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## General Comment

See "David Collins NRC Culture Policy Comments" and associated attached documents

## Attachments

- NRC-2009-0485-DRAFT-0011.1:** Comment on FR Doc # E9-26816
- NRC-2009-0485-DRAFT-0011.2:** Comment on FR Doc # E9-26816
- NRC-2009-0485-DRAFT-0011.3:** Comment on FR Doc # E9-26816
- NRC-2009-0485-DRAFT-0011.4:** Comment on FR Doc # E9-26816
- NRC-2009-0485-DRAFT-0011.5:** Comment on FR Doc # E9-26816
- NRC-2009-0485-DRAFT-0011.6:** Comment on FR Doc # E9-26816
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- NRC-2009-0485-DRAFT-0011.9:** Comment on FR Doc # E9-26816
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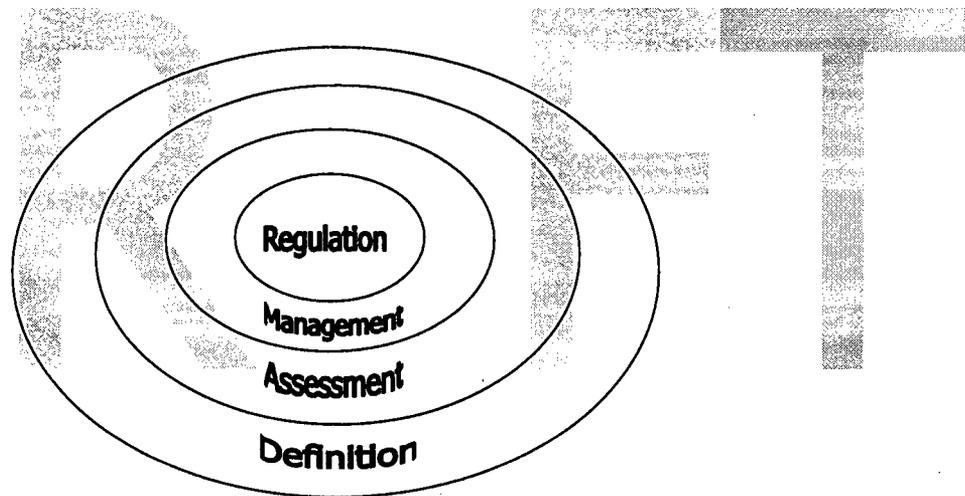
**NRC-2009-0485-DRAFT-0011.11:** Comment on FR Doc # E9-26816

# [DRAFT] A New Definition For HRO Safety Culture

## Abstract

A clear and accurate definition of safety culture is needed so that accurate assessments of HRO safety culture can become possible. Accurate assessments (assessments of the culture, or "the way we do things around here") are important so that those culture characteristics / traits that experts indicate if not properly maintained correlate to increased operating risk (sometimes called 'culture focus areas') can be identified and analyzed by operating companies (and if necessary regulators) and corrected before a significant safety event occurs.

When comparing different safety culture definitions (when comparing "apples and oranges") it may be useful to keep in mind that developing a definition is not an "end" in itself, but a means to an end. The "end" (the goal) is to keep safety culture controlled (regulated either internally by the operating company, or if necessary by an external regulator) at a sufficiently healthy level of performance such that operating risk is maintained at an acceptably low level. Therefore, it may be useful to view the definition of safety culture more as the first layer of an "onion".



## Discussion

### HROs

High Reliability Organizations (HROs) are those organizations that operate and manage processes with potential to adversely affect human life or the environment. A Wikipedia search "High Reliability Organizations" identified the following case studies (I added the associated HROs in parentheses):

- Cuban Missile Crisis, Black Hawk friendly fire incident in Iraq (DOD)
- Three Mile Island nuclear incident (Nuclear Power Industry)
- Challenger & Columbia explosions (NASA)
- Bhopal chemical leak (Chemical Industry / CSB)
- Tenerife air crash (Airline Industry / NTSB)
- Mann Gulch forest fire (Firefighting Industry)

There are many other HROs not listed, such as the Mining Industry, Medical Industry, and other transportation industries (passenger trains, cruise ships etc.).

## **INSAG And The Origin Of The Term "Safety Culture"**

INSAG is the International Safety Advisory Group of the IAEA International Atomic Energy Agency. The ACRS Advisory Committee for Reactor Safeguards performs a similar function for the NRC.

The term 'safety culture' was first used in INSAG's (1988) 'Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident' where safety culture was described as:

"That assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance."

In a speech at the 2002 INPO CEO Conference, NRC Chair Dr. Richard Meserve indicated that the lack of a clear definition is what is keeping the NRC (and others) from doing unambiguous assessments:

"Let me start the examination of this question by exploring the reasons for the Commission's past decision to forego the direct regulation of safety culture. This reluctance stems from actions arising before my arrival at the Commission, but seems to derive from several related considerations.

First, there is the concern that any attempt to regulate and evaluate safety culture is necessarily very subjective. The concept of safety culture has core ingredients on which perhaps all can agree, but the precise limits of this somewhat amorphous concept are hard to discern. *Moreover, given that the concept is not crisply defined, it is not surprising that neither the NRC nor other organizations have found an unambiguous way to measure it.*"

Meserve's observation is derived from the generic Six-Sigma quality management formula DMAIC:

- Define* high-level goals and the current process.
- Measure* key aspects of the current process and collect relevant data.
- Assess* the data to verify cause-and-effect relationships.
- Improve* or optimize the process based upon data
- Control* to ensure that any deviations from target are corrected

The same formula can be applied to the quality management of anything, including the (assessment, management, regulation) of safety culture.

For HRO safety culture quality management, the *improve* function is accomplished by managing safety culture (is accomplished by the actions of the *site leadership team*) the *control* function is accomplished by regulation (by the quality standards developed and monitored by the *oversight group*). in the nuclear power industry the oversight group could be either the site Oversight Department, or INPO or the NRC. In other HROs, the *oversight group* function might be performed by (for example) a transportation / chemical / medical review board.

Here is the formula with functional step descriptions for HRO safety culture quality control:

*Define* high-level goals and the current process.  
*Measure* key aspects of the current process and collect relevant data.  
*Assess* the data to identify culture focus areas.  
*Improve* optimize (manage) the culture focus area (through leadership actions)  
*Control* (regulate) to ensure that any safety significant deviations are corrected

I prefer to customize the formula for HRO safety culture quality control, as I feel it makes the steps clearer and more understandable (DMAMR):

*Define* high-level goals and the current process.  
*Measure* key aspects of the current process and collect relevant data.  
*Assess* the data to identify culture focus areas.  
*Manage* the culture focus area (through leadership actions)  
*Regulate* to ensure that any safety significant deviations are corrected

### **About Using the Six Sigma Process for Safety Culture Quality Management**

Six Sigma has for many years been used for safety management<sup>11</sup>. I have been suggesting since 1999 (in various forums within the nuclear industry) that a new definition for safety culture be developed and that Six Sigma be implemented (see my 2003 presentation to ACRS) here is a little history:

After chairman Meserve identified the definition constraint in his 2002 speech, I was confident the NRC would immediately begin to develop a new definition. A few years later, when it became clear this was not happening, I emailed the then NRC chairman and also the then ACRS chairman, imploring them to have NRC develop a new definition, pointing out Meserve's comment that this is required for NRC and others to do proper assessments, pointing out that in multiple reports GAO has asked for NRC to improve its assessment abilities. The email reply I received from the ACRS chairman was: "the NRC already has a definition, the INSAG definition".

These kind of "level of consciousness" changes take time. Even now, many at NRC feel the only definition change needed is to add the word "security" to the existing (22 year old) INSAG definition, a definition that was created only a couple of years after the term "safety culture" was coined. More than this is clearly needed. People who study safety culture know that we have learned one or two things since 1988. Dozens of books and hundreds of papers have been written on the subject of safety culture since Chernobyl, and it is time (past time) for a significantly better, clearer, more accurate, more focused definition for safety culture, and the Six Sigma process starts with a clear definition. Everything else (objective and accurate assessment, management and regulation) flows from this like falling Dominos - perhaps for this case I should say "like a chain reaction".

(2000 Sznajder "Manufacturing Engineering – Six Sigma Safety")

Traditional safety professionals believe workers' unsafe actions cause 85-95% of most accidents, a theory developed by Herbert W. Heinrich in the 1940s with no scientific proof backing it up. Because managers do not see unsafe actions as system problems but focus on changing employee behavior, the system doesn't change and the accidents keep happening. Accidents are regarded as the result of carelessness or bad behavior. Managers hold workers in contempt, and the workforce is demoralized.

In contrast, quality guru W. Edward Deming, in his book *Quality, Productivity and Competitive Position*, asserts that 99% of quality problems come from the system and 1 from carelessness. Safety specialists are beginning to apply the quality philosophy to safety as well. In 1999, Tom Smith wrote in "Professional Safety", the journal of the American Society of Safety Engineers, that safety managers must act like quality managers, and change the system, not the worker, to eliminate safety problems.

Surveys found that for every serious disabling injury there could be 10 minor injuries, 30 property damage accidents, 600 near-misses, non-visible injuries or damages, and 1800 or more errors. Rating companies the six-sigma way, a company that has 1800 errors per million opportunities, or one serious or disabling injury, is functioning at around 4.4 sigma, and a company with 10 serious injuries or 18,000 errors per million is at around 3.6 sigma. *Poor safety imposes costs on companies, and the cost of poor safety has become as big an issue as was the cost of poor quality two decades ago.*

INPO human performance training <sup>iii</sup> also reinforces the above:

"People have, more often than not, been disciplined for 'honest' mistakes. When an event happens, the organization is culpable, not simply the individual. No amount of punishment, counseling, or training in fact, nothing—will change a person's future fallibility. Events will continue if root cause analyses are stopped prematurely, organizational weaknesses will not be discovered (will remain latent or hidden) and errors and events will persist. Error is not a choice."

### **What Is Safety Culture And Where Does It Come From?**

Safety is making sure that activities do not harm anyone. Culture is "how we do things around here". So a very simple definition of safety culture might be:

"Making sure that activities do not harm anyone is how we do things around here".

Edgar Schein is an organizational development professor at MIT who is credited with coining the term "organizational culture". Schein is a member of the INPO advisory board and a consultant to INPO on matters of safety culture. Schein created the above simple definition of culture as "how we do things around here" and identified the concept that leaders create and manage culture through their actions: <sup>iv</sup>

"Neither culture nor leadership, when one examines each closely, can really be understood by itself. In fact one could argue that the only things of real importance that leaders do is to create and manage culture and that the unique talent of leaders is their ability to understand and work with culture. If one wished to distinguish leadership from management or administration, one can argue that leaders create and change cultures, while managers and administrators live within them."

So it is the organizational leaders that create the HRO safety culture, safety culture being the organizational culture of the functional areas of a HRO that affect safety (the SRFA – safety related functional areas).

### **The Concept Of Professionalism**

Definition of Medical Organization Professionalism (Roberts "The Essential Guide to Medical Staff Reappointment):

" Practitioners are expected to demonstrate behaviors that reflect a commitment to continuous professional development, ethical practice, an understanding of and sensitivity to diversity, and a responsible attitude toward their profession, their patients, and society."

### INPO's "Professionalism Project" (Rees "Hostages of Each Other" Ch. 8 The Professionalism Project)

"The traditional system of industrial management discourages acceptance of responsibility at the bottom of the organization. That, says the professionalism project, is 'the culture we want to turn around'. Trust, respect, communication, professional development, teamwork, (excellence) and responsibility – according to the professionalism project these are some of the core values a nuclear plant's work environment should embody when senior management establishes an overall corporate philosophy that permeates the organization"

"The professionalism project is an extension of well-established management trends ... including most important, the 'principle of supportive relationships'... a supportive yet disciplined work environment that encourages workers to think and act like *nuclear professionals*"

### Dr. Zack Pate Speech to INPO "Professionalism and Conservative Decision Making"

"We are now seeing troublesome events that cannot be traced to inadequate training, or procedures, or equipment failures, or design. Instead, our conclusion is that the principal root cause is a shortfall in professionalism. Just as a doctor must feel a special responsibility for his patient, or a pilot for his passengers, our nuclear professionals must feel a special and unique responsibility for the reactor -- for not allowing damage to the fuel or the core.

Of course, this applies to many other professions but none more so than nuclear. The technology is unique, and the special understanding and respect for the technology by the professionals who manage it must be unique.

Maybe a further analogy with the medical profession can offer additional insight into our unique situation. "A doctor can do many things wrong, but if he brings unnecessary harm to a patient, he has failed professionally in an unmistakable way, with serious consequences ... likewise we in this industry can make a lot of mistakes, but if we damage a reactor core, we have failed in our profession in an unmistakable way, with serious consequences.

In conclusion, the recommendations that I have put forward this morning are the result of a lot of analysis and thought by the senior staff at INPO and with many inputs from industry executives. In our view they are important not only to successful plant operation in the coming decade, but also in establishing the correct operational, regulatory, and institutional climate for a new generation of nuclear electric plants. I am confident you will take these recommendations in the spirit intended, and that you will take them for action.

