BREEZE LFG Fire / Risk

The potential risks associated with liquefied fuel gas (LFG) and particularly liquefied natural gas (LNG) can be analyzed with BREEZE LFG Fire/Risk. Users can predict the vaporization rate and downwind vapor concentrations for explosions hazards and thermal radiation from resulting fires.

BREEZE LFG Fire/Risk is easy to use and quick to run. The intuitive interface guides the user through entering required and optional inputs and selecting the appropriate algorithms. With BREEZE LFG Fire/Risk, EH&S professionals can efficiently analyze the risks from a vessel / pipeline failure as required for regulatory compliance and safe operations.

BREEZE LFG Fire/Risk includes the following models:

- Source5 – LFG-specific model developed by the Gas Technology Institute that predicts the vaporization rate from instantaneous spills and continuous leaks over land or water. Results from Source5 are available in an easy-to-read report.
- DEGADIS – EPA approved dense-gas model that predicts downwind vapor concentrations for explosion hazards. DEGADIS is cited in 49 CFR 193 for LNG facilities.
- Fire models – developed by the Gas Technology Institute to calculate thermal radiation flux associated with a potential explosion and fire, including confined pool fires, unconfined pool fires, jet fires, and BLEVEs.

BREEZE Source5

Source 5 is an LFG-specific model developed by the Gas Technology Institute that predicts the vaporization rate from instantaneous spills and continuous leaks over land or water. Results from Source5 are available in an easy-to-read report.

Included with LFG Fire/Risk

LNG quickly vaporizes upon release, forming a cold, dense gas cloud with a very complex behavior that changes quickly in a short period of time. While DEGADIS is an approved dense-gas model, it lacks the capability to simulate the complicated behavior of LNG as it vaporizes and forms a dense cloud. Source5 was developed by the Gas Technology Institute (GTI, formerly the Gas Research Institute) to specifically handle this behavior. Source5 is an integral part of the BREEZE LFG/Fire Risk package which includes DEGADIS, Source5, and GTI's LNGFIRE3 thermal radiation models.

Source5 predicts the evaporation rate and spreading of an evaporating LNG release. Spills can be over land or water. The model simulates five different release types:

- Confined instantaneous land spills
- Confined continuous land spills
- Unconfined instantaneous land spills
- Unconfined continuous water spills
- Unconfined instantaneous water spills

Source5 produces output that flows seamlessly into DEGADIS. This allows the analyst to run Source5 and DEGADIS without manually typing results into DEGADIS, which is a time consuming error-prone task. Seamless integration of Source5 into DEGADIS reduces errors and reduces the time required to do your job.

49 CFR 193 requires use of DEGADIS in predicting downwind concentrations of liquefied national gas (LNG) vapors for LNG facility citing and modification. LNG is primarily methane and is typically stored as a liquid at about -260º F.

DEGADIS

BREEZE DEGADIS is a dense gas dispersion model that estimates concentrations downwind from an accidental chemical release where the dispersing toxic or flammable substance is initially heavier than air.

It is ideal for determining toxic endpoint distances and distances to lower flammability limits (LFLs) for certain toxic and flammable chemicals in accordance with EPA's Risk Management Program (RMP) requirements.

DEGADIS accounts for ground-level area and vertical jet releases that may be either finite or continuous in duration. For a vertical jet release, the Ooms model is used to predict the trajectory and dilution of the gas or aerosol and DEGADIS predicts the ensuing ground-level concentrations after the plume has returned to ground.

DEGADIS also has the unique capacity to model both of these source types as transient releases, where the emission rate and source dimensions vary with time. DEGADIS can account for heat transfer between the plume/ambient air interface and plume/ground interface.

Features

- User-specified weather conditions
- Customizable chemical database
- Release types: jets, spills
- Designed specifically for dense-gas releases and releases that become neutrally buoyant
- Scientifically validated air dispersion modeling code
- Can view time-dependent "snapshots" of predicted concentrations
- User-specified concentration levels

Benefits

- "What-if" accidental release scenarios
- Makes model easy to use for many chemicals
- Applies to a wide range of accidental release scenarios in industry
- Users can trust and compare results

Applicability

DEGADIS was developed specifically to model **heavier-than-air gaseous releases**.

