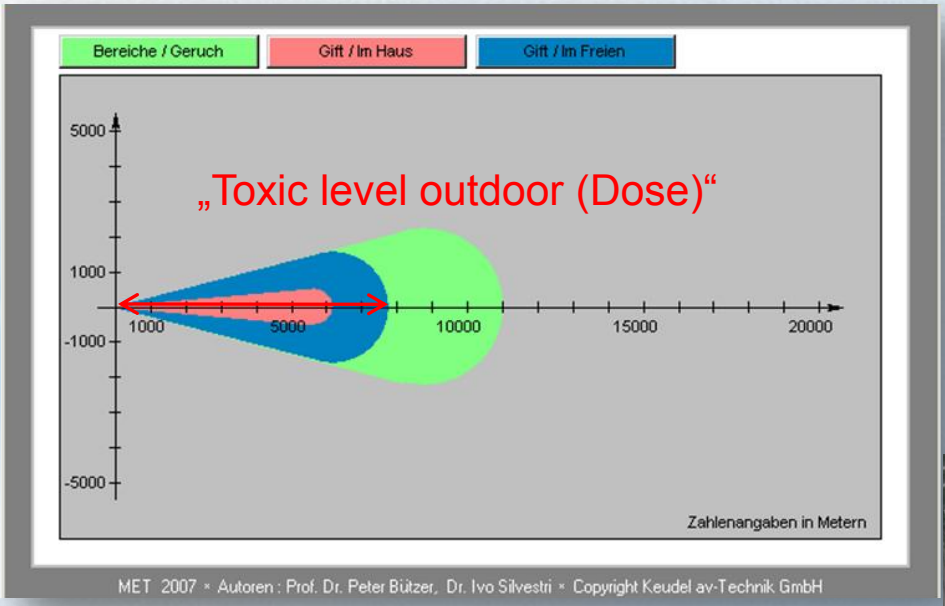
Concentration (ERPG-2) ~ 2 x Concentration (MAK)

Concentration (ERPG-2) ~ 4 x Concentration (MAK)