*Dr Zack T Pate was elected Chairman of the World Association of Nuclear Operators (WANO) in May 1997. In 1998 he was named Chairman Emeritus of the Institute of Nuclear Power Operations (INPO) of the USA. This followed 18 years of service with INPO, including 14 years as President and CEO and a period as Chairman. During his last three years with the navy, he was a special assistant to Admiral Rickover at the Naval Reactors Headquarters in Washington.*

I am writing this just a few days after President Obama's "State of the Union" address in which he stated his administration's support for a new generation of nuclear plants, the strongest presidential endorsement for restarting the industry that I can recall since 1979 (certainly the strongest democratic president's endorsement).

I sometimes tell people familiar with the Davis Besse event, it is a good thing for the restart of the industry that this event occurred a few months after 9-11 and was eclipsed by the continuing 9-11 buzz in the news, and good thing most people in the US (except for people in Ohio) don't know the details and how close the event was to another TMI type event, or we might not be talking about a nuclear rebirth today.

### **Learning from Historical Safety Culture Events**

After the Millstone event (and prior to the Davis Besse event) the NRC believed it had a much better handle on safety culture. I was far from convinced. During the 2 year Millstone recovery Schein culture management methods were applied, and during this time the culture recovered well satisfactory to a level most viewed as excellent. Contrast this to the 2 year Davis Besse culture remediation effort, where culture surveys showed a decline in most major work groups to the point where the NRC culture oversight consultant (John Beck) was conflicted about whether the plant should be allowed to restart.

After the Millstone recovery, plant management could not wait to drop the culture management methods imposed by the NRC that were being labeled "extraordinary". I felt they should not only be continued at Millstone, but that NRC should have (optimized them) and expanded their use to manage culture at all US nuclear plants. Beck was also the primary culture oversight auditor for Millstone, and continued to monitor the culture for a few additional years after recovery. In final letter to Millstone management that he shared with me, Beck identified that the culture had already begun to decline.

In 1999 I asked the Millstone Senior NRC Resident "what has been put in place to keep what happened at Millstone from happening again at Millstone or elsewhere in the industry". He paused and thought about it for a moment, and said: "Nothing I guess".

By this time I had studied all of the various culture management approaches implemented at Millstone, identified the Schein-based leadership-focused methods as very clearly the "best of the bunch", and developed an optimized method far more simple and effective than the hundred-question surveys typically used at nuclear plants (that Schein says do not work) that do not (typically) include facilitated discussions with workgroups (an essential step).

Beck recommended to Millstone management that they use my method, but the recommendation was not accepted. The Millstone Oversight Department (a department that understands the need for quality management better than any other on site) permitted me to run a trial there in 2000 (1 manager, 5 supervisors, about 70 workers). The Oversight management team generally loved getting (anonymous) feedback from their reports on how well they are doing their job. The Oversight manager was particularly enamored with the method and laminated a slide from one of my presentations (the one containing the definition of safety culture) and posted it on the wall inside his office, so (this is what he told me) he could look at it and "remember what safety culture actually is".

Just after the Davis Besse event, Oversight was tasked (by a "red" INPO SOER) with assessing the site wide culture, including the capabilities of the leadership team for managing culture. One of the Oversight supervisors (who was in my trial) headed the Millstone response. Three utilities pooled resources, developed and applied a methodology (headed up I believe by Duke Energy). After the assessment was complete, the supervisor shared the assessment document

with me saying the plant still does not know if the culture is sufficiently healthy (or not) and whether additional culture training is needed (or not). After the effort was completed, he told me he felt I should have headed up the 3 utility task force (nice compliment).

The point is, there are a surprising number of culture assessment and management approaches out there that are not effective, that simply "do not work". Because plant managers (and NRC managers) know very little about culture, methods that are almost entirely ineffective continue widely applied and unchallenged. When a top culture expert like Schein states in his "Corporate Culture Survival Guide" that "culture surveys don't work", people implementing hundred-question culture surveys should question whether what they are doing is effective.

On a separate but related subject of culture assessment, last fall I created a completely new 100+ slide ppt on HRO safety culture and presented about 10% of it to ACRS last November (as in 2003, it focused on "first things first" the need for a new definition). About 20 of the slides (which I did not present) are a high level analysis of the culture event at Davis Besse. I introduce a new (far more effective) tool for performing cultural root cause analysis called "the four-squared method". Running the analysis using this tool demonstrates that what actually happened (both the direct cause and the root causes) were not (at all) what the NRC or the culture consultants indicated that they believed they were.

### **The Concept of Managing Safety Culture To Manage Operating Risk**

Another point is that we (in nuclear power) need to take a close look at everything we are doing with culture and try very hard to get this right for our benefit of our industry and others who look to nuclear for guidance on safety culture. As Zack Pate indicated in 1989, the majority of problems seen since the Chernobyl time frame are culture-based:

"We are now seeing troublesome events that cannot be traced to inadequate training, or procedures, or equipment failures, or design. Instead, our conclusion is that the principal root cause is a shortfall in professionalism."

### **INPO 02-005 "Analysis of Significant Operating Events"**

"The recent Davis-Besse reactor pressure vessel head wastage event is one of the most significant events from a nuclear safety perspective to occur in our industry. Given this "near-miss" event, the Events Analysis Department at INPO examined other "near-miss" events for our industry to determine if there were common causes or meaningful trends. This report summarizes the results of that analysis.

This analysis demonstrates, among other things, that organizational influences on individual behavior often negatively impact the severity of events. The majority of these event causes and contributors were largely a result of human behaviors that were instilled in the individuals by the organizational culture."

In "Managing the Risks of Organizational Accidents" James Reason discusses different types of approaches for determining what is an acceptable level of risk:

- Zero risk approach – safety exists only when there is no risk of an accident with harmful consequences
- De minimus approach – safety exists when risk is considered trivial, commonly taken as a probability of one in a million.

- Comparative risk approach – safety is determined on the basis of other accepted risks (driving, smoking, air travel etc.)
- ALARP (as low as reasonably practicable) risk approach – safety exists at the point where it is not feasible for the organization to do more.

Reason also discusses possible models for the regulatory process, saying that regulators are uniquely placed as one of the most effective defenses against organizational accidents, but also:

“What regulators often lack, however, are the tools, training and the resources to confront the all-important human and organizational factors and to monitor the insidious accumulation of the latent conditions that can subsequently combine to penetrate the system’s defenses. The same also applies to policy makers. The past decade has seen isolated flurries of post-disaster legislation, when what was needed were the statutory and regulatory structures necessary to forestall future accidents rather than trying to prevent previous ones.”

### **Hostility To Change**

In one of the text books I used in the masters program for executives and leaders that I completed in 2003 was called “Strategic Management” . It had a write-up on “Low Performance or Unhealthy Cultures” that listed 4 characteristics of an unhealthy culture, all of which I experienced over the past 10 or so years (ironically) trying to get management at Millstone to adopt better methods for maintaining a healthy culture:

1. A politicized internal environment that allows managers to operate “fiefdoms” and resist needed change.
2. Hostility to change and to people who champion new ways of doing things.
3. promoting managers who understand budgets and administrative controls better than they understand vision, strategies, inspiration and culture building.
4. Aversion to looking ... for superior practices and approaches.

In 1999 I suggested trying out a new culture approach to the HR manager who (in an agitated and hostile manner) said that (of the two of us) he was the one with a behavioral science background, I had an engineering background, and for this reason no, he would not agree to support the use of my culture approach. In 2000 the Oversight management strongly supported switching to the method I suggested, recommending it to HR as a replacement for the existing site survey.

In June 2001 I recommended the method to the Employee Concerns manager (who was responsible for some of the leadership surveys) he argued that the “sophistication” of the current site survey method already addresses leadership issues, and therefore it is not needed. In July 2001 John Beck complained in a letter that the Millstone managers were not using the survey results to drive culture improvements (which is why I argue that culture improvements needs to be driven by the CAP) and recommended consideration be given to a simplified survey tool that can be used on a more frequent basis. Beck then personally recommended to site management that they adopt my approach.

Working as an Oversight assessor in the fall of 2001, I had access to a report identifying culture problems in the engineering department. After getting approval from the site engineering manager, I initiated a wider trial in the Millstone site engineering department. The HR manager called me to his office and asked me (as a personal favor) if I would cancel the survey (which of

course I did). One of the engineering supervisors liked the concept so much that he ignored HR and went ahead and collected the data, but I told him I could not process it. In 2003 there was a new HR manager, and I asked again about HR supporting a trial of the method. He said "Dave, I know that it works, I absolutely know that it works, but I think the culture is doing pretty well and it is more than Millstone needs right now".

I have had numerous culture discussions with Dominion's chief nuclear officer (who is very well educated in culture) and in 2004 he asked about my administering it for the Ops departments of all 7 Dominion operating units. The engineering manager argued that he could not allow me the time it required and the CNO did not want to overrule him. Later, the CNO said he would entertain the idea of replace the existing surveys in Dominion's entire nuclear fleet if the Employee Concerns Program manager would agree to this, but the ECP manager said no, believing it could cause HR problems.

Over the past couple of years Millstone has been concerned about problems with the entire site leadership team, and has been trying out various methods of improvement. Millstone Oversight recently produced a report with the simple frank title "Millstone Leadership is Ineffective" with a supporting shopping list of reasons. With regard to combined overall performance metrics, over the past two years one of the Millstone units has spent a lot of time either at or near the bottom of the industry. Last year I went to the site VP who agreed to a very simple trial (just him receiving feedback from the members of the site leadership team) but the Organization Effectiveness manager found out about it, and put a stop to the trial before it began. Recently the NRC senior resident told me that I could tell plant management that the NRC would like to see the method implemented, but I am done pushing the site to do this. I have accepted a retirement package and will be retiring in a few months.

The point is, no matter how poorly a plant or leadership team may be performing, many plants are not likely to dedicate the necessary resources to the proper and effective management of safety culture unless it is something that becomes required by the NRC. Working as an INPO information coordinator for the past 2 years, I have seen the commonality of issues that continue to afflict the industry. I have seen how the plant I am at responds, how the plants operated by the company for which I work responds, and I have had a number of windows on how the industry responds to various events. There is a strong tendency to do just what NRC and INPO require and little (and very often nothing) more. I call this the (brainchild problem) of "minimal regulatory compliance", where plants comply with the NRC and INPO (the federal and communitarian regulators) in a minimal way, and very often ignore recommendations for improvement from staff. Part of the problem is lack of training in management and leadership (and human performance which has significant elements of both). When an educated staff member suggests an improvement to close a "gap", the leadership often does not embrace the improvement because the solution is beyond (as Einstein would say) their "level of consciousness".

Therefore, the NRC should view safety culture as a *human performance safety system*, and add safety culture to the "10CFR50 appendix B topical report" (a list of all the safety related "stuff" that needs to be managed at a nuclear plant) so that safety culture (at long last!) will receive the resources needed to perform a quality management function. If this does not happen, if NRC does not add safety culture to the topical report, I can assure you (from my personal experience) that plants will never develop the capabilities, will never voluntarily dedicate the resources, to properly manage safety culture. This is one of the lessons I learned over and over again in the decade since Millstone's culture 'recovery'.

## Improving On The INSAG And INPO Definitions

### The INPO Definition:

The INPO definition is an improvement over INSAG as in it incorporates the concepts of *leadership and values and behaviors* as creating the culture (values and behaviors ... modeled by it's leaders ... that serve to make ... ).

However, there is a problem with the INPO definition that is uses part what is being defining (nuclear safety) in the definition, so the concept of "nuclear safety" is not defined. It appears to be a definition of *nuclear safety* culture, but is actually a *generic definition* for any kind of culture.

Example, the INPO / NEI definition for *nuclear safety* culture:

"An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make *nuclear safety* the overriding priority."

Replace nuclear safety with (anything) and you can see the problem. Definition of an *ice cream sandwich* culture:

"An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make *ice cream sandwiches* the overriding priority."

### The INSAG Definition:

"Safety Culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance."

Parts Of The Definition That Are Unclear:

- What characteristics?
- What attitudes?
- What organizations?
- Which individuals?
- Why is attention warranted?
- Why are the issues significant?

