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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARD

(ACRS)

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SUBCOMMITTEE ON RELIABILITY AND PROBABILISTIC

RISK ASSESSMENT

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THURSDAY, NOVEMBER 12, 2009

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. George Apostolakis, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

GEORGE APOSTOLAKIS, Chairman

SAID ABDEL-KHALIK

DENNIS C. BLEY

OTTO L. MAYNARD

HAROLD B. RAY

MICHAEL T. RYAN

WILLIAM J. SHACK

INVITED EXPERTS PRESENT:

EARL CARNES

JOHN WREATHALL

NRC STAFF PRESENT:

JOHN FLACK, Designated Federal Official

MARTIN VIRGILIO

JUNE CAI

AUDREY KLETT

VAL BARNES

MIKE CHEOK

CHUCK CASTO

CYNTHIA CARPENTER

DAN DORMAN

ROY ZIMMERMAN

ALSO PRESENT:

DAVID COLLINS

TOM HOUGHTON

ANTHONY PIETRANGELO

NAJMEDIN MESHKATI

C-O-N-T-E-N-T-S

AGENDA ITEM PAGE

Opening Remarks and Objectives --
George Apostolakis 4

Opening Remarks - Martin Virgilio 5

Proposed Commission Policy Statement
on Safety Culture 16

High-reliability Organization 82

Safety Culture Initiatives 130

Safety Culture in the Reactor
Oversight Process 186

Fostering a Strong Nuclear
Safety Culture 237

Stakeholder Comments on Safety Culture 282

Discussion 307

P-R-O-C-E-E-D-I-N-G-S

(8:32 a.m.)

OPENING REMARKS AND OBJECTIVES

CHAIR APOSTOLAKIS: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Reliability and Probabilistic Risk Assessment.

I am George Apostolakis, chairman of the subcommittee. Members in attendance are William Shack, Michael Ryan, Harold Ray, Said Abdel-Khalik, Arthur Maynard and Dennis Bley.

The purpose of this meeting is to examine the current status of the safety culture initiatives of the NRC and the industry. The subcommittee will gather information, analyze relevant information and facts, and formulate proposed positions and actions as appropriate for deliberation by the full committee.

John Flack is the designated federal official for this meeting. The rules for participation in today's meeting have been announced as part of the notice of this meeting. Previously published in the Federal Register in October 26th, 2009.

A transcript of the meeting is being kept, and will be made available as stated in the Federal Register notice.

It is requested the speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We have received a request from a member of the public, Mr. David Collins, to provide comments, and have allocated time on the agenda to honor this request.

We will now proceed with the meeting, and I call upon Mr. Martin Virgilio of the Office of Executive Director of Operations to open the presentations.

Marty.

OPENING REMARKS

MR. VIRGILIO: Thank you, Mr. Chairman. And good morning, gentlemen.

My role as the deputy director for operations includes being the executive sponsor for this project on safety culture. And that is what I'm here today opening for the staff.

I'd like to thank the committee for the opportunity for the staff to give this presentation today to give you some insights into the activities

that we have underway with respect to safety culture.

We strongly believe that a healthy safety culture is the foundation to good safety performance amongst our licensees, and will give you some insights as to our program and our activities around that belief.

Today with me is Dave Solorio and June Cai who are working on the staff on this project. June is our safety culture program manager, and Dave is the branch chief responsible in this area. There are also various people scattered around the audience from our program office, and from the Office of Enforcement, that actually has the lead for this, although is not really about enforcement. But it just so happens that we wound up with this project in that office.

And at the end of our presentation we really do look forward to hearing your questions and comments on the direction that we've taken.

If I could have the next slide please. This is just an overview of what collectively we are going to be talking about this morning, later on the staff will be presenting some additional information about the reactor oversight process. But for today's presentation and this morning's presentation we'll talk about the safety culture policy statement and

some of what went behind the development of that statement. We will talk about the importance that we see in a healthy safety culture. We will describe in some detail the policy statement, and the culture characteristics that we intend to address as we develop the policy statement.

We'll also provide some details on the contents of the policy statement, and some of the activities that we have underway.

And finally in opening what I want to make sure that I'm clear and that we are clear today. When we talk about safety culture we are really including security within that. I mean safety and safety culture are well used terms; sometimes especially when we are interacting with our international counterparts, when we put security in there it throws a very interesting spin on the discussion.

Our purposes today, when we say safety culture, we mean safety and security culture.

If we go to the next slide, we believe that operating experience has clearly demonstrated a nexus between safety culture and healthy safety culture, and nuclear safety. And when I say nuclear again, I may shorten that term, but I'm talking about all of what we do with reactors, fuel cycle facilities

and radioactive materials.

If you think back to operating experience, some of the major problems that we are all familiar with, if we think about things like Chernobyl, or you think about Tokai-Mura, or you talk about Davis-Besse or Peach Bottom - and there are several events at Peach Bottom, but here I am referring to the security officer inattentiveness.

To me it tracks right back to safety culture. If you think about what were the contributing factors. In the radioactive materials area there have been a number of medical events and overexposures resulting from ineffective controls over radioactive materials. And in each one of those cases I track right back to what I think are the characteristics of a healthy safety culture program.

So we believe that if you promote a strong and healthy safety culture you wind up with a good safety record amongst the industries that we regulate.

The next slide, what we want from this policy statement, or what we intended as we developed, is summarized on this slide. The policy statement should establish clear expectations. It should define what safety culture means to the NRC, and communicate this to the stakeholders. It should make it clear, as

we have in many other areas, that safety is the licensee's responsibility. We are not trying to take that on our shoulders, but we do have a role in the oversight of what the licensees do.

The next slide is a very important slide, and you will see it more than once today. It's the draft safety culture characteristics. Culture as you well know is all about attitudes and behavior, and the draft safety culture characteristics provide some I think tangible manifestations around what we are talking about. When I first entered the discussion about safety culture I was somewhat confused; I'll have to admit that. But as we developed these characteristics and studied the work of others - and particular INPO and others have done a lot of work in this area - you get to the tangibles. You get to realize that what we are talking about are things that are listed on this slide: the work practices, problem identification and problem evaluation; problem resolution, making sure you have adequate resources, making sure that there is accountability. All of these things are the tangibles that go I think to defining what is a healthy safety culture.

Next slide please. Here are some specific issues that we wanted to address in the policy

statement. Some of these are listed on the slide. As we engage the industry, now that the policy statement has been issued for public comment, one of our principal activities is to try to coalesce and find some agreement around some of these definitions and terms that we are using.

We have heard more than once from the industries that we regulate that it's really important that we align on some of the definitions and some of the terms the best we can, and I realize that is going to be a little bit challenging when you think of the broad spectrum of licensees and certificate holders that we are going to be dealing with. The reactors, rather sophisticated today. They have been doing safety culture for quite some time, and they have already developed their own systems, and their own means of communicating about safety cultures. But when you get out, and you are dealing with the radioactive material licensees, particularly some of the smaller mom-and-pop operations, this is new to them. So I think this is going to be very challenging.

Not long ago - it was just last month - I had an opportunity to speak at the Organization of Agreement States meeting. And as you well know,

Section 274(b) of the Atomic Energy Act has us delegating responsibilities for oversight of radioactive materials out into the agreement states. So they are going to be our agents.

So I went out there, and I spoke to them about safety culture. And they had puzzled looks on their faces. So it's going to be I think our challenge to bring the agreement states up to speed, and then to bring what represents the bulk of our radioactive material licensees up to speed through those agreement states. And we have been talking amongst ourselves. That's not a two week or a --

CHAIR APOSTOLAKIS: How many agreement states are there?

MR. VIRGILIO: Roughly 37 now.

CHAIR APOSTOLAKIS: Thirty seven? Okay. And 17,000 licensees.

MR. VIRGILIO: Yes, 17,000 out of about 22,000 licensees that we regulate are regulated by the agreement states.

CHAIR APOSTOLAKIS: And these are hospitals?

MR. VIRGILIO: They're medical, they're industrial and they are academic. So they're the full spectrum of activities out there. And if you think

about events that are still occurring here in the United States, and you think about the abnormal occurrence report that we provide to Congress every year, if you look at the last several years what you see is, it's dominated by medical and industrial events, and it's dominated by events that occur in the agreement states.

So if you think about where is most bang for the buck here, I tend to come back to, it's going to be in the materials licensees, and it's going to be working with the agreement states. But I digress. I'll get back on point so I don't take us off schedule, to the last slide in my opening remarks.

I'm going to turn the discussion over to Dave and June. They have taken a very strong leadership role in the development of the proposed policy statement, and they are going to give you a little bit more on the details of what's included in the policy statement.

CHAIR APOSTOLAKIS: So again, I know you said something about it, but why is the Office of Enforcement doing this, to make it clear it is not a research project or what?

MR. VIRGILIO: We're working with the office of research, and we have office of research

folks here. It just turned out to be how we were - it was just the project management of this activity. It just sort of flowed from the experts, where the experts were located, and the management.

CHAIR APOSTOLAKIS: So the way the agency is looking at this now is that we will have - do we actually have a policy statement out there now?

MR. VIRGILIO: Yes, it was issue on Friday, draft.

CHAIR APOSTOLAKIS: Friday? Okay.

MR. VIRGILIO: But I have to be clear. In 1989 --

CHAIR APOSTOLAKIS: I remember, there's another one.

MR. VIRGILIO: We have two policy statements out there. But the most current has been published for draft, for comment.

CHAIR APOSTOLAKIS: It is actually more detailed, also.

MR. VIRGILIO: Yes, was published last Friday.

CHAIR APOSTOLAKIS: So there is a policy statement out there. So the only - well, obviously we are soliciting now comments, right? This is the comment period. But the idea is for the agency to

modify and then issue a final statement, and then implement it? Is that what it is? Do we know enough to actually implement such a policy statement?

I've read the draft, and it talks about the attributes that you also had there. I wouldn't want to be the person who would actually try to implement such a policy statement. I wouldn't know how to do it.

MR. VIRGILIO: In issuing the policy statement we start the dialogue. And I'm not exactly sure where the dialogue takes us at this point. If you talk to the chairman, and you think back to the priorities that the chairman laid out in his Heritage speech, he's even thinking that there is a range of possibilities here that could take us all the way out to rulemaking someday.

But even he in my discussions with the Chairman and the Commissioners, this is about starting the dialogue on safety culture, and where the agency intends to go with respect to safety culture, and it's not clear to me today that the end game here is the issuance of the policy statement. There are going to be a range of options that are proposed.

CHAIR APOSTOLAKIS: The policy statement is out for public comment?

MR. VIRGILIO: Yes.

CHAIR APOSTOLAKIS: Ninety days, is that what it is?

MR. VIRGILIO: Yes.

CHAIR APOSTOLAKIS: So after the 90 days you will have comments, and presumably the final version will be issued some time after that.

MR. VIRGILIO: Or we may decide to do something else. I mean at the end of the 90-day comment period we could decide that gee, based on the comments we receive, it's not a policy statement we want to do; it's a rule. Or it's something else. It's a wide range of options; you could go from one extreme to the other.

CHAIR APOSTOLAKIS: I hope I will learn more today, but it seems to me, looking at the attributes that you have listed there, for some of them it is kind of clear what to do, like the corrective action program. But for some others I am not so sure, so it will be interesting to see what the reaction of the public will be, and the committee actually.

MR. VIRGILIO: And that's how we went into the publication of policy statement. We put it out there to start the dialogue, and that is clearly

how the Commission voted this out and the direction that they gave to the staff.

CHAIR APOSTOLAKIS: Actually it is very good that we are starting such an important discussion on this issue. Because I've been on this committee for quite a time now, and there was a time when the mention of safety culture was not too politically correct. Nobody wanted to touch safety culture. This is not engineering; this is not science; stay away from it. Now - I'm sorry for the interruption. Who is next?

PROPOSED COMMISSION POLICY STATEMENT ON SAFETY CULTURE

MR. SOLORIO: Good morning. My name is Dave Solorio. I'm the branch chief for the concerns resolution branch and the Office of Enforcement. In addition to safety culture activities, which are assigned to me group, we also deal with the agency's lead for discrimination cases and also the allegations policy and oversight.

I would just to remark to your question about how did the safety culture end up in our office. Already we are focused on safety conscious work environment. We are focused on allegations. We've focused the agency's differing professional fuels

manager, works in the office of enforcement. So it was also maybe one of the better fits in terms of where you would put this responsibility. Am I getting okay feedback from the mikes? Okay, I'm hearing echoing, and I'm not sure if it's affecting it.

The Office of Enforcement has the lead, as Marty said, for coordinating the agency's safety culture activities, and the key word is coordinating. We work with almost all the offices throughout the agency to coordinate this effort, because ultimately the intent here is to increase the focus on safety culture in all licensees we regulate. So therefore we need to work with all offices to achieve that goal.

Ms. June Cai has been introduced by Marty, and in addition to June I'd just like to acknowledge that there are a couple of other people who work with me on a day to day basis who are here today. Mr. Alex Sapountzis is here. He's senior project manager. And he's in the back, Alex, in the back.

And Ms. Maria Schwartz also works with us, but she couldn't be here with us today. Something very important came up for her. She is also a senior project manager.

I also appreciate the opportunity to speak with you today and look forward to your insights and

observations.

CHAIR APOSTOLAKIS: So we have moved on in terms of the agenda to the proposed Commission policy statement. Is that what we are doing now?

MR. VIRGILIO: Yes, we are going to move on to that, yes, sir.

CHAIR APOSTOLAKIS: Which Cindy Carpenter was supposed to do but I guess not.

MR. VIRGILIO: Yes, let me speak to that, sir. Cindy recently moved over to the office of FSME, as the deputy director there. And so we just recently received our new office director, Roy Zimmerman. So since I've been working as the branch chief in this area for awhile, they asked me to take over this.

CHAIR APOSTOLAKIS: Fine, all I wanted is to know where we are. Not that it matters.

MR. SOLORIO: All right, so next slide, please. You've already seen this slide. While the NRC is charged with responsibility for protecting health and safety that they - obviously the day to day operations of the facility lie with the licensees, and therefore they have to rely on their employees to report safety concerns.

The existence of a strong safety culture in which safety issues receive the appropriate

attention warranted is a critical underpinning of the NRC's regulatory oversight. Our presentation is going to cover the topics here on this slide. And I'm going to speak to a little bit of the background that got us here, and the direction from the Commission that led us to draft proposals, and Ms. Cai will provide some more details on what we've done and how we plan to get to the final outcome, which would be a final safety culture policy statement.

CHAIR APOSTOLAKIS: By the way the reason why we are here is just to brief the subcommittee, right?

MR. VIRGILIO: Yes, sir.

CHAIR APOSTOLAKIS: Will there be a point in the future where you will be requesting a letter from the committee, after the public comment period perhaps?

MR. VIRGILIO: Yes.

CHAIR APOSTOLAKIS: Okay, so this is just to get us started.

MR. VIRGILIO: Yes, this is at the committee's request that we come here today. You had originally a schedule that would have had us interacting with the Committee further on in the process.

CHAIR APOSTOLAKIS: The idea was to discuss ideas and thoughts.

MR. VIRGILIO: Yes.

CHAIR APOSTOLAKIS: So this is free for all, okay.

MR. SOLORIO: As Marty mentioned, we are in the public comment period. It just started last Friday. Next slide please.

First off I want to acknowledge that there hasn't been a one-size-fits-all definition of safety culture. There are different organizations and different accreditory bodies and different industries have different definitions. However there is some commonality in these definitions. The safety culture definition here on this slide has provided an NRC draft safety culture policy statement submitted to the Commission in May of this year.

CHAIR APOSTOLAKIS: So this has been out since 1994? The IAEA inset without the security? That's when it came out, in '94?

MR. FLACK: I'm not sure.

CHAIR APOSTOLAKIS: It can't be '84.

MR. SOLORIO: I think it is 1991.

CHAIR APOSTOLAKIS: '91?

MR. SOLORIO: 1991.

CHAIR APOSTOLAKIS: It's INSAG, right?

MR. SOLORIO: INSAG, yes. You covered my next remark.

CHAIR APOSTOLAKIS: Which is being chaired now by our former chairman.

MR. SOLORIO: So this definition was developed by INSAG in 1991 for the IAEA. The staff modified this definition to make it more applicable to all licensees and certificate holders and to focus on - not just to focus on reactors, and to also implement the concept of the security aspects. Next slide, please.

In 1989 the NRC published a policy statement on the conduct of operations that provided our expectations for a positive safety culture at nuclear power plants. This came about after an event at Peach Bottom where the controller operators were found to be sleeping on shift.

In 1996 the NRC published a policy statement on the freedom of employees in the nuclear industry to raise safety concerns without fear of retaliation. In 1996 the policy statement set forth expectations that licensees and other employers subject to NRC authority will establish and maintain a safety conscious work environment in which employees

feel free to raise safety concerns both to the management and to the NRC without fear of retaliation.

A safety-conscious work environment is a very important attribute of a positive safety culture. Next slide please.

The Davis-Besse reactor vessel head degradation event in 2002 caused the agency to enhance its focus on safety culture. The licensee's analysis of this event identified weaknesses in safety culture as the root cause. In addition it showed that problems can occur over a long period of time, and can go undetected if there is a lack of safety versus focus.

As a result of the lessons learned at Davis-Besse and several other operating events, in 2004 the staff began the formal process of looking into how the reactor oversight and assessment process could be enhanced to look at safety culture and provide a set of recommendations to the Commission.

In 2004 the Commission directed the staff to incorporate guidance into the reactor oversight program. The staff formed a task group with industry and other stakeholders, and came up with what is in ROP today.

In 2006 those changes were implemented

into the ROP. Since the initial implementation, additional improvements based on lessons learned have been made. Audrey Klett from NRR will be discussing the ROP changes in more detail this afternoon.

One of the first actions the staff undertook as part of the effort was to identify areas important to safety culture which have been termed, safety culture components and aspects.

CHAIR APOSTOLAKIS: Now these safety culture components, we saw them at one time, I don't think they dealt with security, did they? They are really safety focused.

MS. CAI: Correct.

CHAIR APOSTOLAKIS: They were safety focused. You have to come to the microphone, identify yourself and speak with sufficient clarity.

MS. KLETT: My name is Audrey Klett. I work for NRR.

(Laughter.)

CHAIR APOSTOLAKIS: It's easier if you come over here.

MS. KLETT: My name is Audrey Klett. I work in NRR in safety culture. Inspectors, if there are security inspections and they identify findings, they can't address the root cause of those findings as

they relate to the safety culture components.

CHAIR APOSTOLAKIS: But the set of the components that were identified, they dealt with safety I thought, although there was always room for security too.

MS. KLETT: Correct.

CHAIR APOSTOLAKIS: Now is there an indication here that we want a policy statement because we are unhappy with the ROP components? Or we want to just expand it?

MR. SOLORIO: I think we would probably want to refine it or enhance it.

CHAIR APOSTOLAKIS: Do what?

MR. SOLORIO: Refine it or enhance it. I mean we already look at safety culture --

CHAIR APOSTOLAKIS: What is the policy statement going to enable the staff to do that the staff is not already doing?

MR. SOLORIO: I think the policy statement is going to allow - it's going to basically get the expectations out so that licensees understand there is a need to focus in this area.

MS. CAI: Dave, after we go through the presentation, and talk you through the development of common terminology and descriptions, it's clear out

there that there is a consistent set of terminology expectations, and here is what we mean by safety culture, and here are our expectations. And right now it's not out there, something that is comprehensive.

CHAIR APOSTOLAKIS: That's fine.

MS. BARNES: This is Val Barnes with research. We have actually got two goals in the revisions to the safety culture characteristics. One is to incorporate security more obviously, more explicitly, and the second one is to revise the descriptions of safety cultures so that they are applicable across the range of licenses. The ROP components talk nuke speak, so they are not applicable to medical environments as written, or some parts of them are not applicable.

CHAIR APOSTOLAKIS: Because the ROP focuses on reactors. Very good.

MR. SOLORIO: Next slide, please.

In 2008, after gaining insights from both the reactor community's implementation of the RFP safety culture elements and other events in the materials community, and increased attempts at security, the Commission directed the staff to again focus on enhancing our regulatory involvement in safety culture. So the Commission provided the two

high level objectives you see here on this slide to the staff, the first being to expand the Commission's policy of safety policy to address security; and also to ensure it's applicable to all licensees and stakeholders.

Next slide, please. In addition the Commission provided other considerations for the staff in their efforts to accomplish the two high level objectives which are listed on this slide, the first being, should we strengthen safety culture for the reactor oversight program. How can stakeholder involvement most effectively be used to address safety culture for all licensees, and we've already begun that dialogue, particularly focusing on agreement state licensees and certificate holders. As you've heard, that's a big part of the apple.

Also whether publishing NRC's expectations for safety and security culture is best accomplished through one policy statement or separate policy statements, one being for security and one being for safety, yet still considering the safety and security interfaces. Next slide, please.

To develop the draft safety culture policy statement, next slide please. To develop the draft safety culture policy statement the staff reviewed a

wide variety of information sources including NRC lessons learned, domestic and international documents, organizational science and literature and other high reliability industry approaches.

The staff also sought input and feedback from a wide range of stakeholders through presentations at stakeholder organization meetings, Federal Register notice, public workshop, and teleconferences with stakeholder groups including the organization of agreement states who are responsible for overseeing materials licensees as you heard.

That concludes my remarks. And now I will turn it over to Ms. Cai for the remainder of the presentation.

MS. CAI: Thank you, Dave.

I'm June Cai, with the Office of Enforcement. Before I get started I just want to let you all know, I think we have an older version of the slides that has been loaded on the computer. The handouts you have are the correct version; they match the latest ones we have. So there might be some differences, especially at the end there are a couple of different slides. So we'll work through this as best we can, but if you will look through your handouts, those are the most accurate and up to date.

CHAIR APOSTOLAKIS: Can you tell us a few words about your background.

MS. CAI: My background?

CHAIR APOSTOLAKIS: Are you an engineer?

MS. CAI: No, my background, I have a bachelor's in applied psychology and I have a master in psychology human factors. I've been with the agency about 7-1/2 years. I started in research, and I've worked in NRR for several years in human factors and safety culture. I'm working with several of the regions doing inspection activity looking at safety culture and human performance issues, and now with LD the last couple of years.

CHAIR APOSTOLAKIS: That's good. You are eminently qualified to address this committee.

MS. CAI: Thank you. Okay, so the first slide here I was going to talk about the draft policy statement, safety culture policy statement, that we submitted to the Commission. This was back in May, and we recommended at the time that the Commission approve publication of it in the Federal Register notice for public comment.

It contained several key messages. The first key message is that the policy should apply to anyone performing or overseeing NRC-regulated

activity. It also includes a proposed definition of safety culture, which I went over a few slides ago.

Also based on our evaluation, the staff recommended that the NRC's expectation for safety culture and security culture should be addressed in one single safety culture policy that makes it very clear that the safety and security functions at issue should be given equal importance within the overarching safety culture.

Another message was because licensees and certificate holders use or provide services related to the use of radioactive materials as Marty and Dave both mentioned; they are really the ones that bear the primary responsibility for safely handling and securing these materials, and therefore it's each licensee and certificate holder's responsibility to develop and maintain a positive safety culture in both their organizations and among individuals who are performing regulated activity.

CHAIR APOSTOLAKIS: Talking about positive safety culture, good safety culture, does anybody know what that is?

MS. CAI: That's what we're trying to describe in the policy statement.

CHAIR APOSTOLAKIS: So you will go into

that later, what is a good safety policy?

MS. CAI: We will talk about what a positive safety culture looks like.

CHAIR APOSTOLAKIS: You will? Good.

MS. CAI: That's what the characteristics, the draft characteristics.

CHAIR APOSTOLAKIS: Well, the characteristics just describe what is important. They don't tell you --

MS. CAI: How the organization performs?

CHAIR APOSTOLAKIS: -- how the organization performs.

MS. CAI: Yes, we have to do assessment activities against those descriptions. You want to make sure you have those areas, and then as far as how well the organization is going, you know, in measuring for example attitudes or monitoring the behavior of people --

CHAIR APOSTOLAKIS: Who is going to do it? Is anybody going to do that? Or are we relying on the kindness of strangers to decide that something is good? Are inspectors going to do it?

MS. CAI: We're saying it's the responsibility of the licensees.

CHAIR APOSTOLAKIS: We inspect them, so

we have to make a judgment. I have heard colleagues - one of them is in fact a member of this committee but is not here - he says I walk into a Swiss plant and say, boy, this is great. These guys know what they are doing. So you ask, how do you know? He says, I don't know. It's just a feeling I get when I walk around. And I've heard it from many people. Mr. Siebel, who is another member who is not here, he says, give me an hour and I'll tell you if the culture is good, but they cannot tell me why.

MR. SOLORIO: I would add, we are not at the stage yet where we are dictating to licensees how to actually achieve that positive safety culture. We are right now trying to develop elements --

CHAIR APOSTOLAKIS: I don't expect you to give me an answer, but I think that is a major issue that perhaps today's meeting can address. There are speakers who can maybe say a few words. Because to say I know it when I see it, when you are a regulator maybe that is not a very comfortable position.

MEMBER MAYNARD: I have been on a couple, I can tell you how it's being done now. There is quite a bit of other guidance out there, and it's contained in NRC manual Chapter 305 information, NRC Regulatory Information Summary 2006-13, and NRC

Inspection Manual procedure 95003. In addition to that IMHO has issued principles of good safety culture. These break these characteristics down into much finer detail. Like accountability was one of the characteristics, and these go into, management defines a line of authority, responsibility for nuclear safety. Everybody understands they are responsible for it, and accountability is maintained for important safety decisions, in that the system of rewards and sanctions is aligned with the safety policies, and there is a bullet for each one of these things to look at. The thing that is missing that you will never have is the specific criteria. You can look at work management or accountability, see if the characteristics - there is still going to have to be some judgment that is going to have to be made as to whether that is really meeting it or not. There is more guidance about what items that you are actually looking for. The industry in a number that they are doing they - many of them look at behaviors. And you can define culture easily, you can define and talk about culture, but that's hard to assess. What you assess are behaviors, so you go out and look for the behaviors of these types of decision-making. So there is more guidance out there, but it still ultimately

comes down to a judgment that is going to have to be made as to exactly where you stand within that.

MS. CAI: I think you will hear more of this this afternoon too when NRR makes their presentation on how the ROP handles safety culture. And while in most cases inspectors are not directly inspecting safety culture, there are - and Audrey probably will go into more detail - on how they are looking for indications important to safety culture, weaknesses when there is performance problems. And I think the industry, NEI is going to present this afternoon also, their proposal for looking into this area. So hopefully we will get more information as the day goes on.

MR. CHEOK: This is Mike Cheok from NRR. I was just going to bring up the fact that NEI is going to be talking this afternoon on the process. The staff is working with the industry on a process to determine the characteristics and how they can implement the characteristics, at the management and staff level at other plants. And as Dr. Maynard addressed earlier, we do have guidance documents in 0305 and 95003 to tell us how we can look at the findings and the inspection findings, and how we can tag those findings to potential safety culture

characteristics.

MEMBER SHACK: What triggers a 95003 kind of assessment?

MR. CHEOK: We will talk about this a little this afternoon. But in inspection findings, we would look at what we call cross-cutting issues. And if we do have for example four cross-cutting issues in the same area, and if the staff is not convinced that the licensee is not doing enough in the safety culture area, that would be one figure for the 95003 process..

MEMBER SHACK: How many times have we exercised this?

MR. CHEOK: Off the top of my head, I do not know right now.

MEMBER SHACK: I mean is it a couple or is it many?

MS. CAI: I don't know the exact number for total number of 95003 inspections. But when the safety culture changes in 95003 that were made in 2006, so far there has been one, and that was at Palo Verdes, and we actually have someone in the region in case you have questions.

MS. CASTO: Chuck Casto, the deputy regional administrator for Region 4. 95003 is conducted from the action matrix based on column four

in the action matrix. So you have to have risk significant findings, and move up the action matrix to column four. That triggers 95003, and part of 95003 is an extensive review of safety culture.

MS. CARPENTER: This is Cindy Carpenter. You asked how many. There has been one, and it was on Palo Verde a couple of years ago.

MS. CAI: And after Palo Verde there were some lessons learned. And actually there have been some revisions to 95003 in terms of the safety culture. Audrey has a whole presentation on that.

CHAIR APOSTOLAKIS: So at the end of the day you are saying we will have a much better idea of how specific these things are and how objective?

MEMBER MAYNARD: I think the number one, that might be a little misleading. It might be just for 95003. There has been at least one other, if not two others, that have been - I don't know if mandated is the right term or not, but there have been at least one if not two others that have been done at NRC, consisting of guidance --

MR. CHEOK: Audrey tells me there's two others, San Onofre and Indian Point.

MS. CARPENTER: Palo Verde was the one triggered by the column four, the multiple repetitive

--

MS. CAI: The only one that had the full safety culture, the NRC safety culture assessment, and that was the 2006 --

MEMBER RAY: George, could we move back up maybe to a higher level discussion at this point in time? The definition of safety culture, which is where we were a little while ago, has in it characteristics, attitudes and behaviors. You've used all of those terms so far. Is there any reason why it doesn't include policies? Are characteristics intended to include policies, or are policies not considered to be important?

MS. CAI: You mean policies in terms of policies of organization?

MEMBER RAY: For example, just take compensation for example. Do you incent people to do the wrong thing by your compensation policies? Is that part of safety culture?

MS. CAI: That's part of the characteristics of the organization.

MEMBER RAY: It seems like an odd place to put something like that, but okay, if that's what you mean by characteristics. But we tend to frame all these things, understandably, in very positive terms.

You want to have these good things and those good things. But you also want to avoid bad things. And I search through all the stuff, I have had a chance to read it, and I don't see much that leads me to look for things that are inimical to safety culture. I look for good attitudes, good behaviors, positive characteristics, but there are some negatives out there too, and they are mentioned for example in the context of Davis Besse and so on. So that's just a question on my part as to why we define safety culture to me in this sort of domain like I say characteristics, behaviors and attitudes, all of which are so often hard to measure, whereas there are some things that are pretty specific and which you want to avoid if possible, which is incenting incorrect behavior, incentive programs. I'd mention there that there is traction for that down in the existing - I don't want to call them inspection procedures, but existing guidance - -recognizes that that is an important factor to take a look at, are we incenting people to do the wrong things. And I just therefore was wondering in the definition of safety culture why it was limited to what you named here. And I guess your answer is, well, policies would be part of the characteristics, and that's good enough. Is that

right?

MS. CAI: I'm hearing kind of two separate - one, you asked about policies --

MEMBER MAYNARD: Why policies aren't a part of the culture.

MS. CAI: And they are, and they are captured by the characteristics.

MEMBER RAY: All right.

MR. VIRGILIO: But Harold, I think you raise a very good point. Because you and I can both remember a time when we were dealing with public utility commissions establishing policies that were driving licensees to continue to operate plants in conditions that were not safe. And that was a negative that you are talking about.

MEMBER RAY: Yes, I think you need to look at that again. As I mentioned to you on the side, I think the industry is well aware of that; it's no surprise to them. They acknowledge that in their presentation. I just think at the highest level you guys are talking about here - and I know we will get to all this in more detail later - but somehow somewhere it just seems like being aware of things that are threatening to safety culture is equally important.

MEMBER MAYNARD: One of the things that I think is causing a little bit of - the policy statement just identifies the characteristics and it doesn't really tie it to anything - there is other guidance out there, but the policy is not really tying it to those where it gives you a roadmap as to where to go to look for more detail or what is meant by accountability or what is meant by these various characteristics.

CHAIR APOSTOLAKIS: But that's the job of a policy statement.

MEMBER MAYNARD: I understand, but that's kind of what we are getting into. To get into this detail in the policy statement would require a much bigger document.

MEMBER RAY: George, I'm just aware that you can do a lot of good things and still not deal with underlying disincentives or negative things. And there needs to be some awareness at least, I think, at the highest level, that you have to pay attention to that as well. That's all I'm trying to say.

CHAIR APOSTOLAKIS: I mean if you look at the other policy statement that has had tremendous impact, in '95, the PRA, all it says is, as appropriate, and support defense in depth, it doesn't

go into details how to do that. Then you have the regulatory guide. But this is particularly challenging, because we are talking about in this slide developing and maintaining a positive safety culture, which is a concept that is not well defined. We don't know what that is.

MEMBER RAY: And I would start by getting rid of the things that are negative, inimical, threatening.

CHAIR APOSTOLAKIS: Sure.

MEMBER RAY: Maybe that's where I'd start the process.

CHAIR APOSTOLAKIS: Licensee and certificate holders are responsible for eliminating --

MEMBER RAY: I don't know.

(Laughter.)

CHAIR APOSTOLAKIS: That's an interesting thought.

MEMBER RAY: I know that you can, because I've lived the other side for years. I know that you can have lots of very positive programs, but if you don't recognize and address things that are negative as well you are going to miss the point. And Davis-Besse is probably a classic example of that. Lots of positive things, you're viewed as a star, but you've

got underlying problems.

CHAIR APOSTOLAKIS: You wanted to say something half an hour ago.

MEMBER BLEY: It's gone now.

CHAIR APOSTOLAKIS: It's gone? Okay, June.

MS. CAI: Okay, so I'll just wrap up on this slide, and one last key message is that NRC as the regulator has an independent role in this area. Next slide.

And here they area again, the draft safety culture characteristics. I will go through these, but I will talk a little about how we got to these, the development of the - what we did was, we took the safety culture components that were developed for the reactor oversight program, the ROP which Audrey will talk about more this afternoon, and from that we adapted them for use in a policy statement with several objectives in mind, first of all to address security, so we wanted to be more expressive, so the descriptions talk more about security than the safety culture components under the ROP.

Also we wanted to make the descriptions applicable to all licensee and certificate holders. So for example including materials for making them

broader, and not only reactor focused; reduce redundancy; and to improve clarity to communicate more clearly. So those are some of the changes we made, start with the ROP safety culture components, and develop new safety culture characteristics.

So these are described at a high level in the policy statement, and we also ask several questions in the Federal Register, and we're asking for public comment on these.

CHAIR APOSTOLAKIS: Harold, could one say that the list that June up there, these are the results of policies. So the policies are at an even higher or lower level that are driving these characteristics. What practices, for example, I'm sure the company has some sort of policy, written or unwritten, as to how to do it.

MEMBER RAY: Yes, that's right, George. But no, what I was really getting at I think was best addressed by what Otto quoted which is under the heading of accountability. And somehow, I don't know how it got there, but under the subject of accountability is addressed the issue of incentives.

I'm very focused on incentives. I've lived with incentives - I've had to deal with - I've told you all before - a long-running problem of

incanel cracking, of control rod drive penetrations and instrument taps and everything in the world, pressurizer heater sleeves and on and on and on, and it went on for years, and it was very, very difficult because the parent organization was incented to operate the plant, not to deal with issues like that . And it was a long drawn out thing, went over several years. And people had to take - and they did at that time - they did take the safety goal as the top level as address it at their own personal and substantial sacrifice over like I say not just once but several times over a period of years. And that was difficult.

So I'm just sensitive to the fact that you can build incentives in, and like I said, they happen to fall for some reason in this area of accountability here. To me the policy that I was talking about is not to have incentives that motivate or would give reason for people to make the wrong decisions. And the most common and most universal such reason is the compensation; that is the thing that most broadly and strongly incents people to do what is absolutely the right thing, which is to operate the plant when it's safe to do so. But you've got to be very, very careful, I think, not to incent them to look the other way when the plant shouldn't be operated; instead, you

need to take it offline and deal with some problem like I mentioned.

And so I don't see it in that list up there myself, but I do want to dig down, like Otto has helped you do here, find it in this area of accountability. I find that indeed that issue is intended to be looked at.

I just think it needs to be given some higher level visibility. And I want to point out, I do see it in the NEI and INPO presentations that we'll get to later, they do acknowledge this because it is a reality. And I just would urge our colleagues in the agency to find a way, I don't know what the way is, but find a way to do it in their high level presentations as well as down in the details.

MEMBER ABDEL-KHALIK: You do raise a much broader issue, though, that the present positive attributes in each one of these characteristics does not in and of itself guarantee that you have a positive safety culture. That has to be coupled with the absence of negative characteristics.

MEMBER RAY: That is right. You can always interpret these words to have meaning when you actually understand how they are implemented, so I don't want to be too critical because some magic word

doesn't appear. But as much as we would like to emphasize the positive, and be constructive, I do think that what you said is true. You can undermine like I say with an incentive program that says, this is what we say on paper; this is what we tell the regulator; this is what we believe. But if we don't meet our production goals we are going to get a 20 percent reduction in pay.

MEMBER MAYNARD: I think partly it's the way this thing has been presented. Because in actuality evaluations you are not going in just looking for positive attributes. You really start by looking for the negative things. You go look at work planning and work control, you are looking for what's wrong, and then you balance by okay, now let's take a look and see what good's being done. But you start by looking at what's bad.

The problem is, you go in and work plans and controls are good. You are never going to find one that has perfect work controls. You are always going to find problems, so it's always a judgment as to how bad is it, how good is it. And you are never going to be able to define or put any numerical value that says, okay, they scored a 3.5 so they are okay. It's still going to be end up being a judgment. Is

the work control and work planning, is it meeting the needs? Is it really oriented toward safety?

CHAIR APOSTOLAKIS: But I think from the discussion of incentives, it seems to me we are going to have a problem here distinguishing between cause and effect. Because incentives have a point about - could affect accountability, but I could see most of the characteristics on that list being affected by the wrong incentives.

MEMBER MAYNARD: I think you're just saying that that's where it's included in the guidance is under accountability. I don't think you're saying it only affects --

CHAIR APOSTOLAKIS: But it's a cause that may affect problem identification.

MEMBER MAYNARD: And incentives.

CHAIR APOSTOLAKIS: So one question at least in my mind is whether maybe not a policy statement but when we make this more real if there is a regulatory guidance, should one focus on things like incentives that affect many things, or should one focus on things like what you have on the slide? And what would be the criteria for selection? It seems to me one major criterion should be that whatever you put up there would lead to something observable. So the

inspectors would say, oh, we saw this, and we conclude that, right?

MS. CAI: Right, if I could respond on a couple of points. Regarding the incentives, we do intend for incentives to be covered under accountability. And again these are higher level, and I have a slide, I'll talk about this later, as far as after we finalize the wording here and these descriptions, and we finalize a policy statement, then we'll have to look at implementation, and for implementation plan something. Each program office will have to look at their programs to see how it's implemented.

So let me just talk about ROP a little bit. On the incentives one, ROP has a safety culture component also of accountability. And under that has a lot of details. And one of the details does talk about incentives of reinforcement. And Part of 9503 inspection guidance tells an inspector to go out and to be looking for example and how people are being held accountable for reviews of documents. Are they being reworded --

MEMBER RAY: I can see that. The only issue here is if you compare your presentation to what will come later, you'll see that the economic tension

is understood and recognized and made visible at a high level. I don't happen to see it in your thing here. I'm only trying to sensitize you to that, and asking you to think about it; that's all.

MS. CAI: Thank you.

MEMBER MAYNARD: I do have one comment overall on the characteristics. We've thrown everything in here, and I'm concerned a little bit, are we really kind of diluting the real focus on safety culture. This is basically everything you have to do to run a power plant and you need to do a good job of it, and I'm not sure that it doesn't dilute a little bit from really taking a look at safety culture, the decision making, problem identification aspects and what's the real behaviors out there. When you go into work practices, work planning control, you have a litany of everything that you use to run a power plant and say that that is all safety culture, and now you toss security in there, and I'm not sure that it really gets to the point of nuclear - the aspects of nuclear safety culture.

It's a good list, and you say they're all important to running a good safe operation; I don't disagree with the fact at all. I'm not sure that it doesn't dilute just a little bit from the real focus.

CHAIR APOSTOLAKIS: You are suggesting maybe it ought to be a shorter list?

MEMBER MAYNARD: Well, yes, I would probably come up with a shorter list that was focused more on the thing, a little bit like what we have been talking about. What are the things that we're really looking for from a - do you hide your eyes when you see a problem, or do you really look to identify a problem and fix the problem. Those type of things, far more so than - they all fit into work practice. But just looking at that doesn't really look at your attitudes on the decision making - I would have probably focused a little more on it. Again, these things are all important to running good safe operations; I don't disagree with that at all.

MEMBER BLEY: I guess where I almost said something earlier and didn't, there is a lot of tension here. This is just to open a dialogue, but we're already got the ROP and we've got an inspection process, and we really know how to do this. Well, it's kind of vague. Well, there's been a lot of research. I'm not sure quite where we sit. Are we ready to write reg guides? Do you think you know enough? There aren't any priorities or relationships, and that's where Otto was, and I'm feeling the same

thing. It's a giant catalog. Do we really know which of these things are the real discriminators? It strikes me from reading this and from reading the INPO document, there are a lot of things - this is all good, but do I really know if I do these things that feel right I'm going to have a safe plant? Is there anything here that lets us discriminate, lets us identify metrics of behaviors to find out what are the key things?

Where Otto was, was there are things that are very - below this that we have read in a lot of the documents, things like trusting organizations, ownership, that kind of thing. Is that where the focus ought to be or on these kind of bland overall catalogs of what --

CHAIR APOSTOLAKIS: But let's not forget that I think Otto and Harold have taken the point of view of the plant people, and the staff is trying to address a much broader issue.

MEMBER BLEY: Including safety culture here in the organization.

CHAIR APOSTOLAKIS: Yes, but this includes also the agreement states and all that. So you may need to list in fact of prioritization, yes --

MEMBER RYAN: George just hit the nail

on the head for me. I think there are two lists here. I think the safety-conscious work environment - that is an upfront attitude that you create. And then some of these other things in the list are results of an upfront good attitude. For example work practices. People are aware of it. And so I don't see this as one list. I see it as two lists. Some stuff is upfront things that you try and create, incentives, and attitudes and approaches, and the result is work practices are good. Work planning and controls are taken seriously.

So I think some of these are actually good results, as opposed to good upfront attitudes. So I suggest that the policy statement could be enhanced. But I'm trying to sort those out a bit.

CHAIR APOSTOLAKIS: That's what I meant by cause and effect. You may want to have a list like this one that says these are the kinds of things you can observe, but then there are causes behind them, and the causes really are the important things we should address and go back to that, and I think incentives is one of those, because incentives affects a number of these. And if you can - and that may in fact address Dennis' concern and others. Because when you go down to causes, and you know you have a debate

and all that, there is probably a shorter list. You can identify maybe two or three or four of those that are really important.

MEMBER RYAN: If you look at that list I would pick safety-conscious work environment, accountability, and continuous learning environment as three cultural aspects of a safety culture work environment.

CHAIR APOSTOLAKIS: Okay, so the message is, some sort of prioritization. I don't think we can resolve the issue today, but you are getting - I think that is a good input, and also this distinction between cause and effect.

MR. CHEOK: I have a comment.

CHAIR APOSTOLAKIS: Yes, sir.

MR. CHEOK: I think the committee and the work group has been working on something similar to what you are talking about, the three levels of definitions for safety culture. The highest level is the definition itself, and then the second level just what you guys were talking about, is the high level principles of what safety culture would be, and then the next level would be the characteristics which would be the implementation level which may be different for different applications within the field

itself. It's the concept that you are talking about.

(Simultaneous speakers.)

MEMBER RYAN: Could you say your name just for the record.

MR. CHEOK: Mike Cheok from NRR.

MS. CAI: Thank you, Mike, and I have a couple of slides, and I'll expand on what Mike just said a little later.

CHAIR APOSTOLAKIS: So where are you in your presentation? You have about 45 minutes I understand. You can skip slides if you like.

MS. CAI: I'll just go over these pretty quick. And this is the draft policy statement when the Commission paper up back in May, we also provided responses to several question they asked us. The first one they asked us was to consider the effectiveness of the ROP, and our response back was that the current process was effective. Currently it looks like cross-cutting aspects of inspection sitings - and Audrey will talk more about that - and the process continues to be refine in accordance with ROP built-in self assessment process.

MEMBER BLEY: June?

MS. CAI: Yes.

MEMBER BLEY: Is there anything that kind

of parallels the ROP in the materials area?

MR. VIRGILIO: Not today, Dennis, but it is something that we have talked about. Where we are starting to now is in the fuel cycle area, and Dan Dorman is sitting over here. We are now working with industry to develop something that would be more like the reactor oversight process than what we have today which is the LPR process, the license performance review. That is the first step. But we really going to get down to the hospitals, the academic users, the industrial users - it's not there yet today.

MEMBER BLEY: And even in the fuel cycle facilities, without something that really calculates to the risk you have trouble coming up with the parallels I think to the color codes.

MR. VIRGILIO: Right, our ISAs are not quantitative, they are qualitative assessments by the licensees.

MEMBER BLEY: Even with the quantitative, they're not summed up. They are individual pieces. But that is - you're trying to figure out a way.

MR. VIRGILIO: Yes, we are clearly the most sophisticated in the reactor area, and have gone quite a ways there. But now reaching out the first step to the fuel cycle facilities, and now to the

radioactive material users is the vision.

MR. DORMAN: This is Dan Dorman from NMSS. I'm the director of fuel cycle safety and safeguards. And just following up on what Marty said, and to address your point on risk thresholds, that is an active area of development right now. I expect that's something we'll be coming to talk to you at some point in the future about. But in the safety culture aspect, I would go back to the guidance documents that have been cited on the reactor side, and note that from a regulatory oversight standpoint we typically get into that where other safety issues have manifested themselves, and we're trying to understand what contribution a negative safety culture may have had to that issue, so that when you look at the corrective actions, are they sufficiently comprehensive not just to fix that problem but to turn the performance of the entity around?

And in that respect we have addressed that in the past on an ad hoc basis within the fuel cycle. Right now NFS is operating under a confirmatory order under alternative dispute resolution from the March 2006 spill, and the focus of that confirmatory order is independent safety culture assessment. They have conducted one independent safety culture assessment.

They are implemented recommendations that resulted from that, and are preparing to do the followup assessment of the effectiveness of that. And they have also been reaching out to INPO to understand their insights from the reactor perspective.

And that is overflowing out to some of the other places as well, as part of their construction program LES has done independent safety culture assessment for the National Enrichment Facility in New Mexico.

MS. CAI: Okay, continuing on the slide, another issue we addressed was regarding further stakeholder actions being needed. We talk about holding additional public meetings on the draft policy statement. Continuing to work with agreement states, I heard Marty talk about how they give attention to safety culture, and also their licensees.

And then in general developing strategies to increase attention to safety culture for materials licensees who may not have the same level of exposure, the same level of understanding, as reactor community.

CHAIR APOSTOLAKIS: They do not. They do not, I think. Keep going.

MS. CAI: And then the last thing we already talked about having the one policy statement

for safety and security and treating them equally in an overarching safety culture.

So now I just wrapped up what we sent up back in May, and then in October just a few weeks ago we got some additional direction from the Commission. First they approved publication of that policy statement. It's open for 90 days as we stated. And they actually recommended the longer period, based on recognition that a large portion of the time will be needed to build awareness of safety culture and then giving people an opportunity to comment. So a little bit longer period, and it's open until February.

Also they asked us to consider incorporating suppliers and vendors into the scope of the policy statement.

CHAIR APOSTOLAKIS: What do you mean by that? Did you ask for their opinion?

MS. CAI: It's to consider - well, we just got this direction so we are working with staff who work in this area, and our own, and we'll have to get some further - and strategize on how we are going to address this piece.

MR. SOLORIO: I would add it could mean making it - putting them in the policy statement, applicable to their environment.

MS. CAI: And reaching out to them --

CHAIR APOSTOLAKIS: Are you going to inspect suppliers? Is that what you mean?

MR. SOLORIO: I would - I think we do.

MR. VIRGILIO: As we do today.

CHAIR APOSTOLAKIS: Really?

MR. VIRGILIO: Yes.

CHAIR APOSTOLAKIS: On safety culture? Wow.

MR. VIRGILIO: Oh, no.

MS. CAI: Yes, I think we are pretty early. We are still feeling the ground, because we just got this direction just a few weeks ago, and we have already started discussions with NRR and our own, and we'll have to figure out how to proceed on this one.

MR. VIRGILIO: We have had for some time a vendor inspection program, but now if you think about the new construction in the United States of reactors, where most of these large components are being manufactured is offshore.

CHAIR APOSTOLAKIS: Yes, so you're going to go to Japan?

MR. VIRGILIO: We are. It's happening

today. Our teams are out there inspecting vendors around the world.

MEMBER BLEY: On George's point, if a significant finding should occur at the plant, and then your investigation tracks back to the supplier, would the existing process lead you to look at the safety culture there or not? Is that impossible for you to do?

MR. VIRGILIO: I'm trying to - I don't know if we've got an example. I don't know if Audrey could say whether we have actually done that through the process yet or not. But we could.

MEMBER BLEY: It'd be interesting if you had.

MR. VIRGILIO: I don't know.

MEMBER BLEY: I'm just hypothesizing.

MR. SOLORIO: And let me add that the international community is interested in what we are doing in this area. They have engaged us on various occasions when they come to visit international programs.

CHAIR APOSTOLAKIS: You know about the international community, the disagreement between them and us in the past at least was that we were reluctant to do as much as they do. We were really reluctant to

get into this - getting into people's minds as we were saying. Obviously we have changed our attitude, but we will see how we can coordinate. So please, continue.

MS. CAI: Okay, a couple of other aspects they asked us to consider. One is of course to continue engaging a broad range of stakeholders including agreement states, also other organizations that have an interest in nuclear safety, to ensure that the policy statement that we present to the Commission benefits from the consideration of a full spectrum of views in this area.

And then one last area is, they asked us to seek opportunities to compare our terminology where possible with that of existing standards and references maintained by those the NRC regulates. So I'm going to discuss shortly, we plan to hold some public workshops to work on developing this common terminology.

So what are our next steps? I just mentioned, we have already gone ahead and published the draft policy statement in the Federal Register, and then what we plan to do is engage with stakeholders through a series of public workshops and work through to develop a common definition, a high

level description for describing areas that are important to safety culture that will apply across the industry. I will go into that a little bit here in the next slide.

Right now we have several of these workshops planned for 2010, and then we also have the option to publish an additional Federal Register notice late in to 2010 if we would like to to announce the result of the public meetings and give some additional opportunity for public feedback and comment.

As a starting point for developing this common terminology, we would be looking at what we have already now, existing terminology, and some examples we would look at are the draft safety culture characteristics, which we talked about a few slides ago that are in the draft policy statement. So that would be one set of language we look at.

We also look at what industry has, and this is in accordance with the Commission direction to compare our terminology. So for example we look at IMHO's principles and attributes. We look at that. We look internationally at IAEA's characteristics and attributes. And then we are also looking around in the literature to see if there are other

categorizations or frameworks to describe safety culture.

CHAIR APOSTOLAKIS: You are not looking just at the IAEA? I mean you are looking at what the French are doing, the Germans? Yes?

MS. CAI: Yes, we are going to look broader - right, and we are also going to get feedback from all our stakeholders.

And so the proposed definition description, once we finalize and work with all the stakeholders, will be incorporated into the final draft policy statement, which then we will submit back up to the Commission for their final approval. Next slide.

Okay, so I mentioned this, and this is what Mike was alluding to earlier on the common terminology. So the overall goal we are trying to achieve here with this effort is to develop a high level of definition and a set of descriptions involving a whole range of stakeholders in accordance with Commission direction to compare language with existing standards and references and put all that into the final policy statement.

So we divide it up into a couple of different levels. The first level is the high level

overarching definition that applies to all individuals or organizations that perform or oversee NRC-regulated activities, and some of the characteristics we want to see as part of this definition is, it should be very easy to understand. It should be timeless. We shouldn't have to go back and do updating every few years. It should be very inclusive. And under that we have a high level definition, under that you will have a high level set of descriptions of areas that are important to safety culture. And I think there you get to - if you look at your handouts, we have a couple of differences between what you see on the screen and the handouts, but the handouts are the most accurate.

