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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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RELIABILITY AND PRA SUBCOMMITTEE

OPEN SESSION

+ + + + +

TUESDAY

MAY 8, 2012

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear  
Regulatory Commission, Two White Flint North, Room  
T2B1, 11545 Rockville Pike, at 8:30 a.m., Dennis C.  
Bley, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

- DENNIS C. BLEY Chairman
- MICHAEL T. RYAN Member
- STEPHEN P. SCHULTZ Member
- JOHN W. STETKAR Member

1 NRC STAFF PRESENT:

2 DEREK WIDMAYER, Designated Federal Official

3 VALERIE BARNES, RES/DRA

4 ANDY CAMPBELL, OE

5 RANI FRANOVICH, NRR

6 STEPHANIE MORROW, RES/DRA/HFRB

7 SEAN PETERS, RES

8 MARIA SCHWARTZ, OE-CRB

9 UNDINE SHOUP, NRR/DRA/AHPB

10 DAVE SOLORIO, OE

11

12 ALSO PRESENT:

13 G. KENNETH KOVES, INPO

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

Time: 8:30 a.m.

CHAIRMAN BLEY: 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 Dennis Bley, Chairman of the Subcommittee -- the sub-subcommittee. ACRS members in attendance include Mike Ryan, Steve Schultz, and John Stetkar, and if possible, we may have some others wander in and out during the day from the meeting next-door.

The purpose of this meeting is to discuss the Office of Research White Paper, Independent Evaluation of INPO's Nuclear Safety Culture Survey and Construct Validation Study. The White Paper was prepared to address concerns expressed by ACRS members and comments attached to the Committee's letter report of December 15, 2010, on the agency's final Safety Culture Policy Statement.

The meeting this morning is open except for portions of the INPO presentations which will discuss proprietary information, and when we get there, let us know.

The Subcommittee will gather information,

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1 analyze relevant issues and facts, and will formulate  
2 proposed positions of actions as appropriate. The  
3 Subcommittee will report its findings at an upcoming  
4 full Committee meeting, but at this time does not plan  
5 on issuing a letter report on this matter.

6 Derek Widmayer is the Designated Federal  
7 Official for this meeting. A transcript for the  
8 meeting is being kept, and will be made available on  
9 the web. It is requested that speakers first identify  
10 themselves, and speak with sufficient clarity and  
11 volume so that they can be readily heard. Thank you.

12 We will now proceed with the meeting, and  
13 I call upon Dave Solorio, Branch Chief in the Office  
14 of Enforcement, to open the proceedings.

15 MR. SOLORIO: Thank you very much.

16 My name is Dave Solorio, Branch Chief,  
17 Concerns Resolution Branch, Office of Enforcement. I  
18 am here to kick off the presentation to you all today.

19 OE was asked to take the lead for the  
20 development of the Safety Culture Policy Statement,  
21 and the majority of the staff who did the work for me  
22 within the Office of Enforcement. That is why you  
23 find me up here kicking this off.

24 While OE was asked to lead the effort to  
25 develop the Safety Culture Policy Statement by the

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1 EDO, that was probably because of the longstanding  
2 expertise within the Office in the area of safety  
3 culture.

4 Prior policy statements had come out of  
5 the office. However, the Safety Culture Policy  
6 Statement is truly a superb team effort among a number  
7 of offices to work with our external stakeholders, to  
8 ensure we considered and utilized their input to  
9 develop the policy statement, and it has been  
10 recognized as a model effort by the Commission, FSME,  
11 NMSS, NRR, Research and the Regional Offices have all  
12 worked very collaboratively with OE to put together a  
13 policy that would speak to a wider spectrum of  
14 licensee environments.

15 What you will hear later from the nuclear  
16 power industry representative here today is that they  
17 have confirmed with their own independent efforts for  
18 their environment that to be the case.

19 We were here back last in November and  
20 December of 2010 presenting the work done to develop  
21 the Safety Culture Policy Statement as well as the  
22 industry's efforts to quantify the safety culture in  
23 their environment, and we appreciate the ACRS's  
24 endorsement of the work in their letter, and we are  
25 here today because of the Subcommittee's desire to

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1 have a more in depth discussion regarding some work  
2 done by the industry that attempted to quantify how  
3 safety culture might affect plant performance.

4 In addition, when preparing for this  
5 presentation, Research prepared the report that  
6 provided their evaluation of the industry's efforts in  
7 this area. The report was previously provided to the  
8 ACRS prior to today's meeting.

9 I want to also thank the Subcommittee  
10 Chairman and their staff for their efforts to help us  
11 prepare for today's presentation.

12 The research report was prepared in part  
13 as a result of the user need provided to Research to  
14 look at the industry's work. We saw the work that the  
15 industry as a chance to look at some empirical work  
16 and consider its results in the efforts undertaken to  
17 develop the Safety Culture Policy Statement.

18 So as my Director, Mr. Zimmerman, Mr.  
19 Royce Zimmerman, said last December when he was last  
20 in front of the Subcommittee, we used the user need as  
21 a vehicle to inform the development of the Safety  
22 Culture Policy Statement.

23 The Safety Culture Policy Statement was  
24 issued formally in the Federal Register last June, and  
25 the Commission's expectations are that all licensees

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1 and agreement state licensees strive to follow a  
2 positive safety culture as another way to contribute  
3 to enhancing safety of facilities regulated by the NRC  
4 and the agreement states.

5           Since that time, OE and program offices  
6 have been conducting a number of outreaches to the  
7 regulated community to foster the application of the  
8 Safety Culture Policy Statement under direction from  
9 the Commission, to ensure they have the necessary  
10 support to effectively employ the policy statement.

11           Feedback thus far is that the regulated  
12 community is embracing the Safety Culture Policy  
13 Statement and sees the value for working to emulate a  
14 positive safety culture. Many of them told us that  
15 they were already doing that.

16           I would like to just mention a little of  
17 our involvement in the area of safety internationally,  
18 which has really picked up over the last year. OE's  
19 efforts in the international community have included  
20 responding to several requests for presentations  
21 related to the development of our policy statement.  
22 They included requests from Russia, UK, and several  
23 South African nations and several European nations  
24 through the IAEA.

25           We have worked on a consultancy team to

1 aid in the development of a technical document for the  
2 regulatory oversight of safety culture, and have been  
3 successful in including our Safety Culture Policy  
4 Statement as an Appendix in that document, which will  
5 serve as an example.

6 We have also recently worked on a  
7 consultancy team at IAEA for the purpose of beginning  
8 the process of common language for safety culture  
9 attributes internationally. This is just the  
10 beginning of the process. We expect it will take a  
11 number of years to complete.

12 The group that made this request used the  
13 NRC Safety Culture Policy Statement traits as  
14 examples, along with some IAEA safety culture  
15 characteristics and the language which Japan uses to  
16 begin the dialogue. We continue to see a high level  
17 of interest in the Safety Culture Policy Statement  
18 internationally .

19 Also OE recently was requested to provide  
20 a presentation to the G8 National Security Group by  
21 the State Department. The group was very interested  
22 in the efforts the NRC has engaged in with respect to  
23 the development and publication of the Safety Culture  
24 Policy Statement.

25 The G8 National Safety and Security Group

1 recognizes the importance of safety culture, and will  
2 be recommending endorsement of the IAEA Safety Culture  
3 Action Plan which was developed in response to  
4 Fukushima. Our presentation on the Safety Culture  
5 Policy Statement, as well as the information from the  
6 private industry, was instrumental in providing this  
7 group with the information they needed to make this  
8 decision.

9 Now I want to turn to what I consider the  
10 enjoyable part of my presentation, and introduce those  
11 here to my right who are going to speak to you today  
12 to help explain the research in this area and the  
13 results of industry study and our evaluation of it.

14 Dr. Val Barnes is a Senior Technical  
15 Advisor, to my right, for human factors in the Office  
16 of Nuclear Regulatory Research, Division of Risk  
17 Analysis. She has a Master's degree in organizational  
18 psychology and a Ph.D. in social psychology from the  
19 University of Washington.

20 Dr. Barnes has over 30 years of  
21 international experience researching human and  
22 organizational factors in the NRC. When I was  
23 reviewing the user need again recently, I noticed --  
24 I reminded myself that Val was instrumental in helping  
25 us craft the Safety Culture Policy traits in the ROP

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1 initially, and helped revise them.

2 Dr. Stephanie Morrow, to her right, is a  
3 Human Factors Analyst with the Human Factors and  
4 Reliability Branch in the Office of Nuclear Regulatory  
5 Research, Division of Risk Analysis. She has a Ph.D.  
6 in industrial/organizational psychology from the  
7 University of Connecticut, and nine years of  
8 experience with survey development and safety culture  
9 research. Dr. Morrow has been with the NRC for just  
10 a year, and previously worked for the Department of  
11 Transportation.

12 To Stephanie's right is Dr. Ken Koves with  
13 the Institute of Nuclear Power Operations.

14 Dr. Koves has a Ph.D. in  
15 industrial/organizational psychology from Georgia Tech  
16 and has been working in the area of organizational  
17 culture for over 20 years in the telecommunications  
18 and nuclear power industries.

19 Ken first approached me about three years  
20 ago when we got started on working on the policy  
21 statement as a result of a meeting that the EDO had  
22 with INPO in Atlanta to talk about trying to align  
23 terminology between the reactor oversight program and  
24 NRC's Safety Culture Policy traits that lived in ROP,  
25 and he has been very instrumental in helping us get

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1 information and move forward in this effort. I want  
2 to thank him for that.

3 So without further ado, i will turn it  
4 over to our next presenter.

5 DR. BARNES: I wanted to start out today  
6 by giving a little bit of an update on what has been  
7 going on in the research related to safety culture  
8 from the standpoint of an organizational psychologist  
9 who likes to measure things as opposed to the  
10 anthropological approach or a sociological approach  
11 that focuses on organizational literature that has  
12 been looking at safety culture, has been on attempts  
13 to measure it, and evaluate the relationship between  
14 safety culture and safety performance.

15 The basis of that kind of research, of  
16 course, comes from an assertion and underlying belief  
17 that organizational factors are important to  
18 organizational safety performance. Of course, the  
19 question has always been which organizational factors,  
20 how do you assess them, how strong the relationship  
21 is, let alone how could an organization like the NRC  
22 possibly incorporate organizational factors into a  
23 regulatory oversight regime.

24 Well, the concept of safety culture hasn't  
25 answered all of these questions, but it has given us

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1 some new ways of thinking about organizational  
2 factors' relationship with safety, and it has helped  
3 improve the focus of the research that has been going  
4 on.

5           The initial work that was done on the  
6 relationship between "safety culture" and safety  
7 performance was actually -- The initial study was  
8 actually performed in 1980 by an Israeli researcher  
9 before Chernobyl occurred, and the term came into  
10 common use in our industry.

11           This individual came up with some exciting  
12 results which, I know, are less than thrilling in the  
13 engineering environment, but he was able to find a  
14 relationship, a correlation of about .2 between his  
15 measures of safety culture, although this area of  
16 research is safety climate research within the  
17 literature, but we are not going to go there. He  
18 found a relationship of about .2, which for  
19 psychologists was quite exciting and it was  
20 provocative, between his measure of safety culture and  
21 the safety performance measures that he had available.

22           I say it was exciting to us, because a low  
23 correlation, even at the .2 level or even lower as  
24 long as it is statistically significant and reliable,  
25 can actually be useful.

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1           Last time we got together and talked about  
2 this, we talked about a few examples, but one of them  
3 that came to mind in preparing for the presentation  
4 was the relationship between high school grade point  
5 average and first year college grades. That  
6 correlation runs also at about the .21 to .23 level.  
7 The correlation between SAT scores and first year  
8 college grades is only slightly higher.

9           So, you know, colleges use high school  
10 grade point and SAT scores in making their admissions  
11 decisions, even though those relationships are not in  
12 the .9 type of level that we would want to see for  
13 doing the engineering work to build a bridge, and so  
14 on.

15           CHAIRMAN BLEY: Although we might mention  
16 that the number of prominent colleges have backed away  
17 from using the SATs in recent years, because they  
18 don't find it predictive at all.

19           DR. BARNES: Right.

20           MR. SOLORIO: I definitely want to find  
21 out which ones for my sons.

22           DR. BARNES: So in the 30 years since that  
23 initial study was done, there actually has been some  
24 progress made in understanding the relationship  
25 between safety culture and safety performance, and so

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1 I am going to talk a little bit about that.

2 For the folks who like to try to measure  
3 these concepts, there is a set of interrelated  
4 hypotheses that underlie the research. First of all,  
5 there is the hypothesis that the attitudes and beliefs  
6 of members of an organization provide insights into  
7 the organization's safety culture.

8 Now the attitudes and beliefs of the  
9 members of an organization don't reflect the totality  
10 of an organization's safety culture, but it is a way  
11 to obtain some insights into what is going on in the  
12 culture.

13 The idea behind this hypothesis, of  
14 course, is that culture is a social phenomenon. It  
15 arises as a result of the social interactions between  
16 members of a group. Members of a group learn the  
17 culture through those interactions. They experience  
18 it in their day to day work environment.

19 In response to those social interactions,  
20 they develop attitudes and beliefs about what is  
21 important in the organization, what the rules of  
22 behavior are in the organization, and those attitudes  
23 and beliefs can be measured, and that is where we get  
24 this plethora of questionnaire survey research studies  
25 that are being done, because those surveys are

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1 designed to help measure organizations' attitudes and  
2 beliefs about what is going on inside their  
3 organization's safety culture.

4 Now a second hypothesis here is that the  
5 employees' views, or the organization's members' views  
6 about what is important around here, the  
7 organization's values, and how we do things around  
8 here, the organization's norms, have an influence on  
9 their workplace behavior.

10 In our case where we are talking about  
11 safety, it is the assumption that their attitudes and  
12 beliefs with respect to the safety culture have an  
13 impact on their safety related behaviors.

14 Then a third underlying assumption or  
15 actually testable hypothesis here is that individuals'  
16 workplace decisions and actions, their behavior,  
17 affects the organization's safety performance.

18 So that is the framework for the research  
19 that has been going on in safety culture over the last  
20 30 years.

21 Now in the beginning when this research  
22 was just getting started, it wasn't very  
23 sophisticated. The model essentially was: To measure  
24 safety culture, let's measure attitudes and beliefs,  
25 and we will see what the correlation is to measures of

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1 safety performance that are relevant for the  
2 environment that we are working in. So probably the  
3 first 10-15 years of the work that went on in this  
4 area was focused on, okay, which attitudes and beliefs  
5 do we need to measure to be able to identify that  
6 relationship to safety performance.

7 That is where the initial research and the  
8 continuing research has come from with respect to  
9 identifying the dimensions or traits of safety culture  
10 that are important for safety performance.

11 Then a second piece of this, which is what  
12 INPO did in this study during this first decade or so  
13 of safety culture research, has been, okay, Zohar back  
14 there in 1980 found a relationship between safety  
15 culture and safety performance in the industry that he  
16 was studying. Can we find a similar kind of  
17 relationship in our industry?

18 So there have been a lot of studies where  
19 researchers have gone out and looked at the safety  
20 culture/safety performance relationship in  
21 manufacturing settings, hospitals, construction  
22 settings. They have been asking, you know, does the  
23 same relationship hold internationally?

24 Essentially, the research has continued to  
25 show that, yep, the relationship generally holds,

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1 although again it is at the relatively weak level, at  
2 the .21 maybe to .40 level in those studies.

3 Now within the last few years -- I would  
4 probably say the last five to 10 years -- the  
5 relationship -- the research has gotten a little bit  
6 more sophisticated as our methods have improved and  
7 our theoretical -- you know, and what we have learned  
8 about safety culture has expanded.

9 So that at this point in time the kind of  
10 research that is going on is more focused on  
11 understanding what are the intervening variables  
12 between safety culture and safety performance that  
13 have an impact on how strong that relationship is? A  
14 number of intervening variables have been identified,  
15 and more are on the way.

16 The research has been looking in  
17 particular and borrowing from another area of research  
18 in the area of measurement psychology, which is the  
19 area of the attitude/behavior relationship. You can  
20 see that in the middle of the slide here where we talk  
21 about attitudes, norms, personal agency over to the  
22 little symbol of behavior.

23 This area of research is more than 70  
24 years old. It really took off in World War II, and  
25 the focus of the research has been on understanding

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1 and predicting behavior based on the attitudes and  
2 beliefs that people carry around, with the eventual  
3 goal of being able to influence behavior.

4 So the results of this research -- and  
5 literally, there have been thousands of studies on the  
6 attitude/behavior relationship by now -- has shown  
7 again a moderate size relationship between attitudes  
8 that you measure with a questionnaire and people's  
9 behavior in the end, but they have learned a lot of  
10 about what moderates that relationship.

11 The slide shows a number of the factors  
12 that moderate the relationship between attitudes and  
13 behavior, including the specificity of how you measure  
14 the attitude and the behavior, social influences from  
15 important others. The personal characteristics of  
16 individuals has an impact on the relationship between  
17 their attitudes and particular kinds of behavior, as  
18 well as characteristics of the situation in which they  
19 might perform the behavior.

20 So for example, with respect to the  
21 specificity of the attitude and the behavior when it  
22 comes to measuring and predicting behavior from  
23 attitude, if you want to find out, for example, if  
24 somebody is going to go for a bike ride at 4:30 this  
25 afternoon, you want to ask them, you know, do you

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1 intend or are you favorably disposed to going for a  
2 bike ride at 4;30 this afternoon, rather than asking  
3 them what their attitude is overall toward exercise or  
4 bike riding. Right? The relationship is much stronger  
5 the more specific you are about the behavior -- the  
6 attitude toward the behavior that you want to measure.

7 In fact, depending on how well attitudes,  
8 norms, and these other components of the  
9 attitude/behavior relationship are measured, we see  
10 correlations as high as .7 or .8, which is very high  
11 in the social sciences. This matters for certain  
12 research topics like voting behavior, of course,  
13 purchasing decisions, marketing research. You want to  
14 be able to influence and predict people's behavior.  
15 That has been the impetus for a lot of this research.

16 So by doing a good job at measuring these  
17 components, you can get a stronger relationship. Of  
18 course, attitudes: We have been talking about  
19 someone's degree of favorability or unfavorability  
20 toward a particular behavior.

21 You would want to measure the norms that  
22 the person is operating under in terms of what they  
23 believe that important others do with respect to that  
24 behavior, and how important they perceive that  
25 performing that behavior is to important others; and

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1 then personal agency refers to whether the person  
2 believes that they actually can perform the behavior  
3 and the extent to which they have the wherewithal or  
4 ability to overcome any barriers that might exist  
5 between their attitude, their favorable attitude  
6 toward performing the behavior, and actually being  
7 able to do it.

8 So attitudes, norms, and personal agency  
9 together determine someone's intent to perform a  
10 behavior and how strong their intent is. But even if  
11 someone has an extremely strong motivation to perform  
12 a behavior and intend to do it, real life can  
13 interfere.

14 For example, you know, I might have a  
15 strong desire and all the motivation in the world to  
16 go bike riding at 4:30 this afternoon, but if I get  
17 out there and I have a flat tire on my bike, I am  
18 either going to give up for that day or be delayed in  
19 doing it.

20 Similarly, you might have all the  
21 motivation and intent in the world to go vote, but you  
22 don't have a ride or the bus doesn't run, and you miss  
23 being able to get to the polling place.

24 So the relationship then between attitudes  
25 and behavior is moderated by these kinds of factors.

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1           Now what does the attitude/behavior  
2 relationship have to do with safety culture? Well, it  
3 is useful for understanding the influences on  
4 individuals' workplace safety behaviors.

5           So the question arises, where do people's  
6 attitudes about safety, the norms about safety, their  
7 sense of personal agency about safety behavior come  
8 from? The concept of safety culture helps provide  
9 some answers to those questions.

10           MEMBER RYAN: I've got a quick question.  
11 I am thinking in my own experience of a job that  
12 doesn't really take a lot of sophisticated protective  
13 clothing, a mechanical job of some kind. Now I get  
14 that same job where I in a full PC. I have seen two  
15 very different reactions to the work environment or  
16 the success of the work environment based on those  
17 extra requirements: This is uncomfortable. It is  
18 hot, all those kinds of things.

19           DR. BARNES: Right.

20           MEMBER RYAN: So where does that fit in on  
21 your --

22           DR. BARNES: That would be the situational  
23 barriers.

24           MEMBER RYAN: The situational barriers?

25           DR. BARNES: Yes. You know, and

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1 motivation, of course, as well.

2 MEMBER RYAN: Some people feel  
3 claustrophobic in protective clothing or a mask, and  
4 others don't. So you tend to pick people who don't  
5 mind that environment.

6 DR. BARNES: Right.

7 MEMBER RYAN: Even though they might not  
8 have the same skill level in the activity itself, the  
9 pump replacement or the mechanical or electrical work,  
10 but they are kind of getting judged on their overall  
11 ability to perform it, not just the one  
12 characteristic. Does that make sense?

13 DR. BARNES: Yes. Go ahead.

14 DR. KOVES: Plus, I just think another  
15 variable that comes in there very often that I have  
16 seen is their kind of risk perception. Is it a really  
17 risky thing, either for me personally or for the plant  
18 overall? And if it is high risk they are more willing  
19 to do all that stuff, and if it is low risk, then  
20 they are less.

21 MEMBER RYAN: So that is the perception of  
22 value.

23 DR. KOVES: Right. Just another variable  
24 that comes in and hits that behavior.

25 MEMBER RYAN: Thank you.



1 DR. BARNES: So you want really strong  
2 norms, and you also want strong consequences for  
3 failure to comply, to try to encourage compliance  
4 behavior, despite the discomfort and claustrophobia  
5 and dislike. That is where leaders, supervisors, and  
6 peers come in.

7 MEMBER RYAN: And that is all -- Risk  
8 level awareness is what I call that, because you  
9 really have to make people aware of the risk level  
10 that they are going into; and even though it looks  
11 like you have a job which has a lower risk level, it  
12 is really not, for these reasons and so forth.

13 DR. BARNES: Right.

14 DR. KOVES: Or this one really has more  
15 risk associated with it than you think it does.

16 MEMBER RYAN: Yes, and here is why, and  
17 here is what why we need you to do it this way, and so  
18 on.

19 DR. KOVES: Right. Exactly.

20 MEMBER RYAN: And try and get buy-in for  
21 whatever the task is. Thank you.

22 DR. BARNES: Yes. So with respect to how  
23 safety culture has an impact on the behaviors that we  
24 care about, the research has continued and has been  
25 showing, not surprisingly, that people in different

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1 roles in the organizations have differential kinds of  
2 impacts on these intervening factors between safety  
3 culture and actual behavior.

4 Leaders, of course, set the stage in the  
5 organization for the organization's attitude toward  
6 safety as a whole. They establish the policies, of  
7 course. They play a very important indirect role in  
8 terms of allocating resources. It is leaders that  
9 decide how much money we are going to spend on  
10 training, for example, how much money we are going to  
11 spend on benchmarking, how much money we are going to  
12 spend on safety equipment.

13 Then leaders also, to the extent that they  
14 are visible to the workforce anyway, model behaviors.  
15 In our industry, one that we frequently hear about is  
16 -- They model the behaviors. The example that we see  
17 in our industry of senior leadership often modeling  
18 how important safety is in their organization would be  
19 extending an outage to make a repair to a system that  
20 they could delay, but they want to make the point that  
21 safety is important. So they add a couple of days or  
22 maybe even up to a week to an outage to get that  
23 repair done. So that would be an example of modeling  
24 the importance of safety in the organization.

25 Leaders, the research is showing, have

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1 actually, like I said, more of an indirect  
2 relationship, even though their role is critical;  
3 whereas, in the day to day workplace it is supervisors  
4 that have more direct and strong impact on worker  
5 behavior because, of course, they are the individuals  
6 that administer rewards and sanctions for following --  
7 procedure compliance or violating them. They are the  
8 individuals that actually interpret the leaders'  
9 policies and bring it down to what happens in the day  
10 to day work group.

11 Now peers also have a role to play in  
12 terms of reinforcing norms. Peers also control a lot  
13 of information that you need in terms of being able to  
14 do your job in many different types of jobs. Our very  
15 own Dr. Morrow here did a study that was published not  
16 too long ago demonstrating that co-worker -- that  
17 perceptions of co-workers's views about the importance  
18 of safety are probably less important than we might  
19 have thought about.

20 So we are learning more about some of  
21 these intervening variables and what is important  
22 about safety culture.

23 CHAIRMAN BLEY: You just mentioned that as  
24 an aside, but was that done here or was that --

25 DR. MORROW: No, before I came here, and

1 it was basically that kind of the individual's  
2 perception of the tension between productivity and  
3 safety and the management's commitment to safety, that  
4 perceptions of that were more important than just the  
5 co-workers' and peers' perceptions.

6 MEMBER RYAN: So at the end of the day,  
7 that little equation proves who is the real leader of  
8 defining safety along that peers group, working group,  
9 and supervisors group.

10 DR. MORROW: Of those three things, what  
11 we expected was that it would be the managers, but  
12 actually, it was kind of more general than that, and  
13 that it was that tension between productivity and  
14 safety which is partially informed by the managers,  
15 but it is broader than just your direct supervisor or  
16 your supervisor's supervisor. It is about how the  
17 entire organization is running and kind of the  
18 organizational commitment to safety.

19 CHAIRMAN BLEY: I would be interested in  
20 seeing your paper.

21 DR. MORROW: Sure. Most definitely.

22 MEMBER RYAN: My own experience is -- and  
23 maybe Dennis might be the same -- is that typically a  
24 younger worker or a newer worker to the organization  
25 will tend to look at a more senior worker or somebody

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1 who has been there a long time as to what is the right  
2 answer. They have seen more variation among all those  
3 variables, and they could kind of say, well, here is  
4 where the -- not saying it exactly this way, but tell  
5 you what the mean behavior is to get through.

6 MEMBER SCHULTZ: But I would also suggest  
7 they would be influenced by their peers, too. So I  
8 would be interested in taking a look at your paper.  
9 I want to know if it varies by age of worker, as an  
10 example.

11 DR. MORROW: That is a good question to  
12 look at..

13 MR. WIDMAYER: Was that in the nuclear  
14 power industry, Stephanie, or is it a different  
15 environment?

16 DR. MORROW: No, it was in transportation,  
17 railroads.

18 MEMBER SCHULTZ: So you have a commitment.  
19 In the context of that type of study, are you  
20 considering workplace safety or are you considering  
21 the safety of the enterprise? I am trying to draw a  
22 parallel between nuclear safety and worker safety in  
23 the nuclear industry versus what you may have studied  
24 in transportation.

25 DR. MORROW: It was more worker safety,

1 you are right, in that more kind of the behaviors like  
2 wearing personal protective equipment, following kind  
3 of the safety rules, which are mostly for the benefit  
4 of the worker. There is not as much -- Particularly,  
5 it was mostly like maintenance organizations in a  
6 railroad environment.

7 So they are moving the heavy pieces of  
8 equipment within the railyard, not so much out on  
9 track going across country where you have that risk of  
10 hitting someone or something like that.

11 MEMBER STETKAR: You didn't look at  
12 correlations between those attitudes and axles falling  
13 off rolling stock, though?

14 DR. MORROW: No. No, we didn't have that  
15 data for this study.

16 DR. BARNES: This is actually great  
17 conversation to talk about at this point, because that  
18 was the next step, was to talk about relationship  
19 between behavior and organizational safety  
20 performance, which is another issue complicating the  
21 relationship between safety culture and safety  
22 performance. Those of you that work in the area of  
23 HRA know how complicated this can be.

24 CHAIRMAN BLEY: Yes. One thing I would  
25 just mention here, because everything you have talked

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1 about and everything I read in the papers is searching  
2 for these, I will call them, relationships.

