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Reliability and PRA Subcommittee

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

RELIABILITY AND PRA SUBCOMMITTEE

+ + + + +

THE INDUSTRY TRENDS PROGRAM AND

PERFORMANCE INDICATORS

+ + + + +

WEDNESDAY, MAY 7, 2003

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ROCKVILLE, MARYLAND

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The Subcommittees met at 2:00 p.m. in Room
T2B3, 11545 Rockville Pike, Rockville, Maryland,
William J. Shack, Acting Subcommittee Chair,
presiding.

PRESENT:

- WILLIAM J. SHACK Acting Subcommittee Chair
- MARIO V. BONACA ACRS Member
- F. PETER FORD ACRS Member
- THOMAS S. KRESS ACRS Member
- GRAHAM M. LEITCH ACRS Member
- JOHN D. SIEBER ACRS Member
- GRAHAM B. WALLIS ACRS Member

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NRC STAFF PRESENT:

MAGGALEAN WESTON	Cognizant Staff Engineer
TOM BOYCE	NRR
DALE RASMUSON	RES
PAT BARANOWSKI	RES/DRAA
MARK SATORIUS	NRR

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

2:01 p.m.

CHAIRMAN SHACK: The meeting will now come to order. This is a meeting of the Reliability and PRA Subcommittee. I am William Shack, acting chair, of the Reliability and PRA Subcommittee. ACRS members in attendance are: Tom Kress, Graham Leitch, Jack Sieber, Graham Wallis and, I believe, Mario Bonaca and Peter Ford will be joining us.

The purpose of this meeting is to discuss the Industry Trends Program and the Integrated Industry Initiating Events Indicator. The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full committee. Mag Weston is the cognizant ACRS staff engineer for this meeting.

The rules for participation in today's meeting have been announced as a part of the notice for this meeting, published in the Federal Register on April 4, 2003. A transcript of the meeting is being kept and will be made available, as stated in the Federal Register notice. It is requested that speakers use one of the microphones available, identify themselves and speak with sufficient clarity

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1 and volume, so they may be readily heard.

2 We have received no written comments from
3 members or the public regarding today's meeting. We
4 will now proceed with the meeting, which I think is
5 sort of a Bayesian update of a previous discussion we
6 have had of this, which really it's not based on a non
7 informative prior. I thought we learned something
8 from the last meeting. But I think Mr. Boyce will
9 start us off.

10 MR. BOYCE: Yes, thank you. I also agree
11 that it should be an informative prior or I hope that
12 it is. I'm Tom Boyce. I'm a senior project manager
13 in the Inspection Program Branch of NRR. With me is
14 Dale Rasmuson, senior technical reviewer, in the
15 Operating Experience and Risk Assessment Branch in the
16 Office of Research. My section chief is here with me,
17 Mark Satorius, in the Inspection Program Branch, and
18 the branch chief for the Operating Experience Branch,
19 Patrick Baranowski is also here with us.

20 This is an update of the Industry Trends
21 Program and another briefing of an Integrated Industry
22 Indicator for Initiating Events, and the acronym that
23 we're using right now is the IIEPI, and I can say that
24 because I've actually practiced it. We are, in fact,
25 looking for a snappier acronym and I put out a

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1 request. We're going to have a naming contest, but
2 right now IIEPI is what we're using.

3 There's an outline of the presentation.
4 We'll be going over the current status of the Industry
5 Trends Program and an overview of the Industry Trends
6 Program and the development schedule. I'll be
7 covering some of the previous ACRS comments on the
8 IIEPI. We'll be providing some draft responses, and
9 we're going to tell you where we're going in the
10 future.

11 Right now, just as background, we briefed
12 the Industry Trends Program in May and November of
13 2002 to the, I think it was, subcommittee in November
14 and it was the full committee in May 2002.
15 Subcommittee and full committee in May 2002. We
16 briefed the IIEPI.

17 MR. WALLIS: IIIIEI is the same thing,
18 isn't it?

19 MR. BOYCE: Yes. What you got in your
20 draft report was the IIIEPI, and what you're seeing is
21 the reflection of the struggle we're having trying to
22 come up with something that's easy. But you did hear
23 about the IIEPI or IIIIEPI. In November, we went
24 through the transcripts and we called out as many
25 comments as we could from individual members, tried to

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1 find group consensus, looked for protest problems,
2 etcetera, and we're coming back to talk to you about
3 those today.

4 I'm going to actually open up with an
5 overview of the Industry Trends Program to remind you
6 of the Industry Trends Program process. But it's easy
7 to get side tracked in the programatics, but what I
8 would ask is that we try and focus on the IIEPI today,
9 and we'll be back to dialogue with the ACRS on both of
10 these topics at a future meeting.

11 Having said that, what we're targeting is,
12 and I'm getting ahead of myself a little bit, we would
13 like to come back in the fall to the full committee,
14 and would probably ask for a letter at that time. The
15 purpose of this meeting is just continuing dialogue
16 and verbal feedback, at this point. Okay.

17 CHAIRMAN SHACK: I think you're back on
18 this later.

19 MR. BOYCE: I'm going to come back to this
20 bullet right here, the third bullet down. We briefed
21 the Industry Trends Program and the IIEPI to industry,
22 and the way we've done that is we hold periodic
23 meetings on the Reactor Oversight Process with various
24 representatives from industry, including NEI, and we
25 have probably briefed this concept four or five times,

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1 and I would characterize the feedback as no show
2 stoppers.

3 In general, because it's at the industry
4 level, no individual plant specifically feels like
5 they are being regulated, and so they've been quite
6 amenable to the concept and supportive of the fact
7 that we're moving in a risk-informed direction. We
8 issued our third annual Industry Trends Program
9 Commission paper in April 2003. The number there is
10 SECY 03-0057. I believe you were given a draft copy
11 of that report.

12 MS. WESTON: We have the final copy.

13 MR. BOYCE: You have the final copy?
14 Okay. There was only minor editorial changes from the
15 draft to the final, so you don't have to reread the
16 entire thing. Just to tell you what the intent of the
17 Industry Trends Program is is it's designed to take a
18 50,000 foot look at the oversight that is provided for
19 each plant by the Reactor Oversight Process. In other
20 words, we are looking for the forest here, rather than
21 the trees.

22 Just to set your mind as to the
23 difference, one of the key differences is the Industry
24 Trends Program indicators do not use colors. We're
25 not into white, green, red, yellow. At the moment,

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1 many of our indicators are unthresholded. We're just
2 monitoring for trends. We are, in fact, working on
3 thresholds.

4 I will cover the last bullet as part of
5 the next slide.

6 CHAIRMAN SHACK: I'm having trouble with
7 these integrated overviews, you know. We always focus
8 on the worst case. It's Davis-Besse and it doesn't
9 matter how well the Boric Acid Corrosion Program is
10 doing in every other plant. As long as there is one,
11 there's a problem.

12 MR. BOYCE: Any time you have a
13 significant event like a Davis-Besse, it does call
14 into question all your monitoring programs, Reactor
15 Oversight Process, and you all have questioned that,
16 and the Industry Trends Program. At least as far as
17 the Industry Trends Program, what Davis-Besse did was
18 remind us that while we have nice indicators and we're
19 developing additional indicators, there are
20 limitations to what the indicators can tell us. And
21 so we're continuing to develop a more comprehensive
22 set of indicators, and hopefully some that are more
23 focused on the most risk-significant aspects of
24 performance. Having said that, in hindsight it's a
25 lot easier to detect a Davis-Besse than to proactively

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1 monitor for that sort of thing.

2 Now, at the last ACRS presentation, we
3 tried to talk through the process using words and
4 text, and one of the comments was it wasn't obvious
5 how the process worked, and what the definitions were
6 for adverse trends, and so we went back and we
7 developed a flowchart. So we've really made progress
8 since the last meeting.

9 What this is intended to do is actually
10 put on one page what used to be several pages of text
11 and bullets. And in general, you start here at the
12 lower left. We collect data and formulate indicators.
13 I've listed the indicators here. We're currently
14 using this set of eight for reporting to Congress.
15 We're developing additional indicators based on the
16 plant-specific indicators for the ROP, and you're
17 going to hear more about the IIEPI today.

18 This 2 means there is two indicators, one
19 for BWRs and one for PWRs. So we collect data. Then
20 we look for issues in that data. We've been chartered
21 to report to Congress against the performance measure
22 of "no statistically significant adverse industry
23 trends in safety performance," and so we look for
24 long-term adverse trends and performance. But we're
25 mindful that you don't want to wait for a long-term

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1 trend to develop, which might take several years, you
2 want to look for short-term issues and preclude them
3 from becoming long-term adverse trends.

4 And so what we've done is draw up separate
5 blocks. We follow the same process, whether we have
6 a long-term adverse trend or whether we identify
7 short-term issues, and you might hear more about that
8 later. Once we identify what we think is an issue, we
9 take a look and we analyze the issue. There's several
10 things that are in this block, which I'm not going to
11 cover at the moment. Based on the safety significance
12 of what we've seen, we then take the appropriate
13 agency response. Again, there's a menu of things that
14 are possible here that are listed.

15 Senior management reviews the ACRS Program
16 and the results annually. We just completed the
17 agency action review meeting where the program and
18 results were briefed and senior management confirmed
19 that we were doing the right thing, and that no
20 further actions were required. We communicate the
21 results of the industry trends meeting. We publicize
22 graphs of the indicators on our website. We provide
23 an annual report to Congress. We publish the
24 indicators in the Info Digest, and they've also been
25 used at industry conferences, such as the closing

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1 remarks for the Regulatory Information Conference last
2 month.

3 I have already alluded to reports to
4 Congress, and, in addition, the chairman has
5 historically provided these indicators as part of his
6 annual reports to our oversight committees.

7 MR. LEITCH: Tom, a question before you
8 leave. In the paper that was distributed it lists
9 three main objectives of the Industry Trends Program,
10 and one of those says collect and monitor industry-
11 wide data, so that it can be used in a number of
12 things, but it also says to provide feedback for the
13 ROP. Is there a feedback to the ROP that's not shown
14 on this chart or am I misinterpreting what I'm reading
15 here? I don't quite understand how that feedback to
16 the ROP occurs.

17 MR. BOYCE: Now, you're correct. One of
18 the purposes to provide feedback to the ROP, it's not
19 shown on this process, this process is actually
20 focused on what do we do if we have an adverse trend.
21 You could say that if we take the appropriate agency
22 response, we would be -- that agency response
23 typically comes in the form of additional inspections.
24 And so you could say that that was feedback to the
25 ROP.

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1 I guess that's only half of it. The other
2 half, which is not shown, is we're developing lower,
3 and you'll hear more about this, additional
4 indicators, say at the component level, where we're
5 trying to say "Give news you can use to individual
6 inspectors," that they might be able to compare how
7 their plant is doing against an industry average.
8 That is a future type development effort. I think we
9 discussed it a little bit in the paper, but we're also
10 doing it in response to Davis-Besse Lessons Learned
11 Task Force recommendations to improve our handling of
12 operating experience.

13 So I guess the short answer is only have
14 of what we're doing for feedback for the ROP is
15 illustrated in this flowchart. Is that --

16 MR. LEITCH: Yes, that's helpful.

17 MR. BOYCE: Yes, if you picked that up,
18 you're the first one to pick up on that. Okay. That
19 was the overview of the Industry Trends Program. And
20 what I'm going to provide is an overview of the IIEPI,
21 and I thought we would start perhaps too
22 simplistically, but that way I could at least get a
23 head start on it, before I turn it over to Dale.

24 What we're trying to do is take a look at
25 the most risk-significant initiating events. Now,

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1 we're trying to risk-weight them for their
2 contribution to core damage frequency, and we're
3 trying to combine all those into a single indicator to
4 give us a roll up indicator of how we're doing in the
5 initiating events cornerstone. To do that we're using
6 two sources of information. We're using PRA
7 information primarily from our SPAR models, the Rev 3
8 models that are developed in our Office of Research,
9 and they are combining it with the operating
10 experience information, which we picked up from
11 several sources, and I'll get into that in just a
12 second.

13 So there's only two key elements for this,
14 and that plays into my next slide. This equation is
15 written for an individual plant, but this is a
16 Birnbaum importance measure. This is derived from the
17 SPAR models. It's the relative risk-weighting for
18 each initiating event. Lambda here is the frequency
19 of individual initiating events, and so when you
20 multiply those, you get the relative contribution to
21 core damage frequency for a given initiating event.

22 An example might be LOCAs, steam generator
23 tube ruptures, loss of offsite powers. You sum up all
24 those initiating events and you'll come up with --
25 now, we've dropped down to a single I hear trying to

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1 move in a more simple direction, but you come up with
2 your IIEPI at that point. And for PWRs we have 10 of
3 these terms, so we go from 1 to 10. For BWRs we go 1
4 to 9. The difference being steam generator tube
5 ruptures.

6 MR. WALLIS: So it's a measure of the
7 risks associated with these events?

8 MR. BOYCE: Correct, correct. And the
9 units for IIEPI is core damage frequency or delta core
10 damage frequency.

11 MR. WALLIS: What order of magnitude is it
12 when you do the sum?

13 MR. BOYCE: For PWRs, I think, we came out
14 about $5E^{-5}$, $4E^{-5}$, I think. For BWRs we're at $1E^{-5}$.
15 Now, that's very preliminary and the only reason we
16 did that was for illustrative purposes, but the
17 information was derived from several sources, which I
18 hope Dale can elaborate on later.

19 CHAIRMAN SHACK: Could you pick the
20 initiating events because they comprise, you know, X
21 percentile of the risk in the average CDF or they were
22 the initiating events you had data on?

23 MR. BOYCE: Actually, it's a combination
24 of both, but there was some early work done for
25 initiating events, NUREG 5750, looked at initiating

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1 events from '88 to '95 and that NUREG was published
2 five years ago. The research at our request updated
3 that information and brought it current. In addition,
4 there was a risk-based PI report, which the ACRS
5 reviewed a couple of years ago, and in the risk-based
6 PI report, they took a look at all of the initiating
7 events and said we will focus on those initiating
8 events that contribute greater than 1 percent to core
9 damage frequency and that have occurred once during
10 the '87 to 1995 time frame. So it's a combination of
11 those two. Okay.

12 This is a more detailed explanation of the
13 previous chart, and it tells you how we go from a
14 plant-specific equation to an industry equation
15 starting with the Birnbaum importance measure, which
16 is our risk-weighting factor. What you'll see is to
17 get to the industry calculation, we're going for an
18 average industry Birnbaum. We're calculating the
19 individual Birnbaums for each of the 103 reactors, and
20 we're just getting an arithmetic average there.

