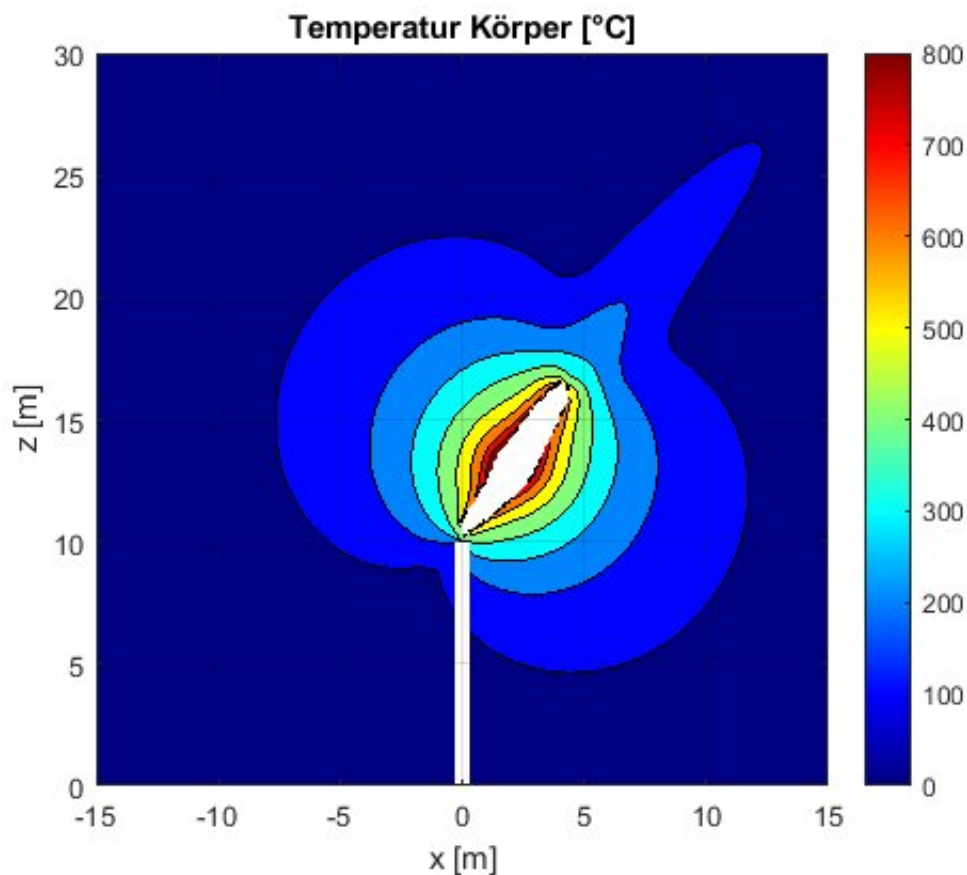# Tool helps prevent fires and explosions in natural gas lines

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Longitudinal temperature distribution. Credit: Fraunhofer-Gesellschaft

Lines in natural gas grids have to be maintained and serviced regularly. This entails using flares to vent the natural gas. With FlareSimulator, research scientists at the Fraunhofer Institute for Factory Operation and

Automation IFF have developed an assistive tool that calculates the correct distance of flares to houses, trees and other nearby objects. This makes it easy to maintain minimum distances and prevent potential hazards and explosions.

Natural gas is one of the safest energy carriers. Accidents rarely occur, ultimately because natural gas lines are serviced regularly. Whenever gas is pumped off and stored during maintenance, a residual amount always remains in the pipes and must be vented from the respective line segment. Since natural gas may not be discharged directly into the environment because it is harmful to the climate and explosive, natural gas flares are used to relieve pressure and vent the lines.

