



# **CHEMICAL SAFETY *VERSUS* TERRORISM**

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# Civilians are the most vulnerable victims

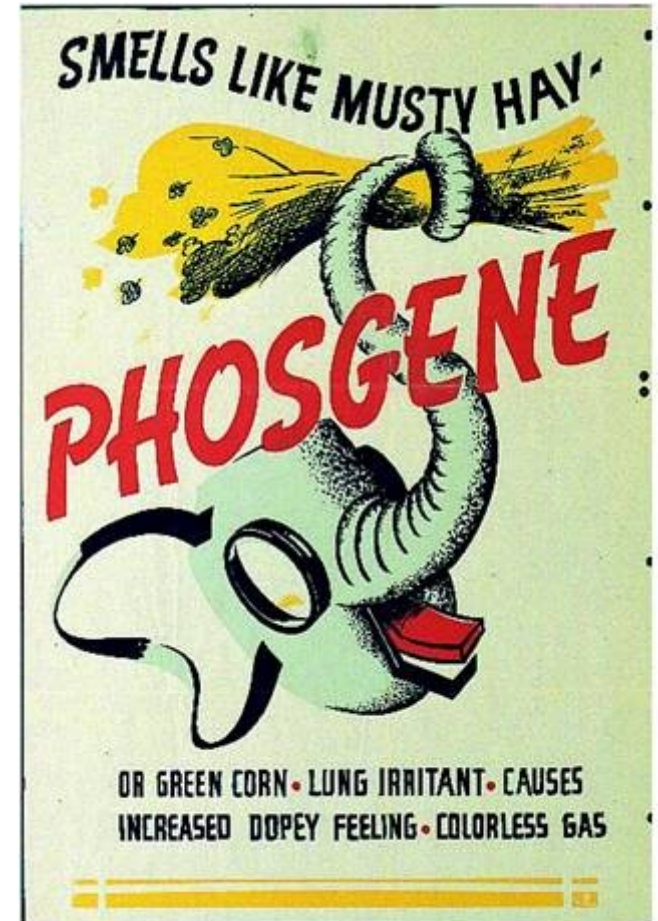


# WWI Phosgene experience

## Guidance for Chemical Terrorism



Phosgene is still there, however, there is no antidote available





# BHOPAL MEMENTO

## Chemical leak of *methyl isocyanide*

THURSDAY 2 DECEMBER 2004

VIEW FROM EUROPE

# Bhopal 20 years on: polluted wa chronic illness and little compenss

THE FAILURE of the Indian government and an American corporation to tackle the after-effects of one of the worst industrial accidents in history has left a legacy of continuing pollution and inadequate medical care for survivors, according to a report released on Monday.

Days before the 20th anniversary of the Bhopal disaster in India a study has shown that survivors are still desperately in need of medical treatment and have not been properly compensated.

On the night of 2 December 1984, poisonous methyl isocyanate (MIC) gas leaked from the Union Carbide pesticide factory in Bhopal. Thousands were killed immediately. Thousands more were to die from the effects of that night in the months and years that followed.

Now, Amnesty International has claimed that neither the Indian government nor Union Carbide have done enough to provide proper redress for the victims or to clean up the site.

"The disaster shocked the world and raised fundamental questions about corporate and government responsibility for industrial accidents that devastate human life and local envi-

By JUSTIN HUGGLER  
in Delhi

"Yet 20 years on, the survivors still await just compensation, adequate medical assistance and treatment, and comprehensive economic and social rehabilitation. The plant site has still not been cleaned up so toxic wastes still pollute the environment and contaminate water that surrounding communities rely on. And, astonishingly, no one has been held to account for the leak and its appalling consequences."

Survivors are marking the 20th anniversary this week by demanding the site is cleaned up and victims given proper compensation. Amnesty found the site of the factory is still severely contaminated, and is poisoning ground water supplies. The report details the case of Hasina Bee, a survivor of the disaster who still lives near the factory site, has been drinking the water from the hand-pump near her house for 18 years.

"When you look at the water, you can see a thin layer of oil on it," she said. "All the pots in my house have become discoloured...green-yellow. We have to travel at least two kilo-



Many lost their sight after the chemical leak in 1984 and the suffering continues, with pollution and toxic waste still in the region. Much of the compensation for those injured has yet to be paid

my health is so bad that it prevents me from carrying the water I need from there."

The report confirms survivors' claims that far more died in the immediate aftermath

of 2,000 claimed by the Madhya Pradesh state government. Amnesty's found that 7,000 died in the immediate aftermath, and 15,000 more have died of related diseases

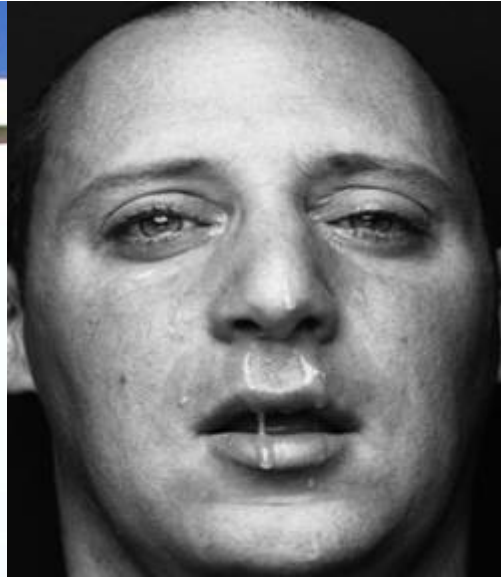
100,000 people still suffer from chronic or debilitating illnesses. "The company decided to store quantities of the 'ultra-hazardous' MIC in Bhopal in bulk, and did not equip the plant

capacity," the report says. "UCC transferred technology that was not proven and entailed operational risks. It did not apply the same standards of safety in design or operations

the USA. Unlike in the USA, the company failed to set up comprehensive emergency or system in Bhopal to protect local communities about leaving Union Carbide has



# Scene of Casualties



EURATOX 2002 courtesy Dr. A. Ziegler

# Terrorism

- The term terrorism was first used to describe the post-revolutionary French "reign of terror" of 1793 to 1794
- The term is now applied also to CBRNE releases and other actions that violate international law, and which seek to intimidate, demoralize, or subjugate a population for political, religious, or ideological purposes

# Terrorism targets

- High-risk targets for acts of terrorism include military and civilian government facilities, international airports, large cities, and high-profile landmarks
- Terrorists might also target large public gatherings, water and food supplies, utilities, and corporate centers
- Further, terrorists are capable of spreading fear by sending explosives or chemical, biological and radiological agents through the mail



