

The Wetteren acrylonitrile disaster: management, media communication and biomarker-based screening

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Disclosure Statement

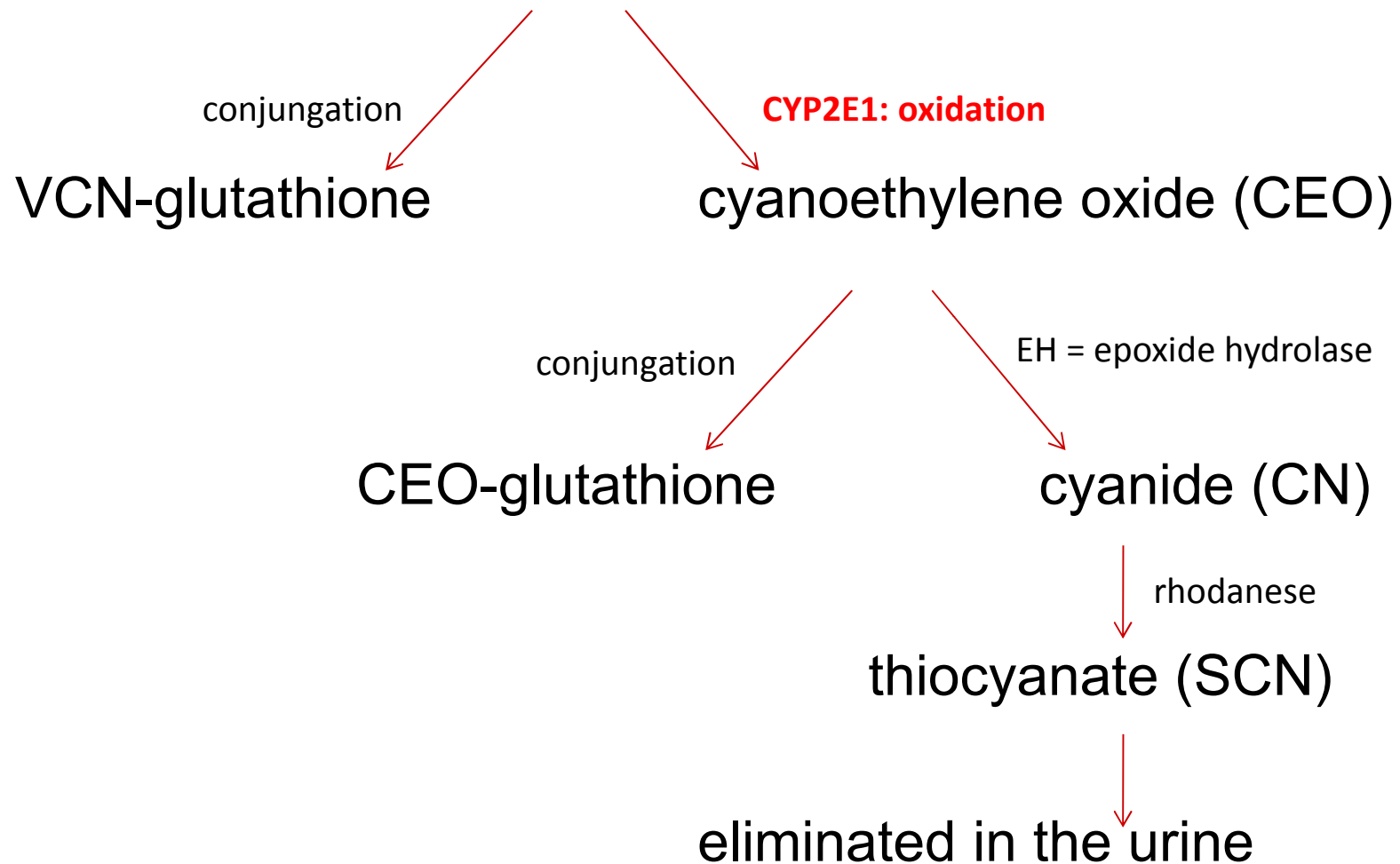
I DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

Alert phase

- ➔ **Alert by 112 emergency call center:**
 - ➔ May 4th 2013 at 2.00 a.m.: “rail road accident in Wetteren: derailment of freight cars, explosion and fire”.
 - ➔ Deployment of the municipal disaster plan and the medical intervention plan.
- ➔ **Three different substances in freight cars:**
 - ➔ Butadiene
 - ➔ Triethylaluminium
 - ➔ Acrylonitrile
- ➔ **No information about which cars were on fire.**
- ➔ **Information about wind direction and importance of upwind approach.**

Acrylonitrile metabolism

Acrylonitrile (=vinylcyanide, VCN)



First impressions on site ...









Coordination

- ➔ Command post operations (CP-OPS): operational coordination
 - ➔ Installed at a safe distance (pub)
 - ➔ All disciplines were represented; led by senior fire officer
 - ➔ Acrylonitrile freight cars on fire with a large leak
 - ➔ Important input from BASF specialists and company medical officers (e.g. delivery of cyanide antidote kits)
 - ➔ Concerns about possible exposure of firemen; decontamination unit
- ➔ Provincial coordination committee (PCC): policy coordination
 - ➔ Led by the governor of East-Flanders
 - ➔ Decision for evacuation
 - ➔ Search for additional antidote kits (poison control center, army, companies, hospitals, producer)