Proposal for a Clearer definition (High Reliability Organization Safety Culture):

**"In a High Hazard Industry, those professional leadership attitudes that manage potentially hazardous activities such that risk to people and the environment is maintained as low as reasonably achievable, thereby fostering stakeholder trust."**

This Proposal Clarifies Six Areas:

- What characteristics? (*attitudes that manage risk and maintain trust*)
- What attitudes? (*professional leadership attitudes*)
- What organizations? (*high reliability organizations*)
- Which individuals? (*the leadership team*)
- Why is attention warranted? (*potentially hazardous activities*)
- Why are the issues significant? (*process carries inherent risk of harm to people, environment*)

## **Rickover And The Concept Of Responsibility**

People outside the nuclear industry may not know that Admiral Hyman Rickover (the "father" of the nuclear navy) is also the father of the commercial nuclear power plant that established many of the engineering (and cultural) foundations for modern US nuclear plants. In Rickover's view, the concept of responsibility was central to the concept of safety:

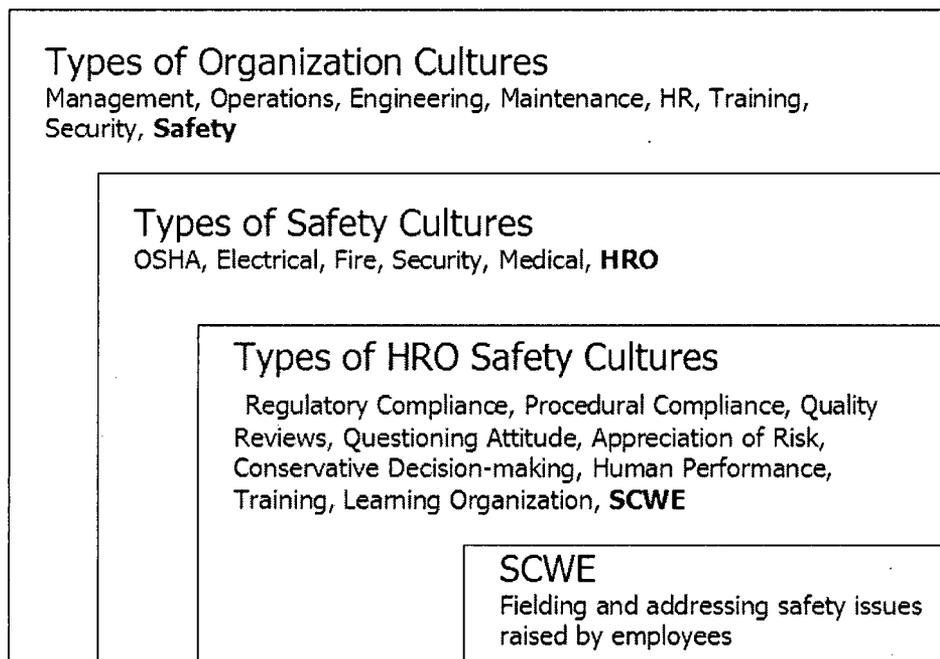
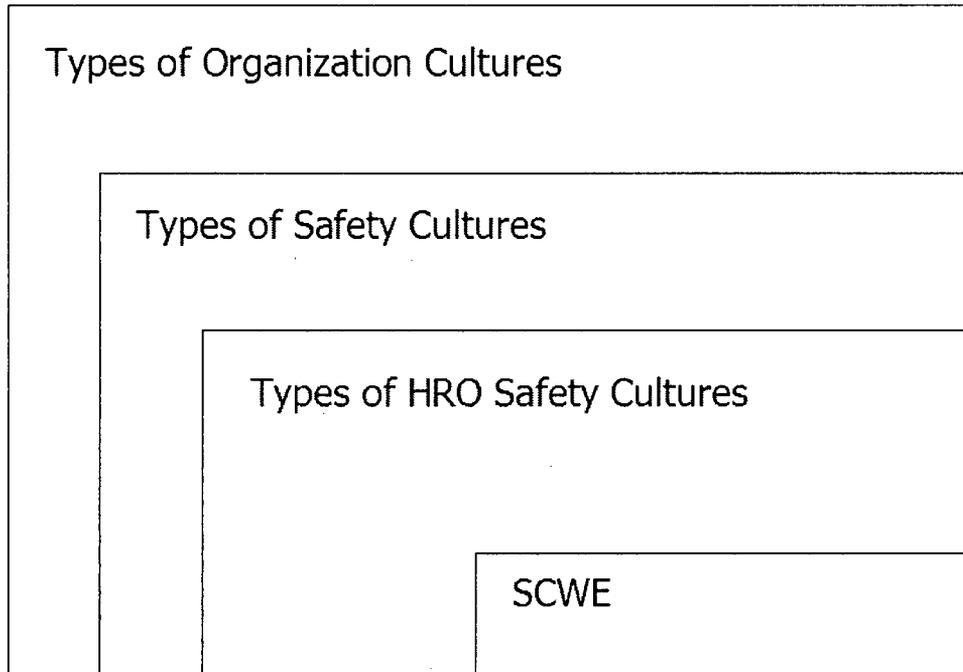
"The idea of responsibility is a unique concept: It can only reside in a single individual. You may share it with others, but your portion is not diminished. You may delegate it, but it is still with you. You may disclaim it, but you cannot divest yourself of it. Even if you do not recognize it or admit its presence, you cannot escape it. If the responsibility is rightly yours, no evasion, or ignorance, or passing the blame can shift the burden to someone else. Unless you can point the finger at the man who is responsible when something goes wrong, then you have never had anyone really responsible." H. G. Rickover.

Proposed Definition Incorporating The Concept Of Responsibility:

***"In a High Hazard Industry, those professional leadership attitudes that manage potentially hazardous activities such that risk to people and the environment is maintained as low as reasonably achievable, thereby fostering stakeholder trust. Maintaining the quality of the safety culture is the general responsibility of the management team and the specific responsibility of the most senior organization manager."***

## **Updating The INSAG Definition By Adding The Word "Security"**

By now I hope I have communicated the need for a completely new definition. However, even if the INSAG definition could be salvaged, it would not be appropriate to add the word "security" as security safety culture is just one type of many safety cultures that support the HRO (hazardous activity management) culture. The operations safety culture (and the engineering and maintenance safety cultures) supports the HRO safety culture just as importantly as the security culture, but different ways. So why not add "operations" and "engineering" and "maintenance" to the definition as well? Maybe the below graphics copied from my 2003 presentation will help to explain the culture relationships in a high reliability organization.



**Other Definitions And The Beginning Of A Safety Culture "Language"**

This paper defines safety culture only in the context of the organizational culture in a HRO. At the end of the presentation I gave to ACRS in November "Nuclear Industry HRO Safety Culture – Next Steps" are 8 slides that contain over 40 definitions related to safety culture, I have included some examples below.

My hope is that this paper and other papers that I may (or may not) write (I usually do presentations, I don't usually write papers, I wrote this one on the train on my way to the conference) will stimulate a trend toward better safety culture understanding, as well as better definition, assessment, management and regulation both inside and outside of the nuclear power industry.

Professionalism (HRO)	An employee attitude in a High Reliability Organization that reflects a commitment to continuous professional development, ethical practice, a sensitivity to diversity, and a responsible attitude toward their profession, stakeholders, and society.
Safety Culture (HRO)	Professional leadership attitudes in a High Reliability Organization that manage potentially hazardous activities such that the risk to people and the environment is maintained as low as reasonably achievable, thereby ensuring the trust of stakeholders.
Safety Culture (Human Performance, Quality Management)	A <i>human performance based safety system</i> requiring maintenance and quality management like any other (e.g. electro-mechanical based) safety related system. NRC needs to include "Safety Culture" in the 10CFR50 Appendix B QA Topical Report so that operating organizations will dedicating the needed attention and resources to properly managing and maintaining organizational safety culture quality.
Safety Culture (Individual)	The professional attitude of individuals in a High Reliability Organization that ensures potentially hazardous activities do not harm people or the environment.

SCM	Safety Culture Management. Managing the component of SOE risk contributed by human performance such that it remains ALARA: As Low As Reasonably Achievable.
SCR	Safety Culture Regulation. Regulating the element of SOE risk contributed by human performance such that it remains ALARA: As Low As Reasonably Achievable.
SCWE	Safety Conscious Work Environment. An HRO business environment where employees trust that they will not be subject to HIRD for raising safety issues. In a true SCWE an employee exhibiting a reasonable pragmatic safety focus is appreciated and supported even when the focus exceeds minimal regulatory compliance.
SRFA	Safety Related Functional Area. An area within the organization responsible for fulfilling requirements of 10CFR50 Appendix B
MRC	MRC is an unproven management "brainchild" theory holding that optimal economics requires that those concerns of staff not associated with satisfying a regulator be ignored. MRC theory relies heavily on the regulator to manage risk, as over time the other "defense in depth" barriers (worker, manager, internal oversight) may become eroded (see opposing theory ALARA).
MSM	Most Senior Manager. Typically the "C" level manager in the HRO (but not necessarily the organization CEO). An energy company may have various types of generating facilities, but the nuclear plants may be the only HROs. In nuclear power the CNO (chief nuclear officer) is specifically responsible (primarily responsible, more responsible than any other manager including the CEO) for the quality of the culture that develops in the nuclear organization. See safety culture definition (HRO): Maintaining the quality of the safety culture in the HRO is ... the specific responsibility of the MSM.

[Additional white papers by David Collins]:

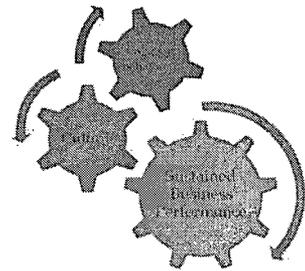
1. DRAFT Method For Objective Quality Assessment, Management and Regulation of Safety Culture in the Nuclear Power Industry
2. DRAFT Quality Management of HRO Safety Culture Using The Six Sigma Process

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- i [http://en.wikipedia.org/wiki/High\\_reliability\\_organization](http://en.wikipedia.org/wiki/High_reliability_organization)
  - ii [http://findarticles.com/p/articles/mi\\_qa3618/is\\_200009/ai\\_n8911518/](http://findarticles.com/p/articles/mi_qa3618/is_200009/ai_n8911518/)
  - iii INPO HU training module "Leadership"
  - iv Schein "Organizational Culture and Leadership" 1992 second edition pg. 5

DRAFT

# Leadership & Safety Culture

## (Understanding the Nexus)



**Edgar Schein** Emeritus  
Professor MIT Sloan  
School of Management

"Leaders *create and maintain* the organization culture. If there are culture problems, it is up to the organization leaders to correct them." (Organizational Culture and Leadership, second edition)

**INPO (Institute of Nuclear Power Operations)** INPO  
Human Performance  
Training

"Without leadership intervention, production practices will overcome those aimed toward prevention. Production behaviors will take precedence over prevention behaviors unless there is a strong safety culture—the central focus of leadership." (Human Performance Training Module: *Leadership*)

**INSAG (International Safety Advisory Group)** Part of IAEA  
International Atomic  
Energy Agency

"Safety culture flows down into the organization from the *actions of senior leadership*"

**Martin Marquardt (TOSAN)** consultant  
with proven record creating  
high performance cultures  
in nuclear power and other  
HHIs.

"There are only 2 ways to change culture, you can *change leaders*, or you can *change leaders*"  
(*i.e. change leader behavior, or change out the leader*)

**Odie Espenship (Target Leadership)**  
leading HHI motivational  
safety speaker

"In order to have a healthy organizational safety culture every member of the management team needs to understand and be able to manage culture"

**Lee Olivier** led the  
culture transition from  
poor to excellent at  
Millstone, currently  
president and chief  
operating officer of  
Connecticut Light and  
Power Co. , profiled in  
"Appreciative Leaders"  
Shiller / Holland / Riley.

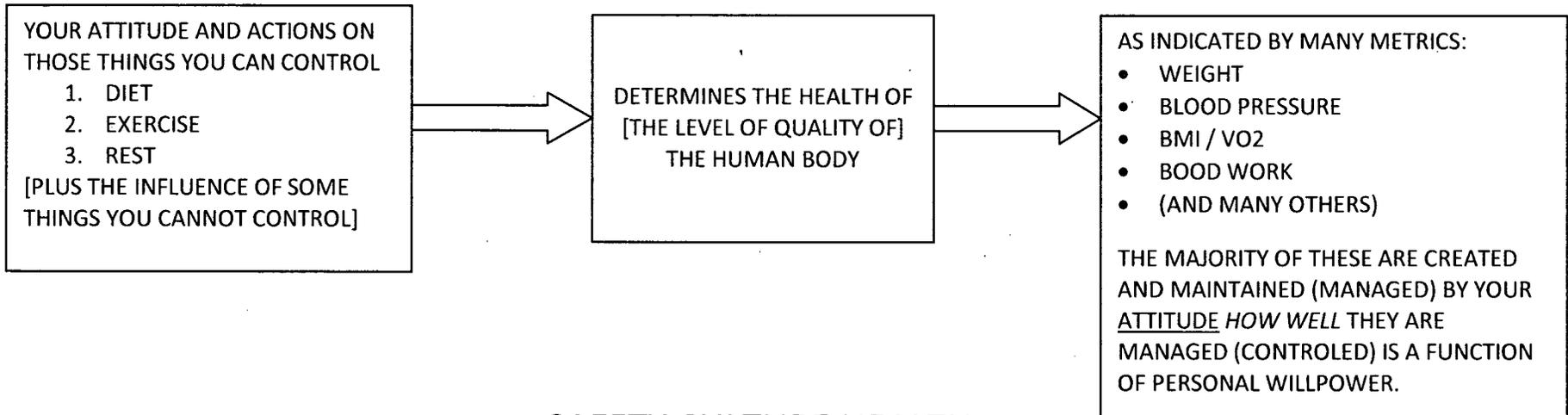
"If nuclear plant executives would concentrate on building trust with employees and helping them reach their highest potential, the NRC wouldn't have to worry about safety culture inspections"

"The first thing you do is prove to people *you care about excellence, and about them*," said Olivier. "When you do these things, you *build trust* coupled with higher standards and expectations."