# Potential methods used by terrorists

- Contamination of reservoirs and urban water supply systems
- Contamination of food, beverages, drugs, or cosmetics in manufacturing, distribution processes and near the point of consumption
- Miscellaneous product contaminations: stamps/envelopes, IV fluids, etc.
- Release of gases or aerosols into building HVAC systems
- Release of gases or aerosols from aircraft and unmanned vehicles
- Dispersal in bombs or projectiles
- Miscellaneous direct methods: hand sprayers, water guns, parcels
- Release of industrial/agricultural chemicals **via attacks on production or storage facilities**
- Release of industrial/agricultural chemicals **via attacks on truck, rail, or barge shipping**
- **Miscellaneous releases of industrial/agricultural chemicals**, especially anhydrous ammonia, fumigants and pesticides, and disinfectant gases (e.g., chlorine, chlorine dioxide, ethylene oxide)

# Criteria for determining terrorist priority chemical agents

- Chemical agents already known to be used as weaponry
- Availability of chemical agents to potential terrorists
- Chemical agents likely to cause major morbidity or mortality
- Potential of agents for causing public panic and social disruption, and
- Agents that require special action for public health preparedness

# Categories of chemicals include

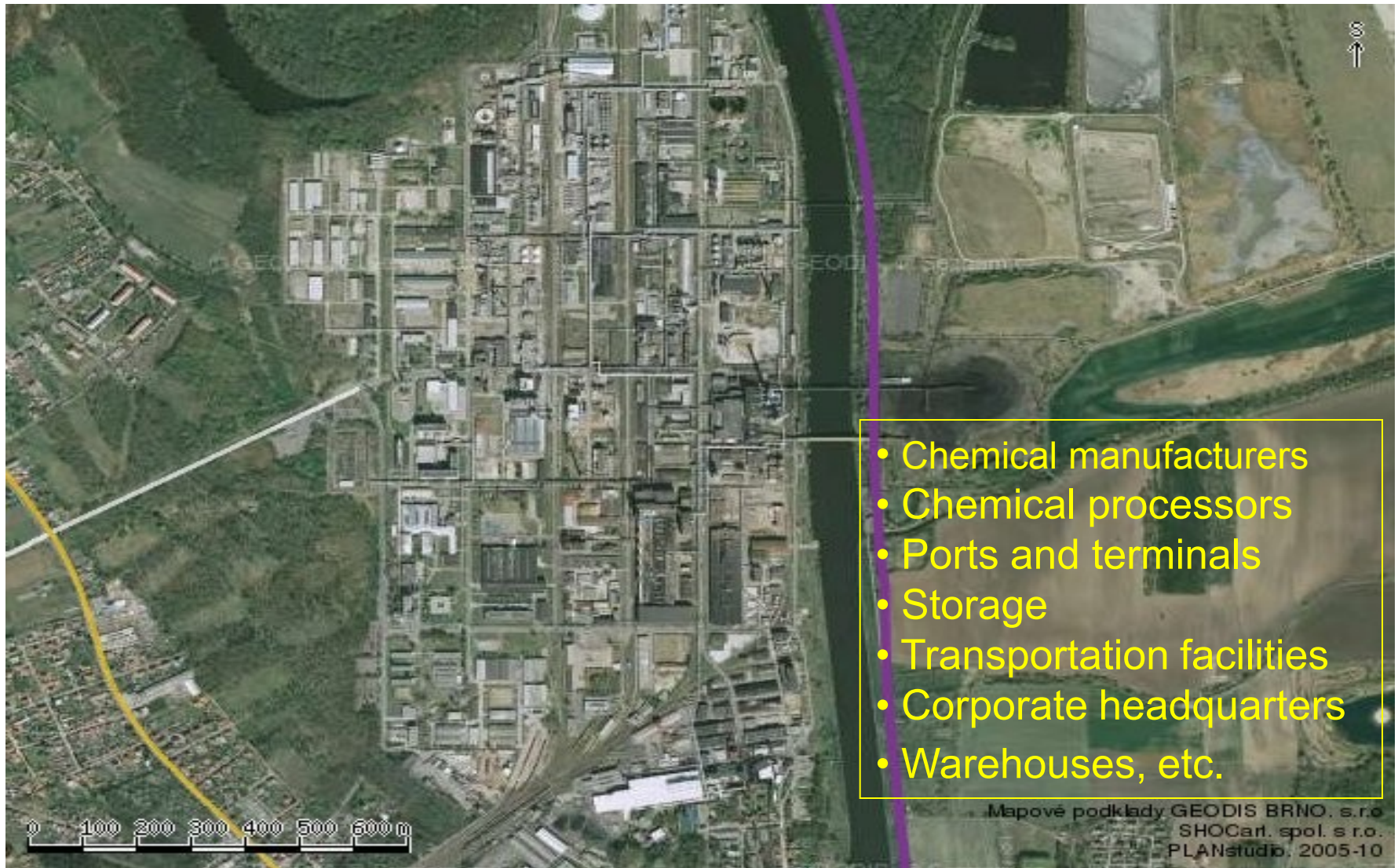
- CW Agents
- Pulmonary agents
  - phosgene
  - chlorine
  - vinyl chloride
- Volatile toxins
  - benzene
  - chloroform
  - trihalomethanes
- Flammable industrial gases and liquids
  - Gasoline
  - Propane
- Explosive nitro compounds and oxidizers
  - ammonium nitrate combined with fuel oil



# Categories of chemicals include cont.

- Psychochemical agents
- Pesticides
  - Persistent, and
  - Non-persistent
- Rodenticides
  - Sodium fluoracetate
  - Tetramethylenedisulfotetramine
- Poison industrial gases, liquids, and solids,
  - Cyanides,
  - Nitriles
- Corrosive industrial acids and bases,
  - Nitric acid,
  - Sulfuric acid
  - Fluoride acid
  - Caustic soda
- Dioxins, furans, and polychlorinated biphenyls (PCBs)
- Heavy metals and compounds
  - Arsenic
  - Barium
  - Lead
  - Mercury
  - Thallium

# Chemical Facility-Security and Safety Concerns



# Chemical Sector vs Other Sectors

## The Chemical Sector covering:

- Basic chemicals
- Specialty chemicals
- Petrochemicals
- Agricultural chemicals
- Pharmaceuticals
- Consumer products

is dependent on, depended on by, and overlaps with a wide range of other sectors, including:

- Transportation Systems
- Energy
- Water
- Dams
- Agriculture & Food
- Emergency Services
- Healthcare and Public Health
- Postal & Shipping
- Information Technology
- Communications
- Banking & Finance
- Governmental Facilities
- Commercial Facilities
- Nuclear Reactors, Materials, and Waste



