

What's A Safety Culture?

How Do I Get It?

How Do I Keep It?

Nuclear Nonoperating Owner's Group

Boston, Massachusetts

September 28, 1989

Andrew C. Kadak

Yankee Atomic Electric Company

What's A Safety Culture?

How Do I Get It?

How Do I Keep It?

As non-operating owners of nuclear power plants, you are in a rather unique position. You may have hundreds of millions of dollars invested in these plants with little or no control as to how that investment is protected and the plant run. As investors, your position is not unlike investors in any company. You must to a large extent trust the management to protect your interest. In fact, that is what they are paid to do. However, as joint owners of a nuclear power plant, you can't simply sell your stock and walk away if problems develop. The liability associated with your investment is unique. The scrutiny with which the regulator and the public monitor a nuclear plant's performance is not like that of Proctor and Gamble. It is a highly visible, often emotional, oversight that can have significant consequences to you as a joint owner.

Although you are not part of the day-to-day operation of a nuclear plant, you are affected by the success or failure of the operating organization. How do you know that the plants you own are well managed? How do you know that your investment is protected? You can check performance records -- capacity factors, forced outage rates, cost of power, Institute of Nuclear Power Operations evaluation reports, NRC Systematic Assessment of Licensee Performance (SALP) reports. You can even read the newspaper. All these can give you is an indirect measure of the most important parameter of all -- safety culture.

Safety culture is a vital ingredient of successful nuclear operations and, as such, is essential to the protection of your investment. If you've got it, you know it. If you don't, everyone knows it. If you have it, you can trust people to do the right things -- operate conservatively, make the right technical decisions, perform preventative maintenance, make design and operational improvements not because someone told you to but because you thought it was the right thing to do.

You, as nonoperating owners, need to know that the management team and the staff operating and supporting the plant have the proper attitude to run the plant safely. Putting it another way, you need to trust the people to do the right thing.

I've told you some reasons why a safety culture is important but I still have not defined it. Just exactly what is it? You can't touch it, smell it or taste it. You can, however, feel it. The dictionary defines culture as:

“The totality of socially transmitted behavior patterns, arts, beliefs, institutions and all other products of human work and thought characteristic of a community or population.”

At last April's Regulatory Information Conference, Dr. Thomas Murley, Director of the Office of Nuclear Reactor Regulation, attempted to define a safety culture by describing four basic attributes:

1. A prevailing state of mind.

He described this as always looking to improve safety with a constant awareness of what can go wrong. This state of mind is associated with a strong feeling of personal accountability for safe operation which develops a sense of pride and ownership in the plant.

2. A disciplined and crisp approach to operation.

Examples of this attribute included a confident, highly trained staff that is not complacent. They follow procedures, exhibit good teamwork and crisp communications.

3. Insistence on sound technical basis for actions.

Procedures, the design basis, and technical documentation should be up-to-date. The plant should be operated within its well-understood design basis.

4. Rigorous self-assessment.

The organization should be open to problem finding and facing. They should be capable of dealing with bad news as well as good news. Problems should be dealt with immediately and not put off.

He also cited examples of two different cultures.

Culture A representing Plant A which has a well-trained staff that rigorously follows procedures, working very little overtime. Unplanned shutdowns are extremely rare although the plant is shutdown to fix safety systems even though, according to technical specifications, you could continue running. A professional decorum exists in the control room. The plant is clean with a low maintenance backlog.

Culture B from Plant B has a slightly different culture. The staff is poorly trained and doesn't use procedures. Many management and staff vacancies exist resulting in routine use of overtime. Dr. Murley mentions a "fossil" culture which is not defined but one can assume that it does not require the kind of adherence to levels of quality control and procedure that a nuclear plant does. Other examples include frequent scrams, equipment allowed to run until it breaks and a high maintenance backlog. The plant routinely runs under Limiting Conditions for Operation, equipment is out of service for a long time, and the plant contains

many high radiation areas.

The contrast is quite apparent. By now you should have at least a sense of what a safety culture is versus what it isn't.. Dr. Murley's slides are found at the end of my paper.

Let me share with you some of Yankee's experiences which hopefully will illustrate whether we have culture A or B. On a recent tour of the Yankee plant, NRC Commissioner Rogers, as have many others, noted that none of our annunciator lights were lit. An annunciator light provides an early indication of some sort of problem with key plant equipment. We are told that operating a plant with a "black" board is rather rare. Why is the Yankee board free of alarms? Is it because we don't have any problems? No. Or is it because we take care of them right away? Our culture does not accept operation with alarms engaged.