21 CHAIRMAN SHACK: See, now I like equation
22 4 better than equation 5. Was that the ones that
23 they're both identical?

24 MR. BOYCE: Yes, they're both identical.

25 CHAIRMAN SHACK: All right.

1 MR. BOYCE: Who picked up on that one?

2 CHAIRMAN SHACK: It's a question of
3 whether you think in terms of the industry average
4 Birnbaum or the average initiating frequency, but you
5 end up at the same place.

6 MR. BOYCE: Right. Over here to calculate
7 the Lambda or the frequency of occurrence of these
8 initiating events, we just look at event counts and we
9 look at operating times. Now, we break this up
10 separately, which we'll get into later, because the
11 choice of operating times determines how sensitive
12 this indicator is. If you pick a very short time
13 interval, a single initiating event will cause the
14 indicator to give you more of a response than if you
15 adopt what we call like a moving average.

16 In this case, I think we've picked three
17 years for a lot of the work that was done in the draft
18 study that you're looking at, and that gives you a
19 more smoothed response. It's similar to the approach
20 that we did for the ROP PIs where we had few
21 occurrences. Scrams or loss of normal heat removal is
22 the example. We would count a scram or loss of normal
23 heat removal over a period of three years as a moving
24 average.

25 MR. WALLIS: Is there some reason you draw

1 it this way? I mean, I think it would be more normal
2 to simply sum over each plant, and you get the average
3 of the product rather than the product of the
4 averages. It would perhaps be more reasonable summing
5 up the risk. It's probably just average difference,
6 but is there some reason why you do it this way?

7 MR. BOYCE: I'm going to defer that one to
8 Dale in just a second if I could.

9 MR. WALLIS: Okay.

10 MR. RASMUSON: We'll answer the question
11 for you as we go along.

12 MR. WALLIS: Okay.

13 MR. RASMUSON: We've got some material
14 that will address that.

15 MR. BOYCE: Are there any questions on the
16 approach that we took here? Okay.

17 MR. KRESS: The operating times, you said
18 you use a three years running average.

19 MR. BOYCE: Right.

20 MR. KRESS: So all you do is subtract out
21 of that the down time, out of those three years?

22 MR. BOYCE: Right.

23 MR. KRESS: And that's some time.

24 MR. BOYCE: Right. Yes, this is only for
25 at-power --

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1 MR. KRESS: At-power, okay.

2 MR. BOYCE: -- events. We don't consider
3 shut down events in the IIEPI or external events.
4 Yes, external events are also excluded. This tells
5 you some of the data sources that we get to determine
6 the number of counts. We take a look at licensee
7 event reports that we get. We take a look at monthly
8 operating reports submitted by all utilities. This is
9 the Lambda portion again, and I've already covered the
10 Birnbaum importance measure.

11 MR. WALLIS: I just wanted to ask you
12 about Birnbaum again. Are there some plants that
13 don't have a good enough PRA for you to get a Birnbaum
14 from their PRA?

15 MR. RASMUSON: No, we have models for all
16 the plants.

17 MR. WALLIS: You got a Birnbaum for every
18 plant?

19 MR. RASMUSON: Right.

20 MR. WALLIS: From your SPAR monitor?

21 MR. RASMUSON: From our SPAR monitor,
22 right.

23 MR. WALLIS: But the industry might not be
24 able to?

25 MR. RASMUSON: They may not, I don't know

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1 on that.

2 MR. BOYCE: Yes.

3 MR. RASMUSON: But I think they probably
4 can also.

5 MR. BOYCE: Right, and jumping ahead into
6 one of the developmental issues, we've seen from our
7 experience with the MSPI the plant-specific mitigating
8 systems performance indicator that there is when we go
9 to compare the SPAR models to licensees PRAs, there is
10 a delta and we do need to work through that. And so
11 one of the developmental efforts is we're taking the
12 SPAR Rev 3(I) models, for those who follow this, 3(I)
13 stands for 3 interim, and we're doing onsite
14 verifications to the extent that we can, and as we
15 reach agreement on certain points, we will move from
16 3 interim to SPAR Rev 3 final.

17 Those are closer to agreement with
18 licensees PRAs, but they are not perfect. We also
19 don't think we need perfection to move this concept
20 forward. This one gets a little bit back to the
21 question you asked, Graham, is to how do we get news
22 you can use to inspectors. Right now, we're targeting
23 right here. This is a hierarchy of indicators is what
24 this chart is designed to illustrate. We're at the
25 IIEPI. We've integrated 10 different initiating event

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1 terms into a single indicator.

2 And if you look, in general, there's a
3 downward curve if you go back to the mid '80s.
4 There's a downward curve there. But let's assume that
5 there was a slight up-tick. If we follow our Industry
6 Trends Program process, we would need to analyze why
7 there was that up-tick. At that point, we would go
8 down to each of the 10 initiating events and start
9 tracking them individually and looking for what was
10 driving the overall indicator up. Again, this is
11 illustrated in the draft report. We've got all the
12 individual indicators shown in that report. So that
13 report shows you these two levels.

14 Finally, let's assume steam generator tube
15 ruptures were driving the overall indicator up. Well,
16 just because you had an up-tick in steam generator
17 tube ruptures, you still don't have enough information
18 to do something about it, so, at that point, you get
19 down to the plant level and you say I've got five
20 plants that had steam generator tube ruptures and you
21 start analyzing the causes, looking for commonalities,
22 and at that point you can start giving the appropriate
23 feedback to the ROP that will make a difference.
24 Okay. So this indicates how we start here at the
25 industry level, but we can monitor down to the plant

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1 level.

2 Okay. Here's the development schedule
3 that we are operating to. The draft IIIIEPI report you
4 have a copy of. It has been sent over for internal
5 review from research to NRR. We're taking a look at
6 it. We expect to have comments later this month.
7 Research is part of its normal process for getting
8 feedback for draft reports. We'll be sending it out
9 for public comment and review, and that will include
10 people like UCS, NEI, NPO, etcetera.

11 We expect that feedback to come back 60
12 days from the date that it is made publicly available,
13 which will be maybe in a week or two. We hope to have
14 a public workshop on the IIEPI concept in about the
15 July time frame. Based on the feedback that we get,
16 we would like to do additional studies, beyond what
17 you see in the draft report, to try and flesh out the
18 concept. You know, find what the weak spots are,
19 explore sensitivities, perhaps look at a different
20 time frame other than three years, look at different
21 equations, that sort of thing depending on the
22 feedback.

23 We hope to have a final report in about
24 the September time frame, come back to the ACRS full
25 committee, and then go to the Commission early next

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1 year. Okay. Now, the remainder of the presentation
2 is devoted to trying to address the comments that we
3 got out of the transcripts from the previous ACRS
4 meetings. Dale went through and organized those
5 comments into six general areas. I'm going to address
6 the first area, and then Dale will pick up the
7 remainder of the presentation.

8 MR. LEITCH: Just before you get into
9 that, Tom, does any of this program require industry
10 submitting additional data or with the data you
11 already have from LERs and so forth, do you already
12 have everything you need to implement this program?

13 MR. BOYCE: A very good question. Right
14 now, we have all the data from existing sources.

15 MR. LEITCH: Okay.

16 MR. BOYCE: LERs come in per 50.73, 10
17 C.F.R. 50.73, monthly operating reports require data
18 submissions and the requirement comes from tech specs.
19 So we have all the data sources that we need right
20 now.

21 MR. LEITCH: Okay.

22 MR. BOYCE: Coupled with the SPAR models,
23 we can do it totally independent of any additional
24 submittals. That's different than the ROP PIs which
25 do require voluntary submission of data.

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1 MR. LEITCH: Yes.

2 MR. BOYCE: And kibitzing a little bit, if
3 we do move forward and get to the point of taking it
4 from industry level down to a plant-specific level,
5 which is a possibility some time in the future, we
6 might then require utilities to come in with more
7 timely submittals than we get from LERs.

8 All right. The first comment that we
9 called out of the transcripts was we needed to develop
10 more concrete examples of regulatory actions. So we
11 took a liberal interpretation and developed a
12 flowchart of our process, which you saw earlier. We
13 also refined what we are calling a two-tiered process
14 for the Industry Trends Program, and what that means
15 is we had talked about just coming up with a single
16 threshold for each of our indicators, so that if any
17 of the data exceeded a threshold, we would take a
18 predictable agency response.

19 We've decided to go with a top tier type
20 threshold that we use for reporting to Congress, but
21 a more performance based type of indicator, based on
22 our prediction limit methodology, which would be more
23 sensitive to past performance and would not be tied
24 exclusively to risk. So we developed that concept a
25 bit more. Again, you saw that in the Industry Trends

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1 Program overview where we had two methods for
2 identifying issues in our indicators.

3 We also developed some example scenarios,
4 which --

5 MR. RASMUSON: There's the flowchart.

6 MR. BOYCE: There's my flowchart. Well,
7 we may come back to that.

8 MR. RASMUSON: I think you've been here.

9 MR. BOYCE: I guess an elaboration of the
10 two-tiered process for the integrated indicator. What
11 we're thinking of here is if you look at the product,
12 its core damage frequency or you could actually use
13 delta-CDF as your metric, and you could set a risk-
14 based threshold for that. And the question was, you
15 know, what's the current levels and it's about E^{-5} up
16 to say $5E^{-5}$. You could arbitrarily set a threshold
17 at $1E^{-4}$, okay, that's one example of setting the
18 threshold.

19 And I think that's currently where we are.
20 You could then take it down to each of the individual
21 indicators of initiating events, such as steam
22 generator tube ruptures. And because they happen so
23 infrequently, setting a risk threshold for those may
24 not make a whole lot of sense. It would be better to
25 go with a more performance based approach and, at that

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1 point, we would be looking at past data points and
2 using the prediction limit methodology. That's what
3 this bullet is intended to get across.

4 Was that clear? Perhaps not.

5 MR. LEITCH: What are the two-tiers?

6 MR. BOYCE: Well, the two-tiers would be
7 the, I guess, industry level would be one tier with
8 thresholds, and the next level down then, if you
9 remember that hierarchal slide, that would be the next
10 tier down, which talks about individual initiating
11 events with prediction limits. And that's what I mean
12 by two-tiered approach.

13 MR. RASMUSON: Yes, but the two-tiers are
14 one is the integrated indicator up here with a
15 threshold, which would reflect safety. The next level
16 down would be looking at the trends of the individual
17 initiating events, and there we would use the
18 prediction distributions and come up with prediction
19 limits, and there we are tracking performance in the
20 individual initiating events themselves. And I have
21 some examples of some slides that might explain it.

22 MR. BOYCE: Okay. Next slide, example
23 scenarios.

24 CHAIRMAN SHACK: I can understand the
25 prediction. How am I going to do the first one again?

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1 I get an absolute measure of the threshold, the
2 integrated one?

3 MR. RASMUSON: For setting a threshold,
4 what we plan to do is to have an expert panel and we
5 would provide them with information, such as
6 uncertainties, simulation runs and so forth to show
7 what the sensitivities are and so forth, and then they
8 would pick some value or we would recommend some value
9 to them for their consideration or they would consider
10 other programmatic things along with the safety goal
11 and so forth. But it would be some type of absolute
12 value.

13 CHAIRMAN SHACK: But then I would still
14 take my model, I would take my updated frequencies and
15 I would go through some sort of predictive model to
16 decide whether my 95 percentile met that threshold
17 limit.

18 MR. RASMUSON: No.

19 CHAIRMAN SHACK: I mean, I still would
20 have to use the predictive model, wouldn't I?

21 MR. RASMUSON: Not on that. For the
22 individual trends, not for the integrated indicator.

23 CHAIRMAN SHACK: I just take the raw?

24 MR. RASMUSON: If I could defer, I have
25 some examples that we can talk about that.

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1 MR. BOYCE: That's where we currently are.
2 But you captured what we said correctly. That's our
3 current thinking is thresholds at the integrated level
4 and predictive limits one level down.

5 All right. I thought it might help if we
6 came up with some example scenarios. In the previous
7 SECY that we issued last year, we actually had two
8 indicators, and I'm not talking from this slide at the
9 moment. We had two indicators that exceeded
10 prediction limits last year. One was scrams and one
11 was collective radiation exposure, and we did follow
12 our process and we investigated what we thought we saw
13 there. We took a look for scrams.

14 For example, we looked at whether a manual
15 scrams, whether automatic scrams, we looked at whether
16 the scrams occurred during startup, shutdown, full
17 power operations. We looked at the reasons that the
18 scrams occurred, whether it was due to maintenance,
19 whether it was due to testing, whether it was due to
20 just on-line operations, some sort of operator error,
21 and then we tracked and trended all of those factors,
22 and we actually did not see anything that was driving
23 our overall scrams indicator to go up.

24 Now, mind you the indicator ticked-up from
25 .55 automatic scrams to .57 automatic scrams, so it's

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1 not surprising we didn't see a whole lot, but we did
2 follow our process and investigated it. We didn't
3 think that that clearly illustrated our intent as to
4 what we wanted, so we tried to come up with some
5 better examples here as to what we might do if we had
6 something come up.

7 So we picked loss of offsite powers. And
8 if we had a large increase in loss of offsite power
9 events in one year, we would try and take a look at
10 it. In this case, we said we found out after looking
11 at that individual indicator, remember we're down one
12 level, that there was an unexpected increase in severe
13 storms on the east coast. Well, as part of feedback
14 to the Industry Trends Program, the first thing we do
15 is provide that information to the inspectors and say
16 okay, here's what we're seeing. Here's why we're
17 seeing it, and then ask the inspectors for the
18 effected plants, now, these storms aren't going to
19 knock out every plant, we ask them to take a look at
20 it.

21 We could review how good our inspection
22 procedure is for adverse weather to see whether we're
23 picking up all the reasons why the loss of offsite
24 power would or could have occurred, and depending on
25 what we found from those sorts of looks, we might

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1 issue an information notice to all licensees. Okay.
2 And this sort of illustrates the news we can use type
3 of approach that you asked about previously.

4 Then we picked an increase in general
5 transients. And at this point, what we would be doing
6 is reviewing licensee event reports to see what might
7 be causing the transients. We might be able to issue
8 a temporary instruction to take a look at whatever was
9 found from the licensee event report review. Now,
10 remember there's a lot of reasons for transients, so
11 it was difficult to get more specific there. And once
12 again, we would possibly issue an information notice
13 to all licensees.

