# Plumecast Overview

Introduction

Plumecast is a system to provide real time display of risk areas from airborne material in an accidental release. It shows emergency services, site operators and incident managers the area at risk from any releases into the atmosphere, and, equally important, the safe areas to help them implement appropriate emergency procedures.

Plumecast is a simple dispersion model using real time wind data. A PC displays the area at risk from an accidental release and makes this information available elsewhere. In an incident it can display the estimated present location of an airborne plume.
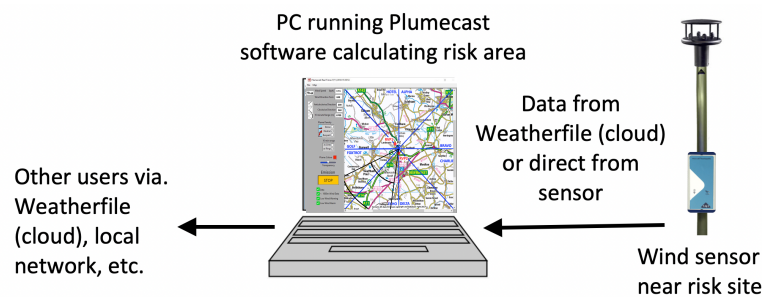

The use of ultrasonic anemometers allows turbulence to be measured rather than estimated making real time dispersion modelling much more accurate. Real-time measurements is the key feature of Plumecast giving it a unique ability to react to changing circumstances.

For risk assessment two lines are drawn from the potential pollution source over a map of the local area. These enclose an 'area at risk', the area over which airborne pollution might pass in the event of a release. These lines are updated continuously even when there is no current release so that in the event of an incident the area at risk is instantly available with no delay in starting dispersion models. This information can be used in advance of off-site agencies responding.

Risk area information is also generated in formats suitable for export to other systems, including widely used GIS systems.

Plumecast displays.

Plumecast gives real-time displays of both area at risk and the position of a plume if a release does occur. The area at risk is shown by lines, the area the plume has reached is plotted as it happens in real time. In addition 'range rings' are drawn to indicate how far the plume is likely to travel in a given period. The picture below shows a plot drawn using Plumecast.
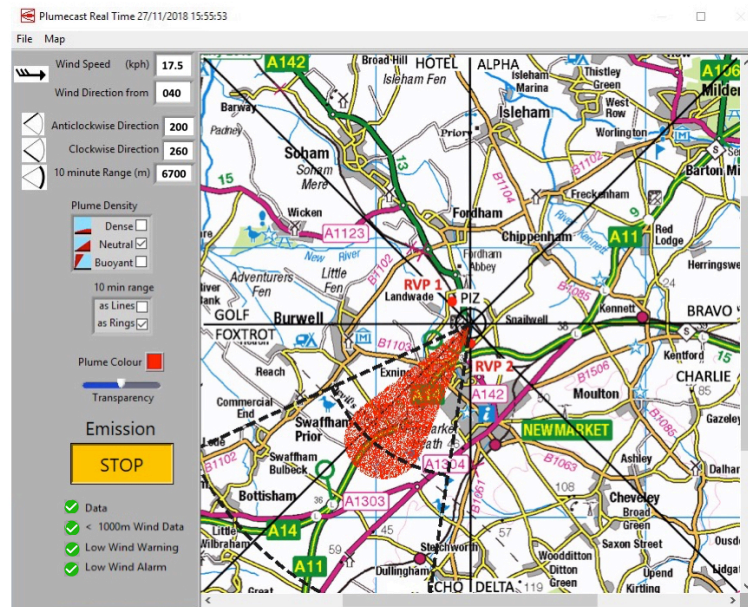
A large icon is used to start plotting of a real plume. It can also be used to stop the emission. Plumecast will continue to plot the spread of the material already released.

The display also shows various alarms. These include warnings of missing data and light winds. If winds are very light the display is 'frozen' and the light wind alarm icon is lit.

The display allows an operator to specify plume density. A site using chlorine for example would probably only use the 'dense' option but a severe fire at a chemical warehouse might need 'dense' 'neutral' and 'buoyant' set.

Current wind data is also displayed. This is based on a run of wind rather than an instant snapshot of varying wind speed and direction that could be very misleading.

Sensors

Plumecast uses real time data from fast response anemometers capable of taking wind measurements with a short averaging time. They allow Plumecast to directly measure turbulence that other systems estimate. This gives Plumecast its speed and superior accuracy.

This may be obtained from sensors connected directly or from stations attached to the Weatherfile network.

This data is also combined with knowledge of the source site location, date and time of day to make assessments of likely variations in wind through the depth of the atmospheric boundary layer.

Software features

The key feature of Plumecast software is that the use of real time data from the incident location allows it to react to changes in conditions during an incident. It also means that Plumecast can react to local winds such as sea breezes or katabatic flows, which can be missed if larger scale models, run remotely, are used to provide guidance.

Plumecast takes a 'fail-safe' approach. For example, the plume displayed during an incident includes not only the area where the plume is but also the area where it has been. This is because some pollutants can leave an area hazardous even when the plume has been moved away by a change in wind direction.

The area at risk can be limited to some extent if the user can specify whether the released material is denser than air, of neutral density or buoyant.

In addition to local displays Plumecast creates KML format files defining the area at risk allowing information to be shared with other emergency response and GIS systems.

These files are available from 'Weatherfile' cloud storage.

Plumecast does not provide guidance on concentration of material within the plume. This is not relevant to the application Plumecast is designed for. In fact, the amount or even type of material released is unlikely to be known until some time into the incident.

Factors considered by Plumecast

The position of the area at risk lines is determined by several factors including the current conditions measured by the sensors, both mean wind and turbulence characteristics, the change in wind direction likely over a given time and wind direction shear. Plumecast uses recent wind data up to the last 10km run of wind.

The area at risk is constantly re-calculated as conditions change. For example, statistically the change in mean wind direction that is likely in a given time depends on wind speed; in simple terms stronger winds are less likely to change than light winds. This allows Plumecast, using empirical rules, to constantly adjust the area of risk accordingly. In a similar way allowances for wind shear, both in speed and direction, are assessed using established relationships connecting it to latitude, surface roughness, time of day, wind speed and atmospheric stability.

Accuracy

Plumecast makes an allowance for the roughness of local terrain. However, like any flow prediction system, it should be used with caution if there are major variations in terrain over the area of concern. Buildings very large in relation to the wind sensor height can cause problems over short ranges. Slopes above about 1 in 10 can sometimes cause problems in light winds if they extend over distances above 500 metres or so.

Plumecast includes a factor allowing for the likelihood of wind direction changes (a function of wind speed) and the area at risk lines can be relied upon for periods up to 30 minutes. Note that the area at risk lines will be adjusted during this time.

For further information contact: -

Mike Brettle FRMetS CMet
Tel: +44 (0)7896 304584
E-mail: plumecast@brettleweather.com