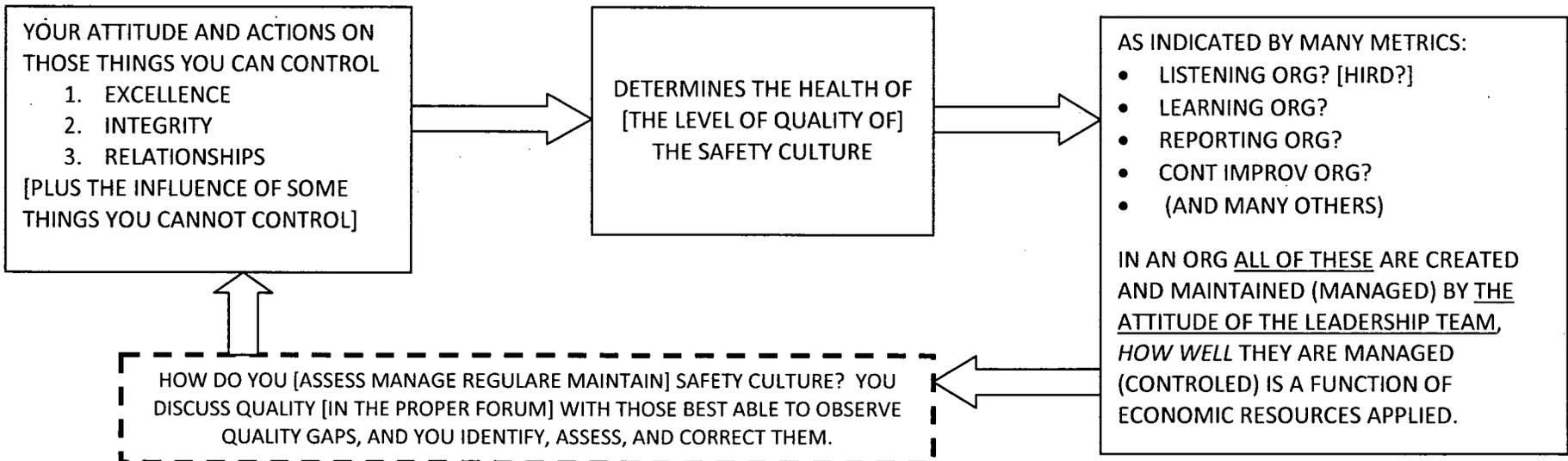
"There are always a couple of managers who, with regard to safety culture, simply "don't get it". The most important thing for maintaining the safety culture is this: these managers cannot remain on the leadership team. This is something very hard for senior managers to do, and something that most senior managers are unwilling to do, but it is something that is essential."

# WHAT DETERMINES [CONTROLS, MANAGES, REGULATES] SAFETY CULTURE HEALTH?

## HUMAN BODY HEALTH



## SAFETY CULTURE HEALTH



# What (Exactly) Are We Defining?

## [Not simply this] "SAFETY CULTURE"

Below is the simplest definition of safety culture, it is not the correct one for this workshop:

*"Making sure actions do not harm people is how we do things around here"*

We are a High Hazard Industry, operating a High Reliability Organization,  
*Therefore we need to define (should be defining) HRO Safety Culture*

## EXAMPLES OF DIFFERENT KINDS OF SAFETY CULTURES

### SAFETY CULTURE (NON-ORGANIZATIONAL)

*Mom tells Mary hold onto the rail when going down stairs  
Dad tells Johnny don't mow the lawn in bare feet*

### SAFETY CULTURE (ORGANIZATIONAL-INTERNAL)

*Town tells it's construction people to wear hart hat, gloves  
McDonalds tells it's people how to safety change fry oil  
Home Depot tells saw operators wear safety glasses*

### SAFETY CULTURE (ORGANIZATIONAL-PUBLIC)

*Town says I want 25MPH speed limit on main street  
McDonalds says keep burger meat frozen  
Home Depot says lock the circular saw so customers can't use*

### SAFETY CULTURE (HIGH RELIABILITY ORG)

*THE PROCESS ITSELF IS  
FUNDAMENTALLY HAZARDOUS AND TO  
PROTECT PUBLIC MUST BE MANAGED WITH  
HIGH PROFESSIONAL STANDARDS  
WHICH ARE CREATED AND MAINTAINED  
BY THE LEADERSHIP TEAM*

*Transportation (Planes, Trains, NASA)  
Petroleum (Pumping, Refining)  
Chemical (Manufacturing, Processing)  
Nuclear Power, Materials  
Medical (all types)*

# **SAFETY IS AN *ATTITUDE***

YOUR (PERSONAL) SAFETY CULTURE = *YOUR SAFETY ATTITUDE*

***SAFETY CULTURE = SAFETY ATTITUDE***

***SAFETY ATTITUDE = SAFETY CULTURE***

AN ORGANIZATION'S SAFETY CULTURE =  
***COMBINED SAFETY ATTITUDE OF THE LEADERSHIP TEAM***

Article published June 13, 2003

## Davis-Besse incident inspires revival of regulatory philosophy

By **MICHAEL WOODS BLADE SCIENCE EDITOR**

ROCKVILLE, Md. - Nuclear safety experts have no official definition of it. They don't know how to measure it. But they desperately want it at each of the nation's 103 commercial nuclear plants. That's the odd status of an idea called "safety culture," the topic yesterday at an unusual session of the Nuclear Regulatory Commission's safety advisory board.

The NRC Advisory Committee on Reactor Safeguards summoned experts to agency headquarters to help it decide whether to recommend that the NRC bolster its regulations with new rules on safety. It would be an upheaval in government regulatory philosophy, with the NRC moving beyond setting rules for mechanical and electrical systems and venturing into the realm of management attitudes, leadership styles, and even corporate ethical values.

"We have no insight into the safety culture of the utilities," noted Stephen Rosen, an advisory committee member.

Safety culture means the collection of characteristics and attitudes found in nuclear power plant owners and employees who put a high priority on safety.

"We need some mechanism for NRC to remove toxic leadership," suggested David Collins, an engineering analyst at the Millstone Nuclear Power Station in Connecticut, noting that overbearing executives could diminish plant safety. Like several other speakers and committee members, Mr. Collins, expressed reservations about extensive safety culture regulations.

Existing rules, they said, could get the same result, if fully enforced by the NRC. The NRC long frowned at the idea of regulating the attitudes and ideas prevailing at nuclear power plants, and in the 1980 even forbid use of the term, Thomas Murley said. He is a former NRC regional administrator who helped pioneer the idea.

"At long last, safety culture is back from the graveyard of forbidden lexicon in this country," he noted at the workshop.

FirstEnergy Corp.'s Davis-Besse Nuclear Power Station exhumed the idea. Investigators identified a defective safety culture at the plant as a major reason for the corrosion incident that has kept Davis-Besse shut down since February, 2002.

A leak of corrosive water, which plant managers overlooked for years while skimping on maintenance, ate a 4-inch by 5-inch hole into the Davis-Besse reactor vessel head. The vessel is a key safety system that keeps nuclear fuel and radioactive water inside the reactor.

"The principal causes of Davis-Besse were cultural," said Jack Grobe, who heads a special NRC panel overseeing improvements at Davis-Besse. "I think this area is very critical," he added, citing belief that other nuclear power plants may have similar problems.

Law Meyers, FirstEnergy chief executive officer, told the advisory panel that safety culture improvements are among numerous changes made at the site, as it heads toward a projected restart date in August.

William Keisler, nuclear power consultant who worked at Davis-Besse in the 1980s, said that the plant's lax safety culture may be deeply ingrained, noting it has spanned three major changes in management.

The culture, he said, seems to result in serious mishaps at Davis-Besse every 8.5 years. He urged the reactor safeguards panel to recommend safety culture regulations and also demand that the nuclear industry issue a code for ethics for all its employees.

ACRS normally allots a maximum of two hours to important topics, Chairman Mario V. Bonaca said. "The decision to assign a full day to this topic gives you an indication of the importance we assign to it."

George Apostolakis, who led the ACRS safety culture subcommittee, said there is no official definition of safety culture.

"I must admit that I really don't know what a good safety culture is and what a bad one is, and I suspect many of my colleagues don't either."

The board discussed a range of possible actions, ranging from recommending that NRC regulate safety culture in cooperation with an industry group to taking no formal action and bolstering the safety environment in other ways.

Sunday, December 29, 2002

## **Davis-Besse workers' repair job hardest yet** ***Employees must fix plant's damaged attitude on safety***

THE PLAIN DEALER, Cleveland, OH

By John Mangels and John Funk

FIRSTENERGY CORP. Randy Fast, Davis-Besse plant manager, holds a "town meeting" with employees at the reactor complex Dec. 19 to discuss issues related to the plant's restart, including the need for a safety-minded culture. FIRSTENERGY CORP. Randy Fast, Davis-Besse plant manager, holds a "town meeting" with employees at the reactor complex Dec. 19 to discuss issues related to the plant's restart, including the need for a safety-minded culture.

For more than two years, the radiation detectors at the Davis-Besse nuclear power plant insistently signaled that something was wrong inside the hulking gray bunker that houses the reactor. The plant's response to those repeated warnings signaled something as well.

The twin monitors constantly sniff the muggy air inside the containment building, searching for signs that the reactor's vital coolant might be leaking. And from 1999 to 2001, the detectors' air filters - which normally require monthly changing - were clogging as often as every day with a fine yellow-brown dust. Consultants identified it as coolant residue and rusting metal, likely carried aloft by steam.

Although they suspected a coolant leak somewhere, Davis-Besse personnel couldn't find one. Instead of pursuing its cause, they moved the monitors' intakes to a different spot. They even bypassed one of the devices' three sensors because it kept triggering alarms.

To experts like Mario Bonaca, a top adviser to the Nuclear Regulatory Commission, the Davis-Besse detectors weren't just registering a leaking, rusting reactor lid, but a corroded attitude toward safety, too. "Those were almost daily events," the nuclear industry veteran fumed at a recent meeting. "Didn't somebody scratch their head and say, 'Why are we overriding these indications?'"

No one did, not the FirstEnergy Corp. managers of the Toledo-area reactor, not the NRC inspectors who were based there, not the analysts for the nuclear industry who gave the plant a clean bill of health. Despite years of obvious signs, the widespread breakdown at Davis-Besse of the "nuclear safety culture" escaped everyone's notice.

"There clearly were some issues with safety culture at that plant that had not been recognized by us, and not recognized by the top-most management of FirstEnergy," said NRC Chairman Richard Meserve. As he told an industry group in November, "the Davis-Besse episode presents the fundamental question as to whether the NRC's approach to assuring an adequate safety culture is sufficient."

Until now, the agency's inspections and rules have focused on hardware and procedures. The NRC has shied away from directly regulating the fuzzier concept of an appropriate safety mindset at the nation's 103 commercial nuclear plants - influenced, in part, by the industry's position that such attention would be meddling in management affairs.

But the shock waves from Davis-Besse have given new urgency to the safety culture debate inside White Flint, the NRC's fortress-like Rockville, Md., headquarters. Some members of the Advisory Committee on Reactor Safeguards, an influential panel of scientists and engineers that counsels Meserve and the four other NRC commissioners, have recently voiced concerns about a possible gap in safety culture regulation. The group will make recommendations this spring.

Meanwhile, the NRC must tackle the more immediate problem of making certain that something it does not yet know how to measure has been restored at Davis-Besse - before the idled plant is allowed to restart.

### **High stakes**

Plumbing an organization's culture sounds better suited for a Harvard MBA thesis than for America's nuclear overseers. But the relative priority that workers and managers give to safety-mindedness is perhaps nowhere more important than at a nuclear plant, where an accident can affect millions of people.

"If it's an industry with catastrophic potential, any lapses are magnified," said Yale University sociologist Charles Perrow, author of "Normal Accidents," a book examining technological risk. With their immense complexity and domino-chain processes, nuclear plants have a built-in propensity for accidents, Perrow argues.

So the organizational sins that might only result in a bad burger or a burned finger at McDonald's - sloppy work, poor supervision, ignored warnings, unnecessary risk-taking - have profoundly greater consequences at a place like Davis-Besse.

The nuclear industry's opposition to formal regulation of the safety culture doesn't mean it thinks the concept is unimportant - quite the opposite. A confidential report in September by the industry's research arm, the Institute for Nuclear Power Operations, analyzed the 20 most significant "near misses" in American nuclear history. (Davis-Besse made the list twice, for its reactor lid hole in 2002 and a 1985 incident in which coolant pump failures brought the reactor's radioactive fuel rods to within two hours of melting.)

The study found that the most commonly reported cause - named in 14 of the 20 mishaps - was plant personnel lacking "an appreciation of the risks associated with their actions" and taking "a non-conservative approach toward reactor safety."

The term nuclear safety culture was introduced after the Chernobyl disaster in 1986. Pinning down exactly what it means has proved elusive.

"I think if you were to talk with five different people about what safety culture is, you'd probably get five different answers," Meserve said in a recent interview with The Plain Dealer.

George Apostolakis, a respected Massachusetts Institute of Technology nuclear engineering professor who chairs the NRC's safety advisory panel, goes further:

"We really don't understand what an adequate safety culture is and how to measure it."

Apostolakis said. "Some of my colleagues with long experience at nuclear plants tell me they walk into a facility, and 10 minutes later they know whether they have a good safety culture. But they can't tell me why."

### **Safety before profit**

The general consensus is that the safety culture is a blend of attitude, behavior and values: a commitment to excellence; a questioning outlook; personal accountability; a willingness to raise

or listen to safety concerns and fix them; a belief from the boardroom down to the broom-pushers that safety comes before everything, including profits.

David Collins, an engineering analyst at Connecticut's Millstone nuclear power station who studies safety culture, likens it to the moral and ethical code that guides doctors: "An attitude that ensures the [nuclear] technology first does no harm." How do you measure an attitude, though?

The NRC historically has avoided much work in the area, to the great frustration of people like Apostolakis, the agency's top safety adviser.

"For the last 20 to 25 years," he said, "this agency has started research projects on organizational-managerial issues that were abruptly and rudely stopped because, if you do that, the argument goes, regulations follow. So we don't understand these issues because we never really studied them."