And for these description areas, again, these should apply to anyone who engages and oversees NRC-regulated activity. These speak to all levels of organization all the way form senior management to individual contributors on the worker level, and just set forth the expectations of the Commission to foster a positive safety culture. Next slide.

And I think we went through this a little bit too as far as implementation. So I mentioned we plan to do these couple of workshops, we work on the common terminology, we will fold all that into the

development, and a final policy statement, and right now our plan is to have that sent up to the Commission for approval in early March, 2011, and then the Commission will review it and if they do approve publication, the final policy statement, then we will have to focus on implementation. And how that is going to be done is each program area will evaluate the public policy statement and the common definition, and descriptions, will be addressed by the oversight programs for their specific licensee environment. And every single Commission paper we sent up, we have a commitment in there, and I'll just pull from that, we say, the staff will review its programs and processes for the oversight of licensees and certificate holders with respect to expectations following approval of the final policy statement.

So once we approve it, we have to evaluate to see how we implement it, and that will be done with the lead by the different program officers.

So there may be enhancements or modifications needed to these programs. For example they need to develop lower level details to describe how these high level descriptions are translated into actual application. Again the descriptions will be very high level. We may need some lower level detail

to describe programs, how they are implemented, processes, procedures, practices, behaviors, these kinds of more tangible concepts of how -- of what it means to support and show and demonstrate these high level descriptions.

And again these details might vary depending on the licensee's type environment. There are a wide range of different organizations so the detail level may differ depending on the environment. So you could have the potential for different sets.

And in addition to the external focus NRC will also look to see how the policy statement applies internally to our own safety culture, because it's important we hold ourselves to the same standards as we are communicating to the licensees. So it will help internally with the application.

CHAIR APOSTOLAKIS: Who is going to inspect us?

MR. VIRGILIO: I just want to inject at this point, going into a project like this you have to have a plan and schedule. So what June has laid out is the nominal plan and schedule. But as I said in my opening remarks, you have the chairman who is sort of signaling that I'm not sure the policy statement is enough, which is at one end of the spectrum, and his

thinking that when you come back you may be bringing back a proposed rule. On the other end of the spectrum we may decide that we want neither. And so we've put together a nominal plan and schedule that June has laid out for you. But I think going into this I think we are very open minded about what the outcome is going to be in terms of the products that we produce, and how we are going to go about affecting the changes in behaviors in the industry, particularly in the radioactive materials side of this that we want to see happen. So I just want you to have that little bit of context. Thank you.

MS. CAI: Okay, next slide, and this is where it differs a bit, if you could just refer to your handouts. We have been interacting with Office of Research and Val Barnes who is sitting over there to conduct some activities for the technical basis for what we are doing here to identify these areas that are important to safety culture. We definitely recognize the benefits of using experience, expertise in this area, to conduct research type activities to inform the development of the terminology which will lead directly to the policy statement. And then also in the longer term to provide validation and analysis for some of these longer term implementation

activities we will have to do once the policy statement is finalized.

So in closing, I think we have already touched on all of these. Safety culture is an essential element for anyone overseeing or performing NRC-regulated activity. As we mentioned several times now it is really the licensee management who has the primary responsibility for establishing and maintaining a positive safety culture, but that the NRC as a regulator has an independent role to be monitoring the safety culture in its oversight program, and we intend to continue outreach efforts with the full spectrum of stakeholders.

CHAIR APOSTOLAKIS: I think your first bullet, I think the NEI representative later is going to ask the NRC to wait until the industry comes back with the proposal, and then see whether the Agency agrees. So that seems to be consistent after the first bullet there, that it's their responsibility. So let them develop something first, and then we review it and see if we agree. That seems to be consistent with Mr. Pietrangelo's thesis later today.

MS. CAI: It is, and we also intend to, on the bullet there about the independent oversight review, also intend to do that, and I think probably

NRR will probably talk more about that.

CHAIR APOSTOLAKIS: Okay. So you're finished?

MS. CAI: I think I am.

MEMBER BLEY: If I may I would like to follow up Harold's earlier comments on the incentives with an observation, and I agree with him completely. In other industries we follow it pretty closely and question people, and what seems to usually be the case is that when the incentives are what I'd call misaligned, it's not really believed to be significant. There is this feeling that even a fool knows that if I break the machine there is going to be a lot more penalty than what I'm going to gain from the production side, but really I'm trading a sure thing on the production side for what I think is an extremely unlikely event. And I trust my design. I know I still have multiple failures to an accident, and I trust my staff, and I don't probably understand the mechanisms in that situation that can lead to the problems that occur in other places.

So it's not - it's not the focus on production over safety; it's the belief that I've still got safety and not recognizing the significance in the erosion that has gone on. And it's not here.

MS. BARNES: I just wanted to reiterate - -

CHAIR APOSTOLAKIS: Your name.

MS. BARNES: Val Barnes, Office of Research. I just wanted to reiterate the point that we made earlier with regard to NEI's proposal, which is that NEI is not proposing a process that would apply to the full scope of our licensees. So while our bullet is indicating we are working with NEI to come up with a process, we still have a large number of other licensees.

MEMBER BLEY: One thing I didn't hear, we've heard that we are tracking what's going on in other areas, and research other people are doing, are we doing research in this area to support wherever this eventually leads?

MS. BARNES: We're - in response to the user need, we have initiated a project back with INL that is similar to one that Wreathall was involved in a couple of years ago where we're taking a look at the data sources, the data types that NRC has, our databases, that at least conceptually seem to be related to safety culture characteristics as we've defined them, and then looking for the relationships among those variables.

CHAIR APOSTOLAKIS: So that would be something? That's what you're saying?

MS. BARNES: Right, and you know, if in the best of all possible worlds, an outcome of this research as well as the common terminology and concept validation were that INPO may be pursuing with us, we could end up actually having an answer to the questions about which of our characteristics are more important or more fundamental than others. But we are just in the very initial stages of this.

MEMBER ABDEL-KHALIK: If I may go to slide #10. You list these as safety culture characteristics. The word, characteristics, means attributes, and if I look at the bulleted items in your list, some of them are neutral, and some have an attribute for a characteristic associated with it. A neutral statement would be, work practices, work practices can be good or bad. Work planning and control can be good or bad. Whereas something like a continuous learning environment, you have sort of associated an attribute that you would characterize with a positive safety culture.

It would seem to me that you are sort of mixing apples and oranges when you come up with a list like this. Perhaps what you ought to do is come up

with a list of focus areas, like work practices, work planning and control, problem identification, evaluation, problem resolution. These are focus areas that you can evaluate from a safety culture perspective, then you come up with a list of characteristics or attributes for each one of these focus areas that you would consider to be contributing to a positive safety culture, along with a list of negative practices in each of these areas that you would consider inimic to a safety culture, rather than mixing apples and oranges.

MS. CAI: Okay, we'll definitely consider it.

CHAIR APOSTOLAKIS: Some oranges there are resources for example. Resources can affect a lot of the other things, right? If you don't have enough resources, maybe I don't have enough people to deal with problem identification and evaluation.

MS. CAI: I think a lot of these overlap.

CHAIR APOSTOLAKIS: I go back to my theme, cause and effect. There are certain fundamental things that are affecting a lot of the others, a lot of the characteristics. There ought to be distinctions, and incentives is definitely one. Resources seems to be another. Now licensee decision

making, that is affected by the resources and incentives and maybe other things. So maybe it's not a fundamental attribute.

And I think you should think that way, what are the fundamental - I think that was Said's point too, and you heard the recommendation to try to write these things and focus on the few that are really important. It seems to me something is very important when it affects many other things. Like common cause failures and risk assessments are very important, because they can defeat many and the same cause. So these are the kinds of things I think you ought to think about. I mean not just make a list and say these are the characteristics.

I guess any other comments on what we've heard? We'll come back to these things later, but before we finish this, something I should have done earlier, we have two guests at the table, and I will ask them to say a few words about why they are invited to sit here, and urge them to participate in the discussions. Don't feel that this is just the members.

So John, can we start with you?

MR. WREATHALL: Yes, George, thank you. For those of you who don't know me, I'm John

Wreathall. I'm an independent consultant, and by my accident you've probably realized I'm from central Ohio. I've been working on the area of human performance and organizational issues since the mid-1970s, and the last nearly 20 years working independently with people like Jim Reason and Erik Hollnagel and others in coming with tools.

Most recently I have not been working in the nuclear field except some work on the medical uses of isotopes and human performance there. More working in patient safety, in rail safety, doing some work on fuel cycles, but related to overseas projects, not in the U.S.

Some of the things that I'll be talking about was work I did with EPRI on organizational factors and pro-active safety indicators in the 1990s.

As Val Barnes mentioned I did some very short period of work with INL on their earlier safety culture program.

The presentation that I prepared at 6:00 o'clock this morning is not the one I would prepare now having listened to the discussions so when I get to that I'll try and be brief there and address some of the issues.

But the one particular comment that comes

up, and I will talk about it in the presentation, I see the issue as built around three critical questions for assessing safety culture, and when we talk of plants or licensees generally. What kind of things do they look at? What kind of things do they look for? And what do they do about it?

And the ways in which you answer each of those defines what the quality of the safety culture is. And therefore I have a very strong belief that addressing those three questions in a very - and there are a range of ways you can do that, some are good, some are not so good. But the ways in which you answer that really tell you whether people have - what the aviation world calls a cosmetic compliance program. In other words it follows the procedures and the requirements but achieves nothing. Oh, well, it has a really effective program is answered by looking at how those three things are done. It gets to things like incentive programs. It gets to things like learning culture. It gets to learning large answers from small events, and I'll talk about some tools and methods.

So for now I think that's all I need to say, because my presentation will get into some of those things.

(Off the record comments.)

CHAIR APOSTOLAKIS: Thank you, John. Mr. Carnes.

MR. CARNES: Yes, good morning. I'm Earl Carnes with the U.S. Department of Energy, and the question is why I'm here.

CHAIR APOSTOLAKIS: John, you are here because we invited you.

MR. CARNES: Yes, exactly, and I appreciated that, but by way of why you invited me, I had come from the U.S. Department of Energy, before that I spent the other half of my career in the commercial nuclear power industry with INPO, and I continue to be the liaison between the Department of Energy and INPO, and so I continue to be part of this community.

Through my responsibilities with DOE I interface with our respective federal agencies. And through that, we call it the high reliability roundtable, which are a number of agencies which are equally interested in the topics we are discussing today, reestablish some of my old relationships with the event commission, and therefore, someone got my name popping up, June, thank you.

So what I will bring to you today are

general reflections of what I have been dealing with. I will tell you that I very, very much relate to the idea of cultural differences by way of coming into DOE from the commercial nuclear power industry, which was a drastic cultural difference, because we are so different. I appreciate your comments about research as opposed to reactors as opposed to materials.

So I work with our environmental cleanup folks. I work with our defense missions. I work with our R&D laboratories, each of which have a particularly unique culture due to the history of their development, due to their differing missions.

So my pleasure and challenge is to work with each of those different types of organizations, trying to use the concepts that we are talking about here in a reflective way. And part of what I picked up on that John and many of my other colleagues and I talk about is the difference between normative approaches, which is an understandable regulatory perspective, and descriptive approaches.

Frankly in my practice if you will I take the - not having to be a regulatory anymore - I take the descriptive approach to try to get my organizations, our organizations, to engage in reflective learning by trying to understand what the

field of research is telling us about culture, high reliability, resilience engineering, and pose the difficult questions at the high levels in terms of what does this mean to us, what should we learn from this, and by initiating and continuing that dialogue, to continue evaluating are we doing as we think we're doing, by the way using a lot -- of course Dr. James Reason being very influential, but also I saw again last week a colleague of yours, Dr. Schein from MIT, whose work I greatly admire. So trying to use those understandings to help us probe and ask about what is important to us, what we say is important to us, why we think this is important to us, and how do we demonstrate that those things that we say are important are actually important.

So those are the things that I hope to share with you later today, and thank you for the invitation.

CHAIR APOSTOLAKIS: John.

MR. WREATHALL: I forgot to mention - John Wreathall again - the UK HSE NII is just starting a program in fact hopefully in a week or so, looking at something very similar. You mentioned earlier looking at foreign programs, and the lead inspector responsible for that will be visiting the NRC in early

December. So that might be another opportunity to get more cross-national fertilization.

CHAIR APOSTOLAKIS: By the way another issue - comment maybe, it's not an issue - but if you look at the literature you see terms like what Earl just said, resilient organizations. I know John has published a few papers on this, on high reliability organizations. And now we are looking at safety culture. One thing I'd like to understand, it comes back to terminology, if we wanted to have - to make the NRC a high reliability organization, would we be approaching the issue differently from the way we are approaching it now using the term, safety culture? Is a high reliability organization a different beast than an organization with a good safety culture, or is it the same thing with different terms? If I have a good safety culture am I also a resilient organization? Or is it something different?

I think this is a good opportunity to clear up these things. And in fact one of the reasons Earl is here is to tell us what a high reliability organization is, so we will always as a group be sensitized to this maybe distinction, and see whether we will learn something, whether we want to change our terminology. I assume, John, you will say a few words

about resilient organizations. That's another thing I'd like us to address later today, but I just take the opportunity to sensitize everybody about it.

MEMBER RAY: George, do we have a minute?

CHAIR APOSTOLAKIS: We have about six minutes.

MEMBER RAY: In other not to load up too much of the rest of the day as you were referring to, maybe I could once again revisit what I said with the background of what Dennis said. Just as a way of trying to get those who have never been in a situation like I'm going to describe sensitized so you can think about it easier.

Imagine yourself in charge of 2000 people running a nuclear power plant somewhere, and let's say that 20 percent, which is a good average -- some people further up the food chain, some less farther down the food chain - of your compensation in a given year is going to depend on the megawatt hours produced. Now of course you are not going to get that if something terrible happens. But in the safety culture is intended to make sure something terrible doesn't happen including regulatory sanctions, not just actual safety events. But compare your decision making day to day with a strict population of people

out there that good to be incented, it's a tough job, requires a lot of coordination. You can't not reward people for doing their work well and making the plant operate well.

But safety culture is set inevitably against the perverse incentives from a safety standpoint that those incentives programs are going to produce. And you are not going to eliminate them; it's not going to happen. It probably should happen, because like I say it's a tough job. People need to have the idea that if I work extra hard and I apply myself diligently to my job and we all do it together and we succeed that there will be a material reward coming. That's going to be part of the calculus.

What I'm trying to convey to you is how much more powerful on a day to day basis that incentive is than the avoided problem that you are trying to achieve through the safety culture. So you are at a disadvantage right off the bat. If you say I'm going to sanction the heck out of you if I find that you don't have a good safety culture. I'm going to shut you down and make you go through a millstone kind of exercise. That's probably not going to have - for most plants - much of a threat on a day to day basis. It's kind of like Wall Street in the world

that we read about there, where if it's short term rewards that are the most compelling on a day to day basis.

That's why I said at the very beginning that I think one of the things you need to do and you need to be explicit about it is that those short term rewards don't become so powerful that safety culture becomes something I think as John said that you go through the motions but it has no real consequence. It has no real benefit.

A lot of time and energy is consumed checking all the boxes, but when it comes to actually how the plant is operated, it doesn't have an impact. At some point you've got to look at things that undermine safety culture, and say, are they too strong, too powerful. So that's my spiel; it's just trying to emphasize what Dennis said, and that is, you can't say, well, we're going to emphasize the positive and make sure you've got a good attitude, and the practices are implemented appropriately and so on and so forth, if on the other side you've got a great big incentive that is driving everybody to not cause problems that affect the output of the plant.

CHAIR APOSTOLAKIS: I take it we have exhausted this particular section. Thank you very

much. This was very informative. So we will recess until 10:30.

(Whereupon, the above-entitled matter went off the record at 10:10 a.m. and resumed at 10:30 a.m.)

CHAIR APOSTOLAKIS: Okay, the next topic is high reliability organizations, and Mr. Carnes from DOE will guide us through it, and at the end we will know everything we need to know about high reliability organizations, right, Earl?

MR. CARNES: Absolutely, that will make all of us, including myself --

CHAIR APOSTOLAKIS: Thank you very much.

HIGH-RELIABILITY ORGANIZATIONsss

MR. CARNES: Good morning, Mr. Chairman, members of the committee, thank you very much for inviting me to be with you here today.

I am Earl Carnes. I'm with the U.S. Department of Energy. I should state that while I'm here as a representative of the Department, the items I'm sharing with you are the items I share with the department as a senior adviser, which means that I get to state my opinions, so my statement should not be inferred as department policy.

So with that, the thought I had brought to

you today is really an introduction - it's a little bit more than a 101 course, that I thought establishing some of the fundamentals of what we talk about, high reliability might be in order; and then to talk about some variations on high reliability, how it started, and where the discussion I think is today. And I am also hearing feedback. Are the rest of you hearing feedback? Is that all right? Very good.

MEMBER RAY: It is our last meeting in this room, I'm told.

MR. CARNES: Oh, I see. Is that a good thing?

MEMBER RAY: It's a good thing insofar as hopefully the sound will be better over there. It's perhaps a bad thing as people are not as incented to try to compromise the sound system here as they might otherwise be.

CHAIR APOSTOLAKIS: Harold, it's incentives again.

MR. CARNES: It's incentives, absolutely. So I do not bring to you the same accent that my friend and colleague, John, does, so if I'm not clear in my Southern accent I will ask John to interpret.

MR. WREATHALL: I will be happy to.

MR. CARNES: And also I do commend the

committee as well as the Commission and those present here for taking on this very important although very complex and difficult task.

So let me begin with an overview of some of the items I believe are relevant to your discussion here as it relates to what are referred to as high reliability organizations, or high reliability organization theory, if you will, and start out by talking - placing the stake at the time of Three Mile Island, where many of us were, or were involved in some capacity in our industry back then, and some of the conversations and studies that took place shortly thereafter being one that I'm sure most of you are familiar with, the work of Dr. Charles Perrow, and his very important book on normal accidents. And the things that Perrow talked about were the kind of - raising important questions about the compatibility between our technologies and our strengths and weaknesses as people, and then by extension, our organizations, and raising the question about, societally are we really capable of taking on the responsibilities of the technologies and the hazards attendant to those technologies that were emerging at that time, a number of important questions that Perrow was raising.

Around this same time, shortly after publication of Perrow's book, there was a group at Berkeley including Todd LaPorte, good friend of mine and a colleague, Dr. Karlene Roberts, and others, who sought to ask a different kind of question. In looking at what Perrow talked about, how organizations, particularly complex high hazard organizations can fail, they said "but at the same time there are other organizations that are succeeding." Their success or what defines success is also the subject of a lot of academic debate. So I will not pretend to try to answer that question, but rather to suggest that the criteria that the Berkeley group applied, the general criteria, and that is that the organization must constantly, continuously, at a very high level, perform its mission, an important distinction, and at the same time do that while performing that mission or the mission activities safely.

So those are the general criteria that they use to define what was a high reliability organization. Now those people freely admit that the opportunities for research like the naval carriers, aircraft carriers, nuclear power plants, electrical distribution systems of the state of California and

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some others that they undertook to research, did have those characteristics in broad general terms, but also were opportunities of research convenience. They happened to know the right people to be able to do this type of research.

To me that research is very important in that it was an initial effort to ask not just what failed, but what succeeds. Okay?

CHAIR APOSTOLAKIS: Is Three Mile Island a failure?

MR. CARNES: I would certainly say that Three Mile Island is a good example of a failure.

CHAIR APOSTOLAKIS: Containment succeeded.

MR. CARNES: Containment succeeded. So I'm sure that we could have these definitional discussions of what's a failure and what's a success. Would we want it to happen again? I would say no.

CHAIR APOSTOLAKIS: Oh, absolutely.

MR. CARNES: Okay, all right. So it's something we want to avoid. Did it result in the dissolution of the utility? Yes. Did it result in a huge cost not only to that particular utility, to the customers of that utility, but to the industry as a whole? Absolutely. Did it cause us to make

fundamental changes which have made things much safer today? Absolutely. So that is the level of discussion that I will try to engage on. Because while your question is still - that type of question is still very heavily asked and debated within the research community, I'm more of an evaluator and a reader and consumer of research. So from a practical matter it doesn't really make a lot of difference to me. I'm out trying to see how I can help an organization improve. More of a pragmatist philosophy if you will.

Significant influences I want to touch on. Our colleagues in the wildland fire fighting community back in the `90s experienced some fatalities among their members in the serious fires that they do so admirably battle every year. They started posing themselves questions, we recognize that this is unacceptable, the loss of any firefighter's life, and they have a very important mission to do. How can they do that better?

I think it's important that this was a discussion initiated by the community, wanting to do better, which is quite different than some external entity saying, we demand that you do better. Very important part of this discussion.

In doing their research they particularly went to two places. They went to Harvard, excuse the mention of that George, and looked at some of the work there that had been done on learning organizations, and engaged some of the professors there in that discussion. They certainly know our friend, Dr. Schein, on the other side of the city if you will.

But they also then went and looked at the high reliability literature, and particularly engaged Dr. Karl Weick and Kathleen Sutcliffe from the University of Michigan, an integral part of the HRO research community.

HRO continues to be a mainstay, a guiding framework if you will, for improvements in the wildland fire industry, in the firefighting community to this day.

The next significant influence to me was the publication of the Institute of Medicine's study, To Err is Human, in the Year 2000, and most of you are familiar with that. The statistics are certainly of variable quality, but indicating that there are somewhere between 40,000 and upwards to 100,000 people a year who die because of medical error, and the experts and writers of that will tell you that the quality of statistics vary, but the real question is,

we know that a lot of people suffer harm not because of the disease or injury for which they are seeking treatment, but by things that happen to them otherwise while they are under medical care.

So you will find today in the literature in the practice that the concept of high reliability organizations, while the concepts have changed and evolved from that as articulated by the original researchers, still provides a framework, a broad conceptual framework, for improvements in safety and quality. Not only safety, but quality and safety in the delivery of health care in the United States as well as in Europe.

Then the third significant thing is the accident in 2005 at BP Texas City. My dear friend and colleague, Dr. Najm Meshkati, has joined in the audience from USC, and on a fellowship to the State Department now, was involved in that investigation along with a number of other colleagues of mine.

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It was very significant in that the issue of culture was for the first time in a major accident raised as a major factor as a result - in the factors that contributed to that accident. And of course there was a major study that was recommended and undertaken to look specifically at that issue.

All of those things, it seems to me, have really catapulted the broader safety community to look at HRO again, and I repeatedly use the word, as framework, to contrast it to normative, and descriptive. There has been a tendency to default to the HRO characteristics which I am about the describe as being normative, but that was never the intent of the original researchers. While theory making continues to be something that researchers try to do, certainly it was not the intention of the original group that I'm speaking of for their research to be used in a prescriptive way.

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Coming from a reactor operations background, as many of us do, we know that we have never met a really successful engineer who can't take something and make it into a technical project. Because that is how they succeed. So the temptation is to take something like HRO and make it into a requirement set, and then we have our checklist on which we can evaluate. This is a very different type of subject matter, particularly when we start talking as John and I and others talk about complex adaptive systems and how we think about them and how we improve them. So that is just a continuous dialogue that we have depending on our relative experience and

perspective, whether we are technical, sociologists, or whatever.

Current state of the conversation, briefly, is, I mentioned to you that because this topic of HRO, and John will then talk about resilience which is an engineering term related, has gotten so much attention; many people in different federal agencies have been very interested in how might this inform our thinking in our respective regulatory and promotional safety quality promotional responsibilities as federal agencies working with our constituents, working with our regulated entities, whatever. That is the extent of the question, which led to us saying, gee, why don't we get together in a nonbureaucratic way, invite people who are knowledgeable in this area, and have these conversations and try to help think about how this could better inform the work of our respective agencies. Thus talking with Val, talking with June, talking with John, talking with others at the Commission. Because that is a venue which we can in an nonbureaucratic way, as federal employees, get together and say, what do we need to know, what do we need to learn, how do we think differently. So that is one thing in the current conversation.

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The medical community, which I mentioned, I will tell you that in February - late January or February, I forget exactly, of next year, we will have another international HRO conference which will be primarily focused on the medical community and the firefighters community in New Orleans. A number of us will be attending to continue this international exchange of research on current thinking and current best practices.

CHAIR APOSTOLAKIS: Is our staff participating in those meetings?

MR. ZIMMERMAN: My name is Roy Zimmerman. I'm the director of the Office of Enforcement. I don't know the answer to that question, but we can find out.

CHAIR APOSTOLAKIS: It seems to me there is a lot of activity that is relevant.

MS. BARNES: We intend to.

CHAIR APOSTOLAKIS: Your name again, please.

MS. BARNES: Valerie Barnes, Office of Research.

CHAIR APOSTOLAKIS: I know who you are, but for the record. Okay.

MS. BARNES: We had intended to in

resources, and timing, just didn't work out. But our intention has been to participate.

CHAIR APOSTOLAKIS: There is all this activity there. It seems to me sending an observer and slowing getting in to participate --

MS. BARNES: Agreed.

MS. CAI: This is June Cai. We have had roles before in some of these activities, and I think we will continue where we can, when we have staff available.

CHAIR APOSTOLAKIS: It's local, isn't it?

MR. CARNES: This particular one is in New Orleans. It's sponsored by Tulane Medical School. The HRO Roundtable is local.

CHAIR APOSTOLAKIS: Yes. I was going to say all you have to do is drive down. We should send someone.

MR. CARNES: We'll make sure that you are on the mailing list.

CHAIR APOSTOLAKIS: What is this PSAM 2010, what's going on there?

MR. CARNES: Oh, we are talking about these topics for the first time really at PSAM. Yes, at the conference in Seattle.

CHAIR APOSTOLAKIS: It's a special --

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MR. CARNES: -- culture, safety culture, HRO, session that is being sponsored at PSAM, and Tracy Dillinger with NASA and Bill Nelson who used to be at INL, they are organizing it, so they asked me to speak about HRO-related topics, and we have --

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CHAIR APOSTOLAKIS: Good.

MR. CARNES: I mentioned, we were talking, Dennis and I were talking, our Pantex facility, some of you are familiar with our Pantex Defense nuclear facility, has made HRO a focus framework for continuing improvement there. So they will be talking about how they have adopted and adapted the HRO concepts to look at continuing improvement.

CHAIR APOSTOLAKIS: They are coming to Seattle too?

MR. CARNES: Yes.

CHAIR APOSTOLAKIS: Oh, wonderful.

MR. CARNES: Actually, the senior gentleman there, Rick Hartley - Dr. Klein by the way was the dissertation adviser - so he's been working with me for a long time, so he and I are partnering on a particular paper.

CHAIR APOSTOLAKIS: Very good.

MEMBER SHACK: And that is a descriptive

rather than a normative implementation?

MR. CARNES: Yes, it is. And again it depends on where you sit, where we sit in DOE it is something that is voluntarily, i.e. at the discretion, of our contractor who runs that particular operation, chose this as being a framework through which they want to interpret their experience and try to make improvements.

So therefore it is definitely descriptive. From the standpoint of how they chose to implement it, it was reflected in actually -- I will segue and get back to the point if that's okay - actually the CEO at the time, now there is a new CEO who is continuing the emphasis, after considerable research and participation in some of these international conferences that I mentioned, decided this was a good framework for Pantex.

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So then he assigned Dr. Hartley to take on and champion research. So we have a case of a good Ph.D. nuclear engineer getting into the sociology and psychology, and go through that difficult work and say, what does this mean within the defense nuclear community speaking to the Pantex situation. Then developing a nine-week training program, mandatory attendance, for all management team. So that they

would have a common framework for discussion. And strive for this elusive common vocabulary. So it was required that way by the management team so they could then discuss what does this mean to us, and then structure customized improvement initiatives, depending on their particular roles and responsibilities in the organization.

MEMBER BLEY: Not to pick on detail, but what do you mean by a nine-week program? Is that like an hour a day?

MR. CARNES: No, this is my recollection, I can always get you the specifics, my recollection is it was nine weeks, one - one or two sessions, four hours per week with assigned reading and a post-text if you chose that got you graduate credit through it was either UT or A&M - and I know that is a terrible thing to say.

MEMBER BLEY: It's a substantial program.

MR. CARNES: This is a substantial commitment - this is after hours by the way - at the requirement of the chief executive officer. And that was followed up also by an HRO workshop if you will with the Pantex people, the DOE responsible management team, and our British counterparts. So and this has been going on for four or so years. Pantex has

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actually published two texts that the Government Printing Office has adopted as HRO text, one on the fundamentals of HRO and the other on their particular implementation of how they use these concepts to do their own - they call it information rich, nonconsequential, inconsequential, information rich investigations. They take something that concerns them, and say, well let's see what we can learn about our organization from this particular event, and now they are getting into the further discussions of, now let's see how we can use the cultural concepts, particularly Dr. Schein's framework, to understand more about this.

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CHAIR APOSTOLAKIS: Let's move on.

MR. CARNES: Okay.

CHAIR APOSTOLAKIS: See what the nature of it actually is.

MR. CARNES: Okay, slide #2, I'm going to speak about these. And I'm not going to cover each point unless you want me to, but describe them in brief. But there are two major ideas behind an HRO. One is that an HRO anticipates, focuses on anticipated and becoming aware of the unexpected.

And this is a hard idea for a lot of people to understand. What do we know, what do we

expect to happen, but what don't we expect to happen? That is the first one.

Number two is, when the unexpected occurs, how do we contain it, so that something really bad doesn't happen. Okay, let's talk about these and the key points within each.

Now whether you call these, as I have, characteristics, or whether you call them process, whether you call them principles, or whether you call them tenets, you see all those words used in the literature; I am taking from Karl Weick and Kathy Sutcliffe at the University of Michigan, because their characteristics I think are the most commonly quoted, and their literature is the most recent in publishing these.

The early work I will tell you didn't focus on process. They said what we see that these organizations are doing differently, The Weick and Sutcliffe work, operates more on the cognitive level. How do we see these organizations thinking differently?

CHAIR APOSTOLAKIS: Isn't this what we call defense in depth?

MR. CARNES: Certainly it is defense in depth, but in a greater depth, because I maintain we

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tend to think of defense in depth in terms of engineering and administrative barriers. Okay, this says you must go deeper, and you must ask how people think about their defenses. How do you understand your defenses? How do you understand the process in which the defense is instilled? How do you know if the defense is working? If the unexpected happens today and the defenses don't work, then what would be the contingencies you would put in place, not blindly trusting to defenses.

So it is getting into how do people think about how they do their work and the totality of what the organization does. And I'm going to get into that distinction in just a little bit if I may.

So let me talk about this first thing of preoccupation with failure, which is different than being consumed with fear and anxiety, which can incapacitate people. But rather this is what we call questioning attitude of okay, we are doing something today. What might happen? And doing this collectively, doing it individually, but doing it collectively, and trying to be as mindful as possible of what may have changed today from the situation that we encountered yesterday, or the last time that we did this particular job, and what would we need to be

attuned to?

Some discussion we had earlier was, conceptually, what could happen, but what are the cues, what are the signals, that we should look for, that would tell us that the way we think things should be going are not in fact going that way.

So the whole idea of preoccupation with failure centers around those concepts. The chronic awareness, hubris being the enemy, being - having this attitude that is based on we are competent, we are trained, we are capable, but we are not omniscient. That's a very important distinction. Any lapse is taken to be a symptom not for blame, but a symptom or an indicator that something could be going wrong with our systems. And this whole thing of reporting of errors is thought about differently. It is not reporting for regulatory compliance's sake. It is reporting because we want to be attuned that something could be going wrong. And if we see something that is unexpected, everybody needs to know about it, because somebody else could put those pieces together, that perhaps I could not, that could create a meaning out of this. And I will talk about that in a little bit.

Continuous reflection, reflective learning is something that is very important in a HRO.

The next thing we looked at is to not simplify. It's very important. I will key on one line that is not underlined, but it is on the first bullet in the chart that you see in front of you that goes so much to the strength of what you look at, risk assessment, okay, but also the weaknesses, other weaknesses in our system, and that is our inability to identify all possible failures.

We know that we cannot predictively do that. And we know from our experience that the things that often fail are not the things that we expected to fail. So if we simply our interpretations, we can ignore those things that are not exactly right, but yet we act as if they are.

So this whole idea of recognizing the complexity of our business, and refusing to make it simpler than in fact it really is, is also a distinguishing characteristic of HROs.

And this - you mentioned earlier causation, I'll touch on this one - is refusing to accept single causation, single failure. I don't know about your experience, but oftentimes when I review accident investigations, or investigation reports, we go to this idea of root cause, and we are determined to seek that one cause that if we only fixed it fixes

everything else. It's a nice engineering solution, but the world doesn't work that way. Because we find that there are multiple factors involved, and you spoke about some of this earlier, Harold. And I can go for example to the work of Jens Rasmussen looking at all those external factor causes, looking at the total society and the different players who were involved, and the things that were done that seemed reasonable at the time by the different players that downstream resulted in unexpected consequences. I would think about those kinds of things.

The next item, number three here is sensitivity to operations. I remember there was a time when there was a big shakeup in the commercial nuclear power industry as you may recall, saying that you advanced to a certain level of management you must have been qualified as a senior reactor operator. You must have that kind of training. And before that that was not the case. That's my recollection at the time.

And then I remember when in the industry working through INPO created the - through MIT - the executive course, so that all executives in the utility, regardless of whether they be chief financial officers, human resource, or whatever, have an opportunity to go and learn about the fundamentals of

the technology with which we are entrusted. So those ideas of making everyone in the organization sensitive to the fundamental operations that we perform, educating people about those operations, not taking it for granted that because they just do HR they don't need to know anything about the technology, is again a distinguishing characteristic of an HRO.

So then I shift to the two other characteristics is in terms of containment if you will, and those are the commitment to resiliency and deference to expertise. Yes?

MEMBER RAY: Earl?

MR. CARNES: Please.

MEMBER RAY: The comments you make is very apt, but I just want to point out that many times the HRO we're talking about is really embedded in a larger organization that is quite different. And so if you talk about HR for example, most, not all - in fact probably a declining number - but many anyway of the facilities that we are concerned about are still embedded in an organization that is really very diverse and has a totally different culture and so on and so forth.

That is a problem. I don't want to dwell on it here, but it is an issue nevertheless, and we

need to keep ourselves mindful of it. They are not all NASA. They are not all - many times they are maybe even a hedge fund take out of what used to be something and now is something different.

So anyway enough.

MR. CARNES: Your point is well made, because we have the fleet corporations these days, and then they have gas operations, and fossil, and I remember way back in my time we did make a distinction between the fossil mentality and the nuclear mentality. No real pun or derogatory idea intended, but that the way we think about doing our business at a fossil plant, and the way we think about doing our business in a nuclear plant, are quite different. Anyway.

MEMBER RAY: Yes, they are involved in markets, they run distribution systems; it goes on and on. And so you meet with the chief financial officer, the human resource officer, may well look at the nuclear piece as a small piece of a big organization.

MR. CARNES: Exactly. So commitment to resilience, basically again what we want to look at is this idea of when the unexpected does happen that we have developed repertoires of response capability. When we practice drills, we shouldn't always practice

the large break LOCA. We want to look at those unexpected power outages. We want to look at something that happens in the switchyard. We want to look at you know transmission coming in from off the grid. We want to look at all those kinds of things. Why? Not necessarily because we are going to experience that event, but rather by helping people train to respond to different kinds of events we give them a broader repertoire of response capabilities, and response experiences, so that when something happens that never happened before, they are not just trying to make it look like the only thing that we know how to deal with. That's basically that in a nutshell.

Deference to expertise is very simply but very powerfully, the decisions that are to be made are not be made by the person who has the most power, but rather in an HRO, not should because that's normative, in an HRO the organization gravitates to where the expertise lies, that is relative to the question or the issue to be addressed. Always respecting the responsibilities of the appropriate management chain, but who do you really turn to? You turn to the person or people hopefully who have the most knowledge of this particular thing, and people at the helm listen

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to them in developing the solution to that event.

Oftentimes the people are able to handle it because they know that's within their role simply to handle it before it spreads. That's unique to an HRO also.

I put that here, which I think is important, hierarchy supports administration. Expertise supports performance. Performance has precedent in critical circumstances. You don't let the bureaucracy run the show if you will.

That's the way basically that Weick and Sutcliffe have identified the characteristics of HROs. And then they said, what does this mean? Particularly Weick comes up with this idea of sense making, and that has to do - it's a simple concept but very difficult concept of saying how do we make sense of what's going on around here everyday? How do we know if it's okay, or how do we know if there is something we need to be attuned to? That successful organization has a way of making sense about what's going on all the time, when the unexpected occurs, we have to notice it, we have to understand it, or at least we have a model of what it's going to be, and then we do something about it, and respond to it. John talked about it a little bit earlier. And I

think this is very important.

Sense making requires formal and informal inquiry sharing and challenging mental models that somehow we develop within the organization, the people. This understanding that we all have not only the responsibility but the ability to question, to ask, to challenge authority, that authority itself is not the deciding factor, it's the understanding of what's going on in our operations.

Even Admiral Rickover talked about that as being an essential characteristic of a nuclear professional. So that is the idea. Sense making, which then relates to the idea of mindfulness.

How do we shift our mindset from our - we get up and deal with the kids, we deal with the family situation, we deal with whatever is going on in our lives, and we go into work and put that aside and be attuned to what is really going on in our workplace that day; finely attuned so that we can notice those subtle signals? Somehow these HROs have developed the individual and collective sense making to be able to do this. Some of those are formal processes, that we use data that we collect, how do we analyze that data. But sometimes it's just this feeling that you talked about. We know that sometimes the experts can say,

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something doesn't seem right here, and they can't really explain why it is, but they know it just doesn't feel right. And we say that should be sufficient basis for taking a time out, for drawing back, to say, let's talk about this, let's figure out if this is okay or not. It will encourage that expert based response that maybe they cannot articulate in a very rational fashion.

So the diagram that you have in front of you is this whole thing of the characteristics give us a general orientation of mindfulness, which gives us the capability of discovering the uncertainty and the ability to manage the unexpected events, which gives us consistently high performance. That is the broad framework of what this HRO stuff is about.

Now let me shift from that to a few other slides, and invite your questions. I go to my friends, Karlene Roberts at UC Berkeley and to Dr. Bob Bea from Berkeley, who kind of sum it up like this, that HROs aggressively seek to know what they don't know; they balance efficiency with reliability; and they communicate the big picture to everyone.

Part of the discussion earlier was this idea of the emphasis on safety, and the discussions that we have in the DOE community is to say and

discuss how this is true that those things, characteristics, behavior, whatever you want to talk about, that promote your mission accomplishment, also promote safety and vice versa. And understanding how that is so is the key, I think, to aligning the incentives appropriately because I had stories, coming in from the field, about when performance award time comes in, you sit down, the CEO or whatever, sits down with the managers and say, okay, what are the awards that we are doing this year. How are those - and actually we started to change the executive behavior to ask these questions - how are those aligned with what we say we value? A lot of times you find that those incentives are aligned by look, they exceeded production quotas. But is that what we expected them to do, and having a different kind of conversation about what should merit an award. That's where I think Bob and Karlene are trying to get to. I then go to why is this important, and to the larger society, and we talked a lot about this, tried to talk a lot about this in DOE. Robert Pool wrote a book in '97, Beyond Engineering, How Society Shapes Technology. And in that what he does is say, you know, and he looked at nuclear power as kind of an exemplar of the broader society and what our

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technology is doing, and saying, we've really done a lot of good things. Not that we are perfect at all, okay, in commercial nuclear power in the United States, but it compared to chemical, petrochemical, compared to some of our emerging technologies, and medicine, there is a lot to be learned, not that we should stop, but there is a lot to be learned and to be shared, and concludes with this line that our ability, he says in a generation or two the world will likely need thousands of high reliability organizations.

And then concluding by saying that our ability to manage a technology rather than our ability to conceive it may be the limiting factor in many cases. And I know that you have seen, because I certainly see, in our operations, that the key to advancing in management is to take someone who is a really, really good scientist and put them in a position of management where they never wanted to be in the first place.

I had one very delightful and really fine gentleman, a physicist, who said, I think it was probably a major facility, he said, I was never trained as an administrator. I trained to be a physicist. I do research. Then they asked me to do

this for the good of the laboratory, for the good of our field, I did this. So then the question is, how do we prepare them to take over these positions of responsibility? That's what I think Pool is getting to.

Where do we go from here?

CHAIR APOSTOLAKIS: You're doing fine.

MR. CARNES: Okay, good. Good. Future problems - and I borrow, I borrow from good researchers, and some of these are like Woods and Cook - where do we go from here. The five transitions I would suggest from where we are - John is going to talk a little bit in terms of where we are now - so maybe where we perhaps should be going. Shifting from a deterministic to an adaptive performance model, this whole thing that success or safety is a function of people's ability to adapt to the unexpected is a very different way of thinking about safety and performance than saying that safety is an inherent property of a well engineered system. Most of us are trained to think, if we only created a better system, if we only created a better technology and got rid of these people problems, i.e. human error, everything would be safe. The new thinking says, that is not the case at all, that in fact it is the people who day by day

moment by moment, because of their ability to adapt to the unexpected who in fact create safety, who create productivity, hopefully supported by the systems, the training and the education that we have provided to them, as well as the supporting environment in which they recognize that taking this initiative and taking the appropriate response, even though it's not specifically spelled out in the procedures, is in fact what you are supposed to be doing. I'll talk a little bit about some research that has been done in Sweden and Finland if I have an opportunity to do that that illustrates that.

Shifting from a focus on error to a focus on complexity, we are still in this paradigm, although it is a more constructive paradigm on error, of still talking about human error. We no longer say that these people -- well, not every place, but more and more we say we don't blame the individual who was involved because of their error. We don't do that. And most CEOs that I talk to now, or senior executives, they certainly espouse that. And many of them have systems in place, "just cultures" to take after Dr. Reason's approach, to build that into their personnel systems. So they are really well intended.

But still the fact is, we talk about

error. We haven't made this cognitive shift to try to understand adaptive responses. The work as done, versus the work as imagined. So that is something that we need to think about how to change to understanding that.

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From a culture of reporting incidents to one of learning. What I have seen, this is Earl again, is that we are still very much in reporting equals compliance. And so we count up the number of things that we have reported, and we say, see what a good job we are doing. And then our lessons learned is, this happened, somebody did that, and the lesson learned is don't do that. That is not a learning. That is not a learning, I suggest.

So how do we really shift to a learning model? Again from that tabulation, from the counting approach, to searching for patterns, because we know again that no event ever happens exactly the same way twice. We don't see repeat events. They do a pretty good job of preventing repeat events. But what are the broader patterns? What do the signals tell us about the patterns that suggest broad more fundamental failures in the systems that could set us up for failure? That is a different way of thinking, and the same way here from looking - on number five - of

looking backward at past events trying to look forward and anticipate future events.

I'm not suggesting we know how to think about these things. A lot of people are talking about them, and suggest that these are major challenges that we need to look at in the future.

MEMBER RAY: Earl?

MR. CARNES: Sir.

MEMBER RAY: Trying to - I'm watching the clock, I don't want to get off the track - but I'm trying to figure out if you are advocating doing something different, or doing something in addition to what we are doing. Because if you are talking about doing something different, I guess I have some concern that I wouldn't have because all of this is very persuasive. I wouldn't have a concern if you were saying that we need to do these things in addition to accounting and following procedures, and trying to comply with requirements and all that kind of thing.

But you use words sometimes that imply to me that we want to do something different.

MR. CARNES: Okay, thank you for allowing me to clarify.

Number one, talking about what an HRO is, I'm not advocating, I'm reporting. This is generally

what the literature says.

Now to your point very specifically, no, I am not advocating doing something different for the sake of doing it. But going forward and adding to, because I personally believe and what I've experienced is, those things that we have developed over let's say 30 years, but more than 30 years, but think of 30 years, that's TMI, again the nuclear business, not to say high hazard business. But those things we do not need to retreat from, because they have been learned at a terrible price and they have been proven to be successful.

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We are today at what, roughly 93 percent capacity in the U.S., 92-point something like that. At the time this research was started, the average capacity factor was about 66 percent as I recall, just taking that data point we've made a huge amount of progress, right. We don't need to back off of that. But the question is, so is that good enough?

MEMBER RAY: That's fine. You've answered the question. This is in addition. I was just listening carefully to try and clarify that, and it wasn't clear in my mind whether you thought we ought to shift and stop doing what we are doing and do something differently, or whether we should do these

things because they will, as you say, provide added benefit.

MR. CARNES: Yes, yes, that's what --

CHAIR APOSTOLAKIS: I have a question that is related, and I think I mentioned it earlier too. I want to understand whether a high reliability organization is different from an organization that has a good safety culture. Because that would help me understand, and the staff, what we need to do. So maybe I'll put it this way. Let's say we achieve what the staff presented earlier today, and the nuclear fleet has a positive safety culture. Is anything else that I need to do to also be called a high reliability organization? Or am I automatically a high reliability organization?

You touched on organizational things, and I'm not sure having a good safety culture also includes those. But my question is, in your view, having heard the staff earlier, is an HRO different from an organization that has a good safety culture, or are they the same thing?

MR. CARNES: In my opinion they may be different. May I explain my --

CHAIR APOSTOLAKIS: Absolutely, yes.

MR. CARNES: What I heard the staff say

is very consistent with the literature and practice that I'm familiar with in safety culture. I'm familiar with NEI, naturally I'm familiar with INPO and so forth. Now, the fact that one could develop let me say a checklist and go inspect and see attributes, whatever we call them, of a safety culture, just means that they are good at taking a test. What happens when the unexpected occurs? That's one question.

I have been an inspector, and I've been inspected, and I've also been a professor as many of you have, and I know the difference between taking a test and performing a job. Next point I want to make is that HRO starts with the idea of performing the job, not being safe per se only, but doing your mission. Now to me that is a distinction in the literature and in the practice of HRO compared to safety culture, as it is expressed in what I read. Because it does focus on what do we think constitutes or demonstrates safety. And it leaves out this most important thing of how do you do your job, your mission. Is that a 93 percent capacity factor? Is it to launch the planes off the carriers before the mission there? What is the job that you are doing?

HRO says that first of all you must do

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your job and do it consistently well and be safe, not be safe. So to have a discussion for me - I'm speaking for Earl - to have a discussion with the senior managers with whom I interact, to get them interested in doing something that required resources, requires their attention, requires staff to change their way of thinking, has to be connected to, what's in it for me. What's in it for me is, does it help me do my research better? Does it help me produce more widgets? Does it help me reduce my wastage? Does it do those kinds of things first, and then does it also help me maintain our improved level of safety.

But I have a real hard sell - I'll use that word - of saying this is going to make you safer. Safer as compared to what? What is the incremental value? Now that is my, Earl Carnes, answer to your question of what is the difference in the HRO approaches and safety culture per se.

CHAIR APOSTOLAKIS: Which is a very interesting interpretation, but again, given the fact that this is a nuclear regulatory agency, and the Commission issued a policy statement, maybe they would take more actions later, I have a hard time seeing the Commission inspecting whether a licensee is 92 percent capacity factor or 95 percent, because that is their

job. So perhaps this emphasis on safety culture is reasonable here; it's the licensees perhaps that should strive to be HROs, of which the safety culture is part. But the regulator really cannot get into that. I mean there is always the assumption that they are there to produce power, but I can't imagine the staff saying that here is an attribute that will test whether you guys are 85 percent or 92 percent capacity. I mean that is not our job.

MEMBER BLEY: That isn't what I heard Earl say, and I'd like to say something and hear your opinion on it.

MR. CARNES: Okay, please.

MEMBER BLEY: I was hearing more of the things Earl is defining as an HRO being things that can be measured in a performance based way for which there might be metrics where his interpretation of what he heard in policy statement is inspections to see if people are saying the right things when you ask them, and I don't - I'm not saying that is a distinction, but that is what I thought I heard.

CHAIR APOSTOLAKIS: No, what he said was that the starting point of HRO is performance of the main mission of the organization, as opposed to safety culture which looks at safety. And my point was, this

is a good attitude for the licensee, but when it comes to the regulator, I don't think we can get into that.

MR. CARNES: May I try to bridge both of those please?

MEMBER BLEY: Please.

MR. CARNES: Because both of you are in one sense correct. The - let me first of all make it very clear, the point I want to emphasize is what I heard, I have not read, what I have heard from the staff is quite consistent with the literature and practices that I'm familiar with on safety culture. No problem with that whatsoever.

Then the question becomes, and I made my comment about the test because, like I said, I was inspected, and I was an inspector, and please forgive me, but we know that if one wants to, which goes to your point about who does what and what you really enforce, I think is, if one wants to anyone can game an inspection. But over time can you demonstrate that you could respond to the things that you need to respond to? When the unexpected happens, that's a different kind of test, okay? May I finish this George? Very important to your question.

So I have in my next chart to shift the chart and make the point --

CHAIR APOSTOLAKIS: But maybe you remember the staff talked about both internal and external.

MR. CARNES: Right.

CHAIR APOSTOLAKIS: Maybe when we talk about the internal safety culture, it would be better to talk about making the NRC a high reliability organization. You see when we talk about external we cannot go and tell San Onofre what to do to improve their performance, but we can say that ourselves we should be an HRO, but then we inspect or we are concerned about the safety culture of the licensees.

MR. CARNES: It could be. May I have the next chart please.

CHAIR APOSTOLAKIS: And also you only have six minutes left.

MR. CARNES: Oh, I apologize. I will try to do this quickly.

Let me say that one of the things that we need to shift our conversation to is - is from, not to replace it, Harold, but to advance the discussion to one of governance. And that is certainly where a lot of the international discussion is going, is that the regulator always has a fundamentally important social responsibility to require certain standards, the

compliance and adherence to standards. But that within itself is not sufficient to deal with the emerging technologies and complexities that we have. A new way of thinking about governance, which is a collaborative approach, is that which is required. And that is what the initial research that was done on HROs in commercial nuclear power started to uncover, that in fact there is a different way even at that time of mutual responsibility, okay, that goes beyond just the regulatory compliance that the industry was striving for. It was different than the traditional regulatory model, okay, and that requires the kinds of things I would suggest as examples that we see going on in what NEI is trying to do, what INPO is trying to do, what the Commission is trying to do, each having their own responsibilities, but going beyond just the intent of the regulation, this concept of governance.

That is where the BP study was going for example, saying that compliance with certain regulations in and of itself, even though that is not the case there, they say you even had the wrong model, okay? You had the wrong model BP in mind. So that industry is talking about do we need to do something differently, thinking about the responsibility of the industry. That's a governance kind of thing.

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So let me get down to my bottom line in the two minutes that I've got left, is the whole thing about what is to be done, I think, where do we need to go to advance the thinking. Is this an art, is it - can we go in and tell whether someone is an HRO or not I don't think is the correct question. I see primarily new opportunities for research and collaboration, recognizing what I said before, to move forward from human error to move forward to the dynamics of systems and look at this issue of human adaptation as creating the safety, creating culture, creating performance. I think we need to collectively as you point out encourage more technical exchange, because there was a lot of research that went on in this country and the Commission did a lot of very good human factors research early on. Most of the research that I see now is in the areas that John talked about in medical, particularly medical in the United States. In Europe you are seeing a lot of good research that has continued on, funded by the European Commission, and a lot of - some applied research that is going on particularly by the Swedes. I'll point to as looking at these concepts as applied in the Finish and Swedish nuclear plants, the kind of research and applied research that we don't see - I don't see, I'll qualify

it - as going on in this country. I think it's very helpful to do three things.

