Company Profile
Activities and Business Areas
June 2024

TEASISTEMI
ENERGY AND ENVIRONMENT TECHNOLOGIES

Company history

- **TEA Center** (**T**ecnologie **E**nergetiche ed **A**mbientali) was set up in 1988, within a consortium among the University of Pisa and a number of industrial companies, including ENI. **TEA Sistemi SpA** has been established in 1998 as a spin-off of the University of Pisa.

- In its early years TEA Center, and later TEA Sistemi, launched a series of R&D projects supported by the EU and ENI that allowed us to set up **a test laboratory operating with real fluids and geometry,** that has been used to develop new equipment/technolohies.

- In parallel, the Company, in collaboration with ENI, **developed software tools to support consulting services** mainly directed to the O&G Industry, in the areas of process development, flow assurance, and safety analysis.

Company history

o The 2014-2016 downturn of the Oil industry caused a drastic reduction in contract research, laboratory utilisation and equipment sales. Consulting services were less affected by the crisis and, starting from 2017, were restructured into two Divisions.

o The Company gradually recovered pre-crisis turnover and in January 2023, decided to transfer the laboratory and the sale and maintenance of equipment to another company, keeping the right to use the laboratory without any charge other than direct costs.

o At present, the Company counts on about 40 employees and senior professionals. Our main office is in Pisa and we have a branch office in Milan. R&D projects are now carried out within the Divisions, as well as Business Development activities.

Organization Chart

Activities & Services (1)
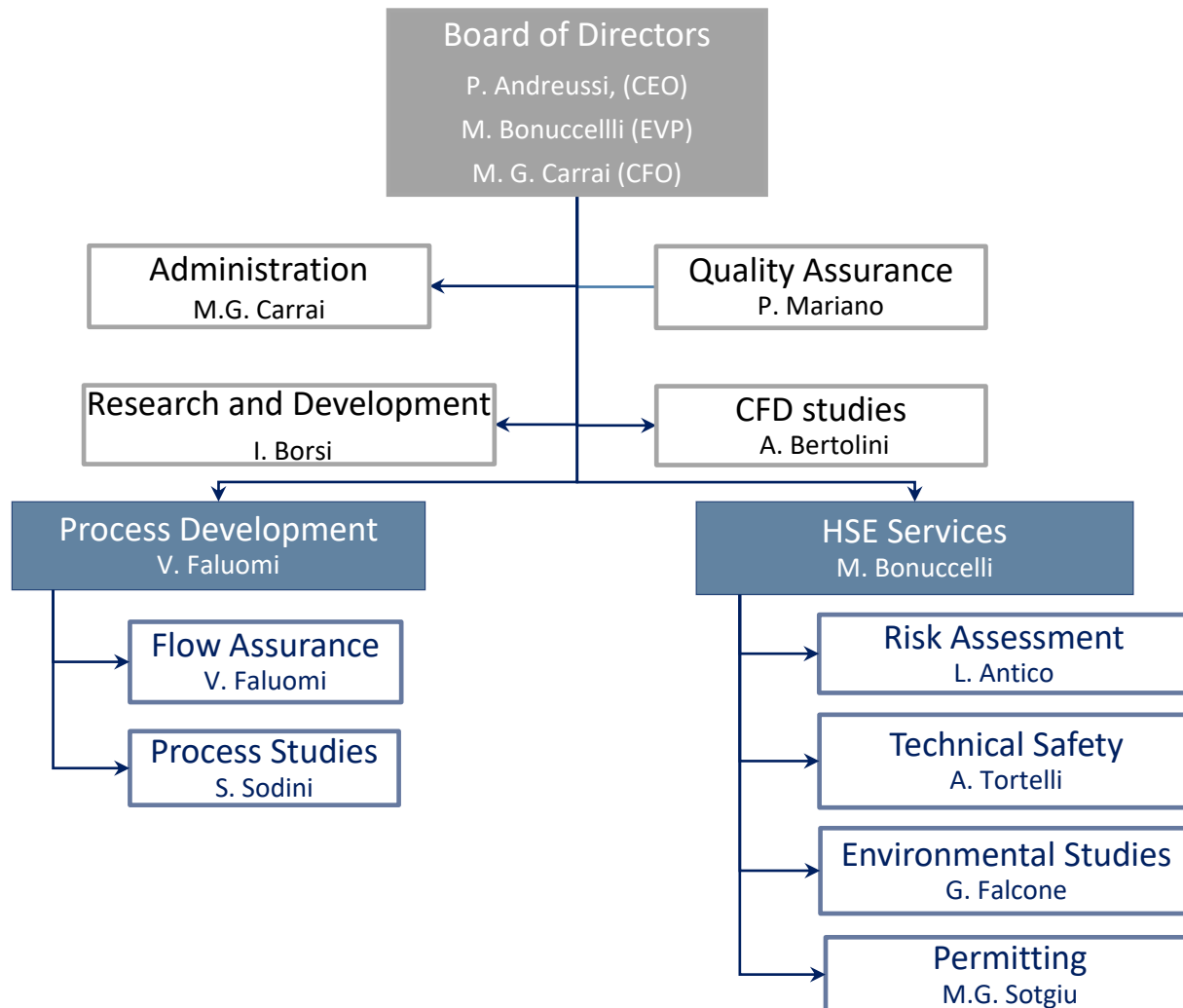
Process Studies