# Processing-Storage-Transport of Chemicals



# Vulnerability of chemical facilities

- When we look at all of the different targets for a potential attack around us and ask ourselves which target present the greatest possibility of mass casualties and are the least well-secured at the present time - „these are chemical facilities“
- The government needs more authority and collaboration with chemical facilities owners to reduce the vulnerability of chemical plants to a terrorist attack or sabotage

# High-risk chemical facilities

- Chemical manufacturing, storage and distribution
- Agriculture and food
- Paints and coatings
- Explosives
- Plastics
- Healthcare
- Nuclear industry
- Energy and utilities
- Mining
- Electronics
- Public Water Systems (chlorine)
- Refrigeration industry (ammonia)
- Sport facilities (ice skating-ammonia)



# Chemical Industry

## Material source for chemical terrorism

- A reasonably open society with a well-developed chemical industry provides many vulnerabilities that might be exploited by skilled, committed, and adequately-funded makers of improvised chemical weapons
- **Safety and security of chemical facilities is still lagging behind nuclear installations**

# Key Shortages in Effective Chemical Security Planning

- Most chemical-related firms have comprehensive emergency planning and response processes
- However, those processes typically don't consider or allow for security-related emergencies and crises
- The most chemical firms have done much to screen and manage their own employees
- While relatively little has been done concerning contractors and non-company drivers who may have equal levels of access and exposure
- Most firms do not have dedicated security managers typically the security function is managed by someone who:
  - wears "many hats," which may include
    - EHS
    - Safety
    - Human Resources
    - Facilities Management/Maintenance,
    - Engineering, etc.

# Chemical Facility Safety & Security

## Course of Action

- Chemical security vulnerability assessments
- Development chemical security plans for chemical facilities
- Build up capabilities and capacities for chemical facilities safety and security

- Gaps in chemical facility's safety & security is an invitation for terrorism to attack chemical facilities and/or gain chemical products for intentional use during terrorist events

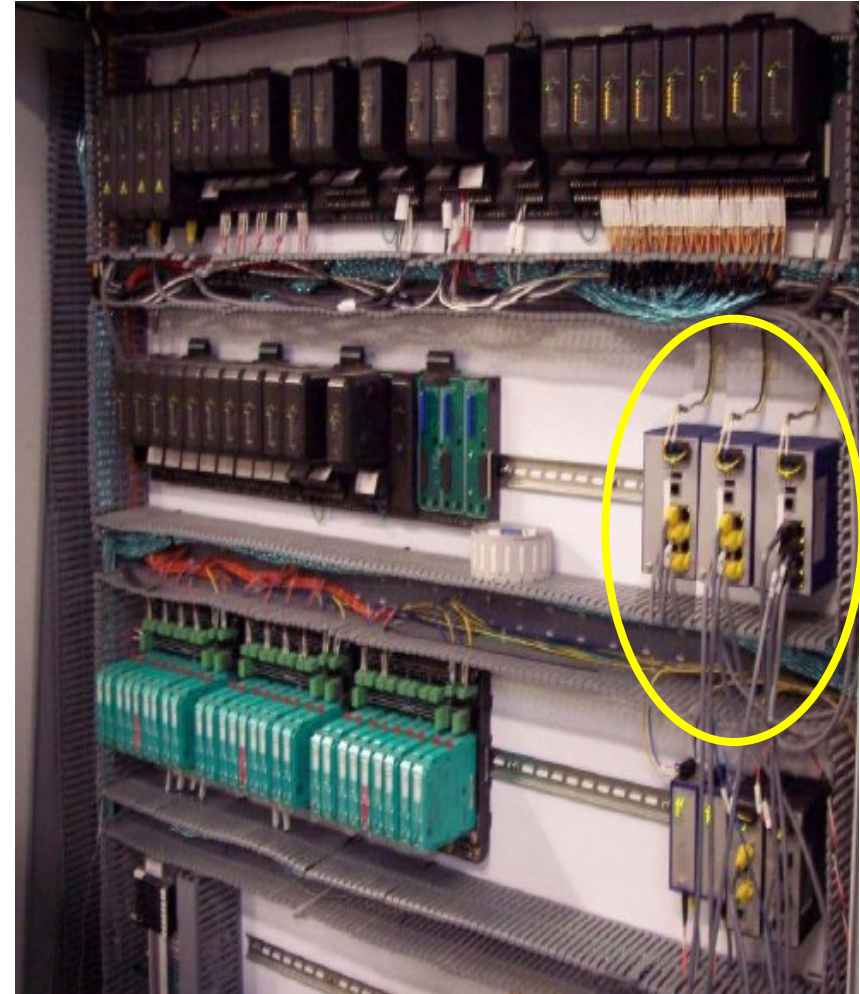
# Chemical facilities as source chemical terrorism

- **Release-Fire-Explosion** - Toxic, flammable, or explosive chemicals or materials that, if released from a facility, have the potential for significant adverse consequences for human life or health
- **Theft or Diversion** - Chemicals or materials that, if stolen or diverted, have the potential to be misused as weapons or easily converted into weapons using simple chemistry, equipment or techniques, in order to create significant adverse consequences for human life or health
- **Sabotage or Contamination** - Chemicals or materials that, if mixed with readily available materials, have the potential to create significant adverse consequences for human life or health



# Cyber attack at chemical facility

1. Defeat the perimeter fence
2. Gain access to the control cabinet
3. Install a wireless “man in the middle” device
  - Use the wireless device to damage the information network
  - Physical Damage (offset by Safety Shutdown Systems)
  - Economic Damage
    - I. Historical Data
    - II. Accounting Information
    - III. Tuning and other instrument information



# Counter-terrorism considerations

- In addition to counter-terrorism considerations, chemical security assessments should consider all sorts of security-related harm that could occur including:
  - Sabotage
  - Arson
  - Theft and pilferage
  - Hijacking
  - Vandalism
  - Trespassing
  - Workplace violence
  - Activist disruption
  - Contamination
  - *Cyber attack, etc.*

# Lower chemical facility's risk

- To assess vulnerability and have plans to reduce hazards
- Two factors that must be considered:
- The ease of access to the site and are security measures adequate?
- To place each plant in a "risk tier" based on the kinds and amounts of chemicals it has and its proximity to dense populations
- Reducing the amount of hazardous substances
- Using less hazardous materials
- To switch chemical facilities to inherently less dangerous processes where feasible and
- Simplifying plant design and procedures