3 When you turn the problem around, though,  
4 and you see bad events happening, if not 100 percent,  
5 I bet it is something like 80 percent or more of the  
6 cases, when you really dig in, you find there are some  
7 of the factors this project has defined as factors  
8 affecting safety culture that are negative and are  
9 partially responsible for those events.

10 So there you see a fairly strong  
11 relationship between negative factors being coupled  
12 with bad events, and I suspect it is a much stronger  
13 relationship than some of the ones we are seeing by  
14 trying to relate overall score in a safety culture  
15 sense against a particular facility's overall  
16 operations where you have so many other confounding  
17 factors going on and affecting things.

18 DR. BARNES: Absolutely.

19 CHAIRMAN BLEY: But you don't -- We are  
20 not pushing on that side of it very much in this work.

21 DR. BARNES: But we are, and that is what  
22 I want to talk a lot about. I want to talk for a few  
23 minutes here about what you just said, which is that  
24 the relationship between individual behavior or even  
25 patterns of behavior that evolve in an organization

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1 and organizational level safety consequences where you  
2 have to look at or are looking at counts of very rare  
3 events, airplane crashes, events in nuclear power  
4 plants, even OSHA reportable accidents. It is a  
5 complicated issue.

6           How do we measure safety performance? And  
7 it is not a one-to-one relationship at all between  
8 individual behavior and organizational level outcomes.  
9 You will recognize this from this concept of the Swiss  
10 cheese model from our friend, Jim Reason, who of  
11 course, has talked to us about the extent to which  
12 patterns of safe or unsafe acts or even momentary  
13 slips or mistakes will impact safety performance, and  
14 that depends on the kind of tasks that the person is  
15 doing as well as the extent to which we have got  
16 organizational barriers or engineering barriers and  
17 other methods to prevent the act or mitigate the  
18 consequences of unsafe behavior.

19           To talk a little bit about the design of  
20 jobs or the tasks that people perform and the  
21 relationship of behavior in those environments to  
22 safety performance, I wanted to talk about an example  
23 of nurses' behavior with respect to needle sticks or  
24 transmittal of infections in hospitals.

25           Nurses' unsafe acts can have immediate and

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1 important effects for not only their own occupational  
2 safety but also for patient safety overall. So this  
3 is an example of a job where individual behavior and  
4 important safety outcomes are closely linked.

5           You probably are all familiar with the  
6 research and theory that is talked about, tightly  
7 coupled behavior and safety performance. So in those  
8 kinds of environments where an individual behavior can  
9 have immediate and direct impacts on some kind of  
10 important safety outcome where they are tightly  
11 coupled, we are going to see a stronger relationship  
12 between behavior and safety performance than we will  
13 in other kinds of task environments where there is not  
14 that close relationship and direct relationship in  
15 time.

16           For example, a finance organization -- you  
17 know, a finance work group within an organization, if  
18 they are sloppy or do a bad job, may eventually have  
19 some impact on the overall safety and functioning of  
20 the organization, but a pattern of unsafe or  
21 undesirable acts within a finance group is going to  
22 have a lot lower relationship with eventual safety  
23 performance.

24           So a big question in this research, as you  
25 guys have brought up, is what are the right measures

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1 for assessing safety performance, if you are trying to  
2 look at the relationship between safety culture and  
3 safety performance?

4 Across the research there have been  
5 different categories of measures as well as different  
6 levels of analysis. As we have been mentioning, a lot  
7 of the studies have been done on occupational safety  
8 measures, the OSHA accident and injury rates,  
9 certainly patient safety.

10 There has been a move in the last five  
11 years or so to focus more on measuring safety  
12 performance by looking at near-misses or what is being  
13 called micro-accidents.

14 Then, of course, there is looking at human  
15 error rates, if you can identify them, patterns of  
16 behavior with unsafe acts, and then self-reports of  
17 injuries, errors, near-misses, because self-reports  
18 often show higher rates of these kinds of phenomena  
19 than your OSHA reportables or report of your more  
20 objective measures.

21 So the research has been done using these  
22 kinds of safety performance measures, as well as  
23 looking at individual behavior, not only self-reports  
24 about I always wear my earplugs or I always follow the  
25 procedure, but also work has been done sending

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1 researchers or others into the field with the workers  
2 and having them make observations about the frequency  
3 with which workers engage in either safe or unsafe  
4 behavior, however that is measured.

5 Work has been done looking at developing  
6 safety performance measures for work groups. Then, of  
7 course, we have got safety performance measures like  
8 we have mostly in the NRC kinds of performance  
9 indicators and measures that look at whole  
10 organizations, whole sites. Other work here has been  
11 looking at whole hospitals or entire companies.

12 In general, the strength of the  
13 relationship that we see in the research literature  
14 between safety culture and safety performance depends  
15 on what you are looking at and at what level of  
16 analysis.

17 If you are looking at individuals, the  
18 correlations between individual attitudes and beliefs  
19 about safety culture and safety behavior are medium to  
20 large in social science terms. In terms of  
21 organizational level or in terms of safety performance  
22 outcome measures, it depends on, like I said, what  
23 kind of task the individual is performing, how strong  
24 that relationship is.

25 If you look at the behaviors of work

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1 groups and you look at their safety behavior as your  
2 outcome measure, again we get medium to large  
3 correlations; and if you look at aggregate measures of  
4 safety performance outcomes -- for example,  
5 accident/injury rates for work groups -- you also get  
6 medium to large correlations.

7           When you start looking at organizations as  
8 a whole, the relationship between safety culture at  
9 the entire organizational level is fairly small. We  
10 are down at that .2 level again, and in terms of  
11 individual behaviors and in terms of overall  
12 organizational level safety performance outcomes, you  
13 get small to medium results. This is across  
14 industries, across measures.

15           So it is not -- So it requires some care  
16 in how you approach the measures that you are working  
17 with and some thought in evaluating the strength of  
18 the correlations that you see in any of the research  
19 literature that has been being performed up until now.

20           So all of the foregoing was essentially  
21 just to talk about how the relationship between safety  
22 culture and safety performance is more complex than  
23 the bubble and triangle model would initially suggest,  
24 and that there is a lot of intervening factors, of  
25 course, that moderate the strength of that

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1 relationship, in addition to which it is very  
2 important to understand how both safety culture and  
3 safety performance are being measured when you are  
4 evaluating research studies in these areas.

5 So all of the foregoing is academically  
6 interesting, but what actually matters is: Is this  
7 research turning out to be useful? In fact, a lot of  
8 organizations are using safety culture type survey  
9 research for several different purposes.

10 One, of course, is to do internal and  
11 external benchmarking. More importantly, a lot of  
12 organizations are using these safety culture surveys  
13 to identify areas in need of improvement. They are  
14 using the information that they are collecting plus,  
15 of course, additional information to help design  
16 interventions, organizational interventions, to help  
17 improve safety performance. Then they are using these  
18 surveys at mid-points and down the road as part of  
19 their assessment about whether their interventions  
20 have been successful or not.

21 Here are some examples of some of the  
22 outcomes of the safety interventions that have been  
23 undertaken to improve safety performance across a  
24 variety of industries. These are pretty exciting  
25 results. You know, 30 percent decrease in unsafe acts

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1 is a pretty valuable outcome.

2 The 70 percent decrease in the ventilator-  
3 associated pneumonia rates across Michigan hospitals  
4 is especially exciting. This study just was published  
5 in February, and some of the estimates said, you know,  
6 it is valuable not to put patients through pneumonia  
7 when they are exposed to having to be on a ventilator,  
8 in the first place, but they are also estimating that  
9 they are saving about 1,000 lives a year as a result  
10 of the safety culture interventions that they have  
11 implemented.

12 CHAIRMAN BLEY: In these examples you have  
13 put up here, was the definition of safety culture  
14 within these facilities and industries essentially the  
15 same as what came out of our work? It is not real  
16 clear what they were trying to change. What did they  
17 change to get these kind of results? Can you talk  
18 about that at all?

19 MEMBER SCHULTZ: Let me add a question.  
20 Was the intervention due to the culture of the  
21 organization or are there basically engineering  
22 barriers that were applied to have caused this effect?

23 DR. BARNES: Both. Both. The culture  
24 survey identified -- helped them identify areas where  
25 there were cultural type problems going on as well as

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1 areas that could be improved by the application of,  
2 for example, engineering barriers, the introduction of  
3 checklists.

4 In fact, you know, I would be very  
5 surprised in our industry if we were able -- Ken can  
6 speak to this, will speak to it, I think, better. But  
7 the 70 percent decrease in the pneumonia rates -- a  
8 significant portion of that had to do with improving  
9 communications among physicians, nurses, and the team  
10 members in changing the flavor or tone of those  
11 communications, the cockpit resource management type  
12 change of attitude where the physician decision makers  
13 listened more to the ICU nurses. But they also got  
14 big bang for the buck by implementing checklists.

15 CHAIRMAN BLEY: People in that field are  
16 getting famous now writing books about checklists.

17 DR. BARNES: Yes. I mean, we have used  
18 checklists and procedures forever in our industry.  
19 So, you know, it is hard to imagine a behavior that we  
20 would want to change where introducing a checklist  
21 would have a big impact. Communications? Probably we  
22 could have some significant impacts on safe behaviors  
23 and overall safety performance by interventions  
24 directed at that, but the problems -- The weaknesses  
25 were identified initially using the Safety Culture

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1 Survey as a screening tool to help identify  
2 weaknesses.

3 Then, of course, they had to go in and do  
4 interviews and evaluate the work environment and get  
5 a more detailed root cause level understanding of what  
6 was going on, and then use that information to design  
7 and implement the interventions. They measured  
8 progress as they went along, with additional  
9 administrations of the survey.

10 As the safety culture scores on the survey  
11 improved at the work unit level, they started seeing  
12 these improvements in pneumonia rates, you know, fewer  
13 infections in their ICUs and so on and so forth. So  
14 the research is showing that this can provide some  
15 useful results.

16 MR. WIDMAYER: I have another question for  
17 you. Because these can be just as enlightening, is  
18 there a bullet that you could put here where there was  
19 no increase or decrease in what they were trying to  
20 measure?

21 DR. BARNES: Tons, yes.

22 MR. WIDMAYER: It gives you a chance to  
23 look at the trait and say, okay, maybe this trait  
24 isn't as important as we had initially thought it was,  
25 and we don't need to measure it anymore, or something.

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1 DR. KOVES: I think you can get to that  
2 point in certain ways, but if you have incidents where  
3 they say, hey, we need to work on this, and they don't  
4 succeed in changing anything, the place I would look  
5 first is, okay, how did you try and change it.

6 I think that is where those  
7 implementations fail most of the time, at least in my  
8 experience, is in the implementation and how they try  
9 to do it. However, I think we do have some data you  
10 might see later where one of these traits in certain  
11 areas is predictive, and most of the time it is not  
12 really very predictive or very useful, actually, so it  
13 is so consistent across the industry and across the  
14 station. There's no variant cells, not very good.

15 CHAIRMAN BLEY: My only problem with this,  
16 as you said -- and I think all four of these cases --  
17 we have been doing the kinds of things that helped  
18 them for a long time. So we are looking at some other  
19 kinds of perhaps marginal gains. I don't know if  
20 there are any big gains out there to be had, but  
21 seeing these doesn't help us know we will do well.

22 DR. BARNES: Well, they are not in nuclear  
23 settings. So until we have got research that  
24 demonstrates this or looks at this in nuclear  
25 settings, we can't say for sure that these kinds of

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1 results generalize or how this kind of research and  
2 organizational intervention approach would benefit or  
3 not.

4 Now that is the kind of work that Ken does  
5 at INPO, but he is not publishing it. So we are not  
6 looking at --

7 DR. KOVES: Give me some time.

8 MR. WIDMAYER: For a small fee.

9 MEMBER STETKAR: To follow up a little bit  
10 on what Dennis, I think, was talking about, have there  
11 been any studies done in other industries that profess  
12 to have a high level of safety culture where errors  
13 can cause fairly severe consequences? I am thinking,  
14 in particular, aerospace, airline industries. Has  
15 anybody done any work in those areas and published any  
16 results like this?

17 DR. BARNES: Yes. They have been doing  
18 similar kinds of work, but I can't say that I can  
19 point out -- I can't bring to mind a study. Can you?

20 DR. MORROW: Well, one -- you know, I will  
21 speak to the interventions -- is coming from working  
22 with the railroads. One study that they did was --

23 MEMBER STETKAR: I didn't say railroads.  
24 In particular, I didn't say railroads, because I said  
25 that profess to have a very high level of safety

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1 culture, aerospace and airline, in particular. I  
2 don't want to pull us to things that you know about.  
3 I want to find out how far you have looked into  
4 industries that are often compared with the nuclear  
5 power industry as having a very high attention to  
6 safety where errors can indeed result in very, very  
7 significant consequences.

8 Railroad industry, regardless of what you  
9 look at, running your train off the track isn't very  
10 severe, usually.

11 DR. BARNES: Two answers. One is I  
12 haven't seen published studies of, you know, flying  
13 related. They are doing work on this in maintenance.

14 MEMBER STETKAR: Well, maintenance is  
15 relevant.

16 DR. BARNES: Yes, aviation maintenance.  
17 So this same kind of work is being done there, the  
18 measurement of safety climate, and then linking it to  
19 different kinds of indices of maintenance  
20 effectiveness, not necessarily linked to safety  
21 performance, because in aviation maintenance  
22 effectiveness --

23 MEMBER STETKAR: Sorry. Occasionally,  
24 flaps don't work, and very often they trace things to  
25 maintenance performance on aircraft.

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1 DR. BARNES: But are like us from the  
2 standpoint that, you know, their procedures and  
3 testing protocols are set up to, hopefully, detect and  
4 mitigate a problem --

5 MEMBER STETKAR: That is exactly why I  
6 asked the question.

7 DR. BARNES: -- before it results in a  
8 crash.

9 MEMBER STETKAR: Because a slide like this  
10 tells me that perhaps there may be benefits in other  
11 industries that perhaps didn't really have a very  
12 strong safety culture or a very high attentiveness to  
13 errors that could result in severe consequences,  
14 regardless of what you might say about the health care  
15 industry.

16 There are a couple that traditionally have  
17 for the last 34 years anyway, certainly. But if you  
18 searched and people haven't done that type of work,  
19 then there is not much --

20 DR. BARNES: Yes. It is not published.  
21 I mean, I would be shocked if it -- I mean, of this  
22 kind of empirical research. Of course, there is  
23 accident investigations that always point back to  
24 safety culture factors, organizational factors as  
25 contributing.

1                   MR. SOLORIO: I want to ask a question of  
2 Dennis. I don't mean to get myself in more trouble  
3 here, but I think what Val was suggesting, for  
4 instance, with the last bullet here, the 70 percent  
5 decrease, is: In the study, they focused on -- One of  
6 the many things they did was focus on communicating  
7 better between individuals, and that contributed to  
8 reducing the pneumonia rates.

9                   In the Safety Culture Policy Statement, we  
10 have a trait, communication. So I thought what Val  
11 was trying to do was draw an analogy that in another  
12 environment they focused on something like what we are  
13 focusing on in the Safety Culture Policy Statement,  
14 and it reduced rates.

15                   So while, you are right, we are perhaps  
16 much more advanced in our way of being safe than other  
17 industries, we are still focusing on something that is  
18 really important, just as in other places, to reduce  
19 accident rates.

20                   CHAIRMAN BLEY: I was thinking -- I have  
21 to go back and look at the Policy Statement again, but  
22 I was thinking that was a more general communication.  
23 We have, in fact, been beefing on communication within  
24 the control room for many years, and adding  
25 requirements and double checks and now triple checks

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1 on that kind of communication.

2 These guys weren't doing that. There was  
3 the king, and everybody did what he said and was  
4 afraid to say anything. So there was a big difference  
5 in the way they operated.

6 DR. BARNES: One of the -- The one study  
7 that I am aware of that has compared nuclear power  
8 related safety culture to other industries was in the  
9 UK, had nuclear power off-scale high in terms of their  
10 safety culture scores compared to some 400 other  
11 industries that they were looking at.

12 CHAIRMAN BLEY: Did they do that or was it  
13 --

14 DR. BARNES: University of Aberdeen for  
15 the government, and that is anecdotal gossip, not --  
16 I can't point to a publication that documents that.

17 So there is a ceiling effect in nuclear  
18 power which, thank heavens, we are glad exists, but it  
19 also argues against there being, like you guys are  
20 saying, a lot of room for safety culture to have a big  
21 impact on safety performance.

22 DR. KOVES: The other side is we still see  
23 incidents where all of these things crop up.

24 DR. BARNES: That's right.

25 DR. KOVES: When it is done right, no

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1 matter what we try to do, what we have tried to do so  
2 far to deal with that.

3 DR. BARNES: Yes. But for these kinds of  
4 reasons, when INPO stepped forward and said that they  
5 were going to volunteer to do this construct  
6 validation study, I was standing back and going, okay,  
7 well, this is good to extend the research that has  
8 been going on in the other industries to see what  
9 happens in nuclear power, but we are going to be  
10 looking at the organizational level of safety  
11 performance, organizational levels of measures of  
12 safety culture, and going into this in advance, I am  
13 going, this will be fun to do, but I don't know -- you  
14 know, I am not very confident that the outcomes will  
15 be -- that we are going to find anything, actually,  
16 that there will be a sufficient variability that the  
17 correlations will show much of anything.

18 So, in fact, when the study was done, when  
19 we started getting the results in, I was kind of taken  
20 aback and a bit shocked, because compared to a lot of  
21 the other work that has been going on, we apparently  
22 do have sufficient variability between sites in the  
23 nuclear power industry that we got -- as Ken and  
24 Stephanie will review next, we actually got  
25 correlations that are generally stronger than what has

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1       been coming out of similar kinds of research in other  
2       industries.

3                   CHAIRMAN BLEY:   Go ahead.

4                   DR. BARNES:   That was it.

5                   DR. KOVES:   Oh, am I next?

6                   DR. BARNES:   You are next, unless you  
7       wanted to discuss anymore of that.

8                   CHAIRMAN BLEY:   We will back.  There are  
9       pieces of it.

10                   DR. KOVES:   While they are switching the  
11       slides and presentation over, I just kind of wanted to  
12       jump back to something at the very beginning that Dave  
13       talked about, and he had thanked me for some of the  
14       help early on in some of the policy statement stuff.

15                   I just wanted to commend you, Dave, for  
16       kind of trying something different in terms of some of  
17       the activities and all and just -- I think Dave just  
18       did a really good job in helping move the policy  
19       statement forward and making it very successful.

20                   So I just wanted to say that.  I told him  
21       that in private, but this is my only opportunity to  
22       say it in public.

23                   CHAIRMAN BLEY:   Go ahead.  Then I will ask  
24       one.

25                   MEMBER STETKAR:   No, I was going to ask

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1 you need to close the meeting yet.

2 CHAIRMAN BLEY: No. I figure he will tell  
3 me when he wants to close the meeting.

4 DR. KOVES: That is correct. Actually,  
5 the plan is to go through all of the presentation and  
6 then I am going to hand out a couple of things at the  
7 end, and that is -- we will go ahead and close the  
8 meeting at that point.

9 CHAIRMAN BLEY: Okay. All of the slides  
10 are okay?

11 DR. KOVES: Yes, all the slides are okay.  
12 It is just my handout and the handouts that I brought,  
13 and I will hand those out at the end, and we will kind  
14 of discuss them, and these are overall results and  
15 more detailed results.

16 CHAIRMAN BLEY: I think the question to  
17 put on the table -- and I can understand you might  
18 tell me you can't talk about it, but if you can we  
19 would be interested.

20 We have had some meetings in the past with  
21 other folks from INPO who are associated with  
22 inspections and drills and that sort of thing. What  
23 I am interested in is are you on a path such that your  
24 results get mixed with what those kind of folks are  
25 doing so that, from the industry side, we are seeing

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1 this research end up in a place where it has practical  
2 impact through other programs that are going on?

3 MEMBER SCHULTZ: Where it connects to  
4 other evidence that INPO collects also from licensees.  
5 Is that what you are looking for?

6 CHAIRMAN BLEY: Well, partially, but also  
7 the fact INPO goes out and inspects facilities and  
8 oversees or at least observes drills, if they don't  
9 run themselves.

10 DR. KOVES: We don't run them.

11 CHAIRMAN BLEY: Okay. So you observe  
12 them, but you have some impact on what people do  
13 there. What I am wondering is there anywhere you can  
14 talk about how this work feeds into -- mixes with  
15 other sources of information and feeds into other  
16 activities would be of great interest.

17 DR. KOVES: Well, I am pretty sure that I  
18 can go ahead and talk about that definitely during the  
19 private session.

20 CHAIRMAN BLEY: Okay, that would be great.

21 MR. WIDMAYER: Excuse me. As far as I can  
22 tell, I think we are okay. Everybody here is an NRC  
23 employee.

24 CHAIRMAN BLEY: Is that right? Okay.

25 MR. WIDMAYER: Yes. So as far as -- It is

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1 okay if you want to go ahead.

2 CHAIRMAN BLEY: Well, we would have to do  
3 it officially.

4 MR. WIDMAYER: Yes, we do.

5 CHAIRMAN BLEY: But we can wait until  
6 later.

7 DR. KOVES: Yes. Let's go ahead and do it  
8 officially, but also I don't completely -- at this  
9 point, completely understand the question. So why  
10 don't we go ahead and go through this.

11 CHAIRMAN BLEY: That's fine.

12 DR. KOVES: Then when we get into that  
13 session, go ahead and ask the questions, and maybe it  
14 will be a little bit more detailed, and I will do the  
15 best I can. Remember that I have never been an  
16 evaluator.

17 CHAIRMAN BLEY: I can't remember, but I  
18 can be informed.

19 DR. KOVES: I have never been an  
20 evaluator. So speaking from that perspective, I am  
21 modestly familiar with it, but I have never been one.

22 CHAIRMAN BLEY: Okay. But you interact  
23 with those folks?

24 DR. KOVES: Yes, quite regularly.

25 CHAIRMAN BLEY: That is what I was getting

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1 to, and we will talk more about it later.

2 DR. KOVES: Yes. Okay, great.

3 Me? We have already talked about me a  
4 little bit. yes, I am a Ramblin' Wreck.

5 What is the purpose? Why did we do this?  
6 First of all, to validate the traits in the Safety  
7 Culture Policy Statement, as we have talked about, but  
8 also then to determine a relationship between INPO's  
9 safety culture survey and the concurrent measures of  
10 safety performance. Is there a relationship there?  
11 Then ideally, because this ended up getting -- going  
12 over time, we were able to look at the relationship  
13 between safety culture survey results and then also  
14 the same measures of safety performance one year  
15 later.

16 CHAIRMAN BLEY: Now you had a safety  
17 culture program before this work that came up with the  
18 policy statement. That's true?

19 DR. KOVES: I will -- Yes. I am not sure  
20 exactly how to answer that question because of the  
21 word program. However, INPO has had a lot of emphasis  
22 on safety culture on the concept without that language  
23 prior to Davis-Besse, and then on that concept after  
24 Davis-Besse ever since then.

25 So the Principles for a Strong INPO Safety

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1 Culture came out in 2004, and I am not sure how many  
2 years, but for a number of years now, INPO has had an  
3 organization effectiveness part of their evaluation,  
4 and then a subset of that is safety culture. So they  
5 have been looking specifically at safety culture for  
6 many years.

7 CHAIRMAN BLEY: I'm sorry, just two more  
8 questions on development of the Policy Statement?

9 DR. KOVES: Yes.

10 CHAIRMAN BLEY: And by the time that  
11 evolved and came out, it matched reasonably well with  
12 what was already there, or have you had to change  
13 things?

14 DR. KOVES: There was a lot of alignment.  
15 This whole language thing gets a little murky, because  
16 of -- The example that I use is that it is like a  
17 cherry pie. I mean, how many different ways can you  
18 divide a cherry pie, you know?

19 So the NRC, the INPO, IAEA, JANTI, VTT --  
20 you know, they all kind of divide a little  
21 differently, but really, we all pretty much agree that  
22 it is a cherry pie, and we agree what the cherries  
23 are, to a large degree. So anyway, that has -- We are  
24 working on that, and also we are in the process of  
25 getting an aligned language with the NRC at the more

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1 detailed level. We made some great progress in  
2 December, and it looks like in July we are going to be  
3 kind of pushing that on and probably coming to -- my  
4 expectation is, coming to a conclusion probably in  
5 July.

6 CHAIRMAN BLEY: Of this year?

7 DR. KOVES: With NRR. So the Commission's  
8 original vision was to have a high level description  
9 of safety culture that applied to all the different  
10 stakeholders, but then each stakeholder group or each  
11 -- what is it, department? I don't know what they  
12 call them in the NRC -- department would work with  
13 their stakeholder group to then define that at a lower  
14 and more detailed level for that group; because they  
15 admit that a power plant is a little different than  
16 maybe Joe Radiographer who has a source in the back of  
17 his van, and that has been moving very well.

18 Okay. Anyway, that was the purpose. Just  
19 for your information, what were some of the roles?  
20 The INPO did survey strategy planning and industry  
21 indicators. A vendor administered the survey. NEI  
22 paid for the vendor, and then the NRC reviewed the  
23 work, and then also analyzed the NRC data. There  
24 should be another little bullet point underneath  
25 there, because they have certain proprietary data that

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1 we don't have access to, and vice versa.

2 So it was a collaborative effort in that  
3 process. Let me move on. I am giving you this slide  
4 as just a bit of background, because it is going to  
5 come into play in the next slide. What this is, is  
6 these are some of the current existing models of  
7 safety culture.

8 We have the IAEA on the left, INPO  
9 principles and the ROP components on the right. The  
10 point here is to show that, even though there are  
11 differences and at a high level they may look --  
12 sometimes they look very different at a high level.  
13 Once again, when you get down to a lower level, they  
14 are really very similar. So this is just kind of a  
15 mapping, a very quick mapping, across the different  
16 models to show the similarity.

17 Now where does that come into play? In  
18 developing the survey or the questions, what we did  
19 was we started with the Utility Service Alliance  
20 Safety Culture Survey, and that was very much -- It  
21 was built off of the principles document, and the  
22 person who put that together, his goal was to align  
23 very strongly with the wording in that document.

24 Unfortunately, that document was never  
25 intended to be a survey. It was intended to be a

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1 guidance document, and that will come back into play  
2 in just a minute. But we started there, first of all,  
3 because I pointed out, particularly in nuclear power  
4 space the models are really similar when you get at a  
5 certain level.

6 Also, there are really only two nuclear  
7 models with any type of existing questions, first of  
8 all, that I was aware of anyway. First of all was the  
9 Alliance Survey, and then secondly is IAEA in their  
10 SCART, Safety Culture Assessment Review Team, process  
11 which is a two-week long analysis of safety culture --  
12 they have a lot of questions. They are not survey  
13 questions, but they are more like interview questions.

14 So those were really the only two sources  
15 of anything in existence in nuclear space that I was  
16 aware of, and we also were under somewhat of a time  
17 crunch. The OA was working forward on the policy  
18 statement, and they were going to make this thing  
19 happen, and we needed to develop the survey. We  
20 needed to administer the survey.

21 We needed to do the analysis in kind of a  
22 limited time frame. So we were fishing on all of this  
23 to get it done. So, therefore, I just started with  
24 the USA survey, and then went from there.

25 What did we do with it? Here you see some

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1 of the editing. Took the original survey, and then  
2 what I did was I did a bunch of editing of the  
3 original 73 items. You kind of see a little bit of  
4 the feel for what that initial editing went like.

5 As I said, it was built upon the  
6 principles. The principles were never intended to be  
7 a survey, and so there was a substantial amount of  
8 editing to just get the questions that were into a  
9 more appropriate survey format; after that, then set  
10 it aside for a little bit, and then came back to it  
11 with fresh eyes, did more editing on it.