o Energy and Mass Balances, Equipment Design, Process Datasheets.
o Hydraulic and Thermal design of production systems.
o Transient analyses of industrial plants and operative procedures definition
o Control and optimization of industrial plants.
o CFD studies of separation systems, chemical reactors, combustion systems.

Flow Assurance

- Off-shore Subsea/Topside equipment design.
- Hydrate, Wax, Scale and Corrosion issues evaluation and management.
- Pipeline transportation of CO_2, H_2 and CO_2/H_2 mixtures.
- Studies of pipeline networks.
- Water hammer studies.

Risk Assessment

- Analysis of Major Hazard in the Process Industry.
- Risk Assessment: Consequence analyses, Frequency assessment, QRA.
- ALARP demonstration.
- Explosion studies with advanced CFD methods.
- Support to HSE Management: Preparation of HSE plans.
- Participation to HAZID/HAZOP/SIL reviews.

Technical Safety

- Fire&Gas detection systems.
- Flare assessment.
- Fire-fighting design.
- Hazardous area classification. Verification of plant layout

Environmental Studies

- Site remediation
- Coastal hydrodynamics and pollution studies.
- Pollution modeling (air-water quality, ground contamination).
- Oil spill models.
- Environmental monitoring and control.

Permitting

- Noise analysis and mitigation.
- Permitting Phase (ESHIA, IPPC report).
- Preparation of HSE plans.
- Participation to HAZID/HAZOP/SIL reviews

Flow Assurance

- In the early 1990s TEA Sistemi was responsible of the acquisition and qualification of the OLGA code within ENI.

- Since then, TEASistemi has been involved in a wide number of flow assurance studies.

- In 2006, TEASistemi launched an R&D activity, supported by ENI, aimed at the development of MAST, an advanced alternative to OLGA.

- A version of MAST for CO2 pipeline transport and a GIS based version have also been developed.
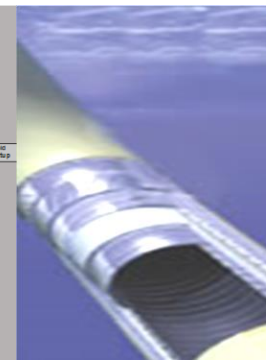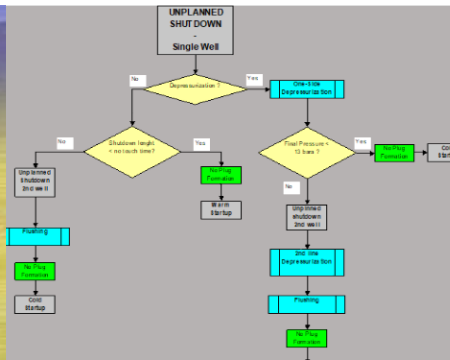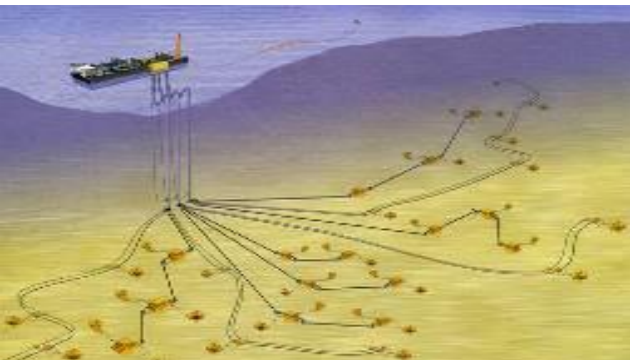
Process Development