One is to start primarily tying research and practice more closely together, because the very good things that I've seen, I think the cornerstone research, that is the cornerstones of the ROP, were a significant advancement in my opinion in looking at things a different way. I think the human performance improvement stuff that was done in the commercial nuclear power industry and culture were very important. I don't see any peer reviewed research that is done that takes those things into consideration and ties them into the literature, the actual research basis. That does two things. One it doesn't tell me if we in the commercial industry are keeping pace with the developments in the new applications, such as what is being done in medicine. There is some really, really good stuff that is being done using the Schein model, the archetype research and all that kind of stuff, in medicine, that I'm not convinced that we are taking advantage of necessarily in the nuclear power industry.

So are we keeping up with what is going on in the broader research arena is an interesting question. The next interesting question is how you

define our societal role towards nuclear power if you will to contribute our knowledge and experience to petrochemical, to medicine, to nanotechnology to the broader technical - I think societally we have a larger role that we could play, again participating more in the broader technical exchange and the research.

And that is really - those are really the points that I wanted to make. We're asking for great opportunities.

MEMBER ABDEL-KHALIK: I'd like to just make a comment. The concept of human adaptation is presented as an important ingredient for a high reliability organization. It is totally counter to the procedure compliance emphasis that we have in the operation of nuclear plants, and in your presentation I'm not sure how we can reconcile that conflict.

MR. CARNES: May I make a few comments? The idea of procedural compliance, and fortunately, the language has changed to adherence, okay, which goes from in my mind and practice goes more from a verbatim following of the procedure to an understanding of the intent and the basis of the procedure, and adhering to that, as opposed to the verbatim language on the paper. That is quite a

transition.

And I don't mean - well, let me give you an example. I mentioned the BP research in Finland and in Sweden. They went in and they looked at maintenance in those nuclear power plants, and they took some of these perspectives as their approach to inquiry, and they used a technique they call core task analysis. And what they found in the maintenance organizations and even in the same organization, there were differing perceptions on this idea of procedural compliance, that there was a group of people in the same organization that said verbatim compliance is our standard; we always do that. And if there is something that happens that is not covered by procedure, we stop work and we go ask the supervisor or whatever.

There was another set of people who said, no, the utility, the organization, pays us for our expertise and our experience. They understand that the procedures cannot possibly cover every contingency. That's where our value added comes in, and that's where they then expect us to go and use our experience where the procedure doesn't cover.

Now the question is not, I submit to you, who is necessarily right or wrong, the question is or

the point is you had different perceptions within the same organization. So it was the organization's expectation. So they sat down and they did an analysis and presented it to the organization. What the organization found was that really maybe only 10 percent of the maintenance work that went on - let's use that figure, that may not be exactly what's in the report - but a very small percentage was so critical that verbatim compliance with procedure was absolutely necessary. So what they did is go back and say, okay, and we all know this routine, these are the verbatim compliance procedures. These are the ones we expect you to follow this way, and the others we expect you to do the following. They got everybody trained, they got everybody calibrated, and that was the organizational expectations. Then they proceeded. Okay? So that was one example.

MEMBER ABDEL-KHALIK: I was asking my question at a conceptual level, that these two ideas are mutually exclusive.

MR. CARNES: These two ideas certainly appear to be mutually exclusive, and as they are typically interpreted are.

CHAIR APOSTOLAKIS: But if you read the literature, especially from France, they will tell you

that the French operators of nuclear plants have this latitude where they don't have to strictly comply.

MEMBER ABDEL-KHALIK: But we don't.

CHAIR APOSTOLAKIS: We don't.

MEMBER MAYNARD: In the U.S. you will comply with the procedures, you have various levels of procedures. Some are more of a reference level, and some do take advantage of skill and craft. But if the procedure says one thing you cannot go out and do something different just because you think you know better. You stop and you get a change procedure or whatever. You do write procedures to different degrees depending on what type of item it is. But the skill or craft can't just change a procedure on his own when he's out there working crew.

MEMBER BLEY: No, but most plans now have defined in their administrative procedures ways in which the operating crew can diverge from the written procedure if they follow their own processes. But they have implemented that through their process.

MEMBER RAY: George, I had an exchange agreement with a French plant and spent a lot of time over there. You do not want to do what they do. Trust me.

CHAIR APOSTOLAKIS: It is true though

that they claim this.

MEMBER RAY: You're dadgum right it is.

MR. CARNES: I will tell you I think it's fascinating the European Commission has invested a lot of money and years of research in what they call work process knowledge, which I think is fascinating in what they simply found, it's very good research, is that there is a very big difference in training a person to do a task, and training a person to do their job within the context of a mission of the overall organization. What it requires is understanding the entire process that you are your colleagues are involved in, and the role that you play, and what your contribution is. And by that broader understanding then you are better able to anticipate and understand the significance of abnormalities or unexpected things.

Also that then translates into your training qualification program, so that you have a team there with the academic community, with the industry, with labor, all saying, how do we prepare the new crop of people coming in, so that once they walk into the organization they are actually able to start working.

Now I'm getting out of nuclear power; I'm

speaking industrial overall. But anyway it's a fascinating field of research, and also suggest - and I'll quit with this, George, because I am fascinated by this - that where that type - you have that type of perspective or orientation on how much people know about their jobs and the mission of the overall organization, that they have developed a different mindset, a different perspective on ownership and contribution, team cohesion, and culture to go back to that word.

CHAIR APOSTOLAKIS: We have an example of this from San Onofre, where we were told, not by you, that by installing monitors, risk monitors, around the plant made some maintenance people better aware of how their work by fixing this would affect that curve that showed the core damage frequency, and that created a sense of ownership and so on. So that confirms it.

I think we should move on to John. And please when you sit there you can still give ideas as the discussion goes on.

MR. CARNES: And John will tell you where I was in error.

A BAG of SC by JW.

MR. WREATHALL: Correct, we will expand

on all these.

SAFETY CULTURE INITIATIVES

MR. WREATHALL: We will expand on all these merry letters.

Thank you, good morning, everyone. I know my name card says invited expert, and I certainly was invited, and I would only claim two aspects of being an expert. One is that I know far less about the whole subject than I actually do know, and the second one is that I will always assume that everybody knows the same background, so I'll no doubt use jargon and things that are not familiar, so please stop me.

The acronym, BAG, on the next slide is something taught to me by trainers at Seabrook Station. It was a technique the operating crew use to share situational awareness when a situation is evolving in the plant. They will take a time out when the plant allows it and review, where the plant has been, what's the history of this event, where are they at now, and going is their anticipation of what they are planning to do next. So I am using this framework a little tongue in cheek, but to sort of provide a shared understanding of this phrase, safety culture, being how did we get here, why has it become an issue, and the kinds of things we are dealing with that

describe safety culture now such as HRO and some other representations that are being used. That's not the only model.

And then where I think things will go, which picks up on Earl's points about the future, future progress. Even though this set of slides was revised at benefit, had I had the benefit of the conversation that's been around this table it would be very different, so I'll try and get through this and then address comments and issues that have been in conversation if you will.

So if I can have the next slide, just before I do this, this is rather a wordy quote, and I apologize for wordy slides, but a former colleague of mine I actually married who worked in the area of safety culture and was a co-author of the book, Culture at Work in Aviation and Medicine, made some observations about why we do find this concept of safety culture particularly as engineers and scientists rather tricky to deal with. We kind of know what it is, but then when we try and wrap our arms around it, it slips away again.

So to use some psychological language, culture is an emergent property. It comes out of how the organization does things. It's not a defined

entity in itself that you can go and apply a magnifying glass and measure and treat as some sort of separate entity. It's a property of that organization, and you have to look at it in ways that reveal it by what the organization does.

So this is one thing you could do, but that's just trying to make an observation about it; it's not actually measuring safety culture.

As a result, when we try and say we need to do something, or as a utility they decide they need to do something, making an intervention doesn't always lead to the expected outcome. Trying to change things when you don't have a deterministic model is, I'll try something, see what happens, learn from that, and try something different next time. And quite often the social law of unintended consequences will come into play, that you wanted to change something in the organization, you put a change in a policy or practice, reward system or whatever, and suddenly you find that people are doing things and a result that was never what you intended. So trying to manage safety culture is very elusive. It's socially constructed; it's the group of people coming together that results in that safety culture. It's a group or a distributed activity, and as the discussion has gone

around the table, and people have no doubt their own answers, it can be soft and it can be hard, it can be loose and fluffy and wooly and at the same time you can say, here's what it is. It's these eight parameters.

So we struggle to try and define what we are trying to tie down in a setting such as your committee does and this agency does and any other regulative agency does with how you can come to grips with safety culture. And my answer that I gave in the introduction is, I think there are three critical questions that we focus on, and different classes or different types of organizations will answer these differently, and it's their answers that give you the measures that should be observed.

Again this is a slide that I would have written had I had this conversation; it's not on any of the slides. So it's what do they look at, what do they look for, and what do they do about it. And those three questions to me define what from the outside and from the performance perspectives you can get by understanding safety culture. And I will go and try and illustrate that, and if I miss that point let me know, because I think that is something that I think needs to be reinforced. Next slide please.

This is the one Been slide, how we got through in history and management of safety. Normally this is a three-slide slide if you will. It goes simply through the age of technology and we looked at things and bits and treated systems with fault trees and event trees and did decompositional analysis, and the role of human error with the 1931 publication of Heinrich's Domino Theory of How Accidents Occur was one of the first in a very general sense if you like a systems view of how safety is achieved. But one thing happens, then as a result of that another thing happens, and as a result of that - and so on.

IT started to come into the system we looked at in the `50s and'60s. But then of course events of March, 1979 with Three Mile Island led to the view, oh my goodness, it's all about human performance, and suddenly the world of human factors arose in the nuclear power field. It had been present in aviation and others, but in the nuclear field it certainly became today's paradigm.

And I guess that persisted for 10 - 20 years, and then of course in the nuclear world Chernobyl occurred. In the UK and in Europe there were a series of other accidents, like the King's Cross subway fire, the sinking of the Herald and Free

Enterprise and so on, where it was recognize that it was the organizational decisions that really had set the system up to fail and the accidents that then resulted with loss of life.

So there was a growing awareness of the role of safety culture, and as a result that became the emphasis with the INSEC publication by the IAEA, the research that took on Challenger, Columbia, those accidents, and perhaps the most recent one that is being looked at is the Air France 447 loss over the Atlantic Ocean.

So that sort of - there is a time history, and it's evolved, our focus has evolved so that now safety culture, safety management, has become the hot topic.

MEMBER RAY: So John, might it have been the case that people concluded that it was a lack of adequate regulatory oversight in those examples that you gave that caused the problem rather than the organization itself having the attributes that you are going to talk about?

MR. WREATHALL: Well, I think we've done a lot to fix the simple things, to put it crudely. The use of fault trees, the use of understanding of how hardware fails and so on, had led to significant

improvements to what used to be the old big failures. In aviation that simplest example is the improvement of jet engines and the elimination of square windows in aircraft hulls led to the elimination of a lot of aircraft accidents.

MEMBER RAY: But we've got all we can get out of the regulatory process? I was just thinking about what you said, and applying it to lots of other things that are going on in the world today. And nobody ever mentions it was a regulatory breakdown, we failed to regulate this activity with sufficient vigor and insight.

MR. WREATHALL: Well, if I can just make the observation, that series of UK accidents, one maritime accident, two railway accidents, a subway accident. In the inquiry system that pertains in the UK which is a Royal court of inquiry that's independent of the industry, the role of the regulator was heavily criticized. But it was at that time as much - it wasn't an area of awareness by the operator, by the regulator, by the safety experts, if you will, that these activities could lead to the consequences that they led to. So it was a failure, but it was more a lack of understanding of how that would play out until they occur.

MEMBER RAY: I'm taking your time, but you mentioned that it was seen that the organization was set up to fail. I'm only wanting to add the part that the regulatory process might have intervened in some of those cases at least and done something to prevent the failure and they didn't.

MR. WREATHALL: Everybody wasn't smart, if I can put it that way.

Okay, so I think we can go on to the where we're at. It's where I think we pick up.

CHAIR APOSTOLAKIS: John, would you go back to the previous slide, please. I do understand this picture there with the human factors, and then one level higher, safety management. I'm hoping that's the end. Ten years from now will there be something else above?

MR. WREATHALL: I honestly don't know. At times we were in an earlier phase than the one shown. We didn't really imagine there was something that was now going to get us - it wasn't like we said, you know, safety culture will get us, but thank god we haven't had an accident. We just didn't have it in our area of consciousness. So to anticipate forward I honestly don't know, George. I don't know what it would be.

CHAIR APOSTOLAKIS: I don't know either. But something beyond safety monitoring, my goodness.

MEMBER BLEY: The good news is that the kinds of things that led to this history are getting less frequent. We have made improvements all the way. But we are still getting surprised once in awhile.

CHAIR APOSTOLAKIS: I think the major turning point in this industry was the recognition that humans can make mistakes.

MR. WREATHALL: And we moved from to understand that humans are in most cases adapting to situations that are put in that lead to failure.

CHAIR APOSTOLAKIS: I still remember the early days of PRAs.

(Off mic comment.)

MR. COLLINS: Is this on? Can you hear me?

Dave Collins, I'm here to present at 4:00 o'clock. And just talking about what might be the next step beyond this, there was a paper written a few years ago by the name of John Sorensen who I think was an NRC fellow who looked at a bunch of different methods for safety culture, and I worked a little bit with him to try to find out what is the next step, where are we heading. And one thing I brought up with

him was, well, if culture is the way we do things around here, maybe it has something to do with leadership, because it's leadership that says how we do things around here.

So at first he was kind of resistant to it, but I actually - he had a communication from our chief nuclear officer who kind of basically said, bought into what I was saying and thought that that was exactly correct. The nexus between safety culture leadership is an important issue. And then I proposed to John, what about using leadership behavior as a metric for safety culture. And he thought that was a pretty good approach.

So I'm just thinking, my presentation, you might disagree, but it's going to talk about focusing on leadership behaviors as being perhaps the next step in managing safety culture.

CHAIR APOSTOLAKIS: That's interesting. Okay, back to you.

MR. WREATHALL: I'm just going to go very quickly over three different views on how to describe organizational safety behavior. I use generally the term, organization safety behavior rather than safety culture, because I am really interested in what they do, not any kind of espoused values and things; that's

not what I'm dealing with.

Westrum to my mind was one of the earliest, and still remains one of the most cogent but non-used ways of thinking about organizational safety behavior, and he defined - more recently published five, but putting that to one side - three different classes of safety behavior ranging from what he terms the pathological, which is the organization that basically lies, cheats and steals its way to economic success. It believes that safety is a barrier to production. It will do work arounds. It will lie to regulators. It will fire the safety whistle blowers. It will do anything it can to get to its perceived economic goal.

At the opposite extreme the generative organization is the organization that has learnt to work in such a way that safety and productivity actually go hand in hand, that if you eliminate barriers to do work well, then that will both improve the availability of the power generation, and it will improve safety.

The characteristics of this kind of organization are somewhat similar to the HRO, although it expresses it in perhaps a different way. They try and learn big lessons from little events, the near

misses, the small things that could have happened. What do we learn about the organization that we can fix? They actually reward safety troublemakers. They are encouraged to come forward, and even if they raise something that is a non-issue, they are encouraged and rewarded for that action. They want a pro-active involvement with regulators. And I did work on the EPRI project that I talk about at the end of this presentation with such a plant that in my view was extremely to the end of the generative organization, that was Rochester Gas & Electric.

MEMBER BLEY: I seem to remember hearing Ron talk about this in the past with examples and put in a bit of a tough spot. Because most of his examples only stayed here for awhile, and then something changes, and they drift out of that.

MR. WREATHALL: And I'll come to that a little bit later about these are dynamic organizations. In fact there was work back in the early 1980s at the University of Minnesota, I'm trying to remember the particular researcher, who looked at the characteristics of a successful - an organization that was both safe and economically successful, to look for predictors. And he was an economist, and his work showed that roughly a five-year time period, any

organization could be successful. The best predictor of that safety performance five years previously was that they were very good safety performance. So it actually turns out to be a dynamic thing, and what happens I think in the formal research is that the organization becomes focused on becoming generative, and they are very successful and then management moves on and takes their eye off the ball, and as a result they fall back into the - shall we say toward the pathological end.

MEMBER RAY: But that creates incentives for trying to institutionalize some aspects of this whole thing in a way that is independent of changing management schedules.

MR. WREATHALL: You're exactly right. I'll talk a little about the effect of mergers and acquisitions and that sort of impact on safety.

But just to go back if I can, and it's a personal anecdote about Rochester Gas & Electric. It was a small utility, one nuclear plant, and they recognized that in terms of economic success the worst thing that could happen to them is that the NRC suspected them of not doing something well, come in, mount a big inspection. It wasn't that the economic loss would be because they blew up a turbine or

because they had a real safety event. It was the perception that something went wrong.

So from their point of view it was very important to be successful at both safety and staying away from any kind of production problem that would lead to some kind of intervention by the regulator. And that sort of integrated view of how multiple paths to losses meant that they had to be very proactive in managing safety, do all the things that's in that bottom bullet, do all the HRO stuff, do all the resilient stuff that I've come on to talk about, was a very possible incentive system, and that was their incentive system up to the vice president nuclear type level, was to stay away from bad things. Whereas at the pathological end, they are doing everything to keep the pedal to the metal at the cost of safety.

And I think the general perception is that 80 to 90 percent of most organizations in a common industry lie in that middle category. Safety is a factor that is taken into account. You read the regulations. You - if somebody says, let's do an improvement, there is a cost-benefit analysis. It's a very sort of thoughtful but not bounding ahead type approach.

So I think all of us - certainly many of

us could think of organizations that fit in across this spectrum.

CHAIR APOSTOLAKIS: In the first one, the safety gets in the way of work and there are shortcuts, my understanding is that this is widely practiced, and this is probably the intent of violations that Jim Reason just talked about. Airplane pilots are notorious for skipping steps on their checklist, but is it really their fault? They are really, as they say, they are even for idiots. I think you are a little bit experienced, you don't want to go step by step.

MR. WREATHALL: I think that comes back to the earlier conversation that was with Earl about the idea of compliance versus recognizing work as an adaptive process. But how the organization resolves that tension, everybody has that tension, how you resolve it, where you enforce one, where you enforce the other, how you make the bridge. And I have some tools that try and lead people to that.

CHAIR APOSTOLAKIS: Good.

MR. WREATHALL: I think how you resolve tensions is the measure of the safety culture, not is it one or is it the other.

Next slide, please.

This is a second view on looking at organizational safety behavior, or safety culture if you want. He worked with me on a project for EPRI in the mid-1990s, and one of the tasks was to look at what would be an appropriate model or set of models of organizational culture as we are using that term here. And he identified after the review of the many theoretical organizational models seven common themes that seemed to emerge; different models express it in different ways. But there were seven components that seemed to play a role in success. I think it relates to things like top level commitment, awareness of what's going on in the organization, being prepared for things going wrong, flexibility and adaptiveness when things go wrong, are among the things that Earl mentioned on his slides.

Having a just and a learning culture, they are somewhat tied together, the just culture is to encourage reporting culture so people will come to you, to you the organization, saying, I screwed up, I'm not getting automatically fired, which is not unknown. So then you are bringing events forward and then learning from them.

So those three critical questions, what you look at and what you look for, requires people

bringing --

CHAIR APOSTOLAKIS: What does the word, theme, mean here? I'm trying to understand.

MR. WREATHALL: FEMA is not - that was in the context of a particular project. We were developing safety indicators for these. So we talked about themes as being the top level thing, and certainly made the point about context. How does that apply in this particular context? So in a large utility top level commitment means this item failed.

CHAIR APOSTOLAKIS: So turning back to Harold's point about the incentives, it's not a theme?

MR. WREATHALL: The incentive system would be a product of top level commitment. How did they set up the incentive system? Was their commitment in such a way that they rewarded people for safe and perhaps loss of production? That is a measure of top level commitment. Setting up a rewards structure that only rewards continuous production is not - that is a different level of top level commitment, not the one you want.

So these are that very top level of if you like mushy stuff. It leads into consequences.

MEMBER BLEY: It's kind of interesting to take Jim's list and lay it against the draft safety

culture characteristics from the NRC's presentation this morning, slide #10 for them. But there is a fair amount of overlap, but there is also some things clearly not the same.

MR. WREATHALL: This is a different model. HRO is this. There's Westrum's work. There were several. So it isn't that any one is right. I think each adds somewhat of a different perspective, or a different language.

CHAIR APOSTOLAKIS: Now Jim has developed these hearts and minds forces. Is that based on this?

MR. WREATHALL: Hearts and minds?

CHAIR APOSTOLAKIS: Hearts and minds, you know what that is?

MR. WREATHALL: Well, I know what hearts and minds are, but I'm not sure what you mean by Jim's version of that. He's moved away somewhat from that.

CHAIR APOSTOLAKIS: Safety culture.

MR. WREATHALL: Yes.

CHAIR APOSTOLAKIS: And you call it hearts and mind, and Mobil implemented it.

MR. WREATHALL: Shell.

CHAIR APOSTOLAKIS: Mobil Oil?

MR. WREATHALL: Shell.

CHAIR APOSTOLAKIS: So it's all based on

this?

MR. WREATHALL: No, I'm going to come to --

CHAIR APOSTOLAKIS: Okay, this is EPRI?

MR. WREATHALL: This is EPRI, and the other program that I'll come to was derived from the Shell - Tripod. Are you talking about Tripod Delta? We moved to a system called --

CHAIR APOSTOLAKIS: Actually called hearts and minds. The CD says hearts and minds.

MR. WREATHALL: That was to you, George.

MR. FLACK: If it was to me, I couldn't find it.

CHAIR APOSTOLAKIS: I did. It was shipped to me. Unfortunately it's proprietary.

MR. WREATHALL: Well, the tool and the concept were still Tripod Delta, and you can find that published.

MEMBER RAY: John, in response to George - and again, I'm mindful of trying to be very quick here - but top level commitment, I agree that's where it belongs in terms of incentives. But it raises a question again of top level what. If you are talking about a Shell or a BP or something like that, God almighty, it's such a - it's a country practically.

You've got to be talking about a piece of it, then if you translate that motion which is inevitably the case to a - I know very well, Palo Verdes, San Onofre and Diablo Canyon, each one are plants embedded in big utilities. So an easy way to deal with incentives it to say, well, here is the incentive, and you've got an escape clause that this or that happens. That's fine, in the nuclear context. You put it in the big corporate context it doesn't work worth a damn. So I'll just leave it at that. So we've got to bear in mind, what do we mean by top level? Do we mean top level of the HRO? Or do we mean top level of the corporate organization when you are talking incentives, because typically they want the incentive structure to be implemented the same across the company so you don't have people pointing to other parts of the organization saying you got your incentive and you didn't perform, blah blah blah.

MR. WREATHALL: No you are absolutely right. Each of these has to be seen in the context of what it is we are talking about. So if we are talking about the safety culture of a plant, of a whole organization, of a team, you could apply these even to a team or a department level if that was the unit you were trying to come to terms with. So they are driven

very much in a broader question of context and relevance.

MEMBER RAY: It's not as easy as it sounds, because you are part of a bigger organization and it has its own culture.

MR. WREATHALL: Working with railroads and health care, that whole question of scalability is a huge issue. Well, at least in the nuclear power plants, plants generally have very similar characteristics. Health care you are dealing with a from a mom and pop GP office through to the Cleveland Clinic and Mayo.

MEMBER RAY: Which is what NRC has on its materials side.

MR. WREATHALL: Yes, in fact if I don't remember someone can remind me about the work we are doing on the medical uses of isotopes. Because safety culture becomes very different issue when you are dealing with that.

CHAIR APOSTOLAKIS: The nice thing about these seven or eight themes if that they don't seem to overlap a lot, which is good.

MR. WREATHALL: They are not truly independent, but they take your mind in different directions. Then you say, well, it kinds of links

with this. So there is some - that's how humans are, we are not all separable compartmentalizeable. I better move on, because otherwise I won't get to the interesting stuff.

And then finally this was just to recognize really what the microtrends Earl had been talking about, HRO, so you have the characteristics of the organization, and a logic model that says how this should work. So I don't plan to talk about this, other than this is one of several different ways of articulating how safety culture works in the world. This is very popular. It's being used, as Earl said, in different industries. I will come on some challenges a little bit in the next few slides, and partly because of the way it's being driven I think to overuse. Not that it's wrong; it's just being overextended in some areas. So maybe I should move straight on.

So this is now the going part. This is where I think the future of this kind of set of issues is going to play out. So I think HRO is great, and nothing I say is meant to imply that it's wrong, but I think we need to talk about more than what an HRO does. To mean an HRO is really about specifying attitudes and thought processes and management, but

the context in which people act also plays a role as to how successful it is. It's I think coming to your question, George, about how if you have the right safety culture, are you automatically so? And the answer is, if you are an HRO in the right context you will probably be safe, but the context has to be understood. And I'll expand on that.

So it's really dealing with not how they do things, I said those three questions, what do they look at, what do they look for, and what do they do about it, aren't really answered by that HRO paradigm. It's leading in that direction, but it's not quite enough.

And they were developed - the HRO principles were developed from very particular contexts. They were developed from flight deck operations on aircraft carriers and firefighting. That was the principal thought processes. Now those are very obvious high risk areas. It's hard to think that you would be very successful in flight deck operations if you didn't evolve the tools that any HRO has, but if you take that to an administrative process, or you take it to the bureaucracy of the NRC, it's not clear that your world would lead to the same set of tools. There has to be a thought and an

inquiry process.

David Snowden, whose work I'll talk about in a short while, comments on the use of firefighters by saying we could train officer workers very easily in that same et of HRO skills that firefighters develop by burning their offices down every morning. It's not the world of experience that naturally leads you to the same set of tools, and it's not clear that they are necessarily the right ones.

And this idea that the properties of the system, the context in which these are being applied, plays a role, is still something we are working at, and that's where I think the resilience question comes in that I'm going to move to.

MEMBER RAY: Well, and you are not talking about the kind of probabilities that we often spend a lot of time talking about either. You are talking about flight deck operations for example. I mean 10 ^-5 possibility of a release. Flight deck operations are much less safe than that I guess.

MR. WREATHALL: But they are surprisingly safe given the situation that we have all this high energy, 18-year-old kids with no education, and things happening by the minute.

MEMBER RAY: Without question, but still

I think there is a probability difference.

MR. WREATHALL: But the place there isn't a probability difference is when you move to the industrial medical uses. Medicine is a high risk environment. The figures that Earl gave translate into - if you go into hospital, this is an average figure, and I'll put the caveat on it - if you go into hospital there is a one in 300 chance you will die as a result of medical error. Now the population in the hospital isn't uniformly at risk. But that is the statistic of failures in the health care system: one in 300. There is a one in five chance you will have a medical event, which means you will be given the wrong drug or some intervention will take place.

CHAIR APOSTOLAKIS: And if you don't go, it's much higher.

(Off the record comments.)

(Laughter.)

MR. WREATHALL: Actually it's a worldwide phenomenon. It's - the message is, get in and get out fast.

CHAIR APOSTOLAKIS: Ah, like Las Vegas. If you stay in the casino you are dead.

MR. WREATHALL: Fair enough, George. Next slide.

Okay, this slide is unreadable, as I see to you this slide is unreadable.

MEMBER BLEY: We have copies.

MR. WREATHALL: Okay, you have copies, okay. I could spend a long time on this, but I want to use it to illustrate the concept of what we are trying to do in resilience, which is in some ways complementary to HRO. If you think on this organization of three basic boundaries - I know there are four boundary lines, but three basic boundaries. To the top right of the slide is an economic performance boundary that if your organization is not inside the center of that basically you are out of business for economic reasons, and there is a lot of pressure coming from that side to change performance.

The bottom right-hand corner is the productivity, labor, resource effectiveness, availability, that are also put in constraints: you can't get the right number of educated workers. So for example in health care, the shortage of nurses, the shortage of residences, thanks to the residency hours rules, put in constant pressure on the organization to work towards more with fewer people, separate from the economic forces.

On the right-hand side there are two lines

there. The outer of those is truly the boundary of safety that we may or may not actually know the true limits of core damage, currents, or whatever. And within that there is a margin where you write the rules and regulations, so you stay within these safety boundaries to prevent yourself ever getting to the limits of safety performance.

But your movement in that space is dynamic, particularly with things like the economic forces, mergers, staff reductions, budget cutbacks, move where the organization is at any time, within that space. One of the ways you can view organizational drift for example is you reach that inner boundary on the right hand side, nothing bad happens because it is a safety rule, not a true safety boundary. You step over it, you find nothing bad happens, and the organization now starts to adapt to that.

So when I talk about resilience, we tried to think about how you manage an organization is this dynamic turbulent environment. How can an organizational system be created that comes less risky in this sort of paradigm?

You look like you were going to ask a question. I see you were just yawning; I'm sorry.

Next slide.

So given that model, then a resilient system can be thought of as having certain properties. That as a disturbance occurs, some outside challenge occurs, an economic challenge occurs, that the system has some kind of buffering capability. It's not immediately pushed over the edge, and can absorb disruptions, economic disruptions, work disruptions, changes in the fundamental way of working, without a catastrophic failure.

The flexibility: the organization can adapt, reconfigure, restructure, in the way that Earl was talking about, in deference to expertise. You have a different way of working to cope with a sudden crisis. You get the organization back under control, and then you revert to the more traditional organization structure.

As the system approaches one of the performance barriers, there is a recognized onset when you get into a problem. It isn't suddenly a cliff edge. Things don't suddenly fail. You can think of that from the physics of the plant. But organizationally, is there some point when you cut staff and you start getting problems, that you cut one more person and suddenly everything falls to pieces.

It's hard to know, but that is something we are concerned about.

And then knowing where you are in that space, so you don't inadvertently go over the edge. And you certainly don't want to rely in a resilient organization on events, failures, accidents occurring as to your navigation point. You want to know where you are, so you can actively manage yourself away from boundaries as you are starting to approach.

That is all I'm saying. This is one slide condensed from the three-day course, so there is a lot more I could talk about resilience, but I just want the idea that this is not entirely independent of HROs, but this is the property of the system that is being managed in an HRO way. It allows the HRO management views or reasoned themes or Westrum's model, coupled with the model you get from this, to stay away from trouble.

CHAIR APOSTOLAKIS: Do you have an example of an organization that meets those, a good resilient system? Is there such a thing?

MR. WREATHALL: In a sense the example I give to other industries of people who are best approaching this is the nuclear power industry.

CHAIR APOSTOLAKIS: Ah.

MR. WREATHALL: You are actually accomplishing many of these, some of it deliberately, and some of it inadvertently, but the concept of defense in depth and so on, not only in the physical plant but in the administration of the plant, you have rules about plant management. You have all the things that you look at beyond fault tree, event tree type embedded information. Sometimes you are more resilient, and sometimes less resilient.

MEMBER RAY: I think you are right, John, but there is one thing that is contrary to that, it seems to me, and that is, at least from my experience, I believe and anybody in the industry would support this, this idea of tolerance, there is such a long temporal lag between embedding a condition that will result in a problem and the problem actually manifesting. So people think they are inside the box, and they are actually outside the box, and it'll go on for three or four years, and then it'll finally surface. So that is what would say to me, nuclear is - has a difficulty, because they don't have the feedback, the prompt feedback that you get in many other places. If you defer maintenance, if you don't do an inspection that you could have done and should have done but you don't do, I could just go on and on

with the litany of things that you do, you don't hire and train people in the pipeline that you need and should have, all kinds of things, they catch up with you way down the road, and there are just so many examples of that you never exhaust the list.

MR. WREATHALL: If I could actually ask you to hold that thought, because I am going to come back to that. In a sense what ultimately I'm going to talk about are tools and methods by which you can create that knowledge.

MEMBER RAY: Okay. I'm skeptical about the tolerance part.

CHAIR APOSTOLAKIS: We are not creating gracefully?

MEMBER RAY: I'm saying - I challenge his answer to your question for the reason that I say.

CHAIR APOSTOLAKIS: Ah, but it's a relevant answer. We are much better than others.

MEMBER RAY: That may well be too.

CHAIR APOSTOLAKIS: Which is a great thing by the way --

MEMBER RAY: Why I traveled out here yesterday.

PARTICIPANT: We probably understand our margins better than any other industry.

CHAIR APOSTOLAKIS: We worry about details.

MEMBER SHACK: But we have more buffering.

MEMBER RAY: I said I agreed with him, George.

CHAIR APOSTOLAKIS: Yes.

MEMBER RAY: I agreed with him. I think what I said is still a reality that we need to have in front of us, and I think John agrees as well.

MR. WREATHALL: I'll just make two comments. One is that certainly other systems like health care, all of these have big problems, and I can give you a whole model on that, but I won't. I'll just say in comparison, you are much better than a lot of others. But the goal of this type of approach is to say, and therefore, how can we make you more resilient? What are the tools, techniques and methods you would need to improve your performance in these areas? And that is where I think we have something positive to say.

MEMBER ABDEL-KHALIK: Your diagram, however, implies that the boundary in this case is regulatory compliance.

MR. WREATHALL: Not necessarily.

MEMBER ABDEL-KHALIK: That's the one from the left.

MR. WREATHALL: You can infer it for your industry, but that is a general model that most organizations that have some kind of failure space create rules of some kind, and they could be their own rules, they could be heuristic rules, not regulatory rules, that are the means by which you judge whether I'm good or not.

MEMBER ABDEL-KHALIK: The problem I'm having here is that that boundary is very fuzzy, versus the boundary for regulatory compliance.

MR. WREATHALL: And I go back, the outer boundary there is the one that we don't really know. We have models, we have beliefs, that if you reach fuel temperatures of this, loss of this cooling, then bad things happen. But it's fuzzy. And we deliberately write rules in any industry that intentionally keeps us away from getting to the fuzziness.

MEMBER ABDEL-KHALIK: No, no, I'm talking about the inner boundary. That is a regulatory compliance, the one that gives you that error margin.

MR. WREATHALL: It may be. It may be. But there are other rules that we are talking about

here.

MEMBER ABDEL-KHALIK: Safety culture, I'm not sure where that boundary is. That boundary is very fuzzy. It may be inside that area that you are talking about; hopefully it is.

MR. WREATHALL: Let me say that I don't see that boundary - I'm meaning that boundary in terms of your operating rules in plants, or operational rules in aviation, or whatever you want to call it. Safety culture is how you navigate inside that space, knowing where you are, knowing what to look for, and how you keep yourself in the right place. Safety culture isn't the dimensions in here; this is the behavior part, and safety culture to me is all about behavior and managing behavior.

MEMBER ABDEL-KHALIK: Okay, thank you.

MEMBER RAY: That's why you call it a gradient I guess.

MR. WREATHALL: This is something that Rasmussen had seen long before us, 12 years ago, so the figure is a very general and abstract concept.

CHAIR APOSTOLAKIS: So this boundary, I was thinking in terms of the finance industry. Where is that boundary? Do they have a boundary?

MR. WREATHALL: They do. And they did.

They fell over it, because the SEC and other organizations recognized - well, didn't recognize that rules were needed. So banks have margins. The rules about mortgaging and collateral CDOs, they didn't have rules in place as to when that is okay.

MEMBER RAY: But they had Alan Greenspan in place who didn't want to enforce them.

CHAIR APOSTOLAKIS: So back to your point about the role of the regulator, right?

MR. WREATHALL: And they wanted to flood the market with money since the year 2000, if we go down that political pathway --

MEMBER RAY: Let's not.

CHAIR APOSTOLAKIS: We want to hear also about the indicators you developed for EPRI.

MR. WREATHALL: That's why if I can move on, George, otherwise I may run out of time.

CHAIR APOSTOLAKIS: You can.

MEMBER RAY: I'm going to take a very quick dip into another area that took me three days of slides, and that is complex dynamic systems, because I want to talk about context.

Very briefly, I'm going to talk about three of the four system types here, the simple, the complicated, and the complex.

Chaotic systems are systems that are completely out of control; nobody is associated one with another; they really don't apply to nuclear power plants in my experience, but the other systems do.

CHAIR APOSTOLAKIS: An example is a small office of a doctor, I remember reading about a chaotic system.

MR. WREATHALL: Chaotic, but not chaotic in this sense. I think the university is chaotic in this sense. Everybody is up to their own tricks, and there is no cause and effect.

(Laughter.)

CHAIR APOSTOLAKIS: Typical outside.

MR. WREATHALL: Next slide, please. Let me go quickly through these, please, because I think it will give yet another context of the way we're talking about safety culture.

Let me first say that no organization is any one of these. All of these aspects apply to different parts of behavior in different systems, different organizations, so the parts where the simple system model works, and so on.

A simple system in this context means that basically there are well established, well understood causes and effects. You know that if this happens,

then as a consequence this is going to happen. Everybody knows it; there's no ambiguity.

Top down management control, somebody telling everybody what to do, is fine. It doesn't have to be coordinated among individual workers. So you can talk about the best practice here. There is no ambiguity; the cause and effect is well understood. So methods of reengineering, business process reengineering, like Six Sigma, Total Quality Management work, because there is a defined good path and when you deviate from it you say here is what happened. I fix it this way, and we are back on path. That is about the only environment where business process reengineering can work.

The way in which you operate in this environment is you gather data about the events that you are interested in; you categorize them, so it's like a human error, retrain the human, you've got a good outcome. It's well established.

It really applies to very small parts of the business world in my opinion. It applies to things that are invariant, constantly repeatable, take one person out, put another person in, exactly the same thing happens day after day. The weather, the time of year, nothing really affects this, and perhaps

the simplest example, at least in my mind, is something on the level of assembly lines in production. But it doesn't really involve anything that is like a cognitive organizational - so it's a simple system. You sense, you categorize, you respond, and you can talk about words like best practice. That little tetrahedron is the top manager issuing directions.

CHAIR APOSTOLAKIS: The small office of a lawyer or a doctor.

MR. WREATHALL: Yes.

CHAIR APOSTOLAKIS: Where a guy says what should be done, and it gets done.

MR. WREATHALL: And if he says it tomorrow, and he said it yesterday, the same things happen; that is the key part of this.

The next one, the complicated system, is an organization where there are causes and effects of things that go on in that organization, but they are not particularly well understood, and they can be true at one time and maybe not at another.

CHAIR APOSTOLAKIS: That's a university.

MR. WREATHALL: Maybe MIT, because it's a bunch of engineers, so it's probably MIT. A liberal arts university does not fit this model. I'm getting

distracted, I'm getting too easily distracted.

Here you don't really talk about single best practice. There can be several ways of getting things done, all of which can be successful. It often involves bringing in consultants at a high pay rate, come in, tell you what the matter is with the organization, fix things, business school type modeling methods work. You get a group of students come in, diagnose, they put you into categories and analyze the situation and then make recommendations. Things like putting in a learning organization team, and safety culture improvement team, whatever you want to call it.

So here you are gather data, you are analyzing expertise, and it applies to many organizations, although maybe only for a short time, because they have to stay relatively stable.

The third one, and I would argue this is where organizations are increasingly headed, or groups within organizations, is the complexity area. And this is where you really don't - because things change in time. You talk about coevolution between the people and the system. The people are changed by the system and they change the system. So you come in with an initiative that says, we are going to have a

business process change, nobody is going to be laid off. Everybody remembers the last time they hard that, and they don't believe it, so they behave differently because of what the previous experience was, and so on.

One of the key things here is, this phrase, hindsight does not lead to foresight. You can look back and say, clearly this event happened because this happened and then that happened and then this happened, and it's entirely understandable. If you were ever to try and predict that sequence again it would never appear in the same light. Any interventions you put in to stop something bad happening is not going to be effective the next time around, because people have learned, they have adapted, they've found ways to fix it.

And think this is - when you talked about mergers and acquisitions and going from the small plant to the big world, it becomes more and more of this kind. The way in which you approach this, this phrase, the probing, sensing and responding, is talking about how you go in and gather data, not waiting for events for you to analyze and characterize.

This is where, for the third of these

models, why I want to talk about this final indicator. So if I can do that, that will be the end of my presentation. So bear with me this very brief presentation.

I'm going to talk about a tool that we worked with with EPRI in the 1990s timeframe to develop a tool that was called Proactive Assessment of Organizational Workplace Factors. And the concept behind it was to allow plant managers to look at what is going on now in the absence of any event or significant occurrence. The frequency of significant events have gone down in the industry from what used to be two or three per year, to one per 100 reactor years. So the industry realized that it couldn't rely on something equivalent to a significant event as a trigger to understand where you were in that safety space, and whether you were moving in it.

So very quickly the concept was to frequently go out and gather information about what INPO at that time called the Latent Organizational Weaknesses, and to look for minor problems. And I wanted to put in something about resilience that is different. That's learning from success. We talk so many times about learning from events, near misses, bad things. Very rarely have we thought of tools to

learn from successes. Why did things go right? And that is going to be a focus in resilience, and that's an area that I'm working on. But I'll just throw that in right now as a concept, because I think we will work on it.

So the techniques of data collection and analysis, an example of what we did, very briefly, in Latent Organizational Weaknesses, I'll just leave that on your slides. I don't want to spend the time talking about it. We developed a software tool that could be emailed to technicians, operators, people at the sharp end who do real work on a daily basis, and ask them to go through 12 factors, and provide a rating, on doing your work today how much of this was a problem. And it's factors like adequacy of preparations, like availability of procedures. Was the work package adequate? Could you get tools and parts available, just to use the examples on here. And this is not when an event has been bad; this is just saying during your work have these been the problems. So when you were talking earlier about, you can have things that are sitting out there that are problems, and they don't force something until months later. The idea was to start uncovering these by getting clusters of people to start reporting them

towards the right hand side of that slide. So the rating was not a problem to make the job impossible. And these are fictitious values. These are just thrown in for illustration. And where somebody reported a problem, more than two, they were asked to put a summary comment in. So you are not only getting a rating, you are also getting a start on a narrative. And I would argue, time permitting, that narratives are the key element in understanding safety culture. It's not do I believe my organization is good or bad; it's tell me a story about why - that reflects how this organization believes in safety. You know the right answer on a sliding scale; creating a story that tells you that is much much harder. And with logging, with audio recordings, you can do that with no cognitive load on people.

So that is gathering data. You sample people, maybe 10 percent of the workforce once a day, once a week, for various strategies we work on. And then looking at the results - this may be hard to read, maybe it's easier to read on the paper - don't plot starting means. That is the last thing I want to talk about on this slide, since Excel is the enemy of understanding.

(Laughter.)

What you want to know is where the outliers are. Where are people having problems, and is that getting worse or less each week? So here we only focused on those people who said it was two or greater or three or greater, and started to capture the stories about what was the problem. That way the manager in this case in maintenance, got to know about things that were an immediate problem. They put in fixes. They started to save a lot of money on the test plants we put in. And on the small scale applications, it was very successful. Now at that time we didn't have a framework to explain how this worked. This was 10, 15 years ago. I think I could tell a better story as to how this now fits into management, but at that time we just put it in as a tool. It was applied by about five or six plants for awhile; I think there's a couple that still use it.

MEMBER BLEY: How much effort did this take on the part of --

MR. WREATHALL: Very little. It was very carefully designed so that it took no more than 90 seconds for an individual. It is an apparent rule of thumb that if a rating, a survey, or whatever you want to call it, takes less than two minutes, they'll do it. It's not an effort. If it's more than two

minutes it's a chore. So the design of this was carefully built so that it was less than 90 seconds, unless they wanted to volunteer more information, and they could, they could do whole narrative reports, narrative and audio capture of it. So the idea was to - and this connects a number of Reason's themes about creating a reporting culture - here is a tool that you can use to gather information to support that.

The other thing that was found was sources of success. There were places where there were problems identified, but on the far left hand side we found ways in which they overcame them, for example, the skill and knowledge of their first line supervisors was exceptional here. And that's important, because if you were to bring in policies, practices, and management tools that got rid of the skilled front line supervisors, you would inadvertently lose that secret of success, and wouldn't know about it until it was too late. Boeing did that, Boeing - remember 10 years ago when aircraft sat around the field, couldn't be delivered to customers. Boeing's great skill as an aircraft manufacturer is not to build parts that fit perfectly together. It's, you build them as well as you can, and then you've got the skilled workforce that then

makes everything fit. Now of course they are the most expensive people on the shop floor, so when you have an economic downturn, who do you get rid of? The people that can fit things together in an aircraft, and they did, and their aircraft sat around all over the Seattle area, months, waiting to be delivered, because people couldn't do the last little things and make them fit, because they lost a skill they didn't know was important.

MEMBER BLEY: Do you have any idea why the plants that tried this and dropped it, dropped it? And why it hasn't spread any further?

MR. WREATHALL: Well, the plants that really seemed to take off were the ones I would say that got the generative thing. They knew that they were at risk if little things happened, not if big things happened, and they wanted to be pro-active in steering away. I think the bigger plants, they tend to be smaller plants who also, for whatever management reason, kind of got where their vulnerabilities were. The bigger plants kind of said, we know how to manage this. We have programs. And they've got to do a ton of things in the afternoon.

So, you know, I think it's jumping or crossing the chasm about how new technology moves and

is adopted or not. I think we were too early and we were talking to people who kind of didn't --

MEMBER MAYNARD: Well, I think also this was an area that INPO and the industry started looking at a lot more in maintenance and some of those areas, and there wasn't maybe a felt need for this. It was just that the plants were getting a lot of help on how to do things without this tool too.

CHAIR APOSTOLAKIS: Okay, John, are you done?

MEMBER BLEY: Earl wants to say something.

CHAIR APOSTOLAKIS: Yes, sure.

MR. CARNES: One thought question, John, is, I think about this, I think about the NEI facility standard nuclear model as a source for a potential metric categories of what you were looking at, and the INPO category one plants. I wonder what the picture would look like if we took those things and put them together, and said, is there a correlation among those who adapted or adopted the standard nuclear model and what the ratings have been. Do you have any sense for that?

MR. WREATHALL: I don't.

MR. CARNES: Okay, thank you. Just

curious.

CHAIR APOSTOLAKIS: Any other comments? Thank you very much, John. And you are staying the afternoon?

MR. WREATHALL: Part of the afternoon. I have to be on a flight at 5:00 out of National Airport.

CHAIR APOSTOLAKIS: Okay. Thank you, again.

So we will recess until 1:30.

(Whereupon, at 12:37 p.m., the proceedings went off the record to resumed at 1:39 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:40 p.m.)

CHAIR APOSTOLAKIS: We are back in session. The next item is "Safety Culture in the Reactor Oversight Process." The presenter is Ms. Audrey Klett. Can you tell us a few things about yourself and why you can address this august Committee?

MR. CHEOK: I don't think --

CHAIR APOSTOLAKIS: No.

MR. CHEOK: Okay. Go ahead.

CHAIR APOSTOLAKIS: Did I ask you my --

(Laughter.)

CHAIR APOSTOLAKIS: Am I chairing this meeting? Okay. Audrey, tell us who you are.

MS. KLETT: Okay. My name is Audrey Klett. I work in the Division of Inspection and Regional Support in NRR. Before that, I was an inspector in Region III for four years, and I was a technical reviewer in NRR's Electrical Engineering Branch for about a year and a half.

CHAIR APOSTOLAKIS: So your background is engineering?

MS. KLETT: Yes, and for safety culture

almost a year now.

CHAIR APOSTOLAKIS: And, Mike, what is it you want to add?

(Laughter.)

MR. CHEOK: I was just going to say the three of us up here are engineers. And in implementation space, I think it is important for us to have engineers that would translate what is going on in safety culture space into something that is implementable in the field for the inspectors, who are mostly engineers also.

I was going to start by saying that I am Mike Cheok, Deputy Director in the Division of Inspection and Regional Support. And you met Audrey. And who is left is Chuck Casto, the Deputy Regional Administrator in Region IV. Chuck has a couple of sentences.

MR. CASTO: If you would permit, Mr. Chairman?

CHAIR APOSTOLAKIS: Please?

MR. CASTO: Just to say a few things about what I heard this morning, if you will indulge me a little bit.

CHAIR APOSTOLAKIS: Okay.

MR. CASTO: On the safety management,

you're talking about what the future might be or is there something coming up? One of the things we -- and I am also co-chair of the safety culture policy statement with Cindi Carpenter. One of the elements, aspects of that policy statement, we wanted to be sure that the policy statement is timeless, that we wouldn't go back and revisit after every event.

Every event comes along. Then you have to go back and revisit, is there another element that is missing? So one of the goals of it was to be timeless, something that could last and be rigorous.

On the cause and effect, you made a statement this morning about cause and effect. I think that is exactly where we are at, particularly in the ROP. As we look for effects and we look for symptoms of causes, those are the attributes that we have in the ROP for substantive cross-cutting issues. Those are basically what you are looking for, just some at some level. But we really look for the effects out in the plant. Are there risk-significant events happening? Are there mistakes happening that cause risk-significant events or upsets? So then we ask the licensee to do a thorough cause evaluation, which is in there.

What you will see in those components that

we have, typically of all of those 13 components, there are only 2 or 3 of them that are ever used. And it goes to your point, and it goes to the point about Val, Dr. Barnes, in Research.

What I see the weaknesses of -- and this is just speaking for me -- is we don't know the hierarchy of those components. Each of them is treated the same as the others. So the decision-making one, for instance, might be a greater influence than the other components. So we don't know. And I think that is one of the aspects that we want to pursue with the research, is what is the hierarchy of those? I believe in my experience, decision-making is probably one of the ones right at the top. So we still have to do that.

Accountability. I know there have been a lot of discussions about accountability this morning. Accountability, as you know, is a two-edged sword. And especially when it comes to the just culture that is talked about, John and Earl talked about, just culture.

What we do see in some of the survey instruments that are being implemented out there in the industry, that there are some staff who are basically tired of not seeing colleagues held

accountable for mistakes. So you do get that.

I just saw one last week, a survey instrument at a licensee that is having some problems. And one of the comments, they had 101 comments. And they were mainly centered around people are not being held accountable for mistakes. So that is a two-edged sword.

And with regard to --

MEMBER RAY: Before you go on from accountability, is there some reason why as it stands today, the incentive issues that we discussed earlier are captured under accountability in the existing manual guidance?

MR. CASTO: I think we tried to make that a pretty big bin. And, if you will see, I would venture a guess there has not been one issue tagged to that issue.

MEMBER RAY: I would stipulate to that too, which is perhaps another issue. But right now, in any event, it's in that bucket.

MR. CASTO: Right.

MEMBER RAY: And you have got to really know to look there to say that the NRC speaks at all --

MR. CASTO: Right.

MEMBER RAY: -- to the subject of incentives.

MR. CASTO: The industry work on the general culture work environment, they call it the GCWE. It goes to that issue. They are doing a lot of survey work on the general culture work environment, which goes to the HRO issue. They're doing HRO. Should we be in the safety culture?

MEMBER RAY: Okay. But I don't want to put incentives in an HRO context. Okay? Because whether you accept that or you don't accept that, they're relevant certainly to safety culture.

And since you mentioned accountability, I couldn't quite make the connection between at least what I think of as incentives and the bucket called accountability. It just happens that is where they are addressed.

MS. BARNES: I think it is important to remember as well. I'm sorry. This is Val Barnes, Research. Chairman, may I speak?

CHAIR APOSTOLAKIS: Yes, you may.

MS. BARNES: Thank you. That the ROP components and aspects are different from what went into the policy statement. And with respect to the accountability component, it is not something, as

Audrey will address, that we ask our resident inspectors to look at when they are looking for safety culture implications of findings. It's something that NRC would only look at during a 95003 or as a result of a self-assessment that the industry does.

But I can guarantee that it is something that we look at. It is right in our procedure --

MEMBER RAY: Yes, it is.

MS. BARNES: -- and the implications thereof.

MEMBER RAY: Does that explain, then, why it is in the accountability category he just said?

MS. BARNES: Oh, why it is in accountability?

MEMBER RAY: Yes.

MS. BARNES: Accountability is the concept of reinforcing roles and responsibilities and the extent to which the organization reinforces desirable behavior. There are a number of different ways to reinforce desirable behavior. And incentives is one of them.

MEMBER RAY: All right. It is not intuitively obvious.

MS. BARNES: That is the theory.

