# FP6 – IST 2nd call
# OASIS IP

## Open Advanced System for Improved Crisis management

**IST-2003-004677**

**4 years project:**

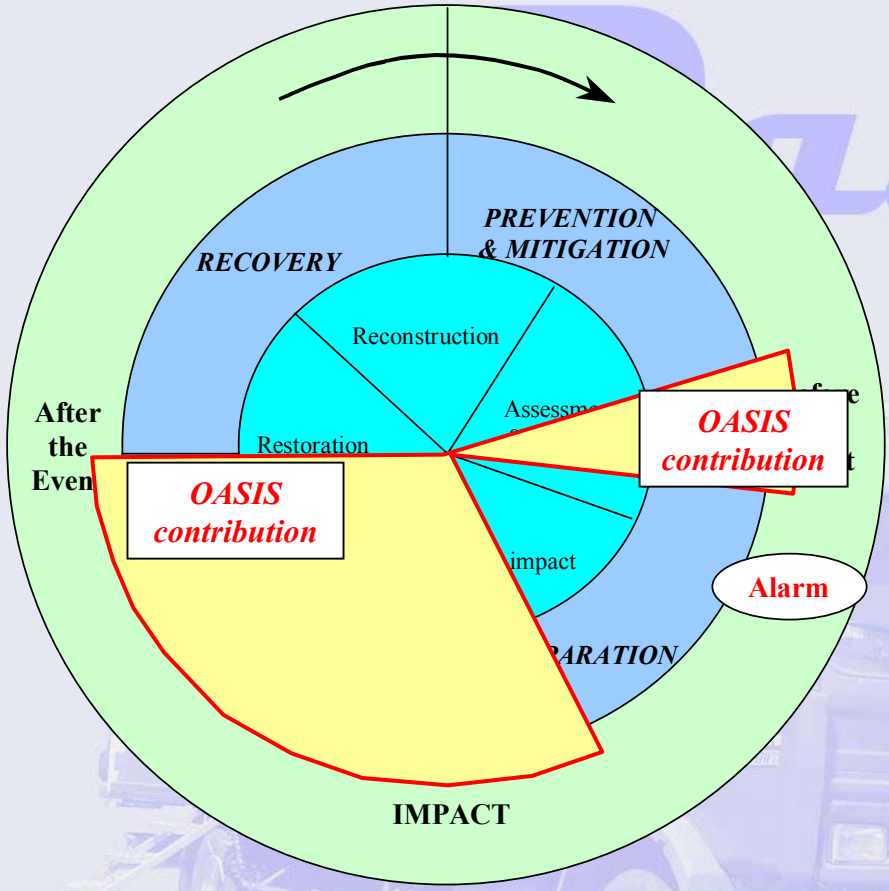
**September 2004 – September 2008**

**http://www.oasis-fp6.org/**

# OASIS Context

- Objective "Improving Risk Management" of the IST 2nd call
- Targeting civil protection authorities or other institutions in charge of citizens protection
- For emergency operations subsequent to any kind of disaster
- Possibly extended to external operations theatre
- Dealing with all phases of the crisis management