A cloud from a dense gas release behaves very differently than a plume from a lighter-than-air release. Since the gas is heavier than air, the cloud characteristics are primarily gravity-driven. Negative buoyancy and stable density stratification are among the factors that prevent the application of a Gaussian dispersion model from accurately simulating a dense gas release.

BREEZE DEGADIS can be applied to a number of scenario types, including:

- Emergency response planning
- Industrial chemicals, highly-toxic chemicals
- Applies to a wide range of accidental release scenarios
- Process industries that use chlorine, ammonia, LNG, and other compressed gases or cryogenic liquids

Release Scenarios

DEGADIS can model a number of release scenarios, including:

Release Type	Duration
Ground-level	• Continuous • Finite • Transient
Vertical Jet	• Continuous • Finite
Evaporating Liquid Spill	• Continuous • Finite • Instantaneous

Release Durations

- **Continuous Release:** A continuous release is a steady-state release of dense gas at a constant rate into the atmosphere over a long period of time. As a rule, any release that is greater than 1,000 minutes is modeled as a continuous release. The output from modeling a steady-state release is concentration estimates at various downwind distances determined by the model.
- **Finite Duration:** A finite duration release is a steady-state release of dense gas at a constant rate into the atmosphere over a short period of time. As a rule, any release that occurs over a period of less than 1,000 minutes is modeled as a finite duration release. Finite duration model output is organized either by time or distance, depending on which parameter is of greater interest.
- **Transient Release:** A transient release varies over time; for example, if a liquid pool boils off or a container of gas depressurizes. As the pool decreases in size, the emission rate and radius change. Other transient releases include near-instantaneous releases such as container ruptures. Transient modeling output is organized either by time or distance, depending on which parameter is of most interest.

Release Method

- **Vertical Jet Release:** A jet release is a vertical release of a dense gas or aerosol. The simulation uses the Ooms mathematical model for a dense gas jet plume. The jet plume model requires that the jet be vertical, with a definable exit velocity. If the jet release is such that the plume centerline does not reach the ground before dispersing, the jet plume model is run alone. If this is unclear, or if the plume centerline does reach the ground, the jet plume model is run in conjunction with the regular DEGADIS model as either a continuous or finite duration release.
- **Liquid Spill:** A liquid spill is the release of a chemical in its liquid state. The liquid is assumed to form a pool at ground level, with the evaporation rate calculated using one of three different evaporation models incorporated into DEGADIS. The results from the evaporation model are run in the DEGADIS model as either a continuous or finite duration release.

Typical Users

The typical BREEZE DEGADIS user includes:

- Plant managers
- Emergency planner and responders
- Process analyst
- PR staff
- Plant-level EH&S
- Students and researchers

Fire Models

- Confined Pool Fire was originally developed for the Gas Research Institute (GRI) and models a fire that occurs when liquid is ignited in a confined area such as a dike or a tank. The dike may be circular or rectangular. The model calculates the distance to various radiation levels specified by the user and also allows for the calculation of the dynamic temperature rise of a nearby target.
- Unconfined Pool Fire was originally developed for the GRI and models a fire that occurs when an unconfined spreading pool of liquefied fuel gas ignites. The model calculates the distance to various radiation levels specified by the user (e.g, the 5 kW/m2 level specified by the U.S. EPA in the 112(r) RMP regulations, or the radiant flux levels specified in the U.S. federal standard 49 CFR 193.2057 for LNG facilities) and calculates the radiation flux as a function of time at a given distance as the pool spreads.

- BLEVE was originally developed for the GRI and models a fire that may result from the leak or rupture of a pipeline containing a compressed or liquefied gas under pressure. The model calculates the distance to various radiation levels specified by the user and can calculate the dimensions of a high velocity jet flame ensuing from a ruptured pipeline.