MEMBER RAY: That is okay.

CHAIR APOSTOLAKIS: Audrey, uno momento de la verita, the moment of truth.

MS. KLETT: Slide two.

6. SAFETY CULTURE IN THE REACTOR OVERSIGHT PROCESS

INSPECTION AND ASSESSMENT OF SAFETY CULTURE

LESSONS LEARNED INCORPORATED INTO

IMC 0305, IP 95003, AND IP 71152

ASSESSMENT OF ROP'S SAFETY CULTURE OVERSIGHT

MS. KLETT: Okay. Today I am going to be discussing safety culture oversight in the ROP. First I will talk about how safety culture oversight is implemented within the ROP. And then I am going to go over the feedback we received and the lessons learned from regional experience that we have incorporated into the guidance documents. And then, finally, I will go over the results of the ROP self-assessments.

One of the lessons learned from the Davis-Besse vessel head degradation was that a safety culture was a contributing cause that led to the degradation. So the NRC staff subsequently provided the Commission options for enhancing its oversight of safety culture in SECY 04-0111.

In response, the Commission directed the staff to enhance the ROP guidance related to cross-cutting issues to more fully address safety

culture, which I will describe on the following slides.

The Commission also directed us to continue to monitor industry efforts to assess safety culture, which we are doing by observing the NEI process.

The Commission also directed us to develop inspection guidance for evaluating the safety culture of licensees with significant performance problems, which we accomplish through our supplemental inspection program.

The Commission also directed the staff, in part, to ensure that the resulting ROP modifications are consistent with the principles that guided the development of the ROP, such that overall assessments of licensee performance remain transparent, understandable, objective, risk-informed, and performance-based.

So in June 2006, the ROP was revised to more fully address safety culture. And the remainder of this presentation will show how the ROP meets the regulatory principles that guided the development of the ROP or how our safety culture oversight meets the ROP principles.

Slide four. Moving into the structure and

framework of the ROP is the concept of cross-cutting areas, which are certain aspects of licensee performance that could potentially impact more than one cornerstone of safety and multiple facets of plant operation.

Cross-cutting areas are human performance; problem identification and resolution, or PI&R; and safety-conscious work environment, which I call SCWE. Issues reflective of cross-cutting areas generally manifest themselves as root causes of performance issues.

In the ROP, the cross-cutting areas are described in terms of nine components of safety culture, which are considered during both baseline and supplemental inspections. The cross-cutting components for human performance are decision-making, resources, work control, and work practices.

For PI&R, they are the corrective action program, operating experience, and self and independent assessments. And for SCWE, they are the environment for raising safety concerns and preventing, detecting, and mitigating perceptions of retaliation.

There are four other components of safety culture that are not reflected in a cross-cutting

area. These include accountability, continuous learning environment, organizational change management, and safety policies.

The four other components are considered only during supplemental inspections. The safety culture components are further broken down into various aspects that the NRC inspectors consider when assessing inspection findings.

These aspects generally manifest themselves as the root causes of performance deficiencies. The most significant contributor to a performance finding is equivalent to one of these aspects. The NRC will assign that aspect to the finding and document the aspect in an inspection report. The guidance for doing this is contained in manual chapters 0305 and 0612.

Five, please. Every six months, the regions will perform a mid-cycle or end-of-cycle assessment. And during these assessments, they will consider the inspection and performance indictor results from the previous 12 months. Included in this assessment is the consideration of assigned cross-cutting aspects.

Within the cross-cutting areas of human performance and PI&R, inspections with the same aspect

can accumulate over a 12-month period to reveal a cross-cutting theme. A theme is defined as at least four findings having the same aspect.

If the NRC is not confident that the licensee is addressing the theme, theme is characterized as a substantive cross-cutting issue for an SCCI.

Competence is related to the licensee's ability to identify and correct issues related to an aspect in a timely and effective manner.

CHAIR APOSTOLAKIS: So can you give us a few examples? I mean, this is the process you are describing.

MS. KLETT: Right.

CHAIR APOSTOLAKIS: Do you have an example or two of SCCI?

MS. KLETT: Currently there are -- based on the end-of-cycle meetings -- I'm sorry -- the last mid-cycle meeting, there are eight sites out there currently with SCCIs, meaning that they had four findings with the same aspect in them.

CHAIR APOSTOLAKIS: Can you give me an example of the four findings within the same theme?

MS. KLETT: In the same theme?

CHAIR APOSTOLAKIS: Do you remember one?

MR. CASTO: Most of them, you'll find, for instance, one we have in Region IV now is corrective action. You'll find four instances of identification where they failed to identify problems that led to a compliance issue. So you'll have that.

We also have four in -- and many times, it's more than four. It can range. It's a minimum of four or evaluation. We have one in evaluation right now. And most of them are in corrective action programs, a number of corrective action programs you have; and then, of course, human performance. We have none in SCWE.

I don't think we have any in SCWE. They're all in corrective action/human performance in the industry, four green findings or greater where they failed to identify the issue, whatever the issue was.

CHAIR APOSTOLAKIS: The four instances the issues, the model was the same?

MR. CASTO: Similar, yes. You might say, are they similar? You might find some that are just way out, like a training problem versus an in-plant problem identifying a valve that's broken or whatever it is. And there may be some differences that are unrelated that our initial assessment says there's

really no common cause between these and we don't see that as a theme.

CHAIR APOSTOLAKIS: Do you remember if there was a common cause to these? I mean, what was the reason?

MEMBER BLEY: What was the theme that tied these together?

CHAIR APOSTOLAKIS: Because that is really what we are after. I mean, the fact that there are four is a good first indication.

MR. CASTO: The theme would be corrective action program identification, that there is a flaw in their identification of --

CHAIR APOSTOLAKIS: What was the cause for you? Why did they fail to identify? Do you ask that question?

MR. CASTO: Oh, we ask that question. And we ask them to make an assessment of why they failed to identify, whether it was training, whether it was procedures, what is the cause for the --

CHAIR APOSTOLAKIS: Do you remember what it was?

MR. CASTO: We have had a number of them that have been training issues, expectations, not providing proper expectations to engineers, and

actually making sure that they review the tech specs or the FSAR, whatever it is.

CHAIR APOSTOLAKIS: It seems to me that, you know, a presentation along these lines of what we see out there and what we learn would be very, very useful to this Committee to understand better. And I'm sure it will be useful to your colleagues who are dealing with the safety culture because this is the feedback from the plants.

MR. CASTO: Right. Well, the number one, for instance, like in human performance, the number one root cause is work practices; that is, work practices. And we have a number of criteria of what constitutes a work practice, whether it is using the right procedure, following the procedure. So work practices is usually number one. Human error in the industry if you look out there, work practices, it's about half of the human error. So some type of work practice.

CHAIR APOSTOLAKIS: And, then again, the next question will be, why?

MS. KLETT: Under work practices, there are three aspects. Each has its own alphanumeric identifier. And it provides a description of examples of what problems and work practices and look like.

CHAIR APOSTOLAKIS: Right.

MS. KLETT: And inspectors will look at the finding based on the best causal information available and determine what was the cause of that finding. And if it aligned with one of those aspects, like the licensee failed to meet an aspect, that aspect is assigned to the finding.

CHAIR APOSTOLAKIS: But again, realize you are giving me the process now.

MS. KLETT: Yes. That's what --

CHAIR APOSTOLAKIS: And the question is really, what have you found? Following this process, what have you found? I think we really -- I mean, we didn't plan for it today, but it seems to me in the future, the Committee should be; in fact, maybe the full Committee should be, briefed on what the field is telling us.

MEMBER BLEY: Yes. I'm a little interested in the history of how we got to this point. I remember some years back a former chairman had said we can't bring these things into ROP because they aren't objective. And it seems like this counting things with the same theme is a way to make it objective so you can find it.

How long has this been in the ROP?

MS. KLETT: Since 2006.

MR. CASTO: Two thousand six is when we put that element into the ROP. There have been cross-cutting issues for a long time. We actually had three bins originally, but then there was some congressional interest that asked us to do some more. And we went back and looked at the program, tried to make it more objective and add in some criteria.

MEMBER BLEY: I agree with George. Seeing some examples and down, at what level are these themes consistent enough that you trigger this that it calls for --

MEMBER SHACK: Well, and I guess George's other question, I thought where he was leading is, how far back do you chase it? You know, once you said it was work practices, what caused the work practices to be deficient? Do you go the next step or do you quit there?

MR. CASTO: The five whys, you know, you are looking down, the five reasons to get down to the bottom. And that is a struggle we have with the licensees, is you'll identify a substantive cross-cutting issue, let's say work practices. And the next step is, do they know about it? And are they resolving the issue?

So then you have to make an assessment. Have they asked enough whys that they have gotten down to the point and whether corrective action is being effective? If it's not, then we have to intercede and do something more.

CHAIR APOSTOLAKIS: I think this could be of great interest to the full Committee. So, John, if you can --

MR. FLACK: Set us up?

CHAIR APOSTOLAKIS: Yes. Maybe, you know --

MEMBER RAY: George, if we're going to do that, could i suggest that this, despite what Dennis said, which I don't disagree with, isn't quite as objective as maybe it sounds like?

CHAIR APOSTOLAKIS: That is why --

MEMBER RAY: As was already said here, this is a major recurrent reason for disagreement between the regulator and the licensee. So perhaps if we're going to hear about it at the full Committee, we ought to hear the other point of view at the same time.

CHAIR APOSTOLAKIS: Other point of view?

MEMBER RAY: Meaning that it's maybe not as objective as it needs to be or it results in --

well, I'm just offering --

CHAIR APOSTOLAKIS: I agree. I agree.

MEMBER RAY: -- that there's another point of view typically. And we don't always need to hear the other side. But in this case, I think it would be a good idea.

CHAIR APOSTOLAKIS: well, what you just said, then, is that it should be picked up by a subcommittee first because that's where we can invite --

MEMBER RAY: I didn't want to say that because you had already suggested the full Committee. I just want to say it's not as easy and it's not as objective.

CHAIR APOSTOLAKIS: I understand.

MEMBER RAY: Okay.

CHAIR APOSTOLAKIS: Well, they are not claiming it is really objective. I mean, everybody understands that --

MR. FLACK: You will hear from NEI in the next speaker on the subject.

MEMBER BLEY: He may need a lever to get in.

MS. KLETT: Could I make one --

CHAIR APOSTOLAKIS: You may disagree with

Dennis, but you did not disagree with the statement he made, which --

MEMBER RAY: I didn't even disagree with him. I said it does. It does make it more objective. I just don't --

CHAIR APOSTOLAKIS: Oh, more objective, yes.

MEMBER RAY: -- want us to be misled to think it's entirely objective.

CHAIR APOSTOLAKIS: Sure.

MEMBER RAY: And it's just a matter of --

CHAIR APOSTOLAKIS: No. You're right. You're right. I think, then, it's a subject for a subcommittee meeting.

June?

MS. CAI: Yes. This is June Cai. I just want to make a quick comment that the four as in the human performance and problem identification, resolution under safety culture work environment, the entry for a substantive cross-cutting issue is, well, it's different.

One of them is you only have to have one finding, but then there are a couple of others, like if we issue a chilling effect letter and some other things, though, we treat that one a little bit

different given the importance of that area to safety culture.

CHAIR APOSTOLAKIS: But these are the kinds of things I really would like the subcommittee to be exposed to and start the debate because what Dr. Shack said, how far back do you go?

Then you said, Chuck, they have to do something about it? So is that how far back you go when you say that you think that you can do something about it and fix the problem or are there any other criteria?

I think now we're getting into the details. They are very important details of how one should go about managing function or risk and so on. So we will do that at some future Subcommittee meeting. I think that would be very enlightening.

MR. CHEOK: So at a future meeting, we can come by with four or five findings and discuss how we tag those findings with certain aspects and show you how the aspects are tied into the same --

CHAIR APOSTOLAKIS: Well, not only that, but, I mean, I think you are getting the message from the Subcommittee now that we are really interested in what you actually see out there, what people like Mr. Casto see out there they have to deal with, rather

than just, you know, what is the safety culture and how do we manage it. And eventually the two hopefully would come together.

Yes, sir?

MR. CARNES: Yes. There is an interesting story that I would like to hear the rest of the story on work practices, what the industry did. The part of the story that I know is after several issues on work practices, but I don't know actually how this came to be, my understanding is there is an industry-wide look and focused on what are the supervisors doing regarding the teams that they are supposed to supervise with an analysis that, gee, well, it's not the supervisory problem because the supervisors are trying to backfill for a deficient work management system. Okay?

Go out. Straighten that up. And then get the supervisors to understand and get them knowledgeable and approaching coaching, observation, and mentoring skills so they can help the work teams clearly understand the expectations and know how to do the work in an appropriate manner through coaching and mentoring. Okay?

That is an interesting story. I don't know the rest of the story. Has there been any change

seen as a result of that initiative? To me, that is an example of what a very informative case study might be.

CHAIR APOSTOLAKIS: Yes. And I think that ties very nicely with Harold's point of view that we should hear from the other side. So when the subcommittee takes place, it would probably invite one or two representatives from the industry to tell us how they faced these problems and how from their perspective it works.

MR. CASTO: And just so you are aware, Mr. Chairman, if I might, regarding timing, we are kicking off a reliability initiative. We're straying a little bit from the word "consistency" among all the regions. We're calling it our values, our organizational values, of reliability. So we're calling it a reliability initiative. And we have four, there are four, components to that reliability initiative we are working on so that we can drive a little bit more objectivity into the process.

CHAIR APOSTOLAKIS: Okay. Back to you, Audrey.

MS. KLETT: Again, in the cross-cutting area of SCWE, the criteria for opening an SCCI are a bit different because of the nature of impact that

SCWE can have on safety culture.

CHAIR APOSTOLAKIS: I understand this is your presentation to us.

MS. KLETT: Yes, sir.

CHAIR APOSTOLAKIS: So you got the message now? Whenever you describe process, somebody will ask, "Where is the analysis on this?" Process is not the end of it.

MEMBER BLEY: Where is the meat?

CHAIR APOSTOLAKIS: Where is the meat? Okay?

MS. KLETT: Okay. Now, I do have analyses showing which aspects are --

CHAIR APOSTOLAKIS: Now, somebody with more experience, like Mr. Cheok, should have told you that.

(Laughter.)

MR. CHEOK: I'm speechless.

CHAIR APOSTOLAKIS: That's why you didn't tell her, right? Okay.

MS. KLETT: Okay. So SCWE issues are considered for 18 months, rather than 12 months. And an SCCI may be opened if at least one of the following situations exist. If there is one finding with an aspect in SCWE, licensees receive a chilling effect

letter, an enforcement action which involved discrimination, or a confirmatory order which involved discrimination.

The purpose of identifying an SCCI is to inform the licensee that the NRC has a growing concern with its performance and associated cross-cutting area. It is not a general conclusion about safety culture. Rather, it is a concern specific to an aspect of safety culture.

Licensee then has the opportunity to address the concern before more risk-significant performance issues pose a challenge to safe operation of the facility and result in escalation of the NRC's regulatory response.

A licensee is notified when an SCCI has been opened. And this takes place in the semiannual assessment letters. In that letter, in keeping with the transparency and predictability ROP, the NRC will specify the criteria for closing an SCCI. And these criteria may vary depending on the circumstances surrounding the issue and the level of NRC's confidence in the licensee's ability to address the issue.

CHAIR APOSTOLAKIS: But there is nothing here that is different from the way the ROP is

supposed to be. I mean, you could have said these things six years ago, when we first --

MR. CHEOK: Not quite.

CHAIR APOSTOLAKIS: What is different now? Maybe I missed it.

MR. CHEOK: I think what is different now is since 2006, we are looking at the findings, and then we are looking at the cross-cutting aspects. And then we are tagging these findings to the different aspects and see if there is a cross-cutting team that the licensee is not addressing fully. And if they --

CHAIR APOSTOLAKIS: I agree with that. I agree with that.

MR. CHEOK: Okay.

CHAIR APOSTOLAKIS: But the rest of the process of interacting with the licensee is always part of our opening.

MR. CHEOK: That's correct. That is correct.

CHAIR APOSTOLAKIS: You added those in '06.

MR. CASTO: We're more specific now, basically, is what -- before there were three big bins. We threw them in there. And with regard to SCWE, the results if you're interested in results, we

have one. I think in the industry one potential chilling effect letter was sent. But other than that, we're really not seeing anything in SCWE.

The traffic we're getting in the SCWE area mainly spills over from the general work culture, the work environment. And so we get a lot of obligations, a lot of concerns. Most of those turn out to be concerns about the general working environment and not substantiated concerns about chilling effect or safety-conscious work environment.

Most of them are -- it's become now symptomatic of a general working environment issue. When you start getting a lot of allegations in the SCWE area, you start seeing now very few. Most licensees get that, right? We don't retaliate against people that speak out. That has pretty much settled the case in this industry. So what you're getting are symptoms of a poor work culture when you get these. That's what you typically in today's allegation process.

I mean, you really drill down. You'll find out it's things like incentives. You'll find out it's how they treat their people, where they have to park. You know, those kinds of things spill over to the NRC because they get frustrated by front-line

supervisors who don't resolve general working conditions. And they start coming to us because they can't see the difference between what is regulated and what is non-regulated. So they start coming to us.

MEMBER RAY: There is a real lever here for contract negotiations, too. So there are lots of things that can affect it.

CHAIR APOSTOLAKIS: Okay.

MS. KLETT: Next slide. There are generally two occasions in which --

MEMBER BLEY: I am sorry. How far back do you look for these four or more inspection findings with a common thread?

MS. KLETT: Twelve months, one year.

MEMBER BLEY: Twelve months. So it's a rolling --

MS. KLETT: Right. During mid-cycles, we look at from July 1st to June 30th and then the end-of-cycle from January 1st to December 31st.

There are generally two occasions in which the NRC would perform or request the licensee to perform safety culture assessments.

MEMBER BLEY: I hate to cut in. I am just thinking about that and trying to come to grips with it. I am wondering. How far have you pushed this?

You know, we have the earlier talks. And John Wreathall talked about before things actually start happening, there are some ways to look ahead. Right now we're seeing things that come out as inspection findings. So things are starting to go wrong somewhere.

Is a year the right time? You know, these things don't happen all of the time. So if things are beginning to surface -- I am just wondering what led us to that or is it just an easy place to start, look for four?

MR. CASTO: I think the program office is receptive. If you have a theme, if you have three or four issues this year and there was something a year and a half ago, we would have dialogue with the program office and say, "Look, you know, this one was back here a year and a half ago. We just didn't know it at the time." So there would be some dialogue.

MEMBER BLEY: It might be bigger than we're seeing it?

MR. CASTO: It might. There would be dialogue during the mid-cycle/end-of-cycle meeting.

MS. KLETT: Two occasions in which we neither perform nor request licensee to perform a safety culture assessment, the first would be the

third assessment letter in a row with an SCCI for the same aspect. The NRC would primarily focus on a licensee's corrective actions for the SCCI with limited focus on the assessment methodology.

Second occasion would be for a supplemental inspection. And depending on the significance of the issues, we would request licensees to perform either an independent or a third party safety culture assessment, which will be discussed in more detail later.

Following inspection procedures, also guidance related to following up on safety culture issues and assessments, the PI&R procedure 71152 provides guidance to inspectors for monitoring a licensee's progress and addressing cross-cutting themes, SCCIs, and safety culture assessment results.

Again, the supplemental inspection procedures include provisions for safety culture assessments to varying degrees. And the reactive inspection procedures, such as event follow-up or a special inspection team, will instruct inspectors to consider the contribution of safety culture to the causes of the events.

Next slide. The staff continuously reviews the implementation of the enhanced ROP to

determine that it metes the ROP regulatory principles.

As a result of these reviews and the lessons learned, the staff developed additional clarifications and modifications to the ROP in 2009. Inspection manual chapter 0305, the operating reactor assessment program, currently contains the description of how safety culture oversight is implemented in the ROP.

This manual chapter provides guidance for defining safety culture terminology, assigning cross-cutting aspects to findings, determining if SCCIs exist and how to follow up on them after they are issued, the description of the components and general expectations for safety culture assessments performed as a result of degrading performance.

This manual chapter was revised in January 2009 to modify definitions of cross-cutting aspect and substantive cross-cutting issues. The definitions of independent and third party safety culture assessments were clarified. The assessment letters now have to contain a brief discussion of any cross-cutting theme that existed and was determined not to constitute an SCCI.

The SCWE SCCI time consideration was expanded from 12 months to 18 months. Follow-up of

SCCIs was more clearly defined. And licensees were given a 30-day period to comment on assigned aspects.

MEMBER SHACK: What is the documentation again? If you looked at four items and you decided there wasn't a cross-cutting issue, you would document that? Is that what you said?

MS. KLETT: Well, that also. For an individual finding, if there were no cross-cutting aspects, I believe the guidance was also modified to state why a cross-cutting aspect was not applicable. However, during the six-month assessment period, for the assessment letters that were issued, if there was a theme for findings but the region decided not to issue an SCCI, for example, if they believed the licensees were in control of the situation, were aggressively taking corrective actions to fix it, we would state that was the reason why we were not issuing an SCCI.

Next slide.

MEMBER BLEY: Back two slides ago -- don't pull it up -- NRC has its choice of whether to do the safety culture assessment itself or to direct licensee to do it. What do you usually do?

MR. CASTO: Typically we have the licensee do it.

MEMBER BLEY: I would think so. Have you ever taken charge of it and done it, NRC directed it?

MS. KLETT: In 95003.

MR. CASTO: Well, in 95003, that is by procedure, but I don't know of a region, I don't know of a case where we have done it ourselves. Typically it is more powerful to get them to do it. And I've kind of changed on that a little bit about this independence. I think they should do a credible review.

MR. CHEOK: If you look at the process and the results, obviously.

MR. CASTO: Right.

MEMBER MAYNARD: Typically these are required to be independent reviews. The utility may arrange for it, but the utility is not doing their own reviews. They bring in independent people to do that.

And the NRC observes parts of that. They're not excluded from that process. They could be in or out as much as they want to, need to be, or whatever. But it is usually an independent with a charter that pretty much keeps them independent.

MEMBER BLEY: We had the right people here earlier this morning, but now we have the policy statement out there. Is there some thought that there

would be some requirement to have baseline safety culture assessments, even if you hadn't had findings driving you to them?

MR. CASTO: There is no thought of that, but I believe that an industry -- Tom Houghton talks this afternoon. He is going to -- he can probably tell you that -- he is going to the mike now --

MEMBER BLEY: He can tell us this afternoon, but go ahead if you want to now.

MR. HOUGHTON: Tom Houghton, NEI. To quickly answer your question, --

MEMBER BLEY: Yes.

MR. HOUGHTON: -- INPO requires licensees to conduct a self-assessment of safety culture every other year to start with.

MEMBER BLEY: Thank you.

MEMBER MAYNARD: And I think those were good. I'm not sure that they really qualify for what you would consider baseline because if you get in trouble and you're required to do one of these under the ROP program, it's not necessarily the same.

It's not a repeat of the same safety culture assessment. A lot of the same things are looked at. And you would be able to see a lot of things, but it may not be a direct apples to apples

comparison. So you would have some baseline. One of these follow-up assessments is a little different.

MS. KLETT: In its April 21st, 2006 letter, the ACRS recommended that the staff should reassess the adequacy of the guideline that specifies about 30 minutes daily for the resident inspectors to review entries in a corrective action program.

The objectives of procedure 71152 are, in part, to provide early warning of potential performance issues that could result in action matrix movement, to provide additional information related to the cross-cutting areas used in the assessment process, to provide insights into a licensee safety-conscious work environment, and determine if licensees are complying with NRC regulations regarding corrective actions.

Inspectors are budgeted to use an estimate of 30 to 50 minutes a day depending on the number of units at a site. To scan through the licensee's corrective action program entries, additional time is allowed for trending and following up on these issues.

The purpose of the routine review is for inspectors to be aware of issues being entered into the corrective action program that may need additional follow-up. The inspectors use other portions of the

procedure and possibly other procedures to follow up on these issues identified during the routine review.

This procedure also contains the following guidance related to safety culture. During all types of PI&R inspections, which include the routine review, semi-annual trending and a follow-up of selected issues, and the biennial team inspection, inspectors consider emerging and existing cross-cutting themes to develop insights into the licensee's progress in addressing those issues and the contribution that components make to performance issues.

MEMBER ABDEL-KHALIK: And these things are not routinely done by residents, the resident inspectors, just essentially trending and monitoring and looking at the entries into the corrective action programs on a regular basis and --

MS. KLETT: Resident inspectors do do that on a regular basis.

MR. CASTO: If the resident has a finding, then that finding gets documented. An assessment is conducted about whether it has a safety culture connection to it or not.

So as they go through their inspection process, they will -- when they identify a finding, they make that assessment. For each and every finding

that they have, they make a substantive cross-cutting issue or safety culture assessment. Does this have a link to safety culture? And then they document that.

So it's an ongoing process. We review it every quarter, but it is an ongoing process. In addition, you have these PI&R inspections that come in and do it by bulk. They do bulk assessments.

MS. KLETT: And additional time is allowed for the inspectors to follow up on SCWE issues.

Next slide. The ACRS had also recommended that inspection procedure 95003 should include criteria for safety culture assessments, clear thresholds for evaluating cross-cutting aspects of findings, and clear expectations for the resolution of staff concerns with the licensee safety culture.

Regarding the clear thresholds for evaluating cross-cutting aspects of findings, manual chapters assigned to a finding and 0612 contain the guidance for evaluating findings to determine if a cross-cutting aspect exists. The guidance explains the criteria for when an aspect can be assigned to a finding.

Regarding clear expectations for the resolution of the staff's concerns with the licensee safety culture, this guidance is also contained in

0305. Essentially the follow-up of safety culture issues identified during supplemental inspections and SCCIs during the mid and end-of-cycle assessments will be performed in accordance with the PI&R procedure.

The regions document their expectations for SCCI closure and the status of the SCCIs in semiannual assessment letters. 95003 contains the criteria for performing safety culture assessments and how to review a licensee safety culture assessment in an integrated manner.

Essentially the NRC would give the licenses the opportunity to first perform the assessment using an independent third party. Then we would review this assessment to determine our response, which may range from the follow-up of a licensee's corrective actions to the NRC performing its own independent assessment. The scope, depth, and focus of our assessment will be based on the results of evaluating the licensees.

Next slide. The first use of the enhanced 95003 was during the 2007 Palo Verde inspection. The safety culture-related lessons learned from that inspection that were incorporated into the ROP guidance included the following.

The timeliness and escalation of the NRC's

actions in response to the identification of SCCIs could be improved. Therefore, we did add guidance to 0305 and 71152 for following up on these items.

The requirements and guidance for conducting the safety culture portion of the procedure significantly outweighed the remainder of the procedure. If the NRC determines that the third party assessment was appropriate, then there should be no need to conduct an independent assessment of all 13 safety culture components. The NRC's assessment should determine which, if any, of these components have not been adequately addressed by the third party assessment. The NRC should then implement safety culture assessment activities to address --

MEMBER SHACK: Excuse me. That is what you mean by the graded approach? Depending on what you think of the independent assessment, you --

MS. KLETT: Yes.

MEMBER SHACK: -- you go in and do whatever?

MS. KLETT: And these recommendations were captured in the January 2009 revision to that procedure. We also added significant guidance to the safety culture assessment portion of the procedure.

Next slide. As previously discussed,

95003 was revised to give licensees the opportunity to perform their assessment using an independent third party under the NRC's observation. You would then evaluate this assessment to determine the level of our regulatory response.

We would evaluate the methodology, the sampling strategies, such as the number of people interviewed in the represented departments, the assessor's qualifications, survey tools and statistical analysis, interview questions, documents reviewed, direct observations, bias potential, and which safety culture components were assessed.

We would also review the results of the licensee's easements by determining if the results and the conclusions were consistent with the collected data.

We would look at the licensee's response to the assessment by reviewing the licensee's corrective actions, their evaluation of differences of changes from their previous assessment, and their messages that were communicated to the site staff.

Based on this review, the NRC will then determine the scope and depth of our review. If we are confident of the licensee's methodology analysis, we may focus only on the licensee's corrective

actions.

We may also want to sample certain departments to compare our results with that of the licensees. We may want to focus on certain components depending on how well a licensee's assessment addressed those components. We can also perform our full independent assessment if we do not have confidence in the licensee's assessment methodology or results.

We will compare our results with that of the licensee and develop conclusions about safety culture. We would then review the licensee's corrective actions, either through follow-up of confirmatory action letter items or other inspection procedures.

MR. CHEOK: Actually, it is in this area that the survey tool that Dr. Wreathall talked about this morning could be used to become important as part of our safety culture assessments.

MS. KLETT: Next slide.

CHAIR APOSTOLAKIS: I guess you still have four colors for each of the items, don't you: green, yellow, white, and red?

MS. KLETT: Safety significance of findings.

CHAIR APOSTOLAKIS: For everything?

MR. CHEOK: Now, we do a safety significance of all inspection findings. And we give them a significance of red and white. With a safety culture padding, we look at any findings that are green and above. So any findings that are tagged with any color, we will look at them to see if there are any safety culture aspects that are common and that we can tag them to be common and see if we can find a theme of four or more in the same aspect.

MEMBER BLEY: Mike, when you see a string of these and you have a cross-cutting issue, has that ever or could that change the color of the finding? Now you are getting common effects.

MR. CHEOK: At this point, the individual finding itself?

MEMBER BLEY: The individual ones would be one thing, but now you have noticed that it wasn't an individual. Then it is a chain of events all tied together, no evaluation of that chain.

MR. CHEOK: Right.

MR. CASTO: It does not escalate them into any action matrix. For instance, you could do that. There are a lot of things you could do, but now at this point, they're not. We don't do that.

MEMBER MAYNARD: You said that for any findings with any color at all, you would take a look, see if there is any safety culture aspects. The characteristics defined for safety culture pretty much covers the whole gamut of operating a nuclear power plant.

Couldn't just about any finding fit into work planning, work control, accountability? You take a look at that list. About anything can fall into one of those categories.

MR. CASTO: And most findings are tagged. And we have debates often about which of those aspects -- there are so many of those aspects that it could -- so you look. And I think the guidance says what is the one that is the biggest component? What is the biggest driver of this finding? You just try to choose which one.

The staff has done a great job in trying to reduce duplication and get it down to be more specific. But still we still have those debates of which one is -- in the end, I think there are, like I said before, only about three of them that are heavily used in the end anyhow.

MEMBER RAY: That's why the other side needs to be heard from.

CHAIR APOSTOLAKIS: Okay.

MS. KLETT: Substantial guidance was added as an attachment to 95003 for performing independent safety culture assessments. It provides detailed guidance for evaluating each component by instructing inspectors as to what documents to review and what behaviors to observe, thus provide sample questions. Inspectors can ask to obtain data related to each of the components.

The guidance for focus group and individual interviews provides information about the strengths and limitations of each type of interview and how to conduct such interviews.

Guidance also provides information for developing and using structured behavioral observation checklists to identify patterns of behavior related to most of the components.

Attachment also provides guidance for sleeting and performing event follow-up studies to identify consistencies and attitudes and behaviors related to the components. This study traces the progression of a single event or condition to learn how organizational behaviors impacted the facility's ability to cope with an event or condition.

The attachment also provides inspectors

with guidance for evaluating the survey tool that was administered by the licensee by describing the strengths and limitations of the survey instruments, how to review the survey questions, evaluating the development of the survey, how it was administered, the statistical methods used to analyze the survey, and how the responses were treated.

Every year the NRR staff performs an assessment of the ROP to the metrics contained in manual chapter 0307, which is the ROP self-assessment program.

The results of this assessment are documented in annual SECY papers. We evaluate the perceived effectiveness of the safety culture enhancements. We look at survey results from external and internal stakeholders that responded to whether the ROP enhancements helped identify safety culture weaknesses and focus licensee and NRC attention appropriately. Meeting the metric would include stable or increasingly positive perception over time.

SECYs 08-0046 and 09-0054 document the recent improvements we have made to the ROP, especially manual chapter 0305 and 95003, as a result of the internal and external surveys in ROP feedback process.

These assessment activities have resulted in improved data collection and tracking of the assigned aspects, improved documentation of assigned aspects, and SCCIs, the removal of inconsistencies and ROP guidance documents.

Next slide. We have also resulted in the clarification of safety culture terminology, improved communication, objectivity, and consistency of application, clarification of applicability of aspects; for example, they must reflect current performance, and improved consistency in SCCI guidance implementation.

Next slide. The ROP self-assessments have shown that the safety culture-related metrics in manual chapter 0307 have been met. The guidance is effective within the ROP framework. ROP was designed to be an objective risk-informed, performance-based assessment process.

The Commission's direction to more fully address safety culture through the use of cross-cutting issues ensures that findings of safety culture aspects are developed and characterized in a manner that is as objective as practicable within the ROP.

The issues are of more than minor

significance if they are documented in the inspection report. And they are transparent to internal and external stakeholders; in particular, the public.

Guidance has proven to be an independent regulatory oversight mechanism that has provided insights into areas important to safety culture. By tagging cross-cutting aspects to inspection findings, the staff has been able to gain insights into performance.

When recurring SCCIs were identified, safety culture assessments have been conducted to determine if an organizational safety culture challenge existed.

The NRC regulatory responses focused on licensee's corrective action plans and their demonstrated improvement through subsequent safety culture and assessments and inspection findings.

Staff continues to enhance ROP guidance documents as needed based on lessons learned and stakeholder feedback. And the regions have endeavored to consistently and reliably implement program guidance. They have also provided valuable feedback for improving the process.

That concludes my presentation. So at this time, we would appreciate any additional insights

the ACRS has to offer.

CHAIR APOSTOLAKIS: Any comments?

MEMBER RAY: I fully appreciate how far more well-developed and detailed this is than what I am about to ask, but could you compare this program as it stands today with SALP?

(Laughter.)

MEMBER RAY: See, there was no joke in that question. And, yet, everybody laughs.

Go ahead.

MR. CASTO: Do you want to try that one?

(Laughter.)

MR. CASTO: Well, you know what? I did some.

MEMBER RAY: So did I.

MR. CASTO: I know I don't look it, but I have 30 years experience in the industry. We did SALP for a long time. And I also was on the other side with work for a utility that had a very bad safety culture, very bad. It was shut down for a long period of time because of its safety culture. And as an operator, as a licensed operator, I had stood up and said no. So I think I have seen it from both sides.

MEMBER RAY: From a regulatory standpoint, how does SALP compare with this?

MR. CASTO: This is much more objective. When you have a finding, you assess the finding against criteria. You know, the days when we did SALP, we had no criteria. It was what the senior managers thought.

MEMBER RAY: Exactly. But it did stand for systematic assessment of licensee performance. So this is a systematic assessment of licensee performance. We don't want to use that name, and it wouldn't be fair because it is much better developed, I grant you.

But at the end of the day, at the end of the day, I think what we will hear is that, like SALP, you referred to debates that go on internal to the agency. I am sure that is true. It would have to be true.

It can't be as objective as we would all like it to be would be my two cents' worth.

MR. CASTO: Yes, absolutely.

MEMBER RAY: And so at the end of the day, I think we all want it to be as objective as possible. The problem I had with SALP was exactly what you said, namely it was more a function of the relationship between the licensee and the regional Administrator than it was anything else in the world.

And we want it to not be the case here.

So what individuals may think of particular licensees, they like some, they don't like others just can't become a factor in this process.

MR. CASTO: And I would say all of that has been driven out by the use of PRA. When you assess the finding, the first thing you do is run it through the PRA model and see what's --

MEMBER RAY: It is the cross-cutting associations that are still problematic and --

MR. CHEOK: Audrey touched on this post-SALP. We have been to the ROP. The objectives of the ROP were to be transparent, understandable objectives, one of them --

MEMBER RAY: I know.

MR. CHEOK: -- predictable risk-informed performance-based. I think in going the SCCIs task direction was to have all of these attributes into how we can apply SCCIs.

MEMBER RAY: I understand.

MR. CHEOK: And I believe that this is what we aim to do.

MEMBER RAY: I would say to you that SALP is still a cautionary tale as you think that, oh, I've now got this matrix and I can find the cross-cutting

issues and I can trigger something to happen based on the binning of the non-compliances, that is pushing the envelope further than I think would --

MEMBER MAYNARD: I agree that it is a much better process than what it was, but still I agree it is not as objective as we would like to think.

I have worked with a number of ex-NRC inspectors and from the region, whether retired or not. And they will all tell you. And it is not malicious, but when you get into these discussions about what things fall into, you are influenced somewhat by your perception of what kind of performance. And it will influence, not maliciously, but there is still a definite influence there.

MR. CASTO: In addition to that, there is subjectivity in what success looks like. We establish these with the licensee. And we say, "Go out and do a root cause. See what you think." And they identify what they think the root causes are.

We may disagree there. And then ultimately we may disagree on the measures of success. So there is a lot of room for subjectivity in the process. And that is why we are doing the reliability effort, to try to drive it further. It is much more reliable than the old program.

It has room for improvement. There is no doubt about that.

MR. CHEOK: And as part of the newest changes, we are allowing a 30-day comment period by the licensee.

MEMBER RAY: That is good. I agree with you. That is good. You never had a chance to comment on SALP until it was too late.

CHAIR APOSTOLAKIS: John?

MR. WREATHALL: Yes. I would just like to touch on the question of this idea of making things objective and putting things into carefully defined bins that are all separate.

In that opening slide or two of mine when I was using quotes from Ashleigh Merritt, culture and safety culture are by their nature ambiguous and soft. And if you try and over-constrain them into a rigid categorization, you actually are going to lose the essence of the beast.

So there are methods by which you can look at classifications that doesn't require you to put things into rigid bins because I think if you do that here, you are actually going to lose a lot of what you have gained.

So I would suggest that you look at

alternative methods of putting things together in classifications. And the social sciences have done that forever because that's what they deal with, the soft, mushy world.

I am trying to say, is it A or is it B or is it C when, actually, it is a little bit of one and something that wasn't even thought of and something else? You have to go that way. Otherwise in the end, the thing will break down under its own constrains of being rigidly binned.

I think you are going in the right direction, but if pushed too far by our engineering and science disciplines, it then collapses again. So I would like that, having --

MEMBER RAY: John, I think that is right and fair and true. What, unfortunately, is also a component here is that inevitably this translates into enforcement. If it weren't for that, we could all find it much easier to converge on --

MR. WREATHALL: But there are methods that don't make it just an equal wishy-washy thing. There are ways of putting soft information together to derive useful information. And I don't hear things going that way.

MEMBER RAY: That may be. And I have a

feeling you should speak up on that line, but, like I say, right now we are having to look at this through the prism of enforcement and --

MR. WREATHALL: And by training, I am an engineer. I understand the desire to put things into rigid classifications. You know --

MEMBER RAY: I don't think it's as much a desire as it is a corollary of the process.

MR. WREATHALL: It is what we are trained to do. I mean, that is --

CHAIR APOSTOLAKIS: Well, it seems to me you have conflicting objectives here. On the one hand, you want to have as much objectivity as you can because of the consequences.

MR. WREATHALL: Oh, sure.

CHAIR APOSTOLAKIS: At the same time, you have to appreciate that this is not a physical process.

Anything else that members would like to raise at this point? Yes, sir?

MR. WREATHALL: I have a second. And it is not connected to this presentation. It's anticipating when you start dealing with the non-reactor side and thinking of how some of the concepts discussed here might connect to the medical

events.

CHAIR APOSTOLAKIS: Well, actually --

MR. WREATHALL: Is that --

CHAIR APOSTOLAKIS: Well, we don't have much time now.

MR. WREATHALL: I was only going to mention what we sort of just --

CHAIR APOSTOLAKIS: Go ahead.

MR. WREATHALL: The ways in which medical events are looked at right now -- and if you look at the reporting in the NMED, the Nuclear Medicine Event Database, 85 percent of events are classified, broadly speaking, under the word "human error."

And if you look to drill down contributions, there are only three contributions to that: events that are caused by inattention to detail, procedures not followed, or inadequate procedures.

In other words, those aren't at a level that you can seriously discriminate, for want of a better word, root causes and events in anything like the way that the reactor does.

So I am in a sense pushing something that I am maybe working on in the future with the agency, but it bothers me that we are treating the policy

statements as going for everything that the agency does.

And there is a lot of I think excellent work in the reactor area. I just wonder where things are going to go when we move to these, which is to my mind where the real risks to the public are.

CHAIR APOSTOLAKIS: Well, I think, first of all, obviously the agency doesn't have sufficient or experience of equal level as the reactor when it comes to --

MR. WREATHALL: Yes.

CHAIR APOSTOLAKIS: But the idea of having two or three or four root causes so we can focus on them is very appealing. And that goes back to your earlier comment, Harold, that maybe by looking at all of these themes and attributes, characteristics for safety culture, maybe we are diluting a little bit the problem. And it would be nice when Wreathall says that these are the three for hospitals, if you could count these are my three for reactors. Are we ever going to reach that? Well, maybe four. But there is a real issue here, I think, of trying to do everything and missing the boat.

MR. CHEOK: And you recall what June brought up this morning about the three tiers in

policy. In the first two tiers and the policy statement, all you are trying to do there is to define them at a high enough level so that the NMSSs, the NRRs, and the NROs can come back to tier three, where you can do implementation consistent with tier two, but it could have different characteristics or different attributes. We are just aiming for consistency in this point to the tier two higher level principles, what we call safety culture.

CHAIR APOSTOLAKIS: Is it possible, for example, from your -- I agree it is a limited experience over three years, not even three, right? -- with the ROP to come up with some conclusion like that that the root causes seem to be A, B, C? Do we have those?

MEMBER BLEY: Chuck was hitting on some of them earlier.

MR. CASTO: Yes. For instance, let's take operators. What is the program telling us about operators? What it tells us about operators is that the number one human performance problem with operators in the courtroom today is decision-making on maintenance and surveillance. So we can extract that kind of information out of the system and tell us that is the problem, operators.

And so for medical, you would have to identify which characteristic and what attribute of it that you would have to look at.

MR. WREATHALL: In the three I was referring to, I was meaning that those were highly inappropriate descriptions of root causes. It was the attention to what was the real circumstance.

CHAIR APOSTOLAKIS: Good. That is good.

Anything else?

(No response.)

CHAIR APOSTOLAKIS: Okay. Thank you very much.

Okay. We recess until 3:00 o'clock.

(Whereupon, the foregoing matter went off the record at 2:44 p.m. and went back on the record at 3:02 p.m.)

CHAIR APOSTOLAKIS: We are back in session. The next presentation is by Mr. Pietrangelo and Houghton of NEI on fostering a strong nuclear safety culture. Tony?

MR. PIETRANGELO: Thank you, Mr. Chairman.

CHAIR APOSTOLAKIS: It is a pleasure to see you again.

MR. PIETRANGELO: It is a pleasure to be back with the ACRS. It's been a long time for me. I

remember I used to come down here regularly to talk to you fellows. And it's been a while.

7. FOSTERING A STRONG NUCLEAR SAFETY CULTURE, NEI 09-07

MR. PIETRANGELO: This is a very important subject for us. And that's why I wanted to come and support Tom and the industry presentation on fostering a strong nuclear safety culture.

We have been at this now for a while. And in the industry, I think, you know, I will get to a few very high-level remarks, but at the end of the day, NEI can't do it. INPO can't do it. The NRC can't do it. A licensee needs to own their own safety culture and assess it on a regular basis.

If we can't instill that, then we have missed the boat on this. It is very hard for an outside organization to come in on a semi-periodic basis to make an assessment and determine what somebody's safety culture is.

This is a responsibility of the licensee that we need to own this activity. And that is what is really behind the industry work here, to come up with a more systematic way that is auditable, that keeps a regulatory footprint on safety culture, and I think provides us a better way of -- there has been a

lot of talk about leading indicators for trying to find someone who is going to fall off the ledge and go into trouble.

From a performance indicator standpoint, we have looked at that a great deal. We can't find anything better than what we have out there right now. At least they incentivize people to take the right action with respect to safety with the performance indicators.

We think this activity has the potential to be a more leading indicator and trying to get at some of the cultural organizational problems that can lead to things that do impact safety.

So if we go to the first slide here, here are kind of the challenges we see with the existing situation we have out there. And I don't have to go through the history lesson. You guys have been talking about this all day.

Post-Davis-Besse, post-congressional hearings in the mid 2000s, the agency integrated within the reactor oversight process an activity to look at substantive cross-cutting issues. And that is really code for safety culture issues.

Part of the challenges with this existing situation today is that INPO does this. Tom is going

to hand out the principles of a strong nuclear safety culture. They have their seven principles. The NRC started with 13 cornerstones or attributes. I think it's ten or nine.

But we have different terminology. And it is very hard to align on the cause of a problem if you're not talking about it in a similar way. So we think it is a very important activity to get on the same page with the regulator in terms of the terminology we use to assess safety culture.

We think we have the responsibility to take the lead on this. We haven't done, though, thus far. We actually created a new working group under Bill Levis from Public Service Electric and Gas, our regulatory process working group. Their lead activity is looking at this safety culture initiative.

What the staff is out there doing now within the ROP is really acting on a limited set of data. There are about 1,200 to 1,500 inspection findings a year across the industry. So that is about 12 to 15 per unit. And then they tag those with a cross-cutting aspect and then at the end of an assessment period classify those or bin those and see if they have a substantive cross-cutting issue.

That is not a very big data set, you know,

12 to 15 inspection findings, from which to draw conclusions about whether someone has a safety culture issue or not. Tom will go over our proposed process later, but it includes the NRC's inspection findings as one input into many inputs.

We have not taken full advantage of all the things we look at as an industry, both from our corrective action program as well as outside the cap, that could indicate weaknesses in safety culture. So we think we need a more systematic way of looking at this as well.

We haven't had -- and I think this really was identified through the 95003 at the Palo Verde station when they did do the safety culture assessment that there is no industry-wide guidance for somebody who is in that situation for conducting that third party assessment.

So if someone does wind up in column four and have to do a safety culture assessment, a lot of time was spent on whether the methodology used was correct or not or valid or not. We think if we could get an agreed-upon methodology -- we sent one in the staff in June, and we look forward to their comments on it -- get an agreed-on methodology for doing that assessment, we can cut right to the chase if somebody

is in column four and have something off the shelf to use. So we look forward to interacting with the staff on that.

Next slide. Again, what we are trying to do is establish a more consistent systematic industry-wide approach. It starts with the common language. There have been already a few discussions between the NRC and INPO on trying to merge the safety principles from safety culture principles of INPO with the staff's substantive components.

We think we are responsible for this in trying to lead here. We think what we have come up with will provide a better regulatory footprint for the NRC. And we will see that in a moment on our chart.

Instead of trying to draw a conclusion off the inspection findings, we can still have the input of the inspection findings and look at the entire process we have laid out to see whether we are taking all of the inputs, assessing them properly, identifying what the cause is, establishing what the corrective action for that cause is, and then monitoring its effectiveness. That would be a better role and a better regulatory footprint for the NRC than the current system.

Again, we want to use all of the available assessment tools -- Tom will go through this in great detail in terms of a survey, site interviews, et cetera -- and, again, this common methodology for conducting third party assessments.

The alignment is proceeding, again, INPO, next slide, then, began discussions with the NRC on this common language. We have developed an approach contained in NEI 09-07, which went to the staff for review.

We are in the process of piloting that guidance at four different plants across the country. And, again, we also looked forward to using this methodology for the third party assessments and submitted that to the agency.

With that, I am going to turn it over to Tom to go through the details of --

MEMBER SHACK: Is this guidance just for these NRC-driven self-assessments or would this be guidance for --

MR. PIETRANGELO: Great question. Actually, you can use it for a self-assessment, an independent assessment, or a third party assessment. It is the same base methodology. Okay? But it is scaled up in terms of the level of independence of the

assessors as well as the scope of the methodology that it is applied to.

So yes, the same thing we would use to conduct self-assessments -- I should say no, we didn't start from scratch with this activity. It is based on the module put together by the USA Group. It's a group with a single unit or single site stations or utilities in the nation.

They have been using this methodology for five years as a self-assessment tool. We have scaled it up to make it applicable to both an independent and third party assessment.

You can actually do some trending across those if you do have to do those other assessments to see and compare apples to apples and not some other methodology to what you were doing in your self-assessment.

MEMBER BLEY: Have you actually been able to try some of that?

MR. PIETRANGELO: Yes. Again, it has got about five years of road testing on it. We want to try the scaled-up version with the independent assessment.

MR. HOUGHTON: There have probably been about 20 of them done so far. And then we are going

to pilot it with NRC observation at three of our four pilot plants over December and January.

MEMBER BLEY: Over this coming --

MR. HOUGHTON: Yes, yes, right.

MR. PIETRANGELO: Okay. With that, if there are no further questions, I will turn it over to Tom.

MR. HOUGHTON: Thank you.

I am going to talk about three things: first, the 09-07, which is our guidance document, which has a sample procedure in it. Secondly, I will talk about the cultural assessment, which is a survey and on-site team, which Tony was just discussing; and, third, talk a little bit about the pilot plants and where we see things going from here.

So the first item is the 09-07. As Tony said, what we were trying to do was think of all of the -- well, first we went and looked at what plants were doing.

As I mentioned before, INPO requires a self-assessment every other year. There had been independent assessments done. There had been third party. And we looked at what they were doing on a continuous basis.

This is a continuous program, more or less

a two-year cycle for this 09-07. And we looked at, well, what are all of the inputs we could have, not just inspection findings with aspects, but what else can we look at?

I'll show a chart in a second. The idea is that the licensee would be monitoring, doing its own oversight, trending data. So these are things that are being done right now.

I mean, I had a question early from NRC staff, "Well, what is different?" Okay? And what is different is we are trying to have an integrated, holistic approach, where we look at all of the data and do it systematically.

I will turn to the next slide, please. And I will just walk through these so you can see that at the bottom of this chart are process inputs. Okay?

From the left, we have NRC inspection results, which we appreciate and believe should be continued because the NRC provides that insight. What we are concerned about is the grouping of the aspects into SCCIs.

The second one we have there is a nuclear safety culture assessment. This is what is required by INPO as a result of the SOER that they did for Davis-Besse. But INPO did not give any specific

guidance on how to do that. That is what the USA Group put together. And that is what we built on as well as looking at international efforts, like the START program, which the IAEA does.

So the third box over there, "Industry Evaluations," that is kind of code for INPO evaluations. So INPO comes in every other year and does an evaluation, in addition to other things, so that in this two-year cycle I was talking about, the first year you would have the nuclear safety culture assessment, self-assessment. The alternate year you would have the INPO evaluation.

The next box over, "Operating Experience," there are issues and items that come up from operating experience, which, like all of these inputs, are artifacts. I mean, that is one of Dr. Schein's terms for you can look at what are the outward signs, what is the data, what is going on, and then from those artifacts try to derive what are the safety culture trends, issues, and concerns that you might have? So we have these for all of these inputs.

QA self-assessment and benchmarking. You gain an awful lot of information from that, observations when people go out in the field and watch what is going on.

Employee concerns program. While there are going to be some things that need to be kept confidential, trends in the ECP program and information that is gathered there is extremely valuable for safety culture.

Performance trends. By that, we mean that the company's internal performance indicators, trends in those, such as operator work-arounds or items like that, rework, things like that, can provide you input on safety culture.

So the concept is that we would have a panel. Well, everything goes into the corrective action program, which is the box above there. But then we would have a nuclear safety culture monitoring panel, which would be made up of the owners of the process inputs. And their responsibility is to look both for trends and issues within their own process input and for them to dialogue with the other process owners to look for trends across all of these different performance indicators.

So this is going to be monthly during the pilot but nominally a quarterly meeting of these process owners to look at all of these process inputs and look for safety culture issues using the lens of the INPO safety culture principles and attributes.

