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General Comment

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Comments on NEI safety culture pilots being implemented now
People who have commented on my culture methodology
Proposed safety culture definitions
My culture bibliography (bookshelf)
"The true university of these days is a collection of books"
- Albert Camus

Attachments

NRC-2009-0485-DRAFT-0013.1: Comment on FR Doc # E9-26816
NRC-2009-0485-DRAFT-0013.2: Comment on FR Doc # E9-26816
NRC-2009-0485-DRAFT-0013.3: Comment on FR Doc # E9-26816
NRC-2009-0485-DRAFT-0013.4: Comment on FR Doc # E9-26816
NRC-2009-0485-DRAFT-0013.5: Comment on FR Doc # E9-26816
NRC-2009-0485-DRAFT-0013.6: Comment on FR Doc # E9-26816

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How NEI May Prevail On Culture Regulation (Again) And Why NRC Should Not Let This Happen

2002 PLAIN DEALER ARTICLE –

ACRS Chairman, MIT Nuclear Engineering Professor Dr. George Apostolakis:
"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."*

The Root Cause: Lack of Professional Attitudes

I have for sometime now viewed NEI somewhat as my philosophical "enemy" as NEI has historically been against any kind of NRC regulations for safety culture. I have always held that the only effective way to (assess, manage and regulate) safety culture is to manage "professional leadership attitudes" or what INPO CEO Zack Pate in a 1989 speech called "professionalism" (attached, excerpt provided below).

> "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."

NEI, An Organization Controlled By Industry Manager, Has A Different View

NEI Comments on Proposed Changes to (NRC Safety Culture) Inspection Procedure 95003 and Manual Chapter 0305 [attached]

> "NRC's conduct of an NRC Safety Culture Assessment as described in these pages oversteps the bounds of a regulator and into the prerogatives of a licensee in organizing and managing their power plant. **Prying into performance evaluations and leadership assessments, to cite two examples, is beyond the appropriate bounds of the NRC."**

I agree with NEI that NRC should not do this, but NRC needs to require licensees to do periodic leadership evaluations and to make the data available to NRC. If there is an ROP finding or violation that may have a cultural root cause component, NRC needs to evaluate whether the root cause is failure in the "defense in depth" barrier that is Management. [The "defense in depth" cultural barriers are: worker, management, internal oversight (QA department), external oversight (NRC, INPO)].

> "This section discusses attitudes, which is strictly subjective. A regulator must regulate to process, procedures and regulations and not assess attitudes. **No criteria exist to assess attitudes nor would any criteria be able to be effectively applied to individuals. The concept of evaluating attitudes, perceptions and values is very dangerous and irresponsible and should be removed from the procedure."**

Good point, but the wrong conclusion. Criteria exists which can be (often has been) effectively applied to individuals. This was done at Millstone during recovery, I did this myself in the Oversight Dept as part of a study in 2000, TOSAN does this in the nuclear industry (and beyond), the Naval Safety Center does this, many have done this, the problem is not that it cannot be done (it very clearly can) the problem is that NEI does not want to do it.

> **"An NRC review of individual (leadership) performance appraisals, even with names removed is inappropriate. There are privacy and confidentiality considerations which could put a licensee in a difficult legal predicament."**

Not evaluating attitudes is the dangerous course. There is nothing "illegal" about reviewing the behaviors of managers. Again, NRC should not do this (just like the NTSB should not do this for trains or airlines) but NRC should require that licensees do this and make the records available if there is a violation.

When we say "managing professional attitudes" what exactly are we talking about?

Consider the recent train accident that occurred because a train conductor was texting while driving, it was likely not the first time, and it is likely someone on the train crew observed this behavior previously. Consider the airline pilot and copilot that recently put a commercial jet on "autopilot" and slept while the jet flew hundreds of miles past the destination, it is likely this was not the first unprofessional action observed by the crew. If crews (workgroups) are periodically asked (anonymously) if they know of any quality probems (such as unprofessional behaviors) these kind of things can be reported and addressed (managed, identified and corrected) before a significant event occurs.

What About Nuclear?

At Davis Besse there were multiple "defense in depth" failures. There are three engineered "defense in depth" barriers at a nuclear plant: the fuel cladding, the reactor piping, and the big reinforced cement containment structure. There are also four (cultural, safety attitude) defense in depth barriers:

1. Worker
2. Management,

3. Internal oversight (the QA department),
4. External oversight (NRC).

Safety culture management (regulation) is about managing (regulating) the quality of the attitudes at these barriers.

At Davis Besse, the NRC believes the worker barrier failed and blamed the system engineer for the failure (for not cleaning the reactor head) and the NRC banned him from the industry, and he was criminally convicted (see attached).

However, the "worker" barrier was not really a broken D in D barrier. With proper (and robust) culture management, the barriers that were actually broken (management, internal oversight, external oversight) could have been identified and corrected before an event occurred.

Here is a description of the D in D failures that (unfortunately) you will probably not see on the NRC web site.

Why NRC Needs To Implement More Effective Safety Culture Regulation

The Davis Besse system engineers made three reactor modification requests (in 1990, 1994, and 2001) for modifications that would make it physically possible to clean the reactor head. Here is the text of one of them, the 1994 request:

> 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 August, 2001 system engineering requested again that three large holes be cut in the Service Structure to allow viewing [inspection] and cleaning. DB managers still did not approve the modification request. The system engineer was accused of hiding that the reactor head had not been fully cleaned, but if the system engineer was trying to hide things, why did he author condition Report (CR) 2000-1037 which identified the leaking control rod drive:

The bottom of the flange of G9 drive is inaccessible for inspection due to the boron buildup on the reactor head insulation, not allowing full camera insertion. Since the boron is evident only under the flange and not on the vertical surfaces, **there is a high probability that G9 is a leaking CRD.**

When the system engineer says "a leaking CRD" what he is saying there appears to be a primary boundary (i.e. reactor coolant piping) through-wall crack. If you suspect through-wall leakage, per technical specifications you are supposed to shut down the plant within 6 hours. Of course shutting down under this scenario is very costly, we are looking at a revenue stream loss of about 1.5M / day likely to last for a couple of months, so we are talking a repair cost of probably around 100M in lost revenue plus additional millions for the repair itself.