Neighbourhood of the train disaster



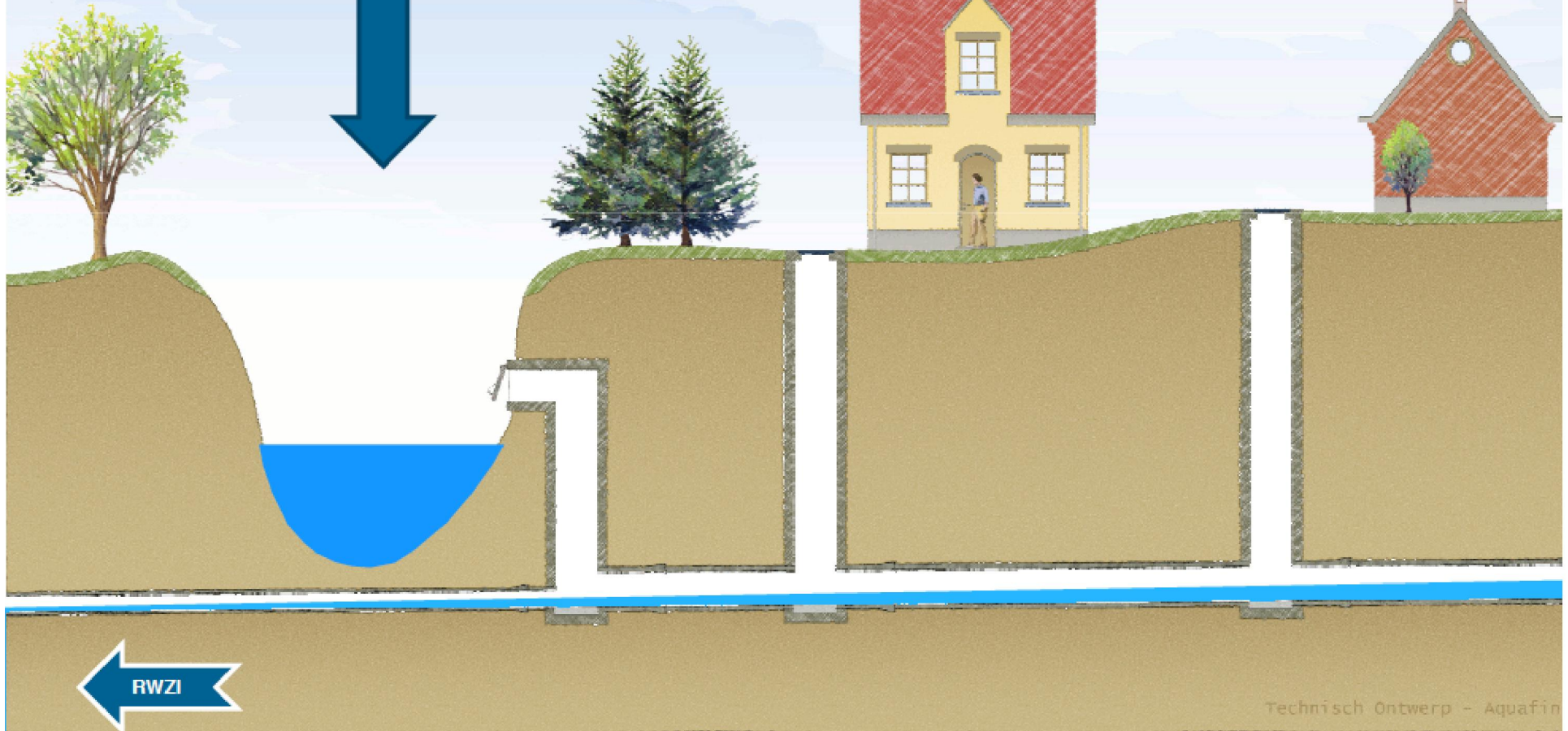
500 M Evacuated zone

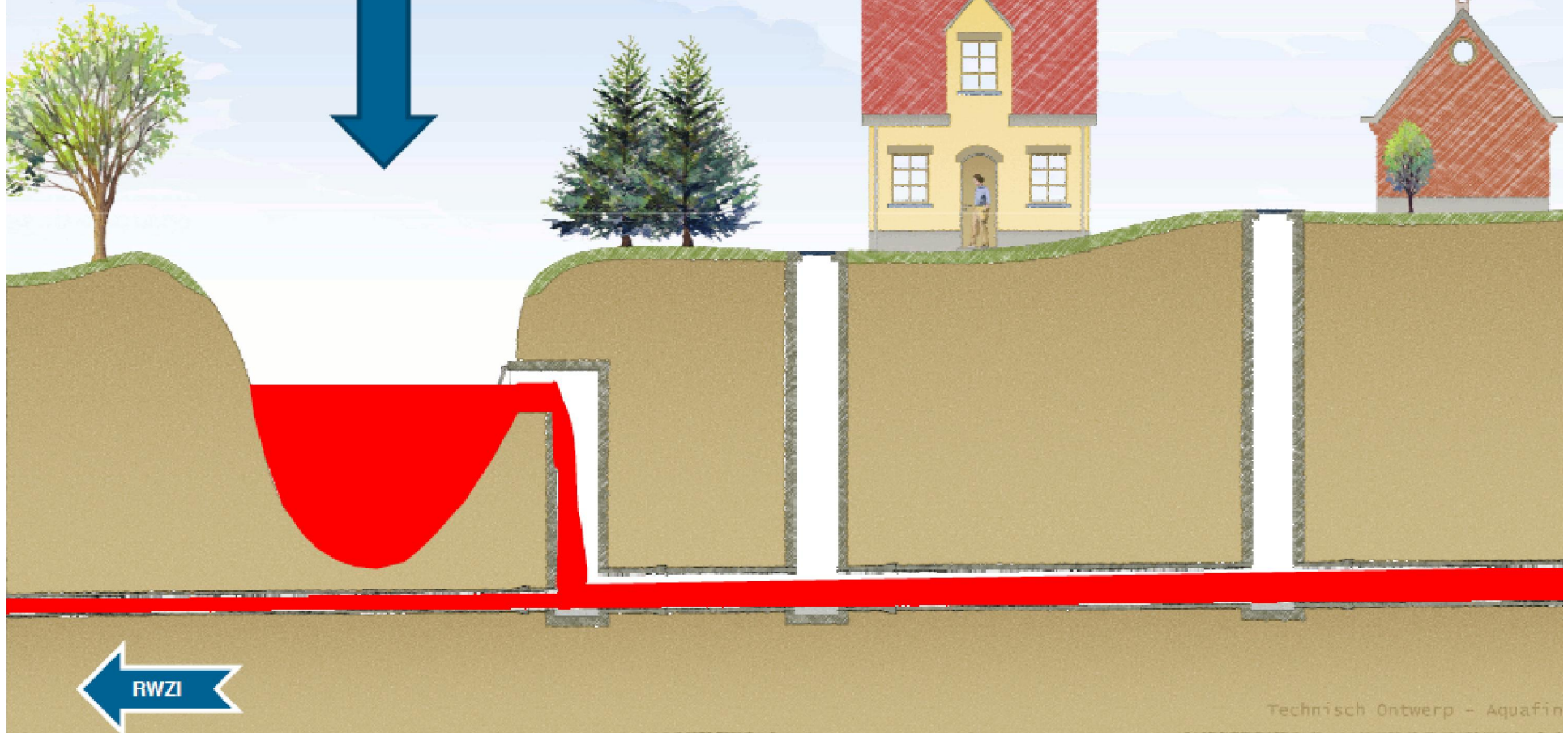
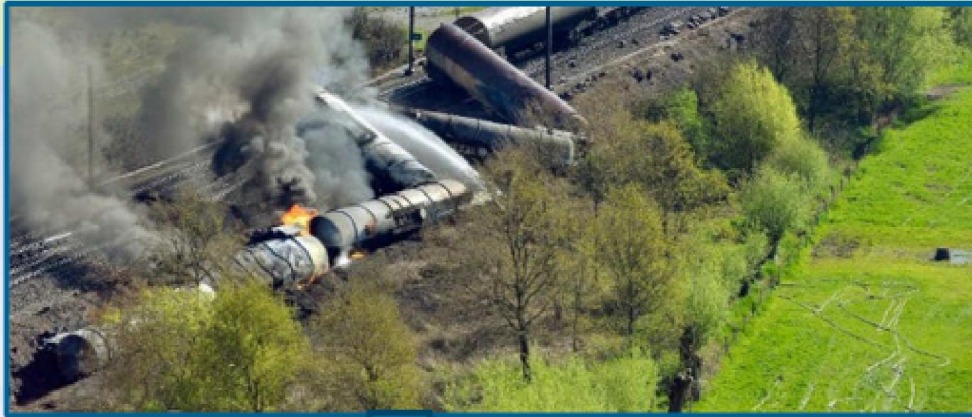
1000 M Safety zone (residents were asked to