Then this group would provide a report to the site leadership team, which is ultimately responsible for safety culture on the site. And the site leadership team, usually headed by the site VP, will review the data, bring their own insights, and develop action and communications, the action end of this, to be disseminated and to be implemented throughout the site.

So, using Tom's concept from this morning, we are looking at what to look at, process inputs. What are we looking for? We are looking for trends and using the lens of the input principles and attributes. And what are we going to do about it?

The site leadership team has the responsibility to take specific actions, be they process, procedure, organizational changes, personnel changes, training, communications, et cetera.

And then, of course, you have all of this feeding back into the process to see whether you have actually made improvement. And then you can check and adjust.

In terms of external eyes looking at this process because you can have denial going on, we see the NRC playing a very important role looking at this process and what is being done with it. We see INPO

looking in, at least every other year and more often as they do.

We see this -- although I call it a self-assessment in the other year, half of the assessment team is made up of outside people, including an external executive, who participates in this one-week assessment. At the North Anna plant, that is going to be Ross Reidenauer is going to be the executive coming in to be the lead of this self-assessment, as they called it.

We also have if you look at the top of the chart the Nuclear Safety Review Board, in whatever name it is called for the particular company. We will also be looking at these reports and results and providing feedback on them.

That is the overall process that we have designed. We will be piloting it at four stations. I will get into that a little bit later about who the pilot plants are.

The next page --

MR. PIETRANGELO: Talk about this piece.

MR. HOUGHTON: I'm sorry. Another piece on this chart if you go to the -- I guess it's yellow -- yellow, NRC will be observing the whole process, but, in particular, in their inspection manual chapter

71152, which is a PI&R inspection, we would envision that they would look very specific ally at the piece/parts of this program and its effectiveness, looking for what is the effectiveness, what has the plant done in terms of actions, and how is it measuring and ensuring that real change has taken place?

MR. PIETRANGELO: That is the largest module, I believe, in the baseline inspection program that already exists. We would see that being modified to pick up aspects of this so that everybody gets this review, not just somebody who has gone from column 1 to column 2 to column 3, but it would be applied to every plant in the country going forward in their baseline inspection.

So if you want to get at something that is a more leading indicator, we really believe it needs to be incorporated in the baseline inspection module.

MR. HOUGHTON: Now, Chuck and I had a conversation a month or two ago. If it were a different inspection module chapter, we certainly have no issue with that. We just see that there ought to be a chapter that looks specifically at this process and its effectiveness. So I just want to get that in. I listened to you.

The next page talks about the NRC role and what we envision as NRC's role. NRC, I hope, through the pilots looks at what their role would be, but we have made some suggestions.

Obviously the first was the enhanced PI&R for our inspection that would look at this process. They have continuing observation through the residents. They would continue to identify cross-cutting aspects, although we would hope that we would wind up with a common set of these components or principles or whatever we call them.

We think that that is essential for being successful that we have this common set. It makes no sense for an inspection report to talk about aspect A and we don't have that, we have principle Z. And there is no reason.

There is good overlap in these. A number of people have looked at it. We know that we could have a common set of words that we could use for this. And, going forward, we believe that the new plant construction ought to be able to have the same set with the NRC, that fuel facilities should have the same set, that radiographer is a much smaller set but a similar set. So that the regulator and the licensee are speaking the same language. We can't talk about

how important we think that is.

NRC would maintain its safety-conscious work environment oversight. It would maintain its traditional enforcement, which essentially has to do with willful violations and withholding information and protected activities.

We believe that NRC would document in inspection reports and assessment letters its reaction to how well the company is doing. If the company were not doing well in NRC's opinion, what could they do?

We believe a very powerful instrument is a public meeting where the licensee has to explain in the public what it is doing and what it is doing to meet NRC's expectations.

There could be a request for an independent assessment, as there is now. And in column four, of course, there can be a third party assessment required. So we believe that this provides a strong footprint for the NRC to observe this.

Next page is what are we doing next. We have submitted the 09-07 to the NRC review. We have submitted the safety culture survey and assessment to NRC. We want to have a pilot program. Again, I will talk about that in a couple of minutes.

We want NRC to observe the pilots. We

want to jointly assess the success of the program. And we have developed some success criteria that we are going to share with NRC and come to agreement on what constitutes success for the pilots, obtain Commission approval.

The staff will have to go to the commissioners to change the way they are doing the oversight of safety culture. And then, of course, we would need to conduct industry workshops and training and procedure writing prior to implementing this and that we believe we could implement in January of 2011.

Now, the next page just gives you a pictorial of what I was talking about. Pilots are going to start this month. We think a six to eight-month period is long enough to observe the panels and the activities of the pilot plants and to gain lessons learned, which we would do over the summer, and that we would be looking for, hoping for NRC approval in the September time frame such that we would have time to do our training and our procedure writing such that we could implement the beginning of 2011.

Let me pause right there. That is the overall program and how we envision it. Do you have questions for me at this stage?

MEMBER MAYNARD: The four pilot plants, is that one in each region?

MR. HOUGHTON: It is. It is North Anna, Hope Creek, Braidwood, and South Texas project.

MEMBER MAYNARD: Okay.

MEMBER ABDEL-KHALIK: Is there logic to how these --

MR. HOUGHTON: How they were chosen?

MEMBER ABDEL-KHALIK: -- how they were selected other than being one in each region?

MR. HOUGHTON: One in each Region, volunteer, different types of reactor, different sites. We have got a three-unit site, two-unit sites, looking at -- we didn't really want to go and say, "Let's pick a bad person and a good person." But one or two of those plants either have or have had SCCIs in the recent past. So we are looking at people that do not have SCCIs now and that do. That is kind of the logic that we used there.

MEMBER ABDEL-KHALIK: That was the underlying reason for my question.

MR. HOUGHTON: And they volunteer.

MR. PIETRANGELO: Voluntary was important.

MR. HOUGHTON: Thanks. Good question.

MEMBER RAY: Tom, are you going to have

another time maybe for questions? I don't know. Let me pose a question here and see if this is a good time to try and answer it.

What I am going to try and ask -- and I don't know whether you or Tony wants to respond -- has to do with the difference between excellence and safety. Now, you have been very consistent -- and I listened carefully -- to focus on safety, what we're measuring, what the metrics are, what the data are that are being processed.

The industry, of course, has a lot of metrics that have to do with achieving excellence as well. Some people try and argue that excellence is the same as safety. I don't want to have that debate now. Let's just assume it's not for the sake of discussion.

What I am trying to ask is whether any of the excellence metrics, which are sometimes different for different plants across the service plant versus a merchant plant, for example.

Whether you are satisfied that what is being planned here provides -- I don't want to call it a firewall but a separation so that you don't get folks who are, let's say, a cost-of-service plant that may not meet excellence standards for outage

management, for whatever reason, mixed up with safety issues, which is what we are here to discuss today.

So that is the question, and either of you can --

MR. PIETRANGELO: Let me take the initial cut at it. You will notice that the chart that Tom put up looked a lot like the ROP chart that was originally developed. And I think in there, it was a clear distinction between the green and the white bands. If you're green, you get the baseline regulatory inspection program, the 2,000-plus hours a year.

It was really INPO's job to push you as high in the green as you could get if you are there. And if you fall below that, then the NRC starts expending additional inspection resources on you.

Given that this is really intended, at least initially, to be a self-assessment in the green column and then what you would do if you tumbled on into column two, three, or four, that is where we see the NRC getting more engaged, as they are now, within the ROP. So It think we would maintain that distinction.

The difference on merchant versus cost-of-service, I'm not sure we have thought through

that enough.

MEMBER RAY: Let me ask it one more time, Tony, because I don't think I was clear, evidently. What I am saying is, could somebody have a very good safety culture but not be so good in the excellence metrics that are measuring capacity factor, timeliness of outage completion, things like that?

MR. PIETRANGELO: Yes.

MEMBER RAY: Is the answer "Yes" or "No"?

MR. PIETRANGELO: It's plausible, but I think our observation is that they are not mutually exclusive.

MEMBER RAY: I know that is the mantra. Don't tell me. I know that story. But I am just asking, in principle, is it possible?

MR. PIETRANGELO: Yes.

MEMBER RAY: Okay. Because I think that is really an important separation. If we have been -- I don't want to say confusing -- conflating the metrics that measure how well you are running your plant from a -- I'll just use outage management. That's why I used cost-of-service versus merchant.

MR. PIETRANGELO: Okay.

MEMBER RAY: If we confuse those things, some of which don't have anything directly to do with

safety such that you just can't have an excellent safety culture without being excellent in these other areas, I think we will have made a mistake or done a disservice. Do you agree with it?

MR. PIETRANGELO: Yes, I do.

MEMBER RAY: Okay. Thank you.

MR. HOUGHTON: You know, if you listen to some folks, like Bill Levis, that are in the field right now at PS&G, he will say they go together. He said if that -- no, no, not necessarily the cost, but the performance in terms of equipment in-service, low rework, the plant is clean, feeds the safety culture. They feed each other exclusive to the dollar cost. The man in the field is not going to put a corrective action item in the system if it never gets fixed.

MEMBER RAY: I appreciate there are alignments. All I am saying is that at some point, safety culture, which is what we are here talking about today, doesn't necessarily align with getting out of an outage --

MR. PIETRANGELO: Correct.

MEMBER RAY: -- on schedule.

MR. PIETRANGELO: No question. I mean, I --

MEMBER RAY: That is as simple as I can

make it.

MR. PIETRANGELO: Yes. If your outage is 40 days versus 30 days that was planned and you took 40, is that indicative of a poor safety culture? No. Is it indicative of a good safety culture? No. I think it is different.

MEMBER RAY: It is. It is. But I do see these things getting overlapping --

MR. PIETRANGELO: It could because that is one of the things I think INPO looks at is outage duration.

MEMBER RAY: You're darned right it is.

MR. PIETRANGELO: That could be mistaken in this environment.

MEMBER RAY: Yes. And I want to make sure that I am hearing you say you see the difference.

MR. PIETRANGELO: Yes.

MR. HOUGHTON: And the metrics we are using are not the -- they are more geared towards the cultural aspects, as opposed to the --

MEMBER RAY: I know, but people can say that culture has to do with completing the work on time and having a well-planned work order and lots of other things. Safety sometimes can call for different behaviors.

MR. HOUGHTON: Correct. No question.

Next slide, please. Next slide. Now we'll talk about the single element, which is the safety culture assessment. Why did we go about this? Well, there was considerable churn, I guess I would say, at Palo Verde when they did the 95003 in terms of what is this assessment going to be, how are we going to do it, what is the survey, et cetera, et cetera, and there were a lot of starts and stops. And my colleague here volunteered that the industry would put together a document on a methodology for doing a 95003.

CHAIR APOSTOLAKIS: Does the industry mean you?

MR. HOUGHTON: That means me.

(Laughter.)

MR. HOUGHTON: And I happily accepted the assignment.

MR. PIETRANGELO: By we, I mean you.

MR. HOUGHTON: Thanks.

(Laughter.)

MR. HOUGHTON: So what we did was we put together a task force of people from the industry, people that do these assessments. And we looked across the country at how people do them, what they

do, who they use.

We looked internationally at what they are doing and scanned around. What we found was that nobody was doing them the same, basically, except for the USA Group. And so we focused on the USA Group. And their effort consists of a survey, which is a pointer into an on-week assessment.

Next slide. Okay. The process uses as its lens the INPO principles and attributes for its survey and its interview. The --

MEMBER RAY: Principles and Attributes of safety culture?

MR. HOUGHTON: Of safety culture.

MEMBER RAY: Not of excellence?

MR. HOUGHTON: No, no, not of excellence.

MEMBER RAY: Right, right. So we want to keep this --

MR. HOUGHTON: Different book.

MEMBER RAY: That's right.

MR. HOUGHTON: And the pre-survey is automated. It's by e-mail. So it's anonymous. The system can e-mail the person back if they haven't responded without knowing who it was. The response rates have been about 70 percent. That is kind of the goal for these things.

Everyone gets it, anyone who has an e-mail address. So it includes security. It includes long-term contractors if they have an e-mail address. Some by hand could be done if desired, but we feel we take away the problems with an administered survey by having it on the internet.

Originally they could not distinguish between different organizations and different levels of the organization, but we can do that now. We have upgraded the survey instrument. So that can be done.

The results come back. Right now the survey for North Anna is being done. For instance, they have their own site assessment in mid December. So they are getting their results now. And that will be used to point the assessment team in the right direction when they come on site.

As I said, the assessment, as Tony said, the assessment can be scaled up for an independent or a third party. So what we do for the self-assessment is half the team is off-site people out of different company people.

Half the team is on-site people. And the advantage of doing that is that you have the knowledge of the site from the inside people with the perspective from the outside people so that you don't

go down any -- you don't follow Alice down the hole in going into the wrong area. You've got someone there that can tell you the aspects of the site that might lead to a certain activity.

Let me just say the independent -- let me just finish. The independent assessment has no one from the site on the team. We can't have people from the corporate office who are not involved in overseeing the site directly.

The third party is completely outside the company, nobody in the company. And the independent and the third party can be scaled up to cover additional areas and additional activities that the site VP may want the team to do.

The team membership is people who have done these in the industry. The company is free to bring in anyone it wants if it wants to bring in a consultant to be on the team.

They have to follow the methodology that is set up, though. We want to have a consistent methodology so that if you have a self-assessment in year one and you fall into column three of the action matrix and the NRC wants you to do an independent in year three, you can do an independent. It will use the same terminology/methodology as you had before.

So you can do a comparison of results from a previous assessment. This is something that many of the independent and the third were unable to do because they had a different methodology when they came in with different people. So that is one of the strengths, we believe, of what we are trying to do.

This page here just gives you a cartoon of the one week. The survey is done ahead of time. The team comes in Sunday night. They talk about their strategies for the assessment. The interview schedule has already been made up.

The off-site team leader selects the interviewees. That is not done by the site. So you don't have cherry-picking, the potential for that by the site.

The team comes on board. They go out and do their interviews. Like the survey, the interviews are based on the INPO principles and attributes of safety culture. And the question sets are already derived. There is an Access database for compiling information as you do them.

There are five different sets of questions. There are questions for craft, individual contributors, supervisors, managers, and senior management because obviously the principles and

attributes apply different to different levels in the organization. So the questions are keyed to do that.

The team meets daily. They look at the data they have collected. They ensure that they are hitting all of the principles and attributes, that they are hitting all of the organizations.

On Thursday, they bring their conclusions together. They brief the site leadership team that evening. On Friday, they do an exit with their findings, conclusions, and recommendations in a presentation as an exit.

About four weeks later, the team leader sends the completed report to the station for action in the corrective action program.

MEMBER BLEY: Tom?

MR. HOUGHTON: Yes?

MEMBER BLEY: Can I ask you a question? We heard some things this morning in some of the readings that were passed onto us drawing a distinction between I guess different kinds of interviews and surveys. Is there guidance here that pushes these questions towards looking at, say, attitudes and understanding versus behaviors or some of these descriptive stories we heard about and we talked about?

MR. HOUGHTON: That is a great question. What is done is that the interview sheets, the question is asked about, what is your attitude? However, does the plan provide adequate explanation of decisions that have been made? Yes, I really think so. Why? So they have to give a behavior that was observed before the attitude can be scored.

It's not just if someone says, "Yes. They really do give us all that information. Explain to me how they do that." If there is no answer, it is a neutral score on that question.

MEMBER BLEY: So you actually drop the question if you don't get any behavior --

MR. HOUGHTON: It gets scored a zero. So you either have a plus, neutral, or minus on it as to how that question is responded to. But it has to be keyed to a behavior or an observation.

Good question. The next slide --

MEMBER ABDEL-KHALIK: Tom?

MR. HOUGHTON: Yes, sir?

MEMBER ABDEL-KHALIK: What is the relationship between the pre-assessment, the automated survey in these interviews? Is it possible that when you compile this automated survey and then after you go through the interviews, you say, "Everybody is in

denial. The pre-assessment survey is just nonsense"?

MR. HOUGHTON: The pre-survey gives you areas to look into and question. Oftentimes responses are more negative than interviews. But all of the data is collated and used.

I mean, you may find that the survey does not accurately -- when you look into the areas of weakness, as identified in the survey, you may either find that it's definitely a problem or you may find that it is not the problem that the survey data told you.

You are giving me a questioning look.

MEMBER ABDEL-KHALIK: Well, I guess the assumption is that this survey -- that the sample is large enough that you will get reasonably good data. And that data actually truly reflects the situation on the ground. I am just wondering if that is always the case.

MR. HOUGHTON: I don't think it is always the case.

MR. PIETRANGELO: Really, though, the team -- the week that you are there with the team is really to corroborate whether the data was useful or indicative or not.

MEMBER MAYNARD: One of the real purposes

of the survey is to help focus where you want to spend more time. If you're getting just out of that one area a whole bunch of negatives and everything else is positive, well, that may focus where you want to spend more time. If you don't get any input from some groups, that may raise a flag and take a look and see why. Maybe there is a good reason, maybe, maybe not.

So a lot of it is it alone is not going to draw any overall conclusions, but it will certainly help the team decide whether you can spend some of the time in areas to look at.

MR. HOUGHTON: Typical coverage pattern. Move from individual to supervision to management so that you have things you can specifically talk about to more senior management.

Generally there are about 40 to 60 interviews. Some are done in small focus groups. With craft, it is more small groups, rather than individual. In addition, there are observations and meetings that are observed so that there are field observations forms that are also fed into this database, this Excel-Access database of results.

So you are not just having the interviews. You are also observing things in the field. So typically there are about 1,000 data points that might

go into this assessment.

Next slide. I think I basically already went over this.

MEMBER MAYNARD: Back to your previous one there.

MR. HOUGHTON: Yes, sir?

MEMBER MAYNARD: Are there provisions for walk-ins, interviews?

MR. HOUGHTON: Yes, there are. Yes. If someone wants to be interviewed, yes. Also let me point out the interviews are done in two-person teams: one external and one internal person. If there is any concern on the interviewee's part, the internal interviewer is asked to leave and just the external interviewer is there. I want to make that clear also.

It is interesting that -- excuse me?

MEMBER ABDEL-KHALIK: Wouldn't that tell you something?

MR. HOUGHTON: Absolutely. That's a data point also, another data point. Yes. Two-person teams is something that the international group, I believe, believes is a useful approach for doing this as well.

Next slide. Exit meeting on Friday, as I said, a written report, which is put in the corrective

action program. It does look at previous assessments that were done. That's part of the assessment process, is to get any previous safety culture assessments and see whether the same issues exist, and/or whether they have taken corrective action for those items, very valuable input to this.

And then there needs to be wide communication of the results. The safety culture manual, which the USA Group put together and which we have expanded upon, is about two or three inches thick. It does have tabs on how to do all parts of this process, including the interviewing techniques, which is part of doing this.

Next slide. We have upgraded. As I have said, we have upgraded the manual to be able to do different levels of all three types of assessments and for different parts of the organization.

We did a validation study, which basically looked at the face validity of the survey questions and the interview questions as how they related to the INPO principles and attributes. We used a team of Ph.D.'s in industrial psychology to do that. And we have submitted that validation report to the NRC to look at.

They did also participate. One of the

members, the lead author, participated in one of these assessments early this year and looked at the psychometric activities that were done in terms of were we being consistent? Is the process consistent? Does it use good techniques for interviewing, et cetera, et cetera? And that is included in that validation look.

NRC will also be --

MEMBER ABDEL-KHALIK: Whenever you have a very detailed manual for how an inspection is to be done, somebody will find a way to game the system. Is that a matter of concern?

MR. HOUGHTON: In terms of quality of this process, you have an external executive. You have an external team leader. The team leader has to have performed some of these assessments before.

They're the quality protection during the assessment. There is a report that the team puts together on the assessment itself at the end of the week. And that information is shared with the USA Group, which is responsible for the ongoing quality.

So I think between the external officer and the external team leader, they make it difficult to game it. The team leader picks the people that will be interviewed.

So yes, I mean, I am sure you can -- someone will find a way to game something, but between 800 survey results and 60 or 70 interviews by outside people, I don't think that you could. It would be hard to game. I think it would be hard to game.

Next slide. Let me pause here. Questions on the survey and on site?

MR. CARNES: I have one, Tom. Tom, I have a sensitivity, to which maybe you can help me. That is particularly with the language of strengths and weaknesses that is being used with regards to culture because clearly one perception -- and you talked about one perspective talked about Dr. Schein. Let's take that model.

Culture simply is/is neither better nor worse, that an inquiry into culture is an approach to better understanding what is going on in the organization in order to inform your understanding of the results that are being achieved. Okay

So I just wondered if you had any thoughts on the use of this particular language because I can go back to my inspector days or evaluator days and understand the reaction from senior executives when the word "weakness," for example, might be used.

What that really means in this context is

what I was wondering.

MR. HOUGHTON: That is a great question, and it's one that the USA Group has wrestled with. I think it boils down to the two-person team on an individual interview looking at whether they believe that what is described to them as the response to the question about the attribute is a strength of a weakness. That is a judgment they are making. And then you have got this being done by 5 teams over a week asking 60 different people.

So I think it is what it is. And there are disagreements. One reason to have the executive on the team is the executive brings some gravidas to the findings and protection for the team in what they have suggested are the weaknesses.

MEMBER BLEY: Tom, what is the interaction with NRC's site inspector? Can they sit in on --

MR. HOUGHTON: Absolutely.

MEMBER BLEY: -- any part of this they want?

MR. HOUGHTON: They can sit in on anything they want.

MEMBER BLEY: They can sit in on interviews?

MR. HOUGHTON: Yes, interviews. They can

sit in on if they want. There is going to be some effect on the interview. I mean, that's going to be the case, but they can sit in on any part they want. And the same thing in our pilot program. We want them to observe everything that they want to observe, yes. Yes. Okay. Others?

(No response.)

MR. HOUGHTON: The pilot plants: Hope Creek, North Anna, Braidwood, South Texas Project. Next slide. We have met. We met with the pilots. We went from the 09-07, which had a draft procedure in it, worked as the pilots together on their own site procedures, which will be somewhat different, obviously, because sites have different corrective action programs and different cultures.

They have all developed their site procedures. They are training their people who are going to be on the monitoring panel and the site leadership team. They are communicating to the site why we are doing this and what it is going to do.

And so that they are ready to start. A couple of them have actually started. They are going to have our monitoring panels and the site leadership team throughout the seven months so that NRC can observe and draw conclusions from those.

Next slide. As I said, NRC, we want them to observe the whole process. And we're excited to get their feedback in how we can improve what we are doing here.

Next slide. We will have lessons learned from the pilots. We will improve our procedure. We will make process modifications. And we will decide whether we have met the success criteria. If we haven't fully met the success criteria, what can we do to correct that area?

Next slide. So, in conclusion, we want to work on the common language. We have got the guidelines sent to the NRC and are looking forward to their feedback. We want them to observe the pilot plant activities, and they are engaging in that. And people are being assigned. And we want to be able if this process and pilot work out successfully to be able to shoot for implementation in the beginning of 2011.

One thing I really didn't cover probably is what happens if the common language takes longer or what happens if the common language is different than the INPO principles and attributes?

We believe we have set up a process and a mechanism that, if proven successful, we can upgrade

or change the language in our interviews and surveys in response to what is decided. And we will be able to move forward with that. We don't see that as a reason to delay doing this pilot. We think that now is the time to do it. And we want to get on with it and have fun doing it.

I think that was my last slide.

CHAIR APOSTOLAKIS: Comments? Questions?

MEMBER SHACK: Does the policy statement have any impact on this? You have already taken it into consideration?

CHAIR APOSTOLAKIS: Policy statement?

MR. PIETRANGELO: Yes. I mean, the policy statement. Go ahead. No one is going to argue that a safety culture isn't important to nuclear power or anywhere else with nuclear technology.

CHAIR APOSTOLAKIS: Safety and security.

MR. PIETRANGELO: Right. We may have a comment with regard to equating security and safety in the same breath when we comment on the policy, but we're not sure that that is exactly the right --

MR. HOUGHTON: We think there are seven cornerstones that apply. And security is one of them. And to elevate security, we are not sure that makes sense.

CHAIR APOSTOLAKIS: So this is exclusively for safety, the questionnaire?

MR. HOUGHTON: The security people are involved in this process, absolutely, and contractors.

MR. PIETRANGELO: The way I look at it, you've got safety culture. Underneath that, you've got radiation protection, security, industrial safety, all the other things we do. Instead of putting security up at the top, I think that is the way we look at it.

It is a little bit different maybe than what is coming out of the policy statement. It is a key element that everybody has to think about, not just the security group but everybody who works at the plant.

MEMBER RAY: Do you think you will comment on those lines to --

MR. PIETRANGELO: Absolutely. We have had some discussions with INPO on that. We will try to get a joint industry --

MR. HOUGHTON: We will comment on the policy statement in the 90-day period. And we will be involved in the meetings that are going to start in January, as I understand.

CHAIR APOSTOLAKIS: Yes, yes, absolutely.

MR. HOUGHTON: Yes.

MR. PIETRANGELO: But, you know, this really was separate from the policy statement. We would have done this anyway if there were no revision to the policy statement.

CHAIR APOSTOLAKIS: Anything else?

(No response.)

CHAIR APOSTOLAKIS: Thank you very much.

MR. PIETRANGELO: Thank you very much for having us, appreciate it.

CHAIR APOSTOLAKIS: I think we will proceed with the last presentation by Mr. Collins, a member of the public. So please tell us first who you had.

MR. COLLINS: I had a bio. Do you have that bio?

CHAIR APOSTOLAKIS: It doesn't matter what you have. Just give us a few words.

MR. COLLINS: It doesn't matter who I am or --

CHAIR APOSTOLAKIS: It matters who you are. And please tell us who you are.

MR. COLLINS: As Ross Perot used to say, I don't care what you've done or where you went to school. Just can you do the job? So you want like a

little background of me, who I am?

CHAIR APOSTOLAKIS: Yes, like the gentleman did in the morning. You were here.

MR. COLLINS: Okay. Well, probably my best qualification to talk to you about this would be having lived through the Millstone experience, where starting in 1980, where the first commander, basically chief nuclear officer of Millstone, was a guy named Leland Silon. He was one of the very first people who kicked off INPO. He is considered an excellent, excellent safety culture person, our culture manager. He spent a lot of money on Millstone, making full-scale mockups of the control rooms. People came from all over the world, operational excellence.

Then we had deregulation. Deregulation brought in a very cost-conscious -- a term I am going to coin cost-conscious work environment, where you focus on cost over an extended period of time more than you focus on safety.

And what happens is you populate your management with not safety-focused managers but cost-focused managers. And then that changed the whole culture of the company over time to something I call minimal regulatory compliance, where you will comply with what NRC wants or INPO wants, but if any

employees bring up issues, you tend to not comply with those.

You might tell the employees, "Please put them in the corrective actions process," but then you give them a low priority. You defer them. And you'll see if you study what happened at Davis-Besse, that that is one of the things that happened at that plant, too.

So part of what I talk about is I am going to present that as kind of a common root cause/common direct cause of a lot of these events.

I have a Master's degree in executive management. I was taught by a number of Ivy League professors from Cornell and Yale and Harvard, but probably just studying, just a natural curiosity in leadership. I've always read leadership books and management books and then the culture of the event happened at Millstone, mostly engineering training. I never cracked open a culture book, but I started studying the subject.

Independently I said, "Okay. You have your desired culture, and you have your acquired culture. And it can get out of phase." I am talking like an electrical engineer now. So when they are out of phase, what is the cause? What do you do with it?

And then I said, "I've got to look for a book," and I read Edgar Schein's book Organizational Culture and Leadership. And he has your espoused values, your shared tasks, assumptions, same thing, your artifacts, same thing. And I said, "Okay. I think I am starting to get a hang of this."

I just kept chewing on the issues, kind of independently developed some of the same things that James Reasons did. But I also have some tools that kind of go beyond some of those things. So that is part of what I am going to to talk about here.

CHAIR APOSTOLAKIS: Okay.

MEMBER BLEY: You are here speaking just for yourself?

MR. COLLINS: I am sorry. Thank you. That is a very important point. This is very important because I am wearing a shirt here that is embroidered Safety Culture Warriors. It was made by Dave Christian, who is an excellent cultural leader I think in the industry. I don't know of a better one. He's the chief nuclear officer at Dominion.

However, there are other people in management who feel that some of my opinions that are different from INPO are somewhat heretical, I guess you could say. And I think that is part of that that

is the difference between management and leadership.

I think Peter Drucker said management is doing things right, leadership is doing the right things. The thought process says I just have to do what INPO says. And anything off the beam to that is wrong. And then there is leadership that says independent thought, do things that make sense.

Our chief nuclear officer is a big believer in that. He has been a big supporter. I can't say that this should not be interpreted as Millstone's or Dominion's position on any of this. This is just my personal views on the subject.

CHAIR APOSTOLAKIS: Very good.

8. STAKEHOLDER COMMENTS ON SAFETY CULTURE

MR. COLLINS: Okay. First I would like to thank ACRS for allowing me to present today. The initial presentation that you have has 102 slides.

CHAIR APOSTOLAKIS: You scared us last week.

MR. COLLINS: My wife said, "Isn't that a lot of slides?"

And Professor Rees, who helped me a little bit, said "Isn't that a lot of slides," from Millstone, "a lot of slides?"

And when I came in here, Dr. Apostolakis

just walked over, "Isn't that a lot of slides?"

And I said, "Okay. It's really just more for reference material. The actual presentation just has about a dozen slides." So don't worry. You won't be here that long.

I would also like to thank Professor Rees, who wrote this very excellent book on, really, the development INPO. This book is handed out now when you go through the INPO academy as part of their normal literature they give people.

Professor Rees is an expert in communitarian regulation. And why is this significant? Because I think NRC doesn't just have to understand their role in safety culture. They need to understand INPO's role so that they know what is INPO doing and what is INPo not doing and make sure that between the two, you cover all the bases.

At INPO, there are things that they are doing, not doing. There are things that they can do. There are things that they can't do. I made a .pdf of Chapter 6 entitled "Professionals in Project and INPO" and how they struggled with developing professionalism in the nuclear industry since 1989.

I just want to point out why is this significant. Well, professionalism is the same thing

as safety culture. It is exactly the same thing.

Okay. I think I need to go to slide 92. We are going to skip through a lot of slides here real quickly. Since it is not in all of the packages, why don't I read this? I suppose I could ask the members to read their parts.

Is Mr. Rosen here?

CHAIR APOSTOLAKIS: No.

MR. COLLINS: He's not. Okay.

CHAIR APOSTOLAKIS: He left a long time ago.

MR. COLLINS: Oh, okay. Well, here is an ACRS meeting, 2002.

Mr. Rosen says, "I don't want to be here three years from now with another plant, XYZ plant, has a serious incident, and we didn't do anything."

Well, kind of the bottom line -- we had Chairman Bonaca saying he is with him and Dr. Apostolakis saying, "I am with you."

Basically the idea is we don't want to see another event like Davis-Besse and that we didn't do something different. So the question is, what is the different thing that NRC should do?

Let's go to slide 6.

CHAIR APOSTOLAKIS: John, I admire your

dexterity. Okay.

MR. COLLINS: The GAO report from 2006, which is not all that long ago, "NRC should increase the effectiveness of efforts to assess safety culture at plants and develop specific indicators to measure important aspects of plants' safety culture." So increase the effectiveness of assessments, develop specific indicators. Okay.

Our next slide is -- oh, no. I am supposed to talk about this for a while. Okay. In 2002, at an INPO conference, NRC Chairman Meserve indicated the reason NRC is unable to effectively assess safety culture is that the concept is not clearly defined.

Quality management theory has a formula that says, "Define. Measure. Manage," meaning if you are going to manage something effectively, you have to be able to measure it accurately. And to measure something accurately, you have to be able to define it clearly.

So how does this apply to what we are doing? Well, plant management and regulation of safety culture are really managing the quality of safety culture. So it is really a quality management issue that we are talking about.

To do this, we need a new definition. But we also need more than that. We need a new language. We have to understand a lot of new concepts.

At the end of this big presentation, there are eight slides. On the 8 slides are 50 definitions. All of them relate to different aspects of safety culture. I am not going to go through them now, but people who are interested in the subject might want to take a read through them.

I am going to look at two definitions now. Next slide is nine. What is a high reliability organization? An organization that operates and manages processes with the potential to adversely affect human life or the environment.

Nuclear power is an example. From the pictures below, you can have landing aircraft on a carrier. You can have the medical industry. You can have NASA. You can have coal miners. And that is a picture of the Texas refinery.

CHAIR APOSTOLAKIS: I guess what you need there is an organization that operates and manages blah blah blah well. Not any organization --

MR. COLLINS: Well is a quality decision. Well is a quality decision. I am just saying, whether they managed it well or not, whether we

managed safety in the nuclear power organization well or not, we are still a high reliability organization.

CHAIR APOSTOLAKIS: Why wouldn't --

MR. COLLINS: A high reliability organization needs to manage safety culture well.

CHAIR APOSTOLAKIS: An organization that operates and manages hazardous technologies is not automatically --

MR. COLLINS: Yes. I am saying it is. In fact, when I went to a conference at Brookhaven, that's pretty much what everybody was saying. In fact, they considered nuclear power -- nuclear power is the --

CHAIR APOSTOLAKIS: It should be. It should be.

MR. COLLINS: Nuclear power is considered the classic high reliability organization.

CHAIR APOSTOLAKIS: I understand that, but it's not because it happens that we regulate reactors. I mean, we try to be a high reliability organization.

MR. COLLINS: Well, we can discuss that more.

CHAIR APOSTOLAKIS: Yes. I mean, that would be fine.

MR. COLLINS: The context of this is

calling it this organization because it is an organization that manages risk for people in the environment. I'm not saying that this is why we need to be highly reliable. This is because that is the kind of organization we are.

One of the INPO eight principles says that nuclear is unique. And one of the things I wanted to communicate is that nuclear is unique in that it is a different was of generating power, different from coal or hydro. But it's not unique in the safety culture sense. In the sense of safety culture, it is one of a number of these high reliability organizations.

And one thing that happens to me when we think of ourselves as unique and we don't think of ourselves as a group of these other types of organizations is we don't look at some of the new tools that they are developing.

I would say that the medical industry, certainly the Naval Safety Center and a lot of industries are considerably ahead of us in safety culture because this industry hasn't really studied it as well as I think that they probably should have.

I wasn't going to get into this, but maybe I will mention it. You just saw the first slide with the ACRS members talking about "I don't want to be

here after Davis-Besse when we have another one of these." Well, the "safety culture" term was coined back just after Chernobyl. So in my mind, that would have been a good time to have started studying safety culture and understanding its impact.

Since 1986, since Chernobyl, we have had 9 of the top 20 most significant safety events, according to INPO 02-005 analysis of significant events. According to INPO, 70 percent of events have safety culture as a causal factor.

Now, if you had perfect safety culture management, you could have avoided maybe about six of those events. What the Naval Safety Center did -- you can see the lower left-hand corner here -- is they set a goal of within a decade of reducing their human performance errors of landing; in other words, through safety culture management, through their safety culture management workshops, reducing safety culture as a causal factor of significant events by 50 percent.

Had the industry studied safety culture, which Edgar Schein wrote his book the year before, Organizational Culture and Leadership, someone from MIT who was at ACRS at the time might have gone down the hall and said, "Edgar or John Carroll, could you

help us out here and get something going?"

Had that happened, if we had the same kind of success -- and the Naval Safety Center is all based on inter-science methodology -- we could have avoided probably not all six events, but we could have avoided three events. So I am saying probably about 3 of the top 20 significant operating events could have been avoided with better safety culture management. I think it is the same metric going forward.

Okay. Slide ten. All right. So what is high reliability organizational safety culture? Let's start with just what is safety culture? Start with breaking it down. What is culture? The simplest definition is how we do things around here.

What is safety? Safety is an ethical attitude that makes sure that how you do things -- I should say some of the word is erased by the graphic there -- how you do things does not harm people.

So you put it together. And you have a definition for safety culture that is an ethical attitude that makes sure that how you do things around here is that we do not harm people.

Chairman Meserve was saying that the reason that NRC can't assess safety culture properly is that we don't have a clear definition. Let's go to

the next slide.

The unclear definition he was talking about was the INSAG definition. I don't think there is anything wrong with INSAG. INSAG came up with the best definition they could, right after Chernobyl. But that doesn't mean that it is immutable or that it is the best that the industry can do.

So here we have the definition that Dr. Meserve is talking about. And underneath we have six problems with the definition. So I am not going to go in detail to this slide or the next slide, but I am just going to say these are six problems. And the next slide is a definition that corrects these 6 problems, which is 12.

I will read it. I probably revised this one 20 times because tweaking it, tweaking it, tweaking it. And it has pretty much stayed this way for a while. So it is firmed up as best as I can firm it.

CHAIR APOSTOLAKIS: This is your proposal?

MR. COLLINS: This is my definition --

CHAIR APOSTOLAKIS: Okay.

MR. COLLINS: -- that I have been working on for probably ten years now. I wish I could have cranked it out quicker, but that was not an easy thing

to define. It took me a while. And it may not be perfect. Other people may very well have improvements or other thoughts, but let me just read it, "Ethical leadership attitudes in a high reliability organization that ensure potentially hazardous activities are managed and operated with a reasonable low risk to people and the environment, thereby maintaining the trust of all relevant stakeholders." We can come back to that at the end of the presentation if anybody wants to.

Page 79.

CHAIR APOSTOLAKIS: Oh, you are not going to talk about the clarification?

MR. COLLINS: We're going to talk about more than that.

CHAIR APOSTOLAKIS: Are you going to come back?

MR. COLLINS: I will come back to anything anybody wants, yes. You know what? I'm sorry. Yes. Let me step back there for a second on slide 12. There was something I wanted to talk about. Dr. Apostolakis was correct.

The last part of that says, "thereby maintaining the trust of all relevant stakeholders." And I attended the 1999 Northeast Utilities' Millstone

restart hearings here.

One of the things that then Chairman Shirley Jackson asked, she said to -- I think it was Bruce Kenyon and the executive management team that was fixing the culture at Millstone who did an incredible job, a good job of fixing the culture. She said they felt it was one of the most -- I'm trying to think of exactly how they said it, one of the most significant recoveries of safety culture of an industry.

And Dr. Jackson said, "Well, a lot of plants have had multi-year regulatory shutdowns. Why is this one the most significant?"

And they all said the same thing, "Because we had to repair a seriously damaged trust relationship, not just between the workers and the managers but between the company and the regulators and the company and the public."

So when this says, "the trust of all relevant stakeholders," it's wider than just what goes on within the boundaries of the plant. Okay?

Seventy-nine. So what is trust? What exactly is trust? It is an expectation for future performance based on past performance. In the context of nuclear safety culture, it is demonstrating to

stakeholders over an extended time that you are consistently and continually doing the right things.

Now, what is doing the right things? Millstone management used to think doing the right thing was shoot the messenger. So what you have to do now is you have to look at to maintain a safety culture, what are the right things to do that.

So the next slide, 81. So this is an integration of a number of concepts, but, really, in INSAG 15, at the end of INSAG 15, there is a long checklist of questions that you can ask to see if you have a good safety culture.

What they do is they start at the board of directors/board of trustees of the company. And they go all the way down through the management levels, the CEO. In our industry, it would be the Com and then the like executive vice presidents, vice presidents, until they get all the way down to beyond a typical management level to what they call a point leader on the shop floor.

So what they are doing is they are looking at leadership from the top to the bottom of the organization. And whenever you have a safety culture that hits the bricks or goes in the toilet or however you want to say it, oftentimes what happens is the

leadership team gets changed up.

So I would suggest that, instead of changing out these leadership teams periodically, we try to get them to do a better job as we go along. Why wait until the culture has degraded and chop off some heads? Why don't we just understand what it is they have to do and make sure that they're doing it?

I have a culture -- I think one of the top culture management consultants in industry is a gentleman called Martin Marquardt from a company called TOSAN, who has done, remediated a number of cultures, at least a half a dozen cultures, across the nuclear industry and in many other industries. I sometimes ask people. I say, "Well, what is the most important thing for managing safety culture?"

And he said, "There are only two ways you can change or fix a culture." He said, "You can change leaders or you can change leaders." So, I mean, what he is saying is one way to do it is to replace the people. The other way to do it is to change their attitudes.

I think we can't afford to replace, continually replace, people. I think we have to look toward managing their attitudes and their behaviors.

So what this is is an integrated process.

You can see it connects to this big chart over here, the relationships. The bottom one is called "Survey of Worker Interactions with Management."

Now, when I say, "Survey," here is Edgar Schein's book, Corporate Culture. Edgar Schein says in the book, "Culture surveys don't work." And what he means is you can't ask 200 questions and then use that to make any kind of a judgment about the culture. You have to sit down and talk to employees. You have to talk to people. You have to talk to workgroups. You have to say, "What are the problems that you are seeing?" And then they have to be addressed.

So is Edgar Schein an expert in assessing organizational culture? I would say yes. Is he an expert in nuclear safety culture? I would say no. I would say you need an integrated process.

Edgar Schein, I think his methodology has been applied at most successfully at the Naval Safety Center, very successfully. And the reason I bring this up is you have to know who it is. You can't just take advice from every person across the board. You have to focus on the expert advice and integrate them to the process.

We have here the first one, assessment, Schein. I reference this book here. We have quality

management Six Sigma process as a defined measure of success, manage, regulate. That is the process that Dr. Meserve was talking about.

The next one down is corrective actions process. I have Peter Drucker down there. SMARTER is -- now, this is the difference between the kind of assessments we do currently and the kind of assessments that we need. We need to integrate these concepts, which is specific measurable, actionable, relevant, timely, effective, and reviewable.

I have I think a slide -- I don't have it in this presentation, but there is another slide that steps through exactly how that works. And then the bottom process is the corrective actions program. So anything you do if you want to drive change at the plant, you have to put it into the corrective actions program. So we have a corrective actions process that gets plugged into a corrective actions program.

So it starts off like that. You have the survey of worker interactions with management. And all the survey is is what is in this block here. You ask all the workers on site of their food chain. You say, "Pick out three of these behaviors that are positive, three of them that are negative, and then send it in."

And then what you do is you look at the percentage of the workers that respond. And if you have a high percentage of workers that say there is a problem, that tells you you have to kick into the Schein-type methodology. You have to sit down and find out what the problem is. And you have to put in the corrective actions program. And you have to fix it.

Now, if it turns out that the problem is that the leadership is not managing culture properly, then that affects however many people report to that supervisor, manager, or director because they are being basically blocked from doing the things that they should be doing or they're not being given the direction that they should be being given.

So you can look at the next slide, 80. How do you do an objective site-wide assessment. This is called MREB, management and regulation of ethical behavior. So it's both management to plant and the regulation, which would be NRC or INPO or whatever the regulator is going to be.

And it is a safety culture quality management approach because the tools we are using that Meserve was talking about are quality management tools based on the theory that the safety of

operations relies on the following three fundamental ethical leadership behaviors. And they are listed down below.

These behaviors tie into INPO human performance training. They tie into INSAG 15. They tie into what was done at the Millstone and at the Naval Safety Center. I'm sure a lot of other culture experts would say this is the area you need to focus on to make sure you have a healthy culture.

All right. So the next slide, 85. How do you do an objective ROP assessment? Now you have something called the MREB number, which is extracted from the MREB theory. It is a number providing an objective measure of site-wide organization safety culture quality.

Basically what you are doing, you're saying, how many managers on site aren't managing culture the way you would like them to? And you take that over the entire population, and you say, "What percentage is that?" And then that is how you come up with your score.

So it is the MREB number calculated by subtracting the number of SRFA -- is safety-related functional areas. So you are not going to run the survey on every worker. You are going to run it on

the workers that have some role in managing safety, some kind of a QA function that they -- some kind of an appendix B function that they associate with.

So the number of SRFA workers affected by weak culture management. You take that from the total number of safety-related functional workers. And dividing it. you come up with a result.

So in this example, 20 percent of the workers were affected. And the culture score is 80 percent.

The next page is 89. So this goes back to Schein saying, "Culture surveys don't work." The classic question that we ask for culture surveys is, would you be willing to report a safety concern? Better than 90 percent of the employees usually say, "Yes, I would."

But if you look at what happened at Davis-Besse, you had multiple times system engineers saying they need to cut access holes in order to clean the reactor head. And you had multiple occasions where the management didn't implement the modification requests.

So the culture, the question, "Would you be willing to raise a safety concern?" if you ask that of the supervisor that is processing this modification

request, he would most likely say, "Yes, I am willing to raise a safety concern."

If somebody were to come up to him and say, "I am going to dump a bunch of acid on the top of the reactor head and burn a hole in it," then he would say, "Well, I would definitely report that."

But if a worker comes to him and says, "We need to cut access holes to maintain our appendix B inspection process," he says, "No, I am not going to approve that."

So the question that we need to ask is a better question. We need to ask, would you be willing to take an ethical stand to get a safety issue addressed?

Now, you may get a very different response than better than 95 percent. I wasn't going to get into it too much, but I guess I have a couple of minutes. But if you take a look at the Milgram obedience experiments that were done in I think the '50s and '60s, it is better than -- it is more like 70 percent of the people will take an unethical action if directed to do so by an authority figure. And if the authority figure is not directly in the room but acting for another authority figure, the number goes up to better than 90 percent.

So that is a much more well-grounded realistic way to look at how would people respond to safety issues that arise in what I am calling a cost-conscious work environment.

I don't know if I defined cost-conscious work environment, but it's over an extended period of time when a company over an extended time puts more focus on cost than they do on safety. And this is common in the culture events that we see.

What happens is your management team becomes populated with managers that have more of a cost focus than a safety focus. And then you wind up with the kind of cultures like we saw at Millstone or we saw at Davis-Besse.

And there is a philosophy that develops of minimal regulatory compliance -- I think I did talk about this, I think I talked about this before I started my talk -- where managers will address issues that are raised by INPO or raised by regulators, NRC or INPO, but they won't address any issues beyond that.

What that does is it puts all of the burden for risk and for safety management on the shoulders of the regulators. Basically it's not I don't think the way the Atomic Energy Act is supposed

to work. I think you are supposed to have workers be able to come forward and have their problems addressed.

Next slide is 91. This is Edgar Schein has been sending me some e-mails on some thoughts. And this is the one he sent me a while ago. He says, "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 the 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?"

And then I said, "Edgar Schein is asking me what I think about a culture?" So I told my wife, "You had better butter the door frame when I come home so I can get my big head through it."

And she said, "Maybe you could come in

through the garage."

So the next slide is what do we call, what does success look like? Someone asked Seven Habits author Steven Covey, "If you didn't have the seven habits, if you only had one habit, what would it be that you could tell managers for success in a company?" He said it would be for managers to listen, to listen very carefully to what the employees and people say. He said it is not always an easy thing to do.

At Millstone and Davis-Besse, that was basically the broken barrier, our defense-in-depth barriers, our worker management, internal oversight, external oversight. It was really the management barrier that was typically challenged.

And so success? What does success look like? It would be a qualified self-auditing, self-reporting industry-wide program that is listening at the leadership level. I think Dr. John Carroll, MIT, and most likely Dr. Edgar Schein would tend to agree with that assessment.

I will take any questions. That is the end of the presentation.

CHAIR APOSTOLAKIS: Well, you were here all day. Can you tell us what the two or three major

points that you're making, the wisdom that are different from what the staff is trying to do and so on?

You are talking about leadership, for example. And I don't recall the staff using that word. So what are the major points where you differ from what the staff is proposing?

MR. COLLINS: Well, I think where I differ is the reactor oversight process. It's -- I don't think I remember all of the attributes -- predictable, objective, understandable, transparent, and then risk-based, --

CHAIR APOSTOLAKIS: Risk-informed.

MR. COLLINS: -- and performance and risk-based.

CHAIR APOSTOLAKIS: Got you.

MR. COLLINS: I would argue that none of those elements exist. It is the same thing as what I am saying about the safety culture surveys that we have and Dr. Schein saying they don't work. It is what I am calling as a brainchild problem.

There was a book called Reengineering by Dr. Michael Hammer and James Champy, I think, that has had more than 70 percent business failure rates. After deregulation, a lot of nuclear plants

implemented reengineering.

Dr. Hammer now goes around and talks about that. And he flagged the problem himself. And he said, "I forgot about people. I learned that people are an essential ingredient in the success."

So I think what we have is we have a brainchild problem or we think what we are doing is accomplishing these things that are associated with fundamental quality management theory, but they're not.

So if I were to sit down and take a look at what the -- step through these different elements of the ROP, I don't think they really exist. I don't think you have a metric that says, "Is this an acceptable culture or not?"

Either on the individual group level or at regulatory level, this process has that, where you say it's risk-based. When you're talking about a transparent, actually transparent and predictable are the same thing. A transparent system is one that is predictable. You have inputs. And you can expect what the outputs are.

I don't think your system, ROP system, has predictable inputs. I don't think you can say, "We see these factors, and this is the outcome." I don't

think it is objective. I don't think it has acceptance criteria. How can it be objective without acceptance criteria?

CHAIR APOSTOLAKIS: How about the NEI presentation? Do you differ from what they are proposing to do?

MR. COLLINS: I hate to say it, but I was working on a lot of this stuff while NEI was going on. Tom Houghton asked me to talk over his stuff with him. And I am going to step through his presentation and get together with him later on.

CHAIR APOSTOLAKIS: Any questions from the members or comments?

(No response.)

CHAIR APOSTOLAKIS: Thank you very much, Mr. Collins.

MR. COLLINS: Thank you, sir.

CHAIR APOSTOLAKIS: Do you have a general discussion for a few minutes or have we covered the important ones or we can go around the table and you give me some ideas, although we are not writing a letter or if we do, somebody else will write it? Maybe you can go around the table, just final thoughts. Who wants to start: Dennis or Harold?

9. GENERAL DISCUSSION

MEMBER RAY: Fine. One thing that -- you know, I've been mulling this admonition that perhaps we heard, perhaps we didn't hear, I think it wasn't intended that we hear, an encouragement to abandon compliance-based schemes for achieving safety.

I don't think that is what was is being advocated, but, as we discussed, actually, to do something more than that. But it did occur to me that there is one arena of very significant risk aside from flag operations on an aircraft carrier, refineries, and stuff like that, that wasn't mentioned but seems perhaps relevant.

It's been a lot of years, but I was for a time involved in nuclear weapons programs. They are very, very prescriptive and do seem to be successful, at least with regard to the bottom line that they have.

Now, you do have planes flying places that have things on them that they aren't supposed to have sometimes. And I do realize that it is not a very transparent system. So what we know about it is quite limited. I am speaking from personal experience, not from what I read in the newspaper. In any event, they are very prescriptive systems.

I would hate to see us end up in a place

where we decided it wasn't necessary to have prescriptive requirements and follow them because we somehow achieve some new level of performance in the workforce and we had a different, more -- better insight into how to achieve safety.

I think oftentimes also, as I mentioned during the course of discussion, we are on different wavelengths when we try and compare ourselves with others insofar as our goal of achieving very, very low risk of probabilities, at least as far as the ultimate threat or ultimate public health and safety risk is concerned.

I wonder sometimes whether some of the skills that we learn in doing things like repetitive maintenance procedures and stuff like that and doing them better and better and faster and with fewer errors really is applicable to what we are ultimately trying to achieve.

Basically I am skeptical, I guess, about the extent to which the outlier events are very well-represented by our ongoing daily activities that we perform.

So I tend to be more, I guess, in the domain that has been often criticized here today of looking at it from an engineered barrier kind of

approach.

But, having said all of that, I don't really dispute any of the things that have been said. I thought that the industry's presentation offered the NRC opportunity to come up with a consensus among all of the stakeholders about how to assess safety culture and do it in a better way than we have done in the past and to do it regularly and not just after the fact when something has gone badly wrong.

So all of that was good. And I don't mean my comments to be critical of any of that. I just think that there is a dimension to what we are concerned about here in the agency that may not be captured by the stuff that we often hear referenced as validation for how we can look at safety differently.