# OASIS scope in the global risk mgmt chain



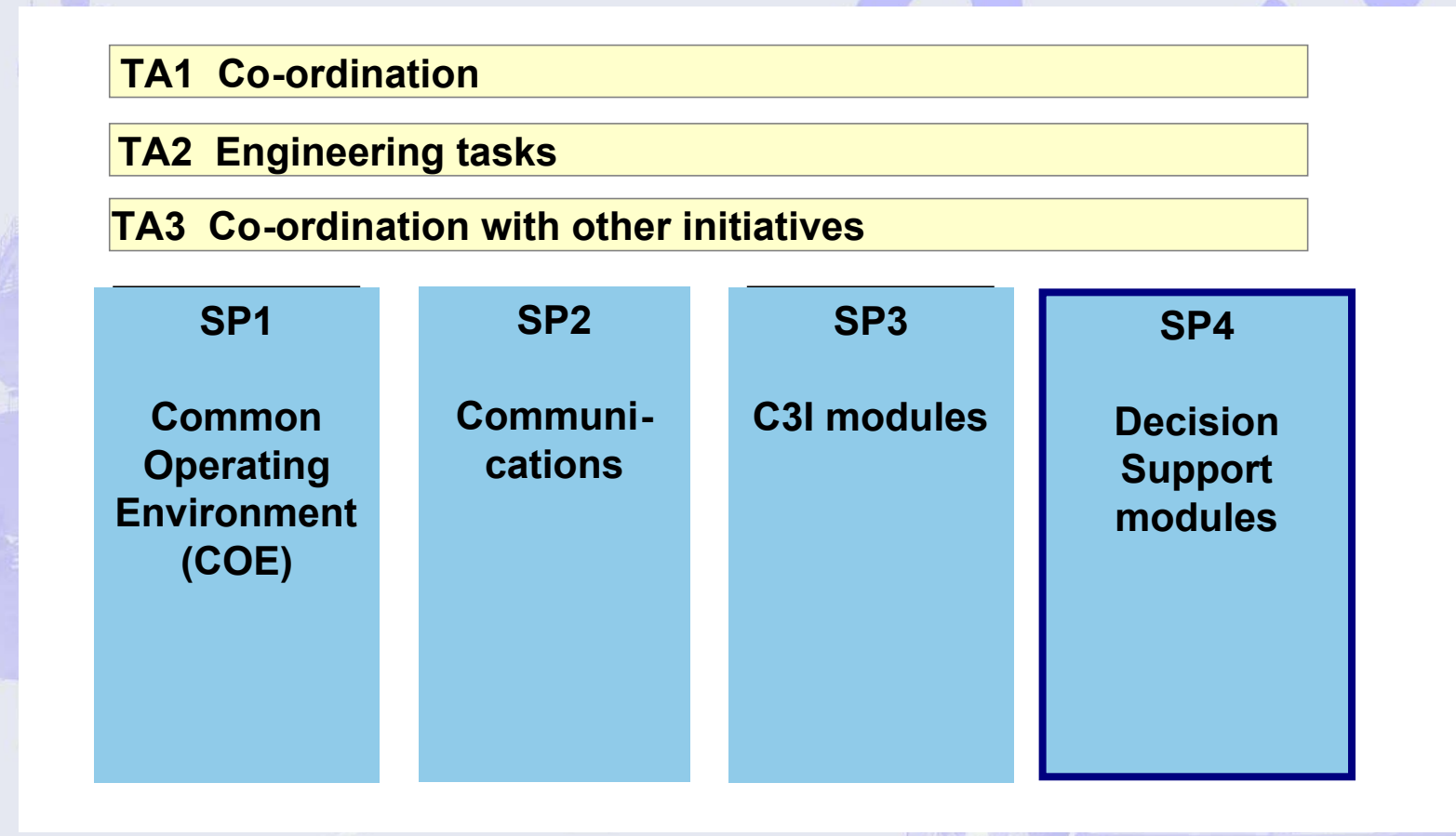

Source: Adapted from D. Alexander, *Principles of Emergency Planning and Management* (Terra Publishing, 2002), p.6. [RD18]

# OASIS Consortium

Coordinator: EADS Defence and Security Systems (France)

- EADS Deutschland
- BAE Systems (UK)
- Ericsson (Sweden)
- Fraunhofer Institute AIS (Germany)
- Datamat (Italy)
- MediumSoft (Czech Republic)
- Russian Academy of Sciences
- Cranfield University (UK)
- Edisoft (Portugal)
- SINTEF (Norway)
- Thales Communication (Norway)
- EADS Astrium (France)

# OASIS project organisation in TA and SP



# SP4: Advanced Decision Support Tools

**Coordinator:**

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**Fraunhofer Institute AIS**