12 Then also as a part of that, did a  
13 comparison between what was in the survey, kind of  
14 mapped it over to the traits, and looking for, okay,  
15 were there any traits that I didn't feel were covered  
16 really adequately by the existing questions. There  
17 were a couple of traits that I -- you know, I only had  
18 maybe like three or four questions. So I ended up  
19 adding another 10 items to the survey.

20 After that, I sent it off to NRC Research,  
21 and they then did editing, and they can talk more  
22 about it, but I know that there were a number of  
23 people in their group and other groups that looked at  
24 it, plus also what they did was they did the same  
25 process of comparing it to the traits, but they also

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1 -- my understanding is they compared it to the IAEA  
2 framework. They also compared it to the ROP  
3 framework, and then also compared it to the research.  
4 As you see, there is a lot of the research that they  
5 are familiar with, and ended up adding another 32  
6 items to it.

7 MEMBER STETKAR: You mentioned IAEA a  
8 couple of times, and they do have some type of  
9 evaluation process. Do you know how frequently they  
10 have actually one those evaluations?

11 I am not familiar with that. I do some work with the  
12 IAEA, but not in that area.

13 DR. KOVES: Yes. I actually know quite a  
14 bit about it.

15 MEMBER STETKAR: Oh, good.

16 DR. KOVES: The very first -- and it is  
17 the SCART. Their long process is the SCART, and their  
18 very first session, the very first time they did it  
19 was in South Africa a few years ago, but that was not  
20 at a nuclear plant. That was at a vendor.

21 Then their first time at a nuclear plant  
22 was Santa Maria de Garona like about a year or so  
23 after that. Their third administration of it was at  
24 Laguna Verde, and I was actually part of that team.  
25 So that is kind of why I know a little bit about it.

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1 Well, I don't know how much -- I could  
2 babble about this for a while, but I am not sure if I  
3 should or not.

4 MEMBER STETKAR: No, no. What I was more  
5 curious about was the number of times that they have  
6 actually performed these assessments. For example, I  
7 know their IPSART process is fairly mature, and it  
8 took a while for them to work the kinks out of that.

9 They have some other review activities  
10 that take a while to review, to work the kinks out.  
11 So I am trying to understand at least how far they are  
12 in the learning process.

13 DR. KOVES: They have done three  
14 administrations, and the short story is the reports  
15 that came back from that, the people inside IAEA felt  
16 that they were just like OSART's. So they have now  
17 gone down a path of trying to do what -- similar to  
18 what INPO does, and that is assess safety culture as  
19 a part of the OSART.

20 They have done two of those, one in Brazil  
21 and the other one in South Africa.

22 MEMBER STETKAR: So it is now becoming part  
23 of the OSART -- a subset of the OSART?

24 DR. KOVES: My understanding is that those  
25 didn't work out quite as well as they have hoped, and

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1 so, therefore, my understanding is the debate as to  
2 what they are going to do is not settled.

3 MEMBER STETKAR: I will let you get back  
4 on track, and thanks.

5 MEMBER SCHULTZ: And also, in summary,  
6 their activity associated with survey and results has  
7 been developmental. They have done it three times,  
8 but not developed something and applied it the same  
9 three times.

10 DR. KOVES: So far with the SCART, they  
11 have not used a survey at all. If the station has  
12 done something related, they will use that as part of  
13 their input, but they have not -- It is not part of  
14 the -- So far, it is not part of the SCART process to  
15 use a survey. However, going forward, they were  
16 talking about doing that, and as of right now -- I  
17 mean, I am talking with them about actually developing  
18 a global safety culture -- doing global administration  
19 of a safety culture survey to try and get global  
20 norms.

21 MEMBER SCHULTZ: So they were using an  
22 interviewing technique?

23 DR. KOVES: Yes. It is all interviewing.  
24 Interviewing and observation is what they were doing.

25 NRC then added these additional items.

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1 What happened then is then they sent it back, and we  
2 had to do some more, and then sent it back; and then  
3 they had to do some more, and then finally we ended up  
4 with a survey of 110 questions, which was 51 percent  
5 more items than what we started out with.

6 CHAIRMAN BLEY: Let me just ask a picky  
7 question. You have 110 items, but when I go to some  
8 of your tables where you count things up, how many  
9 items were put into different labels, I turn up with  
10 like 106 out of 110. Were there some that didn't fit  
11 or is there a miscounting?

12 DR. KOVES: You will see where some of  
13 those went.

14 CHAIRMAN BLEY: During your talk? Okay.

15 DR. KOVES: Later on.

16 CHAIRMAN BLEY: So I am not just a bad  
17 counter. They did go somewhere. Okay.

18 DR. KOVES: Well, yes. Oh, it's four  
19 difference. Perfect. Perfect, thank you. Thank you  
20 for pointing that out. I appreciate it. It's amazing  
21 when a plan comes together, let me tell you.

22 All right. So that was the survey  
23 development. In terms of lousy administration, what  
24 do we do? It was an online survey. It was  
25 administered by the vendor, as I mentioned. They had

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1 a seven-point scale, from strongly disagree to  
2 strongly agree, also had a "don't know" option, which  
3 comes into play, and then also randomly selected a  
4 sample of 100 personnel from each site.

5 MR. WIDMAYER: But the choice of this  
6 scale and "don't know" option and everything, that is  
7 important. I mean there is a reason that you chose  
8 the --

9 DR. KOVES: Yes. If you look in the  
10 literature -- I mean, from a psychometric perspective  
11 the sweet spot for scales is five to seven points, and  
12 over years using both Sprint, I just finally settled  
13 on the seven-point as, really, I think, a little  
14 preferable.

15 Basically, it gives you the option for a  
16 little more variance, and it is -- Variance is king in  
17 this analysis. But other than that, it is pretty  
18 typical Likert scale.

19 DR. BARNES: And this Likert scale of  
20 strongly agree, 90 percent of the studies that I was  
21 talking about earlier use that same format -- item  
22 format, questionnaire item format. It made these  
23 results comparable to the literature from other  
24 domains.

25 DR. KOVES: I thought you guys might ding

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1 me on the 100 people from each site, but if not, I  
2 will move on.

3 MEMBER STETKAR: I was going to ask you  
4 about that. The 100 people from each site randomly  
5 selected, were they clerical people up through  
6 licensed operators and supervisors?

7 DR. KOVES: It was all permanent employees  
8 at the site, including what I call permanent  
9 contractors, you know, those contractors who had been  
10 there for years. It was a dataset of that, and then  
11 just used Excel to randomly pull out 100 people for  
12 each one of them.

13 MEMBER SCHULTZ: So you did all the work  
14 groups at the site?

15 DR. KOVES: Yes, and what they are going  
16 to talk about later is they kind of analyzed it  
17 between the results and your typical -- I guess,  
18 typical pattern that you have in a plant, and it lined  
19 up pretty well. So it seemed very representative.

20 DR. BARNES: I strongly encouraged INPO to  
21 include -- not just limit it to those who have safety  
22 related responsibilities, but to include everyone from  
23 the site, because our measures of performance were  
24 site-wide as well, and research literature suggests  
25 that, even though people in finance have a less direct

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1 relationship, they share in the culture, and so wanted  
2 everybody in the organization who has been there long  
3 enough to experience the culture and participate in it  
4 have an opportunity to be selected for the study.

5 MEMBER SCHULTZ: I guess, in terms of the  
6 selecting 100 as the metric for the survey, it would  
7 get into what was discussed earlier, that 100 might be  
8 adequate to look at the whole organization, but the  
9 importance of being able to go down to the work group  
10 level and draw meaningful conclusions from that may  
11 require a much larger sample size.

12 DR. BARNES: Absolutely.

13 DR. KOVES: Right.

14 DR. BARNES: If you were going to use this  
15 survey to see which work groups might be having  
16 problems compared to others, you would need a much  
17 larger sample, and then design interventions to solve  
18 the problem. But that wasn't what we were doing here.  
19 We were looking at the question, is there a  
20 relationship between safety culture the way we have  
21 defined it out of the workshop and safety performance  
22 at the very broad level.

23 So we needed -- INPO needed enough people  
24 in the sample to give us a reasonable estimate of  
25 perceptions of safety culture at the site as a whole.

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1 DR. KOVES: Station-wide.

2 DR. BARNES: Station-wide, and that is  
3 where our safety performance measures were.

4 You know, we didn't have access to  
5 individual work group measures. So this design was  
6 appropriate for the purposes of this study, but  
7 wouldn't at all be appropriate for solving --  
8 identifying and solving an organizational problem.

9 DR. KOVES: Plus, we were asking the  
10 stations to take this survey out of the goodness of  
11 their hearts, and so we wanted to reduce the burden on  
12 the stations. So this was a way of being able to get  
13 at that station level data, but also reducing the  
14 burden on the stations.

15 MEMBER SCHULTZ: Did any station volunteer  
16 to take a larger sample or did they all go along on  
17 the survey?

18 DR. KOVES: None of them asked for a  
19 larger sample, and we could have done that if they  
20 wanted, but no one really asked for it.

21 MEMBER SCHULTZ: It is about a two to  
22 three percent sample of the -- I don't know how many  
23 people.

24 DR. KOVES: Well, typically, it depends on  
25 the number of units, but I would say for a one-unit

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1 site --

2 MEMBER SCHULTZ: Okay, this is site.

3 DR. KOVES: -- typically, about 500 people  
4 there. So this would have been almost 20 -- asking 20  
5 percent. Now we didn't get 100 percent response. Is  
6 that a fair statement?

7 DR. MORROW: Yes, that is about right.

8 MEMBER SCHULTZ: But it included all work  
9 groups, security included?

10 DR. KOVES: Yes, included security. One  
11 of the questions was -- that had been asked was, well,  
12 is there going to be a difference between what we will  
13 call the core functions like ops and maintenance and  
14 that type of thing, and those other groups. So we  
15 asked a demographics question very early on. We did  
16 a split-out between the two of them, and there wasn't  
17 really much difference. So we didn't pay any  
18 attention to it after that and just used the entire --  
19 all the groups together.

20 So what was our response? We had 63 of  
21 the reactor sites participating, 97 percent of the  
22 industry. One station asked early on to not  
23 participate, because of some other things that were  
24 going on. One station was -- due to a clerical error,  
25 was inadvertently left out. We thought we were

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1 administering them. We were not. Anyway, that is  
2 where those two stations went to.

3 Had an average of 46 individuals. So we  
4 had a 46 percent response rate from each site. Had a  
5 total of almost 300 individuals. It was over 300 who  
6 gave responses and responded. However, a number of  
7 them were missing a lot of data, and so we came to  
8 about this 2876 that we felt provided enough valid  
9 responses to the majority of items.

10 DR. BARNES: He meant about 3000.

11 DR. KOVES: Three thousand, sorry. What  
12 did I say?

13 DR. BARNES: Three hundred.

14 DR. KOVES: Oh, 3000.

15 CHAIRMAN BLEY: Ken, we are running a  
16 little behind. We are not going to be done by the  
17 time of our scheduled break, and it looks like on the  
18 next slide we start getting into the stuff that gets  
19 complicated. So I think I am going to take a break  
20 now for 15 minutes, and we will come back after that.

21 DR. KOVES: Sounds great. Thanks.

22 CHAIRMAN BLEY: We are recessed until  
23 10:15.

24 (Whereupon, the foregoing matter went off  
25 the record at 10:00 a.m., and went back on the record

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1 at 10:15 a.m.)

2 CHAIRMAN BLEY: We are back in session.

3 MEMBER SCHULTZ: Ken, before you move  
4 forward, I have a question on the previous slide. I  
5 was with you with selecting 100 individuals from each  
6 site.

7 DR. KOVES: Correct.

8 MEMBER SCHULTZ: It is a small license  
9 sample, but it is okay. I was surprised that it was  
10 voluntary and that the response rate was only 46 out  
11 of 100 on average, and by that I am wondering whether  
12 the evaluators would be somewhat suspicious about who  
13 did not participate in the survey and who did  
14 participate in the survey, given that the survey is  
15 focused on safety culture.

16 DR. KOVES: I have done a lot of surveys  
17 in the past, and people often talk about, well, you  
18 have got the extremes, what about the extremes, and  
19 all this other stuff. It really just -- When you use  
20 the means and look at the means, the means wash out a  
21 lot of that.

22 Also, my experience is that the response  
23 rate is very strongly driven by executive and  
24 leadership communication. So if the leadership  
25 communicates frequently that this is important, we

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1 need you to do this, then response rates go up. If  
2 they give it to their communication person to send out  
3 some email to everyone, then the response rates aren't  
4 quite as high.

5 MEMBER SCHULTZ: I don't want to drive too  
6 far in that direction, but that is part of my point,  
7 which is when the survey is about safety culture and  
8 the response rate is 46 percent, I am a bit surprised  
9 by that.

10 DR. KOVES: Well, also this is in addition  
11 to all the other things that they do relative to that.  
12 You know, pretty much every station has some type of  
13 safety culture survey. There is a survey as part of  
14 the INPO eval. Typically, they do -- At the mid-  
15 cycle, they will do another one. Very often, they  
16 will do employee satisfaction surveys.

17 So there is -- I am not sure how valid it  
18 is, but there is always this concern about survey  
19 fatigue. So I am not sure. I realize -- Plus, this  
20 also was billed as a research survey. It is not like  
21 something that is going to be directly impacting their  
22 plant.

23 CHAIRMAN BLEY: Can I ask it a slightly  
24 different way? There are two pieces to what I want to  
25 ask.

1           Were there some plants where you got  
2 nearly everybody participating and others where you  
3 had almost nobody? How is that distribution? The  
4 other question was, did you have any idea -- Were you  
5 able to discern whether it was a certain class of  
6 employee that decided not to participate?

7           DR. KOVES: Well, going to the first one,  
8 we had already said that we were not going to give up  
9 on any station until we had like -- I think it was 35  
10 responses, and that is based on central limit theorem.

11           So once they got over that threshold of  
12 like 35, then we stopped sending reminders and that  
13 type of thing. So there was that type of an  
14 attrition, too. If they were a laggard, then we kept  
15 on them until they crossed that criterion.

16           Based on looking at the demographics, we  
17 did not really see any major deviations from kind of  
18 your typical plant demographics. So I would say that  
19 there did not appear to be any difference in them.

20           DR. BARNES: Generally speaking, based on  
21 what we have seen at other sites with other kinds of  
22 surveys, we often see security personnel have a much  
23 lower response rate, in general, which is kind of an  
24 interesting finding.

25           DR. KOVES: Plus, historically, they have

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1 some of the lowest scores, too.

2 DR. BARNES: Yes.

3 DR. KOVES: I mean, I know that we did  
4 have security. Security participated in this.

5 DR. BARNES: Ideally, of course, it would  
6 have been great to have 80 percent or more from the  
7 entire industry from every site, but as Ken mentioned  
8 previously, this was in part schedule driven. So the  
9 focus was on getting enough to have a level of comfort  
10 that the results were likely to represent each of the  
11 sites that were in the population that we were looking  
12 at. So it wasn't perfect, but --

13 DR. KOVES: And if you remind me, I will  
14 comment more on that during the closed session.

15 CHAIRMAN BLEY: Oh, okay.

16 MEMBER SCHULTZ: And your comment that  
17 this as presented as a research survey to understand  
18 relationships.

19 DR. MORROW: When we were evaluating it,  
20 we looked at, okay, what is the typical response rate  
21 in research based surveys, surveys that would be  
22 comparable. That response rate is like on average 30  
23 percent, looking across web based surveys that are for  
24 research purposes voluntary. So 48 percent was a  
25 reasonable response rate for the purpose of this

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1 study, kind of in the context of looking at a cross-  
2 section.

3 We didn't have specific information on the  
4 nonrespondents, but we looked at the distribution of  
5 work groups. It seemed like, even within sites, that  
6 you had a good selection of people from different work  
7 groups.

8 We also did some analyses looking at kind  
9 of the stability of the group mean, because what we  
10 end up using is the group mean to look at the  
11 correlations, and that group mean was very stable in  
12 almost every single case.

13 So adding a few more respondents and  
14 tracking a few more respondents wouldn't have really  
15 changed that. I will talk about that a little bit  
16 more in the next presentation as well.

17 CHAIRMAN BLEY: Thank you.

18 DR. KOVES: In terms of real difference  
19 between, there was only one station that had  
20 accidentally gotten administered twice rather than got  
21 left out. They had a little higher number. Other  
22 than that, they were all fairly within that 35 to 55  
23 range for the n.

24 CHAIRMAN BLEY: I have got another  
25 question here, because both of you have focused on the

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1 mean a lot, but I wondered, thinking from the other  
2 side where we see events and we see people who didn't  
3 do some of the things that the Safety Culture Policy  
4 Statement supports, regardless of the mean, if you  
5 have a substantial number who devalue certain of these  
6 goals, we don't have any way to know. But it could be  
7 that those are the ones who get involved in cases  
8 where they actually do something that is troublesome,  
9 and we blame the safety culture.

10 That is fine, but if you've got wide  
11 variability, I wonder if we are more vulnerable to the  
12 thing not working right. I suspect that has to be  
13 true. Have you thought about that?

14 DR. KOVES: Yes. Also, we look at the  
15 standard deviation and look at some of the variability  
16 within the plants, and that variability of plant  
17 performance was important for the validation and the  
18 correlations with the key performance indicators.

19 You don't need a group of individuals.  
20 You really only need one who doesn't value it to  
21 contribute to -- I won't say cause, but I will say  
22 contribute to an event.

23 CHAIRMAN BLEY: Well, you kind of need a  
24 class of them for the event, the susceptible event, to  
25 match up in the Swiss cheese with that person. So if

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1 it is one, we are pretty unlikely that they are going  
2 to be the ones that catch the hole in the Swiss  
3 cheese, but if there are more of them, if you've got  
4 really wide variability and the same mean, you are  
5 more likely to line up.

6 DR. KOVES: What happens is, if you have  
7 more of them that are in that category, then it pulls  
8 the mean down, and that is where we ended up seeing it  
9 in the results.

10 CHAIRMAN BLEY: That is why I asked about  
11 variability. If you have got some extremely high and  
12 some extremely low, then that is not true. But if it  
13 is just mostly clustered near the mean and you have  
14 got a few outliers on the low side, then --

15 DR. KOVES: Yes.

16 CHAIRMAN BLEY: And I don't have any kind  
17 of a clue about what you saw in that regard. A  
18 standard deviation doesn't quite tell you the same  
19 thing as --

20 DR. KOVES: Well, as looking at the  
21 frequencies.

22 CHAIRMAN BLEY: That is the thing I was  
23 just curious about.

24 DR. MORROW: I was curious about that, too,  
25 maybe in a little bit different way, but other ways.

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1 For the most part, safety culture, when you are  
2 looking at kind of grouping individual responses to  
3 the organizational level, then they are using the  
4 mean, because we just don't have enough information to  
5 know what is more important at this time. But another  
6 way that they have looked at it is just to look at  
7 what percentage of the sample indicated that there  
8 seems to be a problem with the safety culture.

9 So they had scores of strongly disagree,  
10 disagree, that kind of thing. We did look at that  
11 with the INPO survey, and the correlation between the  
12 mean score and the percent of problematic responses  
13 was like .93. So very, very similar there, and we  
14 weren't really getting much new information by using  
15 that.

16 CHAIRMAN BLEY: Well, that is encouraging.

17 DR. MORROW: Yes. It is kind of -- You  
18 know, it is not done as much in the literature yet.  
19 So we are more comfortable with the mean, because that  
20 means that we can continue to compare these results to  
21 what else is out there right now.

22 CHAIRMAN BLEY: That's fine. I just  
23 remember, one of the first PRAs that was done. This  
24 isn't people. This is equipment, and we had grand  
25 mean failure rate from the whole industry, and our

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1 plant aligned all right on that, but when you looked  
2 at distributions, we found that we were out there on  
3 the 90th percentile on a fair number of things. So we  
4 got to do something facility by facility, rather than  
5 just an industry mean, because there was variability.

6 DR. MORROW: I think it is the next step  
7 in the safety culture research, is to try to look at  
8 are there ways we can kind of tweak this rather than  
9 just using the generic mean.

10 CHAIRMAN BLEY: Go ahead. Now we come to  
11 the fun stuff.

12 DR. KOVES: Oh, fun stuff, yes.

13 Principal components analysis: Why? Why  
14 is it kind of the standard in psychological research.  
15 Principal components or factor analysis -- factor  
16 analysis is kind of a more generic term, and why? To  
17 find patterns. What is the underlying structure in  
18 multi-dimensional data is what we are trying to find,  
19 so that we can then use that for data reduction.

20 As I said, this is a research survey, and  
21 with this we throw lots of items in, so that we find  
22 out which ones are the bad ones, which ones are the  
23 good ones, and then can reduce the size of the survey,  
24 not just to eliminate bad items but also -- I am a  
25 really kind practical, applied kind of guy, and

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1 surveys cost plants, organizations, money to  
2 administer, and I don't mean just cash outlay. I mean  
3 the time that is involved.

4 So the better instrument we have is both  
5 a function of its quality and then also of its length,  
6 too. If you have it good and short, that's great.  
7 Also, I view it to then build better scales, which is  
8 a whole part of the process.

9 So very often PCA is used synonymously  
10 with factor analysis. There are some technical  
11 differences.

12 What I am going to do now is I am going to  
13 talk about kind of a conceptual or visual idea of what  
14 PCA is. I am not going into going to the map  
15 explanation. A couple of reasons for that: One is we  
16 don't have time, and also, secondly, because there are  
17 just gobs of resources out there. I mean besides on  
18 the Internet, books and the Internet, also YouTube  
19 videos explaining both, coming at it from a linear  
20 algebra as well as a matrix algebra approach.

21 So lots more examples, but if I took all  
22 day, there is a lot more out there than I could cover.  
23 But what I want to do is I want to give you kind of a  
24 view of, at least in my head, how it works from a more  
25 visual perspective.

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1           Think of the data as an -- and this is the  
2           data of the individuals, so the almost 3000 people in  
3           the data -- as points in multi-dimensional space or  
4           think of them as clouds in multi-dimensional space.  
5           You know what I am talking about, multi-dimensional.  
6           We have 110 items. So we have a possibility of 110  
7           dimensions.

8           What is a PCA effect analysis does is,  
9           first of all, of these clouds of data it allows you to  
10          look at different perspectives of these clouds of data  
11          to find out which perspective gives you the most  
12          information about what is in the data.

13          CHAIRMAN BLEY: So each point in your  
14          multi-dimensional space is one individual score on one  
15          of the 110 items?

16          DR. KOVES: It is the -- Yes.

17          CHAIRMAN BLEY: Okay.

18          DR. KOVES: And so these clouds of data --  
19          So first of all, it allows you to look in different  
20          dimensions to see what perspective will give you the  
21          most information about this. Secondly, what it also  
22          does it also uses the covariance matrix and, by  
23          reducing the variance, finds a point in the middle of  
24          the cloud to best represent that particular cloud of  
25          data.

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1           You will see this in a minute. It gives  
2 you what are the points -- or actually, it is the  
3 items, gives you the items that are associated with  
4 that cloud, and then also what amounts to the  
5 correlation between that particular item and that  
6 theoretical point in the middle of the cloud.

7           I found this example. This is actually  
8 cancer data. What they are trying to do is they are  
9 trying to represent this idea. What they are showing  
10 here is, in three dimensions, they are showing kind of  
11 the plane that best represents this data, how it is  
12 folding through three-dimensional space. But if you  
13 look at this data from one direction, this is what you  
14 get, and this is what you see.

15           Out of that, you might say, well, okay, it  
16 looks like maybe there's two things that are going on  
17 here. If you look, you might say that, well, all  
18 right, so we have something going on over here maybe  
19 and something that is maybe going on over here.  
20 However, if you then look at it from a different  
21 direction, you get a different picture.

22           So you are seeing more and better  
23 differentiation between what is going on over here  
24 and, obviously, what is going on over here, and then  
25 you've got something going on out here and over here

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1 a little bit.

2 So when I saw this, I go, wow, that  
3 really does look like a factor analysis. I thought it  
4 was kind of interesting. It actually never had -- I  
5 had kind of that in my head, but I had never seen it  
6 on paper before.

7 So if you were to then say, okay, how many  
8 clouds do we have here, well, obviously, we have two  
9 large ones. If you were to say we have three, then  
10 probably something over here might be the third one.  
11 If you said we had four, I could easily see this one  
12 being the fourth one.

13 Part of this is determining -- you know,  
14 telling the software how many of these to look at and  
15 what does it look like from these different  
16 dimensions.

17 I do want to point out this one over here,  
18 and I do want to point out this one over here, because  
19 we are going to see some examples -- in my opinion,  
20 examples of something like that later. So that is  
21 kind of just a visual of what PCA looks like.

22 What I want to take my time and focus more  
23 on is exactly what are the mechanics of actually going  
24 and doing this.

25 CHAIRMAN BLEY: I am not a person who has

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1 done much factor analysis outside of school, but when  
2 I read this sentence, I have a question about it:  
3 "PCA attempts to account for all the variants in the  
4 data by creating as many factors as there are data  
5 points."

6 These factors -- The original 110 items  
7 are something that make physical sense to me or real  
8 sense or something like that.

9 DR. KOVES: Right.

10 CHAIRMAN BLEY: I understand it. I  
11 understand the scales. These principal factors -- do  
12 they have any meaning to them or are they  
13 mathematical constructs?

14 DR. KOVES: Those are mathematical  
15 constructs, and the idea is to then narrow that down  
16 to the ones that do have meaning.

17 CHAIRMAN BLEY: Are you going to talk  
18 about that some as you go on, how you do that?

19 DR. KOVES: Yes, and that is exactly where  
20 we are going. Really, the thing that you have to do  
21 is that you -- I mean, that is where I am going.

22 CHAIRMAN BLEY: Go ahead.

23 DR. KOVES: So exactly how do you go about  
24 doing this? Well, you enter the data into some --

25 CHAIRMAN BLEY: This was the least

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1 satisfying part of your paper. You go get a computer,  
2 put stuff in, and out comes the answer.

3 DR. KOVES: Actually, no, it is much more  
4 art. There is more art to it than that, and I will  
5 explain part of that, and we will actually have the  
6 opportunity to -- You will have the opportunity to  
7 experience this.

8 You put it in, you know, whatever it is  
9 that you want to use. Ideally, it is one that you are  
10 familiar with, because as my old stats teacher used to  
11 say, getting answers out is not the hard part, even  
12 though when you are first using these, you think that  
13 is the hard part. The hard part is getting the right  
14 answers out.

15 Then you determine the number of  
16 components, and here is where there are a number of  
17 different methods that have been used over time. I  
18 kind of like looking at all of them to get a feel for  
19 it. Eigenvalue greater than one was Kattell --  
20 anyway, I think Kattell, a number of years ago, and  
21 back when they were doing these by hand.

22 Basically, the theory is that everything  
23 -- all the Eigenvalues lower than, smaller than one  
24 are just noise. That is really the break point where  
25 you really start getting meaningful Eigenvalues.

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1           Then also the screen plot -- it is a graph  
2 of the Eigenvalues, and you are looking for where the  
3 break is between where they are coming down and where  
4 they start flattening out.

5           The last one that I have also been using  
6 that also uses kind of a coherence approach is the  
7 results coming out, does it make any sense?  
8 Basically, what I was using -- I mean, they were  
9 looking at the data also -- is trying to use all  
10 three of these to make sure that they converged.

11           Then what you do is -- What you see is you  
12 see a number of items that are grouped together. At  
13 that point, you have to decide what is the meaning.

14           CHAIRMAN BLEY: Just to keep language  
15 straight, here when you say items, you mean one of the  
16 110 items?

17           DR. KOVES: Questions, yes. I'm sorry,  
18 one of the 110 questions.

19           CHAIRMAN BLEY: I just want to be sure.  
20 It is not a particular score from one particular  
21 person. This is a question?

22           DR. KOVES: Yes, and the reason is -- I  
23 got that from my Chair -- the overlap between surveys  
24 and then like SAT doing testing is so similar, they  
25 just use the term items.