My understanding is a high level FENOC manager (I think a vice president) appealed to a high level NRC manager (in NRC NRR) saying "we believe we have evidence of through-wall leakage, but we believe the risk of continuing to operate to our scheduled refueling date in March is low, so we ask that NRC allow us to keep operating" [see attached UCS and WISE articles] although in (clear) violation of tech specs, NRC allowed FENOC to keep operating until March, at which time it was discovered that the CRD leak had created a (very scary) acid hole. Why did the NRR manager allow DB to keep operating?

1. He did not listen adequately to the arguments being put forward by some members of his own staff
2. He was not adequately trained in Operations and he failed to adequately investigate the tech spec requirements

Since 2002 NRC has done a very good job improving it's own internal safety culture (essentially doing a better job listening to the concerns of staff) consequently in May 09 NRC was rated the best place to work in government (for the second time). The 2002 inability of NRC to have a questioning attitude and to listen carefully (the inability of the NRC resident inspector to listen to the DB system engineers, the inability of the NRR manager to listen to NRR staff) and the ability of NRC to listen well at the Feb safety culture workshop are evidence of effective NRC culture management (effective safety culture management of the 4th D in D barrier).

How do I know so much about all this stuff?

After the Davis Besse event many plants with similar designs decided to replaced their reactor heads. Millstone 2 was one of these plants. As a long time (25+ year) design engineer I was one of two project engineers that headed up the head replacement teams. I was also an Oversight assessor for a couple of years (where I did a safety culture survey and study), and was acting Human Performance supervisor for a while. For the past 2 years I have been in Organizational Effectiveness working as an INPO operating experience coordinator. INPO keeps a bunch of objective metrics on the 100 operating plants in the industry. For most of my time as an OE coordinator, I was rated by INPO #1 in the industry.

I have a masters in executive management and leadership (an Ivy league level program, adjunct professors from Yale, Harvard, Cornell) I did my thesis on safety culture, which has since been referenced by other thesis papers. After Davis Besse in 2003 NRC ACRS invited me (and about a dozen others) to present views on safety culture. The workshop was attended by about 50 members of the media, a number of whom were reporting on Davis Besse which is why I am quoted in a half dozen Davis Besse articles. In 2005 I

assisted MIT with an EPRI project to develop a dynamic system model for safety culture. A couple years ago I tested some software for a company developing a manager training simulator for safety culture.

When We Say Safety Culture Assessment, Management, Regulation, What Exactly Are We Talking About?

All bona fide safety culture experts will tell you **that safety is an attitude**, and **that culture is "how we do things around here"** and that the safety culture in an organization is "how" the managing leadership decides "we are going to do things around here". All bona fide safety culture experts will tell you that ***safety culture assessment*** requires looking at the culture building behaviors of all the members of the managing leadership and asking "are they doing the right things?" and that ***safety culture management*** is making sure the managing leadership team are in fact "doing the right things" and that ***safety culture regulation*** is the regulators making sure that licensees are doing proper assessment and management. In "INPO speak" this is called being able to ***identify, analyze and correct*** culture problems. In "NRC speak" this is called culture ***PI&R (problem identification and resolution)***.

How NEI May Prevail On Culture Regulation (Again)

If I can take a little transcribing license and combine the previous NEI comments:

> **"An NRC review of individual (leadership) performance appraisals, even with names removed is inappropriate. The concept of evaluating attitudes ... is beyond the appropriate bounds of the NRC. No criteria exist to assess attitudes nor would any criteria be able to be effectively applied."**

Lately people like myself and others have been helping NRC to see how culture can be (objectively, effectively) managed and regulated. This may be "scaring" NEI into action – NEI appears to be using it's considerable industry influence to pilot an approach that is not leadership focused, and push for acceptance.

My views on safety culture regulation do not align (at all) with NEI. Therefore, it may not be a surprise that no one at NEI said anything to me about a pilot being implemented at (a different nuclear plant) at my own company. Not until middle of Feb (about a week before I retired on Feb 24th) did I (by chance) find out about it. Our self assessment coordinator told me about a self-assessment write-up on an NEI safety culture pilot that might interest me.

The indicated that the metrics were poor (that problem identification was poor), that the gap analysis was poor, that the actions to enhance safety culture were not clear (so the corrective actions / problem resolution part was poor).

The final comments were "subjective, no quantitative comparison, no acceptance criteria". All the same things I have been arguing for a decade need to be corrected for safety culture assessment, management, regulation to occur. Yet the overall score of the SA was an "A"

(92.8%) because it had things like good management support, and clear process instructions. It is like saying "great workshop - spacious, clean, good lighting, the only problem is that the major tools don't work (the drill press, the table saw, the vise).

The day after our SA coordinator gave me the SA, the manager of the group that implemented the pilot happened to be visiting Millstone and working in a conference room right in our department (I coul not pass up the opportunity) I started talking to him about culture assessments in general and how they are rarely "leadership focused" but need to be (yes, yes of course he agreed) and how the industry needs to develop clear acceptance criteria or we will never really be able to clearly identify gaps and implement effective corrective actions (yes; of course, of course he agreed) then I talked about the weaknesses pointed out in the SA performed by his own department!!!

Now, I was calling "his baby" (not the "industry's" baby) ugly. So now he said:

> "No, that's not true, we have developed some very good corrective actions"
>
> "I don't think so" I said "Not according to the self assessment from your department "
>
> "That's not true, that's not what it says" he said
>
> I said "yes it is, did you read it?"
>
> "I will have to look into this" he said.

This illustrates how NEI may be able to establish their methodology across the industry, even though in 2000 Sorensen described why such approaches are flawed and ineffective. In 2003 I was quoting Sorensen's conclusions during my presentation to ACRS (who had commissioned Sorensen's study) it became clear that the ACRS members were not even superficially familiar with the conclusions in their own study. No one studies this stuff. So, NEI is like the "one-eyed man" in the land of the blind. When it comes to culture issues, industry managers are (for the most part) just as blind as NRC and INPO. They don't understand culture, they don't want to understand culture, they just want to say "thank you NEI for solving this long standing problem, what a wonderful approach!!!" and we are no farther along than where we were right after Chernobyl.