14 And again, this is just for exceeding
15 prediction limits. Presumably, because we would have
16 higher thresholds for long-term adverse trends if we
17 exceeded that higher threshold, we would take more
18 intrusive actions based on the menu of things listed
19 in that process in the flowchart that I showed you
20 earlier.

21 Are there any questions on these
22 scenarios? Well, then, at this point, I'll turn it
23 over to Dale for the rest of the presentation.

24 MR. RASMUSON: Our next area, big area,
25 that we are collecting all the comments was I

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1 collected them under trends. From there there was, in
2 summarizing them, lack of a firm definition of trend
3 and statistical, a significant trend. Performance has
4 been basically flat for several years. Use of
5 horizontal line, industry behavior versus plant-
6 specific behavior, there was comments on that.

7 We have definitions. We did not put them
8 in the report, but we certainly were operating under
9 the definitions of what a trend is, a statistically
10 significant trend and an adverse trend, and we
11 actually did estimate "flat" trends, if you will, in
12 all of our use, you know. So some definitions of
13 trend, if you look in the dictionary, you can find
14 definitions of some trend there. It's a general
15 movement in the course of time corresponding to a
16 statistically detectable change. Also, a statistical
17 curve reflecting such a change is a definition of a
18 trend.

19 For a statistically significant trend, we
20 are looking at the slope parameter in our particular
21 models, and we're saying it's statistically
22 significant if the p-value of that is less than 5
23 percent. Do I need to define p-value for you? Okay.
24 And a statistically significant trend is one that
25 where it exceeds the threshold or a prediction limit.

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1 And for the "flat" trends, we actually estimated the
2 base line trends reach initiating event based on at
3 least four years of data.

4 We developed some rules that we were
5 following here, along with looking at the trends
6 themselves and trying to put some things into
7 perspective, but in the report we have some rules that
8 we laid out there that we were using. For initiating
9 events with few occurrences, the intervals tended to
10 be the whole period that we were looking at, and for
11 some of the others, you know, if you look at the whole
12 trend and sort of the decreasing there and then the
13 flattening out, but it was at least four years.

14 As an example, here's loss of vital DC
15 Bus. We've had three occurrences in two years. There
16 we're using the whole period. These are the
17 prediction limits. This is the 95th and this is the
18 99th prediction limits. This is our mean value here.
19 For BWR transients, here you see our decreasing
20 behavior. Here we have the mean value, and from this
21 we obtain a statistical prediction distribution from
22 which we pick off the percentiles. Here is the 95th,
23 which corresponds to 39 events, and the other one here
24 44, is the 99th percentile.

25 Let me just put up here at this point here

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1 just an example. This is for loss of offsite power.
2 Using the data in the baseline period, you come up
3 with a negative binomial or a gamma poised on
4 distribution, and this is what it looks like. That's
5 the predictive distribution. And so you can pick the
6 percentiles off of here, and this is the decreasing.
7 This is the cumulative here. You can pick off the
8 percentiles, the number of events that you would see
9 here.

10 And so we have done this for each of these
11 initiating events that we have. And this, I think, is
12 a very nice tool to use. What you put in this is the
13 number of occurrences, the operating time that you've
14 seen over the period of the interval, and then what
15 you estimate to be the time for the next year or the
16 next period of time. If you want to do this quarterly
17 or whatever, you can do it and you will obtain one of
18 these.

19 CHAIRMAN SHACK: In your previous graph,
20 you showed us a mean value of 95 percent in the '99.
21 In the paper you've got fitted trends.

22 MR. RASMUSON: The fitted trend is really
23 the mean value. Well, right, right. The fitted trend
24 is the fitted trend.

25 CHAIRMAN SHACK: Is the fitted trend.

1 MR. RASMUSON: And what we would really do
2 is the -- what we're actually using is this mean value
3 over the period.

4 CHAIRMAN SHACK: This mean value.

5 MR. RASMUSON: But the fitted trend sort
6 of shows you sometimes it's going up, sometimes it's
7 going down.

8 CHAIRMAN SHACK: The fitted trends that
9 you have are all statistically insignificant.

10 MR. RASMUSON: That's exactly right.

11 CHAIRMAN SHACK: So you've just replaced
12 them --

13 MR. RASMUSON: Right.

14 CHAIRMAN SHACK: -- with the mean value.

15 MR. RASMUSON: I did in this chart, yes.

16 MR. BOYCE: And you're also seeing some of
17 our thinking of where we are going. That paper talks
18 about our current process, which looks at trends. We
19 have not gotten approval to go forward and go with the
20 thresholds-based approach. This is developmental work
21 right now that we think we're going towards, but we
22 have not yet said we're going to make that our
23 definition of adverse trends yet. That's not in the
24 current paper. When we had sufficient developmental
25 work under our belt, we were going to shift to that

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1 possibly as early as next year.

2 MR. RASMUSON: The next area I want to
3 talk about is industry versus plant-specific. I know
4 we spent a lot of time last time, you know, people
5 said well, maybe we ought to do plant-specific
6 calculations and then just maybe average those. We
7 can estimate plant-specific frequencies for some
8 initiating events. There's enough data that we do get
9 some variability in that and we do have some variation
10 in that.

11 For others, you really don't have very
12 much variability, and really its an industry average.
13 Like for the rare events, such as loss of offsite
14 power, loss of DC Bus, small-break LOCA, those are
15 really industry averages that you're going to use on
16 the plant-specific basis, you know, and basically for
17 those where I do have enough data for this, really
18 those are like the general transients where they
19 really do not make, you know, a very great
20 contribution to the overall core damage frequency, you
21 know.

22 So I think in this case, let me just show
23 you an example here. Here is the distribution of the
24 Birnbaum importance measures for loss of offsite power
25 for PWRs. Here is the distribution if I were going to

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1 do plant-specific frequencies, can you see it all
2 right? Basically, I wouldn't use plant-specific, but
3 I did take and do a three year update, you know, just
4 to say there was one or two plants that had a couple
5 of occurrences. Okay. The values increased. Not
6 very many, but I really wouldn't do it.

7 But now, what's my core damage frequency
8 look like for this contribution? It's like this. It
9 follows this distribution. And so the variability
10 that I see is the variability in the Birnbaum
11 importance measure, not in the frequency itself. And
12 so really, for our purposes at the industry level,
13 we're better off going with the industry approach that
14 we're proposing.

15 CHAIRMAN SHACK: Well, in equation 4, you
16 used the industry average frequencies and the plant-
17 specific Birnbaum. It's perfectly understandable.

18 MR. RASMUSON: Right. But it turns out to
19 be equivalent.

20 CHAIRMAN SHACK: It turns out to be
21 equivalent.

22 MR. RASMUSON: Right, right, you know, and
23 so equations. There was some comment on the
24 equations, you know, on summations or different things
25 like that and we have tried to -- confusion with the

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1 four equations and industry versus plant-specific, you
2 know, and so we've tried to make our presentation
3 clear. Like Tom showed you at the beginning, you
4 know, having a much simpler equation using some
5 charts, some additional charts to explain the
6 calculations and so forth. So hopefully, that will be
7 clarified.

8 MR. WALLIS: The equations are the sum of
9 the two variables? How can you make them simpler?

10 MR. RASMUSON: Well, you make the
11 presentation simpler, but I agree in that sense. And
12 then we've talked about the industry versus plant-
13 specific results there and so forth, you know, so
14 those are the types of things that we've --

15 CHAIRMAN SHACK: I mean, the bigger
16 question comes as to whether you sort of keep the
17 Birnbaum variations and sort of show those all the
18 time, so you realize just how big they can be or, you
19 know, you smear it down to the single average
20 representative plant.

21 MR. RASMUSON: Right.

22 CHAIRMAN SHACK: And you know, when you
23 look back at some of those ones at the back, you know,
24 you really want to ask questions about that guy that's
25 out there.

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1 MR. BOYCE: Yeah, I would just comment on
2 that. I mean, if you want to ask the questions, I
3 mean, part of the developmental work that we are going
4 to do is to take a look at those outliers and find out
5 if it's a problem with the SPAR models. Like it might
6 be a plant-specific issue that has not been
7 incorporated into the SPAR models yet. And we want to
8 rule that out first and make sure it's not a model
9 issue.

10 CHAIRMAN SHACK: And it certainly requires
11 investigation, at any rate.

12 MR. BOYCE: Right, right.

13 MR. RASMUSON: Well, this is a
14 demonstration, at this point, you know, and we're
15 operating on the data that we have. And we know that
16 there are certain things, and we know that some of the
17 things that we've already seen are going to change,
18 you know, and so forth, but as we go along we have
19 actually found that the models have changed in one
20 case and they are going to change some of those
21 outliers. Others they may be real and so forth in
22 that sense.

23 The next area was dealing with uncertainty
24 and sensitivity analyses. The time we talked to you
25 in November, we had not run uncertainties per se. We

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1 had done some work, but we hadn't really looked at it
2 in detail, and certainly sensitivity analyses and we
3 have certainly done a lot of that, as you can see in
4 the report that we have done various things in that
5 regard.

6 Here's a chart here that we have just
7 recently put together. This chart shows the average
8 Birnbaum, the baseline frequency, the baseline CDF
9 contribution. The mean of the percent or the percent
10 of the mean, you can see what it is, and then the next
11 one is the N_{Mean} is the number of events or partial
12 events that contributes to the mean. And the last one
13 there is sort of a sensitivity study where we say all
14 right if we take for the uncertainty distribution in
15 the baseline core damage frequency, take the 95th
16 percentile of that. How many events does it take in
17 the small LOCAs to give me that? And you can see it's
18 like 21.3. For transients it's 167 events.

19 What you find is that for those events
20 that are not very risk-significant that have the low
21 Birnbaums, you know, it really takes a lot of events
22 to go up there. Where in some of the others where
23 they are smaller, you don't have that particular
24 situation.

25 MR. LEITCH: I'm having trouble

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1 understanding what the VAC is. Is that loss of vacuum
2 or what is that?

3 MR. RASMUSON: Loss of vital --

4 MR. BOYCE: Vital power, loss of Vital AC
5 power.

6 MR. RASMUSON: Vital AC power.

7 MR. LEITCH: Vital AC power?

8 MR. RASMUSON: Yes.

9 MR. LEITCH: Now, why?

10 MR. RASMUSON: Well, in this case --

11 MR. LEITCH: What does that mean? The
12 average importance is --

13 MR. RASMUSON: Well, that really has not
14 been included in the models. We thought it was, but
15 it is not. That is why it's zero.

16 MR. LEITCH: Okay.

17 MR. RASMUSON: Okay?

18 MR. LEITCH: Yes.

19 MR. RASMUSON: But it is in the list of
20 the risk-significant initiating events that was
21 identified in the Risk-Based Performance Indicator
22 Program, PWR, similar types of calculations.

23 MR. WALLIS: That's a funny way to write
24 zero. You could write it as $0E^{-6}$. Yes, it would
25 look like the other one.

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1 MR. RASMUSON: Yes. Okay. Here is the
2 integrated indicator. We have updated it to include
3 the year 2000 now. Before, we only had through 2001.
4 You can see that we have actually dropped a little
5 bit. For the PWR, we actually dropped quite a bit.

6 MR. LEITCH: I guess the thing that always
7 bothers me about this is industry-wide versus plant-
8 specific, and I think what I hear you saying is, you
9 know, suppose there is not a statistically significant
10 adverse trends industry-wide, but one plant could be
11 terrible on that particular category, and I guess it's
12 not really -- is it correct then, what we're saying is
13 it's not really a function of this program to identify
14 that terrible performance at one particular plant.
15 Rather, that comes out of the ROP.

16 MR. RASMUSON: ROP.

17 MR. LEITCH: Is that a correct
18 understanding?

19 MR. RASMUSON: Let me answer your question
20 in a couple of ways.

21 MR. LEITCH: Okay.

22 MR. RASMUSON: The initiating events that
23 contribute most to risk don't occur very often, such
24 as loss of offsite power, steam generator tube rupture
25 and so forth. When those events occur, they really do

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1 get quite a bit of attention already from the agency.
2 For the general transients where we get a lot of them,
3 most of those are covered right now under the ROP
4 scrams.

5 MR. LEITCH: Yes.

6 MR. RASMUSON: And so if you have a plant
7 that is going to get a lot of them, you know, they are
8 going to probably be picked up, at that particular
9 point, in that sense. What we're looking at, what
10 this program will tend to do for you in looking at
11 them is suppose that I have an increase where each
12 plant picks up a scram for some reason, you know, they
13 are not going to be tripped in the ROP or anything,
14 but if that did happen, you would really see a spike
15 in our trends for that, because our average right now
16 for general transients, for the Ps is about .75. You
17 know, and so if you got that, you know, you would see
18 quite an increase there.

19 MR. SIEBER: And the agency response would
20 be different.

21 MR. RASMUSON: And the agency response
22 would be different, right.

23 MR. SIEBER: And you would have some
24 generic communication or engaging industry.

25 MR. RASMUSON: Exactly.

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1 MR. SIEBER: As opposed to engaging a
2 specific licensee.

3 MR. RASMUSON: Yes, exactly.

4 MR. FORD: Could you address how, for
5 instance, materials degradation would come into this
6 particular schema? For instance, is there any metric
7 in your program that shows this spike or an increasing
8 trend, for instance, towards this corrosion or an
9 increasing trend of cracking? I mean, would those
10 physical phenomena enter into this analysis?

11 MR. BOYCE: Well, right now, it wouldn't
12 only because the existing set of data and indicators
13 that we have were built from -- I'm sorry. The
14 indicators that we have in the program were built from
15 existing data sources. I believe the Office of
16 Research right now is taking a look at that as part of
17 its response to Davis-Besse.

18 I think they took a look at it as part of
19 the Accident Sequence Precursor Program and are trying
20 to get to that point where they have got enough data
21 that they can get some meaningful type of indicators.
22 But right now, that's not part of our program just
23 because we don't have industry-wide data sources for
24 that.

25 MR. FORD: But if there were industry data

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1 over the last 10 years, for instance, including
2 abroad, is the program compliant enough in its
3 methodology to take into account or show process?

4 MR. BOYCE: Well, I would want to say our
5 process would work. Our process seems like it would
6 work for any set of data like that, but I am dealing
7 in hypothetical space right now. I don't know for
8 sure.