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1 CHAIRMAN BLEY: That's fine. Just wanted  
2 to make sure you were using it the same way.

3 DR. KOVES: What you get is you get these,  
4 and you will see these in just a minute -- You get  
5 groups of questions, and you see what they are or at  
6 least abbreviated versions, and from that you  
7 understand these 3000 people, what was guiding them in  
8 terms of their responses to some of these items.

9 Then you label the groups of the items,  
10 and this really ends up being somewhat of an iterative  
11 process to make sure that either you have got -- you  
12 know, you haven't left something valuable on the table  
13 and that you are not including junk.

14 CHAIRMAN BLEY: In simple language, you  
15 are saying we know there is some redundancy and  
16 overlap in our 110 items; is there a subset that  
17 captures all the key information.

18 DR. KOVES: And that is exactly what we  
19 are looking for. We want the smallest subset that is  
20 complete.

21 So here, hopefully, you can read this.

22 CHAIRMAN BLEY: We can, over here.

23 DR. KOVES: You can see, this is literally  
24 the output, and you are looking at one of the factors.  
25 If you go over to the fourth column here, you see

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1 where it starts with .7. If we read down through  
2 these items, we see that -- what do they say? They  
3 say, my supervisor gives me useful feedback. My  
4 supervisor observes me working. My supervisor is  
5 usually available when I have a question or problem.  
6 My supervisor has personally recognized me. My  
7 supervisor responds to questions in an open, honest  
8 manner. My supervisor discusses safety before I start  
9 work on a job. When I need his decision, my  
10 management is usually available. Supervisors are  
11 responsive to employee questions. Supervisors are  
12 visible in the plant, and my supervisor supports  
13 senior management policies.

14 Now if you had this list in front of you,  
15 what might you -- how might you label this factor?  
16 I'm asking.

17 MEMBER SCHULTZ: Supervisory support.

18 DR. KOVES: Supervisory support,  
19 supervisory responsibility, something like that. I is  
20 obviously very obvious that what all these items are  
21 talking about is the supervisor and what they are  
22 doing.

23 CHAIRMAN BLEY: And, of course, it would  
24 have been this one without the factor analysis.

25 DR. KOVES: Actually, when you get into

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1 these, if you look at some of them -- See, the problem  
2 is that very often the items -- even though you want  
3 to try and avoid double-barreled items, which are kind  
4 of asking about two different things, there are --  
5 Because of the construct of safety culture, all these  
6 dimensions are so overlapping, very often items will  
7 kind of cross different dimensions.

8 So if I ask all of you to look at all the  
9 items and group them together, there would be a lot of  
10 similarity, but some of you would pick on certain  
11 elements of that and then move it over to a different  
12 factor.

13 So, basically, what we have done by using  
14 this approach is, rather than just asking the six of  
15 you or 0 of the people in the room or whatever to do  
16 that and then looking at those results and trying to  
17 come to a conclusion, here we have asked 3000 people,  
18 and we are looking at the results from almost 3000  
19 people.

20 CHAIRMAN BLEY: I wonder how much the  
21 ordering of these among the 110 affects this. You  
22 didn't do any shuffling as you went plant to plant or  
23 something like that to see if --

24 DR. KOVES: No, there was no shuffling  
25 over effects. We did have a question about order

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1 effects with one particular factor, and I can go ahead  
2 and get into that when we talk about that a little  
3 later. But pretty much, these were scattered. Well,  
4 you can see.

5 CHAIRMAN BLEY: Well, they have the  
6 numbers, yes.

7 DR. KOVES: They have numbers. It is 26,  
8 8, 108,24, 104, 57, 82, 85, 41 and 35, were the  
9 different items in the order. So they were spread out  
10 all over. It was the prioritizing safety that we saw  
11 that, and we go, uh.

12 MEMBER SCHULTZ: Ken, what are we looking  
13 at here in terms of the categorization? You directed  
14 us to look at column 4.

15 DR. KOVES: Okay. Well, you see, what  
16 these are, are the -- not loadings component scores --  
17 trying to use the right terminology -- and of how this  
18 item -- and of how this item, number 26, correlates  
19 with all of the 11 factors. So, basically, this is  
20 very close to a correlation.

21 So, basically, you can think of this as  
22 this factor -- or this item, number 26, has a  
23 correlation of .72 with this theoretical data point  
24 called a component. Okay? What you see these other  
25 numbers are, these are the correlations with all of

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1 the other components.

2 The ones that are missing have a score  
3 that is less than .10. That is why there is nothing  
4 there. It is just an option to delete those out, so  
5 it cleans things up a little.

6 CHAIRMAN BLEY: So the numbers, again, in  
7 that column is for the fourth principal component.

8 DR. KOVES: The fourth component, correct.

9 CHAIRMAN BLEY: Given that component, this  
10 is the  $r$ , the correlation factor, square root of the  
11  $r$ -squared.

12 DR. KOVES: Okay. With that particular  
13 theoretical point of the component.

14 CHAIRMAN BLEY: Over all the respondents.

15 DR. KOVES: Over all the respondents.  
16 Correct. Dave? Now don't ask me a tough stats  
17 question. It's been a long time.

18 MR. SOLORIO: I am not going to. Sorry.  
19 I just want to remind myself, because I probably  
20 missed it. The 11 components or theoretical  
21 components are what again? What were they?

22 DR. KOVES: Well, I am answering the  
23 question of how we got to those, and then I will  
24 answer what those were in just a minute.

25 MR. SOLORIO: Thank you.

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1 DR. KOVES: And as you see, these come  
2 down in descending order, a nice sort feature, and you  
3 see down here at the bottom, number 35, "my supervisor  
4 supports senior management policies." You see in here  
5 this is the lowest loading. However, it is loaded on  
6 this factor, because it has the highest loading there.  
7 But you see a number of strong cross-loadings,  
8 particularly with 6, also then with 1 and 2.

9 This is telling you that this item  
10 probably is not really as good at picking this out as  
11 these ones here up at the top with the .7 correlation.

12 Just from experience, as a general rule  
13 usually when they print out like this, it is real easy  
14 to name your factor based upon one of those first  
15 three items. Okay?

16 Here is a different -- another example,  
17 and I want to start down here with 75: "It is my  
18 responsibility to raise nuclear safety concerns. It  
19 is my responsibility to report security concerns. I  
20 am personally responsible. I always use human error  
21 prevention techniques. If a procedure is not correct,  
22 I report the problem, and security is just as  
23 important as safety." So this would probably be about  
24 personal responsibility for safety.

25 You see the factor loadings over here that

1 correlate with that. You also see this one here at  
2 the very bottom, "Security is just as important as  
3 safety." Once again, not very strong on that factor  
4 and a lot of cross-loadings.

5 Now just so that you don't think all of  
6 these are real easy all the time, I have put this  
7 other one up here above it: "Co-workers hold one  
8 another to high standards. Workers usually follow  
9 procedures. Personnel do not proceed in the face of  
10 uncertainty. Workers maintain questioning attitude.  
11 Workers follow procedures and make conservative  
12 decisions. Personal conflicts are not allowed to  
13 interfere."

14 I ended up labeling this one questioning  
15 attitude. Even though questioning attitude falls a  
16 little bit lower, it is what a lot of people talk  
17 about. It is also -- when you do subsequent analysis,  
18 it actually becomes a little more clear, but they are  
19 not always -- I did start out with a couple that are  
20 really easy, but actually, to be perfectly honest,  
21 most of the time, 80 percent of the time, it is really  
22 fairly obvious as to what the items are talking about.

23 Okay. Here is my last one.

24 CHAIRMAN BLEY: You just defined these.  
25 You do re-sort this table with results on every

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1 principal component, so you can see the ones grouped.  
2 Is that what you did?

3 DR. KOVES: You choose the option to sort  
4 them, and it prints them out as sorted. So the ones  
5 that have the highest loadings in whatever factor, and  
6 so it loads them on that factor. It prints them out  
7 that way, and then orders them that way. It makes it  
8 a lot easier than trying to pick through it.

9 Okay. So here we get to the end, and here  
10 we have training: "My managers assure high quality  
11 training. Training helps understand how I contribute  
12 to safety. Continuous learning is expected of  
13 everyone. Training at this station reinforces safe  
14 working behavior. New personnel know the difference  
15 working in a nuclear site."

16 So this takes us out, and you see that we  
17 are out to factor or component nine, and you are also  
18 seeing the loadings are starting to -- normally, the  
19 highest loadings are going to be on the first factors.  
20 Also, the most variance is going to be accounted for  
21 by the first factors. This is just a function of the  
22 way PCA works. However, you get down here, and you  
23 see factor number 10. it has three items in it: "I  
24 know how to enter an issuing cap. Management  
25 oversight is provided for safety significant tasks,

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1 and safety culture assessment -- we have had a safety  
2 culture assessment in the past two years."

3 To me, there was no real coherence or  
4 theme in this particular factor. So here is where we  
5 get into that coherence idea. It is like, okay, that  
6 is junk. Then this very last one: "This station has  
7 a knowledgeable and experienced workforce." You see  
8 that it only has three loadings in the whole survey  
9 that are even registering here, and it is off on its  
10 own.

11 If you recall, we had that graphic, and I  
12 said, you see these little ones out here in the fringe  
13 that are off on their own? I thought that was a  
14 really nice graphic of what these kind of look like.

15 So this is how we ended up with nine  
16 factors and going forward with nine factors.

17 Let's see. Where am I? Basically, what  
18 we then did was, because we had so many items,  
19 obviously, you are going from 110 down to seven  
20 factors or seven components, a number of them had a  
21 lot of items in those.

22 So what we did was we then took those  
23 items -- so, for example, in leadership -- and we then  
24 did a factor analysis or a PCA on just that set of  
25 items on that subset of items, looking to see if there

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1 were any patterns within that subset of items, and  
2 that is how we got to the subfactors.

3 So what did we come up with? The very  
4 first -- and these are in order in which they came  
5 out, which meant that they are accounting for less and  
6 less variance as we go through.

7 The first one was management  
8 responsibility, and I have seen it time and time  
9 again, and you read the literature, and it kind of  
10 lines up with the literature where everyone says, hey,  
11 you know, it is management that takes the lead on  
12 driving the culture. Well, ironically, it actually  
13 works out that way statistically, too. So,  
14 convenient.

15 What were some of the subfactors  
16 underneath there? Respect for work environment;  
17 continuous improvement; performance indicators;  
18 resources and rewards. Once again, these are labels  
19 that I put on it based on -- through that process that  
20 you saw where you look at the items and then you draw  
21 a conclusion as to what it is that they are talking  
22 about, and put a label on it.

23 MEMBER SCHULTZ: Is the subgroup a group  
24 of items or are there any prioritization?

25 DR. KOVES: Once again, these come out in

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1 the order of how much variance they account for. So  
2 it is also listed that way, too.

3 MEMBER SCHULTZ: Thank you.

4 DR. KOVES: Also, you know, we haven't  
5 gone through it, but you will see that usually the  
6 first factor -- not does it account for the most  
7 variance. It typically also has the most items in it  
8 also.

9 Going back to that one graphic, you saw  
10 the one group that was the largest. That is why I  
11 said, wow, this really looks like a factor analysis.

12 The next factor that came out was  
13 willingness to raise concerns. Factor analyzed that,  
14 and came out with kind of two subfactors about the  
15 willingness to raise concerns, both informally and  
16 then formally.

17 In terms of decision making, which was the  
18 next factor, factor analyzed that, and there was  
19 nothing that made sense there in terms of subfactors.  
20 So this is just a definition. Decisions are  
21 conservative, timely, safely focused, and engender  
22 confidence.

23 The next one, which is supervisor  
24 responsibility, had four subfactors that came out:  
25 Communication; presence or availability in the field;

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1 coaching ability; and then one item that was talking  
2 about alignment with management, how aligned were they  
3 with management.

4 CHAIRMAN BLEY: That one is not in your  
5 tables in the report, the fourth one.

6 DR. MORROW: Because it is one item, yes.  
7 One thing we did, especially when we were looking at  
8 the correlations, is because when you get down to the  
9 subfactor level they tend to be just two or three  
10 items, especially -- which Ken will talk about just  
11 briefly -- is once you go from like a 110 item survey  
12 down to this final 60 item survey.

13 So those factors, the subfactors, are no  
14 longer very stable. So to continue to conduct  
15 statistical analyses on these -- it doesn't hold up as  
16 well.

17 DR. KOVES: The reliability of one item is  
18 about .2 in theory, and for our scales we want  
19 reliability at least of .8 or more. So the  
20 reliability really goes down.

21 DR. MORROW: And best practice to kind of  
22 triangulate a factor is to have at least three items.  
23 So when you get down to that subfactor level, there is  
24 just not as many items. They do a really good job of  
25 kind of informing what the factor is, but in terms of

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1 analyses, we kept everything to that main factor  
2 level, so the nine factors that Ken is talking about.

3 CHAIRMAN BLEY: Okay.

4 DR. KOVES: In terms of questioning  
5 attitude: Situation/problem awareness; process use;  
6 plant knowledge.

7 Then for, once again, communication, it  
8 was not a -- there were no real subfactors inside of  
9 there, but it talked about communication that is  
10 broad, includes plant level communication, job related  
11 communication, worker level communication, equipment  
12 labeling, operating experience, and documentation.  
13 These are all the types of things that were in there.

14 Lastly, personal responsibility: It is my  
15 responsibility to report concerns and practice nuclear  
16 safety. You saw that up there.

17 Then this one, prioritizing safety: Nuclear  
18 safety is a priority that is seen in meetings,  
19 expectations, coaching, and decisions. This was  
20 probably the most -- at least from a philosophical  
21 perspective, the most problematic of all the factors  
22 -- or components.

23 CHAIRMAN BLEY: Why it explains so little?  
24 Is that what you mean?

25 DR. KOVES: No, because first of all, it

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1 happened to be -- inconveniently, it happened to be  
2 the first six items of the survey. So we had a real  
3 serious question about order effects.

4 What made it more problematic was that, as  
5 you cut back your number of factors and reduced it  
6 down, it would not go away. It stuck together like  
7 glue. The other factors would blow apart, you know,  
8 and distribute themselves -- The items would blow  
9 apart and distribute themselves across other factors.  
10 This one just kept sticking together and sticking  
11 together.

12 So from a philosophical perspective, those  
13 are the things that were kind of driving us crazy. So  
14 we are not -- Because of the order effects question,  
15 in the 60-item survey we have three items representing  
16 this, and they are spread across. So we are going to  
17 see if this hangs together in the future or not.

18 CHAIRMAN BLEY: Yes. I was kind of  
19 surprised in that first one we looked at that they  
20 were spread so widely. I assumed you did that on  
21 purpose, because you had seen the linkage among them.

22 DR. KOVES: No.

23 CHAIRMAN BLEY: That isn't true? It just  
24 turned out that way?

25 DR. KOVES: It just turned out that way.

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1 CHAIRMAN BLEY: That is curious. Okay.

2 MEMBER SCHULTZ: Ken, we are down to the  
3 eighth component here.

4 DR. KOVES: Safety, yes. Then the ninth  
5 one was training quality. Very narrowly focused:  
6 Training is high quality; supported by management;  
7 encourages nuclear safety.

8 As you see, most of these were really  
9 pretty easy to define and see what it was they were  
10 talking about. That was the other thing about  
11 prioritizing safety. It was really kind of -- It was  
12 more difficult to really say what exactly is this  
13 talking about. So for a number of reasons, that was  
14 our problem child.

15 CHAIRMAN BLEY: On the other hand, Steve,  
16 factors two through eight are of the same order in  
17 contribution and reducing the variance.

18 MEMBER SCHULTZ: That's right.

19 CHAIRMAN BLEY: Even though it is eighth,  
20 it is not that far away from two and three.

21 MEMBER SCHULTZ: Yes.

22 DR. KOVES: So then what was the next  
23 step? The next step is reducing, trying to get down  
24 from 110. My target was around 60 items. Basically,  
25 the way I write items and the way these items go,

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1 people will respond to about two or three a minute.  
2 So then you can -- Sixty items, they can do it in  
3 about 20 to 30 minutes, plus 60 items, if you have got  
4 seven factors, really -- or no, if you have nine  
5 factors, about 30 items is probably about all you need  
6 to capture those factors and have a good survey.

7 So it is kind of giving more information  
8 than the bare minimum, but also reducing the number of  
9 items.

10 Here is where this probably most becomes  
11 an art, because what you do is you take a number of  
12 different facts about these items, and then make a  
13 judgment call as to which ones you are going to keep  
14 and which ones you are going to drop out.

15 So some of the things that we looked at  
16 were, first of all, the number of missing data points.  
17 There were some items that were missing lots of data,  
18 and it made sense when you looked at them, because the  
19 bulk of our sample is coming from craft employees,  
20 front line, that type --

21 MEMBER STETKAR: When you say missing  
22 data, people didn't score that item.

23 DR. KOVES: Didn't score that item, right.  
24 They put N/A, the eighth option. A lot of them, if  
25 you looked at them, these were things that would

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1 probably be more known by management and not by craft.  
2 So for the purposes of this survey, we didn't feel  
3 that those items that a lot of people didn't feel like  
4 they could answer would be good moving forward.

5 Also looking at the reliability of the  
6 scale with the item when you remove it -- However,  
7 this didn't come into play much, because -- I mean,  
8 the reliabilities were so high with so many items, and  
9 the high inter-correlations.

10 Then you look at the inter-item  
11 correlations. If you have two items that are highly  
12 correlated, really, one of them is redundant. One of  
13 them is not giving you a lot of additional  
14 information. So you kind of then also look at item  
15 content.

16 Then also what came into a strong play on  
17 this one was correlations with the key performance  
18 indicators. If there was an item that had a strong  
19 correlation with a particular indicator that maybe was  
20 not in the other items, it was more a candidate to  
21 keep.

22 So it is looking at these, all these  
23 together, and making a judgment call as to which ones  
24 to keep and which ones to drop out.

25 MEMBER STETKAR: Can you go back? I am

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1 trying to get my head around the rationale for  
2 deleting items, because specific elements of the  
3 demographic did not feel they were relevant, let's  
4 say, which is, I think, what I heard you say.

5 DR. KOVES: Right. Yes.

6 MEMBER STETKAR: On the other hand, if the  
7 elements of the demographic that felt they were  
8 relevant and did respond were elements of the  
9 demographic that indeed strongly affect nuclear power  
10 plant safety, are you screening things out that you  
11 ought not to be?

12 DR. KOVES: Now that is a very good  
13 question. It kind of goes back to the purpose --

14 MEMBER STETKAR: I understand in a  
15 holistic organizational sense you might rationalize  
16 that, but --

17 DR. KOVES: And what I would recommend  
18 then is I would recommend -- because you are right.  
19 I mean, you have got a good point, but I would  
20 recommend that you then have a management level survey  
21 that you would administer to management.

22 First of all, it is more targeted. You  
23 can ask better questions, and then also you are not  
24 having a lot of -- you are not spending a lot of  
25 utility time on people reading things that they then

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1 say, I have no idea.

2 So that is a valid point, but for the  
3 purpose of the survey, which is to be very broad, that  
4 doesn't mean that we got rid of all of them.

5 Actually, because of some of the validation, we kept  
6 some of them, but it was one of the criteria that was  
7 mixed in with the whole thing.

8 We did keep a few of them, but I would  
9 say, if that is a concern, then let's put together a  
10 management survey and really do that one right, and  
11 really get what we want to get at.

12 DR. BARNES: And that is where some of the  
13 research is going, is developing targeted surveys that  
14 focus on different levels in the organization, and it  
15 makes sense, you know.

16 DR. KOVES: But, good point.

17 Okay. So if we could go ahead and close  
18 this session now, I would appreciate it.

19 (Whereupon, the foregoing matter entered  
20 into closed session at 11:02 a.m. and went back on the  
21 record at 11:20 a.m.)

22 CHAIRMAN BLEY: This meeting is officially  
23 open again.

24 DR. BARNES: Process question: Do you  
25 want to take a couple of minutes and look through the

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1 rest of the survey items before we gather them up  
2 again?

3 CHAIRMAN BLEY: I don't think we have the  
4 time, really, to do that, actually.

5 DR. BARNES: You have seen enough.

6 MR. SOLORIO: If you want to look at them.

7 CHAIRMAN BLEY: It will be in the record.  
8 We can look at them later. We are an hour behind.

9 DR. KOVES: And Stephanie is glad, too.  
10 She was thanking me.

11 CHAIRMAN BLEY: At least, the  
12 Subcommittee, I think, doesn't have a problem if we go  
13 beyond 3:30. I hope you don't either.

14 DR. KOVES: I think my flight is at six.  
15 Should be leaving about now. So that means I would  
16 kind of like -- I need to leave by four.

17 CHAIRMAN BLEY: Okay. If we aren't  
18 finished by then, we will stop just before then and  
19 see if anybody has anything else for you or you have  
20 anything more for us. You have one more talk. So,  
21 Stephanie, go ahead. We will break for lunch at some  
22 natural place sometime Noon or a little later.

23 DR. MORROW: Sure.

24 CHAIRMAN BLEY: Whenever it feels right.

25 DR. MORROW: Okay. My presentation today

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1 is really focusing on the White Paper that you  
2 reviewed, and is the Office of Research's evaluation  
3 of the INPO survey and the construct validation study  
4 that they conducted.

5 CHAIRMAN BLEY: Now Ken is going to talk  
6 more later. So I guess you will do everything up to  
7 that validation part. Then Ken will go, and then you  
8 will come back.

9 DR. MORROW: Right. So my morning  
10 presentation is really up to where Ken left off, which  
11 is with the six-item survey, so looking at the factor  
12 analysis and kind of the reliability of the survey.  
13 Then in the afternoon, we will show the correlations  
14 between the INPO metrics and the NRC metrics.

15 CHAIRMAN BLEY: Okay. go ahead.

16 DR. MORROW: So again, as kind of outlined  
17 in the White Paper, when we were looking at doing an  
18 evaluation of the INPO study, we were looking at a  
19 couple of primary global questions. One, is the  
20 survey valid and reliable? Do we have confidence in  
21 the survey in the context of this study?

22 Also, does the survey show support for the  
23 Safety Culture Policy Statement traits? Again, we  
24 were doing this as a user need from OE, and this was  
25 kind of happening at the same time as the Policy

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1 Statement traits were rolling out.

2 Also, is there a relationship between the  
3 safety culture survey results and safety performance  
4 metrics? That is what we will talk about this  
5 afternoon.

6 I am going to start right off with kind of  
7 the key findings from the White Paper, which I will  
8 talk about in the remainder of this presentation.

9 One is that we found that the INPO Safety  
10 Culture survey did demonstrate evidence of construct  
11 validity and reliability within the context of the  
12 study that was conducted.

13 Also, although there wasn't one-to-one  
14 alignment with the Safety Culture Survey factors and  
15 the NRC's Safety Culture Policy Statement traits, they  
16 did share many commonalities. So there were some  
17 consistent themes that emerge from the survey factors  
18 and the Policy Statement traits, and each trait was  
19 represented by at least one survey factor. So that  
20 was kind of promising, from our perspective.

21 First, kind of our evaluation approach:  
22 How are we evaluating validity and reliability? We  
23 look at it from the perspective of construct validity,  
24 and we use the term construct to describe an IDS. In  
25 this case it is safety culture, but it can also be

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1 things like intelligence or personality.

2 When we think about kind of the validity  
3 of the construct, what we are asking is: Is the  
4 survey measuring what it purports to be measuring? We  
5 can look at that in a number of different ways, but  
6 the ways that we focused on within this evaluation is  
7 the content validity of the survey -- so, really, does  
8 the survey cover kind of the breadth of the safety  
9 culture construct -- and also the criterion related  
10 validity. This was where we look later at the  
11 correlations: Does the survey demonstrate a  
12 relationship with outcomes that it should  
13 theoretically be related to.

14 So kind of the overlying theory and what  
15 Val talked about earlier today is that we believe  
16 safety culture to be related to safety performance.  
17 We have some research literature showing that there  
18 are about small to medium size relationships. So we  
19 want to see if those relationships appear using our  
20 data and using this INPO survey.

21 Also we were looking at reliability. So  
22 kind of a prerequisite for validity, is it measuring  
23 what it is supposed to measure, but does it measure it  
24 consistently?

25 We looked at two types of reliability in

1 this evaluation, one internal consistency. This was  
2 specifically looking at the items, and do they produce  
3 similar results? So we just saw about how there are  
4 items that are grouped within factors, and do those  
5 items kind of hold together in a reliable way? It is  
6 almost an additional check on the factor analysis to  
7 see if there is some internal consistency there.

8 Also within-group reliability --

9 CHAIRMAN BLEY: So that is a qualitative  
10 look?

11 DR. MORROW: The internal consistency?

12 CHAIRMAN BLEY: Yes.

13 DR. MORROW: That is statistical. That is  
14 a quantitative look.

15 CHAIRMAN BLEY: But separate from the  
16 factor analysis?

17 DR. MORROW: Separate from the factor  
18 analysis. It is a different way of looking at it.

19 Also within-group reliability: This is  
20 really about -- I kind of mentioned earlier the  
21 stability of the group mean. So one thing that we are  
22 doing with safety culture -- and I will speak to  
23 safety culture specifically, because we are  
24 conceptualizing this as an organizational level  
25 phenomenon, but we are measuring it with a survey of

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1 individuals' perceptions.

2           So somehow we have to go from that  
3 individual level to the organizational level. It is  
4 really important to somehow reflect whether or not the  
5 survey results show that this is a concept that is  
6 shared among members of the same organization. So  
7 that is kind of what the within-group reliability is  
8 tapping into. Is this a shared idea?

9           In addition, kind of just some more  
10 holistic evaluation questions that we thought about as  
11 we were reviewing the study is, first, were the data  
12 collection procedures and the resulting sample  
13 appropriate for the research questions?

14           Is the data analysis approach consistent  
15 with good practice in social sciences? And then given  
16 the data, would an independent researcher produce the  
17 same results and arrive at similar conclusions?

18           So here we wanted to go above and beyond  
19 just looking at what INPO did, running the exact same,  
20 identical analyses, and saying, oh, yeah, we got the  
21 same results, we used the same analyses, but going  
22 deeper and looking at, okay, they used this analysis;  
23 was this analysis appropriate. Was this sample  
24 appropriate? Was the response rate appropriate, given  
25 kind of the style of the study? So we were really

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1 looking at all of those questions when we looked at  
2 the study.

3 So I will start by talking about the  
4 content validity, and this is more of a qualitative  
5 subjective view. If we had some perfect measure of  
6 safety culture out there, if there was one that was  
7 well accepted, it existed, then the ideal would be to  
8 compare this survey against that true score on safety  
9 culture, but that doesn't exist.

10 So what we do is we look at, in some ways,  
11 a more subjective look so that we can establish does  
12 this survey seem to get at the same things that other  
13 surveys have touched on. Does the content seem  
14 appropriate? Does the content cover all of the  
15 possibilities?

16 Ken presented quite a bit on kind of how  
17 the survey was developed, how the items were  
18 constructed. So when we look at kind of where the  
19 items came from, they were drawn from multiple sources  
20 that are relevant to the nuclear industry, INPO, NRC  
21 ROP, IAEA, and also surveys from non-nuclear research  
22 literature. So there was a good spectrum of kind of  
23 sources where these items came from.

24 We also look at how the survey was  
25 developed. Is it following good practice in the

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1 social sciences? We talked a little bit about the  
2 rating scale that was used, the 7 point rating scale  
3 from strongly disagree to strongly agree, and that is  
4 one of the most common used in the social sciences.

5 It is also important to kind of go forward  
6 with this more standardized rating scale, because it  
7 allows us to take what is data about employee  
8 perceptions, my perception of the culture, and make it  
9 quantitative.