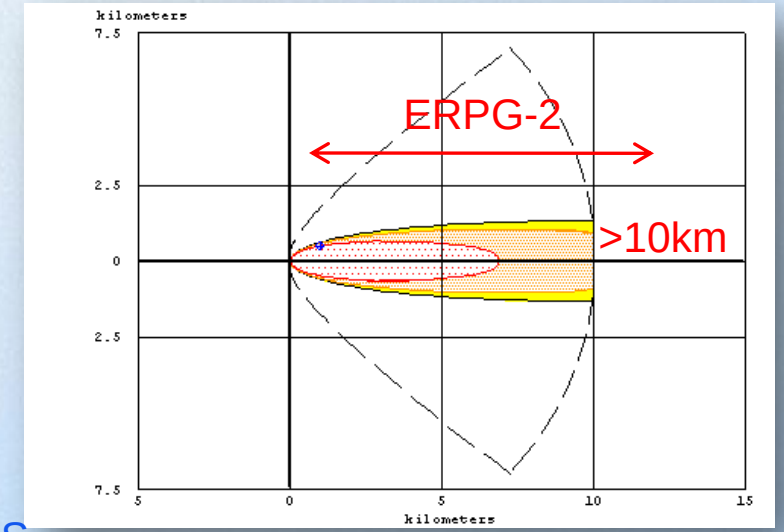
IDLH ~ 10 x MAK

Model comparison

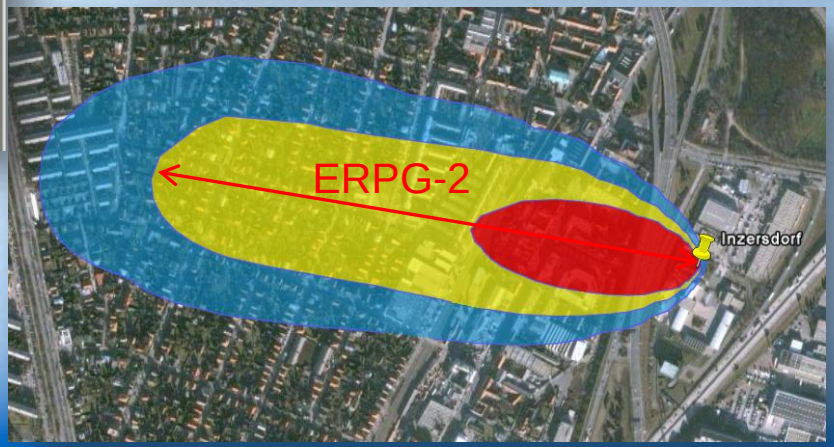
MEMPLEX



ALOHA

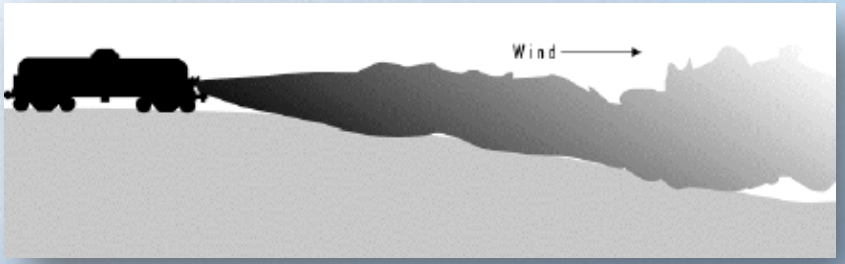


SAMS



Reference scenarios

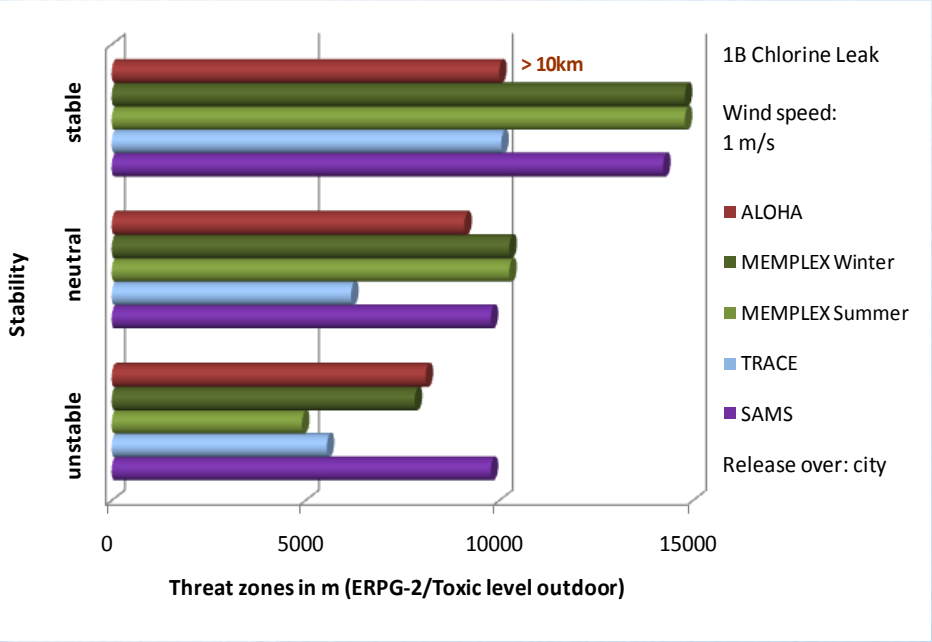
Scenario	Substance	Tank	Volume [m^3]	Filling level [%]	Mass [t]
1	Chlorine	Railway car	30	90	40
2	Ammoniac	Railway car	95	90	55
3	Butane	Truck	17	70	7
4	Petrol	-	-	-	1