Such mobile flares are placed in both residential and open areas. The temperature spread of the natural gas flame on the flare tip with the spark ignition module is a function of the current thermal output and wind speed and can vary strongly. It is essential to maintain a sufficient and safe minimum distance to surrounding objects, such as trees, power lines, wind turbines and buildings. At the same time, excessive safe distances ought to be avoided.
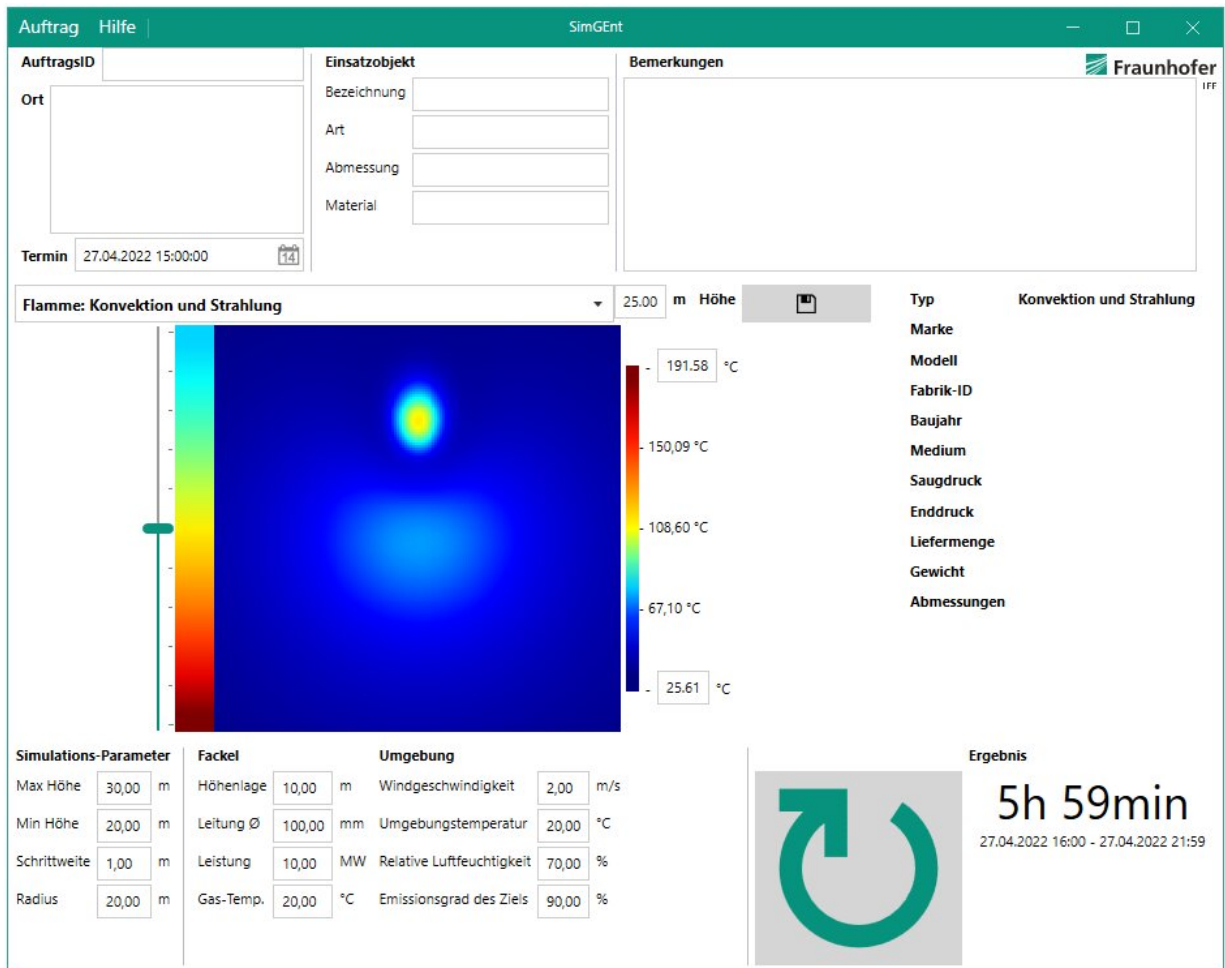
FlareSimulator combines the factors of thermal convection and radiation and accurately calculates the heating of an object. Credit: Fraunhofer-Gesellschaft

Software calculates optimal siting

A team of research scientists at Fraunhofer IFF in Magdeburg has developed an assistive tool with a graphical user interface and reporting functions, which helps users specify minimum distances. The software calculates a three-dimensional temperature profile of the flare flame based on specific input parameters, such as the gas heating value, volumetric flow, flare diameter and height, wind speed and ambient

temperature. The calculated results are plotted, giving the user a visualization of the expected flame geometry and its temperature distribution.

This makes flare siting easier: "The distance of the flare to surrounding objects may neither be too big nor too small. Our assistive tool enables optimal siting based on transparent criteria," says Marcus Kögler, research scientist at Fraunhofer IFF. "The temperature profile in open areas can be heavily distorted during extreme winds. Distance calculation with our software is particularly helpful in such scenarios."

Dr. Wolfram Heineken, Kögler's colleague at Fraunhofer IFF, adds, "There are three heat transfer mechanisms: thermal conduction, thermal convection, that is, the flow of gas over a body, and thermal radiation. FlareSimulator enables us to combine the factors of thermal convection and radiation relevant here and accurately calculate the heating of an object or body in space." Along with minimum distances, venting performance can also be configured with the software. It defines the length of time a flare must operate depending on its type. The tool calculates venting time automatically.

The current version of FlareSimulator meets natural gas industry standards and is already in use at an industrial company. The tool is versatile, though, and can be used anywhere fuel gases have to be vented from pipelines, for instance, in the chemical industry or at industrial facilities, such as oil refineries.

Provided by Fraunhofer-Gesellschaft