10 We are taking someone's saying that they  
11 strongly disagree with this statement, and we are  
12 assigning some number to it. So you need the  
13 standardized rating scale, so that you have perceived  
14 equal distances between the potential options,  
15 response options.

16 The other thing we looked at was how the  
17 items were written, and Ken talked about kind of the  
18 original USA survey, and that those items were not  
19 written to be survey questions. You really want kind  
20 of a specific type of item for a survey question. You  
21 want it to be simply written.

22 You want it address a single topic, and to  
23 the extent possible, you want to avoid double barreled  
24 statements, something like safety and security -- that  
25 would be confusing for someone taking the survey.

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1 Well, what is more important, safety or security? Do  
2 I see those as conflicting things?

3 DR. KOVES: Safety is good. Security is  
4 bad. You know, then how do you answer?

5 DR. MORROW: Yes. So you really want  
6 simple statements. What we saw is, for the most part,  
7 that there were kind of simply written statements.  
8 What we have on the slide there is kind of some  
9 examples of the good practice items in the survey.

10 MR. WIDMAYER: I had a question.

11 DR. MORROW: Sure.

12 MR. WIDMAYER: Is there something that is  
13 typically done to look at content validity that either  
14 you didn't do here for some reason or that you didn't  
15 think it did a good job or did it pass muster in all  
16 of your content validity examinations?

17 DR. KOVES: That is why we added the 51  
18 percent more items, to make sure that it did cover.

19 MR. WIDMAYER: Okay.

20 DR. KOVES: Does that answer your  
21 question?

22 MR. WIDMAYER: No.

23 DR. KOVES: I'm sorry. I will show you.

24 MR. WIDMAYER: You guys are looking at  
25 this independently for validity.

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1 DR. MORROW: Right, yes.

2 MR. WIDMAYER: Okay. You mentioned three  
3 things where you said --

4 DR. MORROW: It passed muster.

5 MR. WIDMAYER: Yes. What did it not pass  
6 muster on, something that is typically looked at for  
7 content validity or did it do well in every area?

8 DR. MORROW: IN terms of content validity,  
9 from what is in the literature now --

10 MR. WIDMAYER: Typically?

11 DR. MORROW: Yes -- it covers the breadth  
12 of kind of safety culture, and we also see that when  
13 we look at the alignment between the survey and the  
14 Policy Statement traits, the fact that -- What I will  
15 talk about later is that, for each trait, there is at  
16 least one factor or subfactor that kind of covers the  
17 idea that is in that trait. So we see some  
18 correspondence there that kind of also bolsters that  
19 content validity argument.

20 MEMBER SCHULTZ: And just for  
21 clarification, were we talking about the 110 question  
22 survey here or the 60 question resultant set?

23 CHAIRMAN BLEY: The traits are with  
24 respect to the NRC Policy Statement.

25 DR. MORROW: Yes, the traits are with the

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1 NRC Policy Statement. In terms of evaluating the  
2 content validity, that was originally with the 110,  
3 but we also looked to see what items didn't make the  
4 cut, and did they seem reasonable.

5 For the most part, it was items that  
6 didn't seem to fit as well within a factor. So we  
7 look at the factor analysis results and, if they were  
8 items that kind of loaded all over the place, they  
9 didn't load cleanly on one factor, then those were  
10 some that kind of were included.

11 So what kind of you ended up with, with  
12 the 60-item survey, is a cleaner survey. You are  
13 tapping into all of the main factors that came out of  
14 the factor analysis without some of the noise that was  
15 with the additional items.

16 MEMBER SCHULTZ: Understood. Thank you.

17 CHAIRMAN BLEY: I don't have the tables in  
18 front of me again, what you just said, I think, says  
19 that if a subfactor under a principal factor also had  
20 effects on other principal factors, you somehow got  
21 rid of that cross-effect? How would you do that?

22 DR. MORROW: A single item.

23 DR. KOVES: A single item.

24 DR. MORROW: A single item.

25 CHAIRMAN BLEY: A single question?

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1 DR. MORROW: Yes.

2 DR. KOVES: If you go back to the tables  
3 that I had, and you saw that usually the items at the  
4 bottom, there were cross-overs. Those are really less  
5 desirable, because --

6 CHAIRMAN BLEY: And are those the ones  
7 that ended up in the four down at the bottom on the  
8 new -- You retained all the 110 somewhere, right?

9 DR. KOVES: Well, they were all on that  
10 list. The 106 were in factors, and it was those last  
11 four that we just basically said --

12 CHAIRMAN BLEY: And those are the ones you  
13 are talking about, that those four didn't align well  
14 with any one factor?

15 DR. MORROW: Right. I think one of the  
16 first things that happened when they went down to a  
17 reduced item survey, which is --

18 CHAIRMAN BLEY: Sixty item survey.

19 DR. MORROW: Yes, the 60 item survey,  
20 which is standard practice, when you are developing a  
21 survey.

22 CHAIRMAN BLEY: So between the 60 and 110,  
23 some of the ones that disappeared were ones that  
24 affected multiple?

25 DR. KOVES: Correct.

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1 DR. MORROW: Right. They didn't load  
2 cleanly on one factor.

3 CHAIRMAN BLEY: Okay. So we haven't  
4 actually seen what those 40 are.

5 DR. KOVES: That went away?

6 CHAIRMAN BLEY: Yes.

7 DR. KOVES: No. What you had was -- This  
8 was what was left.

9 CHAIRMAN BLEY: That is what is left.

10 DR. KOVES: Yes. You don't see that. You  
11 can do the analysis later.

12 CHAIRMAN BLEY: So I expect, when I do the  
13 analysis later, I will find that among those 40 are  
14 the ones that affected multiple principal components  
15 fairly strongly.

16 DR. MORROW: Right.

17 CHAIRMAN BLEY: And that is part of the  
18 rationale.

19 DR. MORROW: Yes, and Ken talked about  
20 that a little bit, that they used different criteria  
21 for looking at which items to eliminate, and still  
22 there was a good kind of breadth of the literature  
23 covered, and items were still taken for multiple  
24 sources.

25 CHAIRMAN BLEY: I think I am envisioning

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1 a problem that doesn't exist. I am just thinking that  
2 if one of them affected many, but really affected one  
3 of them quite strongly, and you take it out, we are  
4 losing something important, but there was enough near-  
5 redundancy in the subfactors that that is almost  
6 surely not a problem.

7 DR. MORROW: Right, exactly.

8 DR. KOVES: And even in the subfactors,  
9 the ones that came out were the ones that had more  
10 cross-relevance as a general rule, but some of them  
11 might have stayed for other reasons on that list of  
12 criteria.

13 DR. MORROW: Okay. So next we looked at  
14 the data collection and kind of the characteristics of  
15 the sample that was used for the study. First just  
16 kind of pointing out, they started with a web based  
17 survey. That is a pretty big assumption, you know,  
18 just as this is the collection methodology that we are  
19 going to use.

20 When we look at what is good practice in  
21 the social sciences, surveys are the most appropriate  
22 means if you are looking at trying to capture employee  
23 attitudes, perceptions, values, things that aren't  
24 directly observable, particularly by outsiders.

25 So just I myself going into an

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1 organization and trying to say what is the safety  
2 culture here is something where it is actually more  
3 efficient, less expensive to do a web based survey of  
4 the workforce, and you get much better data; because  
5 what I see as the safety culture around here, I might  
6 be misinterpreting what I am looking at. As an  
7 outsider, I wouldn't have as good of an idea of what  
8 I am seeing.

9 You can get a lot more rich information  
10 from the employees. So in this case, a web based  
11 survey was an appropriate means to collect the data  
12 for this study.

13 Also they looked at a cross-section of the  
14 nuclear power industry. So in the context of this  
15 study where it was really a construct validation, the  
16 cross-section of the industry was most appropriate.  
17 Again, Ken had talked about this 97 percent of the  
18 operating nuclear power plants. They used a ratified  
19 random sample to select 100 individuals from each  
20 site, and they had a response rate of about 48  
21 percent.

22 That kind of cross-section of the  
23 industry, getting a 48 percent response rate might not  
24 be appropriate in other circumstances, but when we are  
25 looking at this voluntary research based survey, we

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1 kind of just want to get a feel for what does safety  
2 culture look like across the entire nuclear power  
3 industry. Then these are adequate for the questions  
4 being asked.

5 Also, the survey touched on different  
6 occupational groups, and here on the slide you can see  
7 some of the percentages of the final sample of the  
8 survey. Seventeen percent was maintenance, 16 percent  
9 operations, 10 percent security, so on and so forth.  
10 This is just some examples of the percentages, and  
11 also long term contractors were included in the final  
12 sample. The sample was seven percent contractors.

13 CHAIRMAN BLEY: Is this a percentage of  
14 the final respondents or of the 100 selected?

15 DR. MORROW: The final respondents. So the  
16 final sample of 2,876. These are the percentages from  
17 different work groups.

18 MEMBER STETKAR: If I add quickly, that is  
19 61 percent of your respondents. Where were the other  
20 39 percent, just randomly scattered through?

21 DR. KOVES: You know, there is HR,  
22 etcetera, basically balance of plant.

23 DR. BARNES: Housekeeping.

24 MEMBER RYAN: There were 2876 respondents  
25 across 63 sites. What was the distribution for per

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1 site? What is the mean standard deviation for that?

2 DR. KOVES: For each site?

3 MEMBER RYAN: Yes. What was the  
4 variability site to site.

5 CHAIRMAN BLEY: You got at least 35, you  
6 told us.

7 MEMBER RYAN: Did they average about the  
8 same?

9 DR. BARNES: You mean the number of  
10 respondents per site who gave us usable data?

11 DR. KOVES: Okay. It ranged -- I don't  
12 know the exact number, but it ranged from about 35 to  
13 about 55, except for the one station where we  
14 accidentally double surveyed, but other than that, it  
15 was pretty much in that range, although I don't know  
16 --

17 DR. MORROW: It was pretty consistent. I  
18 don't want to misrepresent what the actual mean and  
19 standard deviation were, but it was fairly consistent.

20 MEMBER RYAN: Sixty-five and 35 is the  
21 range of respondents per site, something like that?

22 DR. KOVES: Yes, and I wouldn't even say  
23 65 was. I would say more about like 35 to 55, because  
24 once they got over that 45 limit, we kind of ignored  
25 them, and they would trickle in some more. But it was

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1 a modestly tight range.

2 MEMBER RYAN: Okay.

3 DR. KOVES: That is the technical term.

4 MEMBER RYAN: Very good. Thank you very  
5 much.

6 DR. MORROW: Okay. Ken spent a lot of  
7 time on this. So I only have one slide devoted to the  
8 principal components analysis.

9 Again, principal components analysis is a  
10 type of factor analysis. Some of the unique  
11 characteristics of principal components analysis is  
12 that it tries to create unique factors until all of  
13 the variants in the items is accounted for.

14 So again, you can have 110 factors to  
15 account for the 110 items, and where the Eigenvalue  
16 greater than one comes from is that they looked at  
17 what would be a reasonable number of factors to  
18 retain, and the Eigenvalue being greater than one is  
19 saying that this factor contributes more than a single  
20 individual item would if just had 110 factors. So you  
21 look at keeping the factors that are at least  
22 contributing more than one item would on its own, and  
23 that is kind of where that comes from.

24 The table I have on this slide is just  
25 kind of showing you the variance accounted for by each

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1 of the factors that came out of the analysis, and in  
2 this case, because 110 were near 100 items, Eigenvalue  
3 equals greater than one is about greater than one  
4 percent of the variance.

5 So in this case, you are starting to get  
6 down to, with factor 9, that 2.7 percent of the  
7 variance.

8 CHAIRMAN BLEY: And by this time, you've  
9 got about 60 percent.

10 DR. MORROW: Yes, exactly.

11 CHAIRMAN BLEY: So the remaining 40 is  
12 just scattered over all sorts of little --

13 DR. MORROW: Right.

14 DR. KOVES: The rule of thumb that I  
15 learned -- I don't know about you guys -- was, you  
16 know, the goal is that you want to capture 60 percent  
17 of the variance with 30 percent of the variables or  
18 less.

19 DR. MORROW: And 60 percent is what I  
20 learned as well. So on something we looked at, okay,  
21 we are at 60 percent. So this is reasonable.

22 MEMBER STETKAR: One day you can explain  
23 to me the strong basis for 60 percent, but go ahead.

24 DR. MORROW: So when we looked at the  
25 principal components analysis, we were really

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1 interested in, okay, so this is what you get if you  
2 run it this way; you know, what if we run different  
3 kinds of factor analyses? What if we make different  
4 decisions about keeping items or removing items using  
5 some of the same criteria that ken talked about when  
6 it got down to the 60 item survey.

7 Then again, okay, now we have a 60-item  
8 survey. If we run the factor analysis, do we still  
9 see the same factors coming out when we just look at  
10 those 60 items?

11 CHAIRMAN BLEY: You haven't given the 60  
12 factor to anybody yet, have you?

13 DR. MORROW: It is the same. The  
14 conclusion is it is the same factors, that you still  
15 have the same factors.

16 DR. KOVES: Well, he is asking about using  
17 new data. Actually, we have used it with one vendor,  
18 but that is all that we have used it with.

19 CHAIRMAN BLEY: One vendor? That means  
20 all the power plants that used that vendor or people  
21 at that vendor?

22 DR. KOVES: The people at that vendor. So  
23 that is not exactly a power plant either.

24 CHAIRMAN BLEY: Right.

25 DR. KOVES: And I have the data, but I

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1 haven't factored it. So I am not even sure. However,  
2 we did use the 110 with a different vendor, and the  
3 factor structure stayed pretty stable. It wasn't  
4 exactly the same, but it was pretty similar.

5 CHAIRMAN BLEY: I am just curious. When  
6 do you expect to have some experience using the new  
7 survey with some power plants?

8 DR. KOVES: As the opportunities become  
9 available.

10 CHAIRMAN BLEY: I have no idea what that  
11 means. In the next two years, are we likely to see  
12 one or 50? Any idea?

13 DR. KOVES: Can we talk about this in the  
14 closed session?

15 CHAIRMAN BLEY: Absolutely.

16 DR. KOVES; I will be glad to answer it.  
17 It depends. Six years of graduate school it took me  
18 to learn that. It is the right answer.

19 CHAIRMAN BLEY: Go ahead.

20 DR. MORROW: All right. So it was  
21 basically a sensitivity analysis that we did. So you  
22 can conduct different kinds of factor analyses with  
23 this data to see if we would get the same factors.

24 CHAIRMAN BLEY: Tell me a little bit about  
25 what you did. The 60 items were among the 110 items?

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1 DR. MORROW: Right. Yes.

2 CHAIRMAN BLEY: So you went back to the  
3 original surveys and just looked at those 60 items  
4 then to see?

5 DR. MORROW: Yes.

6 CHAIRMAN BLEY: But we already know that  
7 they are going to work, because they came out of the  
8 factor analysis.

9 DR. MORROW: When you take away items --  
10 When you are doing the factor analysis, part of that  
11 kind of identifying dimensions is based on all of the  
12 variance in the items. So if you take away 40 items,  
13 then you could see different dimensions start to  
14 emerge where some of those items were kind of  
15 contributing to, for example, a safety communication  
16 factor.

17 Once you take away some of those items,  
18 suddenly there is not enough items within the  
19 remaining -- that factor, and they kind of move apart.  
20 They attach to other factors.

21 MEMBER STETKAR: But didn't the winnowing  
22 process, by definition, remove that source of  
23 variability? As I understood it, you said, if you saw  
24 a specific item that had fairly broad applicability,  
25 you tossed it out, because it didn't reinforce the

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1 factor. So why --

2 DR. MORROW: It removed some of that  
3 variability, but what can also happen is, because that  
4 item was in there and it was loading on different  
5 factors, it can force other items to kind of --

6 CHAIRMAN BLEY: Agree with some of the  
7 support from one of the factors. Some rocks may come  
8 up, but it is hard to imagine that it won't still --  
9 won't align with the original factors.

10 DR. KOVES: Well, actually, on the big  
11 ones, yes, it is usually on the ones that are  
12 accounting for a lot of variance. Those are the ones  
13 that usually end up being more fragile.

14 CHAIRMAN BLEY: Yes.

15 DR. MORROW: Right. That is consistent  
16 with what we found, is that the most stable factor was  
17 that management responsibility. Those items tended to  
18 stay together, no matter what other items were  
19 included in the analysis.

20 CHAIRMAN BLEY: We would be looking at  
21 methodology problems, if that didn't come out.

22 DR. MORROW: Right. That is an inherent  
23 part of the principal components analysis, is the  
24 first factor always accounts for the most variance.  
25 You see that, no matter what.

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1           Actually, the least stable factor that we  
2 found was the safety communication factor, which is  
3 sort of interesting, because it is not the one that  
4 accounts for the least amount of variance. It is kind  
5 of in the middle there. It is number six, but those  
6 items were kind of -- Depending on the other items  
7 that were included in the factor analysis, those items  
8 may be loaded on the management responsibility factor,  
9 the decision making factor, I think also the  
10 supervisor responsibility factor.

11           When we look at those items and kind of  
12 look at it more from a theoretical standpoint, it made  
13 sense, because communication is inherent to multiple  
14 aspects of kind of even just plant operations, but  
15 sometimes it is about your communication of your  
16 supervisor or how management communicates to the rest  
17 of the workforce. So those items didn't always kind  
18 of stay together in a single factor.

19           DR. KOVES: Can I throw in what I thought  
20 was an interesting tidbit?

21           DR. MORROW: Sure.

22           DR. KOVES: If you look at the principles  
23 for a strong nuclear safety culture, there is eight of  
24 them, and there is not one for communication. Yet  
25 when you look in the individual items, you see

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1 communication scattered throughout all the eight  
2 principles.

3 Well, what I found just totally  
4 fascinating was, yeah, if you manipulated this a  
5 little bit, that is exactly what happened to  
6 communication. it just kind of splattered across  
7 everything, and wasn't separate.

8 MEMBER SCHULTZ: It is an interesting  
9 observation.

10 DR. KOVES: Yes.

11 MEMBER SCHULTZ: Very telling.

12 DR. KOVES: And "splatter" is the  
13 technical term.

14 DR. MORROW: So the next, once you have  
15 the nine factors that came out of the principal  
16 components analysis, Ken talked about the factor  
17 labeling that happened, and he actually went into that  
18 pretty extensively.

19 So what I have on this slide is just kind  
20 of when we looked at duties, are these factor labels  
21 appropriate? Do they seem to make sense, because this  
22 is a very subjective -- it is more of an art. It is  
23 the art part of the factor analysis.

24 What we have here is just an example item  
25 for each factor that kind of illustrates why we

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1 thought the factor was labeled as it was labeled. So  
2 we found support for the factor labeling. It did seem  
3 like these were reasonable labels for each of the  
4 factors that emerge from the analysis.

5 MEMBER SCHULTZ: Was there some validation  
6 of this part of the process? It seems very  
7 qualitative.

8 DR. MORROW: It is very qualitative.

9 MEMBER SCHULTZ: Did you do a peer check  
10 in terms of this selection in the examples?

11 DR. KOVES: We didn't.

12 DR. MORROW: A peer check of these  
13 examples? No. This was the peer check, in a way.  
14 This is us looking at, okay, INPO labeled these  
15 factors in such a way, does it make sense? If we look  
16 at these items, would we label it the same way?

17 MEMBER SCHULTZ: How broad was "we"? That  
18 is part of my question.

19 DR. BARNES: There were three or four  
20 staff at Idaho National Lab that did a check on the  
21 PCA and the labeling at the beginning, myself, staff.  
22 I think that was the extent of it that I know did  
23 theirs independently.

24 MEMBER SCHULTZ: But a healthy group of  
25 experts who looked at the elements that comprise this

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1 result. That's fine. Thank you.

2 DR. BARNES: Yes.

3 DR. MORROW: The next thing we looked at  
4 was the reliability of the survey factors. So for  
5 this, this was a quantitative analysis. We used  
6 Cronbach's Alpha, which is a measure of the internal  
7 consistency of the items. The kind of rule of thumb  
8 cutoff value is .70.

9 Again, we stayed at the main factor level,  
10 because I talked a little bit that, when you get down  
11 to the few items that are at the subfactor level, they  
12 aren't as internally consistent. You want at least  
13 three items per factor, really.

14 What you can see here is that all of these  
15 values are above the cutoff of .7, which indicates the  
16 good reliability of the factors. This is about  
17 whether the items in the factors seem to be measuring  
18 kind of the same thing. So you can see that there is  
19 a very high value for the safety culture overall.

20 CHAIRMAN BLEY: I didn't chase this  
21 Cronbach's Alpha thing. I don't know it. Tell us a  
22 bit about what it is actually measuring, and why .7 is  
23 good reliability and what you mean by that. You have  
24 told us what you mean by that, but why is that good,  
25 and what actually is it measuring?

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1 DR. KOVES: It is measuring the average  
2 inter-item correlations, and it is a combination of  
3 the inter-item correlations and the number of items.  
4 So that is part of the reason --

5 CHAIRMAN BLEY: Correlations through the  
6 data from the test?

7 DR. KOVES: Right. The inter-item  
8 correlations of those particular items. So for  
9 training quality, we got three items. What are the  
10 inter-item correlations of these three items? So the  
11 number or the actual Alpha ends up really being a  
12 function of the number of items and the correlations  
13 between them.

14 So if they are not very correlated, then  
15 you don't have a lot of confidence that you are  
16 getting at the same thing.

17 Point-seven? You know, honestly I am not  
18 sure if that is one of those things like .05 where it  
19 is just like this is what everyone uses.  
20 So there may be a rationale beyond that, but I don't  
21 know what it is, if there is.

22 CHAIRMAN BLEY: You call it reliability.

23 DR. MORROW: Right.

24 CHAIRMAN BLEY: And if we just take one of  
25 them, the management responsibility one, this is then

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1 going through all of the items that said management  
2 responsibility --

3 DR. MORROW: Correct.

4 CHAIRMAN BLEY: -- and seeing if all of  
5 those are matching on their scores, kind of that sort  
6 of thing?

7 DR. MORROW: Yes.

8 CHAIRMAN BLEY: The error that it is  
9 looking at is -- it is not -- you know, your overall  
10 correlation coefficients measuring -- I am still not  
11 completely sure what this is measuring.

12 DR. MORROW: It goes through a process of  
13 pairwise correlations. So it takes like the 20 items  
14 that are in management responsibility and goes  
15 through, and for each pair of items that looks at the  
16 correlation, and what you get is kind of that average  
17 of all of the pairwise correlations.

18 CHAIRMAN BLEY: Of all of the pairwise?

19 DR. MORROW: Right.

20 CHAIRMAN BLEY: So it is pairwise. If all  
21 of them align, this is going to get a one up there.

22 DR. MORROW: Right. Exactly. if they are  
23 all getting the exact same response, then you will hit  
24 a one. So what this is, is kind of an overall  
25 average.

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1 CHAIRMAN BLEY: It is just like an  
2 algebraic average of all of those pairwise  
3 correlations?

4 DR. MORROW: I am; not certain on that  
5 point.

6 DR. KOVES: I don't remember the exact  
7 formula. I remember the primary elements are the  
8 inter-item correlations and the number of items.

9 DR. MORROW: And the number of items, yes.

10 MEMBER RYAN: I got it for you. It is  $K$   
11 over  $K$  minus 1 times 1 minus the sum over  $K$  of  $\sigma$   
12  $y$  squared divided by  $\sigma x$  squared.

13 MR. WIDMAYER: That is what he said.

14 DR. KOVES: Thanks for reminding me.

15 MEMBER RYAN: There you go.

16 DR. MORROW: But it is an alternative to  
17 like a test/retest reliability where it is like, if we  
18 took this item and only used this item to measure  
19 management responsibility, would we get the same  
20 result as if we used any of these other items? So it  
21 looks at the consistency of the items in measuring  
22 that same thing.

23 So we want there to be at least some  
24 reasonable amount of consistency, so that we can say  
25 that these items are all measuring kind of the same

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1 underlying thing.

2 CHAIRMAN BLEY: And personal  
3 responsibility for safety is getting close.

4 DR. MORROW: Yes. The other thing is, it  
5 is a function of the number of items. So this is  
6 inflated when you have many more items. You will  
7 notice like the .98 with 60 items. That is another  
8 reason why we are looking for at least three items, so  
9 that we have at least the possibility of having some  
10 internal consistency.

11 CHAIRMAN BLEY: Okay.

12 DR. MORROW: The next thing we looked at  
13 was the within-group reliability of the survey items  
14 -- or I'm sorry -- of the survey respondents. Thank  
15 you.

16 What we did for this was to look at two  
17 types of intra-class correlations. So again, all of  
18 this is kind of based on correlations, looking at the  
19 relationships.

20 For this, what we are looking at is the  
21 relationships between how people from the same site  
22 responded to the survey, and the first ICC is looking  
23 at the extent to which individuals at a site had the  
24 same responses. This is very similar to doing like a  
25 test of intra-rater reliability.

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1           For these values, you can see, just  
2           looking at the table that the range of values is lower  
3           than the second type of ICC, and this is expected. We  
4           are not expecting to have extremely high values when  
5           we are looking at whether individuals have the exact  
6           same responses, because we expect some variability in  
7           how they respond to the survey.

8           What we are looking for is that there be  
9           a statistically significant value for this ICC(1). So  
10          that tells us that there is some degree of sharedness  
11          among how respondents are answering the survey.  
12          Again, this is particular to safety culture, because  
13          it is an organizational level construct, and we expect  
14          that there will be some degree of sharedness when  
15          people respond.

16          The ICC(2) is about the internal  
17          consistency of the mean score for the site. So this  
18          is really looking at -- It is similar, actually, to  
19          the Cronbach's Alpha where we want to see, if we took  
20          out one of those respondents, would we have the same  
21          mean score? If we added in a few more, would that  
22          mean score be affected?

23          So this is really important if we are  
24          going to have any faith in using that mean score to  
25          look at correlations. Is this a shared concept? Is

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1 this a score or something that seems to be stable?  
2 Again, we are looking for kind of a rule of thumb  
3 cutoff of .7, and this is a range of values, because  
4 we calculated these ICCs per site.

5 CHAIRMAN BLEY: Personal responsibility  
6 for safety on the range had the widest range.

7 DR. MORROW: Had the widest range, yes.

8 CHAIRMAN BLEY: So does that mean there is  
9 less certainty in how people think about it  
10 individually versus the collective?

11 DR. MORROW: Yes, I think that variable  
12 overall kind of acted differently from some of the  
13 other factors in the survey.

14 DR. KOVES: Communication acts a little  
15 funny for one reason. Prioritization -- This one is  
16 very interesting, because, basically, when you look at  
17 the scores, they are pretty much consistently high  
18 across all the stations, and the correlations don't do  
19 very well, because they don't vary across the  
20 stations.

21 So this is another one that is like, you  
22 know, this is behaving -- kind of interesting behavior  
23 by this one. So I am not sure if that helped any.

24 MEMBER RYAN; Not a lot. I am trying to  
25 figure out why the numbers are large, that the range

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1 is very tight, like number 1.

2 DR. MORROW: Well, this one was  
3 interesting, because this is showing the range of the  
4 values. So we have got the minimum and the maximum  
5 from all the sites. There are actually only a couple  
6 of sites who have those low values below .7.

7 MEMBER RYAN: I see. So you really have  
8 to dive into the full dataset to understand that.

9 DR. MORROW: Yes, and it kind of behaved  
10 weirdly, because for the most part, there wasn't a lot  
11 of variability on that factor, and that is what Ken  
12 was mentioning.

13 MEMBER RYAN; Okay. Thank you. That  
14 helps.

15 DR. MORROW: Again, I think I have talked  
16 about this a bit, but why is within-group reliability  
17 important? It is something that we don't necessarily  
18 look at with all surveys, but again what we are doing  
19 is taking these individual perceptions of safety  
20 culture and aggregating them up to the organizational  
21 level, because kind of the next step is to look at  
22 whether the organizational level score is related to  
23 organizational level safety outcomes.