**Participants:**

**FHG – Fraunhofer Institute AIS (Germany)**

**RAS – Russian Academy of Sciences**

**BAES – BAE Systems (UK)**

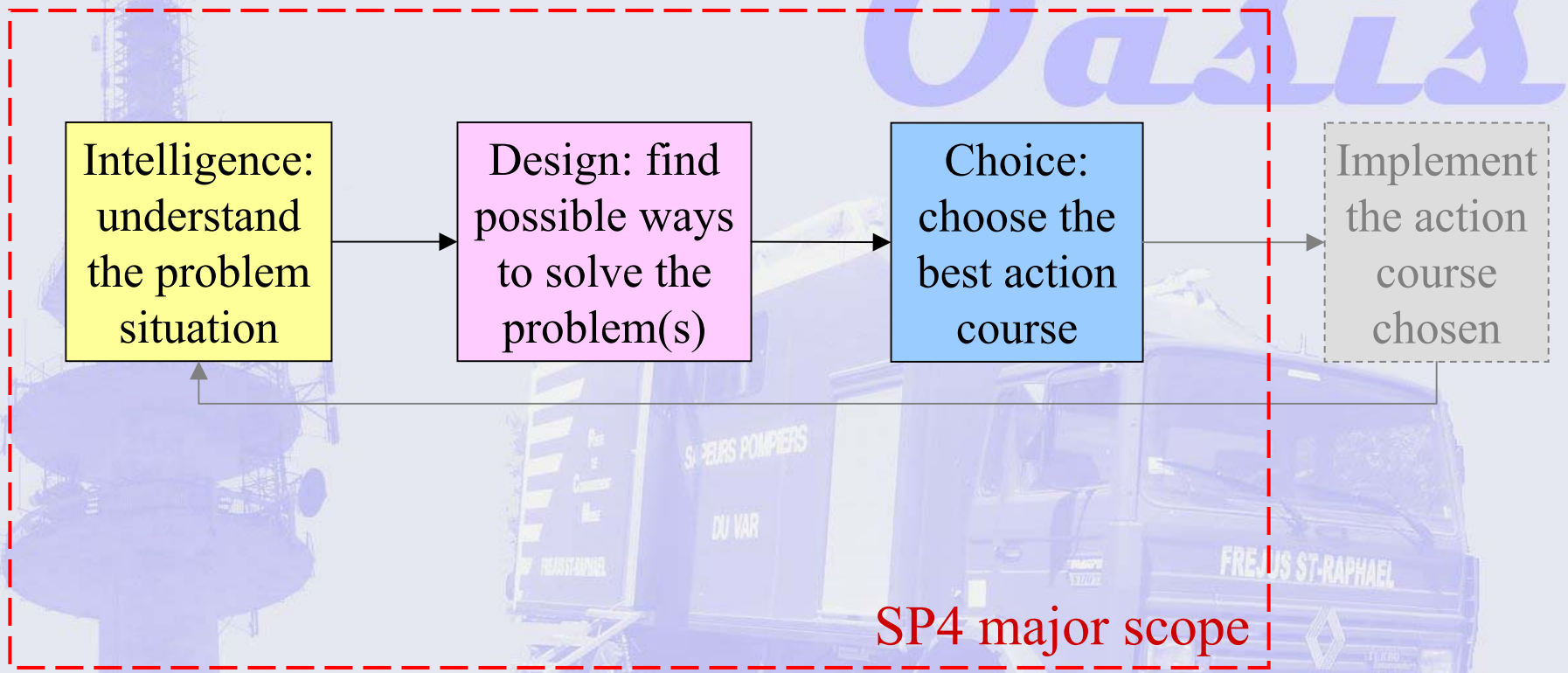
# SP4 goals

- Conduct applied research on decision support in emergency management
- Develop advanced techniques and tools for crisis management personnel
  - as a complement to the regular C3I tools (SP3)
  - intended mostly for people in the command and control centre
  - to increase the efficiency and quality of all stages of the decision-making process
- Requirements expressed during project negotiations:
  - Realistic scenarios
  - Prototype implementation and integration
  - Simplicity (powerful but understandable and easy to use)
  - Account for specific constraints

# Major directions for decision support

1. Reduce the workload of users
   - e.g. by automating routine work
2. Reduce the cognitive load of users
   - e.g. by automating efficient presentation of information
3. Take care that nothing important is omitted
   - e.g. by automatic detection of items requiring attention
4. Improve the quality of situation analysis and decisions
   - e.g. by advising appropriate methods

# Stages of decision making (after H.Simon)



# Two major R&D directions

- Knowledge management and knowledge-based decision support
  - Capture knowledge of experts
  - Make it accessible and usable by ordinary staff
  - …
- Handling specific decision complexities
  - Large amounts of data (esp. spatial and temporal)
  - Multiple conflicting criteria
  - Necessity of on-site situation analysis and decision making
  - …

# Visualisation-Based Intelligent Support

General approach: support emergency decision makers by intelligent information visualisation

1. Visualisation to facilitate analysis and decision making
2. Visualisation for effective informing and instructing

General principles:

- Automated information representation so that the user can concentrate on problem solving
- When possible, automate also basic data processing operations
- Effective, task- and recipient-specific visualisation design to reduce cognitive workload
  - Selection of relevant information (categories and individual items)
  - Appropriate level of detail; intelligent aggregation and generalisation when needed
  - Appropriate presentation forms (map, diagram, text) and techniques (colours, symbols)
  - Emphasising the most important information