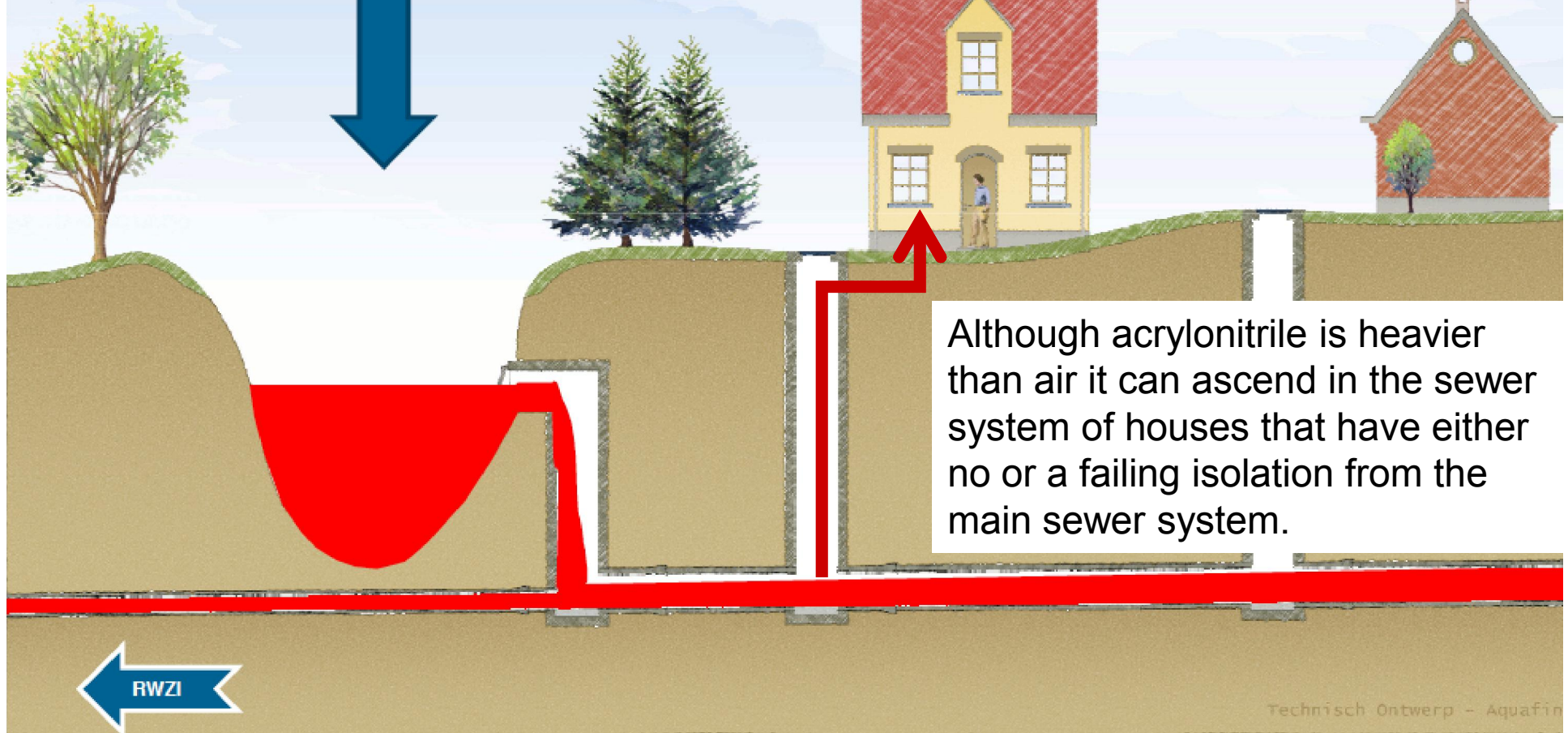
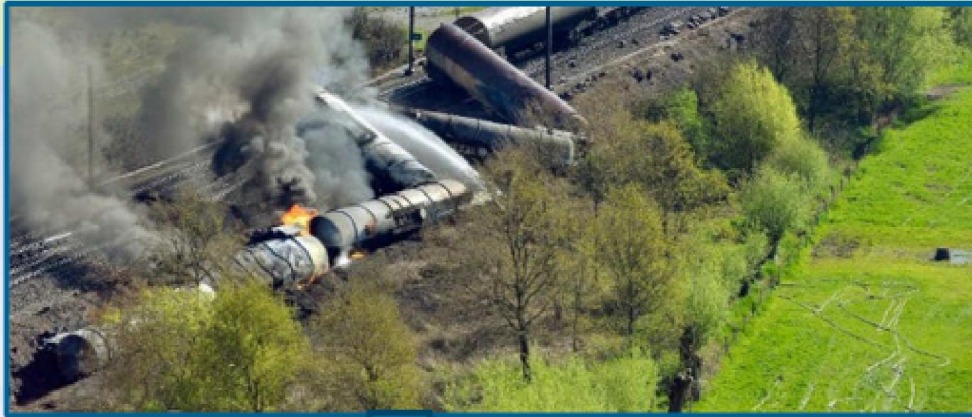
Medical post

