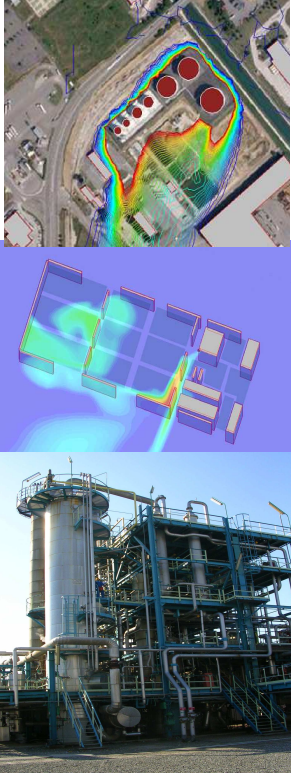




ACCIDENTAL DISPERSION OF INDUSTRIAL POLLUTANTS EMERGENCY PLANNING & RESPONSE



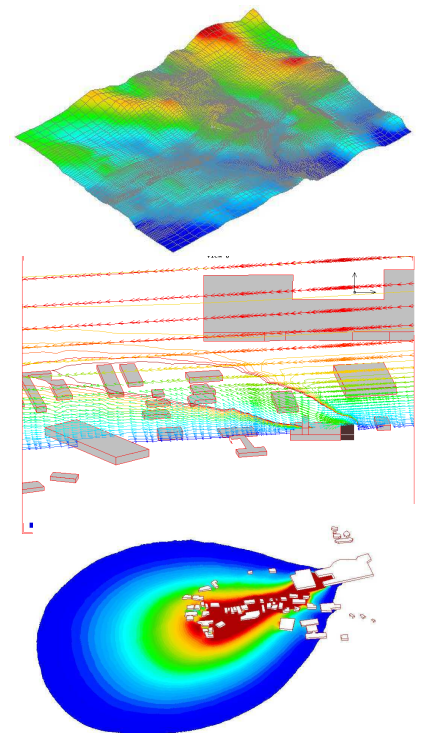
fluidyn-**PANEPR** is the module of *fluidyn*-**PANACHE** dedicated to the 3D simulation of accidental dispersion from industrial sites. It analyzes the consequences of accidental dispersion of pollutant discharge in process industries due to rupture or leaks in pressurized or non-pressurized tanks, pipes, valves, joints etc. and combustion products due to fires.

fluidyn-**PANEPR** is a powerful tool which can be used to plan anticipatory measures and solve problems in case of industrial accidents. It integrates the 3D modelling characteristics (wind, turbulence and pollutant transport) of *fluidyn*-**PANACHE** and takes into account the influence of **topography, obstacles** (in near field), and **buildings**, influence of **vegetation** and terrain on dispersion, solar radiation effects and ambient atmospheric conditions. It can simulate transient effects of the following physical phenomena: compressible flow, buoyancy effects, atmospheric release interactions, and variable source time.

METHODOLOGY

Gas releases are computed by solving the 3D Navier-Stokes fluid dynamics equations on a curvilinear mesh which accurately espouses highly complex terrain and obstacles. Contrary to the generally prevalent Gaussian methods, this 3D deterministic method gives a real estimate of the distance to be maintained between buildings or the site limits. The particles or droplets are modeled with the Lagrangian Model when the sources are not localized. The Puff model is used to establish the trajectory and if necessary conduct a retro-tracing from the measurement points.

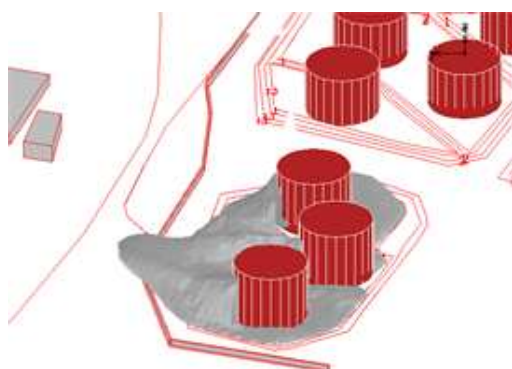
The compressible fluid model of *fluidyn*-**PANEPR** accurately models the dispersion of dense or hot gases, phase changes, evaporation and condensation phenomena in order to visualize the evolution of transient effects. The built-in two-equation turbulence model calculates the mechanical turbulence around obstacles. Complex chemical reactions can be simulated.



CONTEXT:

fluidyn-PANEPR can be applied to accident scenarios such as:

- Gas release from a pressurized storage tank or pipe: two-phase (particles or droplets) with variable rate or liquid release
- Dense gas dispersion with stratification and heat exchange with the ground.
- Multiple kind of pollutant sources, such as stacks and storage leaks.
- Interaction with structures, such as tanks and ground.
- Exact simulation of flow between building and chemical units by curvilinear mesh and a second order solver.
- Source term calculation by computational fluid dynamics for pipeline and storage tank leaks.
- Analysis of toxicology risks from threshold database (does calculation for SEI, SEL and SELS thresholds) and determination of plume opacity
- Dispersion of an explosive cloud (UVCE): Cloud volume and mass inflammability limits (for UVCE or ATEX calculations).

**HARDWARE ENVIRONMENT :**

fluidyn-PANEPR works on all PC platforms (WINDOWS, LINUX) as well as on UNIX work stations. *fluidyn*-PANEPR is a fully integrated software including a pre-processor, a numerical solver and a post-processor. The user interface is designed to be user-friendly, from the preparation of the case to the interpretation of the results. Video animations can also be realised in order to visualise transient effects in simulated phenomena.

CUSTOMERS:

Industries, consultancy firms, architects, consultants, pollution control bodies,...

REFERENCES :

AIR LIQUIDE, AIRMES, AJINOMOTO, ALGADE, AVENTIS, BEGHIN SAY, BUREAU VERITAS, BURGEAP, CALDIC, CEA, COELYS, CONTINENTAL, DECATHLON, EADS, EDF, GDF, HENNESSY, ICF, IDE, INEOS, IOSYS, JOHNSON CONTROL, LITWIN, LVM, NEXTER, NORISKO, NUFARM, PAPREC, ROCKWOOD, RUBIS, SEMACO, SERTIUS, SHELL, SNCF, SOFREGAZ, SOLVAY, SONOVISION, SUNDIS, TCT, TNO, TOTAL, etc.

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