# Key Concepts of Effective Chemical Security Planning

- An effective chemical security program should complement existing programs and processes:
  - including safety and safety awareness
  - environmental management
  - hiring and screening procedures
  - emergency and crisis planning and response
  - shipping and receiving, etc.
- The team-based chemical plant security vulnerability assessment
- Positive security awareness by employees is the most powerful, cost effective and frequently neglected of all security countermeasures
- Modification of comprehensive emergency planning and response processes



# Risk Based Performance Standards

- Restrict area perimeter and access
- Physical Security Around
- Control of Vehicles Around
- Inspection of Vehicles Around
- Background checks on personnel with access to materials or the systems that control them
- Shipping, receipt, and storage
- Secure site assets
- Screen and control access
- Deter, detect, delay
- Theft and diversion
- Sabotage
- Cyber
- Training
- Personnel surety
- Elevated threats
- Response
- Monitoring
- Specific threats, vulnerabilities, or risks
- Reporting of significant security incidents
- Significant security incidents and suspicious activities
- Officials and organization
- Records

# Chemical plant security include

- Perform chemical and refinery security and vulnerability assessments and surveys
- Develop chemical security-related policies, plans and procedures
- Develop self-assessment and audit methodologies
- Train staff in conducting chemical facility security self-assessments
- Provide security awareness and workplace violence prevention training
- Develop emergency and crisis plans, to include workplace violence, bomb threats, terrorism, sabotage, contamination, etc.
- Conduct penetration testing
- Plan for strikes and work stoppages
- Develop and enhance contract and proprietary security officer programs
- Review or develop security departments