Examining The NEI Approach

I presented to ACRS on safety culture management (mostly safety culture definition) in Nov 09. NEI presented at that time as well and the NEI representative gave me a draft copy of NEI 09-07 which is the basis document for the pilot.

NEI 09-07 [Revision 0] DRAFT

Fostering a Strong Nuclear Safety Culture

Process Inputs
The following are the inputs to the nuclear safety culture process. For each input, there are data (e.g., deficiencies, violations, or weaknesses) which can be reviewed in combination with data from other inputs to determine whether there is a nuclear safety

1. Corrective Actions
2. Other Input Sources
3. Nuclear Safety Culture Monitoring Panel
4. Site Leadership Team
5. Site Response
6. Communication
7. External Input
8. Regulatory Oversight

On my "safety culture management flow chart" I would identify all of these as "culture outputs" (resultants, indicators) not as "culture inputs" (determinants, EIR behaviors). All of the things listed here are things affected by the culture, not things that affect culture.

All of these are what Schein calls "culture artifacts". They indicate something about the culture, but you don't know exactly what it is. They are starting points for continued investigation, like when you read your weight on a scale.

Let's say you notice you weigh 3 lbs more than the last time you weighed yourself. You ask yourself why? You might just figure you are eating too much or not exercising enough, or

- Maybe it is in the evening just after a big meal, maybe you will weigh your normal weight in the morning or
- Maybe the scale is losing accuracy.
- Maybe where you are standing on the scale affects the accuracy or
- Maybe someone re-calibrated the scale or
- Maybe the previous scale was defective and someone replaced it

Do you see the problem? The point is you don't know. On the subject of safety culture, you have to be very careful with the conclusions you draw. You have to be able to make a clear "chain of causality" between what you are measuring and operational safety. In Schein's "corporate culture survival guide" he talks about the do's and don't of organizational culture assessment. I am afraid I don't see very many of Sorensen's "chain of causality" or Schein's "do's" in the (current) NEI approach. I think this was reflected in the results of the self assessment.

Developing a State of the Art Approach

In 2000 ACRS contracted NRC Fellow John Sorensen to produce a paper (Safety Culture – A Survey of the State of the Art) that reviewed many different methods and identified some common failings with all of them. Sorensen recommended an approach that is based on scientific rigor (specifically is based on demonstrating the "chain of causality" between the metrics applied and the safety of operations) but no one (including ACRS, the group that commissioned the paper) has to date followed the recommendations in Sorensen's conclusions:

> *Conclusions*
>
> *"What is not clear is the mechanism by which attitudes, or safety culture affect the safety or operations … an important next step in understanding the relationship among safety culture, safety of operations and safety regulation would be to develop consensus on the essential attributes of safety culture. Consensus may not be easily reached, but investigators seem to have made too little use of past work, and constructed new frameworks rather than building on what has been done … The NRC regulatory program must assure that licensee's root cause analysis and corrective actions programs are capable of identifying safety culture issues … The role of the regulator needs to be determined, including the possibility that there is no role other than monitoring."*

In 2002 I sent my "chain of causality" approach to Sorensen for his review (and I also sent it to a couple of other safety culture "experts") here is Sorensen's first comment:

> *"The conceptual framework you have put together looks relatively complete. You will only find out if it is workable when you start trying to make the various pieces work together. Your idea of using leadership culture as a surrogate for safety culture is very interesting, and it will be a step forward if it indeed turns out that leadership culture is easier to quantify than safety culture. One of the problems with using safety culture as an indicator of operational safety is that, right now, safety culture has too many facets to be manageable as a performance metric. Someone has to identify a few key attributes that will adequately represent the organization. Perhaps leadership culture will work."*

One of the experts forwarded my approach to Lee Olivier, the Chief Nuclear Officer at Northeast Utilities hired to fix the culture at Millstone. Olivier was considered at that time the top safety culture manager in the nuclear industry. Olivier replied separately to the expert (and to me):

> *"Thanks for sending along Dave's piece on Safety Culture, or culture in general and leadership's impact on it. Notwithstanding the very flattering things he said about me in his write-up, it was very well done! He does an excellent job in creating the nexus between the leader who has a vision, inspires, challenges the organization to achieve excellence and is also committed to grow his/her people in the process, therefore*

setting the stage for even greater accomplishment, versus a leader who motivates by making the connection to what negative things will happen if you don't. Very well written indeed! Dave makes a clear case of the power of leadership to either positively, or negatively impact a business. Ironically it's so much easier in the short and long run to do it in a way that brings the best out of people. Thanks for sharing this exceptional document with me. Good to hear from you, as always. Lee"

Olivier's reply to me:

"David: Thanks for your kind note. I don't at all mind your using our experience at Millstone as a model of how to successfully make change. And as you have indicated in your e-mail, in any business, let alone nuclear, you can treat people with a deep-rooted respect and care and still make the hard business decisions. I believe the vast majority of folks understand that a business requires hard decisions, it's how it's communicated, it's the level of trust in the organization etc. Really centering around the three questions you quote (trust, commitment to excellence, does the boss care about me). Again, your paper was extremely thoughtful and well written. Good luck with it. Lee"

After reading Olivier's comments, Sorensen's sent me this comment:

"In reading Olivier's comments and re-reading my comments to you on the earlier material you sent, it occurs to me that I may not have given your ideas sufficient reinforcement. I think the idea of using leadership culture as a surrogate for safety culture is a good one. That will be especially true when you confirm that your survey produces a valid measurement of leadership culture. I think there is a reasonable chance that management could accept the kind of measurement you are proposing. The importance of suitable metrics shouldn't be underestimated. You have laid out a very promising approach. I think it has a good chance of advancing the "state-of-the-art."