- ➔ Personnel: 2 medical directors, 2 assisting medical directors, MICU nurses and physicians, paramedics, rescuers from Red Cross Society
- ➔ Logistic equipment from Red Cross Society
- ➔ First victims at 4.00 a.m.
- ➔ At 8.30 a.m.
 - ➔ Call from outside the danger zone for smoke inhalation
 - ➔ 76 yrs old woman found comatose on 2nd floor
 - ➔ 4 other inhabitants complaining of mucosal irritation, nausea, headache and reporting a strange smell
 - ➔ Initial measurements in house negative for acrylonitrile and cyanide
 - ➔ High acrylonitrile levels in the sewer system due to contamination of fire extinguishing water with acrylonitrile









Although acrylonitrile is heavier than air it can ascend in the sewer system of houses that have either no or a failing isolation from the main sewer system.

RWZI

Further course (1/2)

- ➔ Evacuation of residents ($n = \pm 2000$) living in houses along the suspected sewer system.
- ➔ At 12.30 p.m. another woman (50 yrs) was found comatose by her husband who came home after a walk and complained of mucosal irritation.
- ➔ At 3.00 p.m. an elderly man living in the evacuation zone was missing and found deceased in his house together with his dead dog.
- ➔ 375 citizens presented to the medical post (< 160 sent to ED's).
- ➔ 215 citizens presented spontaneously to the ED's.
- ➔ Most frequent complaints were headache, mucosal irritation, numbness and anxiety of which some may have been induced by inappropriate media attention for the carcinogenicity of acrylonitrile.
- ➔ Cyanide antidote therapy was given in 8 patients.

Further course (2/2)

- ➔ A point of care test for lactate was used for triage.
- ➔ Treatment protocol and case definition were sent to general practitioners and receiving ED's.
- ➔ At day 5, after washing the sewer system and repeatedly negative measurements, most evacuees could return home.
- ➔ Clean-up operation took 19 days:
 - ➔ Water treatment plant: contaminated silt was loaded on tankships
 - ➔ Removal of freight cars and their content

"TOESTAND ECHT ALARMEREND"

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MODERN
COMMUNICATION ON
THE CHEMICAL
DISASTER IN
WETTEREN



TWITTEREN



TWETTEREN

Biomonitoring

- ➔ Pressure from the media and public opinion “to do something”
- ➔ Pro
 - ➔ Every individual has the right to know whether he or she has been exposed
 - ➔ Proof of exposure can be used in judicial/insurance matters when developing e.g. cancer
 - ➔ Interesting from a scientific viewpoint
 - ➔ Information can be used in management of future incidents
- ➔ Con
 - ➔ Psychological impact
 - ➔ High cost
 - ➔ Exposure does not mean risk

Acrylonitrile and risk of cancer

- ➔ IARC downgraded acrylonitrile from a category 2a (probably carcinogenic) to a category 2b (possibly carcinogenic)
 - ➔ Lack of carcinogenic evidence from more recent epidemiological studies
 - ➔ The data regarding potential carcinogenicity of acrylonitrile in humans is considered to be inadequate and no evidence of a causal relationship exists
- ➔ In the communication to the residents comparison was made with alcohol and cigarette smoke, two proven category 1 carcinogenics