**Fire at Chemical Plant and/or at  
storage of HazMat  
A model for chemical terrorism**

# Destruction of 122 mm artillery rockets with leaking sarin at Al Muthana





# Fire at Plastic Processing Plant (08.04.2011)



# Fire at Plastic Processing Plant (08.04.2011)

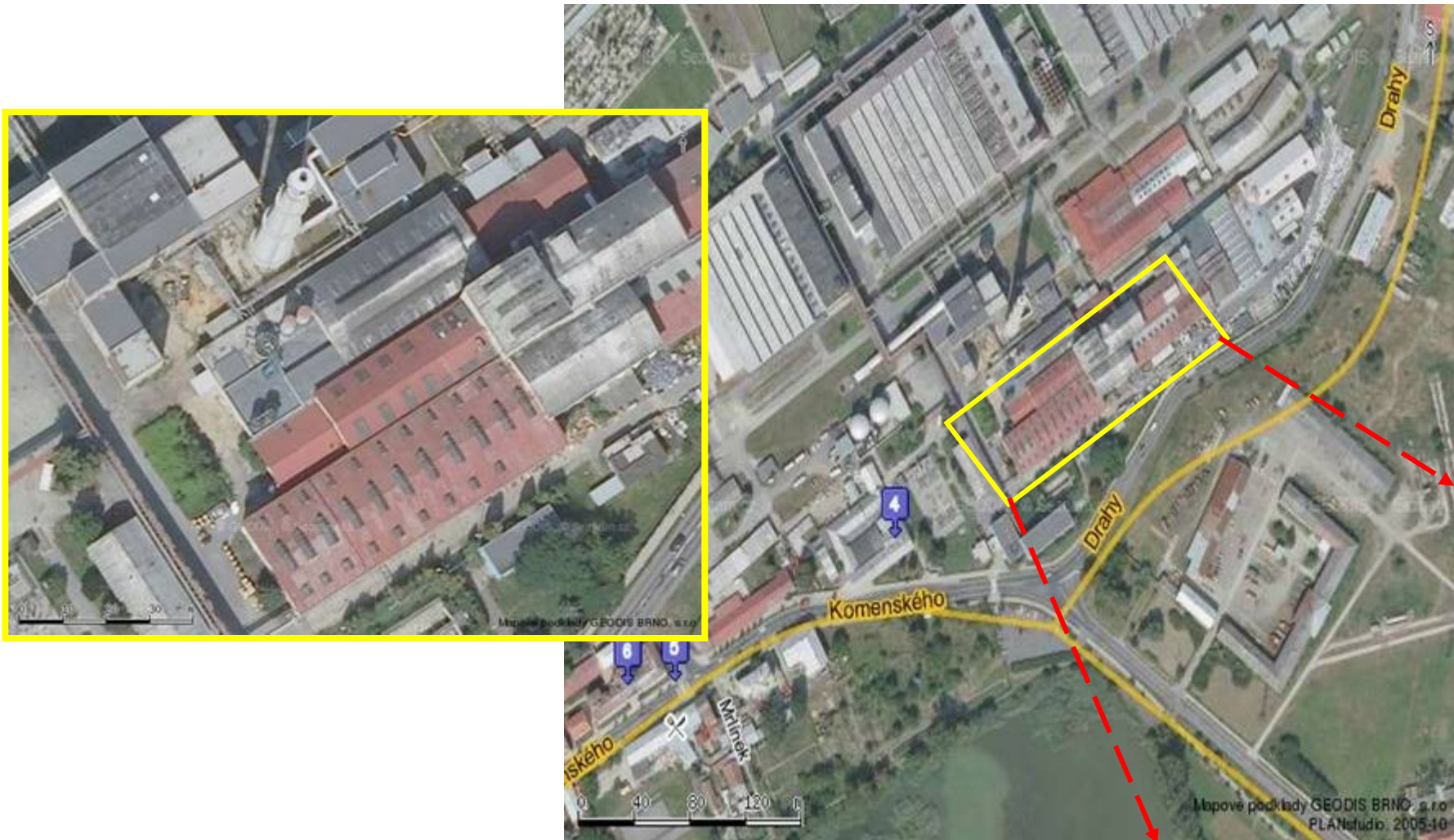


# Fire at Plastic Processing Plant Site (08.04.2011)

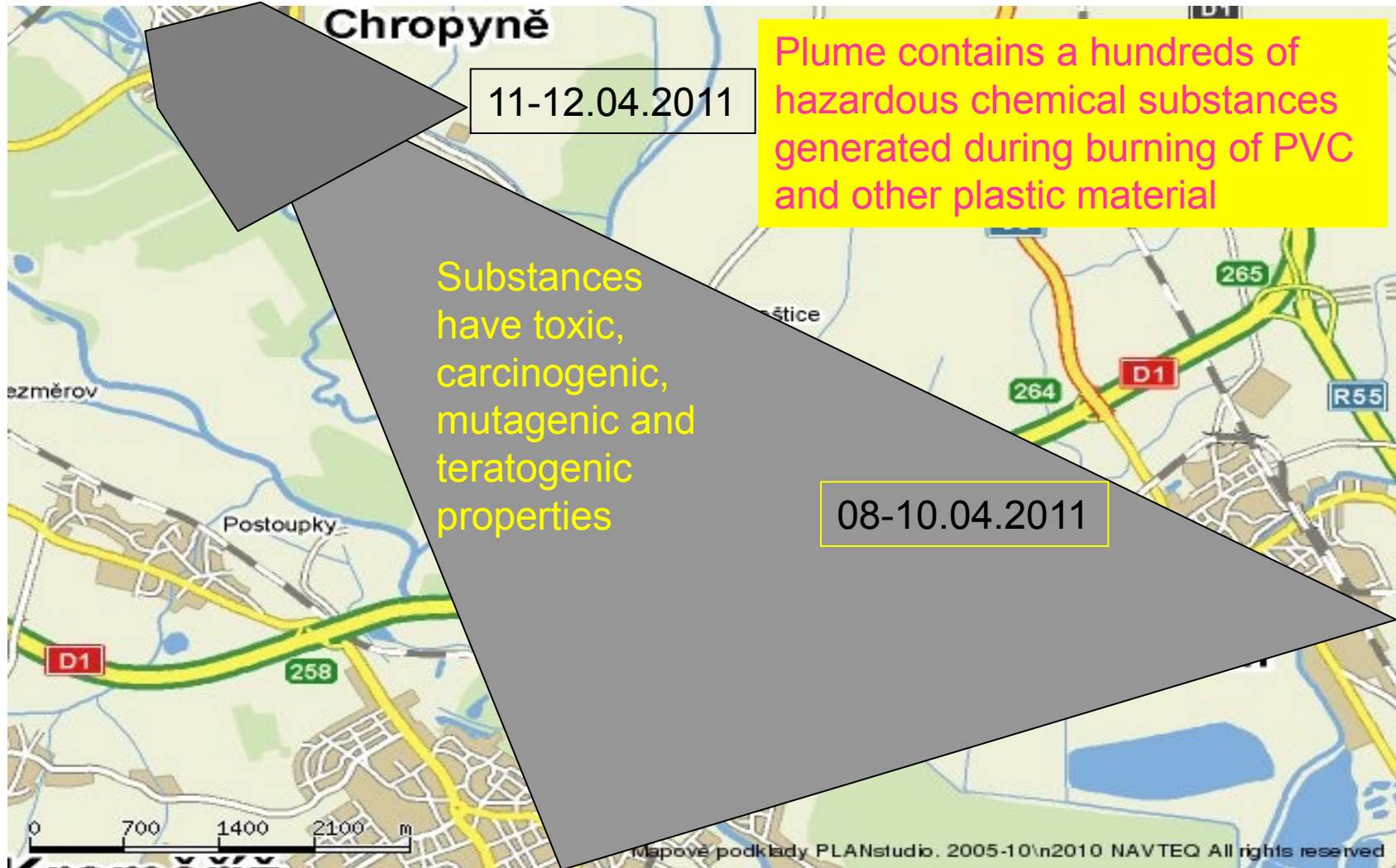




# Plastic Processing Plant Site



# Toxic plume area





# Toxic plume from Plastic Plant Site fire



# Long distance toxic plume affected area (09.04.2011)



# Fire at Tires Recycling Plant (2008)



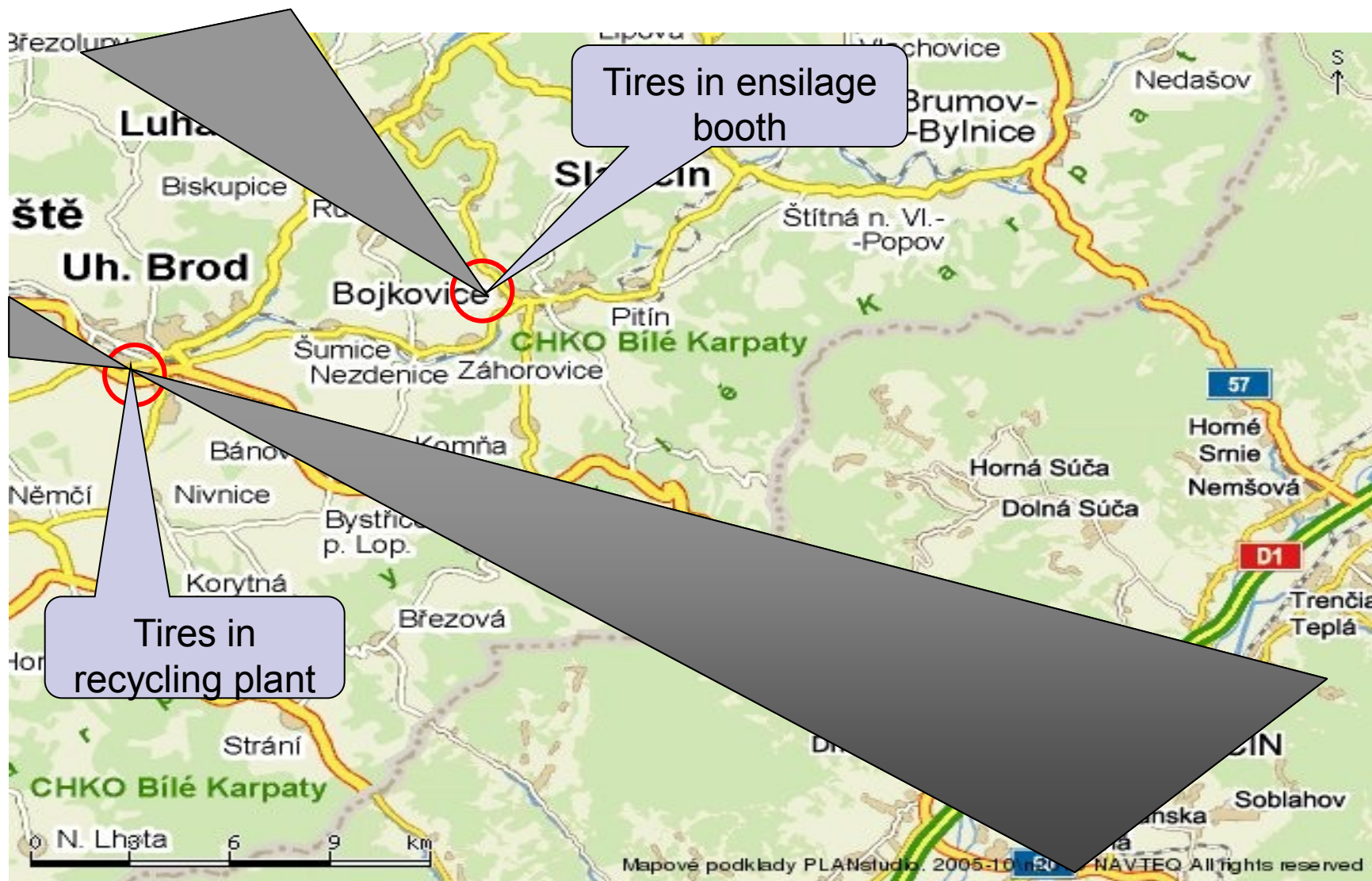


# Tires Depot in Recycling Plant

Grain Silo



# Two large fires at tires depot





# Location of burned tires from ensilage booth (2008)



# Chemical terrorism

- Chemical terrorism acts are likely to be **overt** because the effects of chemical agents absorbed through inhalation or by absorption through the skin or mucous membranes are usually immediate and obvious
- Certain chemical agents can also be delivered **covertly** through contaminated food or water