The NEI Approach - Problems Not New or Unique

The same problems existed with all of the approaches that Sorensen surveyed, with the approach applied during Davis Besse recovery, and most of the approaches applied currently in the industry and with all of the approaches applied during the Millstone recovery save one which was leadership focused, and used the Schein assessment method.

How Do We Address The Issue?

INPO's "Analysis of Significant Operating Events" indicates that safety culture is the most frequently identified contributing factor. Without implementing effective assessment, management and regulation for safety culture; the industry will remain as it currently is, unable to identify and resolve culture problems with enough efficacy to avoid future significant events.

Addressing this issue requires:

1. Clearly defining HRO safety culture
2. identifying those professional leadership attitudes that determine the quality of the safety culture
3. Establishing objective quality acceptance criteria
4. Making safety culture part of the appendix B topical report so that it receives the necessary quality management resources
5. Developing objective regulatory criteria

Email message to me from Ed Schein:

"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.

What makes safety culture so complicated is that we are trying to build safety into badly managed companies!!! What do you think about that observation?"

Ed Schein

2002 ACRS Meeting Comments

MR. ROSEN: I don't want to be here three years from now with another plant, XYZ plant, that's had a serious incident, maybe even an accident, whose root cause was the same kind of safety culture deficiencies that happened at Davis-Besse.
MR. APOSTOLAKIS: Yes, of course.
MR. ROSEN: And that we didn't do something different. That we just saw Davis-Besse, knew what the root cause was and safety culture and said "Okay, we'll just keep doing the same regulatory stuff we have now."
CHAIRMAN BONACA: Exactly. Exactly.
MR. ROSEN: Because what that is is an embodiment of the commonest definition of insanity, right? Doing the same thing over and over and expecting different results.
MR. APOSTOLAKIS: I'm with you. I'm with you.

Federal Agency Scapegoating Nuclear Power Engineer for Near-Accident at Davis-Besse, Science Group Says

August 6, 2008

Trial Will Start Friday in Toledo, OH

Andrew Siemaszko, a former nuclear safety engineer at the Davis-Besse nuclear power plant, will go on trial this Friday for allegedly lying to the Nuclear Regulatory Commission (NRC) about conditions leading to a near-disaster at the plant in 2002. NRC documents, however, show that Siemaszko is not to blame. It was FirstEnergy, the plant's owners, which falsified reports to the NRC, not Siemaszko. In fact, Siemaszko was one work shift away from discovering the problem at Davis-Besse while cleaning the reactor head in 2000, but FirstEnergy prevented him from completing his task.

"Andrew Siemaszko is being used as a scapegoat," said Dave Lochbaum, director of the Union of Concerned Scientists' Nuclear Safety Project. "FirstEnergy and the NRC deserve the blame, not an engineer who was simply trying to do his job and keep the plant safe."

In 2002, after several deferred inspections, operators of the Davis-Besse reactor near Toledo, Ohio, discovered that boric acid had eaten a football-size hole in the reactor vessel. If it had gone undetected for another several months, it could have caused a worse accident than the 1979 core meltdown at Three Mile Island.

The NRC knew about boric acid leaks at reactors sharing Davis-Besse's design. On August 3, 2001, the NRC warned owners of a dozen plants across the country that it would shut down any reactor that had not been inspected for boric acid leaks by December 31, 2001. FirstEnergy, which was undergoing a merger with General Public Utilities, argued successfully several times to postpone inspections and keep Davis-Besse running. The merger negotiations apparently prompted FirstEnergy to avoid any appearance of problems at Davis-Besse by keeping the reactor generating electricity.

After the problem was discovered, the federal government fined FirstEnergy $33.5 million for violating safety standards, the largest fine of its kind in the history of commercial nuclear power. The NRC also conducted an investigation of what went wrong at Davis-Besse. It focused on the role of four engineers at the plant. The NRC forwarded the results of its investigation to the Department of Justice, which chose to prosecute the engineers for lying to the NRC.

A two-year grand jury investigation resulted in charges against three of the four engineers: David Geisen, Rodney Cook and Andrew Siemaszko. A fourth engineer, Prasoon Goyal, agreed to testify against the other three and was not prosecuted.

Geisen and Cook were tried together. Geisen had supervised some of the cleanup and inspection work on the reactor. Cook was a consultant who worked with FirstEnergy to report to the NRC on cleanup and inspections. On October, 31, 2007, a jury convicted Geisen on three of five

counts of lying to the NRC. The jury acquitted his alleged co-conspirator, Rodney Cook, of all four charges against him.

On May 1, 2008, Geisen was sentenced to a $7,500 fine, three years of probation, four months of house arrest, and 200 hours of community service. He could have received a maximum of five years in prison and a $250,000 fine.

Siemaszko's trial is set to begin on August 8 at the United States District Court in Toledo, Ohio. He was in charge of cleaning and inspecting the reactor head in April 2000. Prosecutors say he falsified work orders that FirstEnergy cited in its letters to the NRC arguing to keep the reactor operating. But NRC did not take Siemaszko's April 2000 inspection into account when making its decision to permit Davis-Besse to continue operating into 2002. This is a key point because NRC regulations say that in order for someone to be convicted of lying to agency, that lie must be material to NRC's decisionmaking process. But NRC documents show that even if Siemaszko falsified his work orders, the NRC did not consider those work orders relevant to its decision to allow FirstEnergy to keep operating the reactor.

In April 2000, Siemaszko had been working 16-hour shifts cleaning boric acid buildup from the reactor vessel. During the cleanup, the reactor vessel had to be shut down. After cleaning areas on the vessel, Siemaszko could inspect the surface and look for cracks and holes from the boric acid. Despite the NRC's repeated warnings about the danger of boric acid leaks, FirstEnergy prevented Siemaszko from completing the reactor vessel cleaning so it could restart the reactor and keep generating electricity. Had Siemaszko completed the cleaning, he would have found the hole caused by the ongoing boric acid leak.