The Yankee plant is over 29 years old. Much of the plant has new components since the plant has been kept current technically. Our electronics in the control room have been largely replaced with state of the art equipment which only the newest plants have. The Yankee plant was the first plant in the United States to have Safety Parameter Display System actually operating in the control room. Yankee has applied Probabilistic Risk Analysis to its training and design functions. It has become one of the tools the engineers use to support safe operation.

A recent example of the kind of culture Yankee has is illustrated by the following example. I receive weekly updates of major issues affecting the all the Yankee plants that we support. One item on Vermont Yankee caught my eye. It was related to a one hour notification that Vermont Yankee made to the NRC as a result of the identification of a reactor building closed cooling water valve not powered by a safety related power source as required by original design. I asked how, after 17 years, was such an error discovered. As it turns out, our engineers, after reviewing a copy of the Safety System Functional Inspection report for the Monticello plant in Minnesota in which a problem with this system was identified, decided to see if Vermont Yankee might have a similar problem. As a result of this review, they discovered this original error as well as other smaller problems. This action on our engineer's part was not prompted by an NRC bulletin or information notice, it was just a good safety culture at work.

I could go on about Yankee, but that's not the point. The point is there are different cultures and if you don't have a safety culture, how do you get it, and if you've got it, how do you keep it?

How Do You Get It?

A safety culture is developed over time. It cannot be instituted, regulated, mandated, or delegated. It begins with a keen awareness of the importance of each and every job; of the responsibility that each of us possesses in carrying out our jobs; an awareness of the dependency that each of us have on each other and finally, respect for the very important role

we play in providing a vital product -- electricity. We need to appreciate that we are in a direct way responsible for the well being of the people who work at the plant and the public. If everyone working in the nuclear business had that attitude, there would be no question as to whether a safety culture exists.

Much of what I have described is a work ethic. Some people have it, some don't. We need to hire people that have it because it's very difficult to develop. Even for those who have the proper ethic, you need to reinforce it by keeping people aware of the responsibility that is uniquely theirs.

Clearly, top management of the organization must set the tone and example. But, top management tone setting is not enough. Top management must be involved. Hands-on knowledgeable Chief Executive or Operating officers are essential to safety culture. Interest in and awareness of day-to-day operating problems and issues is very important. Safety cannot be delegated. If you delegate safety, you are not responsible for it.

If the CEO is involved, you can bet the managers are even more technically involved. You don't want to be a manager and be in a meeting where the CEO knows more about what's going on than you do. Attention to detail is vital for a safety culture. Managers, operators and other staff who know the expectations of a CEO will attempt to meet those expectations. Each person working at or in support of the plant must believe in and respect the management team to be successful in establishing a safety culture.

You will note that I felt that the Chief Executive or Operating Officer involvement was essential in the development of a safety culture. Not all companies have such involvement and yet are still able to sustain a safety culture. Others, however, are not so fortunate. If one were to analyze the complex operations of utilities today, one would see companies that are diversified generators of cash with the production of electricity as the fuel for the cash product. A utility executive's life is a complex mix of problems only one of which is the operation of a nuclear plant or plants.

Historically, presidents of utility companies used to be the people who understood how power plants worked - they were engineers. Next came the lawyers as our society and the utility business became more litigious. Now we are entering an era of financial managers whose strengths are in mergers and acquisitions and not safety cultures. In a perfect world these managers can do the job, but the world is not perfect and technical leadership in establishing a safety culture is essential.

The design, construction and most importantly operation of nuclear plants is quite different from coal, oil or hydro power operation. The standards are different and demand a radically different culture. Safe and economic operation of nuclear power plants requires total dedication by staff and all levels of management from the line supervisor to the chief executive officer. The focus of the organization should not be distracted by transmission and distribution problems, customer service departments, billings to residential consumers, handling customer complaints, restoration of power after storms, etc. The entire focus of the

organization should be the production of electricity reliably, safely and economically.

It is interesting to note that the, Yankee Atomic Electric Company was organized in 1954 by 10 utilities in New England to design, build and operate the Yankee plant. These utility companies had no intention of running the plant but signed a power contract to purchase the power from the facility. They purposely kept the Yankee organization strictly focused on nuclear power plant design, construction and operation. This same principle was used to build Connecticut Yankee, Vermont Yankee and Maine Yankee. Even to this day, Yankee's only business is operating the Yankee Rowe plant and supporting the operation of other nuclear plants in New England. The operating record of the Yankee plants demonstrates the soundness of the original decision made 35 years ago.