- Such attacks elicit immediate response from fire, police, EMS and healthcare personnel

# Insidious chemical terrorism

- Chemical terrorism is asymmetric warfare as practiced by non-uniformed forces using light and/or improvised weapons and means against non-combatant as well as combatant targets
- The insidious and somewhat mysterious nature of poisons makes them potential weapons of mass terror, because people in a target area - or simply in what they perceive to be a target area - **will not know whether or not they've been poisoned**

# Overt versus Covert Chemical Incident

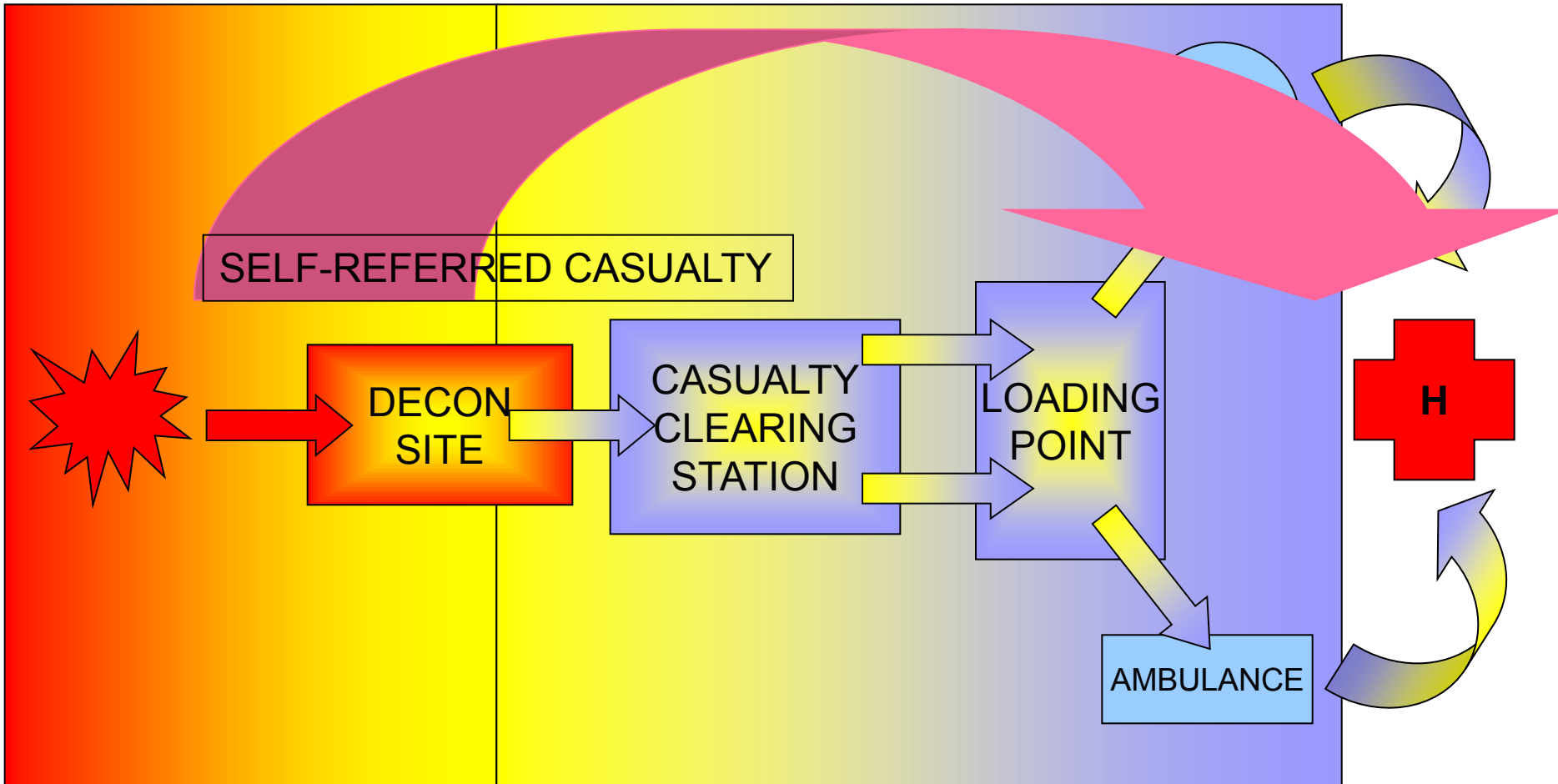
- Hesitation of responders to inform public correctly and in time
- Delay of individual protection measures
- Delay of evacuation
- In the name of „Panic and Rumor Damage Avoidance“
- Bias false-negative information/statements:
  - „*The concentration of hazardous material in the air is below permissible threshold, however, we recommend close and tape the window*“
  - *In the same time the public and environment is being **covertly** exposed and contaminated.*