24 So we are looking at safety performance  
25 metrics that are collected at the site level. We have

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1 to get those on the same level, so that we can make  
2 comparisons.

3 The next question that we were looking at  
4 is whether the survey factors that came out of this  
5 factor analysis show support for the Safety Culture  
6 Policy Statement traits. So are the factors  
7 identified similar to the traits included in the  
8 Safety Culture Policy Statement?

9 What we did for this was really just kind  
10 of a review of the factor labels and the items within  
11 each factor, and then compared those factors and items  
12 to the definitions of the policy statement traits.

13 This was really kind of a qualitative look  
14 at are we seeing the same themes coming out of the  
15 factors and the policy statement traits, and it was  
16 really important to dive down into those items,  
17 because you will recall these factor labels were also  
18 kind of just produced from looking at the items. So  
19 we wanted to make sure and go back and see are there  
20 items that seem to be similar to the definitions of  
21 the traits.

22 This is just a review of the traits that  
23 were included in the Safety Culture Policy Statement.  
24 They are: Leadership safety values and actions;  
25 problem identification and resolution; personal

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1 accountability; work processes; continuous learning;  
2 environment for raising concerns; effective safety  
3 communication; respectful work environment; and  
4 questioning attitude. Conveniently, there are nine of  
5 them.

6 Then this next slide is the crosswalk that  
7 we developed, kind of looking at how do the traits  
8 relate to the INPO survey factors. Of course, kind of  
9 the first observation that you can take from this  
10 crosswalk, just looking at it, is that for each trait  
11 there was at least one factor, in some cases part of  
12 a factor, from the survey that was related to that  
13 policy statement trait.

14 In some cases, it seemed to be pretty good  
15 one-to-one alignment. So there was a questioning  
16 attitude trait. There is a questioning attitude  
17 factor, and those items seem to support the definition  
18 of the questioning attitude traits. Same thing,  
19 environment for raising concerns/willingness to raise  
20 concerns. Personal accountability was similar to  
21 personal responsibility.

22 Then there were some cases where it seemed  
23 like the trait was supported by more than one factor.  
24 So leadership safety values and actions really seemed  
25 to have aspects of management responsibility, decision

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1 making, and supervisor responsibility.

2 Also cases where, because that management  
3 responsibility factor from the survey was so large,  
4 there were areas that were called out as traits in the  
5 policy statement that were supported by the survey,  
6 but by one of the subfactors under management  
7 responsibility. So work processes, for example,  
8 seemed to have elements of the subfactors, procedure  
9 communication and resources.

10 MEMBER RYAN: Why didn't safety  
11 communication have a management aspect?

12 DR. KOVES: Well, very often, like I said,  
13 if it didn't hang together, part of it went to  
14 management; part of it went to decision making, which  
15 is part of -- as you see in the policy statement, in  
16 the leadership category. But also there are other  
17 elements of communication, too: Peer to peer  
18 communication and even some of the items in there, as  
19 I recall, were even more like plant labeling and that  
20 type of thing that were part of the overall  
21 communication.

22 MEMBER RYAN: My question stands, though.  
23 Effective safety communication means everybody has the  
24 same view of safety, based on what they see, what they  
25 are trying to do, what they hear, what they observe --

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1 to me. I like to say communication is about -- you  
2 know, everybody is on the same safety page at the end  
3 of the day.

4 DR. KOVES: But you are talking about the  
5 results. I think the factor or the trait is more  
6 about the doing. It is about the communicating and not  
7 the result. What you are talking about is how I would  
8 measure the effectiveness of the communication.

9 MEMBER RYAN: Maybe that is right.  
10 Nonetheless, I would still think that there is a  
11 management aspect to safety.

12 DR. KOVES: And there is. We could take  
13 all of these, and we could roll them all up in the  
14 leadership, if we wanted. But that doesn't do us any  
15 good.

16 CHAIRMAN BLEY: I think what you were  
17 doing here, you are saying, given the Commission's  
18 policy statement, then effective safety communication  
19 as one of them. So it is a one-to-one match, even  
20 though you could have spread it up in different ways.  
21 I think that is what you are doing.

22 DR. MORROW: Right. The key point is that  
23 in the traits leadership was called out, and safety  
24 communication was called out, and they were different  
25 in the factors as well.

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1 MEMBER RYAN: I got you. Thank you. I  
2 was thinking more about implementation and other  
3 aspects. Well said. Thank you.

4 DR. MORROW: Yes. All of these things are  
5 very interrelated, and I think the kind of global  
6 thing to keep in mind is that these are all aspects of  
7 safety culture. So overall, we have one big global  
8 construct.

9 MEMBER RYAN: Thank you.

10 CHAIRMAN BLEY: I am just wondering -- and  
11 I don't expect an answer right now, but if somebody  
12 wants to -- But as you begin to try to pull the policy  
13 statement into the ROP, these places where the factor  
14 analysis told us some reason things were clumped, I  
15 wonder if that will affect how you think about -- That  
16 is an ill formed question, but if you get the idea,  
17 management responsibility and decision making get  
18 distributed, and in the factor analysis they clumped  
19 kind of nicely.

20 I wonder if that has any practical  
21 implications to what we do with this stuff later on.  
22 I just don't have any idea.

23 DR. KOVES: I think probably the most --  
24 kind of the biggest thing in terms of practical  
25 application was that in the factor analysis it really

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1 kind of put together PI&R and also organizational  
2 learning, and it is kind of like people were saying,  
3 listen to us.

4 You know, if you are learning, you are  
5 going to implement it. You are going to change. You  
6 are going to improve. And if you are identifying  
7 issues, you are learning.

8 CHAIRMAN BLEY: That was a connection you  
9 found in the data for the analysis, yes.

10 DR. KOVES; Yes, that was the connection  
11 that found in the data. To me, I think that is the  
12 one biggest thing, if I understand what you are  
13 talking about.

14 CHAIRMAN BLEY: You must, because it  
15 makes sense to me. Go ahead, Stephanie. I think you  
16 do better than I do.

17 DR. MORROW: Okay. So just some key  
18 observations from looking at kind of the crosswalk we  
19 developed, and overall looking at the factor analysis  
20 of the survey, we saw that management  
21 responsibility/commitment to safety accounted for most  
22 items and the most variance of the survey results. It  
23 was also similar to multiple straits in the policy  
24 statement.

25 An interesting thing that came out was

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1 that supervisor responsibility for safety was a  
2 separate factor in the INPO survey, and it really  
3 seemed to pull out kind of the idea that a  
4 supervisor's commitment to safety was slightly  
5 different from the overall management level.

6 That is kind of rolled into leadership  
7 safety values and actions, but it is something to kind  
8 of keep in mind as we think about safety culture,  
9 because there are -- when we look at employee  
10 perceptions, they differ whether they are thinking  
11 about their immediate supervisor, who they have the  
12 most interaction with, versus kind of the overall  
13 organization and kind of management as this nebulous  
14 being.

15 Also decision making came out in the  
16 factor analysis with the survey, and it seemed to have  
17 elements of the leadership trait and problem  
18 identification and resolution.

19 Kind of in summary, I am going back to  
20 where I started, and it seems like good timing as  
21 well. The design of the construct validation study  
22 was appropriate for the research questions, and we did  
23 see evidence of reliability and validity in the study.

24 Then there were also many common themes  
25 between the factors that emerged from the survey and

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1 the traits in the Safety Culture Policy Statement. We  
2 didn't see that one-to-one alignment, but it gives us  
3 confidence to say that the survey supports the traits  
4 and that there were these in-common themes, and that  
5 the traits were represented by at least one of the  
6 factors.

7 CHAIRMAN BLEY: Okay. Committee,  
8 anything? Thank you.

9 MEMBER SCHULTZ: I had one question on the  
10 listing that you had on slide 35. Ken alluded to this  
11 before. I may have missed it in your presentation,  
12 but prioritizing safety did not show up under the INPO  
13 survey factors that match up with the --

14 DR. MORROW: That is correct.

15 MEMBER SCHULTZ: That is not on the list?

16 DR. MORROW: Actually, I apologize for not  
17 mentioning that, but I ended up leaving it off this  
18 crosswalk. It seemed like it could fit under the  
19 leadership trait or under personal accountability.  
20 There were some aspects to it, but when you look at  
21 those items -- again, Ken mentioned that it kind of  
22 behaved weirdly and that they were the first few items  
23 in the survey, but the content of the items were also  
24 kind of tapping into more global perceptions.

25 So it was kind of like, overall, does it

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1 seem like my organization supports safety. That may  
2 be getting into something different. It may be  
3 getting -- or something kind of more global, that at  
4 the higher level the safety culture construct as a  
5 whole rather than a specific factor within safety  
6 culture.

7 So it is not specific to management. It  
8 is not specific to decision making or communication.  
9 It is just kind of like what is my global perception  
10 of safety culture here. So it didn't fit very well.  
11 I will say that.

12 MEMBER SCHULTZ: I am just trying to get  
13 a personal feeling for it, but it all appeared at the  
14 beginning. It is certainly, within the industry, a  
15 mantra at the site. Safety is a priority. Safety is  
16 a priority. So does that have an effect?

17 DR. KOVES: Well, that was our question:  
18 Was there order effects? I think that safety  
19 conscious work environment and that idea is very  
20 highlighted in the industry. So I think that that is  
21 one reason that it has come out as a factor, but the  
22 items that Steph is talking about - - Nuclear safety  
23 is routinely emphasized as a priority at meetings; The  
24 station ensures the contractors/vendors understand our  
25 expectations to performing work; I am always informed

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1 of current safety concerns or issues that affect my  
2 job; Peers coach each other on behaviors that promote  
3 nuclear safety; I have an influence on decisions  
4 involving nuclear safety that elate to my job; and At  
5 this station nuclear safety takes priority over  
6 production goals --

7 The items weren't really as nice and tight  
8 and as pointed as you saw in some of the other  
9 factors, and like she says, it is kind of they are  
10 more global, plus as you point out, it is kind of the  
11 mantra, plus they happen to be the first six items.  
12 So that is why this is -- You know, we see it as kind  
13 of a problematic factor that we are going to see in  
14 the future.

15 We did keep -- As you see, we kept three  
16 items that represented that to see how it behaves in  
17 the future, but we will see.

18 MEMBER SCHULTZ: Thank you.

19 DR. MORROW: Thank you.

20 CHAIRMAN BLEY: Okay, thanks very much.

21 We will recess for lunch, and start at quarter after  
22 one.

23 (Whereupon, the foregoing matter went off  
24 the record at 12:15 p.m.)

25 - - -

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

2 Time: 1:15 p.m.

3 CHAIRMAN BLEY: We are back on the record.  
4 It is your turn again.

5 DR. KOVES: Why not? I've got good news  
6 for you. A whole bunch of these slides, they have  
7 already covered. So we are going to kind of go over  
8 them modestly -- at least the beginning, modestly  
9 quickly.

10 What is the central question of this part  
11 of the validation? It is does the measure actually  
12 measure what it purports to measure, it says it  
13 measures, and in this situation are the results  
14 related to other measures of safety?

15 We have talked a little bit about  
16 reliability. We have mentioned the words a lot of  
17 times, a number of times. What is reliability? It is  
18 the consistency of a measure. Does the measure  
19 produce consistent results under consistent  
20 conditions.

21 Whereas, validity is about the accuracy of  
22 the measure. You know, does it really measure what it  
23 says it will?

24 I have got an illustration that I have  
25 been waiting about 10 or 15 years to use. So I am

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1 going to go ahead and use it, because this is my first  
2 opportunity since I have thought of it.

3           Anyway, in terms of reliability and  
4 validity, I have a scale at home. It is an old spring  
5 scale. This thing is very reliable. I mean, if I  
6 gained a couple of pounds, you can see it; if I lose  
7 a couple of pounds, you see it right on there.

8           Unfortunately, it is not valid, because it  
9 under -- The weight that it gives you is about 10 or  
10 15 pounds less than you actually weigh. So that is an  
11 example of reliability without validity. Anyway,  
12 thank you for indulging me with that. I appreciate  
13 it.

14           Stephanie already talked about criterion  
15 validity. Is the measure related to a criterion in  
16 the real world, concurrent and predictive? The  
17 concurrent is how well do the results relate to the  
18 current criteria, and predictive is how well do the  
19 results relate to future results of the criteria?

20           Correlation: I put this in here just in  
21 case that there were some people in the audience who  
22 aren't familiar with correlation. I will go over it  
23 very quickly, assuming that the committee is very  
24 familiar with it.

25           It is the degree to which two or more

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1 variables show a tendency to vary together. The most  
2 familiar measure you know as the Pearson correlation  
3 coefficient obtained by dividing the covariants of the  
4 two variables by the product of the standard  
5 deviations.

6 Examples of correlations --

7 CHAIRMAN BLEY: That is a general  
8 statement, and before you leave it, there is just one  
9 thing that I want to whine at you.

10 DR. KOVES: Would you like some cheese  
11 with that?

12 CHAIRMAN BLEY: When you use a -- you  
13 apply that to a model, be it a regression model or  
14 some other model, the two things you talked about,  
15 which were squares, are the -- you are essentially  
16 measuring how far you come from the predicted model,  
17 how far the data come from that, and the square of  
18 your correlation -- I just want to read this, because  
19 you know this, and you say this in the report, or you  
20 say this in the report -- Was it a joint report? It's  
21 their report.

22 You say this in the report. But I am  
23 going to read this, just because I want to make the  
24 emphasis on it. Whereas, the R-square, which is at  
25 least in the regression called the coefficient of

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1 deviation, indicates proportional reduction in the  
2 variability attained by the use of the information  
3 from the X value, as he says, the square root, the  
4 correlation, does not have any such clearcut  
5 operational meaning.

6           Nevertheless, there is a tendency to use  
7 this in most all reports, but R, the correlation's  
8 coefficient, may give the impression of a closer  
9 relationship between X and Y, if you are just talking  
10 two variables, than does the corresponding R-squared.  
11 So if you have a .3 correlation coefficient, you are  
12 only explaining .3 squared, 10 percent of the data.

13           DR. KOVES: Right.

14           CHAIRMAN BLEY: I am afraid, for most  
15 people seeing the report and seeing the correlation  
16 coefficients, they don't get that. They get -- they  
17 read it, they are getting much more confidence in how  
18 much is being explained by the model than is really  
19 there.

20           I think we are putting it in terms that  
21 kind of trick people. Back to the stuff I talked  
22 about a long time ago, and you have been emphasizing  
23 social sciences this time, the .9 -- I was talking  
24 about something quite different. Now I have thought  
25 more about it since then.

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1           In seismic, if there is correlation in the  
2 time histories of the parameters, like acceleration  
3 and frequency, that correlation has to be nearly  
4 perfect before the two things that are being affected  
5 act in a dependent fashion. Otherwise, even if there  
6 is reasonably high correlation but not nearly perfect,  
7 they actually respond as if they were independent.

8           That wasn't good analogy that I brought up  
9 at the last Subcommittee meeting, but still, what was  
10 bothering me is this idea that .3 and .5, which  
11 according to this one fellow you quote, is considered  
12 medium or high correlation really is only explaining  
13 10 percent or 25 percent of the data, which means the  
14 model isn't telling you everything you want to know,  
15 and especially if you are down at the low end, .2, .3,  
16 it is not explaining very much of the data.

17           I am jumping the gun just a little,  
18 because I want you to think about this along the way.  
19 I think part of the problem and part of the reason we  
20 see such low correlations, which you are going to get  
21 to -- to me, are low -- they aren't explaining much of  
22 the data, and because the things we have picked, the  
23 unplanned scrams, safety system actuations, forced  
24 outage hours and equipment outages aren't highly  
25 correlated to bad safety events, things that approach

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1 core melt kind of problems.

2 DR. BARNES: True.

3 CHAIRMAN BLEY: In things like that, which  
4 some real bad events were, people have made errors in  
5 the plant that has come close. They haven't gone to  
6 melt, but they have still been pretty severe events.  
7 There, I think we see these factors very strongly  
8 involved.

9 I am just thinking, if somehow you could  
10 sometime along the way look at things that are closer  
11 to real events that affect the safety of the public,  
12 I really believe we would see much stronger  
13 correlations, and you would have a stronger case.

14 What has bothered me is I see it. When I  
15 look at the events, I see that. When I look at the  
16 analysis, I see very low correlation, in my opinion,  
17 correlations that aren't explaining much of the data,  
18 and I think we are looking at the wrong things to make  
19 the case.

20 The reason we want to do this is to really  
21 protect the public, and those kind of things aren't  
22 real high on the list. If you look at risk  
23 assessments, those kind of events don't contribute  
24 very much at all. They aren't the big actors.

25 I think, if you were looking at some big

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1 actors -- we don't have a lot of them. You don't  
2 have as much data to look at.

3 DR. KOVES: That is a problem.

4 CHAIRMAN BLEY: On the other hand, it is  
5 what is important, and the correlations, I think, are  
6 going to be strong as can be in there. There is a lot  
7 of significant events around, and not hundreds.

8 DR. KOVES: Your correlations would be  
9 higher, but actually it will be harder to get  
10 statistical significance, because the ends are not  
11 reaching one.

12 CHAIRMAN BLEY: Maybe you can change the  
13 kind of statistics you are using where you speak in  
14 terms of the probability as being important, rather  
15 than what you do to look at large samples.

16 DR. KOVES: Yes. Let me --

17 CHAIRMAN BLEY: Those sorts of things  
18 perhaps would get you there, because I think it is  
19 going to be strong.

20 DR. BARNES: Near misses. Like I was  
21 saying earlier, there's a lot of different ways to  
22 measure safety performance, and you know, safety is a  
23 construct, just the same way that safety culture is,  
24 and there is lots of different ways to measure it.

25 CHAIRMAN BLEY: Yes. But what is driving

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1 us to have a safety culture policy is trying to  
2 protect the public from bad things, not -- I mean, we  
3 do want to protect the workers from minor injuries and  
4 even significant injuries, but really, what is driving  
5 the agency to be concerned and want to force the  
6 people that regulate to be concerned is worrying about  
7 the things that could harm significant numbers of  
8 people.

9 I just -- I think there's probably many  
10 ways to go at trying to link this up. I just don't  
11 think this case is all that convincing. I mean, it is  
12 there, but it is -- You explained a little bit of the  
13 data. Yes, that is good. You can, but it is hard to  
14 justify going out and having people do lots and lots  
15 of things to putting up a little bit of the data that  
16 is not affecting the real safety issues.

17 Now it probably does affect them, but we  
18 can't see it does. Anyway, that is my concern. My  
19 other concern was that one about I think people don't  
20 know the correlation coefficient, and they believe  
21 they seem stronger.

22 DR. KOVES: Well, yes, but it --

23 CHAIRMAN BLEY: Stronger association than  
24 is really in the results.

25 DR. KOVES: Yes. The variance explained,

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1 it was only the square root.

2 CHAIRMAN BLEY: Right. I'm sorry, I'm  
3 done. You had something?

4 MEMBER STETKAR: I was going to give my  
5 example, but it's just as well.

6 CHAIRMAN BLEY: Go ahead, Ken.

7 DR. KOVES: All right. By the way, if you  
8 come up with that study and you want, let me know,  
9 will you? I would be more than happy to try and  
10 pursue it

11 CHAIRMAN BLEY: Well, if I am not doing  
12 this anymore, I might talk to you about that.

13 DR. KOVES: All right. Correlations run  
14 from positive one to negative one, you know, perfect  
15 correlation. Basically, if you have it, it is a  
16 straight line, diagonal line. Anyway, what you are  
17 seeing in the upper lefthand corner is data with a  
18 correlation of .9, positive correlation. Upper right  
19 -- excuse me, that was lefthand corner.

20 Upper righthand corner is a negative  
21 correlation of .9, and then in the lower left you are  
22 seeing zero correlation, and on the right you see a  
23 correlation of about .4. Basically, what that is  
24 saying in general as one is moving up, the other  
25 variables are also going to be increasing, too, but

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1 not in a stepwise fashion.

2 In terms of the application to the safety  
3 culture data and most of the variables that you are  
4 looking at, what we do is we have a high score on a  
5 safety culture survey, and then we have these other  
6 safety indicators that are usually good, if they are  
7 low. We want very few of these to happen. So we end  
8 up with a negative correlation. Negative correlation  
9 of about negative one there, and a correlation of  
10 about negative .4, and looks something like that.

11 We've beat on this one quite a bit  
12 already. So I am not going to spend time there.

13 Here is actually an example, and you will  
14 see -- I mean, we really threw this up. This is not  
15 confirmatory but very -- not experimental --  
16 exploratory. Thank you. So we threw the survey in on  
17 the survey results up against a whole lot of  
18 variables, and you will be seeing more of them during  
19 the closed session.

20 These were some of the ones that came out  
21 with the best correlations, and this is an example.  
22 So you see on the lefthand side we have got nuclear  
23 power plants, and you see that they are rank ordered  
24 by where they fell relative to the survey score, and  
25 then you are seeing -- and this is all actual data --

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1 a number of unplanned scrams, unplanned automatic  
2 scrams, emergency power unavailability, personnel  
3 safety index, the chemistry index, and human  
4 performance error rate.

5 CHAIRMAN BLEY: I have forgotten. Remind  
6 me how you calculate the mean survey score for the  
7 power plant.

8 DR. KOVES: The mean? It is the mean of  
9 all the individuals and all the -- I mean, it is the  
10 mean of the means for all the factors.

11 CHAIRMAN BLEY: And the mean -- you are  
12 taking this out of the correlations of the score  
13 itself. Score goes zero, one, two, three, four up to  
14 the seven.

15 DR. KOVES: Yes. So you are seeing plant  
16 one for the entire plant, their mean score on the  
17 safety culture survey was 6.12.

18 CHAIRMAN BLEY: And seven was "agree very  
19 strongly this is good," something like that?

20 DR. KOVES: Yes, correct. And actually,  
21 what I did was I condensed them all. So the bottom of  
22 the range was 5.52. This is an example of what real  
23 data looks like. So you end up with correlations of  
24 about .3, very close to that.

25 MEMBER STETKAR: Average -- Then an

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1 average mean would be three and a half?

2 DR. MORROW: Four. It is one to seven.

3 MEMBER STETKAR: It is one to seven.

4 DR. KOVES: One to seven.

5 DR. MORROW: So four is the --

6 MEMBER STETKAR: So everybody is a little  
7 above average?

8 DR. KOVES: Well, but that is --

9 MEMBER STETKAR: We are still looking for  
10 the one that keeps the average, average.

11 DR. KOVES: Virtually, every survey that  
12 was administered and looked at, the distribution is  
13 skewed, and it is skewed to the positive, and this  
14 data is really no different than that. So, yeah, you  
15 are going to have --

16 CHAIRMAN BLEY: Is there something wrong  
17 with that? The things we are looking at in the survey  
18 are things that plants have been working on for years.

19 MEMBER STETKAR: That is true, but there  
20 is still some average. I mean, you are looking at  
21 objective numerical things you can count.

22 CHAIRMAN BLEY: Yes, but if you are at the  
23 worst power plant, and you evaluate your  
24 communications, you are probably not going to say they  
25 are lousy. You know, if they are bad, they are

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1 probably down in the middle of that scale, and I  
2 forget what the words are associated with that.

3 DR. MORROW: From "strongly disagree" to  
4 "strongly agree." And closest to the midpoint is like  
5 "somewhat disagree," "somewhat agree." I think that  
6 is what the terminology is.

7 DR. KOVES: And then neutral is in the  
8 middle.

9 DR. MORROW: You do see people like, ah,  
10 somewhat disagree, sometimes this doesn't happen, and  
11 that might be effectually a red flag indicator, like  
12 ah, this isn't happening. So at that point, they are  
13 just using the three on the scale.

14 CHAIRMAN BLEY: Sorry, I won't chip in.

15 DR. KOVES: That's okay. So anyway, this  
16 is just an example of the -- you see this in live  
17 data. You will see here that on this first row we've  
18 got mean score for the nuclear power plant, and you  
19 see once again the same correlations we had on the  
20 previous page except we have added the ROP in here,  
21 and this is where they stand on the ROP -- or they  
22 were in the ROP at the time. But also you see some of  
23 the other factors, and them correlated to these.

24 You are seeing more variance here in terms  
25 of how some of the factors relate better to some

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1 safety indicators than others, and then also in the  
2 brackets what you are seeing are some of the  
3 subfactors and those correlations with those  
4 particular indicators, and you will see a lot of that  
5 here in just a minute.

6 Just some select ones, but once again  
7 showing how some of the factors and subfactors can do  
8 a better job of zeroing in on certain things than  
9 others.

10 CHAIRMAN BLEY: What is the score on the  
11 ROP?

12 DR. KOVES: Well, they are in column one,  
13 two, three or four.

14 CHAIRMAN BLEY: Okay. I am still not sure  
15 how you calculated.

16 DR. KOVES: No, it is just what -- It is  
17 what the NRC reports out.

18 CHAIRMAN BLEY: They report out -.26?

19 DR. MORROW: That's the correlation.

20 DR. KOVES: No, that is the correlation.  
21 That is not the score. So what that is, is we have  
22 that -- Going back to the previous page, rather than  
23 here in unplanned critical scrams for this particular  
24 plant, there would be what column they are in.

25 CHAIRMAN BLEY: One, two or three?

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1 DR. KOVES: Yes, one, two or three, and  
2 then going on down, you would see that. So that is  
3 where the correlation comes from with the ROP, is  
4 where that station is with the safety culture and/or  
5 relative to the ROP. Then that gives you that  
6 correlation of -- what is it, .26, you said?

7 CHAIRMAN BLEY: Yes.

8 DR. KOVES: All right. Moving on, so this  
9 is what I use as a sample of concurrent. We will dive  
10 into more detail here in just a minute, and then we  
11 also tried to do the predictive validation.

12 One would imagine or one would assume  
13 that, even if a survey or this construct is related to  
14 current performance, part of the theory around safety  
15 culture is that it impacts plant performance and  
16 drives some of that. And if that is the case, then  
17 you would expect that there might be -- The  
18 correlations might at least stay the same, if not  
19 increase in the future.

20 Whereas, typically if the culture or the  
21 survey is only representing what is going on at that  
22 given time, then over time you would see the  
23 correlations decrease.

24 So what we did was we also then ran --  
25 Because it was a year later, we pulled the results

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1 again for all the stations and did the correlations,  
2 and most of the correlations either did what you would  
3 expect, and that is stay the same, or decrease.  
4 However, we did have a few that actually increased.

5 One was forced loss rate, as you see, from  
6 2010 to 2011, and these were the correlations with the  
7 mean score that increased and then also with some of  
8 the factors. That is industrial safety accident rate  
9 for 2010 compared to 2011, and then also a total --  
10 you expect these to be fairly correlated -- total  
11 industrial accident rate.

12 What was interesting that I didn't mention  
13 earlier and was a little disappointing when we did the  
14 concurrent validation, was the lack of relationship  
15 between industrial safety accidents and safety  
16 culture, and which I was like, boy, that seems very  
17 odd to me.

18 Well, what is interesting is that now you  
19 really see a much stronger relationship between them  
20 after one year than we did in the concurrent  
21 information.

22 MEMBER STETKAR: After one year, what is  
23 the normal variability in the parameters that you are  
24 measuring there? You get to look at 30 year and see  
25 what a trend is, for example?

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1 DR. KOVES: Well, I am going to get to a  
2 problem, a fundamental problem, with these results in  
3 one second, but I think we will address that.

4 MEMBER STETKAR: I guess, just looking at  
5 two snapshots in history and trying to draw  
6 conclusions from those two snapshots -- people have  
7 done that an awful lot with a lot of other things like  
8 losses of offsite power, and tried to draw conclusions  
9 out every year better and better and better until you  
10 get a worse year, and then it is, oh, my god, we have  
11 to redo our statistics.