9 MR. RASMUSON: Pat Baranowski wanted to
10 make a comment.

11 MR. BARANOWSKI: I am Pat Baranowski,
12 branch chief, so both of these activities are going on
13 in my branch. The business of wrapped coolant
14 pressure boundary integrity, if you will, and
15 performance indicators associated with that is pretty
16 difficult to deal with on a plant-specific basis in
17 particular, but it's also difficult on an industry-
18 wide basis, because there is really a sparsity of data
19 in terms of looking at things that mechanistically
20 trigger cracks and being able to track data of
21 sufficient density to see when those triggers are
22 occurring, and then whether or not the cracks are
23 occurring and if the cracks are leading to leaks and
24 so forth.

25 But we do have, as Tom mentioned, a task

1 to go back after the Davis-Besse Task Force made its
2 report to go and see what can be done, but it's just
3 a matter of can we come up with sort of a progression
4 model, if you will, that involves materials and
5 fracture mechanics issues? Can we then collect the
6 data and can we track these kinds of things?

7 MR. FORD: But I get the impression that
8 this is not high on the priority list of things to do.

9 MR. BARANOWSKI: It's not in this program,
10 and I don't know that it would ever go in there. I
11 think this is one of these issues where an event like
12 Davis-Besse is of such importance to us that we don't
13 need any trends to tell us to go and spend a fair
14 amount of activity looking at all these things,
15 including how we might be able to get performance
16 indicators.

17 So yes, that kind of performance
18 measurement activity is not the highest on our
19 prioritization, but it's high enough that we have
20 identified resources and some schedule to work on that
21 over the next year to year and a half.

22 MR. FORD: Okay.

23 MR. BOYCE: Just to add to that. I mean,
24 any time you try and collect data from industry, there
25 is a cost. I mean, there is a burden on industry and

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1 before we would gather that sort of data, we would
2 have to go through a cost benefit analysis to capture
3 it, but I would call that a secondary issue, honestly,
4 in this case.

5 MR. FORD: The cost?

6 MR. BOYCE: Going through that process of
7 establishing cost benefit. The most important thing
8 is is that it's one of those things that we're going
9 to look at in response to Davis-Besse, and if it turns
10 out that looks like something we need, I am sure we
11 would make our best case for it.

12 MR. FORD: It's just that if anything has
13 got a trend, it is materials degradation, and I
14 thought it was going to be --

15 MR. BOYCE: Okay.

16 MR. FORD: -- you know, an obvious input
17 to your model.

18 MR. BOYCE: Well, I won't disagree with
19 you. I will just add to my previous answer that it's
20 harder in material space to get a risk-informed type
21 of indicator. So the indicator would be a purely
22 deterministic type of thing, so just a refined answer.

23 MR. FORD: So we do need a time dependent
24 PRA?

25 CHAIRMAN SHACK: Well, but if you look at

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1 things like Figure C-7 with steam generator tube
2 rupture, you find out that with all the degradation
3 that you have ongoing in steam generators, at least in
4 the sense that it leads to initiating events, it's
5 flat as a pancake.

6 MR. FORD: But is the metric, therefore,
7 CDF, delta-CDF?

8 CHAIRMAN SHACK: If in risk-informed
9 space, yes.

10 MR. FORD: I mean, is that an appropriate
11 metric?

12 CHAIRMAN SHACK: Well, that's a different
13 question, but certainly in Birnbaum importance, it
14 certainly is. It's the metric he's going to be
15 looking at.

16 MR. FORD: Well, has anyone thought of a
17 different metric? I mean, for instance, we have heard
18 arguments until rather recently that delta-CDF for
19 material failure cracking in Pressure Bus, PWR
20 Pressure Bus, is fairly small and yet, it has huge
21 impact. Therefore, the question is is delta-CDF a
22 sufficient metric in this approach? I recognize your
23 comment, Bill, but you are just really following your
24 tail. The central question is is it a sufficient
25 metric?

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1 MR. BOYCE: Well, at this point, I would
2 go back to what Pat said and we'll follow the lead
3 efforts in response to Davis-Besse, as opposed to
4 forging new ground in this program. That is just the
5 practicality of it.

6 MR. RASMUSON: Our next two slides just
7 convert the individual prediction limits to CDF and
8 then just blots their contribution. What I did was
9 just take each one of them, one at a time, kept all
10 the variables at their mean values, and then plugged
11 in the predictive distribute, the predictive limit for
12 the 95th and for the 99th, you know, just one at a
13 time, and this just shows what happened to the CDF
14 value here.

15 This shows you a loss of offsite power is
16 very important, loss of DC Bus. These others are not
17 quite as important. Others are not as sensitive.
18 Just a sensitivity here and just to show some of the
19 things here for the DC Bus, small-break LOCA, the two
20 big ones, the effect for the PWRs. We ran Monte
21 Carlos in the baseline, using the baseline on
22 certainty distributions for each of the initiated --

23 CHAIRMAN SHACK: Just back to that graph
24 for a second.

25 MR. RASMUSON: Okay.

1 CHAIRMAN SHACK: I think I'm getting
2 confused there. Aren't you sort of skewering things
3 a little bit here by using that baseline value,
4 because if I use the contribution from each of those
5 terms at the mean value limit, I would sort of see the
6 same sort of stacking, I mean.

7 MR. RASMUSON: Well, this is the mean
8 value.

9 CHAIRMAN SHACK: But that's the total sum.

10 MR. RASMUSON: That's the total, right.

11 CHAIRMAN SHACK: When I looked at the
12 contribution from each initiating event --

13 MR. RASMUSON: Right, but the contribution
14 from each of them --

15 CHAIRMAN SHACK: On their mean levels
16 would give me again --

17 MR. RASMUSON: If I were to do that, I
18 would see some of these coming in.

19 CHAIRMAN SHACK: I would see spiking,
20 right.

21 MR. RASMUSON: Right, right.

22 CHAIRMAN SHACK: I mean, they contribute
23 to the mean, as well as on the 95th.

24 MR. RASMUSON: Right, and they also -- but
25 I do get different ones sometimes for the variants,

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1 you know.

2 CHAIRMAN SHACK: Yes, but it would be more
3 illustrative to plot them in terms of mean or median
4 95th and 99th, rather than that overall baseline.

5 MR. RASMUSON: Okay. Well, we can
6 investigate some of that, how to show some of these
7 things, you know, but what we are trying to do is just
8 to depict that there are sensitivities, things that we
9 need to look at, especially if we're going to be
10 setting a threshold, you know, an overall threshold
11 value, we need to understand what some of these things
12 are and how they contribute in this regard.

13 Here is the uncertainty in the mean of the
14 baseline distribution. Here, each of the initiating
15 events has an uncertainty distribution with it, and as
16 we propagate that through, this is what it looks like.
17 When we do our Monte Carlos on the actual indicator,
18 we use the predictive distribution, because that is
19 really what it is designed to do is to predict what
20 it's going to look like, and this tends to spread it
21 out.

22 This is usually in a 3-year Bayes
23 estimate. Maybe we can put it on here. You can sort
24 of see that it's a little broader in that sense. If
25 we did a one year estimate, you know, with the

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1 predictive, it would be even broader yet. The 3 years
2 tends to bring it down, you know, narrow the
3 uncertainty. We can do the same type of thing with
4 Monte Carlo or with the maximum likelihood estimates,
5 not Bayesian updates. Other types of another --

6 CHAIRMAN SHACK: Should I be bothered that
7 my maximum likelihood estimate or my Bayesian estimate
8 seem to differ as much as they do?

9 MR. RASMUSON: No, I think that, you know,
10 by using prior distribution in there, it tends to
11 smooth things out.

12 CHAIRMAN SHACK: Now, when you do all your
13 calculations for your -- I keep thinking AEOD, but
14 that's all maximum likelihood.

15 MR. RASMUSON: No.

16 CHAIRMAN SHACK: No? Isn't it?

17 MR. RASMUSON: No.

18 CHAIRMAN SHACK: I thought all those were
19 reported and I always remember MLE, MLE all over the
20 place.

21 MR. RASMUSON: Well, we do a lot, but we
22 do a lot of empirical Bayes analysis and other types
23 of things in our work.

24 CHAIRMAN SHACK: I was just of wondering
25 whether, you know, this indicates that you should be

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1 using Bayesian consistently.

2 MR. RASMUSON: Well, I think we tend to.
3 We do use a lot. We do use a lot of Bayesian updating
4 in that.

5 MR. BARANOWSKI: I think we're actually
6 using it consistently.

7 MR. RASMUSON: I think.

8 MR. BARANOWSKI: I don't think we use any
9 MLE that I know of anymore.

10 CHAIRMAN SHACK: Anymore?

11 MR. BARANOWSKI: For years. Just about
12 everything has been empirical Bayes where we can do
13 it.

14 CHAIRMAN SHACK: Okay. I will have to go
15 back and look at some of those frequency reports. No,
16 really, all those uncertainty distributions are just
17 uncertainties on the initiating events. You didn't
18 put any uncertainties on the Birnbaums?

19 MR. RASMUSON: No, no, we did not.

20 CHAIRMAN SHACK: And that would really --

21 MR. RASMUSON: That would -- there is a
22 section in the report.

23 CHAIRMAN SHACK: Yes.

24 MR. RASMUSON: I don't recall the details,
25 but it was not as much as within the initiating events

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1 themselves, but that can certainly be done and looked
2 at. But we did not feel, at this point, you know, it
3 was worth the effort to go through it, at that time,
4 you know, because it just did not look like their
5 uncertainties were --

6 CHAIRMAN SHACK: Well, it wasn't clear to
7 me, you know, if you're looking at the impact of the
8 initiating events.

9 MR. RASMUSON: Yes.

10 CHAIRMAN SHACK: That was so important.

11 MR. RASMUSON: Right. Yes, yes.

12 CHAIRMAN SHACK: If you're dealing with
13 thresholds and you actually have specific numbers,
14 then it becomes -- then it may be more important.

15 MR. RASMUSON: Right. So another item
16 that the ACRS asked us to do was to look at what was
17 the impact of the plant-specific calculations. This
18 is actually taking the plant-specific Birnbaums and
19 calculating and plugging in the industry average in
20 here, and this sort of shows you the types of behavior
21 that we got there.

22 I will skip the next two slides. They are
23 similar for the PWR on the -- here is sort of the --
24 I think the plant-specific one here is a little, you
25 know, just to show that there is quite a bit. There

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1 is sort of an outlying area out here on some things,
2 but those are the types of things that we have pursued
3 and looked at.

4 We have done a lot of this type of thing
5 and so forth. We can certainly do some more in this
6 area, but it is important to understand if we're going
7 to set a threshold, we need to understand what its
8 behavior is going to be and so forth, and you don't
9 want to set it so low that you're going to be tripped
10 up by an occurrence of one or two items, you know, or
11 a combination of these rare events that you are always
12 going to trip it.

13 But you do want to set it at such a level
14 that you can be, you know, that you don't want it so
15 ridiculously out of the way, you know, you will never
16 hit it.

17 CHAIRMAN SHACK: Because you can't trip
18 it, no.

19 MR. RASMUSON: Yes, I think those were the
20 types of things that --

21 CHAIRMAN SHACK: There were some
22 peculiarities here in some of your uncertainty studies
23 that were sort of interesting. You did a Birnbaum on
24 certainty at a specific plant for steam generator tube
25 rupture, and you came up with an air factor of 2.59

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1 just with the parameter uncertainty.

2 MR. RASMUSON: That was actually going to
3 the SPAR model.

4 CHAIRMAN SHACK: Right.

5 MR. RASMUSON: And this is what you're
6 talking about, of actually incorporating that into the
7 Monte Carlos.

8 CHAIRMAN SHACK: But when you did the
9 Birnbaum variability for the whole 60 plants that you
10 have SPAR models for, you only got a .6 error factor.
11 Somehow, it is --

12 MR. RASMUSON: On?

13 CHAIRMAN SHACK: In the SPAR models.

14 MR. RASMUSON: On one particular one?

15 CHAIRMAN SHACK: Yes, if you look at Table
16 7 and Table 8.

17 MR. RASMUSON: Yes, in the report.

18 CHAIRMAN SHACK: Yes, in the report. It's
19 just very peculiar. One would always sort of expect
20 to find a bigger difference in error factors as I go
21 over the whole range of plants that I would find,
22 presumably, in a parameter uncertainty for a single
23 plant, at least I would think so. But then I saw that
24 you were going to work on steam generator tube rupture
25 models for SPAR.

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1 MR. RASMUSON: I'm just trying to find it.

2 CHAIRMAN SHACK: Page 18 and 19.

3 MR. RASMUSON: 18 and 19? Okay. Yes.

4 CHAIRMAN SHACK: So if you look at Table
5 7, which is the plant variation.

6 MR. RASMUSON: Yes.

7 CHAIRMAN SHACK: It's only .6, but in a
8 single plant, just the parameter uncertainty gives you
9 a 2.6.

10 MR. RASMUSON: Yes.

11 CHAIRMAN SHACK: Which seems peculiar.

12 MR. BARANOWSKI: Well, why don't we look
13 into that?

14 MR. RASMUSON: Yes.

15 MR. BARANOWSKI: I mean, any questions you
16 raise here, we're going to take note of and check into
17 that.

18 MR. RASMUSON: Yes, well, like I said,
19 we're looking at it to show that we could do those
20 types of things when we were doing this, and we'll
21 look at the parameter uncertainty in the Birnbaums a
22 little bit more and pursue that area. Okay.

23 The fifth item was dealing with
24 thresholds, comments on that. The comments were
25 thresholds tell us about safety, trends about

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1 performance, and we certainly agree with that. You
2 have to establish that there has been a change before
3 you can start looking for it, and that is what our
4 process is all about, is trying to determine the
5 change and so our particular response here is is that
6 we do have a two-tier approach that we're trying to
7 use here.

8 One is the top tier, is the integrated
9 indicator with a threshold, which focuses on safety.
10 And at the second tier, we're looking at the
11 individual indicators and trending those and using the
12 prediction limits to look at performance. The
13 individual trends of the second tier are really
14 designed for in-house use at the agency here as a
15 diagnostic tool to help us understand things and in a
16 way, I think that we can also use them as we go along.

17 You know, we don't have to wait until the
18 whole year is up. We can look at it on a quarterly
19 basis or so forth, you know, and see how we're doing.
20 And we can use it as a monitoring tool, and so --

21 CHAIRMAN SHACK: Have you sort of done
22 little experiments where you just started trending
23 something and saw how long it would take you to pick
24 it up?

25 MR. RASMUSON: Sort of, but not a real

1 definitive task in that regard, no.

2 CHAIRMAN SHACK: Somehow, I am suspicious
3 that I would have to actually see a rather substantial
4 sustained increase in some of these before I would
5 ever get -- you know, statistical significance is a
6 two edged sword.