# Example Crisis Situation

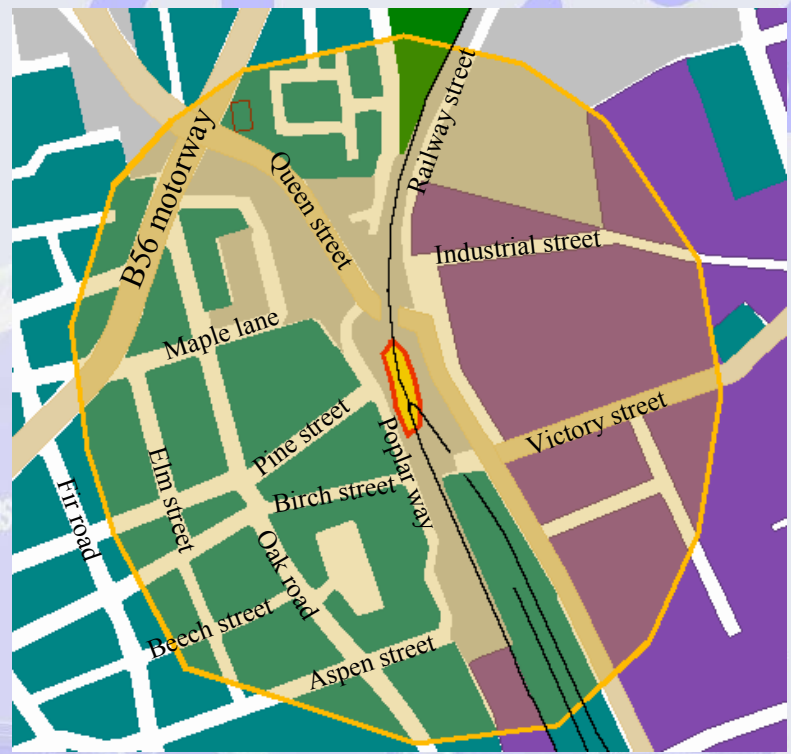
- Train derailment at 23:52, Saturday
- Train cars with propane, caustic soda, styrene, toluene, and chlorine
- Fire, several explosions; one of the explosions sent a flaming car 800 metres away through the air
- Policemen and firemen immediately arrived on site
  - Firemen: fight the fire
  - Policemen: move and keep people out of the dangerous area

# Task 1: Identify the Area Under Immediate Threat (1)

- The control room personnel receives a report from the incident site and enters the information about the incident in the system.
- The location of the incident is indicated on a city map.

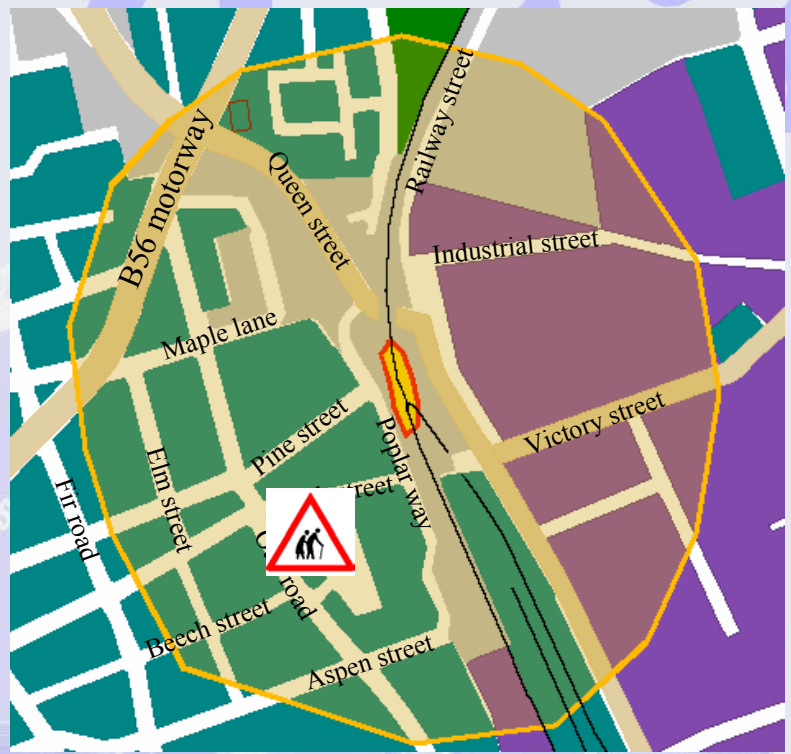
# Task 1: Identify the Area Under Immediate Threat (2)

- The system asks the user about the estimated radius of the zone endangered by the fire and explosions
- The user specifies, e.g., 1000m
- The system builds the outline of the zone
- People must be removed from the zone