CHAIR APOSTOLAKIS: Otto?

MEMBER MAYNARD: Well, I enjoyed all of the presentations today. I think it shows a lot of work has been done, a lot of thought by a lot of people, the staff, Mr. Collins, the industry, and so on.

I think that it is obvious that safety culture is on the minds of everybody. I think that is healthy and good in itself there. And I didn't mean to leave out Mr. Carnes and Mr. Wreathall.

I agree with Harold. I think the industry approach provides an opportunity there. And it still leaves the NRC with quite a bit of flexibility in what they could still do with that and even within their own systems.

A couple of things. First, I don't like the idea of including security into the policy statement on safety. I think it starts putting safety culture in a different light. To me, it almost kind of degrades some of the focus from nuclear safety. So to me, I am not excited about including security.

Security is important. I am not going to deny that. I just think that the more things you start tossing into there, the more you start degrading from safety culture.

I still am a little bit concerned about this long list of characteristics of safety culture. It almost gets into these are all of the things you need to do to manage. So are we getting to management? Are we really getting into safety culture? What is the cause? What are the effect-type things there? So a little bit of caution or concern with just the long list of things, basically everything to do with running a power plant.

I think it is going to be difficult for us

and for the staff to sort out what constitutes adequate protection of the safety, health and safety of the public versus excellence. You know, where do you go with this?

It's one thing if you decide you want to strive for excellence and you want to do different things or whatever. And that is one thing. But a regulator has to regulate for what constitutes adequate protection of health and safety of the public. So I think that is going to be a challenge here, but I do think the safety culture is part of that. You have got to find some place for it.

I guess the one thing that I didn't see in any of the characteristics and one of the things that I think is a challenge we haven't really discussed today at all, and that is just cost of change. One of the things that can affect safety culture is if you are having to go through a lot of changes.

The plants, through their own initiatives, through INPO's help, through NRC's changes and regulations and guidance and stuff, security changes, you add all of this up, and you are hit with a lot of change. Is somebody stepping back, taking a look at all of that, and putting things into perspective from a safety culture standpoint?

Sometimes too much change too quick can be very bad. That is the only thing I haven't seen discussed in any of the attributes and characteristics.

That is all I have.

CHAIR APOSTOLAKIS: Thank you.

Mike?

MEMBER RYAN: Again, I apologize for being out for a few minutes.

CHAIR APOSTOLAKIS: That's fine.

MEMBER RYAN: One point to this morning -- I think, Harold, you were talking about it -- is what is an attribute characteristic and what is a result-oriented? We talked about that. I think those should be clarified.

I share the question about safety and security. Safety culture to me is at its root an activity that promotes open communication. Security, on the other hand, is an activity that by its very nature avoids open communication and, in fact, restricts communication. So I struggle a bit with the fact that you have got two different cultures in those two activities.

CHAIR APOSTOLAKIS: Yes.

MEMBER RYAN: So I think with caution, all

of that should be carefully evaluated.

CHAIR APOSTOLAKIS: But do you object to the policy statement putting the two together?

MEMBER RYAN: I don't object to them talking about it in the same policy statement, but I do object to the marriage of the two. I don't object to them being friends.

CHAIR APOSTOLAKIS: Yes. Well --

MEMBER RYAN: And, again, I don't mean to be flip, but I really think that trying to integrate them intimately is a very tough chore because you end up with a conflicting message of you want to communicate on one side and we don't want you to communicate on the other. And that can lead to some schizophrenia in an organization. So I am concerned about that.

Those are really the two things that came out to me, in addition to what was said. Thank you.

MR. COLLINS: Could I ask the members a question?

CHAIR APOSTOLAKIS: Maybe later. Is it a question to Dr. Ryan?

MR. COLLINS: It's just a general question. I mean, this is still technically part of my presentation time.

CHAIR APOSTOLAKIS: Okay. Go ahead.

MR. COLLINS: Dr. Meserve said that the reason that NRC or the industry is not able to have effective assessments is because they don't have a clear definition. And I listed six problems, clarity problems, with the existing definition, and a definition that solves those problems.

So I guess I would ask and also point out that that is part of what quality management theory says, that you can't have an effective assessment without a clear definition.

So I guess I just want to ask what the thoughts of the ACRS members are as far as moving to addressing some of those clarity issues.

I guess I would add that GAO is asking NRC to come up with effective assessments. And also I think they said that indicators, specific indicators.

And I am saying that that is an essential ingredient that has to happen. And Dr. Meserve was saying that that has to happen. And Six Sigma quality management theory says that has to happen if what you are talking about is the quality management safety culture, which I think is what we're talking about here.

CHAIR APOSTOLAKIS: But isn't that what

the staff is trying to do in the research program they're going to start to try to identify those indicators? We don't have them now. And I think Dr. Meserve was right.

MR. COLLINS: What I am saying is you can't even start to identify the indicators, that that is the idea. You can't come up with effective indicators unless you first establish a clear definition.

There are six problems with existing definitions. So I think you have to resolve pretty much all of those problems before you can get to your effective indicators. That is your biggest constraint, I think, --

CHAIR APOSTOLAKIS: That may be true.

MR. COLLINS: -- to doing what GAO is asking NRC to do.

CHAIR APOSTOLAKIS: I think that is true. That is true.

MR. COLLINS: So if I had any recommendation, one recommendation to make to the Committee, it would be to take a look at that, take a look at that slide that says, "Here is your INSAG. Here are your six problems with that definition," and address all of those problems.

MR. CHEOK: This is Mike Cheok. I think I can comment a little bit on that. We are right now in the middle of the public comment process on the policy. And one of the questions we are asking for comment is on our definition of safety culture. And your comment is a good comment. And we will take that into account.

But the INSAG definition that you see is one that we have proposed. It's not one that we are set in stone with. And so we are still accepting public comments on how the definition should look like.

CHAIR APOSTOLAKIS: Do you plan to submit public comments or you don't know?

MR. COLLINS: You can't consider this presentation, that slide a public comment?

MR. CHEOK: We will consider that a public comment.

CHAIR APOSTOLAKIS: Okay.

MR. COLLINS: And I am available for whoever wants to talk.

CHAIR APOSTOLAKIS: Okay. Said?

MEMBER ABDEL-KHALIK: I would like to echo the comments made by my colleagues earlier regarding the standardized methodology proposed by industry. I

think that is a very good start.

I also would like to echo the concerns about the long list of characteristics. Somehow this has to be prioritized, some hierarchy of this. And also from my perspective, these are not co-characteristics.

These are focus areas. And there are positive attributes that should be sort of assigned to each one of these focus areas along with negative attributes that one should also be on the lookout for.

I think the comment that was made by Harold during the discussion that the presence of positive attributes in each of these folks areas doesn't in and of itself guarantee a positive safety culture. It also has to be coupled with the absence of negative attributes. I think this is a very good insight.

With regard to the characteristics of high reliability organizations, I am just concerned about the conflict between human adaptation and procedure compliance. I think this is something that we need to be on the lookout for.

They may not be exactly mutually exclusive if you were to consider the time constant of the response in a sense that human adaptation, if it is

associated with a very short time constant, that sort of shoots from the hip that is countered to procedure compliance that is inconsistent with the way we do things.

However, if what you mean by adaptation is reflect, collect data, trend, evaluate, assess, come up with a response, that is a learning organization. And that is consistent with the way we do things. So it really is just dependent on the time constant associated with this adaptation process.

That's the end of my --

CHAIR APOSTOLAKIS: Thank you.

Bill?

MEMBER SHACK: It's very interesting today. You know, we heard a lot about the real purpose of the policy statement is to extend the safety culture argument to the other parts of the NRC. Yet, we are spending most of the day talking about reactors, which in many ways I am sort of with Harold. We have a lot of engineered safeguards on reactors. And those are important.

I am not certain that safety culture isn't maybe even a bigger role and the other part, where we have less engineered safeguards to deal with and safety culture really is the sort of almost first line

of defense and the only line of defense.

But, again, with Harold, you know, when we are looking at events at the scale we are interested in and reactors, everything is important, you know, the engineered safeguards. But I think the safety culture is important.

Comparing the discussions we heard on high reliability organizations, resilient organizations, you know, those seem to be more arguments for the industry if they wanted to think about how they wanted to manage things.

I think safety culture is where the NRC has to be. I guess I am less concerned about the number of characteristics, mostly because I am sympathetic with the fact that they have to have something they can make performance-based. And you scramble around for things.

I think the research will look at some of the things, performance indicators they come up with. You know, do they or do they not in some way correlate? I think that is just a matter of it is very difficult to deal with. I am sort of concerned that they do need to get on with looking at that other part of their responsibilities.

Just coming back to Mr. Collins, a clear

definition, you know, I look at his definition. And I'm going to have a hard time coming up with a performance measure for leadership or performance measure for ethics.

You know, all of these definitions I think are difficult to deal with. You know, it is just a difficult problem. And coming up with performance indicators and objective measures is going to be very difficult.

MR. COLLINS: Can I make a comment?

CHAIR APOSTOLAKIS: You have to come to the microphone.

MR. COLLINS: Sorry.

MEMBER RYAN: Can I react to Bill's earlier comment about materials?

CHAIR APOSTOLAKIS: Sure.

MEMBER RYAN: I would add to your comment. I think the material side of the house is a tough problem because it ranges from somebody that has gauges, instruments, and articles that are a very low risk up to probably fuel facilities and other kinds of facilities.

MEMBER SHACK: That is my first risk-informed measure, is to figure out which part of the problem I really need to look at.

MEMBER RYAN: And, you know, we had some data from Jack Sieber on medical misadministrations in his annual review summary. And some of those are probably on the radar screen.

We heard John Wreathall talk a little bit about the problem rates in the medical field. So I would caution that we want to try and not paint that with too broad of a single brush but maybe try to break that up into recognizing that there are segments.

Now, again, I think the important point to me is that 17,000 licensees are in agreement states. Is it 7,000 left at NRC license states?

CHAIR APOSTOLAKIS: The total was 36.

MEMBER RYAN: Thirty-six?

CHAIR APOSTOLAKIS: Twenty-six. Twenty-six.

MEMBER RYAN: Yes. So it's a big and a growing number. I think Pennsylvania and New Jersey, have they gone over yet to be an agreement state?

MR. SOLORIO: I think Pennsylvania has. I am not sure about New Jersey.

MEMBER RYAN: So there is a big number of licensees in both states. So, in other words, the shift is going to agreement states. So you have got

the problem of adding 37 agreement state programs and 37 state governments that are going to have to wrestle with this in some way.

So at least we need to help what are defined for the Commission that this is not easy to -- you know, with 104 power plants, it's a lot different than 17,000 licensees.

MR. COLLINS: Can I just add something? I did spend some time with John Sorenson, who wrote that paper, "The State of the Art." It took me about three times to get back and get back. He didn't believe that it was possible, but at the end of our conversation, he says, "Okay. I think this probably does work." And his quote was "I think this represents the state of the art." Okay?

So they do have absolutely objective performance measures, not only for the individual managers but the entire site, which is the MREB number. That is objective. It's all objective. I mean, there are ways to take this kind of stuff and make an objective assessment out of it, but people not believing it or not being willing to say, "Hey, it is possible," it is a dead-ender at the start.

So I would just say, just try to keep an open mind. And if you think something can't happen,

at least talk it over for an hour. A lot of people have changed their minds that I have talked to.

Thanks.

CHAIR APOSTOLAKIS: Are you done?

MEMBER SHACK: I am done.

CHAIR APOSTOLAKIS: Dennis?

MEMBER BLEY: I think Bill hit one of the big points on the head. We heard very little about the medical and material side except for the intent to bring them along.

On the other hand, the reactor is a place where you can release a whole lot more than most of the areas over there. The worst of the events we have had this woven tightly into them. So it is important still for us.

There are two parts I would mention something about. One is the policy statement. And the other is in general improving maintaining, predicting safety within organizations.

Policy statement is a lot of, yes, you can't object. It's the right stuff. It's got some things maybe we'll get worked out as you get comments and as you interact more with INPO.

I am still staring at Jim Reasons' list of eight or so common elements in troublesome cases and

in good cases. He had both that they looked at.

The longer catalog in the development of the policy statement, which seems to cover everything about management and the idea that we need something of priorities in relationships among these is that something I think needs to get worked out.

It wouldn't hurt to look at Jim Reasons' stuff as one place. There are others, of course.

I guess I am not quite willing to say this is the right definition. This isn't as yet. I think there is a lot of work we need to see done.

Safety and security. I keep bringing that up in other areas. I like the idea the Commission has pushed forward of integrating safety and security with respect to new design, trying to link them tightly together and in oversight and making things work.

Integrating safety and security culture is something that isn't sitting sensibly with me right now. I'm not sure quite what it means. I think I know what safety culture means, but it means lots of things to lots of people.

We heard a lot of things in the directions that judge organizations in how they focus on safety today. And we haven't talked at all about the security.

So sticking it in there right now seems undeveloped and needs more thought. I don't know if there is a reasonable -- maybe it needs a new name, something that includes this proper focus of organizations that would enhance safety/security, all of those good things.

But that needs to get worked out. I think it is not quite prime time yet.

CHAIR APOSTOLAKIS: Thank you.

Yes, I agree with almost everything I heard. I would like to point out that, in addition to the materials area, which was not explored very much, we really didn't hear much about the internal NRC safety culture --

MEMBER BLEY: Yes.

CHAIR APOSTOLAKIS: -- and how some of these ideas might apply to us.

I agree with Dennis and Bill that the HRO idea is more appropriate for the licensee, rather than the regulator. But when it comes to our internal culture, maybe the HRO idea applies to us --

MEMBER BLEY: Yes.

CHAIR APOSTOLAKIS: -- because now we want to come back to performance with safety and so on, though I don't know what kind of safety risk our staff

has in dealing with safety. But they themselves are not --

MEMBER MAYNARD: I think it --

CHAIR APOSTOLAKIS: We have a big one.

MEMBER SHACK: We have the same pressures on us to perform, to make decisions, schedule.

MEMBER BLEY: It is not dollars. It is schedule versus --

CHAIR APOSTOLAKIS: Yes, I understand that, but it is not like running the plant itself.

So that is all I wanted to say, that we also ought to spend more time thinking about the internal culture, that maybe the HRO applies.

MEMBER BLEY: One last thing I wanted to say. It hits on what you said earlier. We would like to have them come back and tell us what they have learned from the NRC inspections. But at the same time, why not have a joint session and have them, everybody, report on what they have learned from the pilots sometime next spring?

CHAIR APOSTOLAKIS: Absolutely, absolutely.

MEMBER BLEY: I think that should be high on our list.

CHAIR APOSTOLAKIS: Eventually the ACRS

will have to write at least one letter.

MEMBER BLEY: Sure.

CHAIR APOSTOLAKIS: And all of this information will be collected.

MEMBER BLEY: Yes.

MEMBER RYAN: Mr. Chair, I would suggest, too, that we seek some input from the agreement states through either the Organization of Agreement States or the Conference of Radiation Control Program Directors. I think it is important to hear their views on this topic of safety culture and how it would work in agreement states.

CHAIR APOSTOLAKIS: That is a good point.

Now, another member of the public? Please identify yourself.

MR. MESHKATI: I am Najmedin Meshkati, a professor of civil engineering and professor of industrial engineering at University of Southern California.

Thank you very much, Mr. Chairman. I wanted to keep my mouth shut in this meeting.

(Laughter.)

MR. MESHKATI: But your excellent point about NRC safety culture inspired me to make a short statement. I have been in this business of safety of

complex systems for the last 25 years. I have worked with the nuclear industry. I have been to Chernobyl and many other nuclear places, aviation. And I was the safety culture adviser consultant to U.S. Chemicals Safety Board on the BP refinery explosion.

I think what was said, Chairman Apostolakis, was music to my ear. Sometime around 1998, I wrote a letter to then Chairwoman Shirley Ann Jackson, saying that why doesn't NRC look at the component of safety culture, does it apply it to itself.

There was a report, which I wrote that down while you were talking because this was the third time, Chairman Apostolakis, you said about the NRC needs to become a safety culture organization, HRO.

I am sure that you have seen this book. It's a small booklet. The title of that is The Role of Nuclear Regulator in Promoting and Evaluating Safety Culture by the Nuclear Energy Agency of OECD, published in 1991.

On page 11 of this -- the reason I know the page number, because I use that in my class. I teach a class called Engineering and Public Policy. Please note that answer. On page 11, it says, "In promoting safety culture, a regulatory body should set

a good example by its own performance."

Here is my question. And this is what my letter in 1998 to then Chairwoman Shirley Jackson said. I said NRC, in fact, has done a great work in that. One of them is this meeting.

My point is that why NRC does not practice the pillars of the safety culture by its own structure? Where is the different expertise among the commissioners? Why are all the commissioners need to be -- I don't have anything against engineers -- why the commissioners, they don't have people like Karlene Roberts in one of the commissioners, why this beautiful body, Advisory Committee of Reactor Safeguards, since its inception in 1954 -- in fact, that was one of my students' projects. I am sorry to say that I have seen a lot of cloning in this Committee in terms of the members' composition and their background.

In my letter, I said that this Advisory Committee of Reactor Safeguards should have members' composition with expertise in safety, human performance, human systems integration, and that.

And then that letter was responded by then a gentleman, Executive Director, Mr. James Taylor or something. He literally said that I am out of my mind

by making that recommendation, that there was a cloning in -- one of my students did a beautiful paper on looking at the background of every single member from 1954 all the way to 1998.

I think this membership of this Committee should be open to people from not my background, engineering, should be invited from other disciplines. NRC chairperson should come from another discipline and the commissioners.

I think this is the way that all these things, preaching the safety culture, at least as far as I know in my last 25 years working with 3 industries, you see that it starts from NRC, in fact.

The other things is NRC needs to put the money where its mouth is when it comes to safety culture. When we see the research budget in safety culture is very meager, that doesn't work well.

Thank you very much.

CHAIR APOSTOLAKIS: Thank you.

Any other comments? Staff? Yes, sir?

MR. SOLORIO: Yes. My name is Dave Solorio. I will just mention that also this year we submitted a Commission paper on what the NRC staff was doing on internal safety culture. So we had --

CHAIR APOSTOLAKIS: We didn't hear

anything today. That is what I am saying.

MR. SOLORIO: Well, the only reason we didn't mention it is I didn't think it was teed up. When Ms. Carpenter mentioned we would be coming and speaking to you, I don't recall that was requested. Otherwise I think we probably would have had that. Ms. June Cai, who was making the presentation, now is our internal safety --

CHAIR APOSTOLAKIS: Anyway, you guys will have more opportunities to come before this body.

MR. SOLORIO: Sure.

CHAIR APOSTOLAKIS: Okay. So it looks to me like the meeting is over. Thanks to the presenters, even though some of them are not here. It was very informative today and the first step towards a long process.

The meeting is adjourned.

(Whereupon, the foregoing matter was concluded at 5:05 p.m.)

1

United States Nuclear Regulatory Commission

Protecting People and the Environment

Safety Culture Policy Statement

Martin J. Virgilio

Deputy Executive Director for Materials, Waste, Research, State, Tribal, and Compliance Programs

ACRS Subcommittee Meeting

November 12, 2009

U.S.NRC
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Protecting People and the Environment

Overview

- Introduction
- Importance of Safety Culture
- Role of Policy Statement and Describe Draft Characteristics
- Specific Issues to Address in Development of Final Policy Statement
- Details of Draft Policy Statement
- Conclusion

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Importance of Safety Culture

- Nexus to Safety
- Historical Events
- Preventing Events

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Role of Policy Statement

- Establish NRC Expectations for Safety Culture
  - Materials Licensees and Certificate Holders
  - Reactor Licensees
  - Agreement States
- Define Safety Culture and Describe Characteristics
- Communicate to Licensees their Responsibility
- Communicates NRC's role to ensure Safety Culture

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Draft Safety Culture Characteristics

- Work Practices
- Work Planning and Control
- Safety Conscious Work Environment
- Problem Identification and Evaluation
- Problem Resolution
- Resources
- Licensee Decision-Making
- Accountability
- Continuous Learning Environment

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Specific Issues to Consider in Developing Final Policy Statement

- Consistent Safety Culture Terminology and Expectations
  - Materials Licensees and Certificate Holders
  - Reactor Licensees
- Coordination with Agreement States
- Treat Security Equal Footing Safety

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Details and Status

- Office of Enforcement will now cover
  - Details of the Proposed Policy Statement
  - Current Status
  - Remaining Activities

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Safety Culture Policy Statement Development

David Solorio
Chief
Concerns Resolution Branch
Office of Enforcement

June Cai
Senior Safety Culture Program Manager
Office of Enforcement

ACRS Subcommittee Meeting
November 12, 2009

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Presentation Overview

- Background
- 2008 Commission direction
- Draft safety culture policy statement
- October 2009 Commission direction
- Next steps
- Research support activities

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Introduction

NRC's draft definition of safety culture

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

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Background

Previous Commission policy documents related to safety culture

– Conduct of Operations (1989)

– Safety Conscious Work Environment (1996)

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Safety Culture and the Reactor Oversight Process (ROP)

- 2002 Davis-Besse head degradation event
- Commission direction to enhance the ROP to better address safety culture
- Implementation of ROP safety culture changes
  - Development of safety culture components

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2008 Commission Direction

- Expand the Commission's policy of safety culture to address the unique aspects of security
- Ensure the resulting policy is applicable to all licensees and certificate holders

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2008 Commission Direction (cont'd)

- Other issues to address:
  - Whether safety culture as applied to reactors needs to be strengthened
  - How to increase attention to safety culture in the materials area
  - Effective use of stakeholder involvement
  - One or two policy statements for safety/security

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Policy Statement Development Activities

- Information collection, review, and analysis
- Stakeholder engagement

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Draft Safety Culture Policy Statement

Submitted to Commission in May 2009 with following key messages:

- Proposed definition of safety culture
- Safety and security are equally important in a positive safety culture
- Licensees and certificate holders are responsible for developing and maintaining a positive safety culture
- The NRC has independent role

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Draft Safety Culture Policy Statement (cont'd)

Draft Safety Culture Characteristics

- Work Practices
- Work Planning and Control
- Safety Conscious Work Environment
- Problem Identification and Evaluation
- Problem Resolution
- Resources
- Licensee Decision-Making
- Accountability
- Continuous Learning Environment

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Response to Commission Questions

- Current ROP process is effective; process continues to be refined in accordance with self-assessment process
- Further stakeholder interactions needed:
  - Public meeting
  - Outreach to Agreement States
  - Develop strategies for engaging materials stakeholders
- One policy statement that emphasizes safety and security treated equally within overarching safety culture

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October 2009 Commission Direction

- Approved publication of draft Safety Culture Policy Statement in *Federal Register*
  - No less than a 90-day public comment period
- Consider incorporating suppliers and vendors
- Continue to engage broad range of stakeholders
- Seek opportunities to comport terminology with existing standards and references

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Next Steps – Stakeholder Outreach

- Draft policy statement published in *Federal Register* for public comment
  - 90 days - open until xx
- Engage stakeholders to develop common terminology
  - Workshops with broad range of stakeholders
  - Factor common terminology into final policy statement

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Common Terminology Development

- Overarching definition that applies to all of nuclear industry
  - Easy to understand, timeless, inclusive
- Set of high level description/traits of what constitutes a strong safety culture
  - Applies to everyone who engages in NRC licensed activities
  - Speaks to all levels of the organization
  - Sets forth expectations of the Commission for fostering a strong safety culture

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Implementation

- Submit final policy statement for Commission approval
- After final approval and issuance, focus on implementation
  - External – oversight programs
  - Internal – NRC's own safety culture

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Technical Basis Research Activities

- Engagement with RES to conduct activities to support technical basis
- Near term activities to support policy statement development:
  - Literature review
  - Conduct confirmation of Institute of Nuclear Power Operation's (INPO) validation study of descriptions/traits

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Technical Basis Research Activities – cont'd

- Longer term exploratory analysis of potential regulatory tools to support implementation, such as:
  - Appropriate weightings
  - Statistical models to predict performance
  - Human Reliability Analysis (HRA) applications

- Start with available data sources - mostly reactors, consider feasibility of expansion to materials
- Approach balances benefits of conducting research with practical implications and needs of agency activities

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Closing Remarks

- Licensee management has primary responsibility for establishing and maintaining a positive safety culture
- NRC has independent oversight role
- Outreach efforts to engage broad range of stakeholders
- Consideration of support by relevant research activities

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Questions?

Advisory Committee on Reactor Safeguards
Meeting of Subcommittee on Reliability and PRA
November 12, 2009

High Reliability Organizations

W. Earl Carnes

U.S. Department of Energy

Overview

- Relevant HRO history
  - TMI
  - “Normal Accidents “ - Charles Perrow
  - Berkeley Group – seek to understand success
- Significant influences – Wild land Fire Fighters adopt HRO mid-1990’s, IOM “To Err is Human, 2000; BP Texas City Accident, 2005
- Current state of conversation (e.g. Interagency HRO Roundtable, medical community, EU Work Process Knowledge, Organizational Ergonomics, Resilience Engineering, DOE Pantex HRO implementation, PSAM 2010)

Characteristics of High Reliability Organizations*

<u>Anticipating and becoming aware of the unexpected</u>

- Preoccupation with failure
- Reluctance to simplify interpretations
- Sensitivity to operations

<u>Containing the unexpected when it occurs</u>

- Commitment to resilience
- Deference to expertise

From **Managing the unexpected: resilient performance in an age of uncertainty by Karl Weick and Kathleen Sutcliffe*

Preoccupation with Failure

- HRO’s have a mind set of chronic wariness …hubris is the enemy
- Any lapse is a symptom that something may be wrong with the system - Near misses are opportunities to improve
- Encourage reporting of errors and surprises
- Continuous reflection to distinguish critical decisions and steps from non-critical ones

Reluctance to Simplify Interpretations

- HROs accept that the nature of the work is complex, that systems can fail in ways that have never happened before and it is not possible to identify all of the ways that systems could fail in the future.
- Do not assume that failure or near misses are the result of a single, simple cause.
- Context is always changing; no such thing as routine work. Be sensitive to situational differences from what you expect or have seen before.

Sensitivity to Operations

- HRO's must have deep knowledge of the technology and management systems
- Pay close attention to the front line where the real work is done
- Aware of emergence of local operating practices
- Recognize that systems are not necessarily deterministic, orderly, stable or routine; but rather dynamic, complicated and the result of continuous social construction

Commitment to Resilience

- HRO's can detect, contain, and bounce back from the unexpected
  - An HRO is not error free, but errors don't disable it
  - Strive to keep "errors" small and improvise when uncertain
  - Imagine worst case conditions and practice response
- Assume surprises will happen, and concentrate on developing resources to notice, react and record
  - Fast real time learning (both content and process)
  - Fast and accurate communication, feedback
  - Modeling. Imagine worst case conditions and practice them
  - Improvisation, maintain flexibility

Deference to Expertise

- HRO expertise is Distributed
- Organization defers to the person with the expertise relevant to the issue they are confronting
  - Usually someone at the sharp end
  - Not necessarily the most experienced person or the person highest in the organizational hierarchy
- Hierarchy supports administration, expertise supports performance. Performance has precedence in critical circumstances.

Sensemaking – how do we understand what is happening, and what to do about it

- When the unexpected occurs we first have to notice it, then make sense of it, and finally do something about it
- Sensemaking requires formal and informal inquiry, sharing and challenging mental models
  - Conversations within and among all organizational groups
  - Each person brings in their own unique knowledge
  - Dialog and Conversation is the mechanism that combines that knowledge

Mindfulness for High Reliability

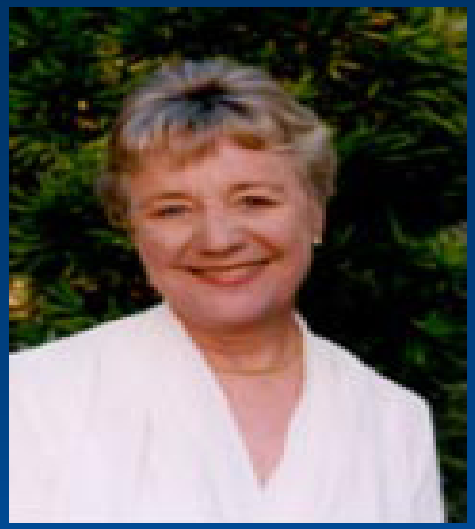
Fundamental Characteristics | **General Orientation** | **Impact on Processes** | **Ultimate Outcome**

- Preoccupation with Failure
- Reluctance to Simplify
- Sensitivity to Operations
- Commitment To Resilience
- Deference to Expertise

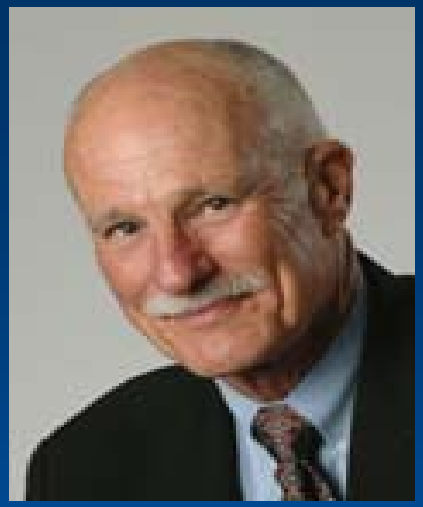
State of Mindfulness

Capability to Discover and Manage Unexpected Events (Sense making)

Exceptionally Safe, Consistently High Performance



Dr. Karlene Roberts



Dr. Robert Bea

Roberts and Bea suggest that HRO's

"aggressively seek to know what they don't know …balance efficiency with reliability …and communicate the big picture to everyone."

“In a generation or two, the world will likely need thousands of high reliability organizations, running not just nuclear power plants, space flight, and air traffic control, but also chemical plants, electrical grids, computer and telecommunication networks, financial networks, genetic engineering, nuclear waste storage, and many other complex, hazardous technologies. ***Our ability to manage a technology, rather than our ability to conceive it may be the limiting factor in many cases.”***

Pool R. Beyond Engineering: How Society Shapes Technology. New York: Oxford University Press, 1997.

Future progress: From error as human failure to adaptation as human strength

Five transitions in emphasis and focus:

1. From ***deterministic*** to ***adaptive*** performance models;
2. From a ***focus on error*** to a ***focus on complexity***;
3. From a culture of ***reporting*** incidents to one of ***learning from*** incidents;
4. From an accounting approach that ***tabulates events*** to a synthetic approach that ***searches for patterns***;
5. From looking backward at ***past events*** to looking forward in anticipation of ***future risks***.

Influenced by "Counting Failures to Anticipating Risks: Possible Futures for Patient Safety", Woods & Cook www.npsf.org

U.S. Nuclear Industry – HRO before HRO was HRO – disconnect between practice and research

- 1990's HRO research examined nuclear power and suggested the emergence of a new model for regulation; an expanding focus on governance as a collaboration of regulator and the regulated toward common safety objectives. Research suggested that HRO's transcend traditional compliance regulatory models.

- Research and practice not connected; e.g. U.S. nuclear practices related to HPI and Safety Culture not subjects of recent research.

- Contrast to ongoing research in medical safety and quality & European research e.g. VTT applying HRO theory to nuclear plant operation; Swedish Radiation Safety Authority (e.g. 2009 "Evaluating safety-critical organizations – emphasis on the nuclear industry"

Directions for new research

Understanding “Work as Done” relative to “Work as Imagined”

Two arguments are central to developing a more holistic understanding of human work in complex systems:

- The first is that systems are fallible; we need to move the focus away from human error to the dynamics of systems

- The second is that human adaptation compensates for uncertainties thus human work practices should be emphasized as core for research and theory building

Examples of future government, academic, industry collaboration

- Technical Exchange – e.g. HRO Roundtable
- "Affirmative research" (how do people create success and safety?)
  - ❑ Understand commercial nuclear industry practices in light of HRO, Resilience and related organization science theories (see VTT studies as examples)
  - ❑ Assure nuclear practices comparable with practices emerging from non-nuclear high hazard domains
  - ❑ Contribute nuclear knowledge to the broader high hazard community via collaborative research to promote broader societal goals for safe technological deployment

A B.A.G. of Safety Culture

John Wreathall

Presentation to ACRS

November 12, 2009

A B.A.G.* of Safety Culture

Topics & Overview

- "***Been***":
  - The evolution of safety culture as an issue in safety
  - "***At***": A range of safety culture paradigms
  - Westrum's Three Behavior Types
  - Reason's Culture Model
  - HRO
- "***Going***": Likely next advances
  - The need
  - Approaches & tools

*Acknowledgments to the Seabrook Station training staff, who introduced me to this great concept.

Safety Culture & Behavior

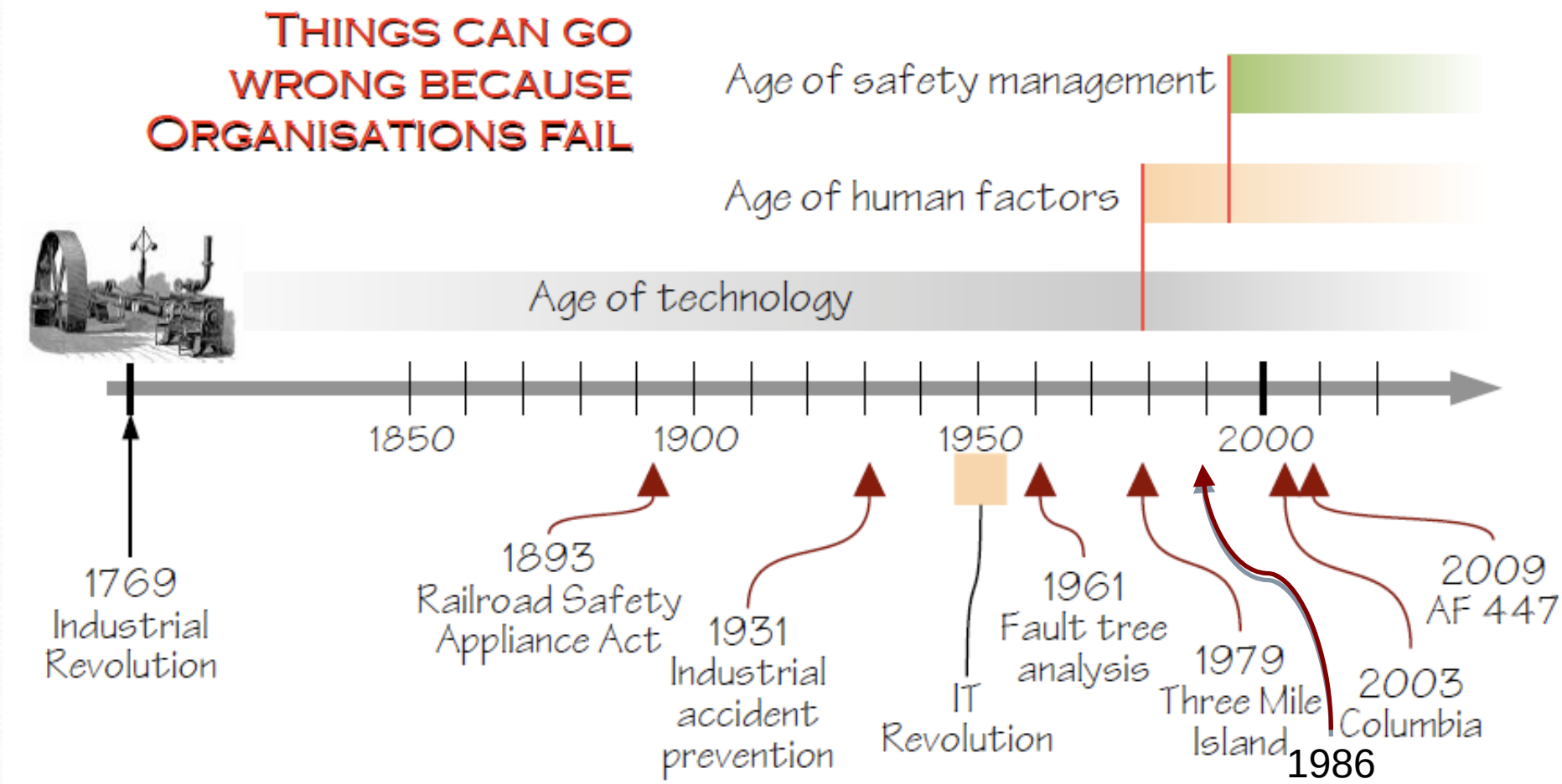
- Culture is tricky because of the following apparent contradictions:
  - If culture is best understood as an emergent property of a complex system, there is no simple deterministic cause and effect. Changing X is not a guarantee that the culture will also change, or will change in the desired direction
  - Culture is socially constructed – created and preserved by the group of people who together form the organization. It is shaped by the past and the future.
  - It is both soft and hard, tangible and intangible, observable and not

-- Ashleigh Merritt
Culture at Work in Aviation and Medicine

- In the end, it's the behaviors that matter, not espoused values & beliefs

Been:

How we got here



At: Current paradigms of organizational safety behaviors

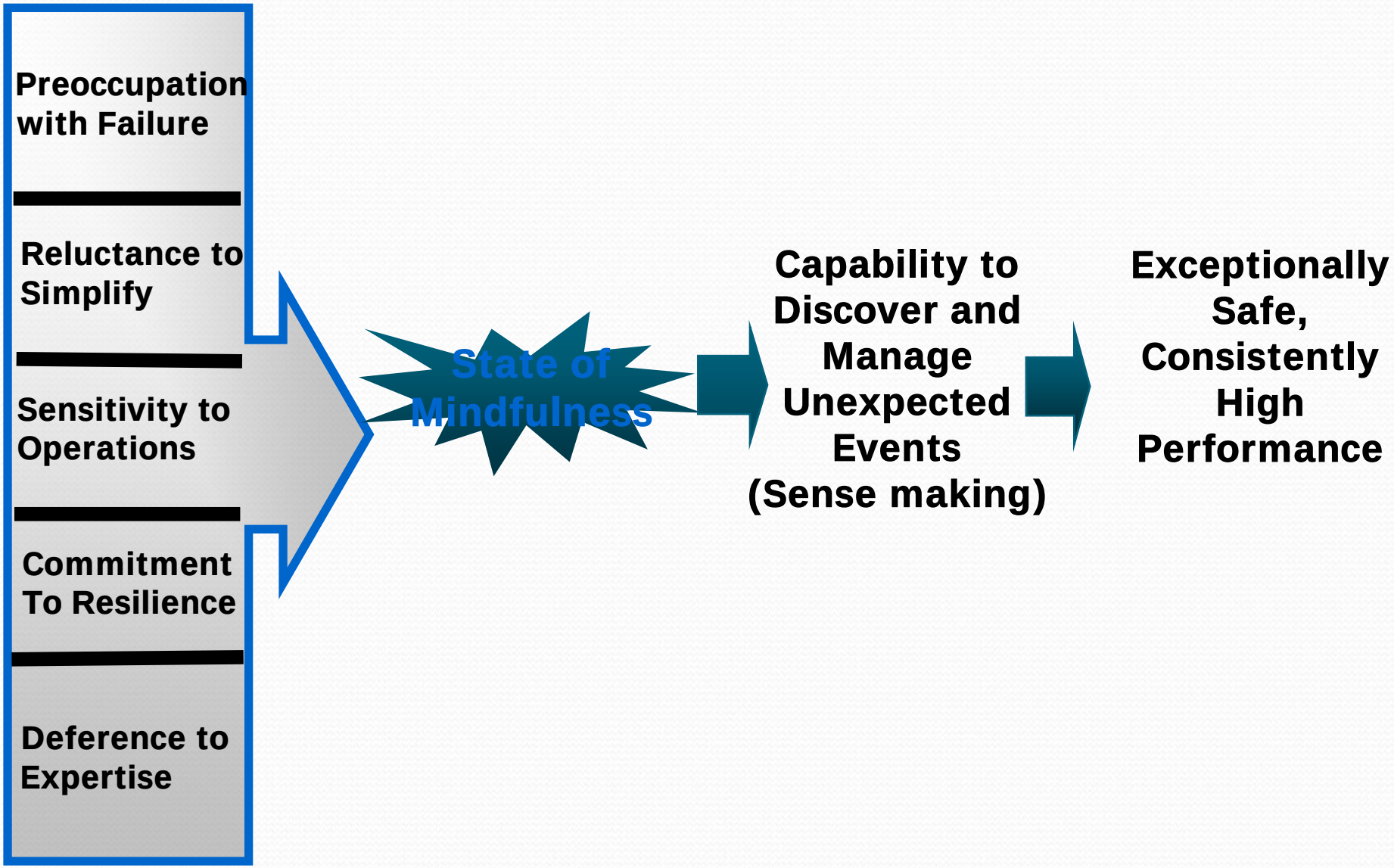
- Westrum's 3 organizational behavioral types (1980's)
  - **Pathological**: Safe behavior gets in the way of work so encourage short cuts; lie to regulators; fire safety "trouble makers", etc.
  - **Bureaucratic/calculative**: Safety is one factor to be taken into account in work; meet the regulations; do cost/benefit trade-offs for improvements; answer regulator's queries, sideline safety "trouble makers", etc.
  - **Generative**: Safety and production go hand-in-hand, learn big lessons from little events, reward safety "trouble makers", seek proactive involvement of regulators, etc.

At: Reason's Safety Culture Themes

- Based on review of about 68 models of organizational impacts on safety & risk
- Identified 7 core themes as common elements in these models
  - Top-level commitment
  - Awareness
  - Preparedness
  - Flexibility
  - Just culture
  - Learning culture
  - Transparency

At: HROs

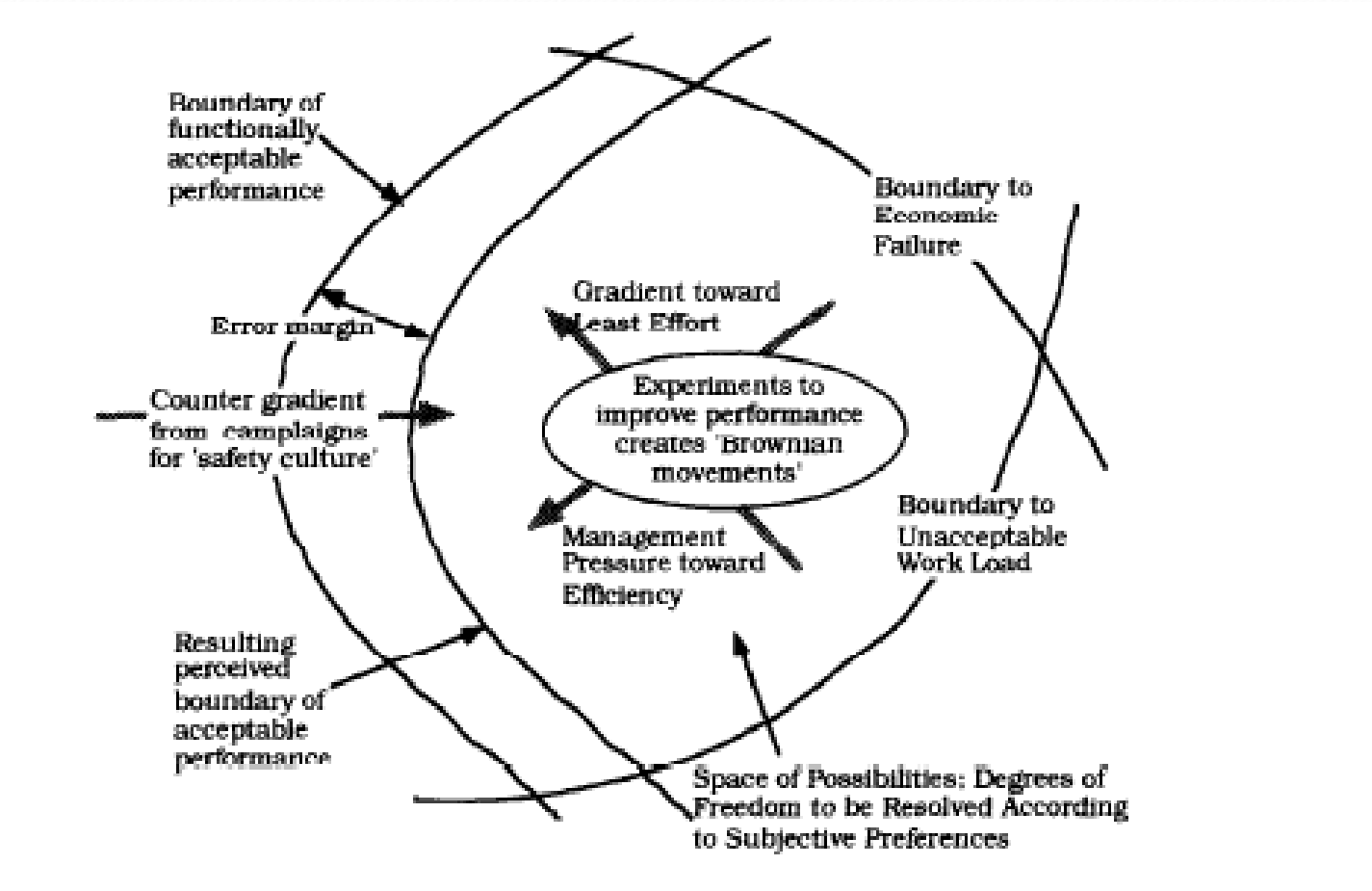
Fundamental Characteristics | **General Orientation** | **Impact on Processes** | **Ultimate Outcome**



Going: One approach

- HRO seems to be an under-specification for safety performance
  - It focuses on management attitudes but not “how’s”
  - It ignores the contextual setting of performance
    - It is largely based on assessments where there are limited alternatives:
      - Aircraft carrier flight ops
      - Fire fighters
  - It ignores the properties of the systems

Going:
Resilience engineering & complex adaptive systems: the dynamics of safety behavior



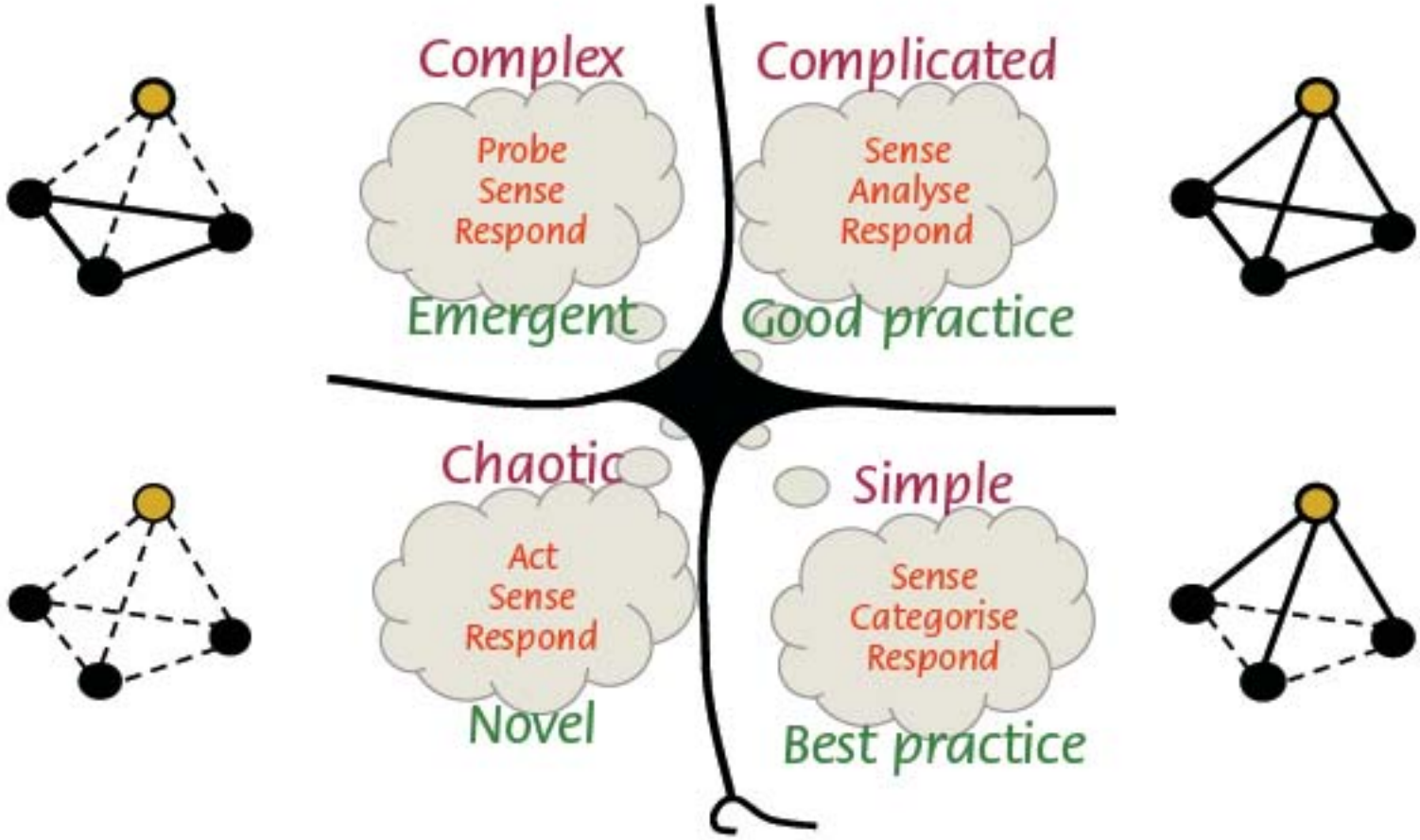
From Rasmussen, *Risk management in a dynamic society: a modelling problem,* Safety Science (1997)

Going:

Properties of resilient systems

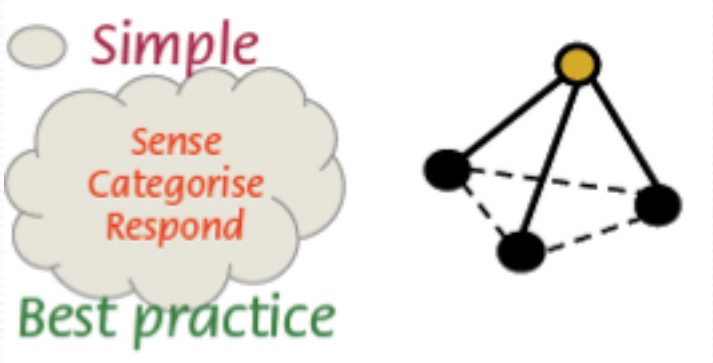
- Buffering capacity
  - System absorbs or adapts to disruptions without fundamental breakdown
- Flexibility
  - System can restructure or reconfigure in response to external changes or pressures
- Tolerance
  - System can perform close to performance boundaries and degrades gracefully as it approaches them
- Managing at the margins
  - System manager has understanding of how close it is to performance boundaries and can anticipate/control future trajectory

Going:
Properties of system types



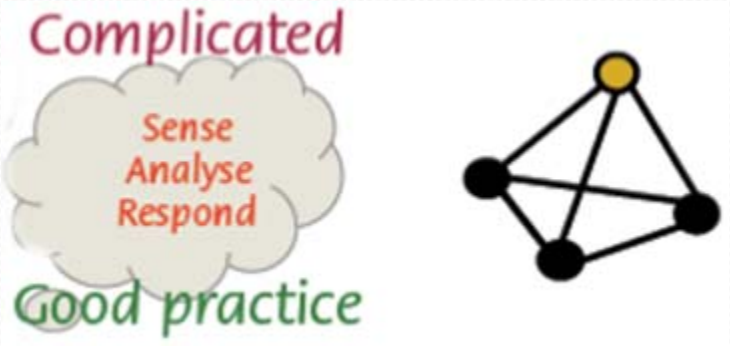
Cynefin Framework: © Cognitive edge Pty Ltd.