7 MR. RASMUSON: Right, right, and you can
8 see that. You know, if you're running the long trends
9 like Tom did, you know, on that and where the behavior
10 tends to flatten out, you know, you are going to get
11 tighter and tighter and tighter, and then what is
12 really, to me, is random variability like an increase
13 of just one or two scrams, you know, could get you.

14 Whereas, you know, you take the flatter
15 trends and so forth, you know, which you have
16 suggested we do, and that is what we have always tried
17 or what we are trying to move forward with, at this
18 point.

19 MR. BOYCE: Sustaining what you probably
20 already know intuitively, you know, events that happen
21 infrequently, such as steam generator tube ruptures,
22 small-break LOCAs, you know, it's much more difficult
23 to say that is a trend when you go from zero to one,
24 but general transients where you are getting, I think,
25 the number was 150 a year, that is much easier to see

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1 a variation. Unfortunately, the contribution to core
2 damage frequency is much lower. So, you know, it's
3 just the nature of what we're dealing with.

4 MR. BARANOWSKI: There is another aspect
5 here that goes along with that. Any really risk-
6 significant event is going to have some agency
7 response, and it might even be generic without looking
8 at trends, but there is always this issue that comes
9 up like with steam generator tube ruptures. Well,
10 gee, can't you just fix that problem?

11 Well, if that means having zero steam
12 generator tube ruptures, we are probably not there.
13 We might be, but I don't know, but we can certainly
14 show whether we are getting better, and that might be
15 an important insight to show that, in fact, the trends
16 on this are declining even though they are still
17 occurring. Now, if the objective is zero, then you
18 don't need to trend anything. Just don't trend
19 anything. Just make it zero. Every failure is the
20 worst thing. Agency goes off on everything. I think
21 that's kind of the strength of what this is about.

22 MR. RASMUSON: The thing that we have been
23 alluding to all along here is that somewhere along the
24 way, we're going to need to have thresholds for the
25 integrated indicator and a process for setting that.

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1 One of the things you're going to need, certainly, is
2 to understand the behavior of it and we have talked
3 about a lot of the types of information that would go
4 into this type of thing here.

5 And then we would like to put together an
6 expert panel to propose the threshold and to take into
7 consideration, you know, policy and other issues along
8 with the indicator itself and its variability and
9 things like that. That is where we're starting. As
10 part of our proof of principle concept that we want to
11 have is we want to actually put together a panel and
12 to provide them information and training, you know, in
13 that to actually try to set a --

14 CHAIRMAN SHACK: And what's the schedule
15 for that?

16 MR. RASMUSON: That will happen sometime
17 after our workshop, we would think. You know, we
18 would like to have our workshop first and then get any
19 input from our workshop, you know, that people would
20 have for that type of thing, so it will probably be
21 late July or August time frame in that regard, but we
22 certainly want to have that and then document our
23 results, summarize our results in our final report of
24 that, putting forth --

25 MR. SIEBER: So today, you have no

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1 thresholds for anything, right?

2 MR. RASMUSON: We do not have a threshold,
3 right, at this point.

4 MR. SIEBER: And when you establish then
5 with the expert panel would be based mainly on
6 Birnbaum?

7 MR. BOYCE: Well, some sort of a CDF,
8 right.

9 MR. RASMUSON: It will be based on the
10 results of things like we have seen here, yes.

11 MR. BOYCE: Right. At least at the
12 integrated indicator level, it would be a CDF, but,
13 you know, the question is what is the right level, at
14 that point? Would you just go with performance based,
15 if I can call it that.

16 MR. SIEBER: That would be my next
17 question.

18 MR. BOYCE: Well, I'm glad I anticipated
19 it.

20 MR. SIEBER: So you can answer it if you
21 would like.

22 MR. BOYCE: Or would it be better to go
23 with one oriented towards the Safety Goal Policy
24 Statement in some way? You know, and then you say
25 well, what should we report to Congress versus what

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1 level should we be monitoring consistent with that
2 Policy Goal Statement?

3 MR. SIEBER: Yes.

4 MR. BOYCE: And that is the sort of policy
5 issue where you hope to ask the board to look at and
6 then, naturally, we would have some sort of a
7 proposal, but I don't think we're there yet.

8 MR. SIEBER: Now, you already report to
9 Congress. That has been in effect for years, right?

10 MR. BOYCE: Correct.

11 MR. SIEBER: And now, you're basing your
12 report to Congress on individual events and individual
13 plants with some significance, sorted by some
14 significance?

15 MR. BOYCE: Well, if I understood you
16 right, yes, the current set of indicators that we're
17 using to report to Congress are the old AUD indicators
18 and there are seven on them plus the total ASP events.

19 MR. SIEBER: Right.

20 MR. BOYCE: And we are migrating towards
21 using the ROP PIs and this IIEPI for reporting.

22 MR. SIEBER: Well, it seems to me the
23 setting of the threshold is the key to whether this
24 works or does not work not only for your report to
25 Congress, but your use as part of agency reaction to

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1 industry events. Like I said, I guess, I would be
2 curious as to the criteria that the expert panel would
3 use and examples of threshold determinations that they
4 made.

5 MR. BOYCE: We are curious, too, actually.
6 We were just kicking this around this morning as to,
7 you know, how to best approach that and we might try
8 several options. One is, and I articulated some,
9 should we be consistent with the policy goal in some
10 hierarchal manner? Should we be using a performance
11 based approach?

12 MR. SIEBER: Well, you are going to have
13 to tell the expert panel what to do.

14 MR. BOYCE: Yes.

15 MR. SIEBER: So you're going to have to
16 have that framework.

17 MR. BOYCE: Right, right.

18 MR. SIEBER: And I take it you don't have
19 it quite yet.

20 MR. RASMUSON: Well, we have some ideas on
21 it, but we have not totally --

22 MR. SIEBER: You haven't formalized it?

23 MR. RASMUSON: Totally formalized it, yes,
24 right.

25 MR. SIEBER: I mean, well, but I think

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1 that would be something you would be interested in,
2 because to me it's the key.

3 MR. BOYCE: I understand. We're
4 struggling with it. I mean, as you know, it's
5 difficult to do it.

6 MR. SIEBER: Well, I can appreciate that.

7 MR. BOYCE: Yes.

8 MR. SIEBER: I can appreciate that.

9 MR. BOYCE: Particularly at the industry
10 level. It's almost easier for each plant to pick a
11 number.

12 MR. SIEBER: Yes, it is.

13 MR. BOYCE: And it just gets harder.

14 MR. SIEBER: But if you're doing it for
15 each plant, you can go back to the ROP.

16 MR. BOYCE: Right.

17 MR. SIEBER: And accomplish the same end,
18 and I see this as a different kind of a program that
19 has an individual plant benefit to it, but it is more
20 an industry program and more satisfies the
21 requirements of the law as far as reporting to
22 Congress.

23 MR. BOYCE: Yes, and segueing a second, we
24 were also trying to figure out who the right people
25 would be to ask to join that. An idea we had would be

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1 to ask members of the ACRS perhaps to participate. I
2 don't know if that's possible, but I am offering that
3 idea.

4 MR. SIEBER: I might be absent that day.
5 I think it's a difficult job.

6 MR. BOYCE: So you are volunteering, I
7 think is what I heard. All right.

8 MR. RASMUSON: Then just let me just again
9 articulate, you know, that the top level is the
10 integrated indicator, which addresses safety and would
11 have the threshold with it. At the next tier would be
12 the trends with predictive distributions and those you
13 could --

14 CHAIRMAN SHACK: But even with a trend,
15 you have to decide when the trend, if you have a
16 trend, when does it concern you?

17 MR. RASMUSON: And that's why you would
18 have the predictive limits, and one thing you can do
19 is you could --

20 CHAIRMAN SHACK: Well, no, that helps you
21 tell when you have got a trend.

22 MR. RASMUSON: Right, but then what you
23 need to do.

24 CHAIRMAN SHACK: What you need to do about
25 the trend.

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1 MR. RASMUSON: That's right. What do I
2 need to do about it? But the predictive limits tell
3 me when I really have something there, sort of the
4 trigger, in that sense, and they focus on performance.

5 MR. BOYCE: Again, commenting a little bit
6 further on that point. You're right. You can track
7 and then say you have a trend, but the so what part
8 turns out to be a key part in setting the appropriate
9 threshold like scrams. In 1988, we were averaging
10 about two and a half total scrams per plant per year
11 and now, we're at about .8, .9.

12 So if we go up, our prediction might limit
13 might say that if we went above 1.1 or 1.2 scrams per
14 plant per year, there was something we needed to do,
15 but the question is what? Preventing scrams is not
16 something you can easily regulate, and we struggled
17 with this.

18 In the paper, we even told the Commission
19 that we -- although, the Commission asked us to
20 develop these thresholds, we struggled for exactly
21 that reason. We adopted this approach. We had these
22 glorious thresholds all laid out and they were
23 beautiful, and then we got to, say, collective
24 radiation exposure and it went up above a level, and
25 then we were left with the well, okay, what do we

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1 really do now?

2 And we are going to continue to work it.
3 It may come down to an indicator by indicator thing
4 with the people joining our policy board and then
5 bringing in technical experts and saying well, it's
6 not perfect, but that's where we're going to draw the
7 line. I am digressing, but I am trying to give you a
8 sense as to how difficult it really is.

9 MR. SIEBER: I think one of the problems
10 that you are going to face is, you know, if you look
11 at the ROP and the cornerstones, some cornerstones
12 reflect themselves in delta-CDF.

13 MR. BOYCE: Right.

14 MR. SIEBER: But the majority do not, and
15 you are faced with the same problem here.

16 MR. BOYCE: Exactly.

17 MR. SIEBER: So you are going to have a
18 diversity there, and the thresholds for the non CDF
19 type indicators are going to require some additional
20 policy decisions.

21 MR. BOYCE: Agreed.

22 MR. RASMUSON: The last area of comment
23 was there is quite a bit of discussion on subset of
24 plants in our last meeting, you know, and how would we
25 handle those? How do we look for them and so forth?

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1 And one of the thing we certainly do in this process
2 is is that if we see a trend, you know, if we trip a
3 prediction limit, we would certainly want to go back
4 and see why we did that.

5 If it was an individual plant, that would
6 probably be picked up in the ROP, but certainly, the
7 ROP is not going to pick up the case where we may have
8 all the CE plants had something that had gone wrong on
9 it, and we would certainly want to go back and look at
10 those types of things and see if there are subsets of
11 plants or that type of thing. And so that is sort of
12 how this would come about in our process or in our
13 analysis of what we're looking at.

14 So our future efforts, as Tom has said,
15 were receiving comments on the draft report. We are
16 going to hold a public workshop. We're going to
17 develop guidance for setting thresholds for the
18 integrated indicator. We will actually go through
19 that exercise to see how we need to refine it and so
20 forth. We will update the reports with the lessons
21 learned, and we want to come back and brief the
22 subcommittee and the full committee, at that time, and
23 request a letter, at that particular point, and then
24 issue a Commission paper on this and then go into
25 implementation of it.

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1 And so those are basically where we are.
2 We have had this scheduled before, but just to put
3 that up there, that's sort of what we're shooting for
4 in that type of time frame, and we think it's
5 reasonable. We can do it and so forth, but it has
6 been nice coming back to you and sharing with you our
7 thoughts and where we are and what we have done.

8 CHAIRMAN SHACK: Well, your expert panel
9 is going to have their work cut out for them, the time
10 between the end of the workshop and the final paper.

11 MR. BOYCE: I agree.

12 MR. SIEBER: I am curious as to where on
13 that schedule you're going to set forth the criteria
14 that the expert panel will use to set the thresholds.

15 MR. BOYCE: I think you have hit a weak
16 point for us, and I think we have got a bit of
17 homework to do. We may be challenging our schedule.

18 MR. RASMUSON: I think that's where we
19 would want to talk about that at the public workshop.

20 MR. SIEBER: Yes, but some place along,
21 and you are going to have to do it.

22 MR. RASMUSON: Yes, right.

23 MR. SIEBER: And the expert panel is going
24 to have to meet and make all these decisions that
25 govern how this program is going to work.

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1 MR. RASMUSON: Yes.

2 MR. SIEBER: And then after you're done
3 with all that, you are going to come in and tell us
4 about it and so, at this point in time, we have no way
5 to give you any input, and by the time we meet again,
6 it will be too late.

7 MR. RASMUSON: Okay.

8 MR. SIEBER: Without going through an
9 exercise like you guys did this and committed
10 yourselves to all kinds of things, and we said well,
11 you didn't do this right and you didn't do that right,
12 and so I sort of get a little bit concerned.

13 MR. RASMUSON: Okay.

14 MR. SIEBER: Because that's the most
15 important part.

16 MR. RASMUSON: Okay.

17 MR. SIEBER: And that's where there is
18 sort of fuzzy concepts involved in some instances, and
19 maybe there is a way to get around that and there
20 comes a time where it will help, as opposed to at a
21 time when all the work is done. I don't know if our
22 Chairman has any additional thoughts on that. He is
23 the Chairman, but that would be my thought, at this
24 point.

25 MR. RASMUSON: Well, certainly, as we are

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1 in draft where one thing we could do is certainly as
2 we have a draft document on that, we could certainly
3 ask you for comments, not necessarily meeting, but we
4 could certainly send that out for review and comment.

5 CHAIRMAN SHACK: Yes.

6 MR. SIEBER: I think that would be good.

7 MR. RASMUSON: Okay.

8 MR. BARANOWSKI: So is that an acceptable
9 way to occasionally work once we have been sort of
10 coming along on this, to send some technical issues to
11 ACRS for information and the staff would figure out
12 how to collect some comments and feed them back or do
13 we need meetings?

14 MR. SIEBER: Well, I think you need a
15 meeting in order to get an official opinion out of us,
16 because if we don't write it down, it's not official.
17 On the other hand, I think if you would send us
18 documents that explain what it is you intend to do and
19 we all get it by email or some other way through our
20 staff, and somebody has, you know, a great concern
21 about it, then we may ask you at the next meeting or
22 some future meeting to come in, so that we can discuss
23 that before it's cast in concrete. That would be one
24 way to do it, but I'm sure the staff knows better how
25 to do those things than I do.

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1 MS. WESTON: Well, I was going to comment
2 that we could try that, you know, as a comment kind of
3 thing. Usually, what happens is we send stuff out.
4 If they have questions, they can send it back and I
5 can send it to you, and it would depend upon the
6 nature of the questions.