Thus, although Yankee is considered a utility -- it really is a specialized generating company whose only business is nuclear operation and support.

Why has the Yankee organization worked so well? There are several reasons. First, with the focus strictly on nuclear, a dedicated, talented nuclear organization can be established along with a culture that demands attention to detail and safety. Both are crucial to reliable and economic operation. Alvin Weinberg, an early nuclear pioneer, used the words, "nuclear priesthood" to describe the kind of skill and dedication required to manage nuclear technology. We, at Yankee, do not consider ourselves "ordained" but our commitment is certainly total.

Second, because of this commitment, Yankee has invested in developing in-house skills and talents thereby not relying on outside contractors for our engineering, licensing and operational support. We developed our own expertise with sophisticated accident analyses tools, probabilistic safety analyses, environmental science and laboratory capabilities just to name a few. To this day, Yankee is the only "utility" that has NRC licensed Loss of Coolant Analysis methods. When something needs to be done or NRC issues new directives, we need only look to our internal staff to resolve or address the issue. This intimate knowledge of the plant yields reliable, safe and economic performance.

Finally, top management focus is essential to strong nuclear operations -- a point that cannot be over emphasized. For instance, as President of Yankee, my priorities are clear and narrowly focused on nuclear electricity production. I do not have to worry about future electricity demand projections, implementation of conservation and load management programs or where the next unit of capacity is going to come from.

Developing a safety culture is an extremely difficult task. A focused CEO is only one important step. It's quite clear that developing a safety culture is an all-consuming task which has more to do with people than things.

How to Keep a Safety Culture

Once obtained how does one maintain a safety culture. How does one avoid going from one of the best plants list to the NRC's watch list in less than 18 months as recently

occurred at Calvert Cliffs. Avoiding complacency is an obvious first answer but there is more.

A safety culture is fragile. It is a harmonious, yet delicate balance of people, problems and pressures. One way to maintain that balance is to assure that strong internal communications foster resolution of problems and not the firing squad. Maintenance of trust in and for the organization is essential to maintaining the value system we call a safety culture.

Trust in competent people is the key. Much of the development of nuclear power technology has focused on hardware. In the early days of the Atomic Energy Commission people were never much of a factor in the safety equation. We designed systems to handle plant failures. After TMI, NRC began to focus on utility management as the root cause of nuclear power's problems. They proposed engineering solutions to management problems, checklists for effective management. NRC somewhat slowly reached the conclusion that you can't really regulate management or even real safety.

Former NRC Chairman Palladino opined that the regulatory system must motivate people to do the right thing. They found out that a safety culture is based on an individual accepting responsibility for what he or she does. If you regulate it away by prescriptive actions -- such as "you will do it this way" -- not necessarily the right way -- you've taken responsibility away from the individual and placed it on the regulation. As a matter of fact, after TMI the Kemeny Commission was appointed to review the Three Mile Island Accident and among their many valuable findings and recommendations was:

"Once regulations become so voluminous and complex as those regulations now in place, they can serve as a negative factor in safety"

They went on to say that human beings who manage and operate the plants constitute an important safety system.

Where does all this lead in the maintenance of a safety culture? The answer is simple. The foundation upon which to build a safety culture is the ability to have a person accept responsibility and be accountable for his or her actions whether it is the CEO or plant grounds keeper. Anything, whether it be a well-intentioned regulation, independent audit committee, NRC inspector or company management action that takes away from the individual the opportunity to think and act and be responsible for his actions is destructive to the maintenance of a safety culture.

As the nuclear industry matures and moves away from hardware solutions to people problems, more focus should be given both by the NRC, operators and non-operator owners of nuclear plants to the organizational behavior issues associated with their actions as it relates to maintaining a safety culture. NRC, as it begins to regulate management issues, is treading on delicate turf. The Advisory Committee on Reactor Safeguards has already pointed this out to the Commission on the issue of the maintenance rule. Audit after audit,

some by the NRC, some by INPO, some by Insurance companies, some by public utility commissions, some by state nuclear agencies, some even by the owners of the plants, after awhile begin to shake the foundation for responsibility and trust not to mention enormous amount of time taken away from the primary responsibility of safe and reliable operation.