- Energy and Mass Balances, Energy saving in process plants
- Equipment Design, Process Datasheets.
- Hydraulic and Thermal design of production systems.
- Transient analyses. Control and optimization of industrial plants.
- CFD studies of chemical reactors or combustion systems.

Risk Assesment

- Starting from 1998 TEA Sistemi developed a software Suite (RAINBOW) for the analysis of relevant incidents in the Oil Industry.

- Rainbow consists of a set of modules organized within a computational procedure able to model all different aspects of a blow-out event or a major accident.

- The project lasted more than 10 years and the results obtained are currently used for risk assessment activities.

- Up to now, more than 300 applications of RAINBOW have been made for ENI.
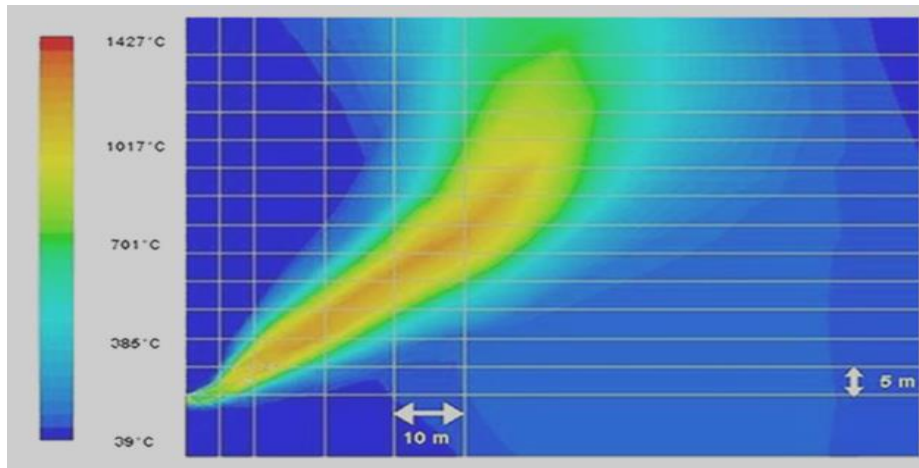
Environmental Studies