7 CHAIRMAN SHACK: Okay.

8 MS. WESTON: How much explanation is
9 required, and we could try that in one round and see
10 how it worked.

11 CHAIRMAN SHACK: Always with the
12 recognition, of course, that the comments are those of
13 the individual member.

14 MS. WESTON: Right, right.

15 CHAIRMAN SHACK: Not of the ACRS.

16 MS. WESTON: And the fact that, at some
17 point, once we get these questions, we will have to
18 come together as a group to discuss them.

19 MR. SIEBER: See, I think one of your
20 interests is to keep moving forward without having to
21 wait for us.

22 MR. RASMUSON: Right.

23 MS. WESTON: Right.

24 CHAIRMAN SHACK: Right.

25 MR. SIEBER: And to not show up here for

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1 another meeting if you don't have to, and so perhaps
2 the staff, our staff, can figure out a way that we can
3 legally make that happen.

4 CHAIRMAN SHACK: Or not.

5 MS. WESTON: There is no prohibition to
6 providing comments or input to the staff without a
7 formal meeting. The only prohibition would be if we
8 are about to write a letter.

9 MR. SIEBER: Yes, we can't write the
10 letter.

11 MS. WESTON: And then of course, we would
12 have to have the reports. So we can do that.

13 MR. SIEBER: We have to work something
14 out.

15 MS. WESTON: We can try that as a means of
16 getting some input for you on a rather quick basis,
17 but recognize that oftentimes some members don't read
18 their email, so you might not have some input.

19 CHAIRMAN SHACK: Okay.

20 MR. RASMUSON: See, right now, all the
21 comments that we have been given are -- you know, I
22 have just been going through the transcript and
23 pulling them out, you know, and it would be just the
24 same way that, you know, you made comments, you made
25 comments and go for it.

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1 MS. WESTON: Yes.

2 MR. RASMUSON: They have just been written
3 down in their public record, you know, but they are
4 not -- nothing has come from the ACRS, except the
5 transcript itself, you know, and Tom has said
6 something, you have said something and I have just
7 pulled it out and, you know, we have tried to address
8 that in that regard.

9 MR. SIEBER: I think that's a good way to
10 work. On the other hand, our individual comments as
11 they appear in transcripts and testimony are still
12 individual comments.

13 MR. RASMUSON: That's right.

14 MR. SIEBER: As opposed to --

15 MR. RASMUSON: That's right.

16 MS. WESTON: Yes, until you come together
17 as a body in a full committee.

18 MR. SIEBER: That's right.

19 MR. RASMUSON: See, so --

20 MS. WESTON: Then the comments are not
21 official.

22 MR. RASMUSON: Right, yes.

23 MR. BOYCE: The only thing I could add to
24 that is is that I don't think we would be waiting for
25 the expert panel to tell us what the thresholds are.

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1 Our plan would be to work these thresholds and come up
2 with our best shot and say this is what we think. We
3 have explored just like we did, we have explored five
4 equations and we think this is the best after weighing
5 the pros and cons of each one.

6 What we would be looking for is
7 confirmation from this expert panel, which would have
8 a variety of stakeholder interests represented. We
9 hope that we have done the right thing, and that keeps
10 us on track and that is just philosophy more than
11 anything else.

12 MS. WESTON: Well, I think one of the good
13 things about doing that and getting comments from the
14 members is you may get a diverse set of comments.

15 CHAIRMAN SHACK: Right.

16 MS. WESTON: Which give you a broader view
17 of, and then you can consider which of those you want
18 to use and which of those you do not wish to.

19 MR. BARANOWSKI: I was wondering if I
20 could follow-up a little on Tom's comment there. The
21 expert panel, I don't believe, is going to be asked
22 what do you think the threshold should be?

23 MS. WESTON: Right.

24 MR. BARANOWSKI: It will be more along the
25 lines should we use some 95th percentile parameter?

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1 Should we take into account the fact, when we look at
2 the total safety measure, that this is some limited
3 amount of risk? It doesn't include all external
4 events or fires or something like that, and how should
5 we cut that down?

6 MS. WESTON: Yes.

7 MR. SIEBER: Well, I think if you do it
8 that way, which I think is a good idea, and document
9 it well, then you're going to have a good paper trail
10 that can be used in the future to determine exactly
11 what it was you intended when you put together this
12 program. So, you know, that sounds like a pretty good
13 way to do it. Otherwise, if you just say to the
14 expert panel come up with some thresholds, I am not
15 exactly sure what it is you're going to get.

16 MR. BOYCE: Yes, I agree, I agree.

17 MR. RASMUSON: No, I agree.

18 MR. SIEBER: That's why one of the reasons
19 why I'm concerned.

20 MR. BOYCE: We would not be tossing this
21 problem to them. We would be giving it our best shot.

22 MR. SIEBER: Well, it depends on who the
23 expert panel is. Some experts are very willing to
24 give their opinion.

25 MR. BOYCE: We'll welcome yours as part of

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1 the panel.

2 MR. BONACA: The issue of feedback to the
3 ROP was raised before, and I just was wondering if you
4 are going to have some kind of a check done before,
5 you know, you come up with the final Commission paper
6 regarding the effectiveness of an indicator of this
7 nature in trending such that you would have the ROP
8 that would be successful, and then define these trends
9 before they occur. Some reconciliation there.

10 One of the reasons is that take, for
11 example, the ROP has a limited number of initiators
12 that you're tracking, although, one of them is a
13 number of scrams, which may occur for different
14 initiators. But here, you have an index that includes
15 multiple initiators. I was trying to understand how
16 you are going to do that kind of reconciliation back
17 to the ROP.

18 MR. BOYCE: It's a good question, and we
19 weren't thinking of developing indicators of
20 regulatory effectiveness. Most of the -- in fact, all
21 the indicators you just cited correctly are outcome
22 measures, how good is performance of industry, and
23 it's a combination of regulatory effectiveness and
24 industry performance.

25 What we use for measures of regulatory

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1 effectiveness are typically found in budget space and
2 there, you know, the number of license amendments we
3 put out, the number of public meetings that we have
4 held on time as a result of the -- in regards to the
5 ROP, how we completed a baseline inspection, those
6 sorts of measures of regulatory effectiveness.

7 And we were not thinking of having an
8 explicit tie like that as part of the Industry Trends
9 Program. We would keep that in budget space, which
10 measures outputs, as opposed to outcomes. Rather, our
11 tie to the ROP would be, you know, in spite of what
12 all our output measures are telling us, you know, that
13 we're completing the baseline, we're holding public
14 meetings, are we really still continuing to achieve an
15 appropriate level of industry performance? So it's
16 more of that macroscopic look. You know, our scrams
17 continually go down.

18 MR. BONACA: I understand. Although, I
19 mean, if you had that adverse trend taking place, you
20 would want to be able to say that the ROP was, in
21 fact, capable of identifying an adverse trend even if
22 it measures different things.

23 MR. BOYCE: Well, I guess we could make
24 that claim that we know why, you know, we understand
25 why the trend is continuing to go down for scrams, and

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1 so I guess you could say that that tie is there. I
2 mean, I can go back and think about that some more.
3 I told you where we are today.

4 MR. BONACA: Sure. No, I understand. I
5 just was --

6 MR. BOYCE: Let me try and think about
7 whether that's a good argument.

8 MR. BONACA: Yes.

9 MR. BOYCE: I was going to also say where
10 we were really headed was trying to get out of this
11 program, news you could use down to the inspector, and
12 that's how we were primarily going towards feedback to
13 the ROP, which was to take all the high-level stuff,
14 disaggregate it down to the plant level, perhaps the
15 component level, and then compare individual plants to
16 an industry average. But let me come -- I mean, I
17 will think about what you said.

18 MR. BONACA: You realize here, in fact, I
19 am not criticizing this. In fact, I think this is
20 quite comprehensive if I look at the initiating events
21 in trending with this index. It simply has more
22 information that you do have with the ROP that you are
23 monitoring there. And, you know, we are still
24 questioning oftentimes the, we say, adequacy of the
25 ROP. I mean, because still it's being on trial, I

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1 mean, it's being -- you know, it's a pretty recent
2 initiative anyway. So to do that kind of thinking
3 process of this back to the ROP, it could be helpful
4 for the ROP.

5 MR. BOYCE: I understand your point. I
6 can go back and see if I can draw some connection
7 there. Thank you.

8 MR. BONACA: Yes.

9 MR. LEITCH: Close to that same issue, it
10 seems to me there is a window of vulnerability here
11 where say, for example, one particular manufacturer of
12 valves is troublesome. If it's real troublesome
13 across the whole industry, the industry trends would,
14 presumably, show that. But suppose it's not enough or
15 maybe those valves don't exist at enough plants to
16 trigger that particular trend, so the industry trend
17 doesn't pick it up.

18 The other extreme is if one particular
19 plant has a whole lot of those valves and there are
20 chronic failures at that plant, why then the
21 individual ROP program would pick it up for that
22 particular plant. But I guess I am wondering is there
23 a vulnerability to a situation where you may have a
24 couple of these valves scattered among three or four
25 plants, and they are troublesome at all the plants,

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1 but how do you --

2 MR. BOYCE: A sticking PORV?

3 MR. LEITCH: Excuse me?

4 MR. BOYCE: A sticking PORV? Is that what
5 you're thinking?

6 MR. LEITCH: Yes, well, yes, exactly, yes.

7 MR. SIEBER: Solenoid valves. Let me
8 expand your question a little bit, because I have a
9 similar concern. The old way they did that was in an
10 LER, you would identify the component that failed.

11 MR. LEITCH: Right.

12 MR. SIEBER: It was some kind of root
13 cause analysis, and the LER, from the licensee's
14 viewpoint, was considered not only an LER, but a Part
15 21 report. And in addition to that, if the licensee
16 told the manufacturer we think your valve is
17 defective, then the manufacturer is required to do
18 that, too.

19 Now, I believe that the NRC has a trending
20 program to look at individual component failures that
21 would show up in LERs provided the licensee properly
22 identifies it with some kind of root cause, and maybe
23 you can assure me that that takes place or maybe you
24 can say you don't know, but that's -- I understood
25 that's the way it's supposed to work.

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1 MR. BOYCE: I would say I don't know is
2 the easiest way out of that.

3 MR. SIEBER: I do know that out of LERS
4 things like a brand name solenoid valve, polyurethane
5 seeps where the scrams were identified, they were in
6 the PWRs. They were in the scram hydraulics for BWRs,
7 and so they would pop out that way and the NRC issued
8 information notices with regard to that.

9 I am looking at LERS that were coming in,
10 and eventually, Part 21s came out that it's not clear
11 to me that our regulatory system is detailed enough to
12 be able to pick out components that maybe experience
13 some generic failure in general service in more than
14 one plant. And the reason why I say that is I don't
15 know. Maybe you can tell me that the NRC does that.

16 MR. RASMUSON: Our branch looks at
17 performance of valves, you know, but we don't
18 necessarily go down and look at the manufacturer or
19 the root cause of those things. We classify failures
20 a little higher than that.

21 MR. SIEBER: Right.

22 MR. RASMUSON: And I don't know what NRR
23 does. Pat, maybe you know.

24 MR. BARANOWSKI: Well, first of all, they
25 would probably have to be risk-significant valves.

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1 MR. SIEBER: Like scram discharge valves?

2 MR. BARANOWSKI: Yes, something that would
3 show up.

4 MR. SIEBER: Right, it would be
5 significant.

6 MR. BARANOWSKI: With a high Birnbaum or
7 achievement worth or one of the importance measures.
8 They would either be detected through the Reactor
9 Oversight Program on individual plants just because
10 they are of such risk-importance if they are failing.

11 In the second place that they should show
12 up would be through the generic studies in which we
13 trend valve performance if they are a risk-significant
14 valve. Not every valve is looked at, but if you just
15 take the risk-significant ones, and it wouldn't take
16 that many actually to make the performance change.

17 MR. SIEBER: Well, I know that it has
18 happened in the past in certain applications. I just
19 don't know that it's systematic.

20 MR. BOYCE: I won't tell you right now
21 that I know whether it's systematic or not.

22 MR. SIEBER: Okay.

23 MR. BOYCE: I know we have an Events
24 Assessment Section that still generates those sorts of
25 looks at things if they notice them as they are doing

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1 their screening reviews, and right now, the Davis-
2 Besse Lessons Learned Task Force told us that there's
3 a large number of recommendations saying we needed to
4 reassess the way we're looking at operational
5 experience.

6 The current status of that is is that
7 there were so many recommendations by the task force
8 for Davis-Besse that we formed another task force just
9 to respond to the Lessons Learned, and they are
10 looking at the full gamut of what we're doing with
11 operating experience. I don't know where they are or
12 whether they will address this specific issue.

13 MS. WESTON: They are going to be here
14 tomorrow.

15 MR. BOYCE: We may have the opportunity to
16 ask.

17 MR. SIEBER: Yes, well, their actual plan
18 is very, very big.

19 MS. WESTON: They are doing a presentation
20 tomorrow.

21 MR. BOYCE: Okay. Well, I know, I mean,
22 in our program, I mean, I know that we have been
23 growing. We started in 2001 and we have been growing
24 at a little bit at a time. We have been working to
25 get down to the component level, because it's part of

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1 that news you can use to inspectors. You need that
2 level of granularity in order to make a difference.

3 MR. SIEBER: Right, yes.

4 MR. BOYCE: And we have asked Research to
5 update some of their operating experience studies,
6 which they have done along these lines in the past.

7 But let me talk to you about resources
8 just a bit. In NRR, there is 1.5 FTE devoted to this
9 and about \$300,000, and that is to process all the
10 LERs as well. So the 1.5 FTE is talking to you right
11 now in NRR, and I haven't been able to get around to
12 that stage yet.

13 MR. SIEBER: A \$300,000 man.

14 MR. BOYCE: I'm looking for my bonus
15 check. But, I mean, I recognize what you're saying.
16 It's outside the scope of the current program is the
17 easiest answer right now, but I recognize what you're
18 saying. I am trying to get to it, so you can get news
19 you can use to the inspectors.

20 MR. SIEBER: Okay.

21 CHAIRMAN SHACK: Any other comments or
22 questions?

23 MR. SATORIUS: No, sir, I apologize. I
24 had another engagement, but I'm back for the end, I
25 guess.

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1 CHAIRMAN SHACK: I think we're just about
2 ready.

3 MR. SIEBER: Very timely.

4 MR. WALLIS: I didn't understand some of
5 these trends in these figures here. I mean, you have
6 a trend, which is going down and then nothing happens
7 and it goes up. It doesn't seem to make any sense.
8 It's full of mathematical details. It just looks very
9 strange.