Instead, the agency has staked its confidence on the ability of its routine equipment inspections and program reviews to act as an indirect barometer of safety culture. If its inspectors find a backlog of maintenance work, the NRC's thinking goes, or repeated failures by engineers to get to the bottom of a stuck valve, that should trigger alarms about an appropriate safety attitude and prompt greater agency scrutiny.

Going any further to impose specific safety culture requirements, the nuclear industry has argued, would force a cookie-cutter approach on plants that are as different as the Southerners or Rust Belt natives who populate them, robbing managers of the flexibility to achieve safety in the way that works best for their employees. A government regulation might also undercut the notion that nuclear plants themselves have the primary responsibility for safety.

Troubling events at the Millstone plant in the 1990s raised questions about utilities' commitment to safety culture and the NRC's capacity to catch its decline. Amidst equipment failures, internal warnings of a "cultural problem" and several dozen claims that workers were penalized for bringing up safety issues, the three-reactor complex landed on the NRC's "watch list" of problem plants in 1996.

The plant's owner, Northeast Utilities, shut it down for repairs and other operations. After Time Magazine exposed Millstone's flaws, the agency ordered Northeast to prove it had a comprehensive plan to ensure that workers who aired safety concerns wouldn't face retaliation before it could restart the reactors. In essence, the NRC demanded that Millstone establish an aspect of safety culture, without saying how to do it.

"Fortunately, Millstone was able to get the right people in there and work with management, with all the consultants we had, to come up with some kind of definition of safety culture," said Paul Blanch, an engineer and former Northeast whistleblower who was brought back to help address the problems.

The two-year effort required replacing about 40 managers and developing programs to re-educate those who remained on how to handle safety complaints and employee concerns. Workers and bosses had to learn to communicate and rebuild shattered trust.

"There were dramatic examples of people changing," but progress was halting and fragile, said MIT management professor John Carroll, who has studied the Millstone case. The lengthy shutdown cost Northeast more than \$1 billion; in 1998 the utility decided for economic reasons that only two of Millstone's three reactors would return to service.

## The Davis-Besse shock

The Millstone debacle was supposed to have heightened the nuclear industry's awareness of the safety culture issue.

The NRC also believed that its new approach to monitoring the nuclear fleet, launched in 2000, would be a more sensitive, less subjective indicator of how well reactors were operating. While the revamped Reactor Oversight Program still didn't directly rate plants' safety culture - or workers' ability to report safety concerns - the refocused inspections were supposed to be able to detect problems in those areas in plenty of time to avert a crisis.

Which is why Davis-Besse came as such a shock to regulators and the industry: Until the day the hole in the reactor lid was found in March, the plant got uniformly high marks from the NRC's inspections and, reportedly, the confidential ones done by the Institute for Nuclear Power Operations that deal even more directly with safety culture.

"It's a major failure of the system, in my view," Apostolakis said.

Even before the Davis-Besse event, the NRC was warming to the idea of requiring that all reactor operators put in place safety-conscious work environment programs to ensure employees' freedom to raise concerns. Senior agency officials have recommended such a rule, and the commissioners will take up the matter soon.

But a broader regulation mandating that plants have - and that the NRC verify - an adequate safety culture is much less likely any time soon. NRC rulemaking is typically a years-long process.

And the Nuclear Energy Institute, the industry's powerful lobbying arm, would oppose safety culture-related regulations because it believes that current rules are adequate, that new ones would be subjective and that Davis-Besse was a unique event, not a fleetwide problem.

"The NRC is excellent at regulating hardware. It's very difficult to regulate mindset," said Ellen Ginsberg, the industry group's deputy general counsel.

While that may be true, Meserve insists that the NRC is "not taking anything off the table" in its consideration of safety culture options.

"I can't tell you that we should change the way we do things," he said. "If we were to find tools to measure a plant's culture objectively, I think a lot of concerns of regulation in that area would diminish."

### Do they care?

One such tool may spring from the advice that a legendary football coach offers leaders. Lou Holtz suggests that whether a business succeeds depends on how the boss measures up to these employee questions: "Can I trust you? Do you care about me? Are you committed to excellence?"

Collins, the Millstone analyst, realized from his experiences during the plant's recovery that workers' feelings about managers are a strong meter of the organization's culture. With input from MIT's Carroll, he fashioned a survey based on those themes. He and others believe that it can pinpoint trouble spots where leadership - and by extension, safety culture - have slipped.

Collins, who already has done a test run of the survey at Millstone, suggests that the survey could be done at least yearly, with the NRC reviewing summary results. If employee confidence

fell below a certain level, the agency and utility could discuss remedies with a time period for improvement before the NRC stepped up enforcement. In short, a measuring tool.

Davis-Besse has undertaken its own employee surveys since the shutdown. Though not based on Collins' model, they are one of the indicators that the NRC panel overseeing the plant's rehabilitation will use to judge its readiness to resume operating. Most are based on how well workers and managers perform while under the NRC's magnifying glass.

"That's the only way the NRC can make a (safety culture) determination - looking at decisions and whether they're made conservatively," said Andrew Kadak, an MIT nuclear engineering professor and former nuclear CEO.

"I don't know how to measure safety culture," said the NRC panel's chair, Jack Grobe, who's been through several restarts of troubled plants. Nonetheless, he is confident there are reliable proxies. An important one is the reports that workers file alerting their bosses to equipment problems or conditions needing attention.

"That's the guy in the field, having an itch," Grobe said. "How he writes it down, how the company responds to that, how they identify corrective actions and follow through - that is one key indicator."

Davis-Besse's response to the discovery several months ago of evidence that the bottom of the reactor - in addition to the lid - might also be leaking is another telling sign, Grobe said. Chemical tests of rust on the vessel's base couldn't rule out that it came from bottom leaks rather than from running down from the lid. Instead of waiting for the NRC to tell it what to do, FirstEnergy on its own proposed a much more extensive test.

To Grobe, that was a watershed of sorts, a hint that Davis-Besse's wilted safety culture might be reviving. "It's very clear to me that the people in the plant (now) feel very comfortable raising difficult issues, in a very direct way."

But the recovery, which has already cost FirstEnergy nearly \$400 million, will be long and difficult, warns Millstone veteran Blanch. "We really objectively did not observe significant improvement for more than two years," he said. "And it was a monumental effort."

For complete Davis-Besse coverage, go to [www.cleveland.com/davisbesse/](http://www.cleveland.com/davisbesse/)  
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# NRC debates 'safety culture' at nuke plants

06/13/03

**Stephen Koff**  
Plain Dealer Bureau Chief

Washington - The Nuclear Regulatory Commission operates in an orbit dominated by engineers, certainty and rules. There are rules for how hot a reactor can get and how cooling pumps are supposed to operate.

But no one dictates to nuclear power companies how to have a safe operating culture. That fact is bedeviling some of the NRC's top advisers as they continue sorting through the lessons of the near-disaster at the Davis-Besse reactor near Toledo, where general management malaise - a defunct safety culture - was determined to be an underlying cause of an undetected hole in the reactor lid.

Can corporate safety culture be regulated? Can the federal government have a rule that tells utilities that own nuclear plants to look and act sharp?

A daylong hearing yesterday by the agency's Advisory Committee on Reactor Safeguards (ACRS) showed the depth of the riddle, with industry insiders at times disagreeing as to whether it's a fool's errand even to attempt to regulate a plant's so-called safety culture.

"I believe that the current regulatory process is adequate for giving us what we need," said Alan Price, a vice president at Dominion Energy's Millstone plant in Connecticut - a plant once shut down, before Dominion bought it, because of safety problems and cover-ups.

A one-size-fits-all mandate would be bound to miss something, Price and others said.

George Felgate, director of analysis at the Institute of Nuclear Power Operations, or INPO, said that "if safety culture is unhealthy, it shows up in the symptoms."

And the symptoms are the way the plant's equipment and components are performing, which already are regulated. INPO was formed by the industry to police itself after the Three Mile Island disaster in 1979.

But the issue clearly troubles George Apostolakis, an ACRS member and professor at the Massachusetts Institute of Technology.

The NRC is charged with protecting health and safety, he said, "and yet we're very reluctant to get involved" in an aspect that might have a real impact.

Thomas Murley, a retired NRC director of reactor regulation, said the very term "safety culture" had been in "the forbidden lexicon" of the agency for years. Yet, Murley said, "We know now that a good safety culture is essential to nuclear safety."

Until the hole was discovered at Davis-Besse in March 2002, the plant was getting the NRC's highest safety ratings. That fact, which was supported by hard data, makes it difficult to say objectively that Davis-Besse's safety culture was worse than that at any other plant, said David Collins, an engineering analyst at Millstone.

Furthermore, before the NRC can force plants to make certain changes, under its own rules it must prove that the changes are necessary for public health and safety. The NRC, whose rules are driven almost

entirely by formulas and mathematical calculations, could have a challenging time quantifying the specific value of a safety culture rule, agency officials acknowledged.

Felgate, of INPO, said his group has asked its members to look at their own management safety cultures. He said INPO would be better suited than the NRC to assess safety culture, and at least one ACRS member, Graham Leitch, agreed.

INPO's inspections and ratings of plants are said to be tougher than the NRC's - though Apostolakis noted that INPO, too, failed to catch the hole in Davis Besse's lid. But INPO as a rule does not release any of its findings to the public.

The fact that the government would consider asking a private group to help regulate nuclear plants - and keep its information from the public - did not appear to trouble ACRS members. Later in yesterday's meeting, however, Jack Grobe, an NRC official overseeing Davis-Besse as it makes repairs in hopes of restarting soon, noted the public's right to NRC information and the possible problem with INPO.

He also said that despite testimony to the contrary, he's not convinced each plant already is reviewing its safety culture. "I think the empirical evidence wouldn't support that [assertion] because we continue to have additional problems. Not as severe as at Davis-Besse, but additional performance problems."

The difficulty of dealing with safety culture was especially apparent late in the day, when several ACRS members disagreed about whether the matter could be regulated at all. ACRS member Dana Powers said he had yet to see a proven correlation between safety culture values and the prevention of a specific significant problem at a plant.

He added that the industry could see complying with new rules as a burden - and though he did not say so, Congress has allowed utilities to fight new NRC rules if they are seen as unduly burdensome.

Countered ACRS member Stephen Rosen: "It's better than nothing. We're sitting here doing nothing."

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# NRC lacks guidelines on safety culture

02/12/04

**John Funk and John Mangels**

Plain Dealer Reporters

Sometime in the next few days, federal regulators will sit down in private to figure out whether FirstEnergy Corp. has done enough to revive safety-first attitudes at its troubled Davis-Besse nuclear power plant.

But the Nuclear Regulatory Commission overseers won't be judging FirstEnergy against the agency's own safety culture standards. It doesn't have any. Instead, the NRC, with its consultants' help, will try to determine the adequacy of the company's own methods.

The agency's relative inexperience in overseeing safety culture improvements and its unwillingness to directly monitor safety culture pose problems, both for Davis-Besse and the rest of the nation's nuclear fleet, some experts say.

"The NRC will have a hard time saying Davis-Besse can't restart because of safety culture, because there aren't regulations," said Paul Blanch, an independent safety culture consultant and former ombudsman at Connecticut's Millstone nuclear plant, which had similar lapses in safety attitude during the 1990s

The assessment routine that NRC inspectors follow has "no meaningful guidance on how and when to intervene for a drooping safety culture," nuclear safety engineer David Lochbaum of the Union of Concerned Scientists wrote last week to the agency's governing board.

The agency's stance has been that safety culture declines can be inferred when a plant's equipment repeatedly fails, long-standing technical problems aren't resolved, or there is a jump in complaints from workers who feel that they have to go directly to the NRC.

But that oversight process failed to alert the agency that Davis-Besse's safety culture was disintegrating.

Lochbaum, David Collins and others want the NRC to look more directly.

Lochbaum wants the agency to better define for its inspectors what safety culture is and how to monitor it.

Collins, a safety culture authority and engineering analyst at Millstone, wants the NRC to require operators of all nuclear plants to educate their staffs about good

safety culture, then regularly measure employees' attitudes and report the results.

Even some members of the NRC's reactor safety advisory committee have raised concerns about whether the agency is doing enough to monitor safety culture. But the NRC's governing board has refused to go further.

"The commission has been pretty clear," said Bill Borchardt, NRC's deputy director of nuclear reactor regulation. "They have instructed staff to stay sensitive, but this is not an area in which they want us to have a dedicated [inspection] program. We don't want to get into the position where we're a co-manager of the facility. We're the regulator."

Despite that apparent hard line from headquarters, the head of the NRC's eastern region two weeks ago took the unprecedented step of intervening before a safety culture crisis erupted. Hubert Miller directed the owner of the Salem and Hope Creek reactors in New Jersey to evaluate the plants' safety culture and come up with a plan to fix their troubled work environment.

"There have been lessons learned from Millstone and Davis-Besse," said NRC eastern region spokesman Neil Sheehan. "I think a regional administrator who sees a problem like this has the ability to make these calls."

If nuclear plant executives would concentrate on building trust with employees and helping them reach their highest potential, the NRC wouldn't have to worry about safety culture inspections, said Lee Olivier, who led the transition at Millstone and is now president and chief operating officer of Connecticut Light and Power Co.

"The first thing you do is prove to people you care about excellence, and about them," said Olivier. "When you do these things, you build trust coupled with higher standards and expectations."

