

Licensing options and technical requirements

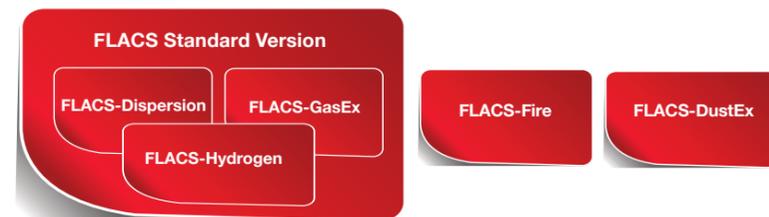
There are various license options for FLACS:



- ▶ Stand-alone or network licenses
- ▶ Perpetual, annual or short term lease

FLACS runs on computers with AMD or Intel (x86, x64 or AMD64) processors and both Windows and Linux systems.

FLACS is available as a standard FLACS version as well as on an individual modules basis.



- ▶ FLACS standard version - for ventilation and dispersion, gas explosions and hydrogen safety
- ▶ FLACS-GasEx - gas explosions only
- ▶ FLACS-Dispersion - ventilation and dispersion only
- ▶ FLACS-Hydrogen - hydrogen safety only
- ▶ FLACS-DustEx - dust explosions
- ▶ FLACS-Fire – jet and pool fire modelling (late 2014)



FLACS

The industry standard for CFD explosion modelling and a comprehensive tool for technical safety issues related to flammable and toxic releases

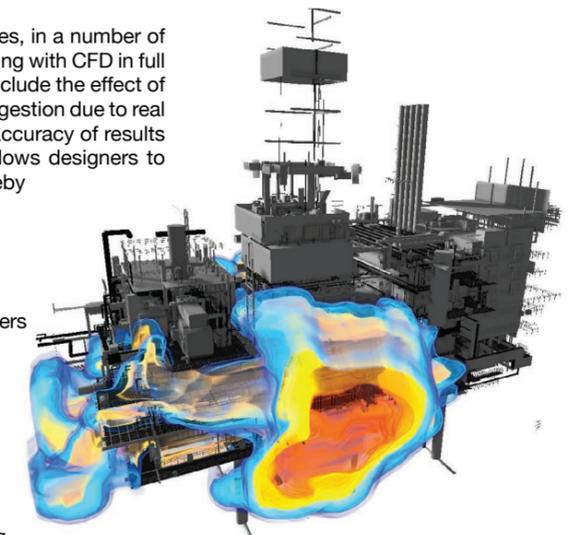
FLACS combines the power and versatility of 3D-CFD (Computational Fluid Dynamics) models with over 35 years of extensive validation work and intuitive graphical user interface. This combination provides a comprehensive, yet easy to use, software tool for modelling (dispersion and explosion) consequences in full 3D for all typical flammable and toxic release scenarios.

FLACS key features and benefits

FLACS is used extensively in the Oil and Gas and Process industries, in a number of nuclear institutes and increasingly many other industries. By modelling with CFD in full 3D it is possible to predict consequences more accurately and to include the effect of all contributing and mitigating effects (such as confinement and congestion due to real geometry, ventilation, deluge). A better understanding and higher accuracy of results not only contributes to raising the true level of safety but also allows designers to choose effective design options and mitigation measures and thereby both improving safety and managing project cost.

Main Features:

- ▶ Full-3D CFD modelling
- ▶ Developed together with the oil & gas and process industry leaders
- ▶ Continuous development and validation during the past 35 years
- ▶ Integrated dispersion and explosion modelling
- ▶ Geometry import (Microstation DGN v7/v8 and indirectly: PDMS, PDS, laser-scanning)
- ▶ Very modest learning curve for a CFD tool
- ▶ Superior accuracy and versatility compared to analytical and phenomenological models
- ▶ The only CFD tool approved by the US government for LNG facility siting
- ▶ Available for both Windows and Linux



FLACS simulation showing a gas explosion on an Offshore installation

To learn more about FLACS visit our website at: www.flacs.com or contact: flacs@gexcon.com

GEXCON

FLACS is a GexCon brand

GexCon is owned by the research institute CMR, with the University of Bergen as majority owner. Our Head Office is based in Norway and we have subsidiaries in a number of locations around the world.

We also work together with partners in China, Korea, Japan, Russia, India, Malaysia, Singapore and Indonesia.