- Pollution modeling (air-water quality, ground contamination, oil spill studies)
- Permitting Phase (ESHIA, IPPC report,...)
- Coastal hydrodynamics
- Noise analysis and mitigation
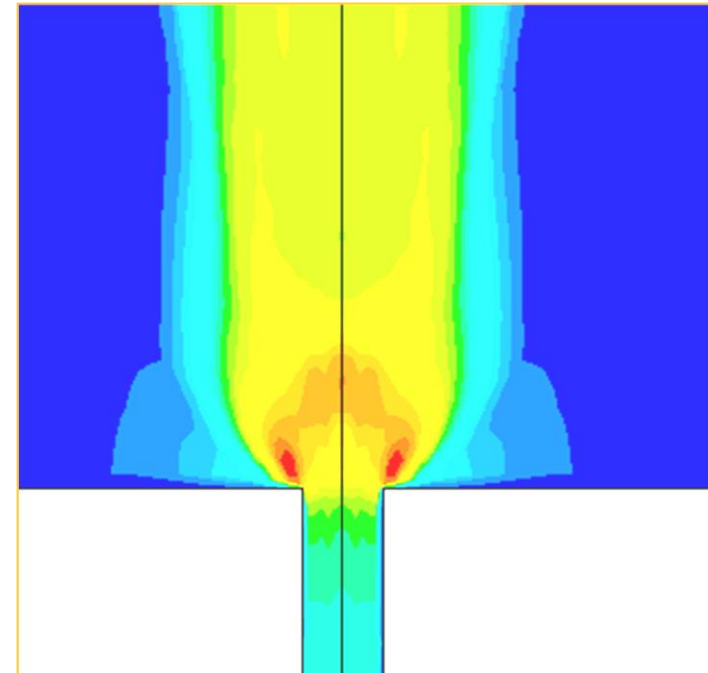- Site remediation
- Environmental monitoring
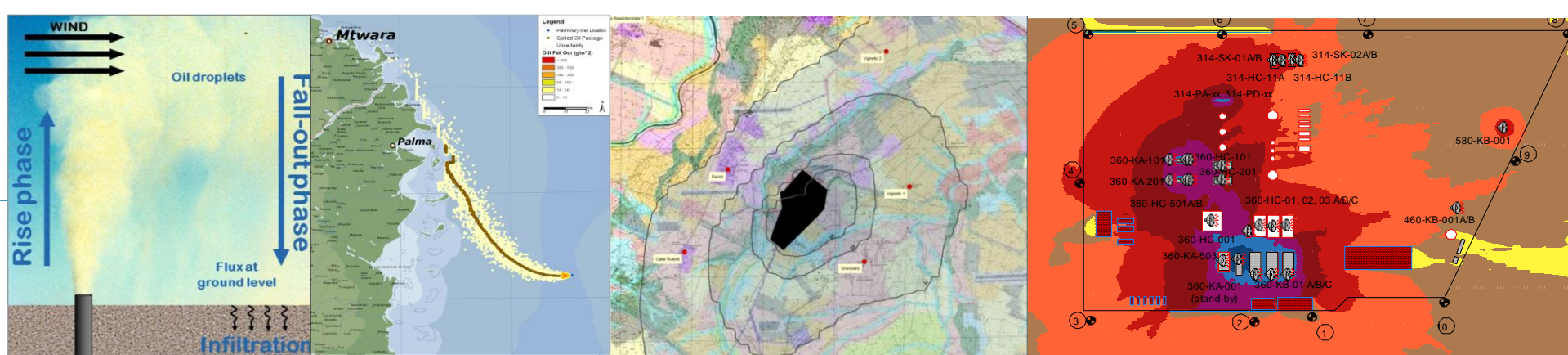
Tools: Computational Fluid Dynamics

- TEA adopts CFD methods to develop models of complex phenomena (jet fire, multiphase discharge, multidimensional flow)

- Similar tools, eventually of reduced order, are used to study explosions or coastal flows

Simulation of a vertical Supersonic gas jet

Simulation of a horizontal gas jet

New Business Areas

New areas of work in TEA Sistemi are directly related to the central issues of energy transition, climate change and major natural hazards