Lest I leave you with the notion that all I want you to do is trust me, I do believe regulation and monitoring of performance is essential. My question is when is the amount of oversight too much to the point where it takes away initiative, responsibility and accountability. Milt Levenson, at the time President of the American Nuclear Society, said, "If there is anything we do not need is another level of audit. What we need is to make people feel responsible." If eight to ten people review and approve, no one is responsible. I once again refer to Chairman Palladino's suggestion: We need to motivate safety.

People should be encouraged to think, question and understand what they are doing and why. Each person should understand the importance of their job in the overall success of the plant's operation. They have to believe in the plant, share in the pride of its accomplishment. Supervisors, managers and executives should be trained not only in technical disciplines but also in people issues fostering the kind of thinking and communication that enhances a value system that is supportive of responsibility and individual commitment.

In summary, a safety culture is difficult to define, yet easy to see. It's a combination of knowing what to do as well as when to do it. Developing a safety culture is more than slogans and fresh paint, it gets to the personal motivation of each person working at and for the plant. It's pervasive in the organization. It doesn't go from top down or bottom up. It's everywhere because people have a common set of values. It's commitment. It's also fragile. It assumes responsibility and demands trust. If they're not there, the culture which calls for accountability is threatened.

Everyone has a role to play in developing and maintaining a safety culture -- the regulator, the staff, the management and the owners of the plants. The key is trust and motivation. We, at Yankee, are fortunate—the safety culture is there. The challenge is to keep it.

Thank you.

WHAT IS A SAFETY CULTURE?

A PREVAILING STATE OF MIND

- ALWAYS LOOKING FOR WAYS TO IMPROVE SAFETY
- CONSTANT AWARENESS OF WHAT CAN GO WRONG
- A FEELING OF PERSONAL ACCOUNTABILITY FOR SAFE OPERATION
- A FEELING OF PRIDE AND “OWNERSHIP” IN THE PLANT

A DISCIPLINED, CRISP APPROACH TO OPERATIONS

- HIGHLY TRAINED STAFF
- CONFIDENT BUT NOT COMPLACENT
- FOLLOW PROCEDURES
- GOOD TEAMWORK AND CRISP COMMUNICATIONS AMONG STAFF

INSISTENCE ON SOUND TECHNICAL BASIS FOR ACTIONS

- PROCEDURES UP-TO-DATE
- DESIGN BASIS UP-TO-DATE
- TECHNICAL DOCUMENTATION FOR PLANT CHANGES
- ALWAYS STAYING WITHIN THE DESIGN BASIS OF THE PLANT

RIGOROUS SELF-ASSESSMENT

- OPENNESS TO PROBLEMS
- FACING FACTS; BAD NEWS
- DEALING WITH PROBLEMS IMMEDIATELY

T. Murley

EXAMPLES OF TWO DIFFERENT CULTURES

PLANT A

- WELL-TRAINED STAFF
- PLANT-SPECIFIC SIMULATOR
- STAFF RIGOROUSLY FOLLOWS PROCEDURES
- FULLY STAFFED

- VERY LITTLE OVERTIME
- GOOD NUCLEAR WORK ETHIC
- PROFESSIONAL DECORUM IN CONTROL ROOM
- SCRAMS EXTREMELY RARE
- DILIGENT, PROBING PORC
- GOOD PREVENTIVE MAINTENANCE
- SHUT DOWN TO FIX SAFETY SYSTEMS
- LOW MAINTENANCE BACKLOG
- EQUIPMENT REPAIRED IMMEDIATELY

- CLEAN PLANT
- SYSTEMS ENGINEERING ONSITE

PLANT B

- POORLY TRAINED STAFF
- NO PLANT-SPECIFIC SIMULATOR
- STAFF DOESN'T USE PROCEDURES

- MANY MANAGEMENT AND STAFF VACANCIES
- ROUTINE USE OF HIGH OVERTIME
- FOSSIL PLANT CULTURE
- NOISY, UNDISCIPLINED CONTROL ROOM
- FREQUENT SCRAMS
- INEFFECTIVE, PRO FORMA PORC
- RUN EQUIPMENT UNTIL IT BREAKS
- ROUTINELY OPEATE IN LCO ACTION STATEMENTS
- HIGH MAINTENANCE BACKLOG
- EQUIPMENT OUT OF SERVICE FOR LONG PERIODS
- MANY HIGH RADIATION AREAS
- NO ENGINEERING SITE PRESENCE

T. Murley

MIT OpenCourseWare
<http://ocw.mit.edu>

22.091 / 22.903 Nuclear Reactor Safety
Spring 2008

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.