# Terrorists are knowledgeable of gaps in CBRN preparedness and response

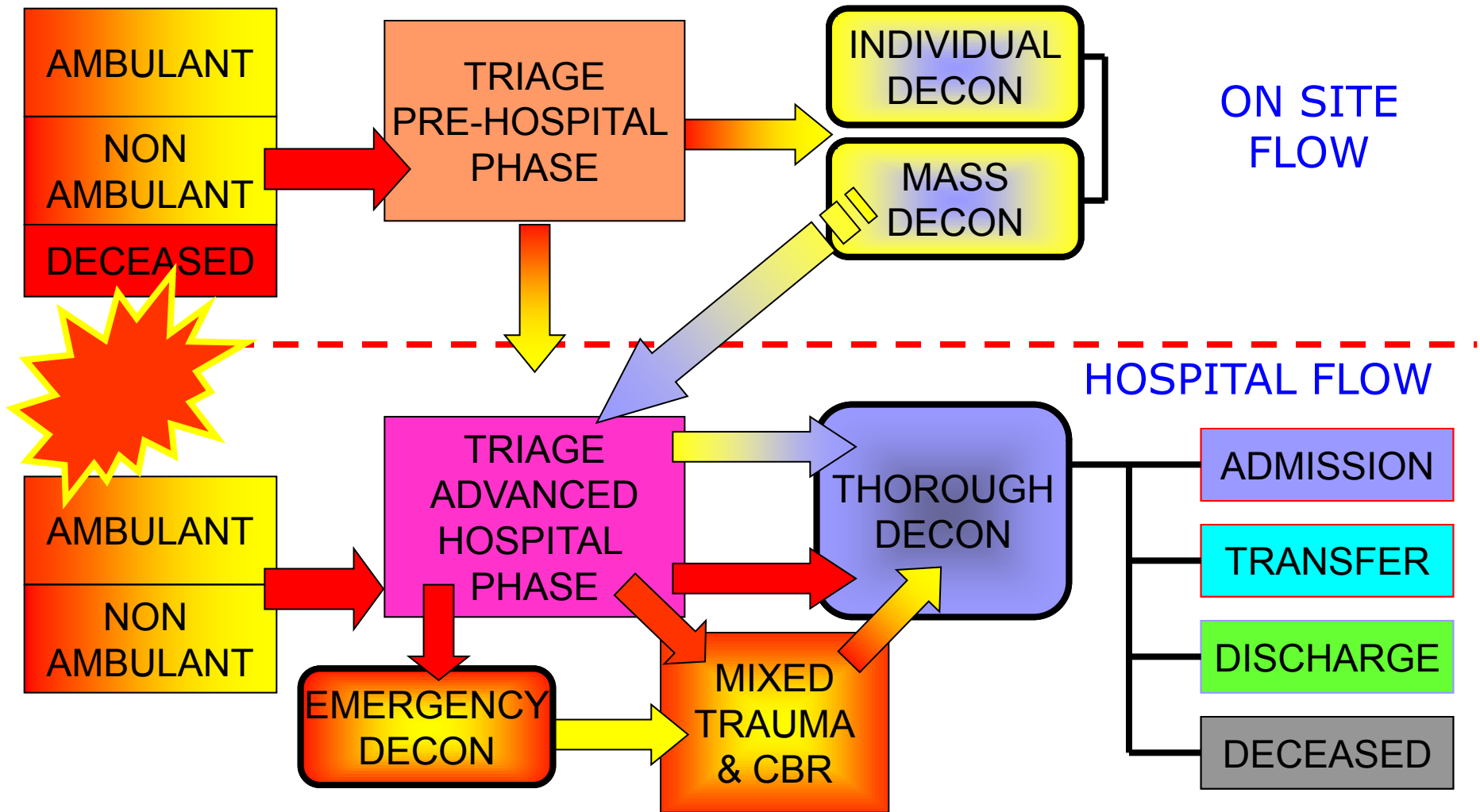
- Without special preparation at the local and state levels, a large-scale attack with CBRN/HazMat could overwhelm the local and national public health infrastructure and trigger „lock down“ hospitals due to potential contamination
- Large numbers of patients, including both exposed/infected persons and the "worried well" would seek medical attention, with a corresponding need for medical supplies, diagnostic tests, and hospital beds
- Emergency responders, health-care workers, and public health officials could be at special risk, and everyday life would be disrupted as a result of widespread fear of contagion and covert contamination
- Because of the hundreds of new chemicals introduced internationally each month, treating exposed persons by clinical syndrome rather than by specific agent is more useful for public health planning and emergency medical response purposes



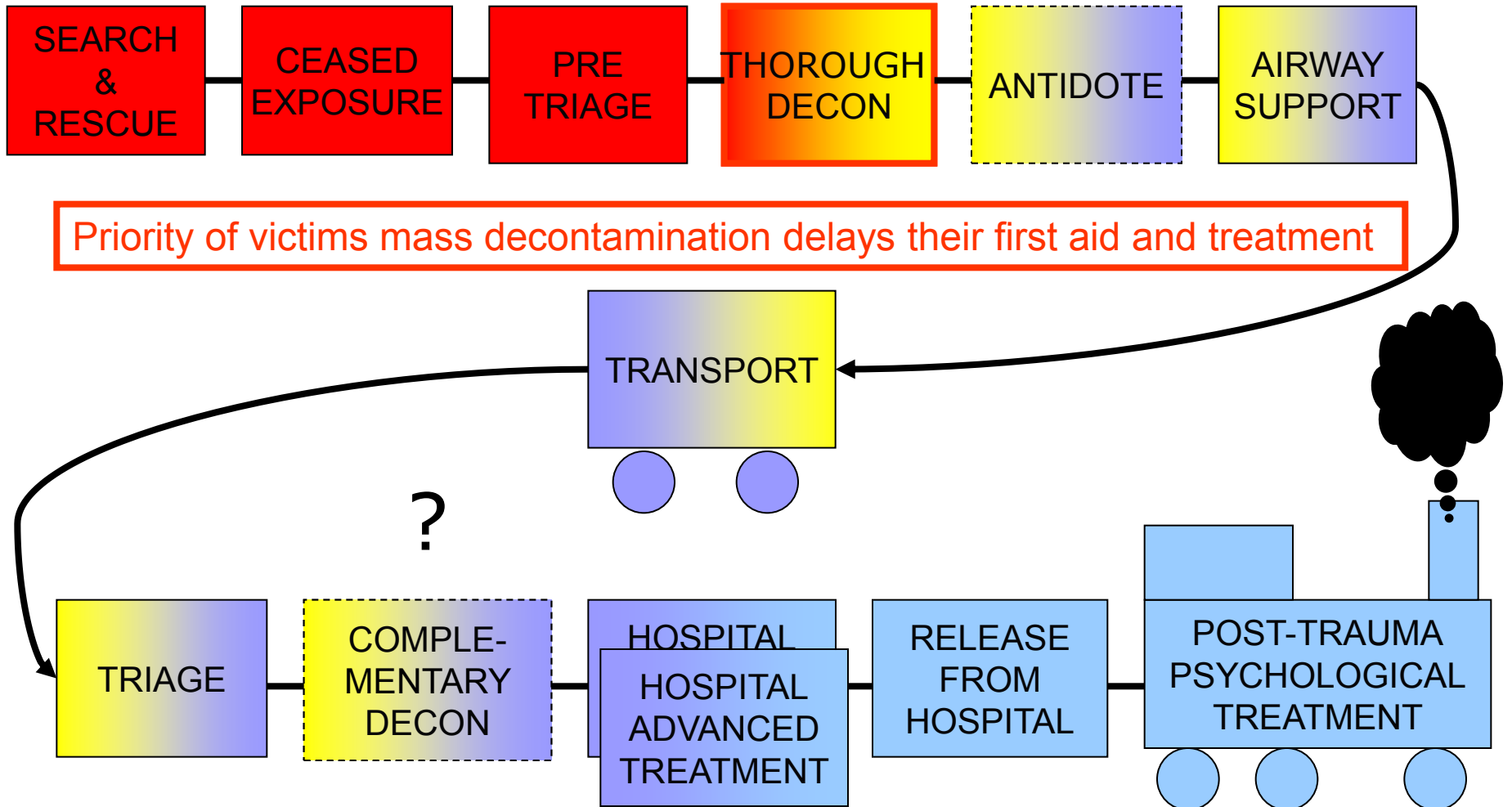
# Flow of self-referred casualties to medical facility