# Task 1: Identify the Area Under Immediate Threat (3)

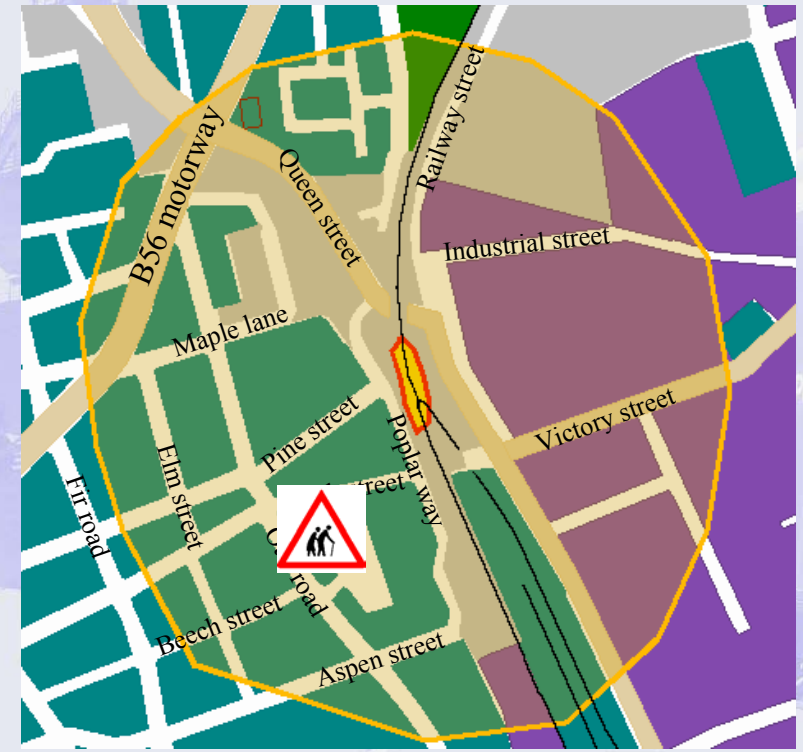
- The system automatically looks through the database whether there may be groups of people in the zone requiring assistance for moving out (e.g. disabled).
- The system takes into account the day of the week and the time of the day. For example, special measures for evacuating pupils from a school are needed only at daytime on a working day.
- If any places with people needing assistance are found, the system automatically shows them on the map. Details are available in the legend.




Aged-home, address: …

# Instruct the On-Site Personnel What Area to Clean of People

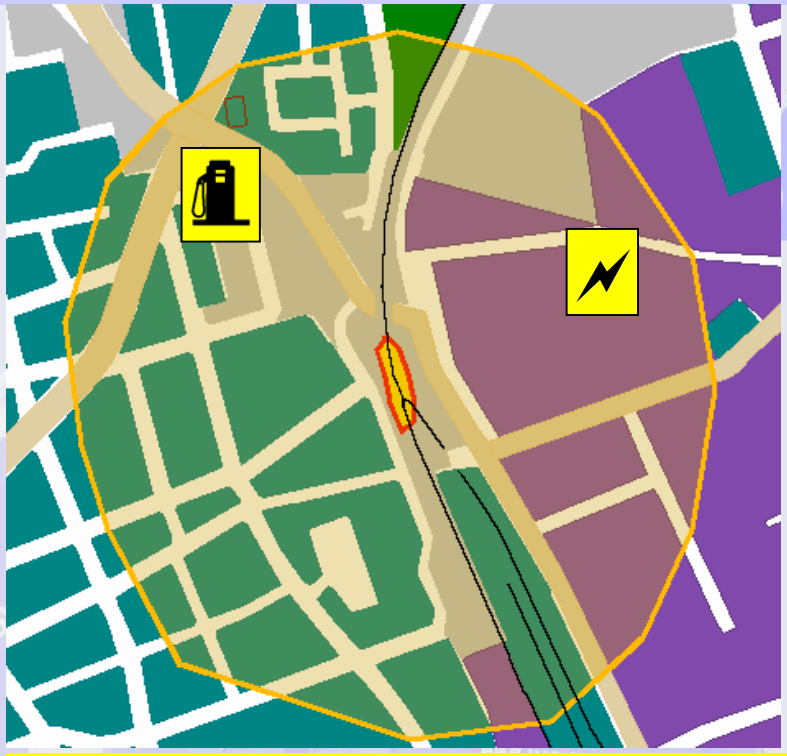
- Information in map form (when possible)