The NRC and federal prosecutors claim that Siemaszko's work order for the reactor cleaning was false. They claim that Siemaszko stated he had cleaned and inspected the entire reactor vessel. But a look at the work order shows this is not true. Siemaszko never signed the section of the work order pertaining to inspecting and cleaning the reactor container. Siemaszko did sign two other sections, but they pertained to replacing covers on the reactor and installing scaffolding.

Days later, however, Siemaszko submitted a "condition report." Nuclear engineers use such reports to notify plant managers of problems ranging from burned out lightbulbs to near-meltdown dangers. Siemaszko's report summarized the NRC's warning to plant owners regarding boric acid leaks. It also noted that he had not been able to fully clean the reactor. FirstEnergy managers ignored the report.

Finally, NRC documents show that the agency was aware of that Siemaszko did not completely clean and inspect the reactor but disregarded that fact in its decision to allow FirstEnergy to continue operating. Because the NRC has admitted it did not take Siemaszko's work into account, it doesn't matter whether or not Siemaszko lied to the agency. Under NRC regulations, only relevant falsifications are violations of the law.

published by WISE/NIRS Nuclear Monitor on October 18, 2002

Davis-Besse: gambling safety for profits

NIRS has obtained nearly 2,000 pages of documents on the Davis-Besse affair under the Freedom of Information Act. The documents show that despite receiving false statements from First Energy, the U.S. Nuclear Regulatory Commission was aware that Davis-Besse was operating in violation of its license, yet still allowed the reactor to keep running.

(575.5448) NIRS - In early March 2002, First Energy (FE), true to its name, revealed a policy to drive electricity production ahead of federal safety requirements. This official policy of mismanagement pushed its Davis-Besse nuclear plant to the brink of disaster. Moreover, senior engineers at the United States Nuclear Regulatory Commission (NRC) realized a "high likelihood" that the reactor was so damaged that the risk of a nuclear accident grew greater with continued operation. Yet, federal officials were unable to issue an order to immediately shut the reactor for the necessary inspection and repair. Instead, the agency chose to ignore safety regulations and gamble with disaster to accommodate the financial interest of yet another corporate delinquent.

An NRC bulletin issued in August 2001 called for utilities operating pressurized water reactors (PWR) to inspect for dangerous cracks found in nozzles that penetrate the top of the reactor and house control rod drive mechanisms (CRDM). The NRC bulletin followed the discovery of cracks in Duke Power's Oconee reactor (see *WISE News Communique* 553.5309, "US: NRC ignores widespread safety flaw for decade"). Operators were instructed to look for "popcorn-like" traces of boron crystals as reactor coolant escaping from nozzle cracks. The bulletin warned that unchecked cracking in nozzles could grow to component failure, a loss-of-coolant-accident and reactor core damage. NRC required all operators to report inspection results to the agency by 31 December 2001.

However, Davis-Besse operators were eager to complete its two-year operating cycle scheduled for a refueling in April 2002. Company management sought a waiver from the inspection and an extension to the reporting deadline to meet their outage date. NRC engineers reviewing the Davis-Besse response were concerned that six of the seven other Babcock & Wilcox's (B&W) reactors like Davis-Besse had already found cracking. Only Davis-Besse had not fully inspected. A rare NRC "Order" to shut Davis-Besse for inspection by December 31, 2001 was finalized in November but never issued. In its place, a senior NRC officer reached a private compromise with the company to extend reactor operation to February 16, 2002.

When FE did inspect, workers found not only cracks but one of the 69 nozzles had come loose from the vessel head as a result of extensive corrosion around its base (see *WISE/NIRS Nuclear Monitor* 565.5385, "Millimeters from disaster").

REGULATIONS AND REALITY AT DAVIS-BESSE		
First Energy actions: Falsely claimed that the reactor vessel head was free of boric acid deposits after supposedly being cleaned	**NRC actions:** Realized correctly that there was a high likelihood of cracking and leaks based on operating experience	**Outcome:** No cleaning: 900 pounds of crystals and hole in vessel head. First Energy facing criminal proceedings
Regulations state: Davis-Besse should shut down within 6 hours of recognition of reactor coolant leakage	**NRC actions:** Initially proposed 31 Dec. 2001 deadline, then 16 Feb. 2002 after First Energy complained	**Outcome:** NRC admitted failure and launched internal investigation

Revelations into the near-miss accident at Davis-Besse go far beyond the reactor site perched on the shores of the Great Lakes near Toledo, Ohio. They warn of a dangerous gambit being played by atomic corporations in an increasingly competitive electricity market where public safety is sacrificed to ambitious production schedules. These revelations show that the NRC is willing to turn a blind eye on safety regulations to accommodate these same moneyed-interests.

Utility Admits Pushing Energy First and Placing Safety Last

For several years nozzles in the Davis-Besse vessel head were allowed to leak corrosive coolant through cracks growing in the welds. Throughout 2001, mystified operators and NRC inspectors ignored rising radiation levels and the growing presence of iron oxide particulate inside the containment. Meanwhile, leaking borated coolant flashed to steam on the carbon steel vessel head leaving a growing mound of caustic crystals.

MORE CORROSION

Inspectors have now found what appear to be rust and boric acid crystals on the bottom of the reactor vessel at Davis-Besse. The deposits are much less serious than on the reactor vessel head, but of course replacing the vessel head will not remove these new deposits. At present it is unclear whether these deposits arise from cracking in nozzles underneath the reactor, or from cleaning the reactor. Nevertheless, First Energy's share price has fallen following the announcement.

The Plain Dealer, 12 and 16 October 2002

NORTH ANNA 2

Recent tests carried out at Dominion Energy's North Anna-2 reactor near Richmond, Virginia found cracks in 49 of the 59 nozzles in the reactor vessel head, compared to 5 of 69 nozzles at Davis-Besse. Yet none of the North Anna-2 cracks were reportedly found in visual inspections last year. This underlines the importance of proper testing (see *WISE/NIRS Nuclear Monitor* 568.5402, "Large numbers of undetected cracks in the world's PWR's"). Boric acid deposits were also found at North Anna-2, but in much smaller amounts than at Davis-Besse. Dominion announced that it will replace the reactor vessel head rather than try to repair the cracks.

