Using CFD for Blast Wave Predictions

**Olav R. Hansen**, Derek Engel, Peter Hinze and Scott Davis
GexCon US, 3 Bethesda Metro Center suite 700, Bethesda, MD 20814
*Email: olav@gexcon.com*

**Abstract**

Explosions will, in most cases, generate blast waves. While simple models (e.g. Multi Energy Method) are useful for simple explosion geometries, most practical explosions are far from simple and require detailed analyses. For a reliable estimate of the blast from a gas explosion it is necessary to know the explosion strength. The source explosion may not be symmetric, the pressure waves will be reflected or deflected when hitting objects, or even worse, the blast waves may propagate inside buildings or tunnels with a very low rate of decay. The use of CFD (computational fluid dynamics) explosion models for near and far field blast wave predictions has many advantages. These include more precise estimates of the energy and resulting pressure of the blast wave, as well as the ability to evaluate non-symmetrical effects caused by realistic geometries, gas cloud variations and ignition locations. This is essential when evaluating the likelihood of a given leak source as cause of an explosion or equally when evaluating the potential risk associated with a given leak source for a consequence analysis.

In addition, unlike simple methods, CFD explosion models can also evaluate detailed dynamic effects in the near and far field, which include time dependent pressure loads as well as reflection and focusing of the blast waves. This is particularly valuable when assessing actual near-field blast damage during an explosion investigation or potential near-field damage during a risk analysis for a facility. One main challenge in applying CFD, however, is that these models require more information about the actual facility, including geometry details and process information. Collecting the necessary geometry and process data may be quite time consuming. This paper will show some blast prediction validation examples for the CFD model FLACS. It will also provide examples of how directional effects or interaction with objects can significantly influence the dynamics of the blast wave. Finally, the challenge of obtaining useful predictions with insufficient details regarding the geometry will also be addressed.