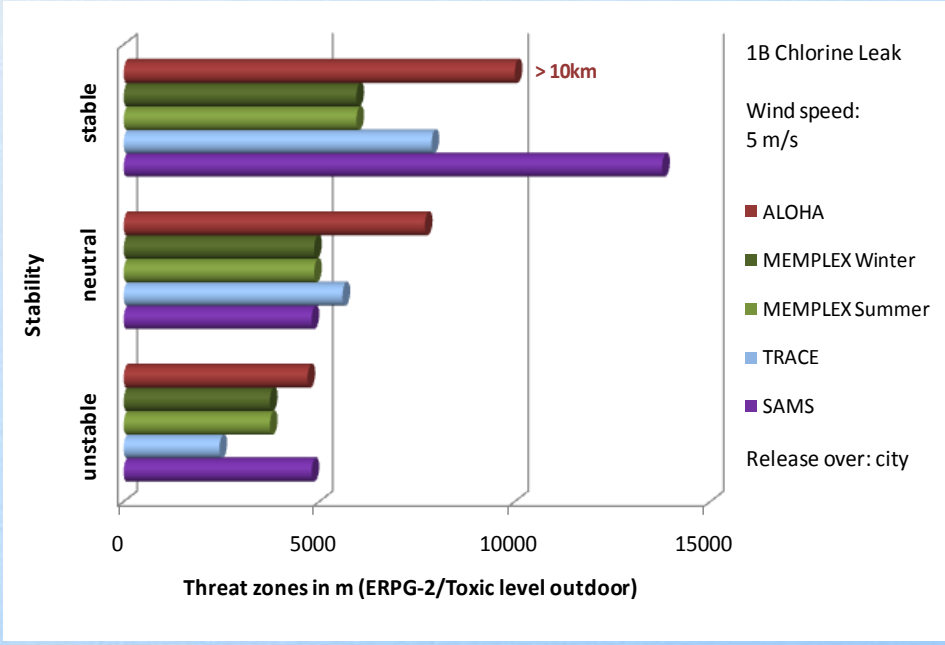
Model comparison

Chlorine

1 m/s



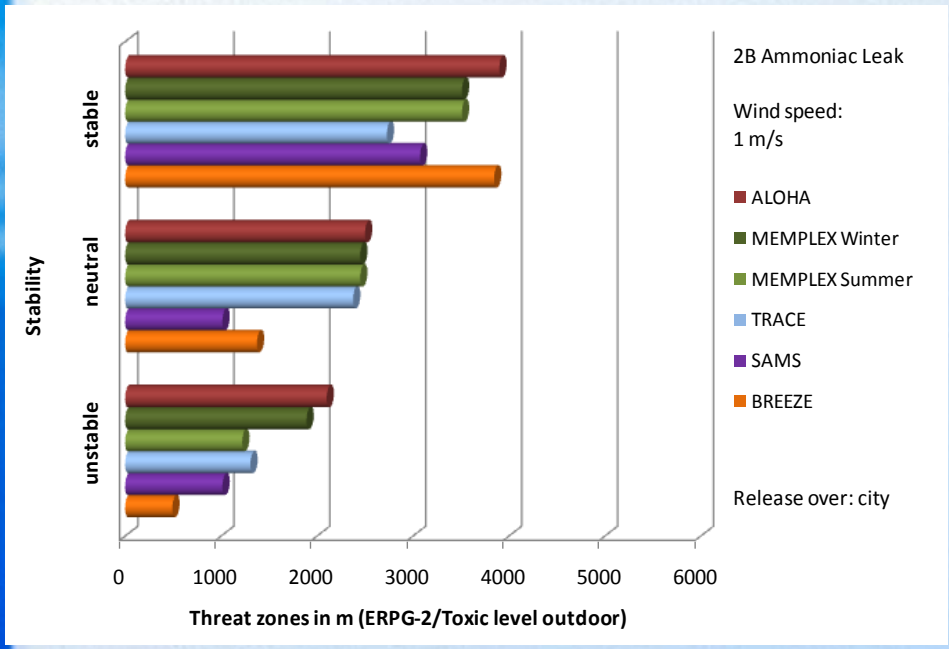
5 m/s



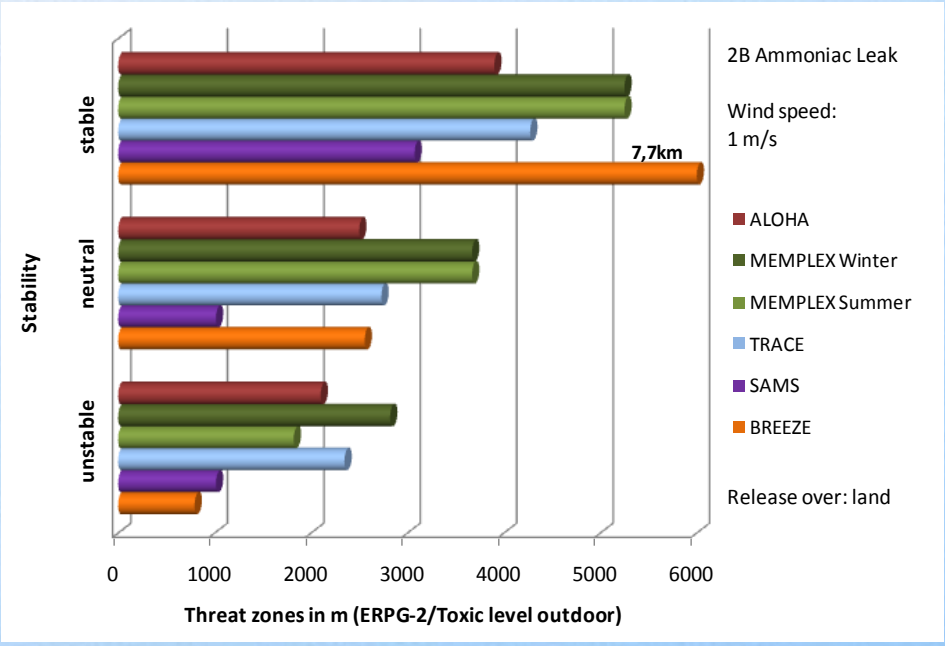
Model comparison

Ammoniac

City



Land



Importance of meteorological input parameters

Accident Report: Fire-accident in Ineos Köln-Worringen on 17.3.2008

Burning tank with acrylonitrile, after inflammation from broken pipe.

BR Feyrer: *„The wind turns. Because a tank with propylene close to the fire became at risk, we must started immediately with the countermeasures.“*

Conclusions

