

First Principles Engineering Risk

Jonathon Sarah (B.Eng. Mech)

As a professional engineer and project deliverer over the past 25 years I have received scopes of work from, but not limited to:

Engineering consultancies (Worley, Jacobs, Aurecon, Wood Group, Contex, Shedden Uhde), EPC Companies (China Tianchen Engineering Corporation), Blue chips (Shell, Caltex, AGL, OneSteel, Qenos, Alcoa, Energy Australia, Godfrey Hirst, Iluka), Government: Project Managers [Economists, arts graduates, social sciences graduates, renewables post graduates], Government Scientific Organizations (CSIRO), Managers that are chemical engineers (Bostik, BASF, Huntsman), Managers that are Electrical Engineers (Cryovac Sealed Air, Downer), Managers in the Rail Industry that were draftsman, replacing the mechanical engineers (IFE Tebel), the end customer being Siemens, Managers that are mechanical engineers and IT professionals and motor mechanics (GM Holden), Mechanical engineering managers that worked under managers that were chemical engineers (Huntsman), Farmer Based Biological Process Plant Specifiers (Pass Inc USA).

The scopes can be developed by consultants, commercial managers, billionaire Collins Street farmers, farmers, chemical engineers, arts graduates, instrumentation technicians, IT professionals, architects, consultants, electrical engineers, renewables post graduates and engineering graduates and draftsmen.

Most scopes have gone through some sort of engineering process that replicates an ISO like approach. At the engineering consultancies they have been squad checked and clash checked, and risk assessed during the design, if the design is for a chemical plant and the P&ID has been changed, then there has been a HAZOP and or a LOPA and they have gone through a management of change process. If OEM process plant is modified, then a FMECA is carried out and the management of change process has been followed. In the process industry there is also risk based integrity, as global data for like plant is used to manage risk. In the rail industry FEA, FMECA and RAMS (using military data) studies are performed, and production prototypes are produced where possible and cycled on test rigs, a process that was also now being replicated for chassis in the automotive industry from the 2000's. In the major projects construction industry qualitative and quantitative risk reviews are performed and if the risk profile is deemed high enough, a Monte Carlo Analysis. When construction takes place, we have the construction management plans, then the SWMS, toolbox meetings and work permitting. Project close out procedures mitigate risk by capturing the engineering compliance, fabrications compliance and construction compliance and risk assessments prior to starting up a new plant. Risk assessments of various levels are performed according to the levels of risk throughout industry. I am lucky to have delivered and or been closely involved with the management of most of these processes.

Everything above is not "first principles and engineering risk". First principles engineering risk is the engineering basis for the project scope and cost structure. It is the first step before all of the above begins. Have you started your journey with the correct information and engineering formulations. It is everything before there is a standard, a code or a regulation. It is the pure engineering. It is compliance with the highest laws we know, the laws of science (engineering). Only by complying with these laws can we deliver a construction cost estimate for a Go or No-Go. Sometimes this takes days, sometimes weeks, and sometimes months of work that are required to find the information and the formulations for a solid foundation in law and a preliminary cost structure. If we cannot find a solid foundation in scientific law (engineering), then there is no "project", we are then subject to science, to discovery.

In this presentation we will include examples of project scopes reviewed from first principles.