

# Some Thoughts on Nuclear Safety

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After half a century of nuclear power world acceptance is still problematic. While this is usually linked to Nuclear Safety and security concerns it is really an issue of perception. I do not mean to say that nuclear safety and security does not need continuous attention but one should not insist on raising the bar simply to gain acceptance. There are so many catastrophic events on record resulting in tremendous loss of life and money in aviation, chemical industry, dams, etc. In one single aviation incident in which two 747 jumbo jets collided around 700 lives were lost. The chemical industry incident in Bhopal is another fearful example. In spite of these recurring disasters there is no public outcry w.r.t. the chemical industry, air travel, etc. When you think about it there is only one reason. No one can imagine a life without a chemical industry or air travel. If anything is done to curtail such industries people understand that they would no longer be able to maintain the standard of living and quality of life as they know it. This is something they do not realize about nuclear power. The fact is that if all NPPs were to be shutdown the Western World will find out very quickly that NPPs are necessary and acceptance would follow. After all after Katrina and the resulting catastrophe was the city abandoned. I believe this is a serious challenge that has to be addressed. It would be worthwhile to conduct a research into advent of new technologies, public reaction and how it subsided. The Scientific American had published a paragraph from the time when electricity distribution with electric poles and cables was first introduced. Doomsday advocates painted horrendous scenarios. When we read that piece now it looks like some kind of a joke. How does this challenge relate to safety and security? When an issue like this is settled one consequence is freeing up of funds that could be better utilized.

As we all know the Fukushima event in Japan has had a tremendous impact on the nuclear industry. One thing we have learned is that nature can hurl untold forces at us. One can never guarantee a design that can claim to hold against all natural forces. Whatever we design for, nature can throw at us what we could not have imagined. The incident has shown that the world's capabilities to predict Tsunamis and their strength is not very reliable. In 1945 an earthquake of 8.3 on the Richter scale 150 km off the Makran coast hurled 45 foot waves on the coast. On the other hand a scales 9.0 earthquake 150 km off the coast of Japan hurled 30 ft. waves. The predicted Tsunami height at Fukushima was much less than 30 feet. Therefore, another challenge is to develop much more reliable Tsunami models. For coastal plants passive heat sinks that can withstand earthquakes and Tsunamis need to be designed. SAMGs also need to be reassessed given the Fukushima experience.

PSA and FSAR methodologies need to be revisited for external hazards given the Japanese event. The question is if we should be satisfied by analyzing the maximum credible external hazard or should we be looking at the "worst possible external hazard". Looking at the PSA one usually decides not to make modifications in design for events that are "very rare" having insignificant contribution to risk. How good is this concept for external hazards. These require a hard look. For NPPs where such external hazards are possible training has to be extended to handling such eventualities.

The ultimate defense is in low tech solutions as was observed in Fukushima. The possible low tech solutions need to be evaluated, trained for and their availability needs to be ensured. Alternate arrangements of

electrical power in case of SBO under circumstances where normal transport is unavailable need to be looked at.

Now moving away from Fukushima, events (other than external hazards) show that human performance needs to be enhanced as it factors-in significantly in almost all significant events. Ageing management must start early with very strong management and corporate commitments. Defense in depth is not only required viz a viz hardware it must also be practiced with respect to human performance defense. Self Assessment, OEF, Safety Performance Indicators and CAP programs play a strong role in this respect. A high performing NPP had to be shutdown due to complacency which significantly degraded performance. Complacency and less than required acceptance of defense in depth for human performance are true enemies.

The challenge for the utilities lie in corporate commitments, oversight and as importantly provision of resources under difficult circumstances. The challenge for the Regulator lies in making it worthwhile for the utility to comply with regulatory directives. For example there should be a transparent system that reduces regulatory oversight visibly for plants showing good safety performance. Risk informed decision making at the level of the regulator needs to be promoted with defined boundaries. Unless there is a break through in alternate energy sources nuclear power is a necessity. For us one big challenge is building the necessary infrastructure for sustaining a developing nuclear program.

I am sure we will stand steadfast in the face of these challenge.

**Inshallah.**