ENS, 10 October 2002; The Plain Dealer, 10 October 2002

WORKERS CONTAMINATED

At Florida Power & Light's St. Lucie 1 reactor, 32 workers inhaled radioactive particles when the reactor vessel head was pressure cleaned so that it could be tested for cracks similar to those found at Davis-Besse and North Anna-2. A further 6 workers were contaminated while a piece of equipment was being replaced. One of the contaminated workers had a radioactive particle imbedded in his underwear, which he brought back to his hotel room. The incident took place in the week ending 12 October 2002.

Palm Beach Post, 12 October 2002; Press Journal, 16 October 2002

The company was aware of the corrosion problem occurring inside the containment. Company documents from 1999 account for degraded containment radiation monitor filters due to the persistent accumulation of rust particulate.

"While the exact source of the rust is not known, the high particulate problem developed about the same time as Plant Startup (10 May 1999) after the mid-cycle outage... Subsequent filter changes were required every 24-48 hours,"

states a condition report. The report says,

"The Iron Oxide particles had a granule appearance indicating the source is from corrosion."

Rather than find on the source of corrosion, First Energy focused on keeping the reactor running and brought in HEPA filters to control the dust in the containment atmosphere.

The company was aware of a "large boron accumulation" on the vessel head. "Boric acid corrosion may be a concern," states a work order during the 2000 refueling outage. The work description is clear. Workers were to

"Clean boron accumulation from top of reactor head and top of insulation"

using high-pressure steam. The safety significance for issuing the work order was clear:

"The program is required due to degradation of the CRDM nozzle caused by Primary Water Stress Corrosion. In order to perform required inspections the nozzles as well as the penetrations must be free of boron deposits. Once the head is free from boron, new boron deposits may be easily noted and remedial action taken."

The order was signed off on 25 April 2000 as "Work completed without deviation." The reactor restarted for its two year run before the next outage.

In fact, the vessel head was never cleaned or inspected. Over 900 pounds of the acid crystal had accumulated on the reactor head. The boron deposit was left to eat a hole roughly seven inches in diameter and over six inches deep through the top of the carbon steel vessel head. A thin stainless steel inner liner, approximately 3/16th inch (less than 5mm) thick, was all that remained at the bottom of the cavity. With the load bearing iron oxidized into dust, the liner bulged out into the cavity from the reactor's internal pressure of over one ton per square inch. The liner, never intended as a pressure bearing material, cracked from the internal stress. Davis-Besse was unpredictably close to shearing open the vessel in a loss-of-coolant accident much worse than the 1979 core-melt accident at Three Mile Island-2.

In August 2002, FE offered federal regulators its analysis of the company's failure to identify and prevent the extensive corrosion of a principle safety component. The company's new and now "humbled" executive officer told NRC that "There was less than an adequate nuclear safety focus. There was a focus on production, established by management, combined with taking minimum action

to meet regulatory requirements that resulted in the acceptance of degraded conditions." Indeed, we almost lost Toledo.

NRC Safety Concerns Eclipsed by Utility Financial Concerns

In theory, regulatory safeguards exist against the reckless operation of aging reactors. The NRC is mandated to "reasonably" assure the safety of the 103 U.S. reactors engaged in the dangerous business of splitting atoms to generate electricity. In practice, the Davis-Besse example warns that safety nets are rolled back to meet production schedules and maximize corporate net profits.

After NRC staff found dangerous cracking at South Carolina's Oconee Nuclear Station early in 2001, concerns over the prevalence of cracks and potential safety implications in all PWRs were raised. Thirteen of the nation's sixty-nine PWR ranked with the Oconee units as "highly susceptible." Davis-Besse was among that number. Staff focused concern on those units to shutdown and inspect vessel pressure boundaries and report back. This concern prompted the issuance of NRC Bulletin 2001-01 "Circumferential Crack of Reactor Pressure Vessel Head Penetration Nozzles" on 3 August 2001.

On 4 September 2001, FE requested the waiver. NRC engineers challenged the company request by preparing an "Order" to require a shutdown by 31 December 2001 for the safety inspection. Nearly two thousand pages of documents obtained by NIRS through the Freedom of Information Act reveal an array of staff concerns as they quietly began drafting the Order. As one NRC staffer wrote following FE's amendment request,

> "The level of degradation that has been found in other plants, if left undetected and uncorrected, would result in a gross failure of the reactor coolant boundary. On that basis, staff does not have reasonable assurance that adequate protection is achieved by plants that do not perform inspections that are sufficient to detect this type of degradation."

Davis-Besse's managers were not to be dissuaded by NRC concerns. On 11 October 2001, FE officials appeared before the Commissioners Technical Assistants to defend their waiver request. Senior managers testified before the Commission that all of Davis-Besse's vessel head penetrations were

> "free from characteristic boron deposits using video recordings from the previous 2 refueling outages"

made both before and after cleaning the head and

> "Davis-Besse has done more and better quality inspections than other plants."

In so doing, company managers provided patently false statements to the Commission. Internal NRC documents show that FE Vice President Guy Campbell pressured NRC officials to allow the reactor to operate until the regularly scheduled April outage.

> "I told him that based on the operating experience there is a high likelihood that they (Davis-Besse) have leaks - he agreed."

states the NRC-sourced email. The communication concluded,

> "I told him that the reactor coolant pressure boundary leakage would not satisfy the regulations or tech specs, that it would fail to maintain defense in depth and margins, and that there could be a crack large enough to cause them problems before April."

In fact, Davis-Besse's licensed condition required them to shut down within six hours of recognition of any reactor coolant leakage. The NRC was technically justified and legally authorized to immediately shut Davis-Besse down. But as a NRC senior official reported

> "we are exercising discretion noting it would be clearly punitive to immediately shut a plant down and they sit there for a month waiting to obtain the correct inspection equipment etc."

By NRC's own admission, the agency compromised safety regulations by deliberately allowing Davis-Besse to operate in violation of its operating license in providing the arbitrary 31 December 2001 deadline. This was a technically indefensible concession to the utility's financial interest. Yet even that was not enough for First Energy.