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# Glossary of Safety Culture Terms

As Low As Reasonably Achievable (ALARA)	A theory holding that full regulatory compliance (government and communitarian, NRC and INPO) is insufficient and that addressing all (reasonable) safety concerns identified by workers is needed to maintain operating risk ALARA (see opposing theory MRC, see James Reason ALARP).
CCA (Culture Corrective Action)	Actionable information to close a culture gap that is input into the site CAP (corrective actions process). A CCA is typically focused on correcting professional attitudes.
CCWE (Cost Conscious Work Environment)	An environment where employees exhibiting a strong cost focus are valued and employees exhibiting a safety focus (beyond minimal regulatory compliance) are either not valued or negatively valued (denigrated).
Culture Focus Area (CFA)	An area of potential culture weakness identified by a leadership behavior assessment such as SWIM – survey of worker interactions with management. A CFA provides no actionable information for culture remediation. Facilitated discussion with work groups and analysis is required before any gaps can be identified (see Edgar Schein “culture surveys do not and cannot measure culture”).
Corcoran Quote 1 (Quality Assurance)	As stated in the Code of Federal Regulations. Quality Assurance is the process for performing “all those planned and systematic actions necessary to provide adequate confidence that a structure, system or component will perform satisfactorily in service.” This goes well beyond the activities of the Nuclear Oversight Department. In fact, it implies that QA is the way business is required to be done.” (see SRFA).
Corcoran Quote 2 (Transparency)	Employees in regulated industries have been heard to say, “It is not my job to make the inspectors’ (or auditors’) jobs easy.” These employees could be disparaging transparency and setting the conditions for their own demise. The most disturbing consequential events include those in which it was impossible for the involved personnel to detect some of the causal factors before the event. Whenever a problem is found later than it should have been found inadequate transparency should be a line of inquiry. And the investigation of most consequential events reveals that one or more important harmful factors could have been found before the event. This goes for financial events, project management events, and regulatory events as well as safety events. Transparency is certainly not a panacea for all of the ills of the high hazard industries. On the other hand, though, <i>the power of transparency as a high hazard industry protective paradigm is still in its infancy.</i>
Degraded	Reduced in rank, reputation, esteem or value
DPM Arrogant, Dismissive, Refuses to Listen (ADRL) attitude	Widespread DPM attitude identified by safety culture consultant John Beck as a primary root cause of Millstone safety culture deficiencies. ADRL behaviors are toxic to the development of a healthy safety culture and defeat development of questioning attitudes, continuous improvement, and a learning organization.

DPM Don't Like It Leave (DLIL) attitude	DPM attitude that an employee (SCW etc) who cannot accept a management decision (that his or her safety issue need not be addressed) should either 1) accept the decision without (continuing) complaint or 2) go get a job somewhere else. A DPM with a DLIL attitude may encourage an employee to leave his or her group or department through some form of HIRD; such as treating the employee with contempt, making unreasonable demands, or damaging the employee's reputation by fabricating evidence of poor performance (see FON, see HIRD, see "shoot the messenger").
DPM Fabrication of negatives (FON)	A variant of "shoot the messenger" where a DPM fabricates or exaggerates worker negatives to encouraging a worker to leave the department (see "get rid of the messenger", see DLIL).
Ethic Cleansing	WHISTLEBLOWER ISSUES IN THE NUCLEAR INDUSTRY CONGRESSIONAL HRG. 103-521 "The industry systematically eliminates its critics in a methodology not unlike ethnic cleansing — or a more apt description in this situation, "ethic" cleansing. The industry's ethic cleansing seeks to silence the voices of those whose only concern is nuclear safety and ethics. An individual who questions either the inaction of the NRC or the licensee is conveniently and viciously discredited, demeaned, subject to psychiatric examinations, portrayed as a radical or a disgruntled employee, and eventually is cleansed by termination or buy-out. "
Ethical Attitude	Concern for the impact of one's behavior on people or the environment.
Going Navy	Personal views contrary to the group are not shared due to peer pressure (not due to any observable behavior or HIRD elements from the leadership team).
Healthy Organization Culture	Organization culture where behavior aligns with the stated desired (espoused) values (see "values").
HHI (High Hazard Industry)	An industry that operates and manages processes that pose significant inherent risk to human life or the environment. Examples: nuclear power industry, medical industry, chemical industry, various mass transportation, military, NASA.
HPM	Highly Professional Manager. A manager in a HRO that ensures stakeholder trust by managing excellence and relationships with integrity over time.
HIRD	Harassment, Intimidation, Retaliation, Discrimination. Adverse actions typically taken against a HEA employee for engaging in a protected activity. The adverse action is typically taken by a LEM to encourage the employee to either stop the activity, or to leave the workgroup or company.
HRO (High Reliability Organization)	The organization in a High Hazard Industry that operates and manages processes that pose significant inherent risk to human life or the environment. Example: a nuclear power operating organization.
INPO (Managing Defenses)	The defense in depth barriers are: worker, manager, internal oversight, external oversight. The way to manage defenses is to identify, assess and correct conditions adverse to quality in a timely manner.
Kings Afloat	A nuclear industry manager attitude (Perin <u>Shouldering Risks</u> ) "Some industry managers, especially Navy ex-officers, reenact the superior-subordinate role and brook no dissent ... some still scream and intimidate. Like captains of yore, some think of themselves as 'kings afloat' "
Messenger (Shooting the Messenger)	(Wikipedia) Shooting the messenger" is a metaphoric phrase used to describe the act of lashing out at the (blameless) bearer of bad news. To blame a problem on whoever reported it. To hold somebody accountable for a problem because he / she brought attention to it.

Messenger (Get Rid of the Messenger)	Strategies employed by DPMs to encourage unwanted employees to leave the department; such as HIRD, withholding promotions, and other discriminatory or culture toxic actions (see ADRL, DLIL, FON).
Minimal Regulatory Compliance (MRC)	MRC is an unproven management "brainchild" theory holding that optimal economics requires that those concerns of staff not associated with satisfying a regulator be ignored. MRC theory relies heavily on the regulator to manage risk, as over time the other "defense in depth" barriers (worker, manager, internal oversight) may become eroded (see "root cause analysis – Millstone", and opposing theory "ALARA").
MSM (Most Senior Manager)	Typically the "C" level manager in the HRO (usually but not necessarily the CEO). In nuclear power the CNO (chief nuclear officer) is specifically individually responsible for the quality of the safety culture that develops in the nuclear organization (the person Rickover might say at whom you can point your finger). Safety culture is also the primary individual responsibility of the MSM (the most senior plant manager) at the plant site.
Not a Team Player (NTP) attitude	A DPM attitude in a CCWE that an employee who raises safety concerns beyond what is required by regulators is "not a team player". NRC investigations at Millstone in the early 90's showed that employees who had raised safety concerns were being given poor performance reviews in the areas of "teamwork" and "communications".
Professionalism (Developing Professional Manager)	A DPM is a manager in a HRO that has been tasked with developing (improving) professional behaviors.
Professionalism (Low Professionalism)	LP is a CFA finding indicating a gap in leadership performance.
Professionalism (High Reliability Organization)	Leadership attitude in a HRO that reflects a commitment to continuous professional development, ethical practice, sensitivity to diversity, and a responsible attitude toward their profession, their stakeholders, and society.
Professionalism (Medical Organization)	From Roberts " <u>The Essential Guide to Medical Staff Reappointment</u> " Practitioners are expected to demonstrate behaviors that reflect a commitment to continuous professional development, ethical practice, an understanding of and sensitivity to diversity, and a responsible attitude toward their profession, their patients, and society.
Professionalism (High Professionalism)	HP is a CFA finding indicating no gap in leadership performance.
Professionalism Not Safe Enough (NSE) attitude	An employee attitude that indicates "I am more concerned with safety than cost". In a SCWE environment displaying this attitude increases promotion and advancement opportunities.
Protected Activities	In an HRO that is regulated as a matter of public policy, is unlawful for an employer to fire you or discriminate against you with respect to pay, benefits, or working conditions because you help the Regulator or raise a safety issue or otherwise engage in protected activities.
Quality Management DMAIC	A six-sigma quality management process consisting of five steps: Define high-level goals and the process. Measure key aspects of the process and collect relevant data. Analyze the data to assess cause-and-effect relationships. Improve or optimize the process based upon data Control to ensure that any deviations from target are corrected
Quality Management DMAMR	A six-sigma process (variant of DMAIC) applied to organizational (HRO) safety culture quality management consisting of five steps:

	Define [safety culture quality goals, process, and performance indicators] Measure [worker perceptions of leadership professional behavior in SRFAs] Analyze [discuss CFAs and determine if the perceptions of LP are valid] Manage leadership performance above a minimum SWIM level. Regulate site-wide culture performance above a minimum MRPB performance level.
Quality Management MRPB	Management and Regulation of Professional Behaviors. A quality management approach based on the theory that the quality of the HRO safety culture is determined by the collective professional management attitudes of the leadership team, and that these attitudes can be assessed (through behavior observations and facilitated discussions) and managed (through behavioral expectations, coaching, and continual ).
Quality Management (Safety Culture, Nuclear Power Organization)	Management actions that maintain the quality of the HRO safety culture by assuring that leadership team professional attitudes are sufficient to maintain SOE risk ALARA. Maintaining the quality of the safety culture is the general responsibility of the management team and the primary responsibility of the most senior manager. In a nuclear power organization, it is the primary responsibility of the most senior site manager and the specific responsibility of the Chief Nuclear Officer (CNO).
Quality Regulation (Safety Culture, Nuclear Power Organization)	Regulator actions that maintain the quality of the HRO safety culture by assuring that leadership team professional attitudes are sufficient to maintain SOE risk ALARA. Safety Culture Quality Regulation is the primary responsibility of the government regulator NRC and is the shared general responsibility of the communitarian regulatory INPO and the policy setting organization NEI.
Quality Management MRPB Number	A number providing an objective measure of a HRO (for example nuclear plant site) safety culture. After leadership SWIM survey results are vetted through the SMARTER process (facilitated discussions and fact-finding), the MRPB number is calculated by subtracting the number of SRFA workers affected by weak culture management from the total number of SRFA workers, and dividing by the total number of SRFA workers. Example: say a site has 1,000 SRFA workers. If the (vetted) survey results indicate a weak culture is affecting 200 SRFA workers, the MRPB number would be $(1000 - 200) / 1000 = 0.8 = 80\%$ .
Root Cause Analysis (Failure of Davis Besse Oversight Dept)	9/10/2002 FENOC Root Cause Analysis Report "It was determined that the root cause was that D-B's nuclear safety values, behaviors and expectations were such that oversight was not set apart, in terms of expectations and performance standards, from the balance of the station." [This implies that Oversight Group needs to maintain higher professional standards than other groups, and that this is acceptable. The DB RCE itself indicates a poor understanding of safety culture and safety culture management, of which Oversight plays (or should play) a major auditing role]
Root Cause Analysis (Davis Besse, Failure of NRC Analysis)	NRC blamed the system engineer and banned him from the industry for 5 years (I assure you this equates to "life" as he will never be hired by another nuclear plant). He lost his job, then he lost his house, then he got divorced, then he was criminally convicted. When asked "why did you convict?" One of the jurors said "I didn't think he was responsible but someone had to be held accountable"

Here is a system engineer modification request (to management) from 1994. There was a similar earlier one in 1990 and a similar one in 2001 (just before the event).

MOD 94-0025 (May 27, 1994): "Initiated MOD 94-0025 to install service structure inspection openings. Reasons for the modification include ongoing industry concern

involving corrosion of the Inconel 600 reactor vessel nozzles. There is no access to the reactor vessel head or the CRDM reactor vessel nozzles without the installation of the modification. Inspection of the reactor vessel head for boric acid corrosion following an operating cycle is difficult and not always adequate. Video inspections of the head for the CRDM nozzle issue and as follow-up to the CRDM flange inspection do not encompass a 100% inspection of the vessel head. Cleaning of excessive boric acid residue from the reactor vessel head also does not encompass 100%. Installation of these inspection openings would allow a thorough inspection and cleaning of the head. All B&W plants with the exception of Davis-Besse and ANO-1 have installed this modification.

In a 2000 report the system engineer had identified a probable CRD leak (through-wall leakage) that was signed by Operations management. Concerned about unusual large rivers of red streaks starting at the reactor head area running down the entire outside length of the rx vessel and dripping off the bottom, the system engineer brought 7 digital photos to show the NRC resident inspector, asking if the resident knew what it was. The attitude of the resident was: "if it is not a regulation violation, it is not my problem". And the resident took no meaningful investigative action.

Note from the DB Oversight Department report on the head cleaning:  
"Engineering displayed noteworthy persistence in ensuring boric acid accumulation from the reactor head was thoroughly cleaned."

*Do you think engineering was (in any way) a "broken barrier?" I don't. The point is, better RCE (root cause evaluation methods) for safety culture are needed. See my "four squared" RCE method it is a quantum leap in cultural RCE and clearly identifies the broken "defense in depth" barriers.*

[Therefore NRC should immediately:]

- 1) send an NRC letter of apology to the system engineer and
- 2) tell FENOC to provide back pay and
- 4) as compensation to retire him immediately with a full (30 year) pension.