Source: Acute Exposure Guideline Levels (AEGLs) for Acrylonitrile, 2009

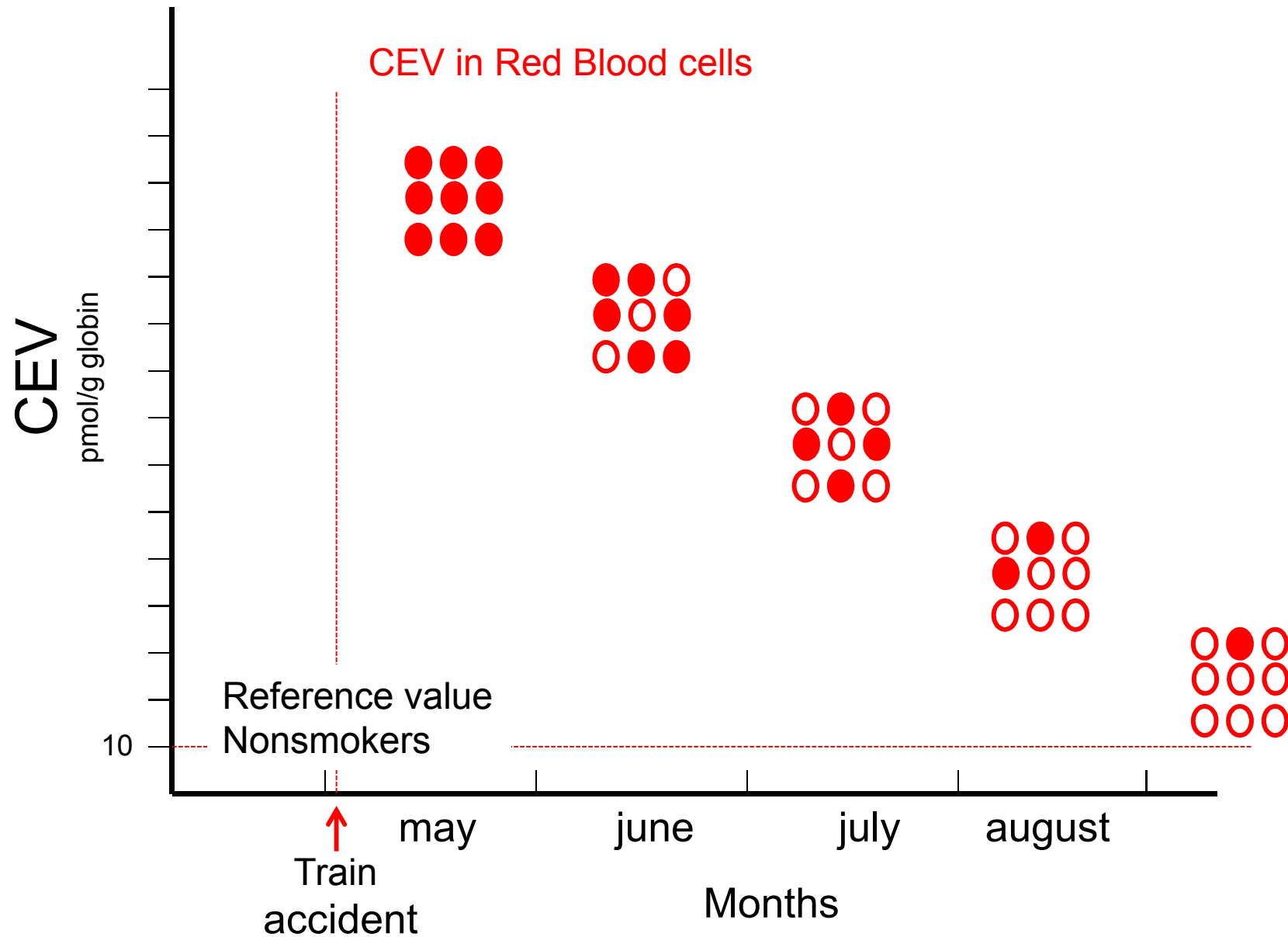
Human Biomonitoring Study: General Objective

To assess the human exposure to ACN in the populations with highest suspected exposure, i.e. the residents of Wetteren and the persons that assisted professionally in the incident.

Biomonitoring: Cyanoethylvaline (CEV)

- ➔ CEV is an adduct resulting from the binding of a metabolite of acrylonitrile to hemoglobin
- ➔ CEV is not toxic
- ➔ Highly sensitive and specific for exposure to acrylonitrile
- ➔ CEV level declines linearly to the background value during the lifespan of the circulating erythrocytes (126 days)
- ➔ Cigarette smoke contains acrylonitrile; CEV levels in smokers up to 30 times higher compared to nonsmokers

Time course of CEV concentration in a nonsmoker



Study population: Residents

Populations with highest suspected exposure (n= 474)

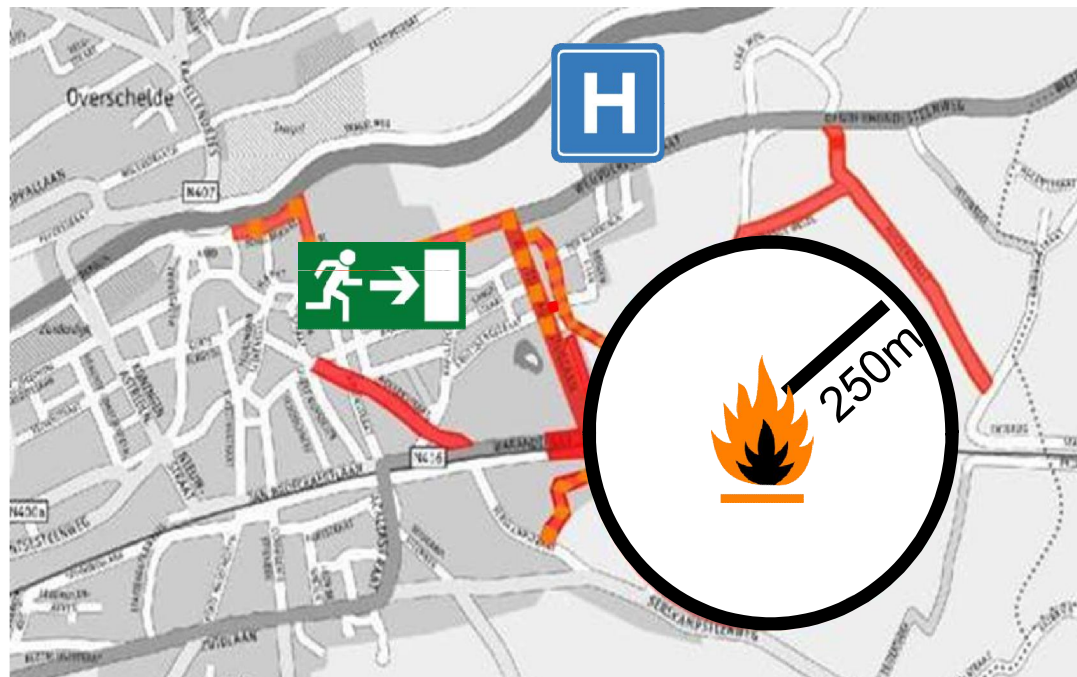
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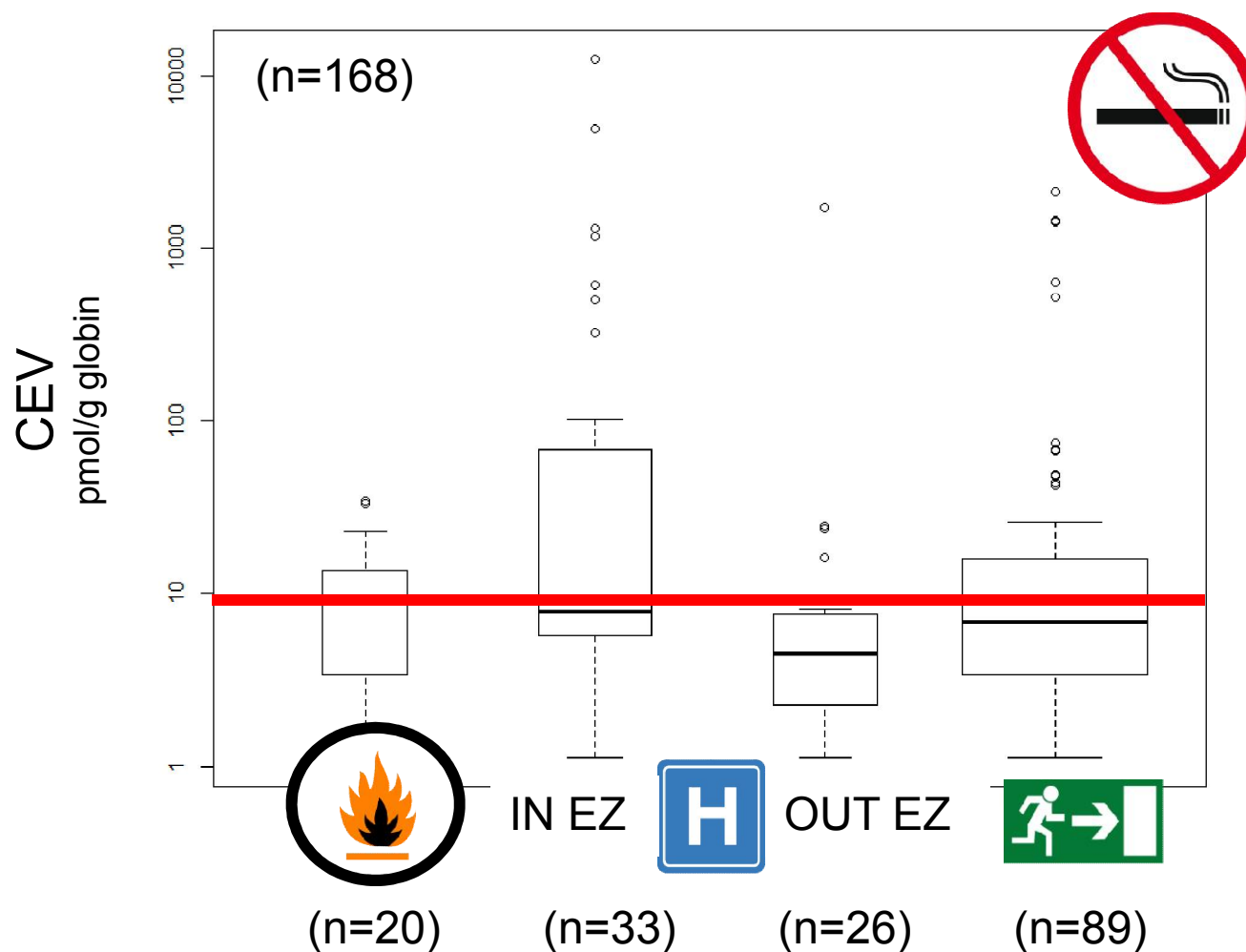