By letter dated 21 November 2001 a detailed Order was finalized by staff and signed by Nuclear Reactor Regulation Director Sam Collins. It was forwarded to the Commissioners through the agency's Executive Director of Operations. The Order was to be issued to the utility no less than 5 days upon Commission receipt. The Order states

"...a potentially hazardous condition exists and warrants the issuance of an Order"

to shut down Davis-Besse by 31 December 2001 and perform inspections on the vessel head.

An internal NRC memorandum dated the same day and exchanged between two technical assistants to Commissioners Nils Diaz and Greta Dicus reveals what happen next:

> "Sam Collins stopped by around 3:00 pm. RE: Davis-Besse status... Licensee does not want an order: perception; replacement fuel; financial markets... Licensee is trying to come with contingency plans if stopped at end of January or end of February. If February, would have fuel and contracts in place. Minimum impact. If January, significant."

The Order was suddenly withdrawn following a meeting with FE on 28 November 2001. Instead, Mr. Collins allowed Davis-Besse to operate until 16 February 2002.

Federal Investigations Mount As Davis-Besse Lumbers Towards Restart

The Davis-Besse damage and the negligence of the utility and the NRC has launched three federal investigations including a criminal proceeding against FE for providing false information and an internal investigation into how the NRC deferred its regulatory responsibility. At the request of Ohio members of Congress the U.S. General Accounting Office is also looking into the near-miss accident. A Republican-led Congressional inquiry has already quietly closed without any findings but the call for a Congressional investigation continues to be heard.

After going through an extensive "junkyard" of cancelled reactor construction projects, FE managed to find an unused B&W vessel head of similar vintage at Michigan's unfinished Midland reactor. The total cost to replace the corroded reactor lid, fix other equipment and buy replacement power now stands at US$400 million, mostly to be paid for by company stockholders. The utility sought restarting the reactor by early December 2002 but company projections are being delayed by an unraveling story of mismanaging an inherently dangerous industry.

Once again, NRC bowed to corporate concerns that idling a reactor with an early shutdown would be perceived poorly on the financial market. NRC will likely continue its business-as-usual approach to defer safety standards to protect the coffers of an economically struggling atomic power industry. The public interest community must remain focused on the fact that our safety is increasingly at risk from utilities running aging reactors harder while seeking to cut costs under diminishing regulatory oversight. Left unchecked, this kind of corporate advocacy over public safety becomes an increasingly dangerous bargain converging on nuclear disaster.

Source and contact: Paul Gunter, Reactor Watchdog Project, NIRS

Comments on Dave Collins Safety Culture Methodology (1999 – 2009)

"I don't at all mind your using our experience at Millstone as a model of how to successfully make change. You can treat people with a deep rooted respect and care and still make the hard business decisions...it's how it's communicated, it's the level of trust in the organization etc. Really centering around the three questions you quote (trust, commitment to excellence, does the boss care about me) Again, your paper was extremely thoughtful and well written. Good luck with it. Lee"	*Considered one of the most effective culture managers in the energy industry, in 2000 Olivier became CNO (Chief Nuclear Officer) of Northeast Utilities. Entergy hired Olivier in 2001 to address culture problems there but in 2002 NU hired Olivier back as president of CL&P. The 2001 book "Appreciative Leaders" profiles Olivier along with Dr. Warren Bennis and a number of other "culture positive" leaders.*
Hi Dave, I'm impressed with your work - it's well thought out and would have significant benefit if Millstone leadership would implement it.	*Dr. Michael Quinn, "The Cornerstone Group"* *Culture Consultant* *Headed the Employee Task Force Study of the Millstone culture*
David, I consider you to be much more qualified than any of the academicians, psychologists or navy nukes that I know or have read about. You have actual experience with nuclear safety culture where the "rubber hits the road".....ground zero on the firing lines.	*Dr. Jonathan Wert* *Management Diagnostics Inc.* *Management and Culture Consultant for the Industry*
Dave I welcome your survey being performed in the Oversight Department. I recommend the survey be administered across the Millstone site. I feel it would provide useful data to assist Oversight in performing it's SCWE monitoring function.	*Paul Parulis, Manager of Millstone Oversight*
There is a state of the art risk-based safety culture measurement method that has been developed by a technical specialist at Millstone. This person has studied the various culture measurement methods applied at Millstone post recovery. Working with unpublished MIT studies of nuclear plant culture, and various culture experts, this person has developed what may be an optimal tool for culture measurement.	*May 2003 Letter from Paul Blanch, Nuclear Safety Consultant, to the NRC Commissioners:*
Kathleen, Please tell David I am looking forward to working with him and Michael Golay of MIT. David and I have had many discussions, email and otherwise about safety and safety culture. I think he is among the finest intellects and communicators in this area. Don't tell him that if you are worried it might cause undue swelling in his head. - David Christian ;-]	*David Christian was Dominion CNO (Chief Nuclear Officer) until June 2009 and is currently CEO of Dominion Generation. Christian is highly educated insafety culture and was agreeable to a large scale trial of the Collins culture management approach at Millstone (and at other Dominion sites) in 2005 but there was resistance from some key members of the leadership team.*
"You can tell Millstone Leadership that the NRC would like your culture tool used to assess the operations departments at Millstone 2 and 3."	*Senior NRC Resident Inspector Steve Shaffer* *Nov 09*
"The conceptual framework you have put together looks relatively complete. You will only find out if it is workable when you start trying to make the various pieces work together. Your idea of using leadership culture as a surrogate for safety culture is very interesting, and it will be a step forward if it indeed turns out that leadership culture is easier to quantify than safety culture. One of the problems with using safety culture as an indicator of operational safety is that, right now, safety culture has too many facets to be manageable as a performance metric. Someone has to identify a few key attributes that will adequately represent the organization. Perhaps leadership culture will work." "In reading Olivier's comments and re-reading my comments to you on the earlier material you sent, it occurs to me that I may	*NRC Fellow John Sorensen* *Author of NUREG* *"Safety Culture – A Survey of the State of the Art"*