12 So looking at two individual snapshots out  
13 of the universe is something you put on a slide, but  
14 it doesn't seem to make much sense.

15 DR. KOVES: Well, and there is another  
16 confound in this data and with all of these, is that  
17 these numbers of 2010 and 2011 for these here are not  
18 totally independent, because what INPO does is, for a  
19 lot of these indicators, it will take a score and  
20 average generally between outage cycles. So they go  
21 from outage to outage.

22 So you cannot say that the 2010 and 2011  
23 scores are --

24 MEMBER STETKAR: Are really a calendar  
25 year ago.

1 DR. KOVES: -- are really totally  
2 independent exactly. Now some of the other data --  
3 Some of the data is separate, but this is not. So that  
4 kind of throws a little confound into the whole  
5 analysis piece.

6 We will close the session here and get to  
7 the details in a second, the "what does it all mean?"  
8 You know, safety culture appears to be solidly related  
9 to other measures of safety at the plant, and then  
10 also it may be a predictor of some indicators of  
11 safety and safety culture, but we obviously need more  
12 research into the clarifying of things about this.

13 Shall we go into the private session?

14 CHAIRMAN BLEY: I guess I don't need the  
15 hammer for that one. We are now in closed session.

16 (Whereupon, the foregoing matter went off  
17 the record at 1:39 p.m. and went back on the record at  
18 2:40 p.m.)

19 CHAIRMAN BLEY: We are back in session.  
20 Welcome back. I think you are up.

21 DR. MORROW: Yes. So our final  
22 presentation of the day is looking at similar  
23 information from what Ken just presented, we are  
24 looking at the results of the INPO survey with NRC  
25 performance metrics.

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1           So just some of our key findings from this  
2 analysis: Like Ken just said, based on accepted  
3 standards in the social sciences from other studies,  
4 they do measure safety performance.

5           CHAIRMAN BLEY: I know where this came  
6 from, but we would communicate better, I think, if  
7 instead of trust us, we are social scientists, we  
8 explain -- I know that is what it means to you, but it  
9 probably doesn't to some other people.

10          DR. MORROW: Yes, and actually I have a  
11 slide that shows the correlation.

12          So we saw moderate, statistically  
13 significant correlations between the safety culture  
14 survey results and some of the NRC performance metrics  
15 that we looked at. We also saw some moderate  
16 correlation between the survey result and performance  
17 metrics that were measured one year after the survey  
18 was administered. These were similar to what Ken  
19 found with the INPO data. These are kind of more of  
20 the broad based performance metrics.

21          So we used, which was a variable, looking  
22 at whether a plant was in an elevated oversight  
23 position in the ROP Action Matrix, so basically  
24 anything other than the baseline column 1, and also  
25 counts of allegations from the licensee personnel.

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1           We also, again, just want to clarify our  
2           acknowledged limitations of this research. One, this  
3           study was a single study, of course. So these results  
4           would need to be replicated to show reproducibility.

5           We have talked about this is a snapshot in  
6           time, and we are looking at a snapshot of performance  
7           metrics. So this can kind of give us some information  
8           that can be used for more focused exploration in the  
9           future, but it is still just a single study.

10           We also were just looking at correlations.  
11           So you can't establish a causal relationship with just  
12           a correlation. All this says is that these survey  
13           results were in some way related to or associated with  
14           the performance metrics that we looked at.

15           Also this study in particular was cross-  
16           sectional, looked at a high level across the entire  
17           nuclear industry. It only made comparisons between  
18           sites rather than with a single site over time. So to  
19           do more research where we look at what is the safety  
20           culture score this year, what is the performance, what  
21           is the safety culture score the following year, kind  
22           of looking at within a site, would provide us with  
23           some different but also valuable information.

24           I will mention, because this site was  
25           particularly kind of related to the Safety Culture

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1 Policy Statement, keep in mind this is only nuclear  
2 power plants. The Policy Statement was written to  
3 apply to all of the NRC's regulated communities.

4 CHAIRMAN BLEY: I guess the only thing  
5 that bothers me -- you briefly talked about it in the  
6 report -- is although, as you say, you can't establish  
7 causal effects, we are introducing it to begin to  
8 justify putting requirements on people to do things in  
9 accordance with this.

10 DR. BARNES: What requirements?

11 CHAIRMAN BLEY: Now that we have a Safety  
12 Culture Policy Statement, it is hard to imagine we  
13 won't have requirements to go along with that  
14 sometime.

15 DR. BARNES: Will we want to address that?

16 CHAIRMAN BLEY: We could.

17 MR. SOLORIO: Currently, there is no move  
18 afoot to take the Safety Culture Policy Statement and  
19 turn it into a rule, for example. Right now, we are  
20 waiting for various industries to work with it. I  
21 think the nuclear power industry is showing very  
22 strong initiative for doing so, but in the other areas  
23 that we regulate, the materials area, there is  
24 actually quite a lot of -- the best word to use --  
25 passion for trying to implement it.

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1           We have been working very closely with the  
2 agreement states, and they are trying to get the word  
3 out the best they can. We have actually taken our  
4 Safety Culture Policy Statement brochure, and they  
5 have actually used the electronic copy and modified it  
6 for the agreement states, and in many cases their own  
7 document.

8           So, really, we are in a situation now, I  
9 think, where we want to give it some time to see what  
10 it can do based on it being a policy statement. So I  
11 wouldn't think -- Well, right now there is clearly no  
12 move afoot to take what the industry has done and use  
13 it to justify a rulemaking.

14           MEMBER RYAN: A quick follow-up. The  
15 agreement states are aiming at, I'm sure, the larger  
16 licensees.

17           MR. SOLORIO: They are aiming at all  
18 licensees.

19           MEMBER RYAN: All licensees?

20           MR. SOLORIO: All licensees. We were just  
21 in uranium -- excuse me -- in Colorado last week --  
22 Maria was. She is sitting over there, Maria Schwartz  
23 -- presenting to uranium miners -- what do you call  
24 them, uranium --

25           MS. SCHWARTZ: Uranium Mining Association.

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1 We have like a workshop every year.

2 MEMBER STETKAR: Identify yourself, so you  
3 are on the record.

4 CHAIRMAN BLEY: Use your microphone.

5 MS. SCHWARTZ: Maria Schwartz, and I work  
6 in the Office of Enforcement, and I made a  
7 presentation on safety culture at the Uranium Mining  
8 Workshop, Recovery Workshop, sponsored jointly by the  
9 NRC and the National Mining Association.

10 They received it very well. I got a lot  
11 of compliments on the presentation. They actually  
12 said they were very interested, and there wasn't  
13 enough discussion about safety. They were more focus  
14 on regulations and requirements, but this sort of  
15 larger view toward safety, safety first focus, really  
16 seemed an important part of their activities. So they  
17 were very interested.

18 MR. SOLORIO: This week, Josie Piccone is  
19 in Glasgow, which is in England -- Scotland -- if I  
20 ever get to Europe.

21 MR. WIDMAYER: Not now.

22 MR. SOLORIO: IRPA.

23 MEMBER RYAN: Yes, International Radiation  
24 Protection Association.

25 MR. SOLORIO: There you go. They have a

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1 -- It is a world conference going on right now, and  
2 she is speaking about the Safety Culture Policy  
3 Statement.

4 MEMBER RYAN: That is two weeks from now.

5 MR. SOLORIO: And one of the things she is  
6 going to speak on is actually an IRPA document that  
7 was just produced, I want to say, in the last few  
8 months by a committee. Basically, it is called  
9 Radiation Protection Safety Culture, kind of the name  
10 of the document. Basically, IRPA is working on  
11 inculcating their membership with safety culture.

12 The document actually contains a table  
13 with the Safety Culture Policy Statement traits. So  
14 it is being --

15 MEMBER RYAN: For those who don't know, I  
16 might just add real quickly, IRPA is the health  
17 physics societies from all of the world countries in  
18 one international organization for radiation  
19 protection.

20 MR. SOLORIO: Right. So I would say a lot  
21 of -- I could name others. I could give you a table  
22 after the meeting that kind of shows you all the  
23 different places we have outreached in the materials  
24 area, and continue to do that.

25 Cindy Flannery was here in the morning,

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1 she is from the Office FSME. She is not here now.  
2 There's other outreaches I think she is doing this  
3 month.

4 In the materials area, also the upcoming  
5 conference that NMSS has annually. It is called the  
6 Annual Fuels meeting they have every year.

7 MEMBER RYAN: Actually, I think it would  
8 be helpful we could get that list from you. That  
9 would be very helpful.

10 MR. SOLORIO: Yes. So we are on the  
11 agenda for that. So there's a lot of -- I would say  
12 all our licensee organizations are trying to get it  
13 into their meetings. We want to see how that works  
14 first, and then if there is a lead, then we might  
15 consider down the road, but right now I think we are  
16 trying to get everyone to be educated about it and  
17 start to use, and they are showing us they are using  
18 it.

19 MEMBER RYAN: And I guess -- I don't want  
20 to put words in your mouth, but it sounds like you  
21 have an ongoing plan that you are going to be  
22 following, and learning, and then maybe adjusting as  
23 necessary, that kind of thing.

24 MR. SOLORIO: Right. Well, under the  
25 Commission's direction in the SRM they wrote for the

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1 SECY that we put the Safety Culture Policy Statement  
2 in last year, they directed the staff to do education  
3 outreach and provide support to the various regulated  
4 communities to help them implement this Policy  
5 Statement. So that is what we are doing.

6 CHAIRMAN BLEY: Thank you.

7 MEMBER STETKAR: Let me follow up a little  
8 bit, though. Dennis asked the question immediately  
9 reactive with the word rulemaking. I think what I  
10 have been hearing today, though, it is not clear to me  
11 when or how some of these notions may be integrated  
12 into the reactor oversight process, which certainly is  
13 not rulemaking, but it certainly has an effect on how  
14 people are rated and how people do business.

15 So although it might not be rulemaking, it  
16 may very well affect how people are evaluated, which  
17 is the same thing, in my mind. So back to Dennis'  
18 question that, if we can't establish causal effects,  
19 if there is -- This is a nice research effort -- how  
20 does that affect our interactions with licensees from  
21 a regulatory -- a reactor oversight process, from a  
22 regulatory oversight process?

23 MS. SHOUP: Certainly. Thank you. This  
24 is Undine Shoup again.

25 If you look -- Actually, the Common

1 Language Initiative was started before the Policy  
2 Statement even came into being, actually. We deferred  
3 the Common Language Initiative until after the Policy  
4 Statement was complete, because we recognized that the  
5 Policy Statement had the potential to change the  
6 Common Language Initiative.

7 So that is actually an initiative that  
8 industry came and asked us to do well before the  
9 Policy Statement. So how we see this having an impact  
10 is that, as Maria had alluded to earlier, after we  
11 develop common language, and common language will  
12 include all the common language for power reactors --  
13 I should say it is not being developed for all  
14 licensees, just power reactors. After we develop the  
15 common language, then we will be able to evaluate how  
16 to best incorporate it into the ROP, and I think Rani  
17 has more on that.

18 MS. FRANOVICH: Just to add to the  
19 response on the slippery slope question, after Davis-  
20 Besse, the GAO made it very clear that the NRC needs  
21 to look at safety culture, and I think it was in 2006  
22 the Commission directed the staff to do that using  
23 cross-cutting areas of the ROP.

24 We also have safety culture assessments  
25 that we can do with the 95-002 and 95-003

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1 applications. So I don't see the slippery slope  
2 happening as a function of this work. I think we are  
3 already there, and it is a matter of getting alignment  
4 between the policy statement, INPO terminology, and  
5 ROP terminology and how we do the ROP implementation,  
6 as I had mentioned, is really a future activity that  
7 we haven't started yet, but we are getting very close  
8 with the common language framing up.

9 CHAIRMAN BLEY: Interesting. Thanks.

10 MR. WIDMAYER: Well, frankly, your  
11 question kind of goes to the additional comments that  
12 the other members made to the letter: Are these  
13 really the right traits to be looking at? So the  
14 question sort of still stands.

15 CHAIRMAN BLEY: Thank you for pointing  
16 that out, and that is true.

17 DR. BARNES: Yes, thanks a lot, Derek.

18 MR. WIDMAYER: We don't write user  
19 newsletters.

20 CHAIRMAN BLEY: If we had a project.

21 MR. CAMPBELL: Just to jump -- Andy  
22 Campbell. I forgot. Sorry, sir. I am the Acting  
23 Director today for OE.

24 It is important to keep in mind, though,  
25 that when you say are these the right traits that the

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1 basis and how these were all derived isn't just that  
2 there is one set of traits that are absolutely perfect  
3 for all circumstances, but that these traits were  
4 developed through a process that got large unity of  
5 our licensees to buy into, and that they represent and  
6 are tied back to the history of the different aspects  
7 of safety culture characteristics.

8 So although there could always be  
9 different traits, there could always be additional  
10 traits, there could be less traits, but these, I  
11 think, represent the collective efforts of a fairly  
12 large cross-section of our community, and then there  
13 are things like the ROP to make them to be appropriate  
14 to what we are trying to do.

15 CHAIRMAN BLEY: Thanks. The origin of the  
16 question was, though, not that process, which we all  
17 appreciate, but was, now that we are there, will we  
18 actually improve safety if we push ahead in this area.  
19 It smells good, but do we have any real evidence that  
20 it will improve safety.

21 DR. BARNES: Correlational study can't  
22 answer that question, and that is why at the beginning  
23 of this I was talking about some of the interventional  
24 studies where they have actually used results like  
25 these to go in and identify what kind of interventions

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1 need to be made in a particular work group, in a  
2 particular organization, to address real problems.

3           Something like this, like a survey like  
4 that, it is a screening tool. Helps you identify  
5 where the problems are. In terms of whether there is  
6 value in doing those kinds of interventions in nuclear  
7 industry, that is what we see with corrective action  
8 plans, and at least we walk away from some of the  
9 plants where we have seen problems with greater  
10 confidence that, because of the interventions that  
11 they have made, that they have solved the real  
12 problem.

13           Now that is Ken's business. So, you know,  
14 other than developing survey tools, Ken spends the  
15 majority of his time working with sites on solving  
16 problems related to organizational effectiveness and  
17 safety culture, and he is still employed. So I think  
18 maybe he is achieving something. I don't know, Ken.

19           DR. KOVES: I would say most of my time,  
20 some of my time. That is one of the things that is  
21 most fun. It is actually making a difference, and I  
22 think at one station -- I was just talking with Steve  
23 about it -- recently, in certain areas they have made  
24 a real turnaround, and their goal actually was culture  
25 change.

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1           They were a good plant before, and now in  
2 a number of these indicators, number of these areas,  
3 they have really stuffed it up and made a difference.

4           CHAIRMAN BLEY: Okay. I think we better  
5 forget ahead. We will be here until midnight. Go  
6 ahead, Stephanie.

7           DR. MORROW: All right. This is just kind  
8 of a breakdown of the performance metrics that we used  
9 when we are looking at correlations between the survey  
10 and various performance metrics that the NRC  
11 maintains.

12           What we tried to do was to kind of get a  
13 broad spectrum of sources when we looked at  
14 performance metrics, and also pick out ones that had  
15 some variability. So we are not going to see any  
16 correlations, if all of the plants are always at zero.  
17 So that was kind of our approach when we looked at  
18 these.

19           The next slide is just kind of another  
20 view of those performance metrics, looking at them  
21 from where they come from. So we have some  
22 performance indicators in there. We have data that  
23 comes from inspection reports. One is just kind of  
24 total count of inspection findings, but also looking  
25 at the cross-cutting aspects that are part of the ROP.

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1           We broke that down into just looking at  
2           the total number of cross-cutting aspects that were  
3           tagged to inspection findings, but also where those  
4           aspects kind of sat within the framework. The aspects  
5           are within components which are within cross-cutting  
6           areas.

7           So you see there are two of the three  
8           cross-cutting areas of the ROP here, human  
9           performance, problem identification and resolution.  
10          There is a third one, safety-conscious work  
11          environment. That was not included in this analysis,  
12          because those aspects are not used very frequently.  
13          So there wasn't a lot of variability to that data.

14          We also looked at overall performance  
15          assessments in terms of total number of substantive  
16          cross-cutting issues, and this is for end of the year  
17          2010, and then also end of year 2011; and as I  
18          mentioned earlier, the site's placement o the action  
19          matrix.

20          So we looked at -- Basically, we just  
21          divided this into two, whether they were in column or  
22          in another column. So the other column would be in an  
23          elevated oversight role. They are not in that  
24          baseline condition of the action matrix.

25          We also looked at allegations from

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1 licensee personnel to the NRC. We looked at total  
2 counts and then also an exploratory variable that was  
3 more specifically related to allegations that were  
4 categorized as relating to the organization's safety  
5 conscious work environment.

6 Just another background slide of  
7 correlation. I think we've all got it now. Some of  
8 these are a bit duplicative. One thing is that the  
9 Pearson's correlation is sensitive to outliers.

10 So the additional analyses that we did  
11 were to also look at the Kendall tau correlations,  
12 which is a non-parametric test that basically just  
13 ranks the data. So what is your rank on the safety  
14 culture survey compared to all of the other sites, and  
15 what is your rank on this particular performance  
16 metric.

17 We saw the same patterns of results. That  
18 does kind of take away some of the variability in the  
19 data. So where we can, we report the Pearson's  
20 correlations.

21 The other thing about being sensitive to  
22 outliers is that makes it that much more important to  
23 look at the scatter plots. I think that was brought  
24 up the last time we talked about this in ACRS. So we  
25 do have some scatter plots to show you of the

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1 relationships between the survey results and the  
2 performance metrics.

3 Here is the percent variance that Dennis  
4 mentioned. Again, the effect size rules of thumb that  
5 we are using are a correlation of .10 is about a small  
6 effect size, and that is only accounting for about one  
7 percent of the variance. So it relates to how  
8 overlapping these variables are.

9 When we look at meta-analyses of previous  
10 safety culture research, these are large studies that  
11 capture all of the correlational results from  
12 individual independent safety culture studies and say  
13 what was the overall effect look like.

14 Those studies have found the correlation  
15 between safety culture surveys and accident and injury  
16 rates to be about a medium effect size, between -.22  
17 to -.39. This actually goes back to what Val was  
18 talking about earlier, that when we look at, more  
19 specifically, individual attitudes and individual  
20 behaviors and look at just the survey results against  
21 self-reported safety behaviors, we do see larger  
22 effects.

23 That just illustrates that kind of when  
24 you look at something that is more focused, you are  
25 going to see larger effects. When we are talking

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1 about organizational level variables, those effects  
2 are smaller, because there are so many other  
3 intervening variables' moderators that can affect that  
4 relationship.

5 So to put it into variance terms, what we  
6 are talking about is these meta-analysis studies have  
7 shown that there is a four percent to a 37 percent  
8 degree of sharedness between safety culture and safety  
9 performance, just a very high level, and it really  
10 depends on how safety culture and safety performance  
11 are both defined and measured.

12 Now we get to the good stuff, the  
13 correlations. Just to orient you to the table, again  
14 the safety culture safety is listed in the first  
15 column going down. What we have here is the  
16 performance indicators also calculated oversight on  
17 the action matrix, total inspection findings and total  
18 substantive cross-cutting issues.

19 The cells that are highlighted are the  
20 statistically significant correlations, and you can  
21 kind of see the patterns of results, just looking at  
22 the shaded cells.

23 Some that I want to kind of just note is,  
24 if you look just down the first column, unplanned  
25 scrams, and see the overall safety culture survey, and

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1 most of the factors were negatively related to  
2 unplanned scrams. Same for total inspection findings.

3 One of the largest correlations on this  
4 table is between questioning attitude and total  
5 inspection findings -.41.

6 We don't have questions here.

7 This is a scatterplot showing the overall  
8 relationship between the safety culture survey score  
9 and unplanned scrams. So we are looking at this.  
10 Does there appear to be any kind of outliers that  
11 stand out that might be affecting this correlation.

12 There is one point that is a little  
13 farther out, but if you look at the scale, we are  
14 talking about from zero to five unplanned scrams. So  
15 there's quite a few sites that are clustered around  
16 zero, but there is also a slight trend that you can  
17 see, kind of follows that best fitting line.

18 CHAIRMAN BLEY: What you get then is how  
19 much is accounted? Did you try taking that last point  
20 out and seeing what it does to your--

21 DR. MORROW: Not in this situation.

22 CHAIRMAN BLEY: Because that is a nice  
23 technique in this kind of analysis, and it is  
24 everything disappears.

25 DR. BARNES: She did it in others.

1 DR. MORROW: Yes. when there were  
2 outliers, when they related in the outliers, we took  
3 it out to see if that effect held, and I will actually  
4 show you --

5 CHAIRMAN BLEY: Just staring at this one,  
6 you can't tell, but I wouldn't be surprised if it  
7 flattened ut a whole lot.

8 DR. KOVES: I would say it would flatten  
9 out a little bit, but if you look -- to me, looking at  
10 it, you are looking at the bottom there where you've  
11 got the one, two and three.

12 CHAIRMAN BLEY: It is a nice thing to do.  
13 Go ahead.

14 DR. MORROW: These are additional  
15 concurrent correlations looking at some of the survey  
16 results, the allegations, total count of ROP aspects  
17 tagged to findings, and then also the kind of  
18 different subcategories.

19 CHAIRMAN BLEY: Is this one in the report?

20 DR. MORROW: Yes, it corresponds to Table  
21 8 in the paper.

22 CHAIRMAN BLEY: Oh, there it is. I  
23 skipped a page. Thank you.

24 DR. MORROW: Again, just some of the  
25 interesting patterns that we saw on this was total ROP

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1 aspects was correlated with the safety culture survey  
2 overall, and many of the factors. You will notice  
3 that willingness to raise concerns and personal  
4 responsibility for safety were not correlated with any  
5 of the variables on this table; and again, we talked  
6 about personal responsibility for safety. That really  
7 just did not seem to be related to any of the metrics  
8 that we looked at.

9 CHAIRMAN BLEY: Then you talked about why  
10 that is.

11 DR. MORROW: Right. Again, this is a  
12 scatterplot looking at the safety culture overall and  
13 total ROP aspects in 2010. Again, we do have some  
14 clustering. What I found interesting looking at this  
15 scatterplot is that kind of the top performers on the  
16 safety culture survey were all within under about 15  
17 aspects tagged to findings, and then you've got quite  
18 a few that follow the line of best fit.

19 CHAIRMAN BLEY: Since you brought up Jim  
20 Reason, there is one thing he talks about in  
21 organizational accidents. I guess it refers to the  
22 Swiss cheese idea.

23 That is that he is trying to deal with  
24 people from, say, Dow Chemical and other places that  
25 really put a big focus on lowering the incident rate

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1 of industrial type accidents, minor accidents; and  
2 some argue that that makes you less susceptible to  
3 large accidents.

4 At this point, I kind of agree with it.  
5 I don't think there is anything to strongly support it  
6 except good intuition and studying some bad accidents.  
7 If you are bad on those everyday kind of things, it is  
8 real hard to be good on the serious risks. If you are  
9 good on those things, it is no assurance that you will  
10 be good in the big ones such as the plant John was  
11 talking about earlier.

12 You almost kind of see that, a because on  
13 this one you see there's a lot of people with low  
14 scores here, and they are not sticking out, but don't  
15 have anything related to the bad, really serious sorts  
16 of events here, at least not clearly. There might be  
17 some of the ROP aspects that get there. Go ahead.

18 DR. MORROW: Well, the alternative to that  
19 is also that those who do have good safety cultures --  
20 how do we show that they didn't have an accident, when  
21 it didn't happen? How do we show the nonexistence of  
22 an accident?

23 CHAIRMAN BLEY: The bad accidents, we  
24 know.

25 DR. MORROW: Yes. But you can't look at

1 the opposite.

2 CHAIRMAN BLEY: Well, that's true.

3 DR. MORROW: This is a situation where we  
4 look at the correlation here and the correlation was  
5 -.28. So we are talking about seven, eight percent of  
6 the variance. But when we look at the scatterplot,  
7 this is where the correlations can be misleading if  
8 you don't look at the actual data and go into the  
9 data.

10 So when we took away this outlier, there  
11 was not a significant correlation. So this was --

12 CHAIRMAN BLEY: It just went away.

13 DR. MORROW: Yes. Safety culture overall,  
14 and the allegations that were specific to safety  
15 conscious work environment, which sounded promising,  
16 but at least looking at this snapshot of data, we  
17 can't really establish it according to that we can be  
18 confident will be repeatable.

19 Our key observations looking at those concurrent  
20 correlations are that the overall safety culture  
21 survey was moderately correlated with unplanned  
22 scrams, total inspection findings, and also total ROP  
23 aspects. Specifically, it seemed to center around  
24 that problem identification and resolution cross-  
25 cutting area.

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1           We found, similar to what the INPO  
2 correlations looked like. Questioning attitude seemed  
3 to kind of stand out as we saw higher correlations  
4 when we just looked at that questioning attitude  
5 factor compared to all the other factors. So that  
6 questioning attitude was correlated with total  
7 inspection findings, total substantive cross-cutting  
8 issues, allegations from licensee personnel. We know  
9 that SCWE related allegations, one, because we know  
10 there is a terrible outlier there, total ROP aspects,  
11 and also the human performance area and problem  
12 identification and resolution area, specifically.

13           We also saw -- and training quality is one  
14 we haven't talked about too much, but training quality  
15 was moderately correlated with some of those  
16 performance indicators, which was interesting in that  
17 it was correlated with the performance indicators  
18 which are more plant safety equipment performance and  
19 not so much the inspection findings or the broad  
20 indicators.

21           MEMBER STETKAR: We are back on the  
22 record, so I have to be careful about what I speak of.  
23 The example I used: The folks at that plant were very  
24 well trained for the things that they did every day.  
25 There was a high correlation.

1           They said they were very well trained, and  
2           indeed they didn't have many unplanned scrams. They  
3           didn't have many forced outage hours, and their  
4           equipment outages were very infrequent and of very  
5           short duration when they had to do something.

6           Yet they were completely untrained on  
7           things that could be of substantial safety  
8           significance. How do you rationalize those kind of  
9           examples, given this type of process? Let me call it  
10          a process.

11          DR. MORROW: It is almost a question of  
12          where would that show up, if we look at the factors of  
13          the safety culture survey.

14          MEMBER STETKAR: At what point?

15          DR. MORROW: It might not show up. Yes,  
16          well, but it might not show up in training quality,  
17          because they believe they are well trained, but it  
18          might show up in other areas like questioning attitude  
19          where we don't question things.

20          So it might be that they believe they are  
21          well trained. It is really an issue of that they are  
22          not trained for emergency procedures, that sort of  
23          thing. They are not trained in every way that, if we  
24          look at it from an outside position, they should be  
25          trained on this. They should have emergency operating

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1 procedures. They are not aware of that. That is a  
2 blind spot for them.

3 So it might not show up in the factor that  
4 we would expect it to, and that is why it would be  
5 necessary to dig deeper. That is why it is necessary  
6 to do more than just a survey.

7 MEMBER STETKAR: But what in this process  
8 -- and I will call it a process. What in this process  
9 gives me confidence that that flag will be raised,  
10 because I don't see anything here.

11 DR. MORROW: I am going to consult a  
12 friend.

13 MEMBER STETKAR: Because that is what we  
14 are trying to do ultimately, I think.

15 MS. FRANOVICH: Rani Franovich, NRR staff.  
16 My perspective: We have regulatory requirements in  
17 this country that ensure that plants have EOPs, and  
18 that they train and they practice on EOPs. I think  
19 that what staff is presenting here is a framework with  
20 that premise, that it is our regulatory environment we  
21 have here. Could we rely on some of these  
22 implications.

23 If you take that out of this context in  
24 which we are talking, all bets are off. In another  
25 country where they are not required to have EOPs,

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1 maybe safety culture is not a requirement.

