



**APPLIED ANALYSIS CORP.**

## NUCLEAR PLANT ENGINEERING DESIGN MENTORING

The US commercial nuclear plant fleet was designed between the 1960s and 1980s. The design engineers involved in these design activities with Architect / Engineering (AE) firms and utilities have either already retired or will retire within a few years. This means that the pool of commercial nuclear plant design engineers with actual plant design experience is very small and these individuals are about to become extinct!

Nuclear utilities are currently involved in major capital projects, such as extended power uprates (EPUs), which require a thorough understanding of the plant design basis in order to efficiently and safely prepare design modification analyses, mod packages, and license amendment submittals. Often, these utilities rely on AE's and NSSS vendors to perform most of the design engineering work associated with these large capital projects. These AEs and NSSS vendors, however, are competing for the same dwindling pool of design engineers and analysts to support their projects. Competition forces these AE/NSSS firms to keep training and mentoring of young engineers (if ANY) to a minimum to maintain their rates at a reasonable level and maximize profits. On the regulatory side, the NRC is now staffed with many young and inexperienced engineers with little or no design background and only Regulatory Guides and SRPs to go by. There are a lot of pitfalls in this working environment picture just described.

My name is Juan Cajigas. I have over 40 years' experience in the commercial nuclear power industry and, for the last 25 years, owned and operated Applied Analysis Corp. (AAC) an engineering design and analysis firm. Our staff is comprised of engineers whose engineering design and analysis experience was gained in the actual design and analysis of PWRs and BWRs in the 70s and 80s. Yes, you guessed it, we are old. Like most senior engineers in your staff we are in our 50s and some even in our 60s. AAC understands exactly how your plant was designed and the basis and methods used in your FSAR safety analyses. We did not learn this from books or looking at calculations prepared by others; we actually performed the original design and analysis of many PWRs and BWRs currently in operation. In the post-construction era, we have been busy supporting projects such as design modifications, design basis reconstitution, power uprates, and new generation reactor design to name a few. Our clients include utilities, AEs, and NSSS vendors.

AAC's core experience and expertise is in the nuclear, mechanical, thermal hydraulic and radiological engineering analysis of systems and components. We prepare numerous Chapter 15 related analyses using codes such as GOTHIC, RELAP5, PIPE-FLO, RADTRAD, MicroShield, MicroSkyshine, ORIGEN, GALE, PAVAN, ARCON96 and many old codes you may not recognize. Although I would like to elaborate on this core experience, I prefer to cut to the chase and quickly get to my point.

I truly believe that if you have an experienced design and analysis engineering staff (the level of expertise would vary depending on your company objectives) you could:

1. Avoid re-inventing the wheel and reduce engineering costs.

More and more we see plants attempting to engineer or re-engineer projects from scratch while the methods and tools for those tasks were developed long ago. As complicated as we think our plants are, we are just moving water, steam, and air around within piping and inside concrete and steel buildings. Even the principles of nuclear engineering were developed over 60 years ago. We went to the moon using computers with less technology than your cell phone. It is NOT that complicated, but unfortunately not all documented in one place. A good knowledge of your plant design and how it was developed can save you hundreds of thousands of dollars in re-engineering work.

2. Improve your consulting engineering management and negotiations; reduce consulting costs.

You probably research before you buy that new electronic gadget or car. Often, you know more than the salesman yourself. The same should go with your dealings regarding engineering consultants, mainly AE and NSSS vendors. Although budgets, priorities and organizational goals could prevent you from performing lots of engineering work in-house, knowledge is power and a good understanding of the engineering methods used by these organizations will improve your bargaining power and perhaps more importantly, insure that your review of their deliverables is thorough and able to discover obvious mistakes. Remember, the analysis or calculation you just received may have been performed by an engineer younger than anyone currently on staff and with far less knowledge of your plant. You can demand rework from your consultant but you are ultimately responsible for their deliverables as far as the NRC is concerned. Calculation mistakes, if and when discovered by the regulatory staff, can result in costly re-inspections and additional scrutiny. You cannot afford to have a "blind leading the blind" situation in this case.

### 3. Improve your regulatory communications; avoid costly regulatory exposure.

As indicated earlier, the current NRC staff is young. If your staff is equally young and inexperienced, you will be the ball player and the NRC the umpire; keep in mind, the umpire wins every time. On the other hand, if your staff is well versed in your plant's design basis and analysis methods, there is no need to agree to reduced design margins or additional modifications if you can properly defend your case. We have acted on a utilities' behalf in many of these cases with great success. The costs associated with additional modifications, increased inspections or frequency of inspections or perhaps future modifications or engineering costs due to lost design margins can amount to hundreds of thousands of dollars or even millions.

These are just a few of the advantages of having an experienced design engineering staff at your plant. Having established the fact that the pool of experienced design engineers is small and dwindling every day, it makes sense to train some of your staff to achieve this level of expertise, or near it. Unfortunately, our current nuclear plant fleet is made of many one-of-a-kind designs and the supporting documentation is often not readily available. In short, the answers are not always "somewhere in the book." Mentoring can be an excellent medium to transfer this knowledge to your young engineering staff. By working side by side with our experienced staff, your young engineers can be mentored in these key design engineering skills while at the same time completing design engineering projects that you would have otherwise contracted for. At AAC we have mentored engineers in both our core engineering analysis skills, thermal hydraulics and radiological engineering, while at the same time getting them started in their own plant projects.

Please take time to consider engineering mentoring as an alternative to the entire or part of your next design/analysis engineering project; or even to gain/establish this knowledge for improved decision making or future projects. Our core experience allows us to provide engineering mentoring in the areas of:

- Thermal Hydraulics
- Radiological Engineering
- Mechanical Engineering Analysis

In addition, our location near the home office of a former PWR/BWR design A/E provides a core of recently retired engineers in the following disciplines among many:

- Electrical Engineering
- I&C Engineering
- Mechanical Engineering
- Piping Engineering
- Structural Engineering

Mentoring sessions can be preferably conducted in our Reading, PA offices or in combined plant and AAC office locations.

Recent AAC mentoring projects include:

- Alternative Source Term (AST) Implementation using RADTRAD.
- Containment and Sub-compartment Pressure and Temperature analysis using GOTHIC.
- High Energy Line Break (HELB) Program Upgrade and associated EQ implications.
- Normal Operation Radioactive Release Calculations using GALE.
- Accident source term development using ORIGEN-ARP
- Control Room Toxic Chemical Assessments using HABIT

For more information on how design engineering mentoring can improve your bottom line please contact:

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