✓ **Energy Transition**
- o Hazards of the hydrogen infrastructure
- o CO_2 pipeline transport
- o CO_2 seabed reinjection
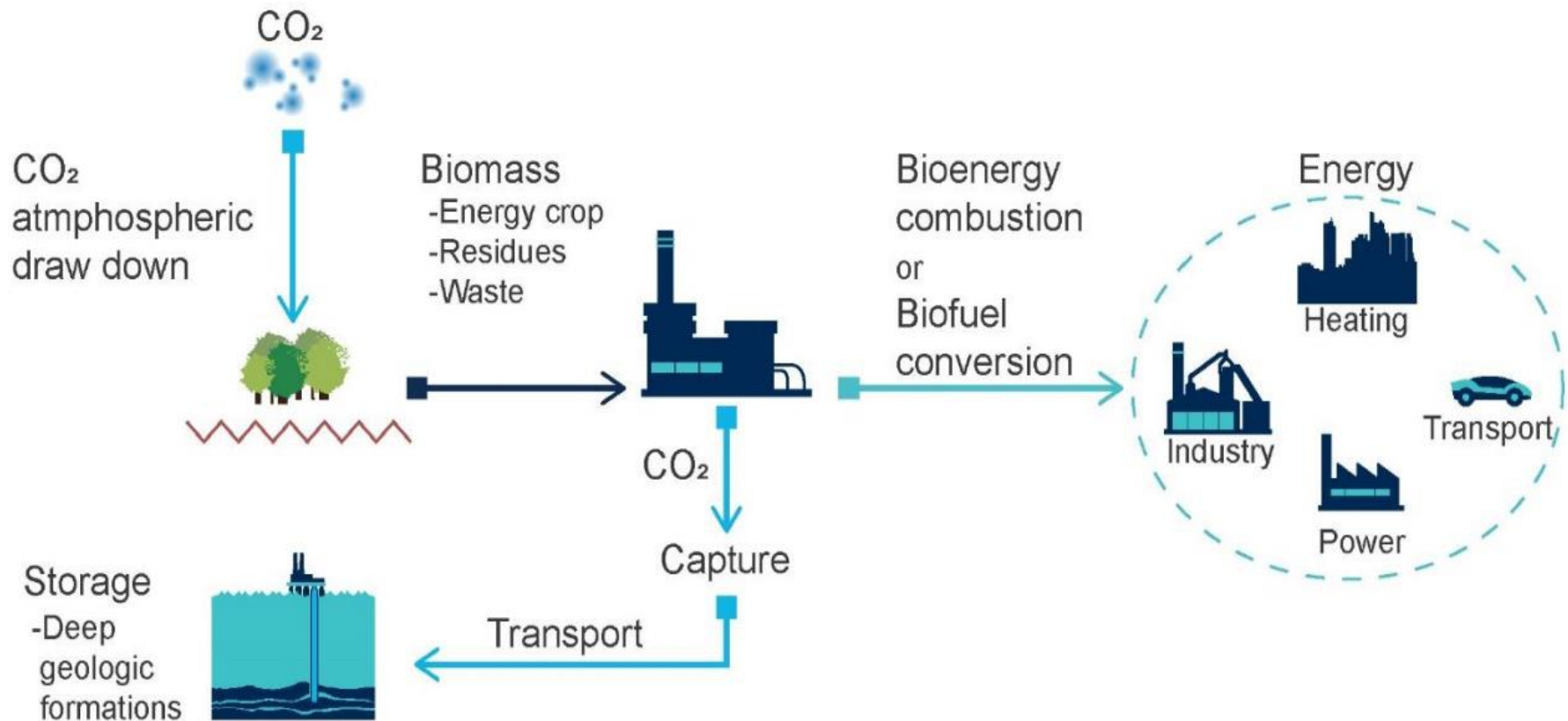- o Hydrogen production from biomass gasification.

✓ **Climate Change &Major Natural Hazards**
- o Study of NaTech events
- o Mitigation of the seismic hazard
- o Pipeline transportation of flammable, toxic or pollutant fluids
- o Early warning

Biomass Gassification

○ BECCS Bio-Energy and Carbon Capture and Storage

Natech risk for pipelines
(earthquake, flooding and landslides)

Since 2020, TEA has contributed to developing a specific **methodology** to conduct both **preliminary screening** of pipeline critical points and **advanced risk assessment** (including mitigation measures and cost-benefit analysis).

