Understanding The Basics Of ‘Tolerable Risk’

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Abstract

All of us must have started preparing to wrap-up 2017 and most may have already made firm resolutions for 2018 in their own way.

As I prepare to close 2017, I would like to share one frequent observation while interacting with many customers in India. This provoked me to write this article that is related to the domestic industry’s struggle to understand the concept of risk that is acceptable to them. It was surprising to note that many professionals working in hazardous facilities still consider Process Safety and General Safety as ‘same’ and that is definitely a gross mistake.

In this article, we will emphasize on a must-know topic under the process safety basket i.e. Tolerable Risk. The article attempts to simplify the concept of tolerable risk and explains a typical tolerable risk matrix in a process safety study. Developing a tolerable risk matrix is a very exhaustive subject which is beyond the scope of this article.

An organization may engage the best consultant to carry out a process safety risk assessment study like HAZOP, LOPA, HAZID, etc… but a consultant cannot bring the risk of a facility to a tolerable level when that tolerable level is unknown. In simple terms, imagine the case that you go to the market to buy a cell phone and you don’t know your budget, the brand to buy and its specifications. Then the shopkeeper gains the free will to decide what is ‘acceptable’ to you that may actually be no where near your expectations.

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**Introduction**

Ask any Health Safety Environment (HSE) professional and their first response to a question related to acceptable risk would be, “We have targeted ‘Zero’ risk in our facility and we strive hard to achieve it”. We know that zero risk is impossible even in normal day-to-day life and that there are umpteen possibilities of the risk pointer deviating away from zero.

Tolerable Risk or Acceptable Risk is defined as: Level of risk which is accepted in a given context based on the current values of society (IEC 61511-1, 2016 Ed.)

**Risk** is calculated as: **Frequency of occurrence of harm x Severity (Consequences) of the harm.**

If we want zero risk that would mean either frequency or consequence has to be zero and we all know that it is not possible when working in any process industry. Risk can be brought to an acceptable level by reducing the frequency or mitigating the consequences.

Let’s look at figure 1 that helps simplify the concept further.

In figure 1, the EUC is the Equipment Under Control and E/E/PE is Electrical/Electronic/Programmable Electronic System [typically a Safety Instrumented System (SIS)].

The three distinct boxes represent separate layers of protection that need to be present/designed to prevent the EUC from experiencing the consequence of a hazard and to help bring the risk to a tolerable level. At the extreme right we have to define the ‘Tolerable Risk Target.’

The ‘Necessary Risk Reduction’ is the risk reduction to be achieved by the protection layers to ensure that the tolerable risk is not exceeded.

**Key concepts**

Tolerable risk value is used to determine if existing risks are tolerable by comparing them with estimated risks and then to look for risk gap and if that exists then using suitable risk reduction measures to bridge the gap.

The Tolerable Risk Matrix is the first and prime document that an end user (facility owner/corporate/organization) must have (thoroughly checked and calibrated) before any process safety assessment study is initiated. It would be a gross mistake to use a tolerable risk matrix of an oil and gas plant and apply it to a chemical manufacturing plant.

Identification of what level of risk is tolerable within an organization can be a challenging task. The basic philosophy of risk and the perception of risk by the technical authorities, management and decision makers should be very clear to arrive at the correct tolerable risk matrix.

It is vital to note that all organizations have moral, legal and financial responsibilities to limit the risks that their operations pose. The four common receptors of risk are: People, Environment, Assets (Financials/Business) and Reputation. As Low As Reasonably Practicable (ALARP) principle is a good basis for justifying a level of tolerable risk and it should be effectively employed.

- **Moral responsibilities:** Priority is to make the plant as safe as is reasonably possible. No personnel (employees or public) should be exposed to a risk greater than what is morally tolerable. Cost is secondary.
- **Legal responsibilities:** Comply with laws, regulations as it is specified (written). Cost is secondary.
- **Financial responsibilities:** Priority is to build the lowest cost plant. Cost dominates.

For an organization, especially with multiple operating sites, it would be prudent that all sites implement a risk matrix that meets or exceeds the requirements of the corporate risk matrix, local legislation and obligations. It shall be ensured that no operating site will reduce its current risk evaluation and control requirements when implementing the

![Figure 1: Risk Reduction Concept Understanding](Figure from IEC 61511)
Currently, the process industry is struggling with a contagious disease – Not following the correct safety practices and lack of process safety knowledge. Don’t spread this disease further, rather become a safety doctor and bring about a cultural change in the industry. The most essential document for an organization that is focused on implementing process safety is the ‘Tolerable Risk Matrix’ and it is vital that the entire team understands the concept of tolerable risk and are aware of their tolerable risk matrix. There will always be an element of confusion or dilemma in the minds of decision makers and safety experts that is related to safety and cost but organizations have to ensure that they meet all legal, moral and financial responsibilities and in true spirit.

Wish you all a very happy and safe new year 2018!

References
1. IEC-61511, Ed. 2016, Parts 1, 2, 3: Functional Safety - Safety Instrumented Systems for the process industry.
2. Safety Integrity Level Selection- Systematic Methods Including Layers of Protection Analysis - By Ed Marszal and Eric Scharpf.