Going:
Simple system



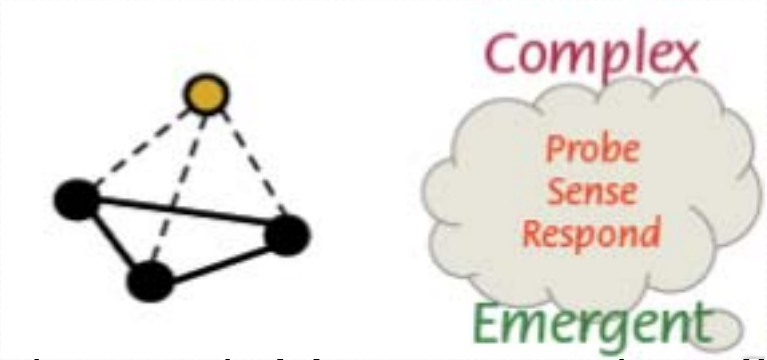
- Cause/effects observable, repeatable, well understood & accepted by all
- Top-down command & control is reasonable
- Single 'best practice' exists so business process re-engineering so methods like 6 ∑, TQM, etc., can be applied
- Gather data, categorize it and respond
- Applies to processes that are invariant & constantly repeatable
  - auto assembly lines

Going: Complicated system



- Cause/effect not fully understood (in most cases) but is capable of being understood (needs "experts")
- Can be several good practices (no one 'best practice')
- Legitimate use of analytical frameworks and multiple 'good practices' ("Learning organization", "systems modeling", safety culture analysis, etc.)
  - *Domain of HRO?*
- Gather data, analyze it, and then respond
- Appropriate for stable organizations for short periods of time

Going:
Complex system



- Cause/effect not repeatable since system & actors co-evolve
  - People adapt to changes in system, thereby creating new system states
  - Cannot return the system to previous state
- "Hindsight does not lead to foresight"
- Have to rely on <u>probing</u>, <u>sensing</u> and <u>responding</u>
- Applies to organizational management of culture

Going:

Gathering data about current state

– "Pinging" An Example System developed for EPRI

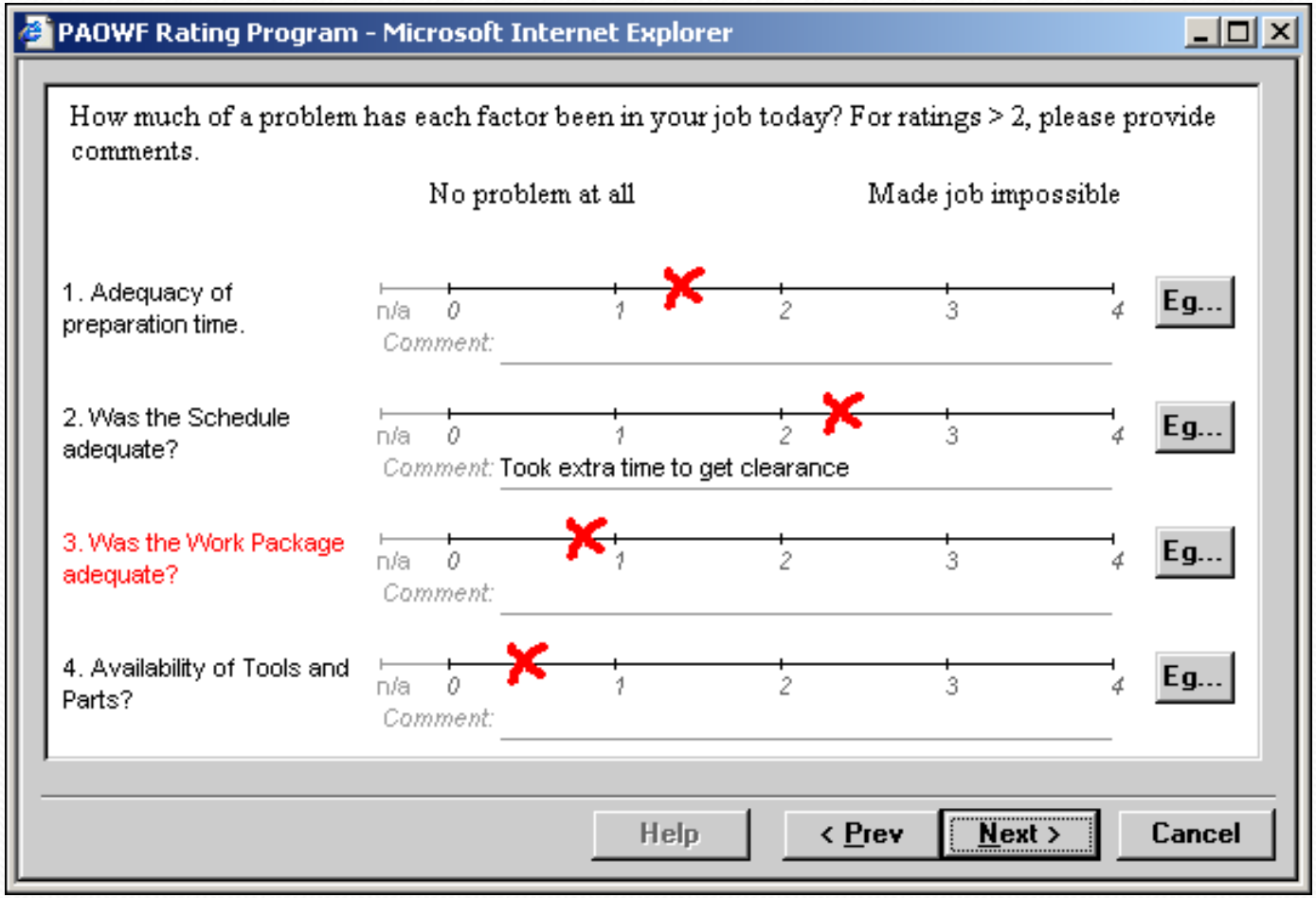
- Proactive Assessment of Organizational & Workplace Factors (PAOWF) (1992 – 1999)
  - Frequent assessment of key workplace factors
    - Selected using INPO Latent Organizational Weaknesses as initial guide
    - Identifies minor problems before events & near misses
    - Identifies sources of strength (*learn from successes*)
    - Techniques of data collection & analysis critical to success

INPO's Latent Organizational Weaknesses

- ***Training***
- ***Communications***
- ***Planning & Scheduling***
- ***Controls, measures, & monitoring***
- ***Design & Modification***
- ***Task structure***
- ***Values & Norms***
- ***Construction***
- ***Maintenance processes***
- ***Procedure development***
- ***Goals & Priorities***
- ***Organizational structure***
- ***Roles & Responsibilities***

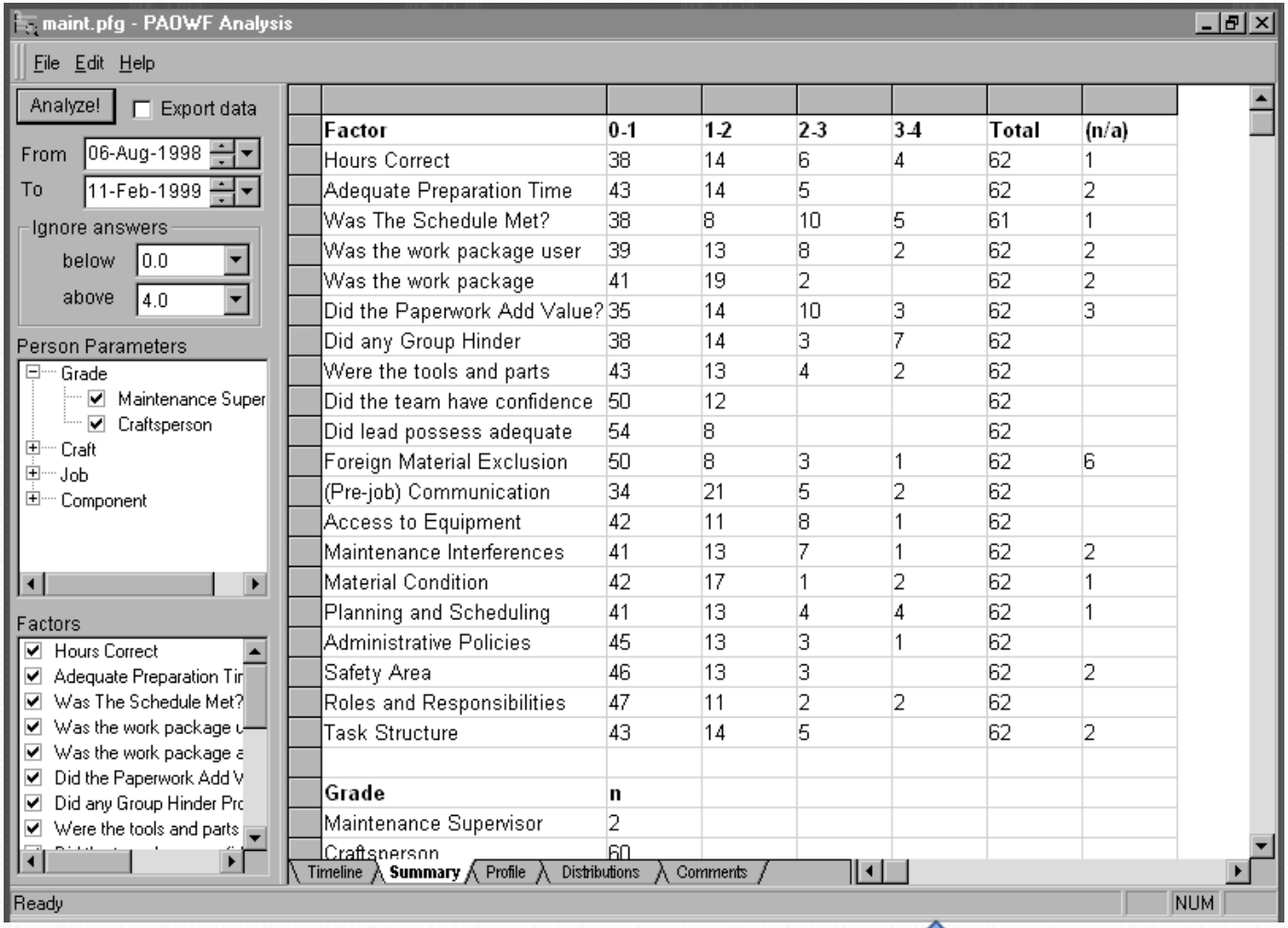
Source: INPO (1998) after Reason (1991)

PAOWF Data Collection Tool



© EPRI

Data Analysis Tool



Factor	0-1	1-2	2-3	3-4	Total	(n/a)
Hours Correct	38	14	6	4	62	1
Adequate Preparation Time	43	14	5		62	2
Was The Schedule Met?	38	8	10	5	61	1
Was the work package user	39	13	8	2	62	2
Was the work package	41	19	2		62	2
Did the Paperwork Add Value?	35	14	10	3	62	3
Did any Group Hinder	38	14	3	7	62	
Were the tools and parts	43	13	4	2	62	
Did the team have confidence	50	12			62	
Did lead possess adequate	54	8			62	
Foreign Material Exclusion	50	8	3	1	62	6
(Pre-job) Communication	34	21	5	2	62	
Access to Equipment	42	11	8	1	62	
Maintenance Interferences	41	13	7	1	62	2
Material Condition	42	17	1	2	62	1
Planning and Scheduling	41	13	4	4	62	1
Administrative Policies	45	13	3	1	62	
Safety Area	46	13	3		62	2
Roles and Responsibilities	47	11	2	2	62	
Task Structure	43	14	5		62	2
Grade	**n**					
Maintenance Supervisor	2					
Craftsperson	60					

Look for outliers, not at means

© EPRI

Lessons from This Work

- If management doesn't listen and act on it, data will dry up
- Not having an underlying framework of safety leads to collections of pretty charts that mean nothing
- Excel is the enemy of understanding

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Protecting People and the Environment

Safety Culture in the NRC Reactor Oversight Process

Audrey Klett, Reactor Engineer

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Inspection and Regional Support

November 12, 2009

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United States Nuclear Regulatory Commission
Protecting People and the Environment

Topics

- Inspection and Assessment of Safety Culture (SC)
- Lessons Learned Incorporated into Reactor Oversight Process (ROP) Guidance
- Assessment of ROP

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Commission Direction

- SECYs 04-0111 & 05-0187
- Cross-cutting issues should more fully address SC
- Monitor industry efforts
- Evaluate SC for licensees with significant performance problems
- ROP changes are consistent with ROP principles: transparent, understandable, objective, predictable, risk-informed, performance-based

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Cross-Cutting Areas, Components, Aspects

- Licensee performance that could impact more than one cornerstone of safety
  - Human Performance (HU)
  - Problem Identification & Resolution (PI&R)
  - Safety Conscious Work Environment (SCWE)
- SC Components: 9 of 13 are cross-cutting
- Aspect is assigned if it is the most significant contributor to an inspection finding
- Inspection Manual Chapters (IMCs) 0305 and 0612 contain guidance for assigning aspects to findings

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Substantive Cross-Cutting Issues (SCCIs)

- Findings with aspects evaluated during assessment cycle meetings
- SCCI identified if
  - Four or more inspection findings have a common aspect (theme) in HU/PI&R and
  - NRC not confident that licensee is addressing HU/PI&R theme or SCWE cross-cutting aspects
- SCCI closure criteria specified in assessment letters

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Safety Culture Assessments (SCAs)

- NRC will perform or request licensee to perform a safety culture assessment
  - Repeated SCCIs
  - Supplemental inspection procedures (IPs) 95002 or 95003
- SC issues and assessments also considered
  - PI&R inspections – IP 71152
  - Supplemental inspections – IP 9500X
  - Reactive inspections – IP 71153, 93800, 93812

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Lessons Learned – IMC 0305

- January 2009 revision
  - Definitions of SC-related terms
  - Documentation in assessment letters
  - SCWE SCCI time consideration
  - Follow-up of SCCIs
  - Licensee comment period for assigned aspects

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Lessons Learned – IP 71152

- 4/21/06 ACRS letter recommendation on routine review time allotment
- SC-related guidance
  - Consider licensee's progress in addressing emerging/existing cross-cutting themes
  - Resources can be increased to follow-up on SCWE issues

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Lessons Learned – IP 95003

- 4/21/06 ACRS Letter Recommendations
  - Clear thresholds for cross-cutting aspects of findings
  - Clear expectations for the resolution of staff concerns with a licensee's SC
  - Criteria for SCAs

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Lessons Learned – IP 95003

- Incorporated Palo Verde 95003 lessons learned recommendations
- Improved SCCI follow-up guidance
- Allowed graded approach to 95003 SCA
- Incorporated additional SCA guidance

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Lessons Learned – IP 95003

- Graded Approach for SCA Review
  - Evaluate licensee's 3rd-party SCA
    - Methodology, results, response
  - Determine scope of NRC review and follow-up
    - Limited focus or independent assessment
  - Develop conclusions
  - Evaluate licensee's response

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Lessons Learned – IP 95003

- Independent NRC SCA – 95003.02
  - Sample inspection requirements for SC components
  - Sample questions for SC components
  - Guidance for focus group and individual interviews
  - Guidance for event follow-up studies
  - Guidance for evaluating SC surveys

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ROP Self-Assessments

- SECYs 08-0046 & 09-0054
- Incorporated lessons learned into IMC 0305 and IP 95003
- Improved data collection and tracking of aspects
- Improved documentation of assigned aspects and SCCIs
- Removed inconsistencies in guidance

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ROP Self-Assessments

- Clarified definitions
- Incorporated external ROP survey comments (improve communication, objectivity, consistency)
- Clarified that aspects reflect current performance
- Assessed consistency of SCCI guidance implementation

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Conclusions

- SC metrics were met
- SC guidance was effective within ROP framework
- SC guidance provided insights into areas important to safety culture
- SC guidance was enhanced based on feedback & lessons learned
- Regions endeavored to consistently implement program requirements

Fostering a Strong Nuclear Safety Culture

Tony Pietrangelo
Tom Houghton
Nuclear Energy Institute

NEI
NUCLEAR ENERGY INSTITUTE

Challenges with the Existing Situation

- Different NRC/INPO terminology creates confusion
- Industry has the responsibility, but has not taken the lead
- Inspection findings are a very limited set of data
- Industry is not taking full advantage of all the possible indications of safety culture weaknesses
- There is no industry-wide guidance for conducting safety culture assessments – self, independent, or third party

NEI

Objective: Establish a Consistent, Systematic, Industry-wide Approach

- A common language of nuclear safety culture
- Industry responsible and leading
- Providing NRC a better regulatory footprint
- Use all available assessment tools to assess, identify and correct weaknesses
- A common methodology for conducting assessments, including third party

NEI

Alignment is Proceeding in Three Areas

- INPO and NRC have begun discussions on creating a common language
- A common industry approach using all available tools to assess and address issues, and with effective NRC oversight, has been submitted to NRC
- A common industry approach for conducting self, independent and third party assessments has been submitted to NRC

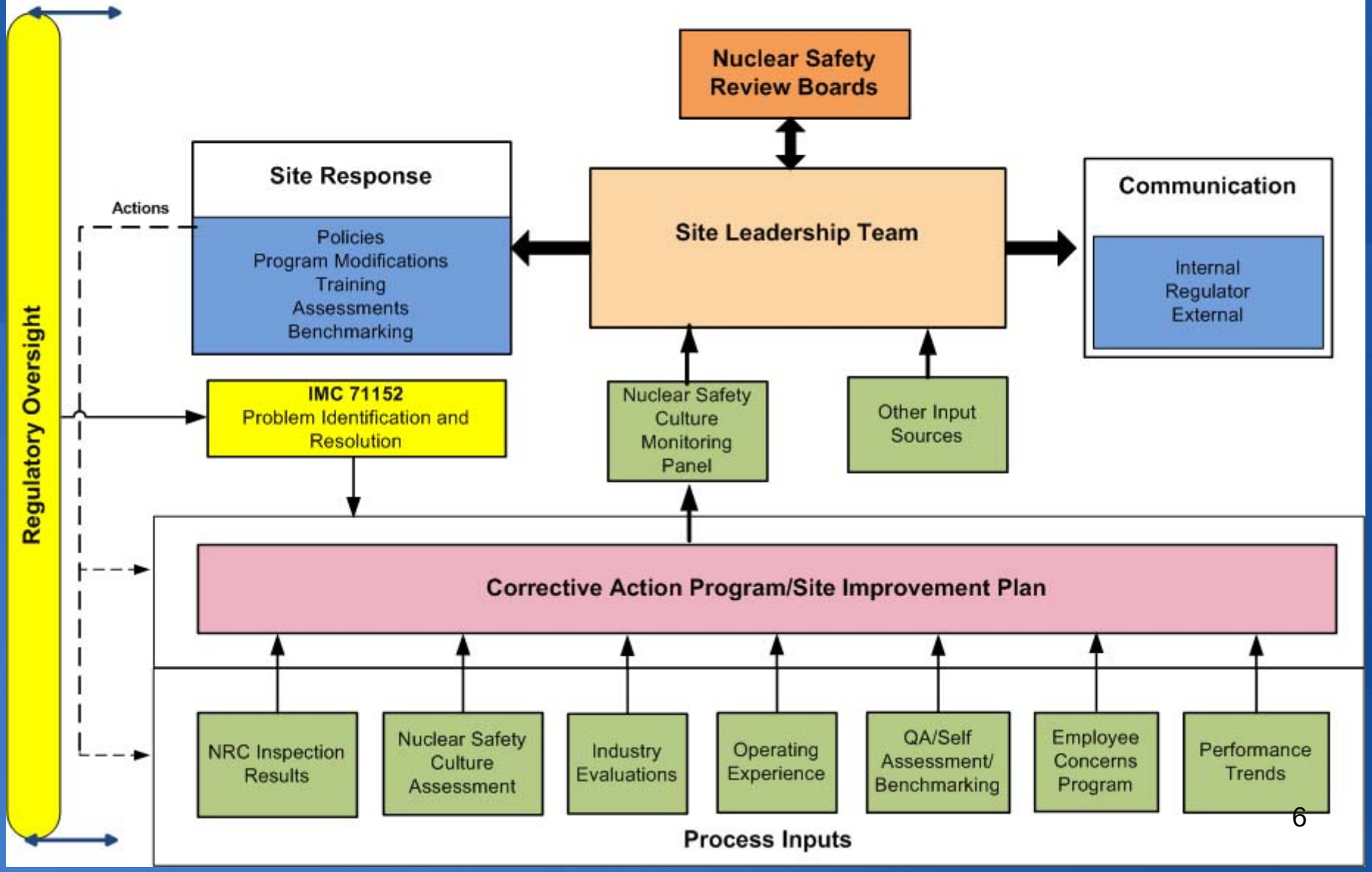
NEI

NEI 09-07 Fostering a Strong Nuclear Safety Culture

- Uses multiple inputs to the CAP and other key inputs including external assessments
- Licensee monitoring, oversight and communication
  - Trends and analyzes input data
  - Ensures effective corrective action
  - Communicated to key stakeholders
- Monitoring review panel and site leadership team conduct periodic reviews
- Provides systematic approach

NEI

Site Nuclear Safety Culture Process



NRC Role is to Independently Assess Licensee Actions

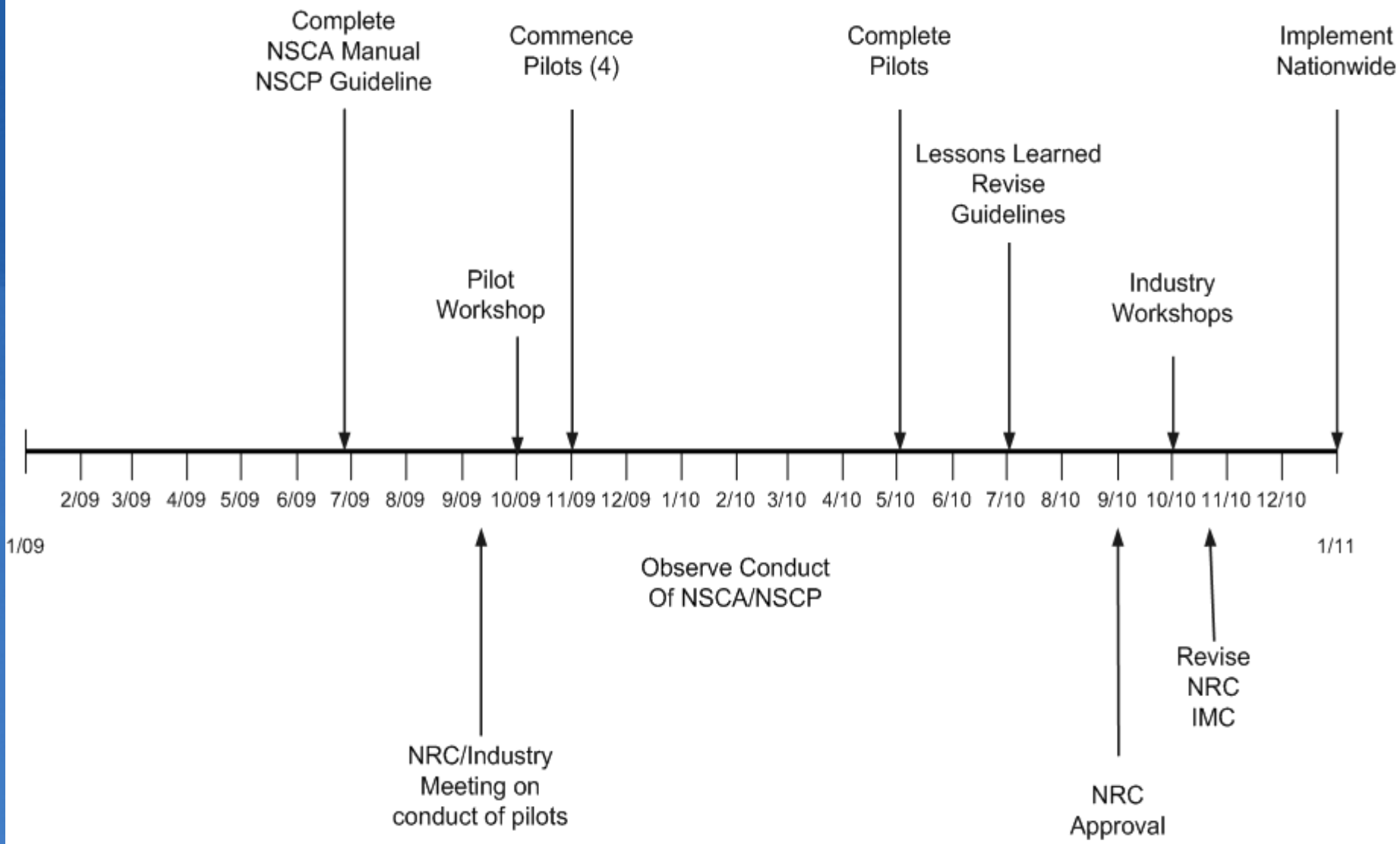
- Enhanced PI&R inspections
  - Effectiveness of licensee program in identifying weaknesses
  - Corrective action effectiveness
- Observation/assessment of licensee process
- Continue identifying crosscutting aspects
- Maintain SCWE and traditional enforcement
- Document in inspection reports and assessment letters
- Request public meeting for licensee to explain lack of progress
- Request an independent assessment for degraded cornerstone if safety culture is believed to be major cause
- Request a third party assessment for column 4 plant

Key Steps Going Forward

- Establish a pilot program to test industry approach against success criteria
- NRC observe pilots in parallel with current oversight approach
- Jointly assess success of the pilot program and apply lessons learned to governing documents
- Obtain Commission approval
- Conduct industry workshops and implement nationwide

NEI

NUCLEAR SAFETY CULTURE PROCESS IMPLEMENTATION PLAN



Nuclear Safety Culture Assessment

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NUCLEAR
ENERGY
INSTITUTE

Why Develop a Standardized Methodology?

- NRC and industry dissatisfied with 95003 safety culture assessment experience at Palo Verde
- NEI agreed to develop industry guideline
- Established task force to develop guideline that could be used for self, independent and third party assessments
- All sites required to perform biennial self assessment (INPO 02-4)
  - Some use contractors for surveys and/or assessments
  - No industry-wide consistency
  - Discussed existing approaches including IAEA's SCART
  - USA has a methodology it has used successfully for five years
- Industry is modifying the USA approach to create a Nuclear Safety Culture Assessment Process Manual

NEI

USA NSCA Process

- Structured on INPO's *Principles and Attributes for a Strong Nuclear Safety Culture;* results are provided in that context
- Pre-assessment automated survey and document review
- Assessment of leadership and worker attitudes, opinions, and perceptions through structured interviews and behavioral observations
- Full week evaluation with Friday exit
- Can be scaled up for "independent" or "third party" assessment

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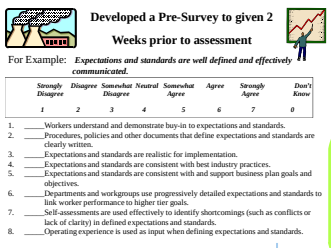
What the Process Looks Like

Pre-Work | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday



Developed a Pre-Survey to given 2 Weeks prior to assessment

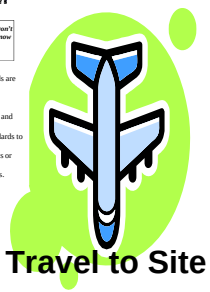
For Example: *Expectations and standards are well defined and effectively communicated.*

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree	Don't Know
1	2	3	4	5	6	7	0

1. _____Workers understand and demonstrate buy-in to expectations and standards.
2. _____Procedures, policies and other documents that define expectations and standards are clearly written.
3. _____Expectations and standards are realistic for implementation.
4. _____Expectations and standards are consistent with best industry practices.
5. _____Expectations and standards are consistent with and support business plan goals and objectives.
6. _____Departments and workgroups use progressively detailed expectations and standards to link worker performance to higher tier goals.
7. _____Self-assessments are used effectively to identify shortcomings (such as conflicts or lack of clarity) in defined expectations and standards.
8. _____Operating experience is used as input when defining expectations and standards.

Pre-Survey & Discussion

Plant Records - CAP
Bus. Plan
Indicators
Prior Assessments,
Prior NSCA
Focus Areas
Equipment History etc.



Travel to Site

Training & Schedule

Individual Contributor Interviews

Supervisory Interviews

Exit Meeting

Multiple Meeting Observations

Field Observations

Final Consolidation Discussion

Recommendations

Travel Home

Data Consolidation Meetings

Typical Coverage Pattern

- Start with individual contributors, then supervision
- Data tracking ensures coverage of all INPO attributes and all organizations
- Generally includes:
  - 40 to 60 interviews of individuals or small groups
  - Attend 10-15 meetings and make 10-12 Field Observations
- Provides varying levels of coverage for 250-300 employees on site
- Typically over 1000 data points go into profile

NEI

Assessment Results

- Exit meeting followed by written report
- Can include other areas of Site VP interest
- Both descriptive and graphic results
- Strengths, weaknesses, recommendations
- Follow-up from previous assessment
- Entered in the CAP and/or improvement plan
- Wide communication of results

NSCA Process Manual has Been Upgraded

- Modified to reflect three levels of assessment (self, independent and third party)
- Upgrade survey to distinguish between departments and levels in the organization
- Conducted validation study of process
- Reviewed against revised 95003
- Continuous improvement built into process

Pilot Plants

- Hope Creek
- North Anna
- Braidwood
- South Texas Project

Preparation

- Site Procedures using NEI 09-07
- Training
- Communications

NRC Involvement

- Continue baseline inspection program
- Observe Nuclear Safety Culture Assessment
- Observe Nuclear Safety Culture Monitoring Panel
- Observe Site Leadership Team meeting

Post Pilot Activities

- Lessons Learned, plus, deltas
- Success Criteria met?
- Process Modifications

In conclusion

- Efforts continue to develop common language
- Industry has completed two guidelines and has provided them for NRC comment:
  - NEI 09-07 Fostering a Strong Nuclear Safety Culture
  - Nuclear Safety Culture Assessment Process Manual
- NRC will observe pilot plant activities
- Industry is interested in refining the approach, including NRC's oversight role, for Commission consideration and implementation in 2011

NEI

INPO

Nuclear Industry HRO Safety Culture

Next Steps

ACRS November 12, 2009

david.collins@dom.com 800-269-9994 x3710

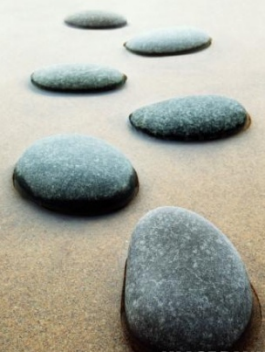
Purpose

To identify management and regulatory focus areas. Many extra slides are provided as reference he presentation will focus on just a handful. Additional slides of interest can be discussed during the Q&A.

Next Steps

- Need for Regulatory Improvement
- Language and Responsibilities
- Learning from Significant Events
- Economic Pressure
- The Root Cause of Most Culture Events
- Learning From Davis Besse
- Leaders Create Culture
- Learning to Assess Manage Regulate
- Conclusions, Q&A, Glossary

Note - this presentation should not be interpreted as reflecting the views of the Millstone Power Plant or parent company Dominion



Next Step

Need for Regulatory Improvement

2002 PLAIN DEALER - Meserve
"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."

2002 PLAIN DEALER - 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."*

Need for Regulatory Improvement
Oversight Failure

2002 PLAIN DEALER
Davis-Besse workers' repair job hardest yet
The Millstone debacle was supposed to have heightened the nuclear industry's awareness of the safety culture issue. The NRC believed Reactor Oversight Program**,** its new approach to monitoring the nuclear fleet would be a more sensitive, less subjective indicator of how well reactors were operating.

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

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

Need for Regulatory Improvement
Oversight Failure

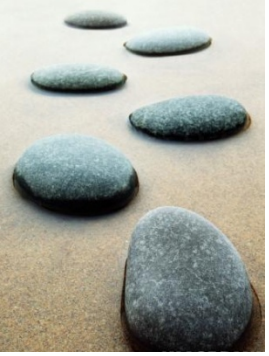
2004 PLAIN DEALER
Nuclear agency blasted for Davis-Besse work
The Nuclear Regulatory Commission's refusal to fix the deep oversight flaws that caused it to miss a rust hole in the Davis-Besse nuclear reactor means there may be major incidents at other plants, congressional investigators say.

Need for Regulatory Improvement
Oversight Failure

2006 GAO Report

NRC should increase the effectiveness of efforts to assess safety culture at plants and develop specific indicators to measure important aspects of plants' safety culture.

Need for Regulatory Improvement
Public Perceptions



Next Step

Language and Responsibilities

2002 PLAIN DEALER - Meserve
"I think if you were to talk with five different people about what safety culture is, you'd probably get five different answers."

2002 INPO CEO Conference - Meserve
"the concept [of safety culture] is not crisply defined, (therefore) it is not surprising that NRC and other organizations have not found an unambiguous way to measure it."

Language and Responsibilities

What is a HRO?

High Reliability Organization

An organization that operates and manages processes with the potential to adversely affect human life or the environment.

Example: Nuclear Power Organization

Language and Responsibilities

What is HRO Safety Culture?

Culture
"how we do things around here".

Safety
an ethical attitude that makes sure how you do th
not harm people.

Safety Culture
an ethical attitude that makes sure "how we do things around here" is that we "do not harm people."

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

What is Wrong With 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."

2002 Meserve Said *"Not Crisp"*
What kind of characteristics?
What kind of attitudes?
What kind of organization?
What individuals?
Why is attention warranted?
Why are these issues significant?

Six Sigma Quality Management
Must start a clear definition to have effective assessment

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

Clear definition - HRO Safety Culture

Ethical leadership attitudes in a High Reliability Organization that ensure potentially hazardous activities are managed and operated with a reasonable low risk to people and environment thereby maintaining the trust of all relevant stakeholders.

This Definition Clarifies:

What kind of characteristics? *(leadership attitudes that maintain stakeholder trust)*
What kind of attitudes? *(ethical ones)*
What kind of organization? *(a high reliability organization)*
What individuals? *(the leadership)*
Why is attention warranted? *(operating potentially hazardous activities)*
Why issues significant? *(involves managing risk of harm to people / environment)*

Language and Responsibilities
Why Not Use Existing INPO Definition?

Unfortunately
Part of what is being defined (i.e. nuclear safety) was put in the definition, so not a "functional" definition

Example

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."

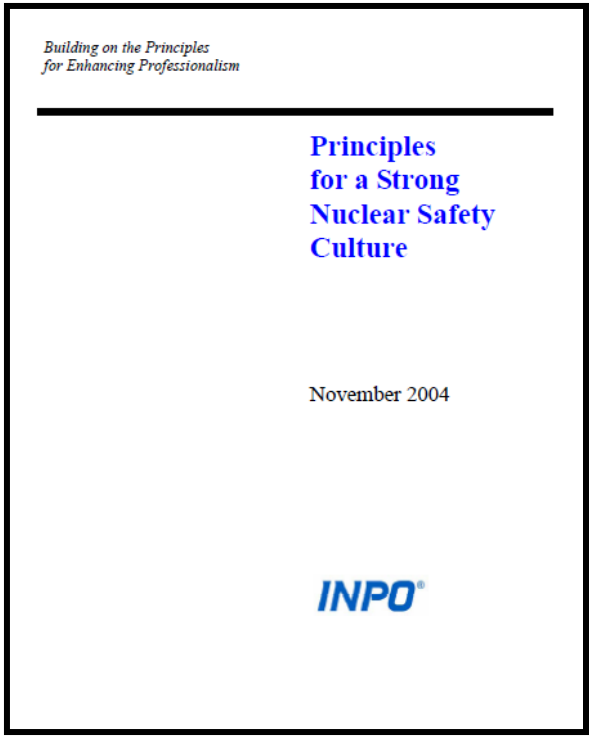
Cost Cutting Culture
"An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make cost cutting the overriding priority."

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."

Language and Responsibilities
Why Not Rely On Existing INPO Guidance?

INPO 2004 “Principles for a Strong Nuclear Safety Culture”
Is widely considered excellent industry safety culture guidance.

Unfortunately
The same problem observed with the definition exists throughout the “Principles” document.


Building on the Principles for Enhancing Professionalism

Principles for a Strong Nuclear Safety Culture

November 2004

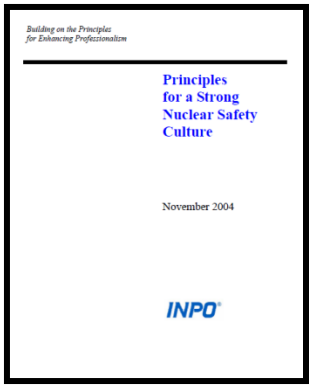
INPO

Like the definition, much of the “Principles” document is non-functional (cannot be used for fostering a strong culture) **many areas are incorrect or misleading.**

What is the Root of this Problem???

Language and Responsibilities

The Problem With “Principles” is the Brainchild Problem


Building on the Principles for Enhancing Professionalism

Principles for a Strong Nuclear Safety Culture

November 2004

INPO

Principles was written by nuclear industry executives not culture experts. **An analogy is your grandmother knits you a seat belt**. You know that it is well intentioned, but you also know that you really need to use something that was been developed and tested by experts.

Sample of the INPO Human Performance Guidance References

38 Reason. Managing the Risks of Organizational Accidents. 1998; p.237.
39 Geller. The Psychology of Safety. 1998; pp.34-35.
40 Larkin and Larkin. “Frontline Employees,” Harvard Business Review 1999; p.147.
41 Schein. Organizational Culture and Leadership. 1992; p.231

Sample of the “Principles” Authors (Safety Culture Advisory Group)

L. Joseph Callan Ops NRC
Charles M. Dugger VP Ops NEI
Frederick G. von Ahn Ops Director FENOC
Bryce L. Shriver CNO Susquehanna
Mano Ken Nazar CNO American Electric Power

Language and Responsibilities

The Problem With “Principles” is the Brainchild Problem

Some of the Problems

“EVERYONE IS RESPONSIBLE FOR SAFETY”

BUT NOT EVERYONE IS RESPONSIBLE FOR THE ORGANIZATION SAFETY CULTURE, AND THIS IS WHAT WE ARE TALKING ABOUT HERE.

MIT ORG CULTURE PROFESSOR EDGAR SCHIEN SAYS CULTURE IS “HOW WE DO THINGS AROUND HERE” AND SCHIEN SAYS “LEADERS CREATE CULTURE”

SINCE IT IS A LEADERSHIP FUNCTION OF MANAGEMENT TO DECIDE “HOW WE DO THINGS AROUND HERE”, SAFETY CULTURE IS THE GENERAL RESPONSIBILITY OF THE SITE MANAGEMENT TEAM, AND THE PRIMARY RESPONSIBILITY OF THE MOST SENIOR MANAGERS. AT THE SITE, THE SITE VP. IN THE NUCLEAR ORG THE CNO.

Language and Responsibilities

The Problem With “Principles” is the Brainchild Problem

Some of the Problems

“LEADERS ARE COMMITTED TO SAFETY”

BUT THEIR ROLE IN MANAGING SAFETY CULTURE (AND THEREFORE THEIR COMMITMENT TO SAFETY CULTURE) IS NOT CLEAR. IN 2002 NRC CHAIRMAN MESERVE SAID “IF YOU ASK 5 PEOPLE WHAT SAFETY CULTURE IS, YOU GET 5 DIFFERENT ANSWERS”.

IF YOU WERE TO ASK 5 DIFFERENT LEADERS IN NUCLEAR TO DEFINE “SAFETY CULTURE” YOU WOULD PROBABLY GET 5 DIFFERENT ANSWERS. SAFETY CUTURE IS MUCH BIGGER THAN SCWE, BUT MANY PERCEIVE IT AS IDENTICAL.

INPO HU TRAINING SAYS “SAFETY CULTURE IS THE CENTRAL ROLE OF LEADERSHIP”. INPO ALSO SAYS “MANAGEMENT IS DOING THINGS RIGHT, LEADERSHIP IS DOING THE RIGHT THING”. THEREFORE SAFETY CULTURE MANAGEMENT IS ABOUT MAKING SURE THE ORG IS “DOING THE RIGHT THING”. HOW EXACTLY DO MANAGERS DO THIS IN THEIR DAY TO DAY ACTIVITIES? TO BETTER THAN 90% OF INDUSTRY MANAGERS TODAY, THE CONCEPT IS NOT (AT ALL) CLEAR.

Language and Responsibilities

The Problem With “Principles” is the Brainchild Problem

Some of the Problems

NUCLEAR IS UNIQUE

BUT ONLY IN THE SENSE THAT IT IS A METHOD OF GENERATING ELECTRICITY DIFFERENT FROM COAL, WATER, ETC. RELEVANT TO SAFETY CULTURE, NUCLEAR IS ONE OF MANY ORGS CALLED “HIGH RELIABILITY ORGANIZATIONS” (HROs) MANAGING AND OPERATING ACTIVITIES WITH SOME RISK TO PEOPLE OR THE ENVIRONMENT. OTHER HRO INDUSTRIES ARE MEDICAL, TRANSPORTATION, CHEMICAL, MINING, MILITARY, SPACE.

THE PROBLEM WITH SAYING THAT “NUCLEAR IS UNIQUE” IS IT HAS KEPT THE INDUSTRY FROM JOINING THE LARGER HRO COMMUNITY AND LEARNING FROM THE VERY SIGNIFICANT SAFETY CULTURE MANAGEMENT IMPROVEMENTS MADE IN MANY OTHER HRO’S OVER THE PAST 30 YEARS.

THIS COULD GREATLY BENEFIT NUCLEAR SAFETY, BUT THE INDUSTRY (NEI) REJECTS THESE METHODS AS INTRUSIVE TO MANAGEMENT. PART OF THIS (I BELIEVE) HAS TO DO WITH DEREGULATION AND FEAR OF LOSING COST-FOCUS (RIGHTLY OR WRONGLY) PERCEIVED AS ESSENTIAL TO NUCLEAR’S SURVIVAL.

Language and Responsibilities

What is Safety Culture Management / Regulation?

Ensuring that the frequency of Safety Culture as a SOE causal factor is maintained ALARA and is perceived this way by all relevant stakeholders.

Language and Responsibilities

Who is Responsible for Safety Culture Management?

Primarily Responsible - Most Senior Leader

Generally Responsible - Site Leadership Team

Language and Responsibilities

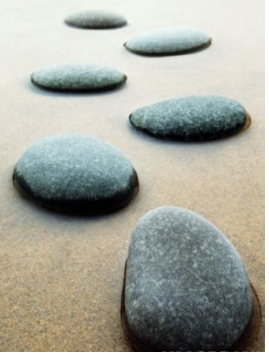
Why are Leaders Responsible for Culture?

Leadership Culture Nexus

Schein Leaders create the org culture, and if there are culture problems, it is up to the org leaders to correct them INPO safety culture is the central role of leadership INSAG safety culture flows down Into the org from the actions of senior leadership Marquardt There are only 2 ways to change culture, you can change leaders, or you can change leaders Olivier there are always a couple of managers who just don't "get it" the most important thing is, they cannot remain on the leadership team Espenship to have a healthy org culture every member of the management team needs to be able to manage culture

Language and Responsibilities
Who is Responsible for Safety Culture Regulation?

Primarily responsible – NRC
Generally responsible - INPO, NEI



Next Step

Learning From Significant Events

Learning From Significant Events
Culture as Cause

INPO 02-005 Cause Analysis of Significant Events

Culture: Most Frequently Identified Causal Factor
70% of the 20 most significant events

"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."**

Learning From Significant Events
Culture as Cause

Navy Program –Goal of Reducing Events

In 1996, following a string of high-visibility mishaps, the naval aviation Human Factors Quality Management Board (HFQMB) was chartered and tasked with reducing the number of human-factor flight mishaps by 50 percent before the turn of the millennium.

One intervention strategy adopted by the board, on a trial basis, was a successful Air National Guard culture-assessment program.

Subsequently, the (very successful) program was endorsed by the Air Board and has evolved into the current **Naval Safety Center culture-workshop program** and is currently being expanded to other service branches.

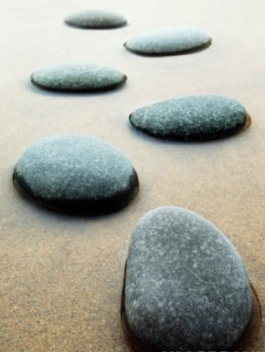
Learning From Significant Events
Culture as Cause

Bases of the Navy and Millstone Recovery Programs

In his 2008 Master of Military Studies Thesis Paper Titled "Naval Aviation Culture Workshops" USMC Major Robert Rubio described the impressive success of the Navy program, how it is structured on the Schein methodology, and the importance of managing the leadership values that maintain trust in the organization.

In my 2003 Master of Executive Management Thesis Titled "Getting Safety into the Bloodstream of the Organization" I described the impressive success of the Millstone program, how it was structured on the Schein methodology, and the importance of managing the leadership values that maintain trust in the organization.

My 2003 thesis recommended that the nuclear industry set a goal of reducing by 50 percent (from 70% to 35%) the frequency of safety culture as a SOE causal factor over the next decade.



Next Step

Economic Pressure

Economic Pressure
Pressure to Stay On Line

Not Seen as a Causal Factor Until 1993
In the 14 major SOEs before 1993 “Pressure to Stay On Line” was not identified as a Causal Factor. Since 1993 it has been identified in 83% of events

INPO 02-005 Analysis of Significant Events
“Pressure to Stay On Line was a factor in all but one of the Most (since 1993) events. Therefore, given today’s competitive environment, **pressure to continue operating** may be a **notable contributor to future significant events.”**

Economic Pressure

Pressure to Stay On Line

Pressure to Continue Operating 5 / 6 events

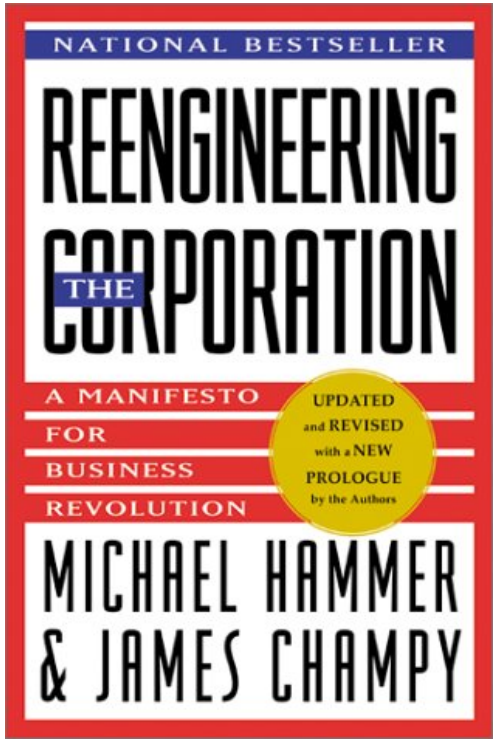
The 20 Most Significant Events in the History of Nuclear Power Generation*

INPO 02-005, Analysis of the Twenty Most Significant Events

Location	Date	Event
Dresden 3	10/31/74	Localized Fuel Failure as a Result of Improper Control Rod Movement
Browns Ferry 1	3/22/75	Plant Fire Results in Loss of Control of Safety-Related Components
Three Mile Island 2	3/28/79	Loss of Coolant Accident
Crystal River	2/26/80	Improper Steam Generator Level Control, Loss of Heat Sink, and Operator Uncertainty Following Loss of an Instrumentation Power Supply and a Stuck-Open PORV
Browns Ferry 3	6/28/80	Control Rods Fail to Insert Upon Scram
Hatch 1	9/20/81	Fuel Clad Failures Following a Cold Water Reactivity Insertion Transient
Salem 1	2/25/83	Reactor Trip Breaker Failure to Actuate
ANO 1	9/26/83	Improper Recovery of a Misaligned Control Rod Results in Fuel Clad Damage
Connecticut Yankee	8/12/84	Reactor Cavity Seal Failure
Oyster Creek	12/19/84	Fuel Failures Due to Improper Control of Power Changes
Davis Besse	6/9/85	Loss of Main and Auxiliary Feedwater
LaSalle 2	3/9/88	Automatic Scram Following Neutron Flux Oscillations
McGuire 1	3/7/89	Steam Generator Tube Rupture
Vogtle	3/20/90	Reactor Scram, Loss of Offsite Power, & Loss of Shutdown Cooling Resulting From Switchyard Maintenance
Palo Verde 2	3/14/93	Steam Generator Tube Rupture
Millstone 2	8/5/93	Increased Leakage From Unisolable Reactor Coolant Leak After Repeated Sealant Injections
Salem 1	4/7/94	Reactor Scram & Inadvertent Safety Injection Results in Solid RCS & Thermal Hydraulic Transient
Limerick	9/11/95	Stuck Open SRV Leads to Plant Depressurization and RHR Pump Cavitation
Clinton	9/5/96	Non-Conservative Operation While Isolating a Reactor Recirculation Pump Seal Leak
Davis Besse	3/7/02	Reactor Pressure Vessel Head Degradation

Economic Pressure

Reengineering: A Failed Business Model



Published in 1993

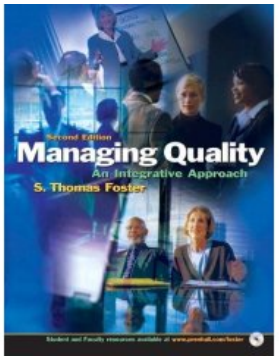
Extreme Cost Cutting

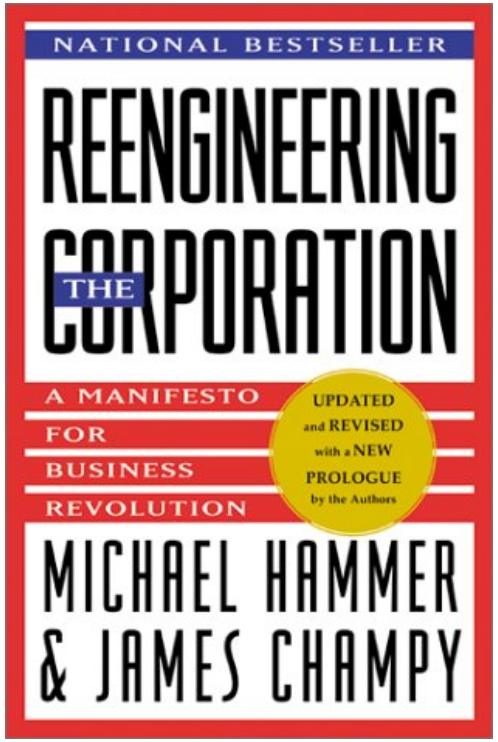
Extreme Staff reductions

> 70% business failure rate

Economic Pressure

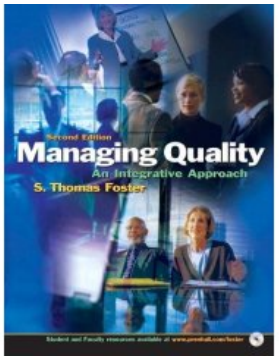
Reengineering: A Failed Business Model





"Three years after release of "Reengineering" Dr. Hammer **pointed out a flaw**. He and other leaders of the 4.7B reengineering industry had **forgotten about people"**

Economic Pressure
Reengineering: A Failed Business Model

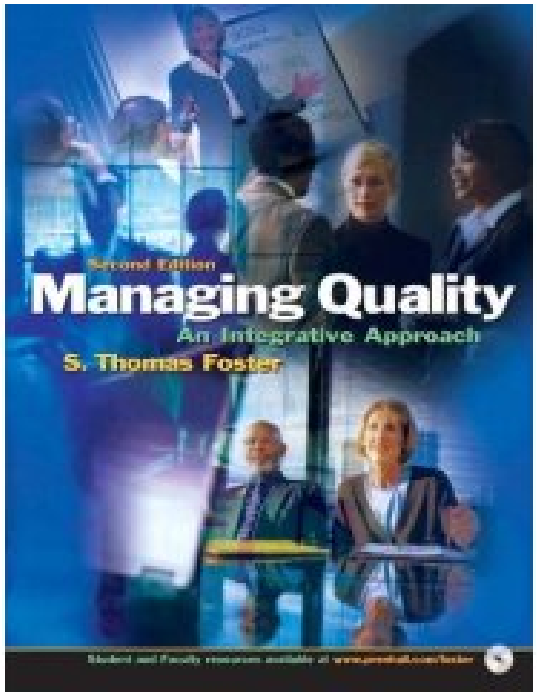


Michael Hammer co-author:
Reengineering the Corporation:
A Manifesto for Business
Revolution

"I wasn't smart about that, I was reflecting my engineering background and was insufficiently appreciative of the human dimension. I've learned that critical."