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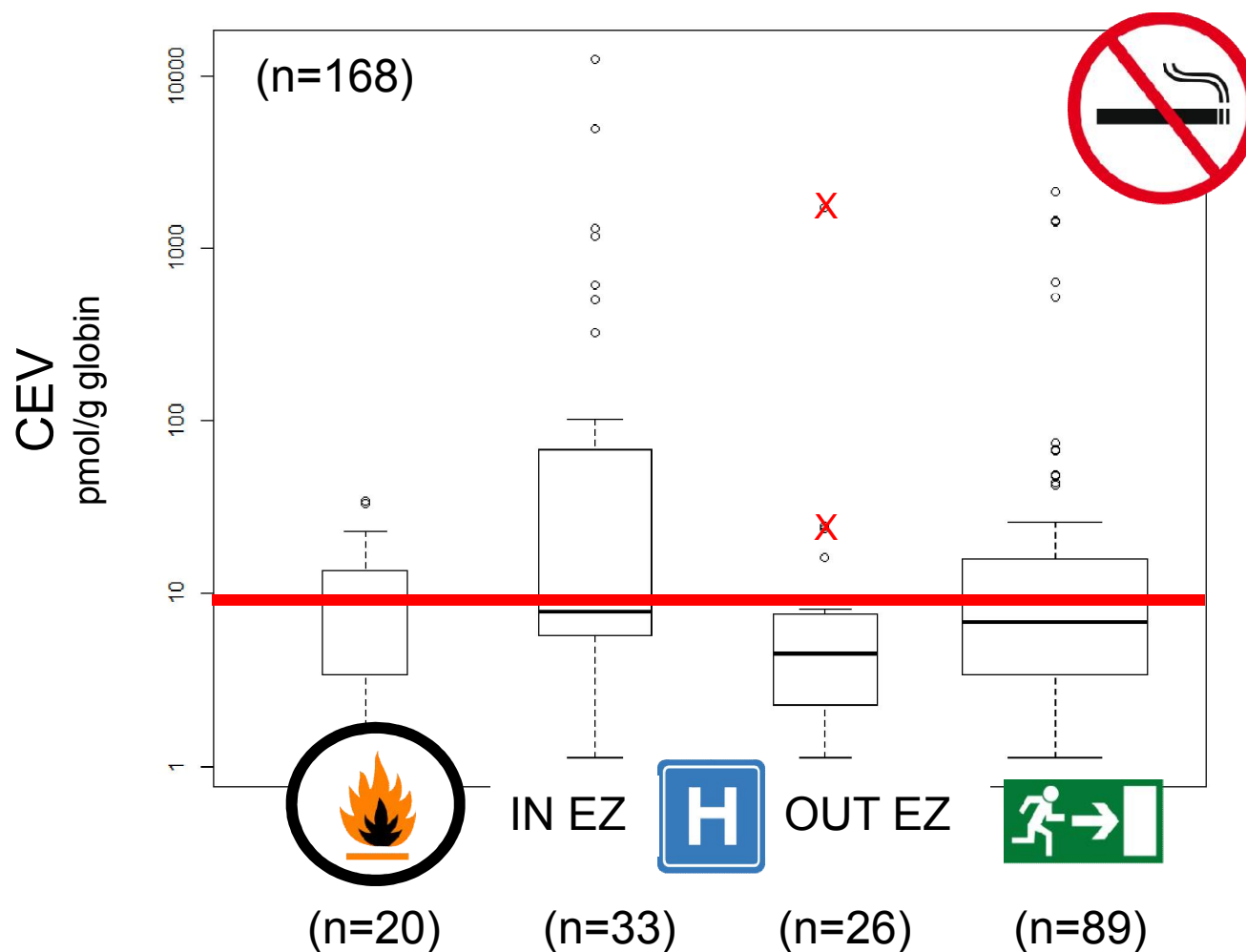