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FLACS

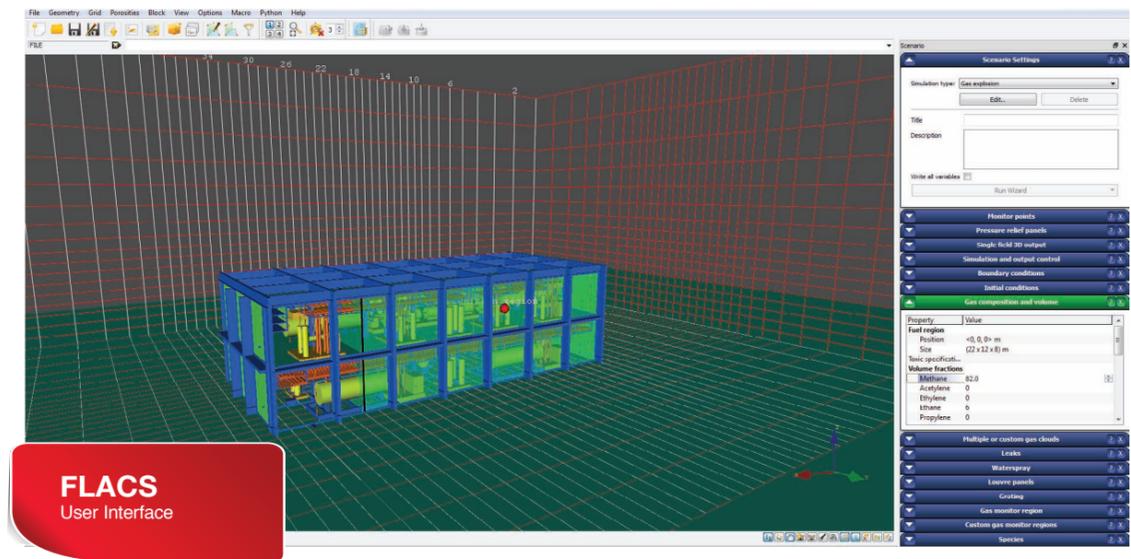
Date: 2014

FLACS



FLACS

Safety studies are usually only a modest part of the total project scope, however the results of these studies provide important input to many other disciplines (process, structural, piping etc.) and can therefore have a much wider impact on project design choices and subsequently costs/schedule. With ever more complex installations and projects, it is paramount to use the most accurate and validated 3D consequence modelling tool available. FLACS provides a solid framework for evaluating various design options and helps in choosing the most (cost) efficient and practical measures to reduce risk. FLACS can help your company or your clients achieve the expected high standard of safety required.



FLACS
User Interface

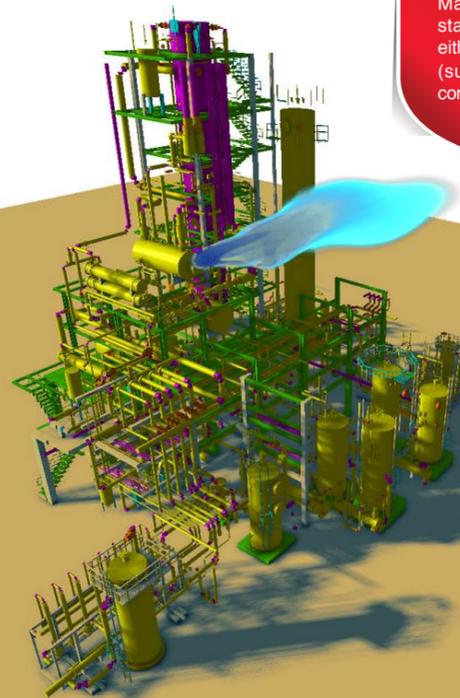
FLACS detailed functionality:

- ▶ Very efficient setup of scenarios (including grid) and running of simulations
- ▶ All environmental conditions (any wind speed, including zero/low wind speeds)
- ▶ Includes effects of actual geometries (which is usually dominant for both gas dispersion and explosions)
- ▶ Can include various mitigation measures (explosion relieve panels, water deluge)
- ▶ Transient (time dependent) modelling
- ▶ 2-phase modelling (HEM & Liquid pool model)
- ▶ Better understanding of the phenomena and results
- ▶ Comprehensive user guidelines based on extensive validation against experiments
- ▶ Can be used in all phases of design: from concept design, through FEED to detailed engineering

A wide range of applications

- ▶ Offshore/onshore explosion studies (e.g. according to standards such as NORSOK Z-013 and ISO 13702/19013-3)
- ▶ Onshore building risk assessments (e.g. API RP-752 & RP-753)
- ▶ Installation/module layout optimization
- ▶ LNG siting studies (NFPA 59A / 49 CFR 193 & EN1473)
- ▶ Gas detector optimisation
- ▶ Toxic dispersion calculations
- ▶ Dust explosions (with FLACS-DustEx)
- ▶ Accident/incident investigation (FLACS was used for investigating accidents such as Piper Alpha, Buncefield, Deep Water Horizon, Texas City Refinery and the TWA 800 aircraft accident)

Many of the major national/international safety standards (Norsok Z-013, ISO 13702/19901-3) either explicitly or implicitly prescribe 3D CFD tools (such as **FLACS**) for dispersion and explosion consequence modelling.



FLACS simulation showing lower flammability limits (LFL) of an accidental gas release



FLACS
Installations Worldwide

FLACS is used in the following industries:

- ✓ Oil and gas industry
- ✓ Chemical industry
- ✓ Risk and safety consulting companies
- ✓ Manufacturers of safety equipment
- ✓ Shipyards
- ✓ Construction/engineering companies
- ✓ Nuclear industry
- ✓ Research organizations
- ✓ Aerospace & Automobile
- ✓ Universities
- ✓ Governmental institutions and Authoritative bodies