ABB discuss how to be an Intelligent Customer when outsourcing Consequence Modelling as part of COMAH Report development.

Blog by Robert McGregor

Confounded by Consequences?

In previous posts my colleagues Sarah Bickerstaffe and Stephen Beedle discussed how to define a Representative Set and develop scenarios for the purposes of a COMAH Safety Report submission and discussed the benefits of Consequence Likelihood Ranking (CLR). In this blog I am going to focus on the consequence part of the CLR and how we predict whether a scenario is likely to result in an injury or multiple fatalities.

Muddled by Models?

Consequence models can be complex and often seem impenetrable, but they really shouldn’t be seen as a black box and are very customisable. If you are using a consultancy to do your consequence modelling you may be wondering how to get the best out of your modelling. Here are my thoughts on how to be an intelligent customer...
In defining the scenario, you will have established the nature of the major accident hazard and its point of origin; this information allows us to select an appropriate modelling tool. Depending on the type of hazard to be modelled and the complexity of the area into which the release occurs, the modelling tool could be a spreadsheet based around a published methodology, dispersion modelling software, or full Computational Fluid Dynamics (CFD) analysis. But keep in mind that the level of effort spent on the scenario should be proportional to its severity.

The next step is to specify the model, this includes defining the source term for the release and providing the model with supplementary information known as base assumptions. The source term will require information relating to your process and you should consider how up to date this is. For example, can your process still reach the same maximum pressures and temperatures? Is the composition of the process fluid the same as when the plant first started? Have operating flowrates changed? As with most mathematical models, some assumptions are likely to be required to fully specify the problem. These assumptions can be critical to the output of the model and need to be fully justified and marry up with how the process is operated. For example, an isolation time may need to be defined and should be appropriate to the installed systems i.e. manual isolation (possibly requiring an operator to wear Breathing Apparatus (BA)) will have a longer isolation time than a Remote Operated Shut-Off Valve (ROSOV). The base assumptions are more general parameters that define the environment in which the hazard is occurring. Even so, some of these will be specific to the location of your plant; surface roughness for instance will depend on the nature of the land upwind from your process.

Requesting a summary of the base assumptions used in any modelling will give you confidence that the values used are appropriate to your process and consistent with any other modelling work that you may want to do in the future. Helpfully, the Competent Authority (CA) for COMAH publish Safety Report Assessment Guides (SRAGs) which provide more detailed guidance on specifying models helping you to ensure that you have used appropriate values.

**Perplexed by Predictions?**

Having completed our model how do we use the output to determine the ultimate consequence of our hazardous event? We do this using a number of fatalities calculation which takes the population density of your site, the footprint of the hazard and a vulnerability factor and converts this to a number of fatalities and major injuries which then relates to a consequence category on your site’s risk matrix. At this point it’s worth taking a step back and thinking about the results and the language that we use in describing them. Depending on the software package being used and the type of model being run, the uncertainty in the result of the model can be in the order of ±50 %, this is especially true of dispersion modelling which uses very complex mathematics. So, in practice we should think of the results as a prediction rather than a precise calculation, and we may want to do
some sensitivity analysis to test our earlier assumptions especially if we find that the final outcome is close to a consequence category boundary.

**In Summary**

Consequence Modelling is an important part of understanding your major accident hazards and is the critical step in defining their severity. However, it is worth remembering that consequence modelling has applications in other aspects of process safety such as Layer of Protection Analysis (LOPA), Occupied Buildings Risk Assessment (OBRA), and emissions permitting. The intelligent customer will be able to extract maximum value from any modelling and ensure that it provides the best representation of the hazards on their site.

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