PSA versus RAM(S)
What can we learn from other Industries?

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Introduction

PSA in the nuclear industry started its success story in the early 1990s. RAM(S) in other industries came some years later, mainly in aviation and other areas with high requirements on availability, reliability and/or economic pressure. In the meanwhile, RAM(S) has spread over all branches of industry, the costs for the analyses are reduced due to standardized methods and tools and the results are important and used for all kinds of investment decisions. While PSA is strictly focused on safety applications, RAM(S) covers many more areas.

TUED SUED has performed and reviewed many PSAs and PSA applications within the nuclear industry. With these experiences we are now also very successful in other industries, performing RAM(S) and risk analyses. Since these applications cover a variety of questions and requirements, we have learned much that can be used in PSA applications within the nuclear industry.

Main Topic

The success story of PSA started with WASH-1400, the first comprehensive analyses that showed the risk of nuclear power plants in comparison with other industries. The only focus was risk and safety, as it did not consider questions such as those of reliability or economic questions, and this has not significantly changed. In the meanwhile, PSA is used all over the world with similar methods and applications, but still focused only on safety and safety applications. The main parts of PSA are fault tree and event tree analyses, data and common cause analyses, initiating and external events and evaluations to determine weak points in plant design.

In addition to these basic requirements of safety analyses, other industry branches have requirements of much higher complexity. The results of such analyses are used for

- investment decisions

- contractual questions of reliability and availability – and penalties

- development of cost effective maintenance concepts

- questions and decisions for retrofitting, life-time extension or shutdown

- assurance conditions and costs, and

- many other "financial" and "risk" questions

The methods and depth of the analyses vary from "simple" calculation sheets to system simulation with high-end-tools and a complex mathematical background. The development of tools and methods is still ongoing, with tools no longer only created for experts but also for "normal" engineers and users.

TUEV SUED has made RAM(S) and risk analyses in different industries, including:
- Semi conductor manufacturing
- Container Terminals
- Truck manufactories
- Gas and steam power plants
- Aviation industry
- Military mission concepts

The methods, tools, requirements and results were always different, but able to be used to support the decision making process.

TUEV SUED is now able to use its experience with RAM(S) and PSA for important topics such as the optimization of NPP operation, answering questions of life time extension, financial risks of new built, risks and risk mitigation for power upgrades and other questions that go beyond the traditional, yet of course important, assessment of safety of nuclear power plants. We still use fault tree and event tree analyses and all the "old" methods of PSA, but we have added new methods and applications based on these experiences.

In my paper I will show how our experiences with RAM(S) and risk analyses can be transferred to the nuclear industry, what we learned and now use in nuclear industry, and what boundary conditions and requirements have to be considered.