The methodology has been **applied** to existing **pipelines**

Exposed Petroleum Pipeline Due to Flood

Early Warning of Floods

Work on natural hazards related to climate change can be based on our previous work in the field of Artificial Intelligence, such as the study of river floods that we developed more than 25 years ago. This application may regard industrial plants and, as well, an urban settlement or the countryside.
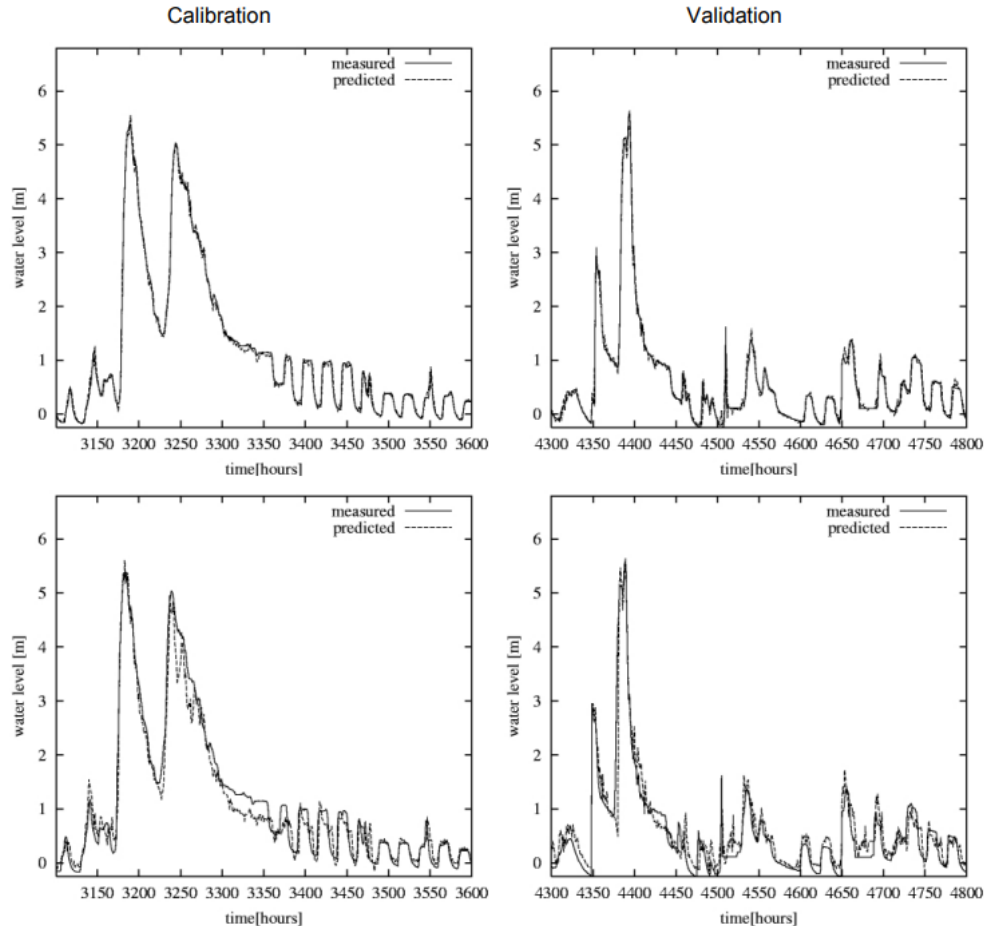
Commercial Software

- Standard approach: PHAST, EFFECTS, HGSYSTEM, FRED, IMMI

- Advanced approach: OLGA, FLUENT, PHAST, FLACS, MIKE, STAR-CCM+, SAFETI, HYSYS.