10 MR. RASMUSON: Well, that is in fitting
11 the -- that is when you go through and you do the
12 particular statistical technique that we're doing, and
13 you're fitting a median line and you're converting
14 that median line to a mean. That is why you have that
15 little shift.

16 MR. WALLIS: This one where it actually
17 goes up?

18 MR. RASMUSON: Yes.

19 MR. WALLIS: Although, nothing is
20 happening?

21 MR. RASMUSON: Yes.

22 MR. WALLIS: It didn't seem to make any
23 sense.

24 MR. RASMUSON: Yes. Which particular
25 graphs do you have in mind?

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1 MR. WALLIS: Let's look at C-16. There is
2 two events. I tried to follow the math and I couldn't
3 see how any math could make it go up over the years,
4 '95 to 2001, when there are no events.

5 MS. WESTON: Let's see what he's talking
6 about here.

7 MR. RASMUSON: We are doing points on
8 regression.

9 MR. WALLIS: Yes, I tried to follow that,
10 but it still doesn't make any sense.

11 MR. RASMUSON: Which fits the median line
12 to it, then we are converting that median line into a
13 mean.

14 MR. BOYCE: Cory, can you help? Cory, can
15 you help?

16 MR. WALLIS: Well, it started up high when
17 nothing was happening.

18 MR. BOYCE: Please, step to the mike.

19 MR. RASMUSON: You have to step to the
20 microphone and identify yourself.

21 MR. ATWOOD: Cory Atwood, I am contractor
22 for the NRC. That line that is plotted is not the
23 median, which would be expedientially decreasing. The
24 line that is plotted, and maybe we should have just
25 plotted the median, but what is plotted is the mean of

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1 the log normal distribution, which goes up as the
2 variance increases. So that increase you see is a
3 reflection of the fact that out at the end of the
4 plot, we have greater uncertainty than we do in the
5 middle.

6 MR. WALLIS: So if you went on and on
7 having no events, this line would go up some more?

8 MR. ATWOOD: I believe that's possible.

9 MR. BARANOWSKI: No, I don't believe
10 that's possible. If you went on and on and there were
11 no events, it would have to come down.

12 CHAIRMAN SHACK: If you extrapolate from
13 the data that you do have, the curve is going to --

14 MR. SIEBER: Yes, that's right.

15 MR. BARANOWSKI: But if you go on for
16 years with no observations, it will come down.

17 MR. WALLIS: The curve will change, yes.

18 MR. BARANOWSKI: I'm sorry. I'm not a
19 statistician, but I know that's the case.

20 MR. RASMUSON: Yes, yes, if we keep adding
21 that data in.

22 MR. WALLIS: It still looks weird.

23 CHAIRMAN SHACK: I know.

24 MR. WALLIS: Any explanation, it still
25 looks weird. So what is the message in the line then?

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1 MR. RASMUSON: Well, that is why we're
2 maybe -- maybe we should have just plotted a flat line
3 across there instead of this one here to show that
4 there is no trend.

5 MR. ATWOOD: Or a median.

6 MR. RASMUSON: So that is one of the
7 things that we are considering, how to best display
8 those things, so that they are not -- so we get a
9 message across, but still, you know, get the right
10 thing. And so in this case, it will probably be just
11 we ought to plot the mean, the overall mean there
12 where we show that it's flat.

13 MR. WALLIS: Okay.

14 CHAIRMAN SHACK: Further questions?
15 Anybody else have any other questions? If not, I
16 think I'll thank the gentlemen for a very good
17 performance. I thought it was interesting reading the
18 paper. Now, I go back and stretch my statistical
19 knowledge here considerably. But with that, we'll
20 adjourn.

21 (Whereupon, the meeting was adjourned at
22 3:51 p.m.)
23
24
25

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on
Reactor Safeguards
Reliability and PRA
Subcommittee

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.



Matt Needham
Official Reporter
Neal R. Gross & Co., Inc.

Industry Trends Program (ITP) Briefing



Tom Boyce, NRR
Dale Rasmuson, RES
U.S. Nuclear Regulatory Commission

May 5, 2003

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Outline of Presentation

- Current status of ITP
- Overview and schedule
- Previous ACRS comments on IIEPI
- Responses to ACRS comments
- Future plans
- Implementation issues

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Current Status

- Met with ACRS joint subcommittee in May 2002 and Nov. 2002
- RES sent out draft report on the IIEPI for internal and external review
- Briefed ITP and IE indicator to industry at public meetings on ROP
- Third annual ITP Commission paper issued in April 2003

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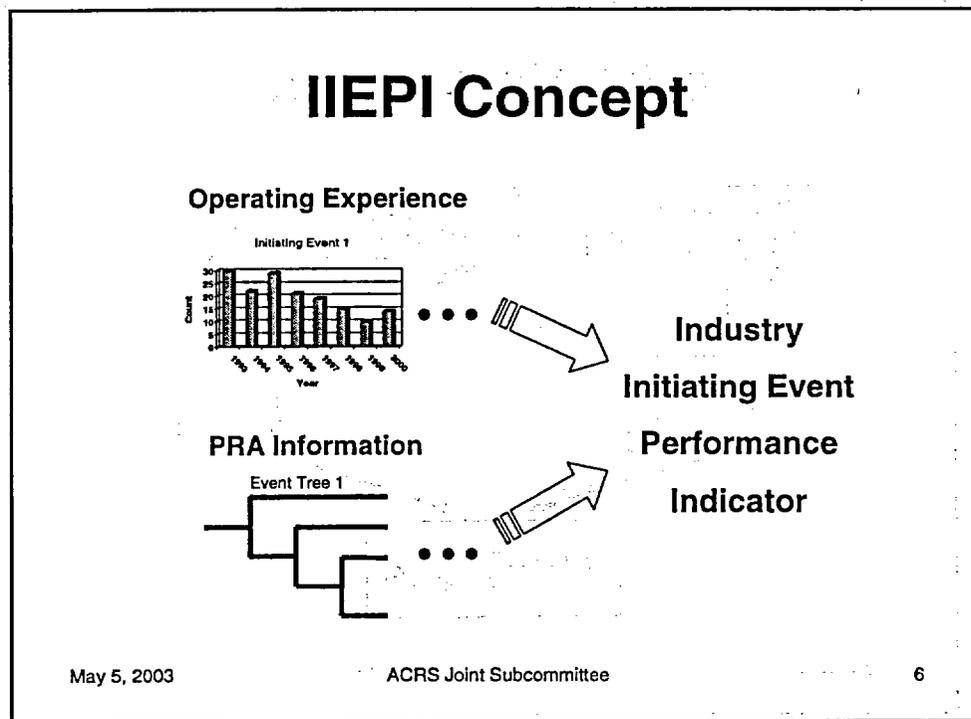
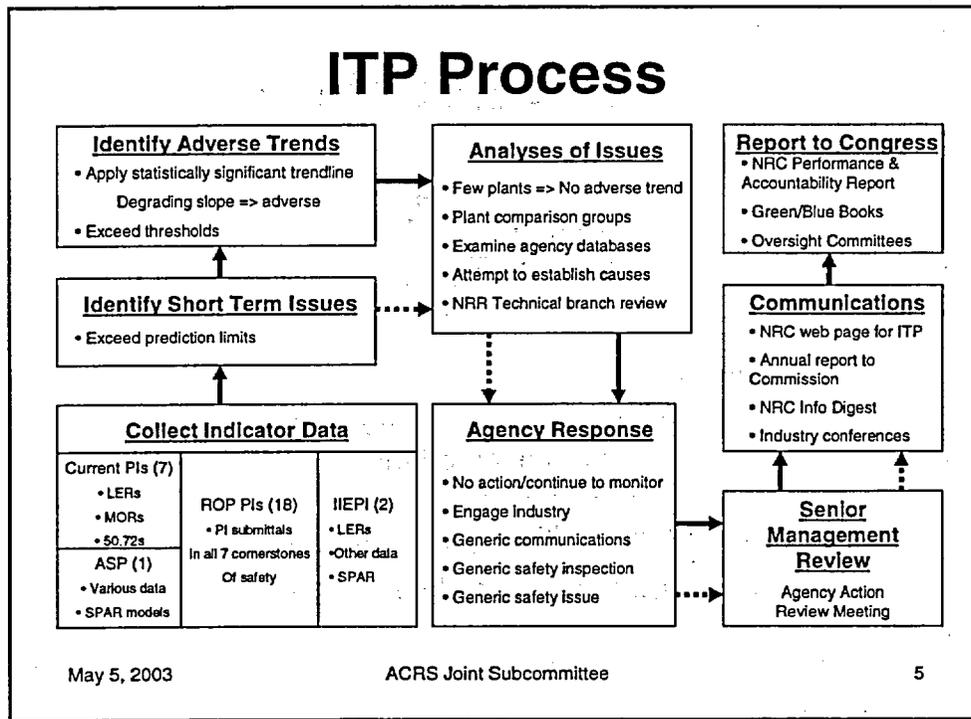
Overview of ITP

- The ITP is designed to complement the plant-level oversight provided by the Reactor Oversight Process (ROP)
- ITP focuses on industry-level performance; does not use colors as in ROP PIs
- Adverse trends analyzed and agency response IAW existing agency processes for addressing generic issues

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IIEPI Equation

$$IEPI = \sum_{i=1}^m B_i \lambda_i$$

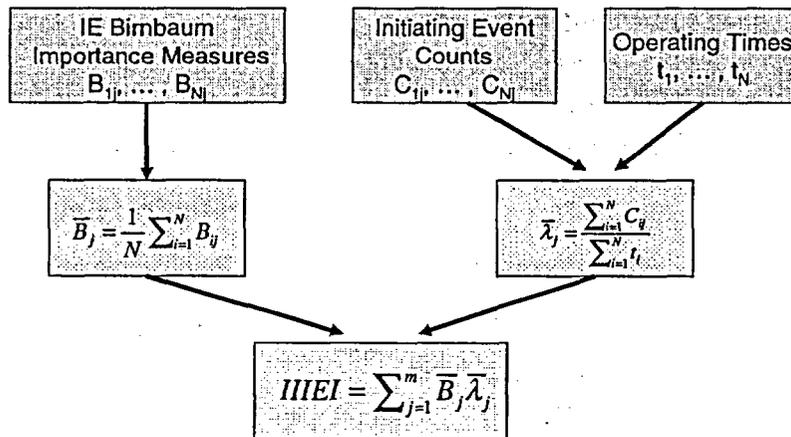
where

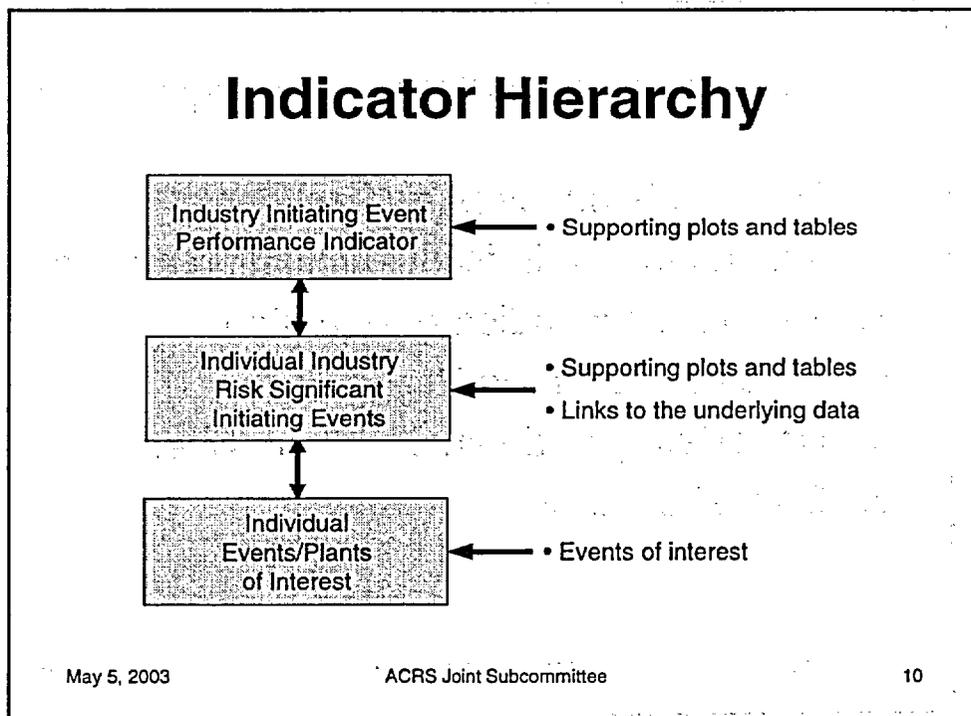
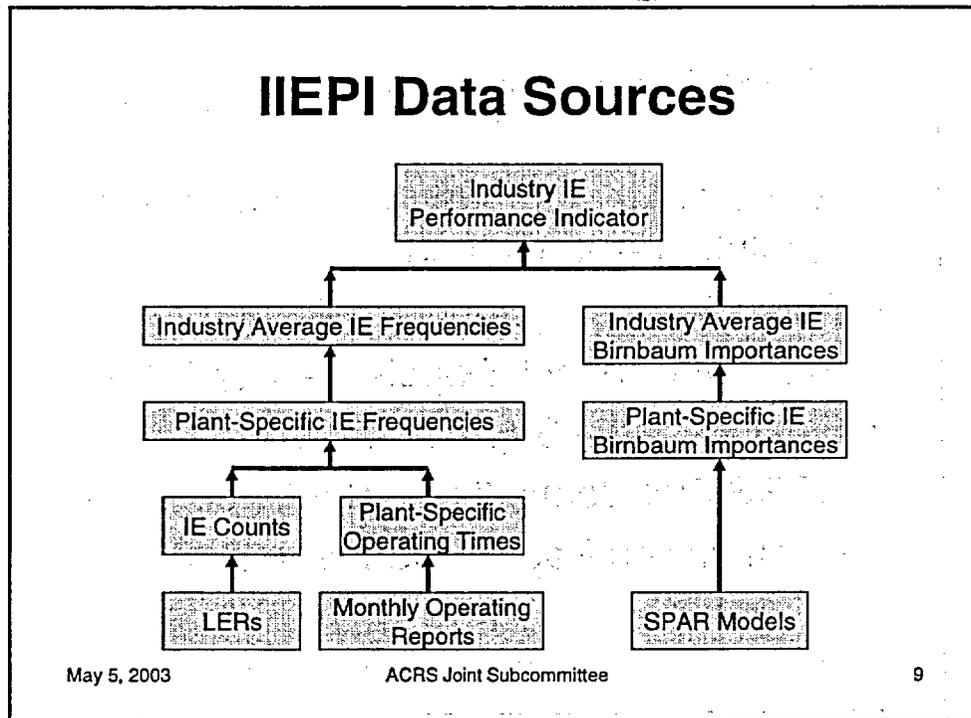
B_i = industry average risk weighting factor
(Birnbbaum importance measure) for
initiating event i

