



Enhancing safety
through advanced
modelling



FRED for Future Fuels

Fire, release, explosion, and dispersion consequence modelling tool developed by Shell and available exclusively through Gexcon

Features full thermodynamic model for safety and risk management across multiple assets.

Based on more than 40 years of R&D, the software is a well-validated consequence modelling tool, with a range of models that are well suited for future fuel applications.

Uses and application

FRED can be used for broad applications, enabling the analysis of various scenarios that involve future fuels, including hydrogen, ammonia, CO₂, methylcyclohexane, and methanol.

Utilise FRED to analyse the consequence of accidental releases at a production and storage facility, from a vehicle, or at a distribution terminal. It is applicable throughout the design, construction, operation, and modification phases.



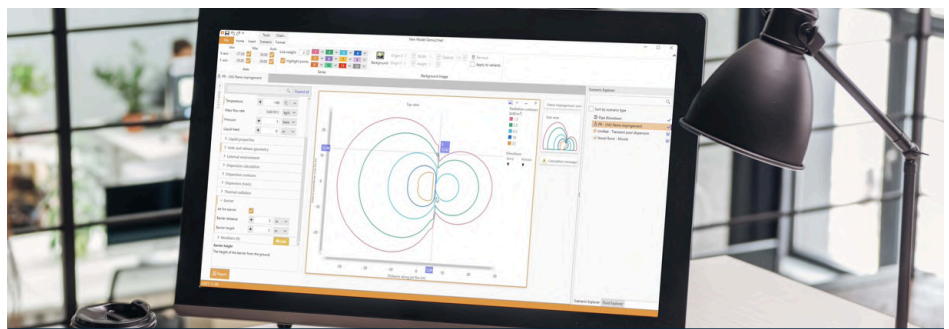
Perform various simulations at the same time

The software has been developed based on the need for accurate results and actionable outputs, such as:

- Justifying new design and operation.
- Optimising facility and equipment layout.
- Optimising prevention and protection measures.
- Analysing domino effects/escalation management studies, through specific scenarios for modelling the effect of Passive Fire Protection (PFP) and vessel heat-up.
- Preparing and updating safety cases.
- Analysing pre-incident and emergency response planning studies.
- Conducting accident investigation.
- Performing quantitative fire and explosion risk analysis – with results directly integrated into Shell’s QRA tool Shepherd.



Analysing missile fragments after vessel burst



Assessing the top-view output of the LNG Flame Impingement Model



Large-scale experiment to develop Shell Code for Overpressure Prediction in gas Explosions (SCOPE)



Modelling Escalating Accident Scenarios and the Use of Risk-reducing technology for Explosion safety (MEASURE) JIP



Liquid hydrogen jet fire testing to generate validation data

Predict the behaviour of multi-component mixtures

The software features an advanced thermodynamic model, which allows extended multi-component fuel representation to be used across nearly all models.

Users can accurately model the behaviour of simple and complex mixtures, such as:

- Temperature changes on high-pressure release (e.g., Hydrogen – Joule-Thompson Effect).
- Pool flashing/off gassing for liquid releases (e.g., methanol).
- Flashing of dense phase releases (such as CO₂ and ammonia), and ensuing dense gas dispersion.

Create mixtures to match any real-world scenario

FRED includes over 1,200 chemical components, which can be blended to create custom compositions for your analysis. The thermodynamic package will accurately model the release behaviour of these mixtures.



LNG BLEVE experiment

Trustworthy based on over 40 years of validations

FRED has been extensively tested and validated against experimental data for more than 40 years. It has a range of models that are well-suited for hydrogen, ammonia, methanol, methylcyclohexane, and CO₂ applications.

Specific validation has been conducted for over a decade for future fuel applications (such as hydrogen dispersion and jet fires, dense CO₂ dispersion).

Shell has invested well over \$100 million in experimental studies and actively participates in numerous Joint Industry Projects (JIPs), alongside conducting bespoke research. This ensures results reflect real-world conditions and give users greater confidence in the outcomes.

User-friendly interface

Easily navigate through FRED when performing your safety studies. The software's ease-of-use decreases your search time and increases your productivity.

The software underwent a major update in 2020, featuring a complete redesign of the user interface.

The result was a brand-new, intuitive, and easy-to-use experience, shaped by extensive feedback from users around the world. FRED has continued to receive regular updates to further enhance usability.

Communicate results effectively

Use a background image with a chart or export consequences to a 3D platform to show the effects of accidental releases. Create visual results that can be clearly understood even by non-technical professionals.



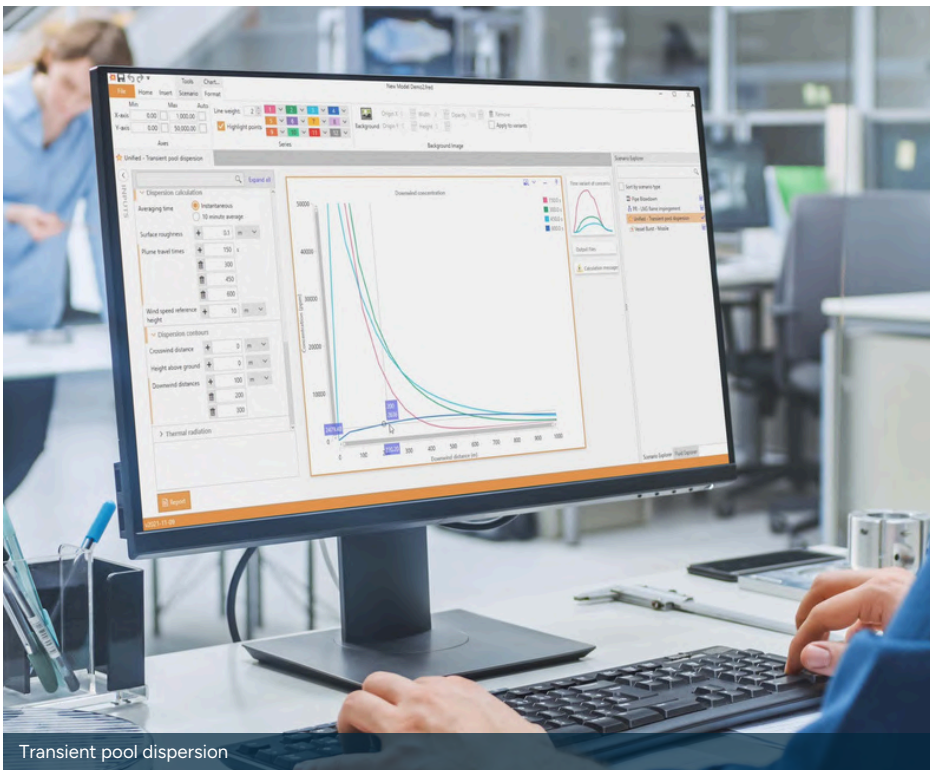
Large-scale CO₂ experiment

FRED can be used in conjunction with Shepherd (QRA tool) and PIPA (pre-incident planning tool).



“The ever evolving breadth and depth in features offered by FRED ensure the engineered solutions for our clients meet the highest standards of process safety.”

Process Safety Engineering Team,
Petrokon Utama Sdn Bhd



You can watch a webinar to learn how FRED has been validated for substances like hydrogen, CO₂, ammonia, methanol, and methylcyclohexane, making it a reliable tool to support decision-making in projects and operations.

Please scan this QR code to visit the webinar page.



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