- Long term dispersion analysis: CALMET-CALPUFF, OSCAR, GNOME
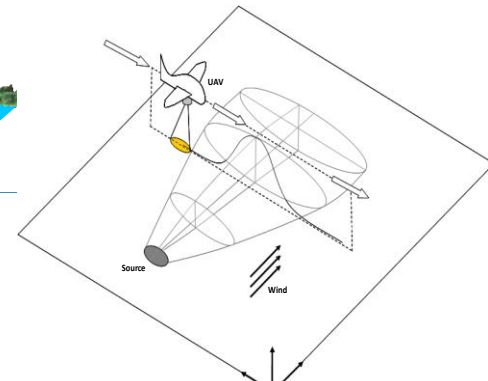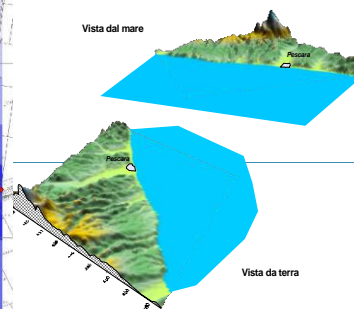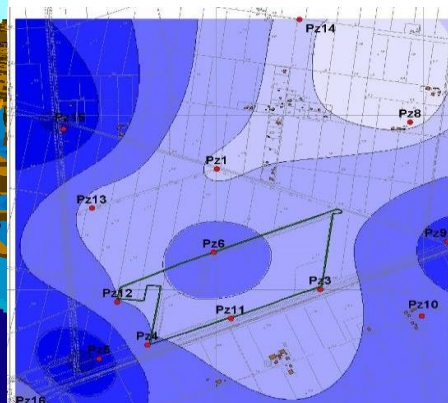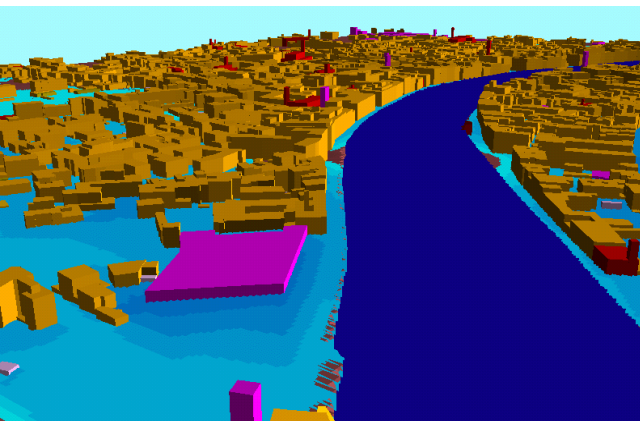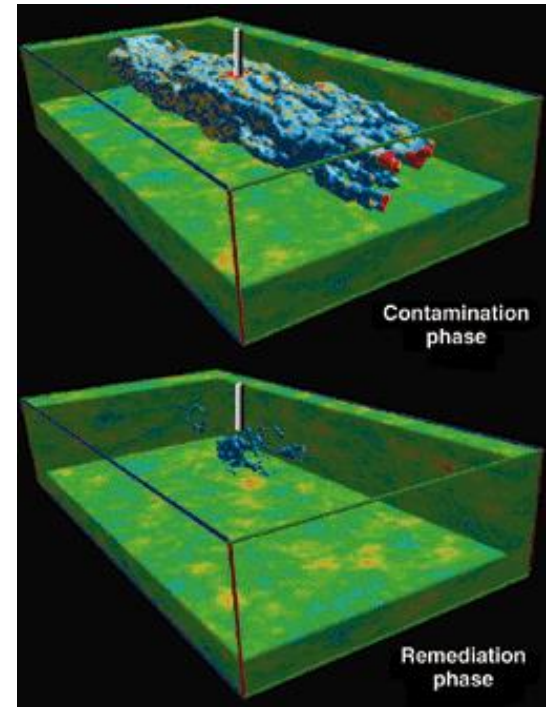
In House tools : MAST

- MAST is a one-dimensional multuphase solver for pipeline network analysis, similar to OLGA code

- The solver is based on a multi-field description of the phases: each fluid is modelled to be made of a continuous and dispersed field.

- Based on dynamic pattern recognition concept, the flow pattern transition is automatically captured by the numerical solution of the governing transport equations.

- Development started in 2005, as internal R&D initiative

- MAS has been validated against laboratory and field data, and it has been used in several activities along the years

In House tools : QTEARisk

- QTEARisk is a GIS tool embedding most of the current methodologies, as well as the geospatial procedures needed to prepare inputs and outputs for risk assessment