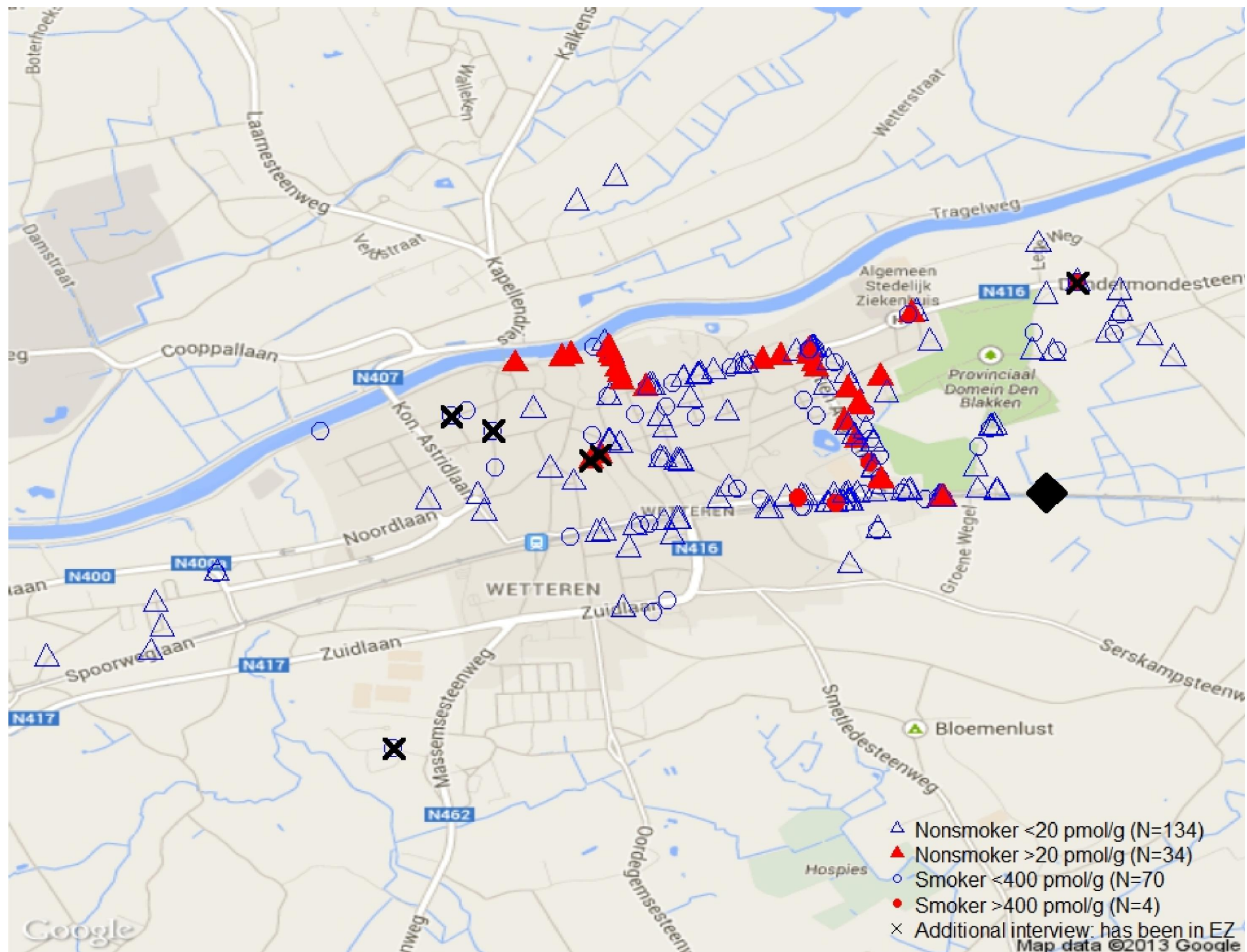
Participation rate 51%

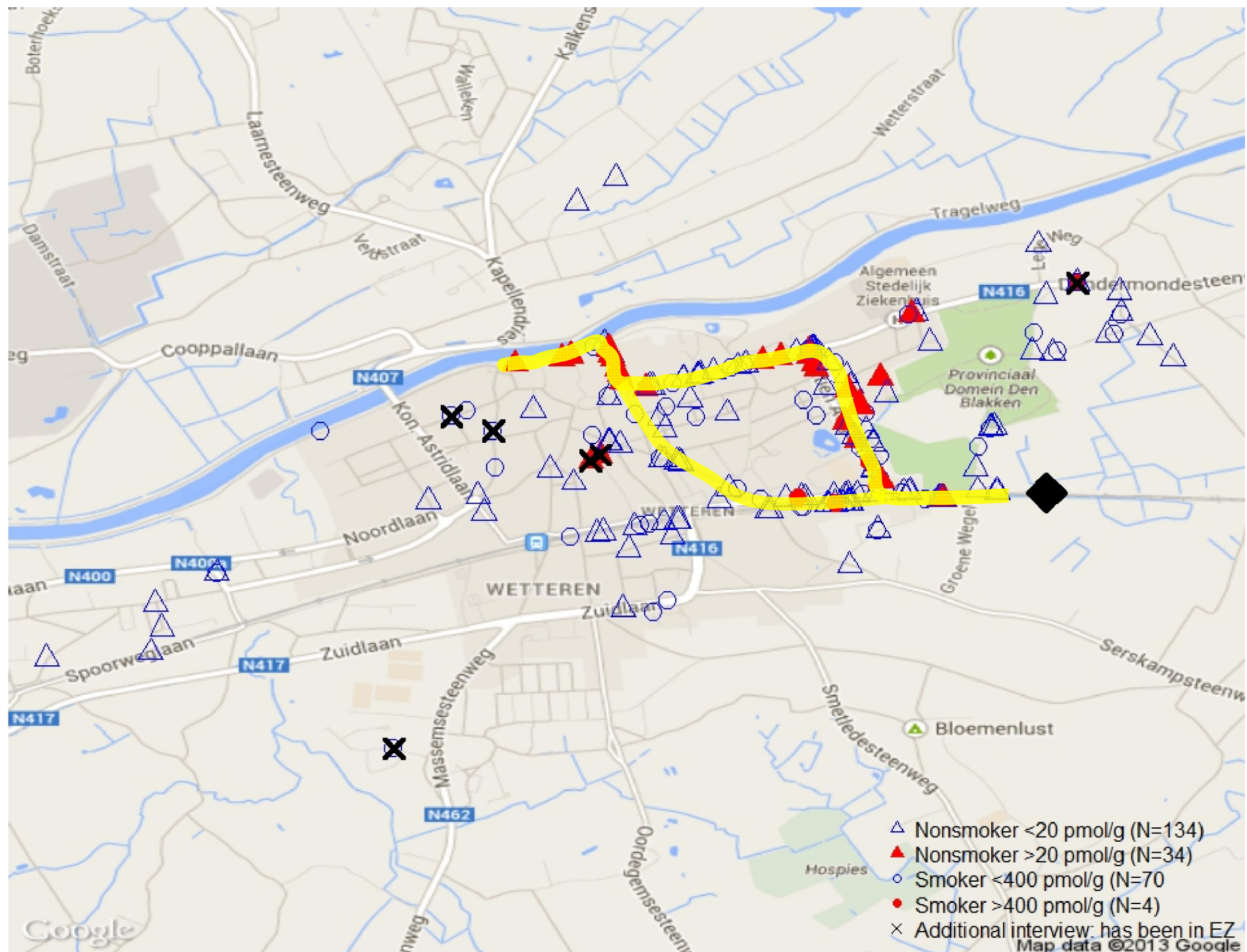
The residents study: 34 % of non-smokers have CEV concentrations > 10 pmol/g globin



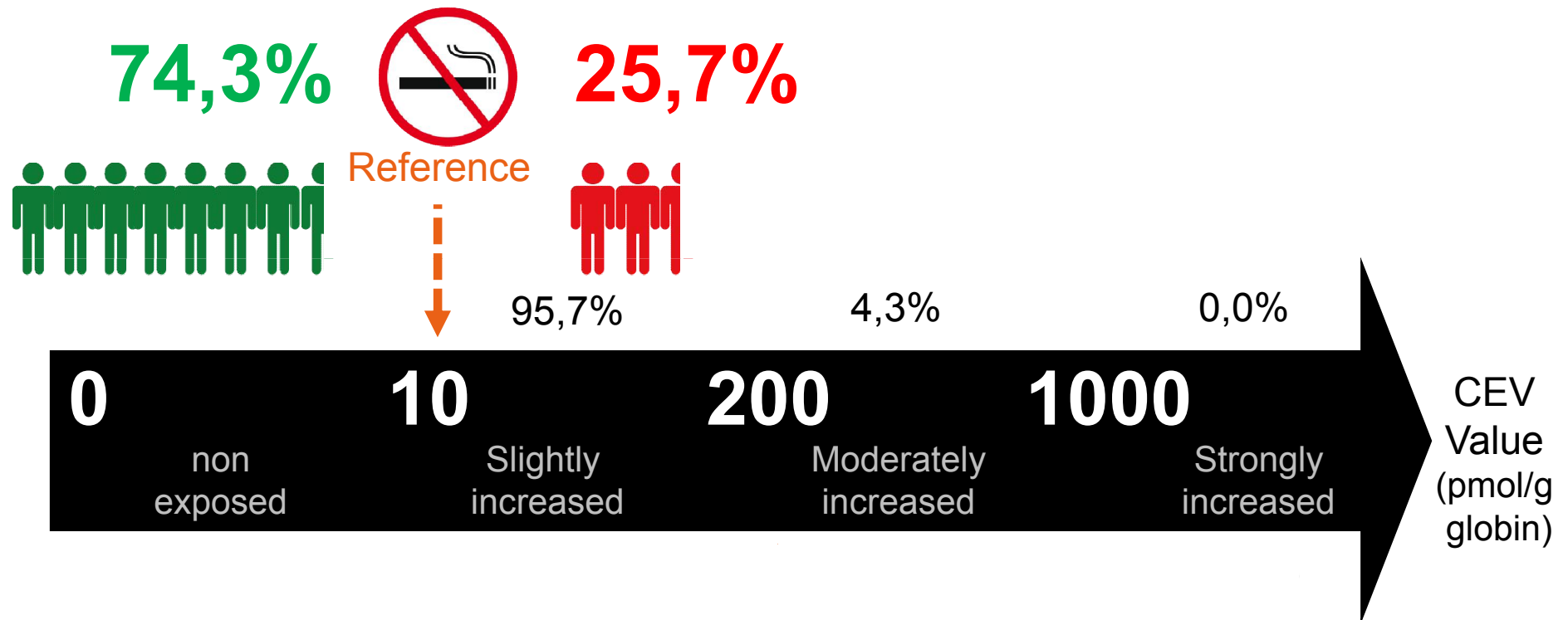
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CEV values in nonsmoking rescue workers (n=635)



Summary and conclusions

- ➔ Evacuation policy was adapted to changing dangers
- ➔ Potentially insufficient availability of cyanide antidotes
- ➔ ED overcrowding was avoided by an on site medical post (with POCT lactate)
- ➔ Need for clinical toxicologists on-the-spot
- ➔ Acute major public concern due to non-objective media communication
- ➔ Biomonitoring revealed exposure in a substantial part of selected residents and rescue workers which was challenging to communicate
- ➔ Recommendations on follow-up currently are being formulated by the Superior Health Council

... and which hazardous materials will we transport today?

Blood samples from Wetteren ...

