CT-Analyst
Fast and Accurate CBR Emergency Assessment

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**Physical Processes**

**Fluid Flow**
- Complex building vortex shedding and recirculation zones with associated turbulent stochastic backscatter
- Consistent stratified urban boundary layer with realistic wind fluctuations
- Solar heating including shadows from buildings and trees
- Aerodynamic drag and heat losses due to trees
- Surface roughness variations and turbulent heat transport

**Contaminant Transport**
- Contaminant transport is controlled by convection, *not* diffusion
- Effects of unsteady, non-isothermal, buoyant flow crucial
- Backscatter will carry particles to/from surfaces
- Typical particulate and gaseous contaminants behave similarly
- Larger particles must have their dynamics included
- Evaporation and chemistry is important for some contaminants
Influence of Source Locations: Chicago

- Release points separated N-S by 350 m.
- Channeling effect of river may have narrowing effect on plume for release 1.
- Flow deflection and recirculation zones may cause the significant spreading in release 2.
Comparison of FAST3D-CT with HPAC

- Identical input conditions
- Neutrally buoyant gas
- Mass = $10^3$ kg (1 ton)
- Size = 20 m x 20 m x 20 m
- Release height = 10 m

Comparison by courtesy of J. Pullen, Stanford University
The Dilemma …
Simulations of Chem/Bio scenarios are practical but expensive …
Operational users cannot afford to wait for computations!

![Graph showing walking direction in degrees relative to the wind versus fatality rate with different warning delays.](image-url)
Faster More Accurate Emergency Assessment for Airborne WMD Threats

**FAST3D-CT** (detailed CFD)  
**CT-Analyst™** (operational model)

*Dispersion Nomographs™*  
a new fluid dynamics representation
CT-Analyst Screen Showing Backtrack, Plume Envelope, and Escape Displays
Comparison of CT-Analyst with FAST3D-CT

- Contaminant concentrations 18 min. after release
- FAST3D-CT results (left) show a single realization of the plume.
- CT-Analyst (right) shows the plume envelope from multiple realizations.
CT-Analyst Capabilities

- **IMMEDIATE DATA FUSION**
  - Anecdotal information, qualitative data and sensor data

- **IMMEDIATE CONSEQUENCES**
  - Simple, instantaneous computation of exposed and soon-to-be exposed regions based on very limited data

- **SITUATION-BASED ESCAPE ROUTES**
  - Quickly project optimal evacuation paths based on the current evolving situation assessment

- **EMERGENCY MANAGEMENT TOOLS**
  - Web broadcast of results, connection to urban GIS
  - Coordinate remotes & backtrack to unknown source
  - Integrate threat profiles against building parameters