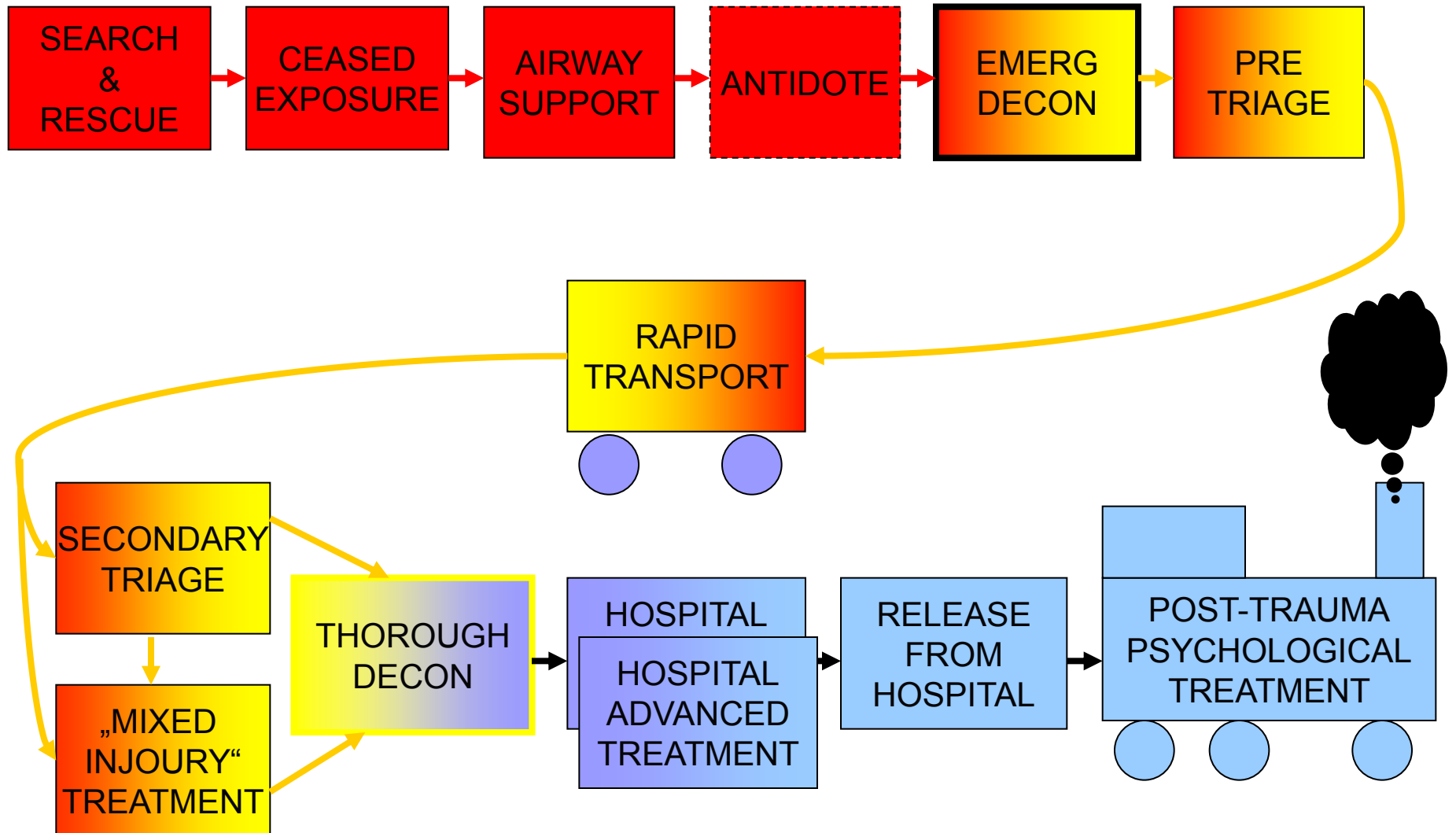
# Concept of Casualty Decontamination Flow



# CURRENT EMERGENCY MEDICAL TRAIN



# ADVANCED EMERGENCY MEDICAL TRAIN



# ???

## Budget for chemical mass panic and social disruption project???

- Chemical Facility  
Free of Charge
- Safety Matches  
50 cents
- Lighter  
1€
- Cyber-Internet  
20 €/month





# Test of 1 ton chlorine release



Released gaseous chlorine plume is heavier than air and also due to its dropped temperature during expansion is „grounded“ and more stable

# Test of 1 ton ammonia release





# Comments & Questions

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# Biography-Pavel Castulik

- Education: University of Defense, Chemical Engineering and NBC Defense, Dipl. Eng., PhD
- Commander of NBC Battalion
- ▣ PhD Thesis on Decontamination
- ▣ Head of Research & Development Decontamination Department
- ▣ Head of R&D Protection Division against Weapons of Mass Destruction
- ▣ UNSCOM-Search chem/bio program in Iraq and destruction of chemical weapons
- ▣ Development of the Technical Secretariat of the Organization for the Prohibition of Chemical Weapons
- ▣ Head of Training at the OPCW
- ▣ Head of Chemical Weapons Demilitarization at the OPCW
- ▣ Chief Inspector at the OPCW
- ▣ University lecturer
- ▣ Consultant on CBRNE matters
- ▣ Member of the Association for Crisis Preparedness of the Health and
- ▣ Co-Editor of the association's magazine