Comments on Dave Collins Safety Culture Methodology (1999 – 2009)

not have given your ideas sufficient reinforcement. I think the idea of using leadership culture as a surrogate for safety culture is a good one. That will be especially true when you confirm that your survey produces a valid measurement of leadership culture. I think there is a reasonable chance that management could accept the kind of measurement you are proposing. The importance of suitable metrics shouldn't be underestimated. You have laid out a very promising approach. I think it has a good chance of advancing the "state-of-the-art."	
"Dave, Very good stuff. Your tool, used intelligently, could be of benefit to management if they chose to take advantage of it. If nothing more, it would reinforce the already existing knowledge of where the "hot spots" were and why."	*John Beck* *Little Harbor Consultants* *Lead culture assessor Millstone recovery* *NRC Culture Oversight Davis Besse*
David "With your consent I would like to use some of your prepared materials as part of the SCWE training I do for the industry"	*Attorney Billie Garde*
David - I resonate with your formulation of trust as both "trust in their values" and "trust in their competence", i.e., trust that they care ... trust that they will act effectively and consistently with these values to get things done. I hope they elevate SCWE and leadership to where there can be regular assessments and reflective conversations around those assessments.	*Dr. John Carroll, Professor of Behavioral and Policy Sciences, MIT Sloan School of Management.*
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. What makes safety culture so complicated is that we are trying to build safety into badly managed companies!!! What do you think about that observation? - Ed Schein	*Edgar Henry Schein* *Emeritus professor at the MIT Sloan School of Management, has made a notable mark on the field of organizational development in many areas. He is generally credited with creating the term "corporate culture".*
I would like to stay in contact and hear more about how your work develops. In the UK we are facing a massive investment in the nuclear industry through both decommissioning and new build. Energy security and safety is probably one of the biggest challenges faced by the world today but most people seem to be blissfully unaware of this fact! Regards - Kathryn Mearns	*Kathryn Mearns IPRC* *School of Psychology* *University of Aberdeen*
Dave I think you are way more knowledgeable on the topic of safety culture than anyone I met on the task force. You should have been heading up the task force.	*John Fillion* *Supervisor Millstone Operations Oversight* *Member of a (three energy company) task force that developed a culture assessment methodology to respond to the INPO Davis Besse Red SOER. Fillian led the Millstone culture assessment team.*

Safety Definitions

Safety = An ***Attitude***

Your Personal Safety Culture = ***Your Safety Attitude***

An Organization's Safety Culture = ***The Combined Safety Attitudes Of The Leadership Team***

High Hazard Industry
An industry that operates and manages processes that pose significant inherent risk to human life or the environment. High Hazard Industries are managed by High Reliability Organizations. Examples: nuclear power industry, medical industry, chemical industry, various mass transportation, military, NASA.

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. Examples: nuclear power operating organization, air traffic control system.

Safety Culture (Human Performance, Quality Management)
A human performance based safety system requiring maintenance and quality management like any (e.g. electro-mechanical based) safety system. In the nuclear power industry, "safety culture" needs to be added to the 10CFR50 Appendix B QA Topical Report as a "safety related human performance system" so that operating organizations dedicate the resources needed to manage safety culture quality.

Safety Culture (High Reliability Organization)
Professional leadership attitudes that ensure hazardous processes are managed such that the risk to human life and the environment is maintained acceptably low, thereby fostering stakeholder trust.

Strategic Management
Irwin McGraw-Hill
JIM COLLINS GOOD TO GREAT
THE LEADERSHIP CHALLENGE
21st Century LEADERSHIP
McFarland Scott Children
JOHN C. MAXWELL
1001 WAYS TO ENERGIZE EMPLOYEES
OUR ENDANGERED VALUES
JIMMY CARTER
Managing Quality
MAKING HARD DECISIONS
EFFECTIVE BEHAVIOR IN ORGANIZATIONS
THE COST-EFFECTIVE ORGANIZATION
PROFIT BUILDING
REENGINEERING CORPORATION
PIERS PAUL READ
IDAHO FALLS
McKeown
Reactor Accidents
MINUTE MOTIVATORS FOR LEADERS
PROCESS CONSULTATION
HOW TO ASK SURVEY QUESTIONS
WESSLAGEN
Emotional Intelligence at Work
Influencer
Patterson • Grenny • Maxfield McMillan • Switzler
MAVERICK MANAGEMENT
FIRST, BREAK ALL THE RULES
MARCUS BUCKINGHAM AND CURT COFFMAN
THE ABILENE PARADOX
crucial conversations
FIGHT, FLIGHT, FREEZE
TYPE TALK
HOW TO WRITE FOR THE WORLD OF WORK
HOW TO WRITE
RICHARD RHODES
Theory of Constraints
Goldratt
STRUNK AND WHITE
Reactor Accidents
REES REFORMING THE WORKPLACE
HOSTAGES OF EACH OTHER
JOSEPH V. REES
THE CORPORATE CULTURE SURVIVAL GUIDE
ORGANIZATIONAL CULTURE AND LEADERSHIP
SECOND EDITION
Managing the Risks of Organizational Accidents
JAMES REASON
THE MORAL COMMONWEALTH
MANAGING THE UNEXPECTED
WEICK AND SUTCLIFFE
Roughton / Mercuno
LYRICAL AND CRITICAL ESSAYS
John F. Kennedy
IN HIS OWN WORDS
New Methods for the Analysis of Change
Latent Class and Latent Transition Analysis
ORGANIZATIONAL CHANGE
Statistical Models in Engineering
Applied Statistical Forecasting
Goodrich
THE EXCEPTIONAL PRESENTER
KOFORD
Human Competence
QUINN
DEEP CHANGE
QUINN
MASLOW ON MANAGEMENT
LEADING WITH VALUES
THE SPEED OF TRUST
STEPHEN M.R. COVEY
ETHICAL ISSUES IN ENGINEERING
The Nuclear Lion
MANAGING NUCLEAR OPERATIONS
AMERICA POWERLESS
Minding Machines
Shouldering Risks