- Information in text form:
  - list of streets with house numbers (automatically generated), e.g.:
    - Queen street: houses 56-72 and 53-71
    - Poplar way: all
    - …
  - Places with people requiring assistance, e.g.
    - Aged-home, address:…
  - Transportation arrangements made, e.g. with a bus company

# Task 2: Identify Secondary Threats

- The system automatically finds in the database the potential sources of risk that may be triggered by the fire or explosions
- The system automatically displays the secondary threats on a map using prominent, easily identifiable symbols
- Some threats may be spread rather than localised, e.g. potential gas leakage from damaged buildings. Such threats are not shown on the map but only in the legend or other appropriate place.
- The information about the threats is available in the map legend (including relevant addresses and telephones).



General: gas leakage from damaged buildings

petrol station

electric transformer station

# Inform the On-Site Personnel About the Secondary Threats

- Automatically generated text (possibly, with inclusion of standard, easily recognised iconic symbols)
  - May be hyperlinks or references to additional information, depending on the medium (computer or paper)
- List of potential dangers requiring precautions
  - Should be prioritised according to the level of risk
- Addresses of dangerous objects
- Recommended actions

# Task 3: Identify the Danger From the Chemicals

- The user enters the known information concerning what chemicals may be present in the wreckage
- The system automatically looks through the database of chemicals for information about properties and dangers
- The system presents the information found in a text and iconic form
- The presentation may be used to inform the on-site personnel, ambulance, and population





- Propane
  - Gas, explosive
- Caustic soda
  - Solid, generates heat in contact with water, corrosive

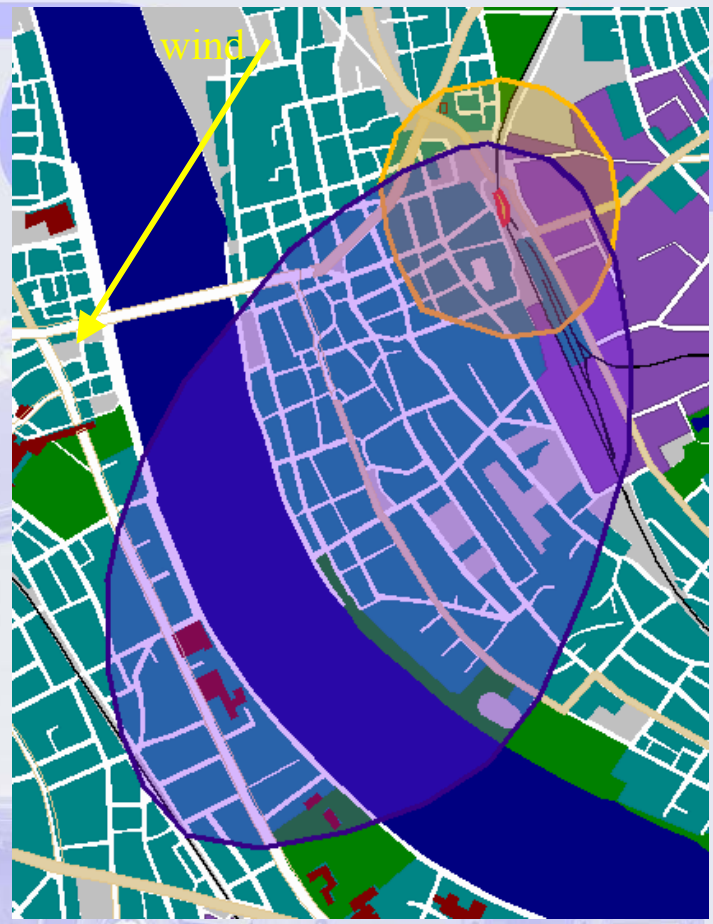
- Toluene
  - Liquid, explosive, inhalation may be lethal