- Dr. Michael Hammer

Economic Pressure
Reengineering: A Failed Business Model



"By ignoring the attention to detail and analysis that has characterized many world class firms, **Hammer and Champy led many firms to make radical changes that have led to major failures.**

If there is a lesson to be learned from the reengineering failures it is this: *Some quality and performance improvement approaches are brainchildren, some have been proven to work in a number of organizations, in a variety of cultures, and in a number of economic sectors.* ***Avoid the former until they become the latter."***

Economic Pressure
Reengineering: A Failed Business Model

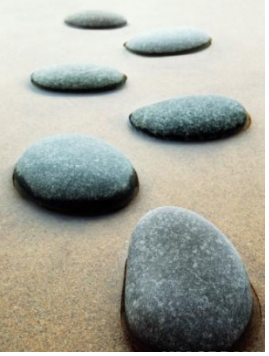
John Beck (final letter to Millstone Managers)
"Never forget that previous management failed so miserably, not because they were not intelligent, and not because they did not clearly understand what successful economics looked like in a competitive environment. They failed because they were arrogant, dismissive and refused to listen to the issues and concerns of the people who make this place run."

Essentially, they failed because they "forgot about people"

Economic Pressure
Reengineering: A Failed Business Model

APS (Palo Verde) Chairman Post
"How does a management team that was responsible for taking Palo Verde to one of the highest nuclear performance levels in the country and sustaining it for a decade allow it to fall into Column 4?"

APS (Palo Verde) CNO Edington
Some of the reengineering efforts, took away some of the control functions … so they start degrading on us … the overall piece was starting to fall apart."



Next Step

The Root Cause of Most Culture Events

The Root Cause of Most Culture Events
Development of Cost Conscious Work Environments

INPO Human Performance

"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."**

The Root Cause of Most Culture Events
Development of Cost Conscious Work Environments

Production vs. Protection [CCWE vs. SCWE]
When a “cost focus” is more highly valued than a “safety focus” over an extended period time, over the years the leadership team becomes heavily populated with managers who are more cost than safety focused.

A “cost conscious work environment” develops and becomes dominant over a “safety conscious work environment” and a **philosophy of “minimal regulatory compliance” develops** where cost focused workers are valued more highly than safety focused workers.

The Root Cause of Most Culture Events

Development of Cost Conscious Work Environments

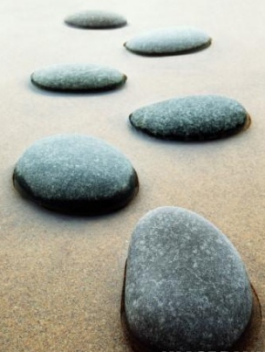
Minimal Regulatory Compliance

A cousin of “reengineering” theory, MRC is an unproven management “brainchild” theory 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) will become eroded.

How it typically works

Workers are told to put all issues of concern into the CAP immediately, creating the perception that Management is interested in addressing issues promptly. Citing a lack of resources, Management then defers the issue multiple times, this can go on for 10 years or more. Cancellation may then be justified on the basis that “we seem to be doing fine without this, (and) if this was important we would have addressed it years ago”.

Managers denied DB engineers attempt 1990 and again in 1994 and again in 2001 to get access holes / ports installed. This is the “direct root cause” of the DB event.



Next Step

Learning From Davis Besse

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Learning From Davis Besse

Managing Defenses and a Just Environment

INPO Human Performance

Reducing active errors (Re) plus managing defenses (Md) equals no significant events (ØE)

Re* + *Md* = *ØE

What (exactly) is managing defenses (Md)?

Learning From Davis Besse
Managing Defenses and a Just Environment

Managing defenses (Md) =
Managing Safety Culture =
Assuring The Existence of Acceptable
Safety Attitudes at the following four barriers:

Defense in Depth Barriers
Fourth - External Oversight (NRC, INPO)
Third - Internal Oversight (QA Department)
Second - Management
First – Worker

Which D in D barriers failed at Davis Besse?

Learning From Davis Besse
Managing Defenses and a Just Environment

Assessing D in D Ethical Attitudes

Doing a Proper Root Cause Evaluation of Culture Issues and Events

The "Four Squared" Method

Four safety culture attitudes are assessed at each of the four levels of defense.

Issue	Attitude	Attitude Deficiency	Leadership CAPRs [Corrective Actions to Prevent Recurrence]
WNT	Was Not Trained	Questioning	Reinforce expectation that individual should **stop when unsure** and seek out additional guidance
DNA	Trained but Did Not Act	Complacency	Reinforce use of HU tools and defenses.
GFE	Good Faith Effort. Made several attempts to resolve issue, did not report issue to management	Reporting	Reinforce importance of reporting.
FES	Fear of Ethical Stand. Issue was reported to management but not addressed. Afraid to continue to report due to fear of retribution.	HIRD / SCWE issue	Train leadership team in SCWE management and in other issues related to Safety Culture Management (e.g. How to Maintain Just, Reporting, Flexible, Learning Environments).

Learning From Davis Besse
Managing Defenses and a Just Environment

Leadership Guidance from a Top Industry Culture Manager

(I am not aware of a better culture manager in or outside of the Industry)

Dominion CNO David Christian's

"Wildly Important Goal" Number 3:

Dominion leaders clearly understand the role they are expected to fulfill.

Leaders are engaged. They live the philosophy of Continuous Improvement. They manage performance continuously through expectation setting and observation, monitoring, coaching and performance feedback.

If you think about it, my wildly important goals fit hand-in-glove with our Nuclear Vision, Principles of Professionalism, Nuclear Safety Policy, Focus on Four, and the five strategic pathways in our Nuclear Business Plan.

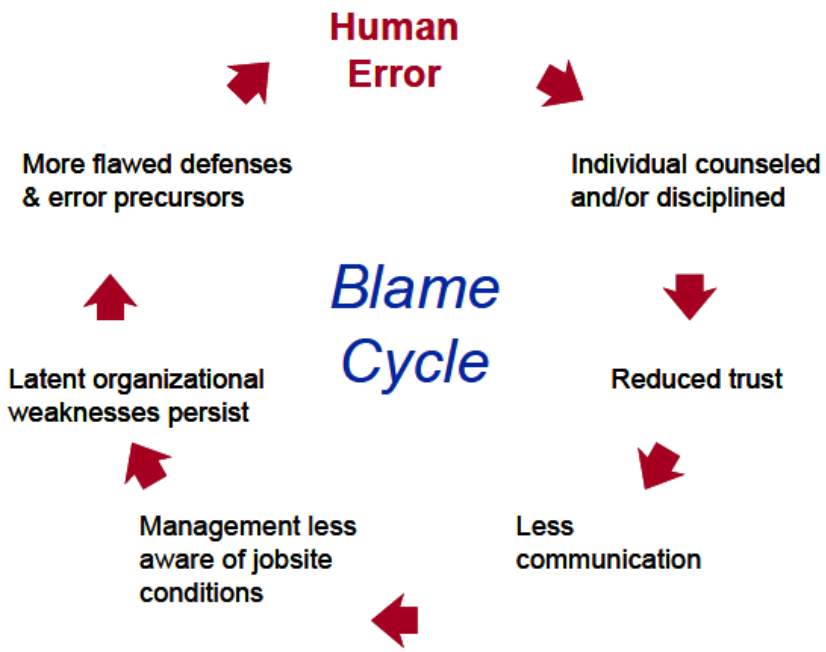
If we make these goals wildly important in all aspects of our work, we will achieve success beyond our wildest imaginations.

Learning From Davis Besse
Managing Defenses and a Just Environment

INPO Human Performance

An organization cannot consistently learn from error/failure and punish professional individuals at the same time.

People have, more often than not, been disciplined for "honest" mistakes. When an event happens, the organization is culpable, not simply the individual."



Error is not a <u>choice</u>.

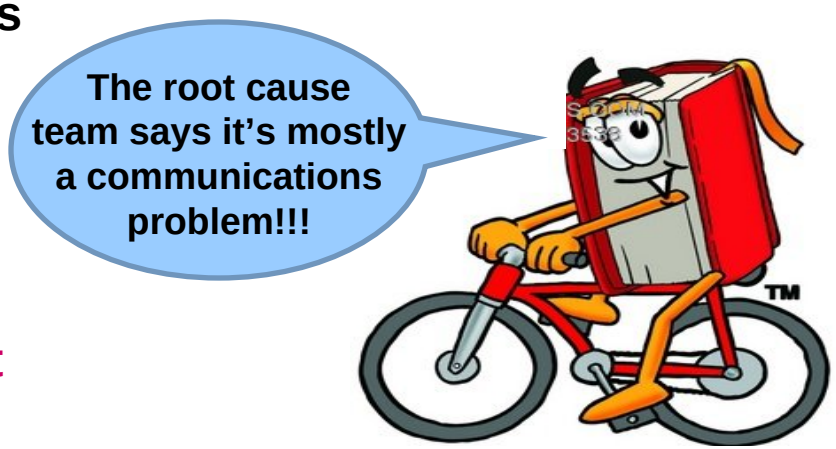
Learning From Davis Besse
Managing Defenses and a Just Environment

INPO Human Performance

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.**

Is blaming and terminating workers a quick way to safer operations?

Actually, failing to maintain a "just environment" is a quick way to a weak reporting, cause analysis, corrective actions, and learning culture. **Culture management is not just about doing a lot of communicating,** it is about understanding, communicating, and reinforcing expectations for ethical behavior.



FENOC

ATTEMPTING TO RIDE A
WORKER BLAMECYCLE
TO SAFER OPERATIONS

Learning From Davis Besse
Managing Defenses and a Just Environment

2004 NRC Recovery Inspection Team Report
"Management actions were taken by the crew as retaliatory, derogatory, were not properly assessed, potential negative impacts, no effective corrective strategy identified … **the NRC Team did not identify any performance deficiencies attributable to the (culture) decline."**

Poor culture regulation - NRC should try to not do this again

Learning From Davis Besse
Managing Defenses and a Just Environment

Why Millstone Recovery Was Successful, but Not Davis Besse
Millstone **addressed all stakeholder (regulator and worker) concerns.** Management took responsibility for past culture failures and future culture health. facilitated discussion sessions based on the Schein model were held with work groups, issues were identified, managers committed to address them and addressed them. **Consequently, at restart the culture was universally perceived by most stakeholders (regulators, employees, media, local public, local government) as robustly healthy.**

Davis Besse addressed the concerns of the regulator, but ignored the concerns of staff (and actually blamed and punished large numbers of staff). **NRC started this ball rolling by banning four workers. FENOC then viewed this behavior as not only appropriate, but expected by the regulator. NRC then stood by and watched, never telling FENOC that this was inappropriate (extremely so).** Consequently, at restart the culture was perceived by most stakeholders as still being challenged or as having actually degraded.

Poor culture regulation - NRC should try to not do this again

Learning From Davis Besse
Managing Defenses and a Just Environment
Was is the Fault of the System Engineer?

Whistleblower and former Davis-Besse engineer Andrew Siemaszko.

Former FirstEnergy Employees Banished from Nuclear Industry

Jan 6, 2006 12:00 AM, By Josh Cable

The Nuclear Regulatory Commission earlier this week banished four former employees of the company that operates Davis-Besse Nuclear Power Plant in Oak Harbor, Ohio, for misleading the agency about the conditions at the plant in 2001.

Siemaszko found guilty in Davis-Besse case

WORLD NUCLEAR NEWS 27 August 2008

The worker at the centre of the most serious nuclear safety incident of recent years was found guilty yesterday of concealing information from safety regulators. He could now face five years in jail $250,000 fine.

At the trial Siemaszko's attorney wept at the apparent injustice. After the trial, she asked a juror: "what made you decide Andrew was guilty?" The juror replied: "I didn't think he was personally guilty, but someone had to be held accountable".

Learning From Davis Besse
Was is the Fault of the System Engineer?

Whistleblower and former Davis-Besse engineer Andrew Siemaszko.

June 2003 UCS Lochbaum

MOD [Modification] 90-0012 **(March 21, 1990):** "MOD 90-0012 initiated to install multiple access ports with closure plates in the closure head to permit cleaning and inspection of the reactor head. **Boric acid has leaked from the CRD flanges and has accumulated on the reactor head. The reactor head is carbon steel and therefore is subject to degradation."**

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.**

If the modifications requested (apparently multiple times) by engineering were inappropriately deferred by management, and this made it functionally impossible for Siemaszko to adequately clean the head, then this was a broken management (and not a broken worker) barrier.

Learning From Davis Besse
Was is the Fault of the System Engineer?

Whistleblower and former Davis-Besse engineer Andrew Siemaszko.

IA-05-052
Order Prohibiting Involvement in NRC-Licensed Activities
On April 27, 2000, (FENOC manager REDACTED) signed and closed out Condition Report (CR) 2000-1037 which included the following problem statement associated with the identification of five leaking control rod drives:

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.

On August 11, 2001, Mr. REDACTED received an E-mail that stated, in part: ``it was pointed out that we cannot clean our head thru the mouse holes and **a system engineer is requesting (was this Siemaszko?)** that three large holes be cut in the Service Structure for viewing [inspection] and cleaning.

(Again) if the modifications requested (apparently multiple times) by engineering were inappropriately deferred by management, and this made it functionally impossible for Siemaszko to adequately clean the head, then this was a broken management (and not a broken worker) barrier.

Learning From Davis Besse
Managing Defenses and a Just Environment

EA-05-071 - Davis-Besse (FirstEnergy Nuclear Operating Company)
NOTICE OF VIOLATION AND CIVIL PENALTIES $5,450,000
Quality Assurance Audit Report AR-00-OUTAG-01, dated July 7, 2000, stated, in part, "Boric Acid Corrosion Control Checklists and Condition Reports were initiated by inspectors when prudent to document and evaluate boric acid accumulation and leaks. Boric acid leakage was adequately classified and corrected when appropriate. **Engineering displayed noteworthy persistence in ensuring boric acid accumulation from the reactor head was thoroughly cleaned."**

Oops – an Oversight from Oversight

Note comment from Oversight:
"Engineering displayed noteworthy persistence in ensuring boric acid accumulation from the reactor head was thoroughly cleaned." Do you still think engineering was a "broken barrier?"

Learning From Davis Besse
Managing Defenses and a Just Environment

GAO-04-415
What GAO Found:

NRC should have but did not identify or prevent the corrosion at Davis-Besse because its oversight did not generate accurate information on plant conditions. NRC inspectors were aware of indications of leaking tubes and corrosion; however, the inspectors did not recognize the indications' importance and did not fully communicate information about them. NRC also considered FirstEnergy—Davis-Besse's owner—a good performer, which resulted in fewer NRC inspections and questions about plant conditions.

NRC was aware of the potential for cracked tubes and corrosion at plants like Davis-Besse but did not view them as an immediate concern. Thus, NRC did not modify its inspections to identify these conditions.

An NRC resident inspector at Davis-Besse was shown, by a Davis-Besse engineer (was this Siemaszko?), a photograph that revealed streaks of rust-colored corrosion products on the head of the reactor vessel, in the midst of the expected white crystals. But the inspector was not aware of the significance of these rust streaks, and he did not report this information to other NRC personnel.

Learning From Davis Besse
Managing Defenses and a Just Environment

GAO-04-415 (What GAO Found)

NRC's process for deciding to allow Davis-Besse to delay its shutdown lacks credibility. Because NRC had no guidance specifically for making a decision on whether a plant should shut down, it used guidance for deciding whether a plant should be allowed to modify its operating license. NRC did not always follow this guidance and generally did not document how it applied the guidance.

The risk estimate NRC used to help decide whether the plant should shut down was also flawed and underestimated the amount of risk that Davis-Besse posed. Further, even though underestimated, the estimate still exceeded risk levels generally accepted by the agency.

NRC has proposed no actions to help it better
(1) identify early indications of deteriorating safety conditions at plants,
(2) decide whether to shut down a plant, or
(3) monitor actions taken in response to incidents at plants.
Both NRC and GAO had previously identified problems in NRC programs that contributed to the Davis Besse incident, yet these problems continue to persist.

Learning From Davis Besse
Managing Defenses and a Just Environment

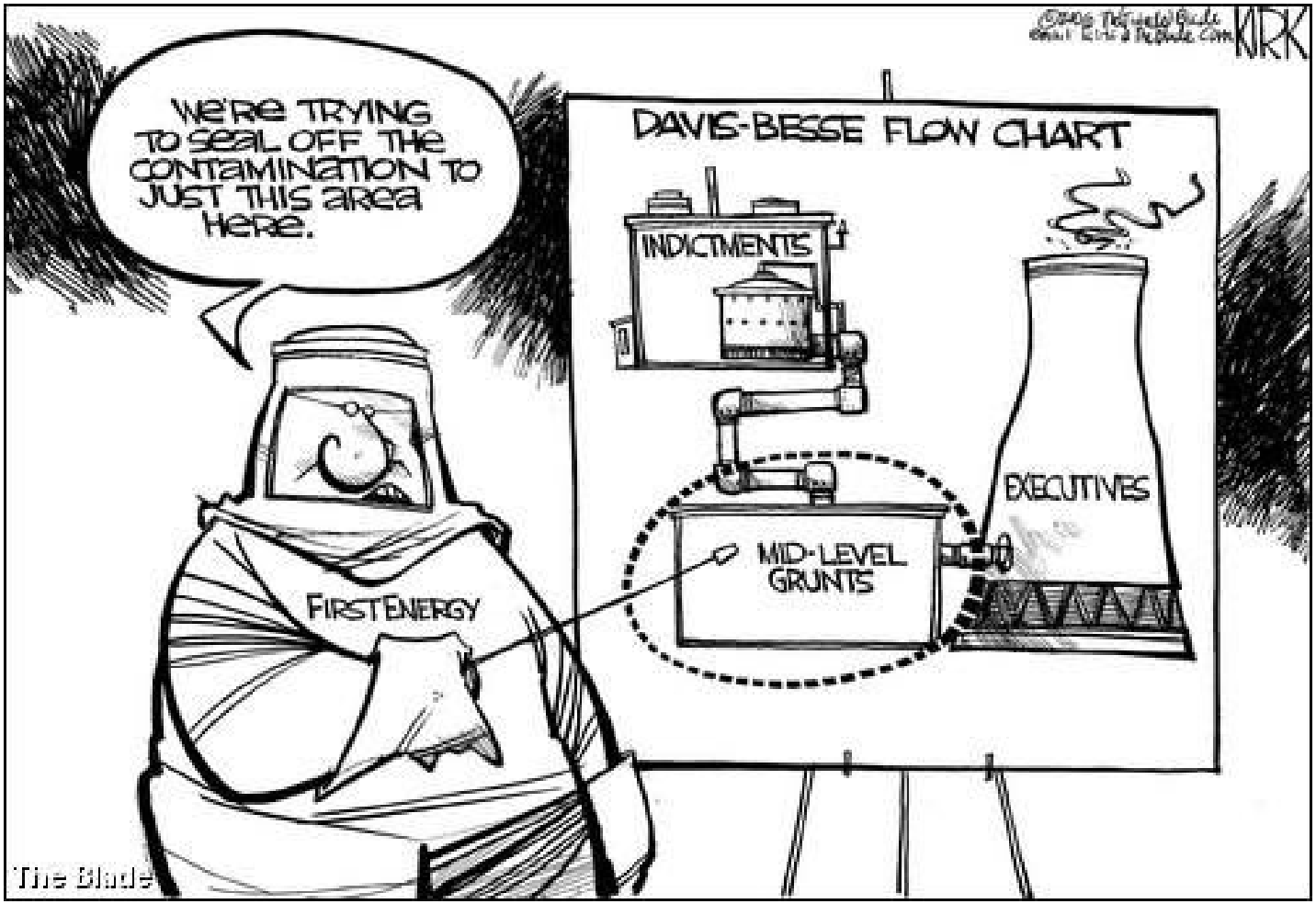
FENOC Signs Agreement With Justice Dept on Davis-Besse Reactor Head Issue *Jan 20, 2006 / PR Newswire-First Call*

Under the agreement, the Department of Justice will refrain from seeking an indictment or otherwise initiating criminal prosecution of FENOC for all conduct related to the reactor head issue. **FENOC is a better and stronger company today than in 2001 when this occurred**," said FENOC President and Chief Nuclear Officer Gary R. Leidich. "The agreement closes an important chapter on the Davis-Besse reactor head issue for the company. **FENOC has agreed to pay a penalty of $28 million.**

Nice "protection" for FENOC execs, but what about the 200 or so "mid level grunts" that FENOC execs blamed punished or terminated? Did they get an opportunity to take corrective actions as well and become "better stronger workers"? Did they get their jobs / lives back?

Learning From Davis Besse

Managing Defenses and a Just Environment



Learning From Davis Besse

Managing Defenses and a Just Environment

Which barriers failed at Davis Besse?

These Three "Defense in Depth Barriers" Failed:

Fourth - External Oversight (NRC, INPO)

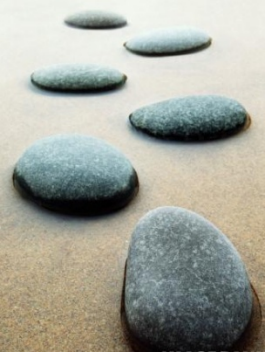
Third - Internal Oversight (QA Department)

Second - Management

This Defense in Depth Barrier Did Not Fail:

First – The Worker

Whistleblower and former Davis-Besse engineer Andrew Siemaszko.



Next Step

Leaders Create Culture

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Leaders Create Culture
Safety Culture – the Central Focus of Leadership

Management is “Doing Things Right”
Leadership is “Doing the Right Things”

- Peter Drucker

Leaders Create Culture
Safety Culture – the Central Focus of Leadership

INPO Human Performance

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.

Healthy relationships between managers and workers are necessary to promote a sense of wariness toward error and an intolerance toward error-likely situations. Wariness and intolerance are attitudes, generally derived from one's beliefs about hazards in the plant.

Safety and prevention behaviors do not just happen. They are value-driven. **Hence, the need for leadership."**

Leaders Create Culture
Safety Culture – the Central Focus of Leadership

INPO Human Performance

To help understand the need for leadership, the differences between production and prevention behaviors are listed in the table below:

Production Behaviors:	Prevention Behaviors:
• will *accomplish* the station's mission	• will *avoid* challenges to the mission
• will *achieve* desired results	• *will protect* desired results
• are *process* driven	• are *values* driven
• are *easy* to measure	• are *hard* to measure
• are frequently *reinforcing*	• are perceived as *burdensome*
• provide natural feedback	• provide little or no feedback
• can be perceived as *mandatory*	• can be perceived as *optional*
• involve the *mind* (logic)	• involve the *heart* (emotion)
• require ***management*** practices	• require ***leadership*** practices

Leaders Create Culture
Safety Culture – the Central Focus of Leadership

INPO Human Performance

"A robust safety culture requires aggressive leadership emphasizing healthy relationships that promote open communication, trust, teamwork, and continuous improvement.

Continuous improvement needs ongoing leadership attention to improve the plant's resistance to events triggered by human error (defense-in-depth).

Those in positions of responsibility must see themselves as leaders as well as managers to create an atmosphere of open communication. Therefore, leadership is a defense.

Interactions involving quality coaching and counseling will promote clear values and improve performance."

Leaders Create Culture
Safety Culture – the Central Focus of Leadership

Millstone Recovery Restart Meeting April 1999

CHAIRMAN JACKSON:
Let me ask you this kind of summary question. **You believe this has been the most unprecedented recovery in the history of the industry.** Other plants have shut down for multi-year shutdowns and they have had to work through a number of issues and have spent a lot of money. **What has made this the most unprecedented recovery?**

MR. OLIVIER:
In my mind there were two issues. I think the **restoration of trust with the employees** I think was a significant effort. I think **re-establishing the safety conscious work environment** that I think was really damaged in the past is different than any other plant that I have known, at least of the magnitude of what we had at Millstone Station

CHAIRMAN JACKSON: Mr. Kenyon looks like he wants to say something.

Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

MR. KENYON:
The trust relationship that you would want to exist between employees and management had been damaged very badly, and thus the challenge of re-establishing that relationship, which you can't legislate. You have to earn it.

MR. BOWLING:
I would like to also add that we had really **lost your trust as well and also the trust of the public**, so I think from my perspective what has made this unprecedented is not only having to restore the trust of our employees but **having to restore your trust and to restore the trust of the public.**

As Chairman Jackson said, "what was so unprecedented about the Millstone Recovery?"

Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

"Unprecedented" was …
how badly damaged the (stakeholder) trust relationship and how Leadership repaired it to the point where stakeholders universally felt it was (not just acceptable but) "robust".

Engineering Arrogance
NRC (and INPO) had evidenced culture problems at Millstone for (at least) 10 years prior. Since 1986 NU had been ignoring NRC demands to address backlogs that were allowed to developed in the push to get unit 3 completed and on line. The unit 3 project manager learned if he argued with NRC, they would let him do pretty much what he wanted (such as starting up unit 3 with a hopper full of unfinished paperwork). This saved a ton of money, and the CEO promoted the PM to CNO which set the table for the 1993 442 valve SOE, the 1996 Haddam ECCS and inventory events, and the 1996 shutdowns.

Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

Engineering Arrogance
the INPO leadership academy has a training video of NU managers circa 1990 interacting with NRC it is labeled: “engineering arrogance”.

What if NRC had studied culture in 1985 and intervened?
Schein wrote “Organizational Culture and Leadership” in 1985. What if NRC studied culture management and learned to regulate culture effectively at that time (say right after Chernobyl in 1986)?

Instead of waiting for the Millstone culture to become a TIME magazine cover story, what if in 1993 or even in1986 NRC had required the kind of culture management imposed on Millstone in 1996?

It is inconceivable that you get the 1996 shutdown event and it is unlikely the unit 3 PM becomes CNO. It is unlikely you get the 1995 ECCS or 1996 loss of inventory events, or the 1993 un-isolable reactor coolant leak “top 20 SOE” event.

Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

In 1986 MIT Professor Edgar Schein was 57 years old and already a world leading expert in Organizational Culture.

What if right after Chernobyl (when the need for robust safety cultures had become painfully clear) some MIT engineering professor (who also happened to be an ACRS member) either read the culture management guidance in Schein's 1985 book "Organizational Culture and Leadership" or simply walked down the hall and said: "Hey Edgar, how do you think we should manage culture in the Nuclear Industry?"

How many of INPO's top 20 "Most Significant Operating Events" might have been avoided?

Answer - Probably About 70%.

Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

Davis Besse 6/9/85 Loss of Main and Auxiliary Feedwater LaSalle 2 3/9/88 Automatic Scram Following Neutron Flux Oscillations McGuire 1 3/7/89 Steam Generator Tube Rupture Vogtle 3/20/90 Reactor Scram, Loss of Offsite Power, & Loss of Shutdown Palo Verde 2 3/14/93 Steam Generator Tube Rupture Millstone 2 8/5/93 Increased Leakage From Unisolable Reactor Coolant Leak After Repeated Sealant Injections Salem 1 4/7/94 Reactor Scram & Inadvertent Safety Injection Results in Solid RCS & Thermal Hydraulic Transient Limerick 9/11/95 Stuck Open SRV Leads to Plant Depressurization and RHR Pump Cavitation Clinton 9/5/96 Non-Conservative Operation While Isolating a Reactor Recirculation Pump Seal Leak Davis Besse 3/7/02 Reactor Pressure Vessel Head Degradation

We might instead have had this many events:

Limerick 9/11/95 Stuck Open SRV Leads to Plant Depressurization and RHR Pump Cavitation Clinton 9/5/96 Non-Conservative Operation While Isolating a Reactor Recirculation Pump Seal Leak Davis Besse 3/7/02 Reactor Pressure Vessel Head Degradation

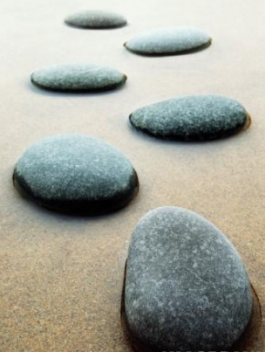
Leaders Create Culture
Reestablishing a SCWE - Restoring Trust

2002 PLAIN DEALER – 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.*

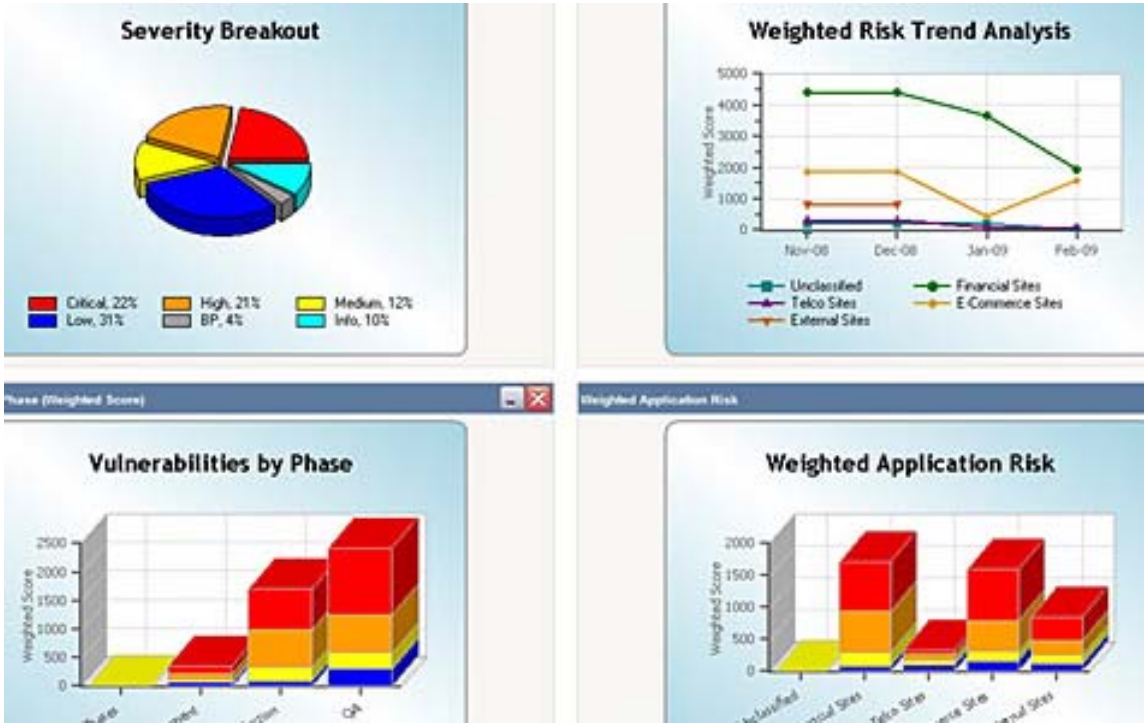
So we don't understand these issues because we never really studied them."

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment



Next Step

Learning to Assess Manage Regulate



Learning to Assess Manage Regulate
Are You Willing to Raise a Concern?

Are You Willing to Raise a Concern?

"If you knew of a situation that was making appendix B compliance impossible, would you raise this concern?" I am highly confident almost all employees would answer "yes" including the members of the pre-event Davis Besse management team.

But Davis Besse managers did not address this kind of issue. Part of what we need is to find out to assess culture if employees are afraid to take an ethical stand, afraid to fight (if necessary) for safety.

"Are You Willing to Raise a Concern?" Is really a specious question. A better question would be "if management was not addressing an issue you felt was important, and you wnet to ECP and it was still not addressed, what would you do?"

Learning to Assess Manage Regulate

Davis-Besse workers' repair job hardest yet
2002 THE PLAIN DEALER

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."

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?**

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.**

Learning to Assess Manage Regulate

Davis-Besse workers' repair job hardest yet
2002 THE PLAIN DEALER

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.

Learning to Assess Manage Regulate
What (Exactly) Are We Managing?

Managing defenses (Md) =
Managing Safety Culture =
Assuring the existence of acceptable
safety attitudes at the following four barriers:

Defense in Depth Barriers
Fourth - External Oversight (NRC, INPO)
Third - Internal Oversight (QA Department)
Second - Management
First – Worker

Obviously "External Oversight" cannot be assessed at the site, but **safety attitudes** at the other three barriers can.

So how (exactly) do we assess barrier **safety attitudes?**
[Let's look at the definition]

Learning to Assess Manage Regulate
What (Exactly) Are We Assessing?

Clear definition - HRO Safety Culture
Ethical leadership attitudes in a High Reliability Organization **that maintain the trust of all relevant stakeholders** that potentially hazardous activities are and will continue to be managed and operated at the lowest reasonable level of risk to people and / or the environment.

[Because leaders create culture] the definition is saying, the "safety attitudes" we need to assess to measure culture quality are the "ethical leadership attitudes" that "maintain the trust of all relevant stakeholders"

What "ethical leadership attitudes" are we talking about? How do we know this is what "maintains stakeholder trust?"

Learning to Assess Manage Regulate
What (Exactly) Are We Assessing?

If we read INPO HU training (carefully)

INPO HU training tells us that **leadership** maintains the "defense in depth" barriers (i.e. the organization safety attitudes, the safety culture) **and** it tells us **what leadership needs to do** to maintain these barriers. It tells us that managing safety culture is all about leadership.

Culture management (and regulation) is about **assessing whether leaders are maintaining the three site "defense in depth" barriers** at an acceptable level of quality such that the safety of operations is not significantly adversely affected.

Learning to Assess Manage Regulate
What (Exactly) Are We Assessing?

INPO Human Performance Training Literature:

"A robust safety culture **requires aggressive leadership** emphasizing healthy relationships that promote open communication, **trust,** teamwork, and continuous improvement.

Continuous improvement **needs ongoing leadership attention** to improve the plant's resistance to events triggered by human error (defense-in-depth).

Those in positions of responsibility must see themselves as leaders as well as managers to create an atmosphere of open communication. Therefore, **leadership is a defense.**

Interactions involving quality coaching and counseling will promote clear values and improve performance."

What is trust?

Trust is an expectation for future performance based on past performance. In the context of nuclear safety culture, it is demonstrating to stakeholders over an extended time that you are (consistently and continually) “doing the right things”.

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

MREB Management and Regulation of Ethical Behaviors.
A safety culture quality management approach based on the theory that the safety of operations relies on the following three fundamental ethical leadership (EIR) behaviors.

Commitment To Excellence
Leadership has to provide training, coaching, set expectations, do monitoring, reinforcement.

Commitment To Integrity
If a project is experiencing time or cost pressures you must not punish / blame staff for having schedule or quality problems, if under normal circumstances you would investigate what was wrong and provide the extra time, training, resources needed.

Commitment To Relationships
Leadership has to treat staff with respect, fairness, humanity (work / life balance) and value reporting so staff will continue to flag (and leadership can continue to fix) problems.

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

Trust (Culture) Management Processes

Assessment (Schein) *Corporate Culture Survival Guide*
Quality Management (Six Sigma) *Define Measure Assess Mange Regulate*
Corrective Actions Process (Drucker) SMARTER
Corrective Actions Program (Existing Site Program)

Fundamental and Rollup EIR Behaviors

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

TRUST FORMULA

Trust = Observed Ethical Behavior Over a Period of Time
= [Excellence + Relationships + Integrity] x Time

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
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Decision-making
Safety Policies
Continuous learning
Resources

Decision-making
Safety Policies
Accountability
SCWE
HIRD

Decision-making
Continuous learning
Resources
SCWE
HIRD

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".

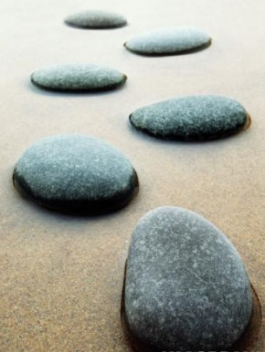
Learning to Assess Manage Regulate
How Do We Do an Objective **ROP** Assessment?

MREB Number

A number providing **an objective measure of site wide organization safety culture quality.** The MREB 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 (i.e. normalizing the result).

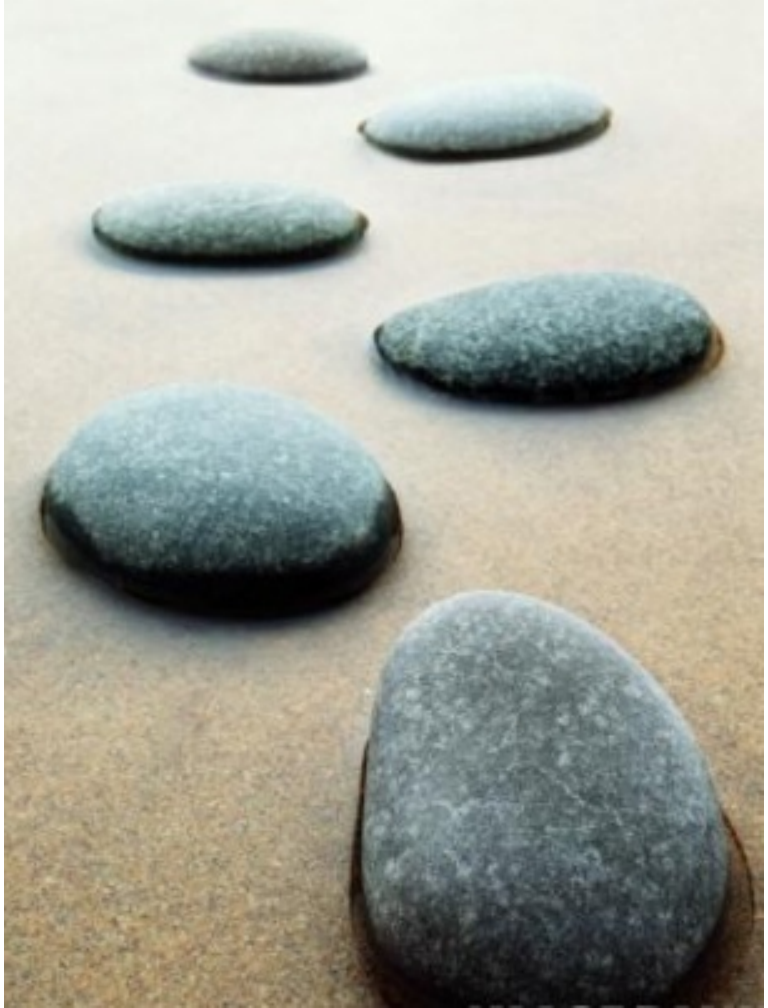
Example:

Site with 1,000 SRFA workers. SWIM results indicate a weak culture is affecting 200 SRFA workers, the MREB number would be (1000 – 200) / 1000 = 0.8 = 80%.



Next Step

Conclusions



Conclusions
Good Management Produces Safety

We have the necessary pieces we can begin
Minimal Regulatory Compliance is high risk (not good) management in a HRO. There are now successful safety culture management models both inside and outside of the nuclear industry that can be used to develop a program. All the necessary pieces are there for effective assessment, management and regulation, all that is required now is for NRC to pick them up and begin the “next step”.

What success looks like
Over the next few years we should see an industry-wide accredited program that is self-assessing and self-reporting (with a standard normalized objective threshold value). Only when the culture (quality, health) drops below the established threshold would a licensee report to NRC be required.

Better ROP assessments
Site wide culture heath leadership reports for SRFAs (safety related functional areas) would be made available as needed for NRC to triangulate NCVs NOVs against and evaluate whether violations have any managerial or cultural basis.

Conclusions
Good Management Produces Safety

INPO "Brainchild" Problem:

INPO (and NRC) Reluctance to Engage Academic or Subject Matter Experts on Issues Like Culture

Currently on the INPO Website:

Continuing Progress toward a Common Nuclear Safety Language
The NRC and INPO continue to make progress in their efforts to develop a common nuclear safety language. **Since the public meeting this last June** – at which leaders from the NRC and INPO discussed the initiative and formally stated the desired outcome of agreeing to common language – both organizations have been moving forward toward the next steps.

INPO / NRC "You are Just the Bird Dog, I am the Master" Attitude
A few months prior to June I flagged a number of significant language issues to NRC (in a public meeting) and to a number of culture-connected INPO managers. I believe (am not certain) that my actions spawned the above NRC / INPO communication actions, but there has been no acknowledgement of this from either INPO or NRC, and neither has communicated with me on this subject.

I believe the attitude of INPO (and NRC) is "you can point out an issue, but your involvement ends there, our executives will decide what to do with it."

Conclusions
Good Management Produces Safety

Industry Culture Assessment "Brainchild" Problem:

Schein says "culture surveys don't work"
Yet the industry continues to attempt to manage culture through surveys with dozens of questions, an unproven "brainchild" method. A number of top culture experts (MIT Schein, MIT Carroll, Tosan Marquardt, NRC Sorensen et. al.) have indicated that this kind of method either does not work, or has no clear link to the safety or operations.

The industry needs to move away from existing methods toward proven methods such as the Schein-based methods applied at Millstone during recovery and at the Naval Safety Center since1996. The NSC culture workshop method has (statistically demonstrable) impressive results and is currently being expanded to all branches of the military.

If we are to safeguard the health of the public (and the industry) we need to follow a similar tack.

Conclusions
Good Management Produces Safety

From: Ed Schein [mailto:scheine@comcast.net]
Sent: Friday, October 09, 2009 6:31 PM
To: David M Collins (Generation - 4)
Subject: Re: I am doing a presentation at NRC ACRS the afternoon of Nov 12th

Thanks for your note and the various items of information which I won't read immediately but which I am very glad to have as I work my way farther into this. On the use of my quotes, the one where I talk about INPO would now be out of date--they are paying attention to culture so it would not be appropriate for you to use that quote unless you put it in the context of the past.

The other thought for you to consider is that good management produces safety. When there are safety problems it usually means bad management somewhere in the system.

Conclusions
Good Management Produces Safety

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

Learning to Assess Manage Regulate
Comment on NRC Continuing to do “Same Stuff”

2002 ACRS Meeting

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.

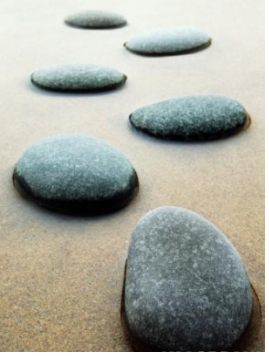
Conclusions
Good Management Produces Safety

In a dangerous situation we have chosen the most dangerous of courses - we have chosen not to face our danger!
- Edward Teller

Quis Custodiet Ipsos Custodes? (Who Will Oversee the Overseer)
-Roman Poet Juvenal

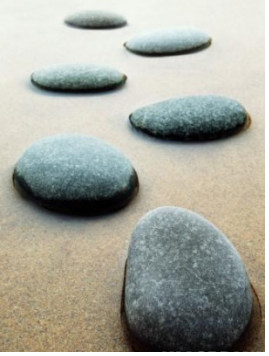
"NRC does not need to get into plant management, but NRC needs to ensure that the plant Management is into managing safety."
- Dave Collins

Q&A



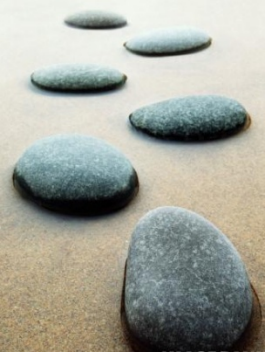
Glossary of Safety Culture Terms

ADRL	Arrogant, Dismissive, Refuses to Listen. Characteristic LEM behaviors identified by safety culture consultant John Beck. ADRL Management Team behaviors are toxic to the development of a healthy safety culture. ADRL behaviors block development of questioning attitude, continuous improvement, and a learning organization.
CCA	Culture Corrective Action. An area of culture weakness vetted by facilitated workgroup discussions. A CCA provides actionable information for culture remediation to the SLT.
CCWE	Cost Conscious Work Environment. An environment where a strong cost focus is appreciated and a safety focus beyond minimal regulatory compliance is denigrated.
CFA	Culture Focus Area. An area of potential culture weakness identified by a culture survey for focused investigation. A CFA provides no actionable information for culture remediation, no conclusions should be inferred.
Degraded	Reduced in rank, reputation, esteem or value
DLIL attitude	"Don't like it then leave" attitude. Manager attitude that an employee who does not accept an organizational (i.e. manager) decision (e.g. that a safety issue need not be addressed) must accept the decision or go work elsewhere. A manager with this attitude will take actions to encourage such an employee to leave, such as treating the employee with contempt, or damaging the employee's reputation in some manner such as fabricating evidence of poor performance (see FON).
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



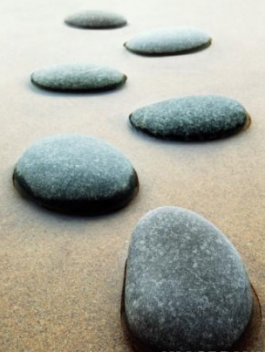
Glossary of Safety Culture Terms

DMDMR	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 ethical behavior in SRFAs, identify CFAs. *Analyze* the CFAs and determine if the LEB perceptions are valid MREB deficiencies. *Manage* leadership performance above a minimum SWIM level. *Regulate* sitewide culture performance above a minimum MREB performance level.
SWIM standard	An ethical quality standard applied to SRFA managers. The same standard that legislates (regulates) permissible behavior in a democratic society. If there is evidence of unethical behavior and more than 2/3 of a workgroup view it as adverse to safety, corrective actions are needed. The manager is provided summary results with written basis, written expectations for behavior changes, coaching is provided if desired (such as from a cohort in management who has demonstrated high SWIM scores) after three months a follow-up SWIM assessment is performed. If a manager does not show a trend toward a minimal acceptable performance after two periods (6 months) corrective action may include reassigning the manager to a non SRFA.
Ethic cleansing	WHISTLEBLOWER ISSUES IN THE NUCLEAR INDUSTRYCONGRESSIONAL 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. **“**



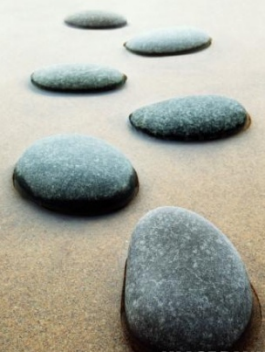
Glossary of Safety Culture Terms

Ethical Attitude	Concern for the impact of one's behavior on people or the environment.
FON	Fabrication of negatives. A common type of HIRD where a manager fabricates or exaggerates worker negatives with the intent of encouraging a worker to leave (see DLIL).
HEA	High Ethical Attitude. The belief that the culture in an HRO is insufficiently focused on protection / safety and overly focused on production / cost cutting.
Healthy Organization Culture	Organization culture where behavior aligns with the stated desired (espoused) values.
HEM	High Ethics Manager. A manager in a HRO that exhibits a HEA (high ethics attitude) characterized by behaviors that build trust, relationships and commitment to excellence.
HEW	High Ethics Worker. A worker in a HRO that exhibits a HEA (high ethics attitude).
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. An organization that operates and manages processes that have the potential to adversely affect human life or the environment. Example: a nuclear power operating organization.
Kings Afloat	A nuclear industry manager attitude identified in Perin **"**Shouldering Risks**"**. [*Some industry managers, especially Navy ex-officers, reenact the superior-subordinate role and brook no dissent. "Some industry managers still impose that requirement, and by random report some still scream and intimidate. Like captains of yore, some think of themselves as 'kings afloat'*]. If this attitude continues unchallenged (by subordinates) and uncorrected (by senior management) this can evolve into an accepted culture, can become **"**how we do things around here**"**.



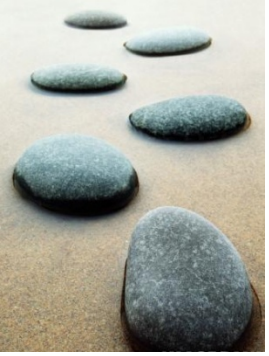
Glossary of Safety Culture Terms

LEA	Low Ethics Attitude. The belief that the culture in an HRO is overly focused on protection / safety and insufficiently focused on production / cost cutting.
LEB	Leadership Ethical Behavior. Leadership behavior demonstrating a sufficient HRO safety attitude.
LEM	Low Ethics Manager. A manager in a HRO that exhibits a LEA (low ethics attitude) characterized by ADRL, DLIL, FON, HIRD, NTP behaviors.
LEW	Low Ethics Worker. A worker in a HRO that exhibits a LEA (low ethics attitude).
MREB	Management and Regulation of Ethical Behaviors. A safety culture quality management approach based on the theory that the safety of operations relies on ethical management behavior.
MREB 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 MREB 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 MREB number would be (1000 – 200) / 1000 = 0.8 = 80%.
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.*



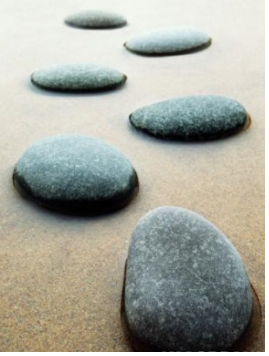
Glossary of Safety Culture Terms

NSE attitude	**"**Not Safe Enough**"** attitude. An employee (often HEW) attitude that indicates **"**I am more concerned with safety than cost**"**. If a SCWE environment has been established, promotion and advancement opportunities are increased by this attitude (decreased if a CCWE has been established).
NTP attitude	Not a Team Player. Manager 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 (High Reliability Organization)	An HRO employee attitude that reflects a commitment to continuous professional development, ethical practice, an understanding of and sensitivity to diversity, and a responsible attitude toward their profession, their stakeholders, and society.
Professionalism (Medical Organization)	From 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.
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.
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.



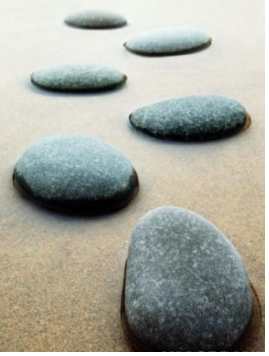
Glossary of Safety Culture Terms

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)	Ethical leadership attitudes in a High Reliability Organization that ensure potentially hazardous activities are managed and operated with a reasonable low risk to people and environment thereby maintaining the trust of all relevant stakeholders.
Safety Culture (new INPO definition)	An improvement over the old (vague) INSAG definition, but still not a real definition because it uses what is being defined (nuclear safety) is in the definition, and so is not actually defining anything: ***"An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority."*** For example, replacing the words **"**nuclear safety**"** (with anything) provides a generic definition of any kind of culture **"**An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make *cost cutting* 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 ethical attitude of individuals in a High Reliability Organization that ensures potentially hazardous activities do not harm people or the environment.



Glossary of Safety Culture Terms

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 Quality Management (Nuclear Power Organization)	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. In a nuclear power organization, it is the shared primary responsibility of the most senior site manager and the Chief Nuclear Officer (CNO).*
Safety Culture Quality Regulation (Nuclear Power)	Ensuring that safety culture remains ALARA (As Low As Reasonably Achievable) as a SOE contributing or causal factor by ensuring that the management team takes appropriate actions to maintain the trust of all stakeholders. *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.*
Safety Culture (OSHA)	An ethical attitude that helps ensure construction and maintenance activities are performed without injury.
Schein quote	Leaders create culture.



Glossary of Safety Culture Terms

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*.
SCW	Safety Culture Warrior. An extreme type of HEA employee that values safety above reputation or employment success. A SCW will continue to argue a position that the organization management team and (or) industry regulator do not support, and may view as unnecessary, unreasonable, or wasteful.
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.
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.