ABSTRACT

Many facility Siting studies have been conducted applying a methodology based on a fixed and limited number of hazard event scenarios. Typically, minimal effort is expended to review the process and define the maximum credible event (MCE) scenario for those hazards with reasonable probability of occurrence. The consequences of these fixed and limited scenarios are then quantified to assess impacts to buildings intended for occupancy. Owners of these facilities are often left with trying to access just what risk they truly have and what can be done to mitigate the risk. The authors will present an engineering approach to completing a risk-based facility siting analysis that starts with identifying the MCE scenarios in terms of API 752, assessing severity and likelihood, and then identifying ways to minimize the risk associated with buildings intended for occupancy.

Identifying MCE scenarios start much like a process hazard analysis with identifying initiating causes applicable to the type of processing units at a facility. These causes must be quantifiable in terms of frequency rates. MCE scenarios can encompass a small leak with a high initiating cause frequency, or a large leak at a very low initiating cause frequency. The next step is to collect process conditions around the hazard scenario. This information is then used as input into an appropriately selected model to access the severity of the consequence. Available models include, but are not limited to, Dow F&EI and CEI, EPA’s Aloha, PHAST, TNT equivalences, BST, TNO, and CFD models such as FLACS. Once modeling results are validated, the impacts to buildings intended for occupancy are risk ranked in terms of severity. With reference to the product of the initiating cause frequency and the MCE scenario severity, the unmitigated risk can be documented.

With the unmitigated event likelihood defined, existing safeguards can be identified, i.e. independent protective layer (IPL) and associated probability of failure on demand (PFD), i.e. likelihood, used as a basis to determine if the current design meets the companies tolerable risk criteria. If a gap exists, then additional means of reducing the likelihood and/or reducing the severity will need to be identified by a competent hazard assessment team. Safeguards can be classified into; inherently safer design, pressure relief devices, safety instrumented functions (SIFs), consequence mitigation system (CMS), and administrative type controls, with preference based on this order respectively.

The authors will present examples to illustrate this process and how different models affect the results. Hazard scenarios to be presented include leaks from flammable and toxic storage and transfer systems, vessel ruptures, outdoor vapor cloud explosions, and indoor explosions. Through these examples, differences in hazard impact distances will be presented. Various likelihood references and resultant risk rankings will be shown. Based on these risk rankings and a tolerable risk criteria, proposed safeguards used to close a gap will be described. Presenting information in this manner will allow the plant management team to better allocate resources more effectively in implementing the preferred safeguards.