Emergency Plume Risk Plotting with Plumecast & WindSonic

Around the world there are a large number of processes being carried out at manufacturing facilities or chemical plants etc. that can be harmful to the workers and the local population. Caution needs to be taken with these types of processes in not only avoiding spills in the first place but also in understanding where smoke or gases in the form of a “plume” may travel to if there is ever an issue at the plant i.e. a spill.

A large number of facilities simply look to local forecast sites, direction flags, windsocks or even the direction of smoke rising from other industrial plants to indicate wind flow when an issue arises. However, this is not always acceptable to the authorities who will have to provide emergency response if there is ever an issue and so Plumecast has been developed using its own unique dispersion models to assist individual facilities and authorities.

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What is Plumecast?

Plumecast provides a real time display of possible and actual dispersion of atmospheric pollutants in an accidental release. It shows emergency services, site operators and incident managers the area at risk from any toxic releases into the atmosphere to help them implement appropriate emergency procedures.

- Plumecast is a combination of a simple dispersion model and fast response anemometers. A PC monitor displays the area that would be at risk from an accidental release and in an emergency it displays the estimated present location of an airborne plume and areas at risk from its further spread. The use of real-time measurements taken at or near the source of the release is the key feature of Plumecast and gives it not just greater accuracy but a unique ability to react to changing circumstances.
- The system can be used for both emergency situations and continuous and operational risk assessment.
- 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 actual release so that in the event of an accident the area at risk is instantly available. Therefore there is no delay in starting dispersion models and this information is available and can be used in advance of off-site agencies responding.

How is Plumecast set-up?

Plumecast is a combination of software running a dispersion model on a PC and a wind sensor providing real-time wind data every second.

PC running Plumecast software displaying risk area in real time

Wind sensor on or near risk site

Data stream in NMEA 0183 format via. RS-232, RS-485 internet etc.

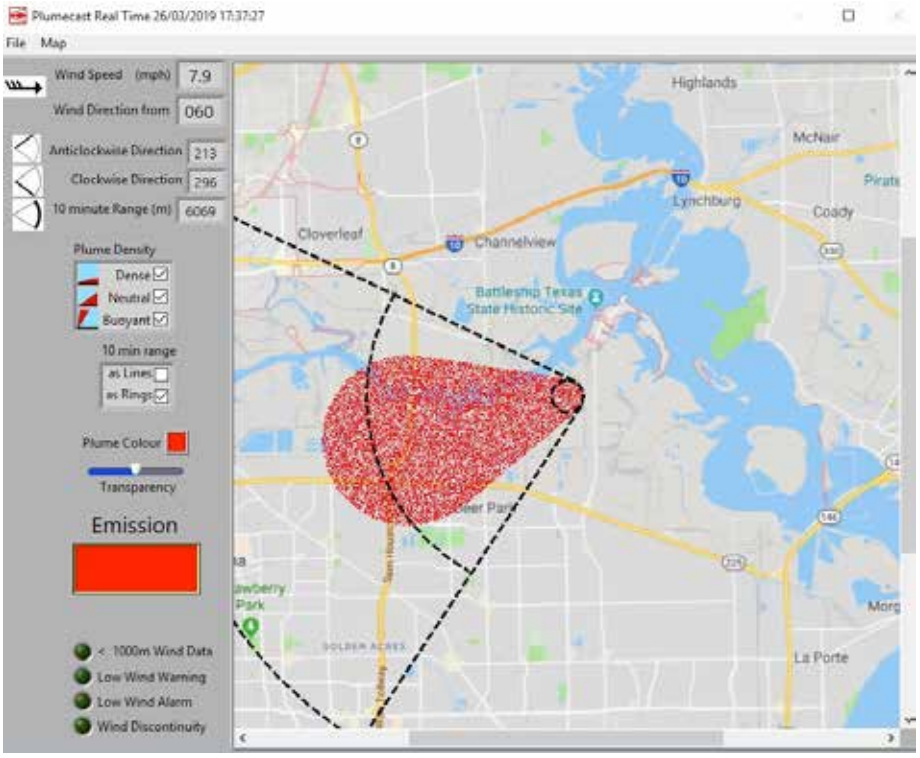
This data is also combined with knowledge of the source site location, date and time of day to make assessments of likely variations in wind through the depth of the atmospheric boundary layer.

User Software Display

Plumecast is intended to give real-time displays of both area at risk and, optionally, the position of a plume if a release does occur. The area at risk is shown by lines, the best estimate of the area the plume has reached is plotted as it happens in real time. To assist incident managers ‘range rings’ are drawn to indicate how far the plume is likely to travel in a ten minute period. The picture below shows a plot drawn using Plumecast.

As an option a large icon is used to start plotting of a real plume. It can also be used to stop the emission. In this case Plumecast will continue to plot the movement of the material already released.

The display also shows various alarms. These include warnings of missing data, light winds or ‘marked discontinuity’. A marked discontinuity alarm means that there has been a major and sustained change in wind direction or speed within the last 10km run of wind. In these conditions Plumecast only takes into account data back to this discontinuity. If winds are very light then 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 representative run of wind rather than an instant snapshot of varying wind speed and direction that could be very misleading.

User Software Features

The most important 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.

- As visualization is very important, the image below shows the dispersion model run on real wind data and after the 'plume' had traveled about 3 km the wind had veered clockwise. At this point the plotting color was also changed to show how Plumecast copes with this situation.

Pure red shows where the plume was but has now cleared

Arrows show original spread (red) and final spread (green)

Pure green shows where the plume is

- The development of 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 can be configured to give XML format output representing the area at risk. This allows information to be shared with other emergency response software and GIS systems.

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