Models comparisons based on reference scenarios show partly big differences:

- Need of verification studies – e.g. COST Action in preparation

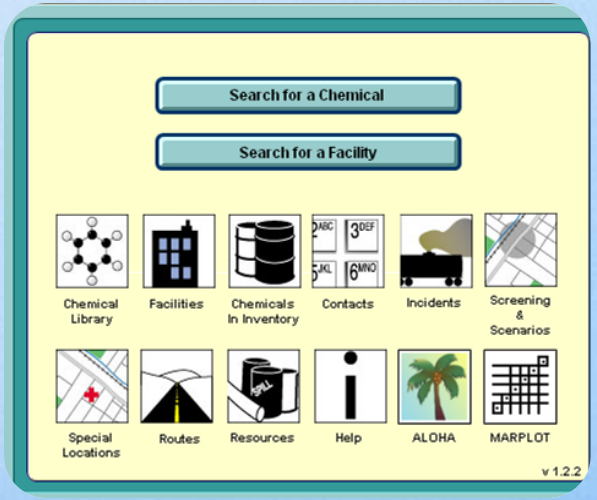
Recommendations for the model choice:

- For establishments (e.g. plant or chemical factory): e.g. SAFER or SAM-S.
- For mobile applications: e.g. MEMPLEX/MET, ALOHA.

Importance of the meteorological input:

- Wind, atmospheric stability
- Air temperature (relative to release temperature)
- Humidity, fog, rain

The choice of the appropriate model is up to the particular demands of the authorities.



Thank you very much for your attention!