- Chlorine
  - Gas, toxic

- Styrene
  - Liquid, flammable, anaesthetic

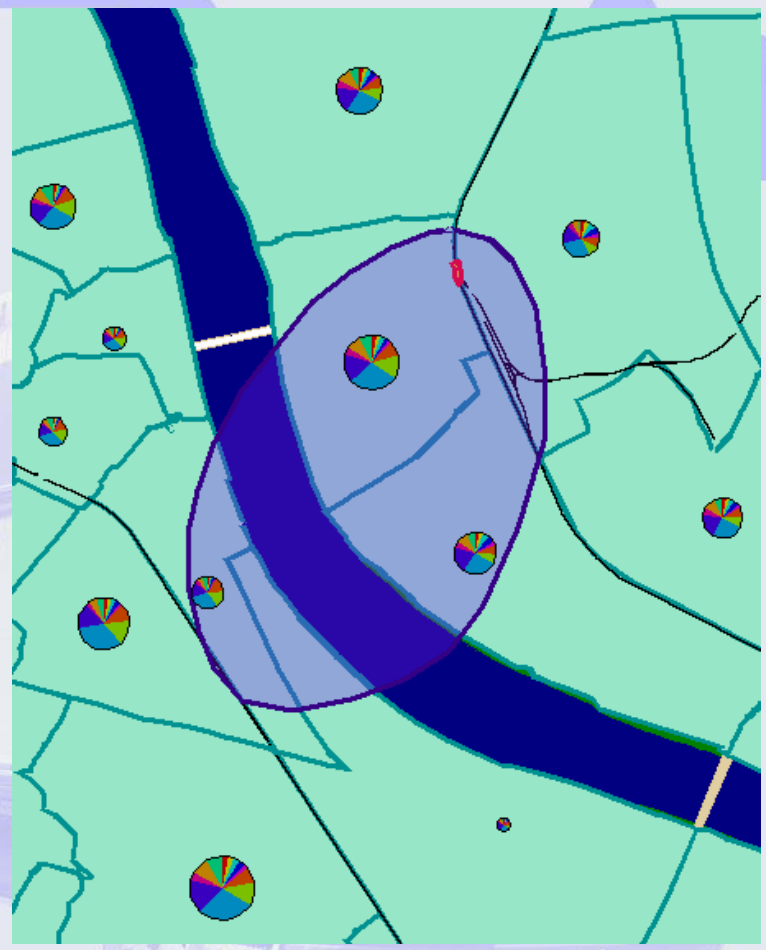
# Task 4: Identify the Area Endangered by the Chemicals

- If there is a simulation model that computes the spreading of various substances through air, the intelligent assistant may help the user to run the model.
- The output from the model is automatically shown on a map.
- If there is no model, there may be a formula (?) for a rough estimation (takes into account the properties of the substances, wind direction and speed, air humidity, …).
- Alternatively, a rough expert estimation of the endangered zone may be manually entered



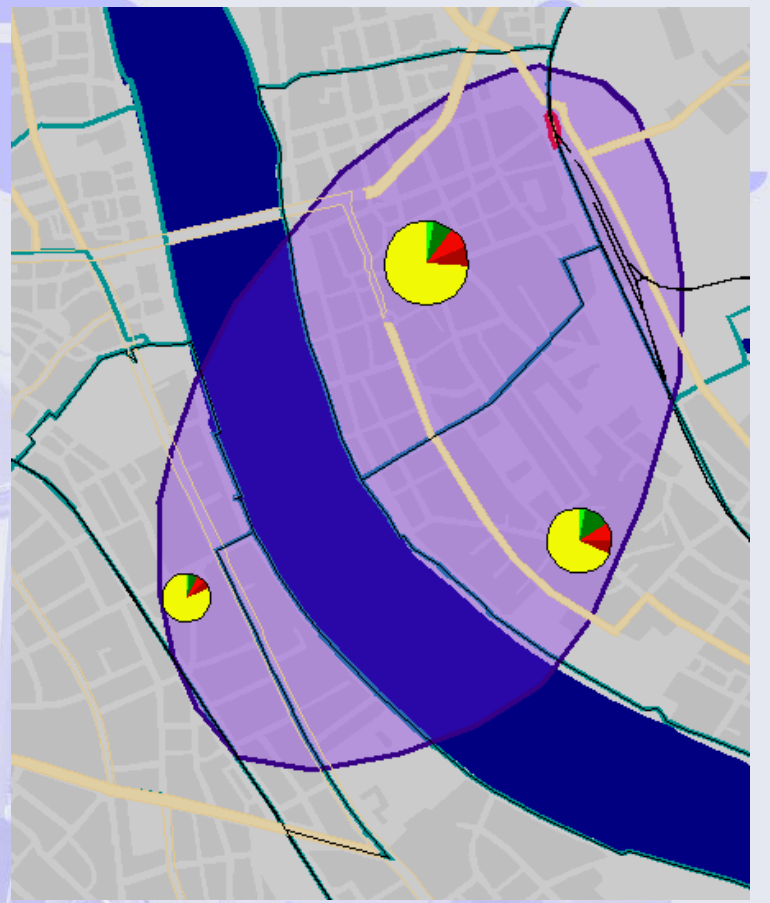
# Task 5: Identify the Endangered Population (1)

- The system finds a database with population data.
- The population database available contains only data by administrative districts (total population numbers and by age groups).
- The system determines what districts overlap with the zone, computes the proportion of the overlap, and, on this basis, roughly estimates the total population number in the area and the number of people in the age groups that may require special care.