If FENOC does not comply, I suggest NRC shut down one of the FENOC plants for an undetermined time until FENOC complies. This is justifiable based on a continuing low level of safety culture leadership attitudes and observable performance that (to date) remains uncorrected. *If NRC has trouble establishing a well founded basis for the regulatory argument, I can supply supporting information from communications I have had with John Beck and other sources. I will be supplying detailed information on this to the GAO later this year, and I will continue to take whatever actions I can to resolve this intolerable (and self-serving) injustice. I encourage NRC OI to address and resolve this as soon as is practically possible.*

Root Cause Analysis  
(Millstone, Palo  
Verde)

The direct root cause of the Millstone and Palo culture problems was the implementation of the (failed) business model "Reengineering" in the 1990's (see "Reengineering the Corporation Hammer, Champy). Reengineering was (and remains) a "brainchild" (unproven model) and since the 1990's >70% of companies who implemented it have failed (often catastrophically as did NU). A contributing cause at Millstone was a leadership that was "... arrogant dismissive and refused to

*listen to the issues and concerns of the people who make this place run*" (quoted from John Beck's final advisory letter to Millstone management) in 1996 there was substantial evidence that this attitude had for at least a decade extended to the regulators as well. The root cause of culture problems at Millstone today (and at many other sites) is more focus on cost than safety (see CCWE), leadership professionalism problems, and the continuing implementation of minimal regulatory compliance (see MRC).

Root Cause Analysis  
(Four Squared  
Method)

A root cause analysis method for culture that identifies safety leadership attitude gaps at four "defense in depth" barriers. At each barrier, four levels of leadership attitudes are examined from the least culpable (employee was not trained) to the most culpable (employee was afraid to raise or to continue to raise the issue)

*Leadership failure*  
WNT - Was Not Trained  
DNA - (Trained) Did Not Act  
GFE - (Trained, Acted) Good Faith Effort. Made several attempts to personally resolve the issue, but did not report the issue to management  
FES - Fear (of taking an) Ethical Stand. Issue was reported to management (or the CAP) at least once, issue was never adequately (fully, properly) addressed (was not resolved), individual was aware it was never adequately addressed, but fearful to continue pushing the issue.

Realistic  
Conservatism

NRC Strategic Plan (NUREG-1614, Vol. 3) As the agency continues to learn from operational experience and develops more effective ways of assessing risks and using risk-informed and performance-based approaches founded in "realistic conservatism," it is better able to make appropriate safety decisions and to better allocate resources to areas where they will have the greatest positive effect.

Regulatory Relief  
(Congressional  
Philosophy)

There is a debate in congress over whether the NRC should be able to impose requirements that are unquantifiable. Some feel legislation (to be effective) must force regulatory agencies to base regulatory decisions on costs, benefits, and calculated risks. Therefore, as long as safety culture regulation is viewed as "unquantifiable" (it is not, it is quantifiable) it is unlikely there will ever be sufficient impetus to enact effective safety culture regulation.

Safety Culture  
(High Reliability  
Organization)

In a High Hazard Industry, those Professional Leadership Attitudes that ensure intrinsically hazardous activities are managed such that risk to human life and the environment is maintained as low as reasonably achievable, thereby fostering stakeholder trust.

Safety Culture  
(INPO definition)

An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority."  
Unfortunately, not a true definition because what is being defined (nuclear safety) is in the definition (example) : "An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make ice cream sandwiches the overriding priority."

Safety Culture  
(Human Performance,  
Quality Management)

A human performance based safety system requiring maintenance and quality management like any other (e.g. electro-mechanical based) safety related system. NRC needs to include "Safety Culture" in the 10CFR50 Appendix B QA Topical Report so that operating organizations will dedicating the needed attention and resources to properly managing and maintaining organizational safety culture quality.

Safety Culture (Individual)	The professional attitude of individuals in a High Reliability Organization that ensures potentially hazardous activities do not harm people or the environment.
Safety Culture Quality Management (HRO)	Ensuring that safety culture remains ALARA (As Low As Reasonably Achievable) as a SOE contributing or causal factor. Maintaining the quality of the safety culture is the general responsibility of the management team and the primary responsibility of the most senior manager.
Safety Culture (OSHA)	An ethical attitude that helps ensure construction and maintenance activities are performed without injury.
Schein quote 1	Leaders create culture. It may be argued that the most important thing that leaders do it to correct the culture when it is found to be misaligned
Schein quote 2	Culture change happens through clear articulation of new behavior geared to some new value. Without stating the behavior, you're not accomplishing anything
Schein quote 3	The soft judgmental stuff that confronts people every day as reality tends not to be viewed as important or valid, yet what people do under those soft circumstances may make the difference as to whether you have a big incident or not
Schein quote 4	Good management produces safety. When there are safety problems it usually means bad management somewhere in the system. What makes safety culture so complicated is that we are trying to build safety into badly managed companies
Schein quote 5	At some point the safety assessors have to be prepared to call the problem what it is--senior executives who care more about finances than safety, middle managers who care more about productivity because that is what senior managers reward them for, and supervisors who suppress employee complaints and efforts to identify safety problems because it takes too much time to look into things and to convince their bosses about critical maintenance issues that may be surfacing.
Safety Culture Management	Managing the component of SOE risk contributed by human performance such that it remains ALARA: As Low As Reasonably Achievable.
Safety Culture Regulation	Regulating the element of SOE risk contributed by human performance such that it remains ALARA: As Low As Reasonably Achievable.
Safety Culture Warrior	An employee that holds professionalism to be a higher value than reputation or professional advancement. A SCW will continue to argue a position until his or her professional ethics are satisfied, even if the management team (or regulators or industry) may view the position as incorrect, or unnecessary or unreasonable and wasteful of time and resources.
Safety Conscious Work Environment (SCWE)	An HRO business environment where safety comes before cost. In a SCWE, employees trust that they will not be subject to HIRD for raising safety issues. In a true SCWE an employee exhibiting a reasonable pragmatic safety focus is appreciated and supported even if the focus exceeds minimal regulatory compliance (see MRC).
Safety Related Functional Area (SRFA)	An area within the organization responsible for fulfilling requirements of 10CFR50 Appendix B (see Corcoran quote 1).
SWIM standard	A pass / fail quality standard applied to SRFA managers. The standard that legislates (regulates) permissible behavior in a democratic society. If more than 2/3 of a workgroup view a managerial behavior as adverse to safety, leadership corrective actions are required.
Values	Beliefs and ideas about common goals and proper behaviors.

David Collins Public Comments  
NRC-2009-0485  
Feb 14, 2010

Questions for Which NRC Is Seeking Input

(1) The draft policy statement provides a description of areas important to safety culture, (i.e., safety culture characteristics). Are there any characteristics relevant to a particular type of licensee or certificate holder (if so, please specify which type) that do not appear to be addressed?

Suggest that NRC clarify what it is makes the nuclear orgs regulated by NRC (by the 10CFR50 "public policy" laws) similar (and different from other orgs that do not need this special federal oversight) which is that they all deal with hazardous (nuclear) materials and they all require safety cultures to ensure the materials are handled carefully and safely.

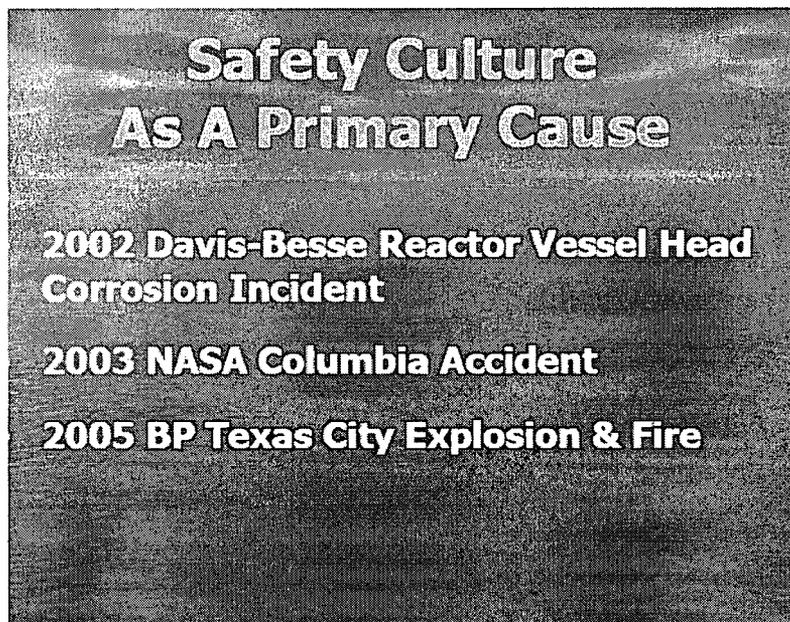
All the licensees (reactor, materials, medical) are members of what are called *High Hazard Industries*. All of them manage activities with *intrinsic and significant risk of harm to human life* (and the environment). All of them operate *High Reliability Organizations* that (like doctors) need to operate with a *high level of professionalism*.

[Characteristics Relevant to a Particular Type of Licensee]

All HROs (nuclear power / materials / medicine, NASA, chemical industries) manage safety culture in the same way (by assuring that professional attitudes are maintained) so there are no characteristics that would be relevant to one licensee but not relevant to the others.

*Below is Dave Compton's slide from a 2006 DOE ISM workshop I attended at Brookhaven National Lab. You can see nuclear is grouped with a couple of other HHIs / HROs (NASA, chemical industry). Dave appeared (I would say unusually) impressed with the presentation I submitted to the workshop and treated me as a kind of "special guest star" introducing me (with great pleasure) around to the many various people at DOE who manage safety culture.*

[http://www.efcoq.org/wg/ism\\_pmi/docs/Safety\\_Culture/Dec07/DAVID\\_COMPTON\\_DOEHSS.pdf](http://www.efcoq.org/wg/ism_pmi/docs/Safety_Culture/Dec07/DAVID_COMPTON_DOEHSS.pdf)



*Watching the various DOE ISM presentations (including one on the Davis Besse event) I eventually began to understand that our industry (nuclear power) is viewed as the "classic" HRO, and we are looked (up) to by others (in DOE anyway) for safety culture guidance. As I am not sure how evolved we are at this point in time, to me this felt a little scary, (I felt a little like Tim Allen in the movie "Galaxy Quest"). During the Davis Besse presentation, someone behind me asked the presenter a number of specific (really penetrating) questions on the root cause analysis of the DB culture, none of which the presenter could (begin to) answer. After the presentation, as people were leaving, I went over to the questioner and offered to try to answer the questions.*

*The questioner was stunned by my depth of my answers and asked me "who are you!!!???". I said I work in the nuclear power industry so I am familiar with the event. We then discussed safety culture management, and I was surprised at his level of understanding of safety culture (I would say more evolved than anyone I met at the recent NRC workshop). He said he oversees the nuclear weapon production facilities for DOD, and then asked me to go to Washington and meet with the Secretary of Energy, and explain my views on safety culture management (to date I have not done this). If I continue to be unable to get my own industry to embrace improved concepts for safety culture management in any meaningful way, I doubt it is likely that any amount of discussion would cause the nuclear weapons industry to do this.*

**(2) Are there safety culture characteristics as described in the draft policy statement that you believe do not contribute to safety culture and, therefore, should not be included?**

I covered this on 3 slides in my Nov 09 presentation to ACRS.

*I only had time to discuss about 10% of the (105 slide) presentation in the half hour I was allowed at ACRS, so I just concentrated on a few definitions. In my 105 slide ppt are enough slides for about 10 (30 minute) presentations. I also have an older 86 slide presentation (all different slides, many on more basic generic culture concepts) this is the one I submitted to the DOE ISM workshop in 2006. This one has material for about 9 (30 minute) basic presentations. Combined I have material for about 19 (30 minute) presentations on safety culture any one of which capable of putting any size, any kind of group to sleep. Probably 30% of the material in the older presentation is established basic (Schein, INPO etc.) stuff, about 70% is new stuff. The newer presentation is much more evolved, maybe 10% established 90% new. It appeared many people at the workshop were unaware of established concepts, so it appears a "culture 101" presentation might be useful (who knows, some people might even stay awake).*

Below are slides from my Nov 09 presentation to ACRS. What is needed is observable behaviors that indicate "do the right thing" attitudes (excellence, integrity, relationship) are good.

So seven of the components "decision-making, resources, learning, accountability, safety policies" I would say are good. I think covering "HIRD / SCWE" is important, but I would caution culture assessors to be sensitive to practical applications (work group discussions) and stay away from these "purple" kind of words and language. I captured these a little differently on the SWIM leadership survey below, but how they are captured doesn't matter (only THAT they are captured matters). See the SWIM slide for about a dozen others I would recommend adding.

