

Technical Excellence

Presented by

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Thank you for this opportunity to talk to you at the Nuclear Executive Leadership Training. The topic I want to address with you today is technical excellence. The Defense Nuclear Facilities Safety Board (Board) has for the past fifteen years worked with you to improve the Department of Energy's (DOE's) technical competence and it remains a concern today. In Board Recommendation 2004-1, *Oversight of Complex High Hazard Nuclear Operations*, we pointed out that DOE needed to achieve not only technical competence but the much higher goal of technical excellence. Given the complexity of DOE's defense nuclear enterprise, the technical competence of federal personnel needs to surpass that of the best contractor organizations, so that you are not unduly dependent on the contractor. You must have the ability to recognize weaknesses in contractor capabilities and have the ability to elicit or force actions to strengthen these weaknesses. This responsibility as a "demanding owner" calls for seeking a level of technical excellence that is well within your grasp and there is a model very close at hand for you to emulate . . . an organization that is also a part of DOE . . . the Naval Reactors program.

Admiral Rickover and his successors (Admirals McKee, DeMars, Bowman, and Donald) have been consistent and persistent in striving to achieve and maintain technical excellence at Naval Reactors. I would like to address four areas that I believe are key in the success of establishing this type of technical excellence: selection, interviewing, education and training, and qualification.

In the selection of high quality technical personnel, the key attributes you should look for are: intelligence, technical orientation, forcefulness, self-confidence, common sense, industriousness, analytical ability, intellectual curiosity, all of which are essential elements of professionalism, and a strong commitment to public service. These are the attributes that we at the Board look for in our technical staff. For example, the Board interviews and selects very bright engineering college graduates for our Professional Development Program. As one measure of intelligence, we look for young engineers with grade point averages of 3.5 or better (in fact, the average GPA for our interns is 3.9). We examine the engineering, science, and mathematics courses they have taken, how well they performed in these subjects, and then probe them on their understanding and retention of the material through an exercise on a few fundamental problems. This method also gives us an idea of their analytical capability. We also question them on their extracurricular activities to get a sense of their intellectual curiosity and their ability to be creative and flexible. Lastly, we discuss their views on service with the government. Studies have shown that the generation recently emerging from college has a strong propensity toward public service.

Another key area toward achieving technical excellence is picking and developing the right interviewers. Being an interviewer is a huge responsibility and plays a vital role in achieving technical excellence. An interviewer must be knowledgeable and technically savvy to be able to winnow out the best candidates for entry level engineers and other technical positions. Interviewers concentrate on demonstrated reasoning ability and look for the key attributes

previously discussed. An interviewer must also be able to conduct a rigorous qualification or oral board, and be capable of challenging a candidate intellectually through a series of cascading events with spontaneous, open-ended technical questions. Interviewing is a learned technique but it starts with a high level of technical expertise and a firm understanding of and commitment to the organization's mission and operation. Interviewing and being able to conduct oral boards should be further developed as a skill for middle and senior managers at DOE.

An intensive education and training program focused on nuclear and engineering fundamentals is the best investment DOE can make, but you have to do it right. At the start of the Naval Reactors program, Admiral Rickover understood that he could steal trained people from the laboratories but he chose instead to create more nuclear engineers through his own intensive training and education program in nuclear technology. By doing so, he created a national asset that benefitted the entire nuclear industry. It is my understanding that during the first 6 months at Naval Reactors, a new engineer receives on-the-job training with an assigned mentor, and also undergoes a 10-week course, complete with examinations, in areas of nuclear reactions and physics, reactor plant operations, reactor core materials, reactor core design and construction, electrical power systems and instrumentation, primary and secondary fluid systems, water chemistry, radiological controls, and reactor protection and safety. Then the new engineers are sent to the Bettis Reactor Engineering School for six months of intensive graduate-level training in nuclear engineering, mathematics, reactor dynamics, structural mechanics, radiological fundamentals and shielding design. Additionally, these engineers go on field assignments to an operating nuclear power plant and a shipyard to learn plant operations and maintenance practices firsthand.

The Board has taken a similar path in the training and education of our young engineers with our 3-year Professional Development Program. We bring them to Washington where they are paired up with a senior mentor, attend a series of technical lectures with homework. We require them to take one to two graduate level courses in a nuclear-related subject from a nearby college. Then we send them off to a top-notch graduate school for one year, typically MIT, UC Berkeley, or Princeton. There they pursue a Masters degree in an engineering field that has been previously approved by the Board. Upon completion of graduate school, we then send them for one year to a commercial nuclear engineering firm or national laboratory to work as an engineer working on challenging engineering projects related to their recently completed course of study. This is basically free labor for one year for the receiving firm or laboratory, but this is the investment the Board makes in developing our young engineers. It acts as an incentive for attracting young technical talent and it sustains the technical excellence of our staff. I ask, will the rejuvenation of the DOE Technical Leadership Development Program be as technically challenging and rewarding as the two programs I just discussed?

The pursuit of technical qualifications and engineering certifications is a continuation of the education and development program. It focuses on an operational understanding and practical application of a technical discipline. In the Nuclear Navy, an officer will undergo qualification of his watch station on a nuclear reactor plant. This qualification is obtained after a

series of knowledge and practical demonstrations observed by senior qualified operators. Final qualification occurs after successful completion of intensive written and oral examinations onboard ship. After a year or so of operating a nuclear power plant, the officer will commence an intensive study program in all aspects of nuclear engineering and reactor plant operations. This study program culminates in a trip for the officer to Naval Reactors Headquarters in Washington DC where the officer takes a grueling, closed book, six-hour written examination followed by three oral examinations by Naval Reactors staff engineers. Successful completion of this battery of exams grants the officer the title of a “Naval Nuclear Engineer Officer.” Prospective commanding officers (PCOs) of nuclear-powered ships are required to attend a three-month course of instruction at Naval Reactors Headquarters taught by senior Naval Reactors staff engineers. PCOs also take extensive written and oral examinations that are more comprehensive than the Engineer Officer examinations.

DOE’s Technical Qualification Program is a step in the right direction. In particular, the qualification process used to support the Facility Representatives Program draws a close parallel with the nuclear watch station qualifications onboard ship. However, the Senior Technical Safety Manager qualification does not, in my view, come close to the level and rigor of study and examination that officers undergo for the Naval Nuclear Engineer Officer qualification. I ask, what technical qualifications or training does a Site Manager undergo before he or she assumes the job? This course is another step in the right direction, but is it enough and how does it compare to the investment that the Navy makes in their prospective commanding officers?

In summary, technical excellence comes from seeking, demanding, and achieving high standards of technical competence from entry level personnel to senior managers. Technical excellence begins with a highly competitive selection process of top notch engineering and science graduates, and continues with an intensive technical education and training regiment in nuclear disciplines. This is coupled with rigorous qualification and challenging assignments to reinforce and build upon sound engineering concepts and practices. Striving for technical excellence doesn’t stop at the entry level...it must persist at each level through the attainment of technical qualifications, advanced technical degrees, engineering certifications, involvement in national technical standards development, active participation in engineering professional societies, and other such activities. You will know when DOE has arrived when you have achieved a vision set forth by then Secretary of Energy, Admiral Jim Watkins, in a 1990 Secretary of Energy Notice (SEN-20-90), that reads:

“We will have ‘arrived’ at my objectives in this area [interaction with oversight organizations] when all departmental elements welcome with open arms any authorized outside visitors and dare them to find something out of line...”

If this objective is reached through your achievement of technical excellence, then maybe the DNFSB can close its doors and celebrate your success.

Thank you.