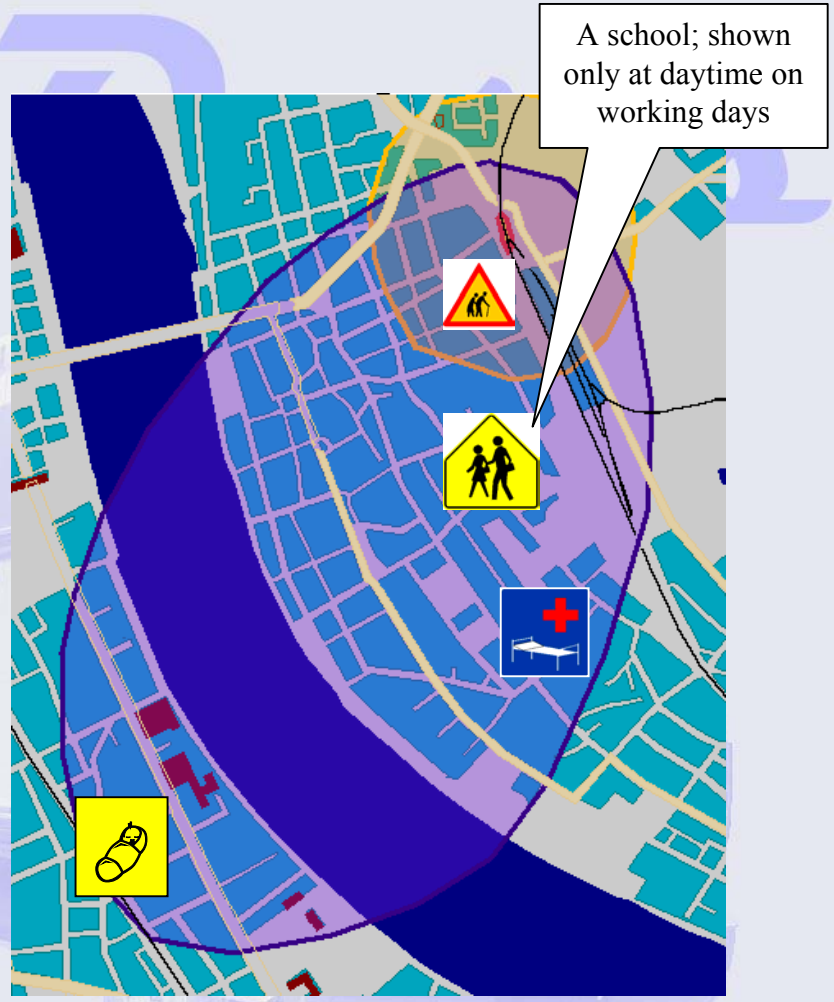
# Task 5: Identify the Endangered Population (2)

- Total: 15 924
- Children 0-3 years: 401
- Children 4-15 years: 1 422
- Elderly 65-75 years: 1 257
- Elderly over 75 years: 1 071



# Task 5: Identify the Endangered Population (3)

- The system checks whether the danger zone contains places with people requiring special care (e.g. hospitals).
- The system takes into account the day of the week and the time of the day.
- The system shows the locations of the special population groups on the map and provides the necessary information (from the database).



# Instruct the Transportation Services About the Evacuation Plan

- In map (when possible) and text form
- Whom?
- From where?
- To where?
- Recommended routes

# Instruct the People Subject to the Evacuation

- Map + text
- Shelter locations (for those who evacuates on their own)
- Meeting points (for those who cannot evacuate on their own)
- Dangers
- Protective measures (e.g. wear cloth masks, close windows in homes)
- What must be taken (e.g. documents)
- Recommended routes

# The Approach

- Knowledge-based technologies (Artificial Intelligence)
- Knowledge resources required:
  - Domain-specific knowledge of possible crisis situations, threats, actions and actors, etc.
  - Data semantics (e.g. population age groups)
  - Knowledge on data analysis methods and tools
  - Knowledge relevant to visualisation design: visualisation methods, perception, media
  - Knowledge about potential users: roles and responsibilities, education, experience, etc.
- Demonstrate feasibility on 2-3 example scenarios

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**http://www.ais.fraunhofer.de/and**