- Development started in 2017, as internal R&D initiative

- It is now the in-house software tool applied to support QRA, FERA and EERA studies
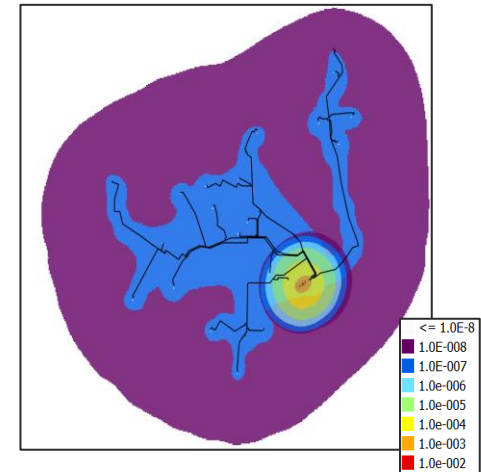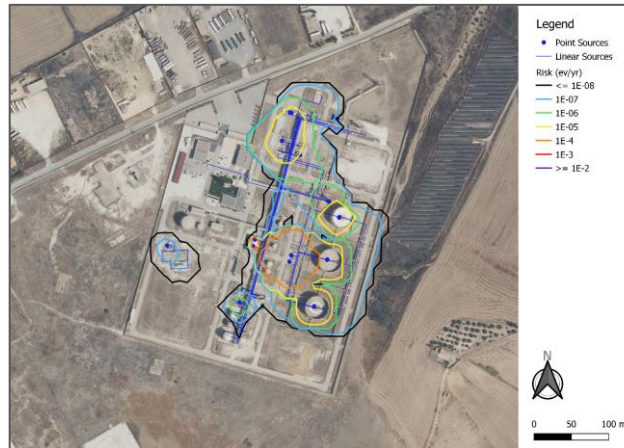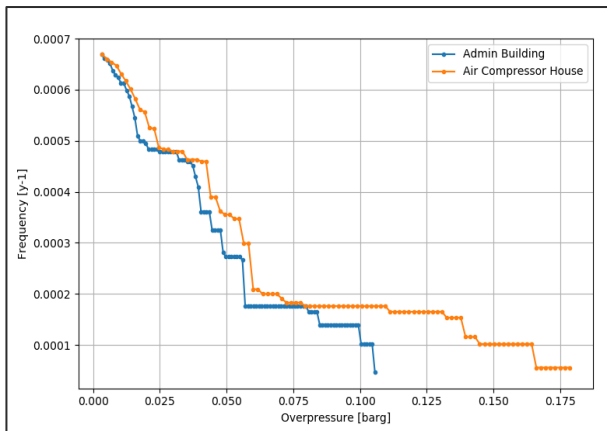
Intellectual assets

Main intellectual assets of TEA Sistemi are software packages developed for our final clients, within EU project, or own funds:

- **RAINBOW**, a sorftware suite used for modelling the consequences of severe accidents in the Oil Industry

- **MAST,** a complex transient code able to model pipeline transport of multiphase mixtures (Oil, Water and Gas)

- **QTEARisk**, a GIS tool used to prepare inputs and outputs for risk assessment.

- **FREEWAT**, an open-source software tool for water resources management.

TEA also own perpetual licences of commercial software tools of relevant cost.

Main Clients & Frame Agremeents

- **ENI/ENIPROGETTI :** Frame Agreement for HSE, Technical Safety and Environmental Studies

- **SAIPEM :** Frame Agreement for onshore and Offshore Pipeline Process and HSE and Technical Safety Studies

- **TECNIMONT :** Frame Agreement for HSE Analyses

- **TECHNIP** : Frame Agreement for Process Studies

- **ENERGEAN :** Frame Agreement for Process Studies

- **EDISON :** Frame Agreement for Process Studies

- **SNAM :** Frame Agreement for Field Activities

Other Clients

- **TECHINT**
- **DNV**
- **ILF Consulting**
- **ROSETTI MARINO**
- **RENCO BU Energy**
- **RINA Consulting**
- **BONATTI**
- **ENERECO**
- **HPC**

Process, Hydraulic Studies and Energy Transition

    Vittorio Faluomi

    +39 347 3638617

    vittorio.faluomi@tea-group.com

HSE, Techical Safety and Permitting

    Michele Bonuccelli

    +39 329 0509867

    michele.bonuccelli@tea-group.com

Tea Sistemi