2 MEMBER STETKAR: You know, I didn't say  
3 that -- and I have to be careful here -- that my  
4 specific example did not have EOPs. They had very,  
5 very detailed EOPs.

6 MS. FRANOVICH: I thought I heard you say  
7 that they did not.

8 MEMBER STETKAR: Not for this particular  
9 class of events.

10 MS. FRANOVICH: Okay. Okay.

11 MEMBER STETKAR: They had extremely  
12 detailed, and they were reviewed and trained on them,  
13 and their regulators looked very carefully at the  
14 EOPs that they had.

15 MS. FRANOVICH: That is a different  
16 understanding than I had earlier. That said, I think  
17 --

18 MEMBER STETKAR: They were not a  
19 developing Third World country that was doing this ad  
20 hoc.

21 MS. FRANOVICH: That said, I think it is  
22 probably appropriate to look at what the staff is  
23 presenting on the context of this country, these  
24 plants, the regulatory basis that override the things  
25 that we would expect them to do.

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1                   MEMBER STETKAR:  And I don't want to  
2                   belabor that specific example.  I just bring it up as  
3                   an example to kind of pique curiosity about this  
4                   process, and trying to gain some assurance that  
5                   somehow -- Now I said how do I gain confidence that,  
6                   if something like that were to exist at any of the  
7                   plants in our country, it would be flagged.

8                   DR. KOVES:  Do you mind if I jump in here?  
9                   Okay.  You know, when you say "this process," I would  
10                  have a -- To me, you are asking the question, you  
11                  know, will this survey always catch everything?  And  
12                  the answer is no.

13                 MEMBER STETKAR:  Obviously, not.

14                 DR. KOVES:  Obviously not.  That is why,  
15                 you know -- and as Steph had said, you need to do the  
16                 follow-up.  There are areas that you see that are weak  
17                 or even that you don't see that are weak.

18                 The assessment process, the nuclear safety  
19                 culture assessment process, SCART, SCAV which is being  
20                 done by the Wano Paris Center now - they all come  
21                 back, and even on areas that are correlated strong,  
22                 they will do some interviewing and questioning about  
23                 that to see, okay, where do these people think they  
24                 are?  Where do I as an evaluator think they are  
25                 relative to a national or international scale, not

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1 just what they think.

2 So there is a follow-up that way, plus  
3 more follow-up in the areas of where they are  
4 perceiving themselves to be weak.

5 So when I would say the overall process,  
6 I think that overall process, the survey with the  
7 interviewing and observation -- I think the two of  
8 them together will give you indications 95 -- this is  
9 my number, okay; I am just pulling it out of my ear --  
10 95-98 percent of the time, you are going to catch  
11 something.

12 It is still guaranteed to, you know, not,  
13 but I think the two together -- When you are just  
14 using the survey alone, well, you know, is there a  
15 greater chance that something is going to slip by?  
16 Yes, there is. But it also can be very useful to  
17 point out those hot spots where you need to dig in.  
18 Thanks.

19 CHAIRMAN BLEY: I find this slide  
20 interesting in a few key ways, and suggest it to  
21 others. There are some nice things here, but down at  
22 the bottom it points concerns about unplanned scrams  
23 and forced outage hours. Training quality seems to be  
24 a key, and it crops up across the board.

25 There are other ones up here that would be

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1 very useful in the plants, What isn't here are those  
2 links to serious events, events that could challenge  
3 offsite risks. I can think of a couple of ways to go  
4 at that.

5 One is flipping the process around and  
6 looking at real events and overlaying them with the  
7 survey and trying to -- not with the survey --  
8 overlaying them with the issues, with the factors, and  
9 seeing how they align with what happened in those  
10 events.

11 It is not the same kind of analysis, but  
12 I think it could generate a similar chart that might  
13 relate to those. There is a project going on now in  
14 research with one, from rumors I have heard, maybe  
15 some other utilities in actually collecting data from  
16 simulator exercises for those simulator exercises that  
17 put people through really challenging events, and  
18 looking through that information, and playing it  
19 against these, maybe even in a similar way to the way  
20 you have done this might be able to tease that out.

21 Right now, what you are showing us says we  
22 have some confidence that the things we have tagged in  
23 safety culture will help us in a number of areas, but  
24 they are not saying they will help us in the big nasty  
25 area that we are really concerned with, and I think

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1 there are things that could be done that would go a  
2 long way to doing that.

3 I hope you can think about that some, and  
4 maybe we will think about it more here. But I think  
5 there are ways to go at it, and this chart shows you  
6 very nice things that are important and operations  
7 that this can help with. So we are on the edge of  
8 something that might really link to public safety if  
9 we can push it.

10 DR. KOVES: It is very interesting you  
11 mentioned simulators, because INPO this year has  
12 stepped up evaluation of simulators and people working  
13 in the simulators.

14 CHAIRMAN BLEY: And actually urging to get  
15 more complex scenarios.

16 DR. KOVES: Right.

17 CHAIRMAN BLEY: Like some of the real  
18 events that have happened in the last year or two.

19 DR. KOVES: Exactly. More complex events,  
20 and also then evaluating more people, because my  
21 understanding is before they would just like evaluate  
22 one team and naturally that is some A-team for that.  
23 But I am not part of that. So that is just my  
24 understanding.

25 Yes, if we were doing that, and we were

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1 seeing more failures, that could be a very interesting  
2 research project, obviously more qualitative. You  
3 could kind of do a quantitative aspect, too. Coming  
4 from that direction, it would be more qualitative, but  
5 it could be very interesting.

6 CHAIRMAN BLEY: And I think there is a  
7 growing body of information like that. One of the big  
8 events was the Robinson fire a year or two ago, and  
9 there have been a number of drills run that tried to  
10 set up that kind of complication, and people don't do  
11 as well with things coming in multiples and hiding  
12 behind each other. It is no big surprise, but we  
13 haven't been working on that real hard, and now we are  
14 starting to. So there might be something there.

15 DR. MORROW: That also reminds me that OE  
16 has been doing a number of case studies, I think, both  
17 inside and external to the nuclear industry, and they  
18 have been doing, actually, similar to what you were  
19 talking about.

20 They have been viewing those studies as  
21 severe accidents and applying the Safety Culture  
22 Policy Statement traits and going through the  
23 documents from those accidents and looking at whether  
24 there seemed to be issues cropping up related to the  
25 Policy Statement traits.

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1                   MEMBER STETKAR: I don't even think it  
2 needs to be severe accidents. I was just reading an  
3 event report the other day where, because people  
4 didn't check and ask about things, something was not  
5 programmed correctly. This was a nuclear plant.

6                   As a result of that, a plant lost not only  
7 offsite power but all AC power because of the plant  
8 configuration, and although it wasn't as severe as the  
9 Robinson event, it wasn't as severe as Davis-Besse, it  
10 is an indicator of -- I don't want to point --  
11 organizational or individual or something that was not  
12 done that led to this process.

13                   I think you can look at those things. It  
14 doesn't have to be big dramatic things.

15                   DR. KOVES: But I think what you are -- If  
16 we go back to the Swiss cheese model and reason and  
17 some of the reading that I have been doing recently,  
18 I think you are going to define -- those big events  
19 are going to define as multiple barrier failures.

20                   I think you are -- My hunch is that what  
21 you are going to see is that on those big events you  
22 are going to see failures in across multiple areas.

23                   CHAIRMAN BLEY: But you will find latent  
24 problems that are linked to these. I am convinced of  
25 it.

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1 DR. KOVES: Oh, yes.

2 MEMBER SCHULTZ: It goes back to what was  
3 on your slide, Val, of looking at micro- events or  
4 mini-events, however you want to classify them, but a  
5 database that would categorize -- collect and  
6 categorize that information would be extremely  
7 valuable to set up against this process.

8 DR. BARNES: The question that I have  
9 about doing those post-event analyses or post-  
10 event/post-accident is whose judgment are we going to  
11 rely on to determine what trait was active in the  
12 event, number one, and number two, how bad or good the  
13 organization was on some scale in terms of that trait?

14 It is not that those kinds of analyses are  
15 not very informative. It is simply that we lack a  
16 large number of people agreeing that this trait was  
17 important in this incidence or we are missing some  
18 inter-rat er reliability there, and often, you know,  
19 if you have been involved in accident investigations  
20 and are trying to go back and figure out why something  
21 occurred, there is often large amounts of  
22 disagreement, and it takes a lot of data gathering and  
23 arguing to come to agreement about what the causes and  
24 contributors were to an accident.

25 So I think that we would be at risk of --

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1 unlike a study like this where we have got opinions  
2 from 30 or more people about the state of each trait  
3 sort of within their organization, and then go out and  
4 link it to whatever performance indicators we might be  
5 interested in, when we go back and do these detailed  
6 events analyses, we would have small counts of traits  
7 being contributors, because we -- and there's lots  
8 more room for disagreement about which trait was  
9 actually having what impact where.

10 Not that it is not worth doing. It is  
11 just that that approach also has some limitations in  
12 terms of being able to identify causal relationships  
13 and the strengths of causal relationships between a  
14 particular trait and one kind of outcome or another.

15 MR. PETERS: Dennis, this is Sean Peters.  
16 I did have a question about how you would envision  
17 collecting safety culture information from simulator  
18 trials. What types of ways do we see how we gather  
19 organizational performance or safety culture  
20 capabilities based upon basically made-up simulator  
21 accidents?

22 How we have been relating safety to  
23 culture is associated with a number of real events out  
24 there in industry.

25 CHAIRMAN BLEY: Real events of very little

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1 importance to reactor safety, actually.

2 MR. PETERS: Yes.

3 CHAIRMAN BLEY: So these would be  
4 simulated events of significant importance to reactor  
5 safety. So while there is a tradeoff there, I lean  
6 toward the second. It would be rather like post-event  
7 analysis of certain exercises that were of real  
8 significance, but also real events. And sure, there  
9 are problems, but for the more significant events  
10 there have been whole teams get together and analyze  
11 them, and eventually agreement between the regional  
12 inspectors and the utilities on what were the key  
13 factors involved.

14 i could envision in the future that the  
15 safety culture traits could be incorporated into  
16 reviews of events. They weren't in the past, but very  
17 often those events are tagged to things that you can  
18 link with at least as much confidence as we have given  
19 large labels to the primary factors as to their  
20 significance.

21 MR. PETERS: I guess my question is: The  
22 actual events out there, a lot of the initiators and  
23 other underlying defects are associated with some type  
24 of safety culture trait in the plants.

25 CHAIRMAN BLEY: Sometimes. Some of our

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1 responses along the sequence of events that occurs  
2 after the initial, and some things that were  
3 preexisting latent problems that you didn't notice  
4 until you got in the middle of the event, and they  
5 cropped up and caused problems.

6 MR. PETERS: Sure. And here the existing  
7 latent problems would be pre-programmed by a trait or  
8 something along those lines. So I was a little  
9 worried that we wouldn't be evaluating those aspects  
10 of the safety culture; maybe you just evaluate  
11 operator performance under the assumption that, hey,  
12 you already know we have issues; how do we perform.

13 That seems to be more of an evaluation of  
14 like the training quality of certain sub-aspects but  
15 not the whole safety culture as a whole.

16 CHAIRMAN BLEY: I am not sure we linking  
17 the whole safety culture to real safety right now.  
18 Making this up on the spur of the moment, I can't  
19 completely testify, and we don't have the whole answer  
20 here. We have a good answer for some things. So I  
21 would see that as a research project to do it right.

22 MEMBER SCHULTZ: Trying to make a  
23 connection to it, one way would be simulator, and it  
24 is another set of data that could be used. I don't  
25 know if you have to attribute all kinds of human error

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1 problems and issues related to what events you might  
2 catalog on the simulator, but the information could  
3 certainly be useful, or at least we could find out how  
4 useful it is.

5 Another area to explore might be a  
6 station's Correction Action Program, and thinking of  
7 micro-events and so forth. Now I think it would be  
8 difficult to do, but perhaps there are categories  
9 within the Correct Action Program that you could  
10 investigate and identify certain trends that might be  
11 associated with elements here.

12 If Davis-Besse happened today, we have got  
13 a tool here we could look at immediately, use  
14 immediately to assess safety culture pre-event,  
15 because it would only be yesterday.

16 The problem we have today is what has been  
17 developed at INPO comes from the state safety culture  
18 and Davis-Besse safety culture, and so that is where  
19 that -- That is where the technology of safety culture  
20 has emerged from, and we are trying to identify how we  
21 would connect this into, I think, the micro- or mini-  
22 events that need to be identified to connect to.

23 What is being developed here is an  
24 important link. I don't think we have it, but it is  
25 certainly worth thinking about in a research sense.

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1 MS. FRANOVICH: Rani Franovich, NRR staff.  
2 I just wanted to add that when there are events and  
3 reactive inspections for those events, to the extent  
4 that performance deficiencies are identified, they  
5 will get a cross-cutting aspect assigned, and those  
6 cross-cutting aspects, whether they are event related  
7 or performance deficiencies in routine operation, will  
8 be rolled up into the cross-cutting issue process,  
9 which was one of the things that the staff looked at  
10 for their correlations.

11 MEMBER SCHULTZ; And Ken mentioned that in  
12 his presentation as well, and I think that is a good  
13 approach. I think it is has the potential to produce  
14 information that can be useful for the licensee and  
15 for the regulator as well.

16 DR. MORROW: All right, we will move on.  
17 Now we are into the predictive correlations.

18 CHAIRMAN BLEY: I was just wondering if  
19 you are getting ready to leave. Are you?

20 DR. KOVES: Getting set up.

21 DR. MORROW: Take a little more time.

22 DR. KOVES: I don't have to run out yet.

23 CHAIRMAN BLEY: Okay. Well, but when you  
24 get to the point you have to run, if any members of  
25 the Subcommittee have anything for you, this would be

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1 a good time maybe to interrupt the flow of things. I  
2 guess not.

3 So we appreciate your being here, and  
4 whenever you have to slip out, we thank you very much  
5 for your presentation and discussion.

6 DR. KOVES: Well, thank you. Thank you  
7 for the opportunity to be here. I just want to say it  
8 has been great fun, like always. Hopefully, we can do  
9 it again in the future with new data and be able to  
10 narrow in on some of these things. So thank you.

11 CHAIRMAN BLEY: We will give it back to  
12 Stephanie now.

13 DR. MORROW: Well, this table is the first  
14 of two tables looking at the correlations between the  
15 survey results and the same performance metrics but in  
16 2011. So before, you were looking at the performance  
17 metrics assessed at the same time period, and this is  
18 one year later.

19 First off, what you will notice right away  
20 is that there are fewer shaded cells. So there are  
21 many fewer significant correlations when we look at  
22 this information. Mostly what we see is the  
23 correlation between the Safety Culture survey results  
24 and the problem identification and resolution cross-  
25 cutting area, specifically the Corrective Action

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1 Program component of the PI&R cross-cutting area.

2 CHAIRMAN BLEY: Now these with this -- No,  
3 never mind.

4 DR. MORROW: Okay.

5 CHAIRMAN BLEY: So where did they go?

6 MEMBER SCHULTZ: Is there a conclusion you  
7 have, Steph, about having looked at these two sets,  
8 2010 and 2011? It is a dramatic change.

9 DR. MORROW: Right. This is not  
10 unexpected, because what we were looking at first is  
11 kind of everything happening at the same time period.  
12 So the employees' perceptions of their safety culture  
13 related to how the plant was performing during the  
14 same time period.

15 Now if we look at -- You know, as we get  
16 farther away from that same time period, things change  
17 over time. So the safety culture may change as well,  
18 but these kind of plant safety metrics are going to --  
19 during the next year, are not necessarily going to be  
20 as related to the safety culture in the previous year.

21 Now we would love to see these predictive  
22 correlations, and actually on the next table that I  
23 will show you -- I will skip forward just a second.

24 MEMBER STETKAR: Let me ask you something  
25 before you get to this. On the statement you just

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1 made, I understand how plant performance can vary from  
2 year to year. Get a bad year, a couple of times. Do  
3 you really think that plant safety culture is that  
4 variable over time year to year or did I misunderstand  
5 what you were saying?

6 DR. MORROW: I will correct my statement,  
7 because I misspoke.

8 MEMBER STETKAR: Okay.

9 DR. MORROW: What I think can vary from  
10 year to year is employee perceptions of the safety  
11 culture, so what the survey is tapping into. The  
12 underlying safety culture, it is much more stable, and  
13 it doesn't necessarily change from year to year unless  
14 there is some significant event that will change it.  
15 However, if there are smaller events that are  
16 occurring, such as they move in the action matrix and  
17 suddenly they are a lot more doing reactive  
18 inspections or something like that. The employees'  
19 perception of the safety culture may change as a  
20 result of that.

21 So I will distinguish between kind of the  
22 underlying overall safety culture and what the survey  
23 is tapping into, which is more of the surface level.  
24 So those perceptions are much more likely to change.

25 CHAIRMAN BLEY: What has to have happened

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1 in the intervening year is that all of these things  
2 that get measured have changed in a way that they no  
3 longer correlate as well as they did.

4 DR. MORROW: Right.

5 DR. KOVES: Except a few of them.

6 CHAIRMAN BLEY: A few, but even those are  
7 down a little.

8 DR. MORROW: Actually, if you look --

9 CHAIRMAN BLEY: I want you to swear it is  
10 not, but --

11 DR. MORROW: But still, if we are talking  
12 about 10 percent of the variability in these plant  
13 safety metrics, if that is a unique 10 percent, then  
14 it might be worthwhile to look at. What was  
15 interesting about the significant correlations,  
16 looking at the 2011 data -- and I actually have an  
17 extra slide which I may need to pull up in a minute,  
18 but the elevated action matrix, the totals of standard  
19 cross-cutting issues and allegations, looking at the  
20 2010 results, they weren't significant correlations.s

21 I just have this up here in case it came  
22 up, which it seems to. This is looking at the 2010  
23 versus the 2011 data. So you will see the overall  
24 safety culture results were not significantly  
25 correlated with this data in 2010, but it was in 2011.

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1           You will also note that these three  
2 variables in particular are the more broadbased  
3 performance assessments: Whether a site is in one of  
4 the elevated oversight columns of the action matrix;  
5 whether they have outstanding substantive cross-  
6 cutting issues.

7           So this was a rather interesting finding  
8 in that it seems that, if we are looking at data in  
9 the future, the safety culture survey results seem to  
10 be more strongly related to the broadbased performance  
11 assessments the following year.

12           MR. WIDMAYER: You need to send me a  
13 slide.

14           DR. MORROW: I will send this slide to  
15 you. Actually, it is in the electronic file.

16           MR. WIDMAYER: Oh, it is?

17           DR. MORROW: Yes.

18           MEMBER STETKAR: Personal responsibility  
19 for safety is very dramatic, at least in the elevated  
20 source column -- in the first metric.

21           DR. KOVES: To me, just on a very simple  
22 level, particularly the allegations results -- I mean,  
23 to me it was like, if you have a poor safety culture  
24 this year, you are going to have more allegations next  
25 year, you know. Also, I mean in terms of the cross-

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1 cutting issues, next year you are going to have more  
2 of them. To me, it is logical.

3 DR. MORROW: Well, we could speculate  
4 that, if employees at a site feel like there isn't a  
5 strong questioning attitude, they feel like issues  
6 aren't being raised through the Corrective Action  
7 Program, then it might be kind of when they fail at  
8 that, that later on they start to go to the NRC and  
9 make allegations, or if they feel like there is not a  
10 respectful work environment.

11 That is kind of later on in that process  
12 that they will start to look outside of their  
13 organization for help with these issues.

14 But it is one possible explanation for these  
15 correlations.

16 Okay, now we are going backwards. This,  
17 for example, is the scatterplot looking at the overall  
18 safety culture survey scores and allegations in 2011.  
19 So there is some dispersion of data around kind of  
20 that best fitting line, and it is not just a single  
21 outlier.

22 These are some of the key observations we  
23 noted from the correlations of the 2011 data.

24 Sorry. There we go. Okay. Most of the  
25 correlations when looking at the 2011 data between the

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1 survey results and the performance metrics that were  
2 from the sources of data from inspection reports were  
3 small and nonsignificant, looking at the 2011 data.  
4 That was that first table that I showed you, but the  
5 overall safety culture survey was moderately  
6 correlated with elevated oversight and action matrix  
7 and allegations from licensee personnel.

8 Kind of the strongest correlations that we  
9 saw looking at the 2011 data were with, again,  
10 questioning attitude was correlated with allegations,  
11 and the management responsibility and willingness to  
12 raise concerns factors. This is what you were asking  
13 about, I think, and the 2011 data was correlated with  
14 allegations

15 DR. KOVES: Yes. Right. It wasn't  
16 correlated well with the '10 data.

17 DR. MORROW: Right.

18 DR. KOVES: But it was correlated very  
19 well with the '11 data.

20 MEMBER SCHULTZ: Steph, I am trying to  
21 compare the two 2010 and '11 for allegations. One is  
22 titled SCWE-related allegations, and the other is  
23 allegations. Are they, in fact, the same?

24 DR. MORROW: The allegations is the more  
25 general variable. So that is the total count of all

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1 allegations from licensee personnel. The SCWE-related  
2 one is a variable that we had with the 2010 data. It  
3 is allegations that were specifically categorized as  
4 relating to a safety conscious work environment. We  
5 didn't have that specific categorization when we were  
6 looking at the 2011 data. So it just looks at the  
7 general allegations.

8 MEMBER SCHULTZ: All right. Thank you.  
9 And that explains why there are more in 2011, and it  
10 is a different data structure for the correlations.

11 DR. MORROW: Right.

12 MEMBER SCHULTZ: Do you have the 2010 for  
13 total allegations?

14 DR. MORROW: The correlation is there. I  
15 don't think I have the scatterplot.

16 MEMBER SCHULTZ: Okay. I will try to  
17 compare that. Thank you.

18 DR. MORROW: Sure. I will bring that last  
19 slide up again. these were the comparisons, 2010 to  
20 2011, because you don't have that with you.

21 MEMBER SCHULTZ: Okay, thank you.

22 DR. MORROW: And that concludes my  
23 presentation. So if you have additional questions for  
24 us about -- while we still have Ken here as well for  
25 a few more minutes.

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1                   MEMBER STETKAR: See how quickly we get  
2 done when you are not here.

3                   CHAIRMAN BLEY: Thank you. Anything more?  
4 I think we will go around and just make comments from  
5 committee members. Steve, I will start with you.

6                   MEMBER SCHULTZ: Thank you. I am very  
7 impressed with the work that has been done and the  
8 presentations that have been made today. I certainly  
9 appreciate, Ken, you being here and providing the  
10 insight that you have developed and the methodology  
11 that you have been developing on behalf of industry,  
12 in collaboration with the NRC. I think overall that  
13 program has provided what appears to be a more  
14 promising product that has been aimed at developing a  
15 program that will be useful to the licensees as well  
16 as to the NRC, and time will tell.

17                   As we have discussed today, I think it is  
18 important to continue to look for the connectivity  
19 between the questionnaire and information we can  
20 derive from safety culture to a real safety benefit,  
21 which we have discussed today. I still feel we are  
22 missing that connection, although, certainly, it would  
23 appear that progress has been made on that accord in  
24 two different areas.

25                   I think we have a much better

1 understanding about how one is able to quantify these  
2 relationships and the difficulty -- at least some  
3 understanding of the difficulties related to that.  
4 But I think, from what we have seen today, there is  
5 certainly some promise, but I think we are still  
6 missing that connection to, as Dennis described  
7 earlier, what we are trying to connect to as an end  
8 product, which is public health and safety. But I do  
9 believe we are making some progress there, because as  
10 we have discussed safety, in and of itself, we know  
11 has a benefit, I believe, to public health and safety.  
12 It is a difficult one to quantify.

13           These last results, which we haven't had  
14 a chance to study, are interesting, looking at this  
15 information related to the survey results and its  
16 correlation to these measures, broad measures, both  
17 from INPO and from the NRC's program, are somewhat  
18 telling.

19           Again, clear connectivity to public health  
20 and safety has yet to be established, but it would  
21 appear that I am gaining some ground and understand  
22 certain input with regard to understanding. But thank  
23 you very much for the presentations. It was very high  
24 quality, and it has been very helpful in moving the  
25 technology, as it were, forward. Thank you.

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1 CHAIRMAN BLEY: John.

2 MEMBER STETKAR: Thanks. I have said, I  
3 think, most of what I need to. I would echo Steve's.

4 I think my sense is that the survey, the  
5 questions, I think, is -- it seems to be asking the  
6 right things in the right format. I think that the  
7 process that you have gone through to winnow down the  
8 questions and to sort of systematically challenge  
9 yourself in terms of what is a reasonable set of  
10 information to derive is very, very good.

11 I will share Steve's concern. It is not  
12 -- pretty evidently to me anyway, not clear to me that  
13 correlating those responses with particular metrics  
14 that you are using in terms of either INPO or reactor  
15 oversight process is the right way to look at the  
16 problem.

17 I don't know if it isn't the right way.  
18 It is not clear that it is. So I will just leave it  
19 at that. Thank you.

20 CHAIRMAN BLEY: Thanks, John. Mike.

21 MEMBER RYAN: Thanks, Dennis. I guess I  
22 would second Steve's comments, too, and offer a few  
23 that it is fascinating data, particularly the way you  
24 have laid it out. I would second that idea. It is  
25 very insightful and helpful to somebody that hasn't

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1       been involved to learn quickly.

2                   Two questions come to my mind.   Okay, what  
3       do we do with this now?   And it is obvious you've got  
4       a next phase planned, and that is underway, and you  
5       are going to collect some additional data.

6                   Whenever folks talk about collecting data,  
7       I have a favorite question.   When are you done?   The  
8       answer is never, okay.   What benchmarks are you going  
9       to have along the way to assess when you are done, and  
10      then when you are done, what do I do with it?   I am a  
11      licensee.

12                  So I think those are two big questions  
13      that come after the accolades that Steve talked about,  
14      and I agree with every one.   Now is the time that you  
15      are kind of in the middle with the alligators swimming  
16      around, and stuff to see.

17                  You know, where are you going to take all  
18      of this in terms of the guidance, regulations,  
19      requirements and things of that sort to memorialize  
20      what you are learning and how you are learning it and  
21      the way you would, I'm guessing, recommend that  
22      licensees use this information or gather this  
23      information and analyze this information in the way  
24      that you recommended.

25                  So it is not too early to start thinking

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1 a little bit more about that, I think. So I just  
2 offer that to you as an observation. Thank you. And  
3 again, I think you did a great job. It has been very,  
4 very well prepared and well presented.

5 CHAIRMAN BLEY: I would like to thank you  
6 very much for the White Paper and for coming back. I  
7 won't say that I wished I had a long time ago, but it  
8 is really good. It makes it very clear.

9 At the last Subcommittee meeting, there  
10 were a lot of issues about the analysis that just  
11 weren't clear to us. So it has really helped a lot,  
12 and having all three of you here to talk about it is  
13 very helpful.

14 We are still stuck with we've got  
15 correlations that aren't causal or predictive, maybe.  
16 I have to say again what the other guys said. You  
17 need to test it against public safety significant  
18 events somehow. That is what we are really after.

19 This last bit on the 2011, I got to think  
20 about that. I don't know what that is telling me, and  
21 I hate to see all those, albeit in my opinion weak  
22 correlations, sort of go weaker, and I don't know  
23 exactly why. I have heard speculations, and I can  
24 speculate as well. I don't know, maybe this is  
25 something that always has to go hand in hand in

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1 comparing the current culture with what is going on.

2           Anyway, it was a very useful day for us,  
3 and thanks very much for coming.

4           I forgot to ask earlier, which I should  
5 have done. I don't think we have any members of the  
6 public, but if we do, is there anyone here who would  
7 like to make a comment?

8           Hearing none, thanks again, and this  
9 meeting is adjourned.

10           (Whereupon, the foregoing matter went off  
11 the record at 3:49 p.m.)

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