*MIT Schein may be the "father of org culture" but his contemporary at MIT John Carroll is much more experienced with HRO industry (nuclear power, NASA etc) safety culture. Carroll says the survey is not the important thing, the important thing is the dialogs with the work force, the "opportunity for cultural examination". At a small plant (say <100 workers) you don't need a survey, you just take a day once a year and have a trained culture facilitator sit down with the workgroups. At a larger plant (say >100 workers) it becomes too resource intensive to interview the entire workforce, so you ask a few simple global questions about the culture, about "how we do things around here".*

*Caution about investigating the topics of SCWE, HIRD.*

*There is a concept in Stephen R. Covey's excellent book "Speed of Trust" that talks about a very important concept called "loyalty to the absent". It is essential (imperative) that managers are not "smeared, tried and convicted" in the culture focus discussions, but that workgroups view the sessions as "helping managers to learn how to better help the workgroups". Don't forget, criticizing "the food chain" in front of peers (some of whom may later try to ingratiate themselves to "Management" by reporting what they see and hear in the meetings) can be scary stuff to many workers.*

*So, instead of asking "do you see any HIRD / SCWE behavior" better to ask "do you see the org doing the right things" ethical behavior etc. Believe me, if you start out by build trust with the work groups right at the start, any HIRD behaviors (and any other culture toxic behaviors) will surface.*

## Learning to Assess Manage Regulate How Do We Do an Objective Assessment?

### What About the NRC 13 Safety Culture Components???

1. Decision-making
2. Resources
3. Work control
4. Work practices
5. Corrective action program
6. Operating experience
7. Self and independent assessments
8. Environment for raising safety concerns
9. HIRD, preventing, detecting
10. Accountability
11. Continuous learning environment
12. Organizational change management
13. Safety policies

## Learning to Assess Manage Regulate How Do We Do an Objective Assessment?

### Seven are Covered by the SWIM (Survey of Worker Interactions with Managers)

Excellence Behaviors	Integrity Behaviors	Relationship Behaviors
Communicates and models values	Does the right thing (behaves ethically)	Listens carefully to suggestions
Clearly communicates expectations	Communicates openly and honestly	Welcoming and respectful
Focus is on value not cost	Makes conservative decisions	Promotes diversity, development
Ensures training, resources	Addresses issues promptly, properly	Does not under manage, over task
Good problem-solver and coach	Uses failures to learn, not punish	Compliments more than criticizes
Promotes open, deep org learning	Ensures appropriate accountability	Promotes work / life balance

Decision-making

Safety Policies

Continuous learning

Resources

Decision-making

Safety Policies

Accountability

SCWE

HIRD

Decision-making

Continuous learning

Resources

SCWE

HIRD

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## Learning to Assess Manage Regulate How Do We Do an Objective Assessment?

### Six are Programs that are Audited by internal Oversight

Operating experience

Self and independent assessments

Work control

Work practices

Corrective action program

Organizational change management

#### Auditing these programs

Is of low value in assessing / managing / regulating culture as they are the “**resultants**” and not the “**determinants**” of culture. Behavior affects the quality of these programs, these programs do not affect the quality of behavior.

**Example** there was nothing wrong with the Davis Besse CAP, it was how management was using it to defer mods essential to full appendix B compliance. Not likely you will pick this up auditing the program, you need to have discussions with workers. You might say “what if we see large numbers of CAP items being deferred?” I would say “you will also see this in a healthy culture”.

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(3) Regarding the understanding of what the Commission means by a "positive safety culture," would it help to include the safety culture characteristics in the Statement of Policy section in the policy statement?

The definition should capture the essential concepts of what is HRO safety culture, and the policy statement should expound on, should explain the concepts. On the 6 hour train ride to the NRC safety culture workshop, I wrote a 13 page paper (titled "new definition HRO safety culture") that explains the basis for all of the concepts in the definition that I proposed at the workshop as the new industry definition for HRO safety culture. I recommend that NRC consider using this paper to developing a policy statement that is fully and properly integrated with the definition (or at least a policy statement that is fully and properly integrated with whatever definition is ultimately decided).

*After observing a full day of conversations and dialectics at the workshop, I suspected that I might have done a little more study on the topic of safety culture than any of the members of the workshop panel or gallery. Since I began studying safety culture in the mid 1990's (even before the Millstone event) this should not be surprising. Having been trained as an engineer (no training in organizational culture) I formed by own theory of culture dynamics by observing leadership behavior in the HRO that was the Northeast Utilities Nuclear (i.e. Millstone) operating organization well before I was aware of the existence of Edgar Schein. I identified an analog to Schein's three elements of culture, I said there was "the desired culture, the inspired culture, and the acquired culture". (If NRC ever develops regulations for culture which is essential if the industry is to have good quality culture) there may at some point also be "the required culture".*

*When I finally read Schein's "Leadership and Organizational Culture" it was a verification of my concepts. My "desired culture" was Schein's "espoused values". My "acquired culture" was Schein's "shared tacit assumptions". The third concept is not completely the same. My "inspired culture" refers to all the behaviors the leadership team does to create the culture, some of which do not necessarily align with the "desired (espoused) culture". This is where safety culture management lives, changing how the leadership team "inspires culture" so you wind up with the "desired culture". Schein's third element is the concept of "artifacts" or everything you see and hear around you. I would argue this "everything" concept is not very helpful for the quality management of HRO safety culture (however I cannot speak to and defer to Schein's "organizational culture" in general) for HRO safety culture, the important thing to focus on are those leadership behaviors that indicate the existence of the attitudes espoused in Rickover's "principles". If the concepts I espouse extend beyond what Schein talks about in his books, this should not be surprising. Schein is an expert in "leadership and organizational culture" (dynamics and assessment) whereas "HRO safety culture" requires the integration of some additional concept such as:*

1. safety risk (Reason, Carter / Steinbruner),
2. quality management (app. B, six sigma, Foster, Demings, Juran, Ishikawa, Taguchi, Corcoran) ,
3. human performance (INPO, Deming, Mallot, BSA - behavior systems analysis) ,
4. SOE event analysis (INPO, Mosey, Evan / Manion, McKeowan, Roughton / Mercurio et. al.)
5. leadership in a HRO (Rickover, Rees, Pate, Olivier, Marquardt, Espenship, Bagian, Rubio et. al.)

(4) The draft policy statement includes the following definition of safety culture: Safety culture is that assembly of characteristics, attitudes, and behaviors in organizations and individuals which establishes that as an overriding priority, nuclear safety and security issues receive the attention warranted by their significance. Does this definition need further clarification to be useful?

Yes further clarifications is needed, my paper "new definition HRO safety culture" explains in detail the clarification that is needed.

Here is my new (post workshop) proposed definition:

## Language and Responsibilities What is HRO Safety Culture (exactly)?

### **Clear definition – High Reliability Organization Safety Culture**

In a High Hazard Industry, those Professional Leadership Attitudes that ensure intrinsically hazardous activities are managed such that risk to human life and the environment is maintained as low as reasonably achievable, thereby fostering stakeholder trust.

### **This Definition Clarifies:**

What kind of characteristics? (*leadership attitudes that ensure stakeholder trust*)

What kind of attitudes? (*professional ones*)

What kind of organization? (*a high reliability organization*)

What individuals? (*the organization leadership*)

Why is attention warranted? (*managing potentially hazardous activities*)

Why issues significant? (*involves managing the risk of harm to people, environment*)

Something that tends to be overlooked is that H. G. Rickover not only developed and established the engineering design foundation upon which safety for the nuclear power industry is based (the "engineering" piece) but also developed and established the leadership foundations of a healthy safety culture (the "management" piece). This is why Dominion's CEO of generation Dave Christian has for over 20 years now carried a dog-eared copy of Rickover's "Basic Principles for Doing Your Job" in his wallet wherever he goes.

Rickover's "Principles" are those leadership-focused attitudes that set the criteria (the leadership "standards") for the quality management of HRO safety culture. They are the "professional leadership attitudes" that I refer to in my proposed definition for HRO safety culture, and why I remain in (occasional) email contact with Ted Rockwell, author of the excellent book "The Rickover Effect". Although written by Rickover's chief engineer (Rockwell) the book is as much about Rickover's leadership / management style as it is about his engineering philosophies. Rickover's "Principles" can be seen and read at the below web site.

[http://www.nightscribe.com/Military/rickover\\_basic\\_rules.htm](http://www.nightscribe.com/Military/rickover_basic_rules.htm)

### **Responsibility -**

**"Along with Ownership comes the need for full acceptance of full responsibility for the work. Shared responsibility means that no one is responsible. Unless one person who is truly responsible can be identified when something goes wrong, then no one has really been responsible." H. G. Rickover.**

The point is, the concept of "professional leadership attitudes" needs to properly represented in the definition, and in addition the most important of Rickover's concepts for the quality management of culture ["leadership responsibility"] should be discussed somewhere in the text of the NRC policy statement.

Here is the definition of *Safety Culture Quality Management* from my Glossary, it is a central concept for maintaining safety culture quality, and as such needs to be discussed somewhere in the NRC policy statement:

Those management actions that maintain the quality of the HRO safety culture by assuring that proper leadership team professional attitudes exist and are acceptable to maintain SOE risk ALARA. Maintaining the quality of the safety culture is the **general responsibility** of the management team and the **primary responsibility** of the most senior manager.

*In a nuclear power organization, safety culture quality management is the **primary responsibility** of the most senior site manager and the **specific responsibility** of the Chief Nuclear Officer (CNO).*

(5) The draft policy statement states, "All licensees and certificate holders should consider and foster the safety culture characteristics (commensurate with the safety and security significance of activities and the nature and complexity of their organization and functions) in carrying out their day-to-day work activities and decisions. Given the diversity among the licensees and certificate holders regulated by the NRC and the Agreement States, does this statement need further clarification?"

Clarity has been the big problem with safety culture. Here are some suggestions to improve clarity:

**"should consider and foster the safety culture characteristics ... "**

Safety culture is a *human performance safety system* (see my safety culture glossary). For proper safety culture management to occur, NRC needs to clarify that safety culture (like any other safety related topic) requires quality management, and so needs to be considered within the appendix B safety culture quality management framework.

*Safety Culture (Quality Management)*

*A human performance safety system requiring maintenance and quality management equivalent to any other (e.g. electro-mechanical based) safety system. [NRC needs to include "Safety Culture" in the 10CFR50 Appendix B QA Topical Report otherwise operating organizations will not dedicate the attention and resources needed to properly manage and maintaining organizational safety culture quality, and culture-based SOEs such as the Davis Besse event will continue to occur].*

**"commensurate with the safety and security significance of activities ... "**

What kind of "safety and security significance?", are we dealing with protecting money in a bank? CIA national security interests? Instead simply say that nuclear (power, materials,

medical) are all members of a type of industry known as a HHI, and then provide the definition of a HHI.

**“and the nature and complexity of their organization and functions in carrying out their day-to-day work activities and decisions”**

What kind of “nature and complexity”, are we doing brain surgery? Rocket science? (one of my favorite sayings mixes these metaphors: “this isn’t rocket surgery you know”) ☺

Just say nuclear (power, materials, medical) all manage processes that present intrinsic and significant risk to human life and the environment, and then simply provide the definition of a HRO.

(6) How well does the draft safety culture policy statement enhance licensees' and certificate holders' understanding of the NRC's expectations that they maintain a safety culture that includes issues related to security?

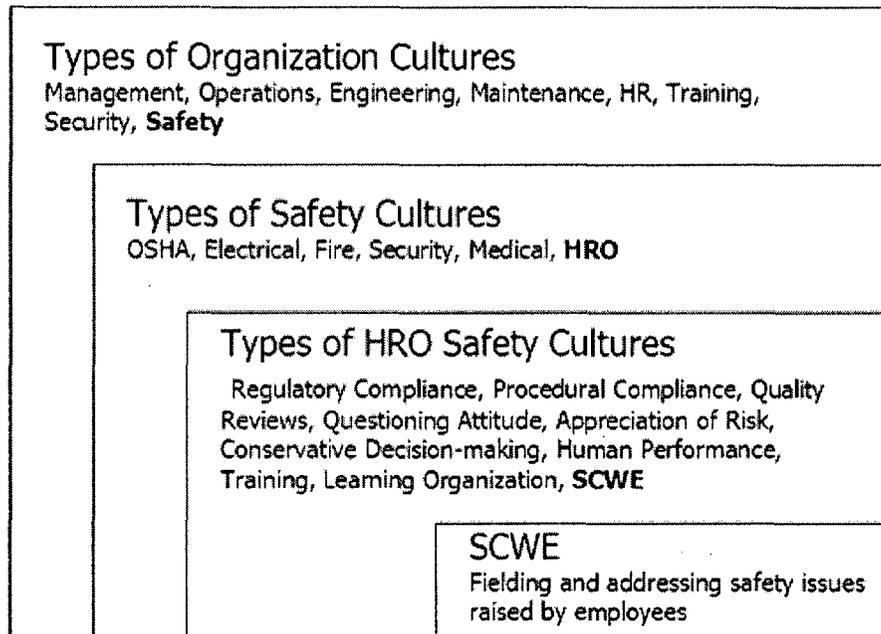
At the workshop I created and presented a simple ppt presentation to try to explain how safety is an *attitude*, not a function, that safety culture is the *attitude of the operating organizations* (specifically the “do the right thing” professional leadership attitudes in the organizations).

“Security” is a safety related function and “The Security Department” is the organization that implements the security function (the same is true for the engineering, operations, maintenance, management, oversight etc. functions and departments).

So it is not appropriate to add the word “security” to the definition and it would similarly not be appropriate to add the words (engineering, operations etc) to the definition.

Hopefully the following slide will help clarify the different kinds of safety cultures within the organizations. As you can see not all of them are nuclear (HRO) safety cultures. Many have elements of both OSHA and HRO safety cultures within the departmental “safety cultures”.

## Language and Responsibilities Why Not Use Proposed NRC Definition?



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(7) In addition to issuing a safety culture policy statement, what might the NRC consider doing, or doing differently, to increase licensees' and certificate holders' attention to safety culture in the materials area?

I am in reactor power so I will leave this one to the materials people to answer specifically, but in general NRC might consider recognizing safety culture as a *safety related topic* (recognizing that safety culture is a *human performance based safety system*) and after doing this, NRC might consider adding safety culture to the appendix B QA topical report.

This action will assure that the quality of safety culture is managed and regulated to an established minimal level of quality performance (as it should be, and as it should have been as soon as the concept was first identified as a safety related topic following Chernobyl).