λ_i = industry initiating event frequency

m = number of kinds of initiating events

IIEPI Calculations





IIEPI Development Schedule

- Review of the draft report and comment resolution – June 2003
- Public Workshop – July 2003
- Proof of Concept Exercise – July 2003
- Final Report – September 2003
- ACRS Full Committee – Sept/Oct. 2003
- Commission Paper – January 2004

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Summary of ACRS Comments

1. ITP regulatory uses and actions
2. Trends for the individual initiating events
3. Performance indicator equation
4. Thresholds for the PI
5. Uncertainty and sensitivity analyses
6. Subset of plants

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1. Regulatory Uses and Actions

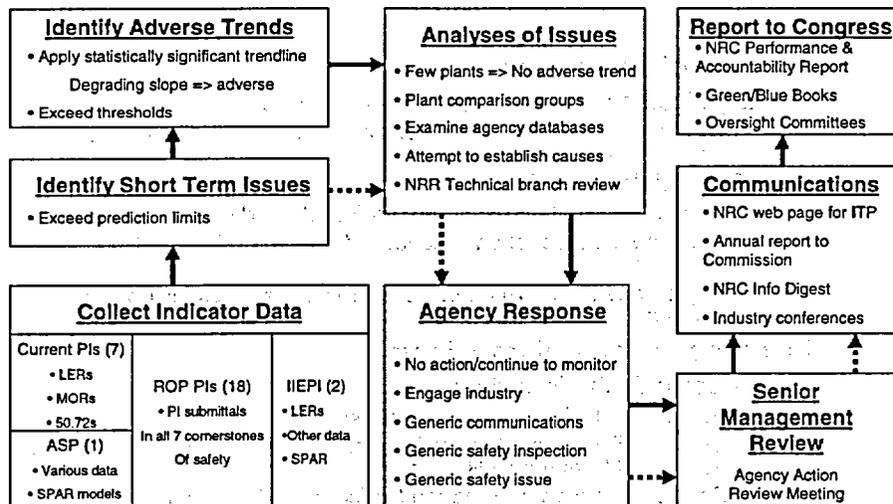
- Comments
 - Develop more concrete examples of regulatory actions
- Response
 - Developed a flowchart of the ITP process
 - Refined the two-tier process for the ITP
 - Integrated indicator with thresholds
 - Individual IE trends and predictive distributions
 - Developed some example scenarios and potential NRC actions

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ITP Process



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Two-Tiered Process

- Two-tiered approach addresses safety and performance
 - Integrated indicator with thresholds
 - Use thresholds, anchored to the safety goal for the integrated indicator (safety)
 - Individual IE trends and predictive distributions
 - Use prediction limits for the individual trends (performance)
 - Prediction limits help us assess if there has been a change in performance

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Example Scenarios

- Loss of offsite power
 - Large increase in LOSP events in one year
 - Events occurred because of unexpected increase in severe storms on east coast
 - ITP could do the following:
 - Provide information to inspectors for affected plants
 - Examine the inspection procedure for Preparation for Adverse Weather
 - Might issue an Information Notice to all licensees giving lessons learned
- Increase in general transients
 - ITP could do the following:
 - Review the LERs to ascertain causes
 - Create a Temporary Instruction directing inspectors to look at what was found from the LER review
 - Possibly issue an Information Notice to all licensees

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2. Trends

- ACRS Comments
 - Lack firm definition of trend and statistically significant trend
 - Performance has been basically flat for several years
 - Use a horizontal line
 - Industry behavior versus plant-specific behavior
- Response
 - Provided definitions of trend, statistically significant trend, and adverse trend
 - Estimated “flat” trend

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Definitions of Trend

- Trend
 - The general movement in the course of time corresponding to a statistically detectable change
 - Also, a statistical curve reflecting such a change
- Statistically Significant Trend
 - A trend in which the p-value of the trend parameter is less than 5%
- Adverse Trend
 - A statistically significant trend that exceeds a threshold or prediction limit

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Flat Trend

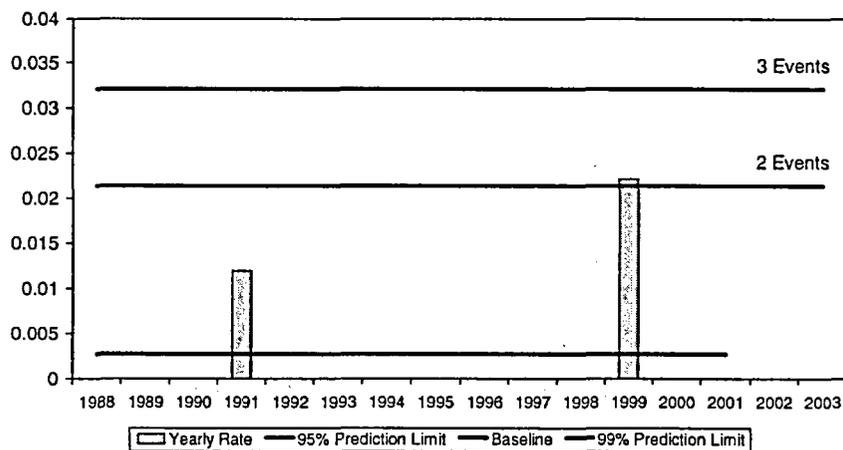
- Estimated flat baseline trend for each IE based on at least 4 years
- Developed rules for determining “flat” trends
- For initiating events with few occurrences, the interval is 1988-2001. For those with more occurrences, the interval is shorter, but includes at least 4 years

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Loss of Vital DC Bus

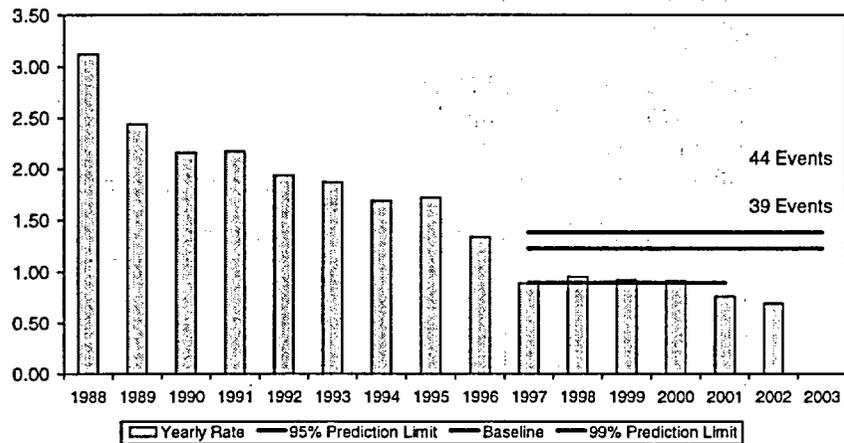


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BWR General Transients



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Industry vs. Plant Specific

- Can estimate plant-specific frequencies for Initiating events that are not major contributors to CDF
- For those IEs that are major contributors, very little difference in IE frequency
 - Variation in CDF contribution is the variation in the Birnbaum importance measure

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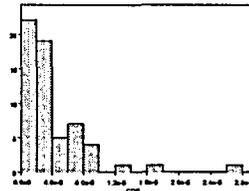
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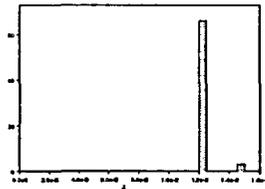
PWR Plant-Specific Example

- No statistically significant plant-to-plant variation in LOSP frequency
- Therefore plant-specific LOSP frequencies are almost equal
- Variation in CDF is due to variation in Birnbaums

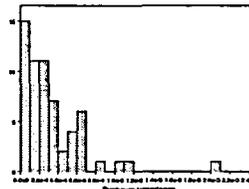
LOSP CDF Contribution



Plant-Specific LOSP Frequencies



Birnbaum Importances



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3. Equations

- ACRS Comments
 - Confusion with equations (summation, notation)
 - Confusion with the four equations
 - Industry equation vs. plant-specific equation
- Response
 - Rewritten equation to make it simpler
 - Show details of calculations and data sources in flowcharts

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4. Uncertainty and Sensitivity Analyses

- ACRS Comments
 - Suggested that uncertainty and sensitivity analyses be performed
- Response
 - Performed uncertainty analyses
 - Performed Monte Carlo simulations
 - Summarized contributors of mean and variance
 - Evaluated individual IE prediction limits

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BWR IIEPI Summary

Initiating Event	Average Importance	Baseline Frequency	Baseline CDF	Percent of Mean	N_{Mean}	N_{95}
IE-LOCA	5.62E-05	0.0047	2.62E-07	2.5%	0.4	21.3
IE-TRANS	1.36E-06	0.8950	1.22E-06	11.6%	28.6	167.0
IE-LOHS	8.44E-06	0.1900	1.60E-06	15.3%	6.1	29.9
IE-LOFW	1.45E-05	0.1020	1.49E-06	14.2%	9.7	49.5
IE-LOSP	3.22E-04	0.0125	4.03E-06	38.4%	1.2	3.6
IE-LODC	2.70E-04	0.0030	8.00E-07	7.6%	0.3	5.9
IE-VAC	0.00E+00	0.0275	0.00E+00	0.0%	2.6	–
IE-LOIA	8.20E-06	0.0108	8.86E-08	0.8%	0.3	55.7
IE-SORV	4.71E-05	0.0213	1.00E-06	9.5%	0.7	7.8
Total	–	–	1.05E-05	100.0%	–	–

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PWR IIEPI Summary

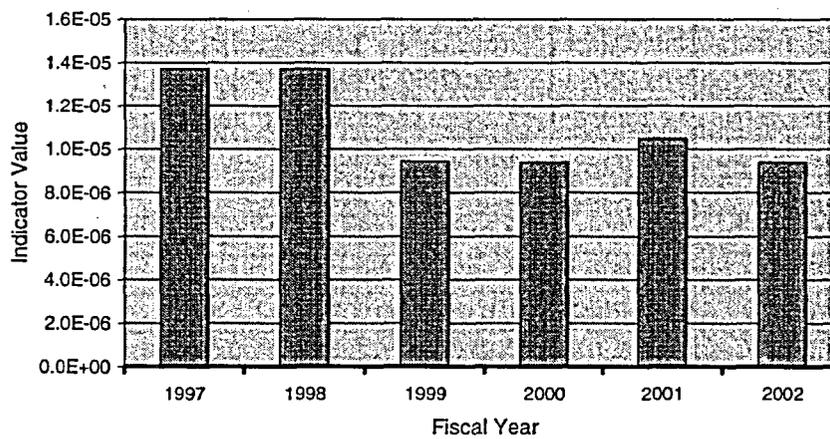
Initiating Event	Average Importance	Baseline Frequency	Baseline CDF	Percent of Mean	N _{Mean}	N ₉₅
IE-SLOCA	2.52E-03	0.0047	1.17E-05	32.2%	0.4	2.2
IE-TRANS	2.01E-06	0.7640	1.54E-06	4.2%	47.9	739.8
IE-LOHS	1.88E-06	0.0974	1.84E-06	5.1%	6.1	85.2
IE-SGTR	7.90E-04	0.0044	3.45E-06	9.5%	0.3	5.2
IE-LOFW	1.88E-05	0.1025	1.93E-06	5.3%	9.7	125.8
IE-LOSP	3.25E-04	0.0125	4.07E-06	11.2%	1.2	10.3
IE-LODC	2.99E-03	0.0030	8.84E-06	24.3%	0.3	2.2
IE-VAC	0.00E+00	0.0275	0.00E+00	0.0%	2.6	-
IE-LOIA	8.35E-05	0.0122	1.02E-06	2.8%	0.8	28.1
IE-SORV	6.36E-04	0.0031	1.97E-06	5.4%	0.3	9.1
Total	-	-	3.64E-05	100.0%	-	-

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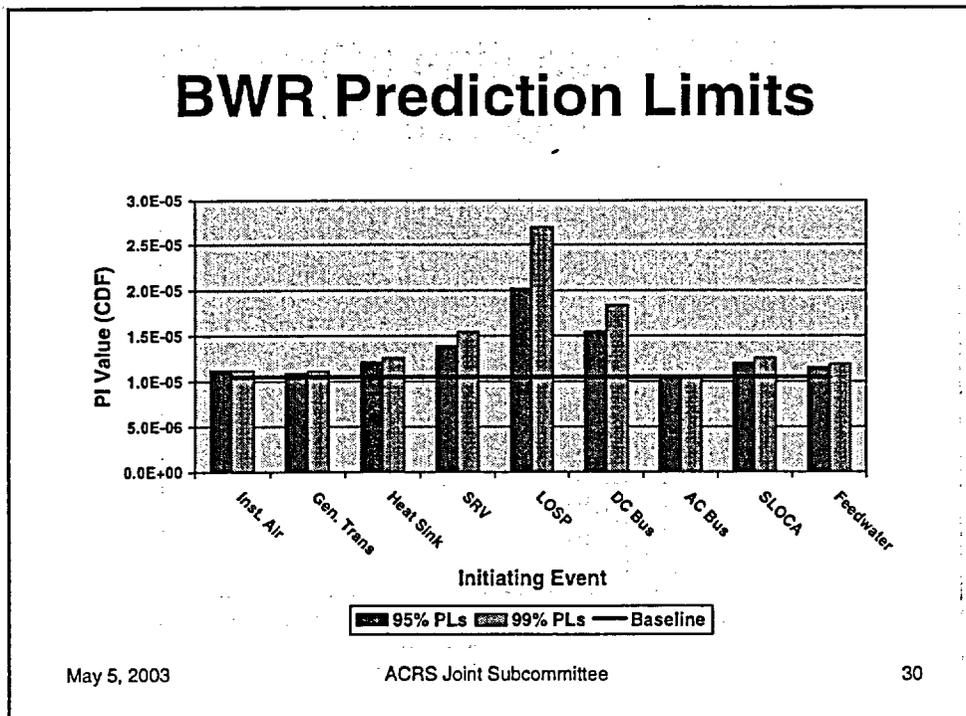
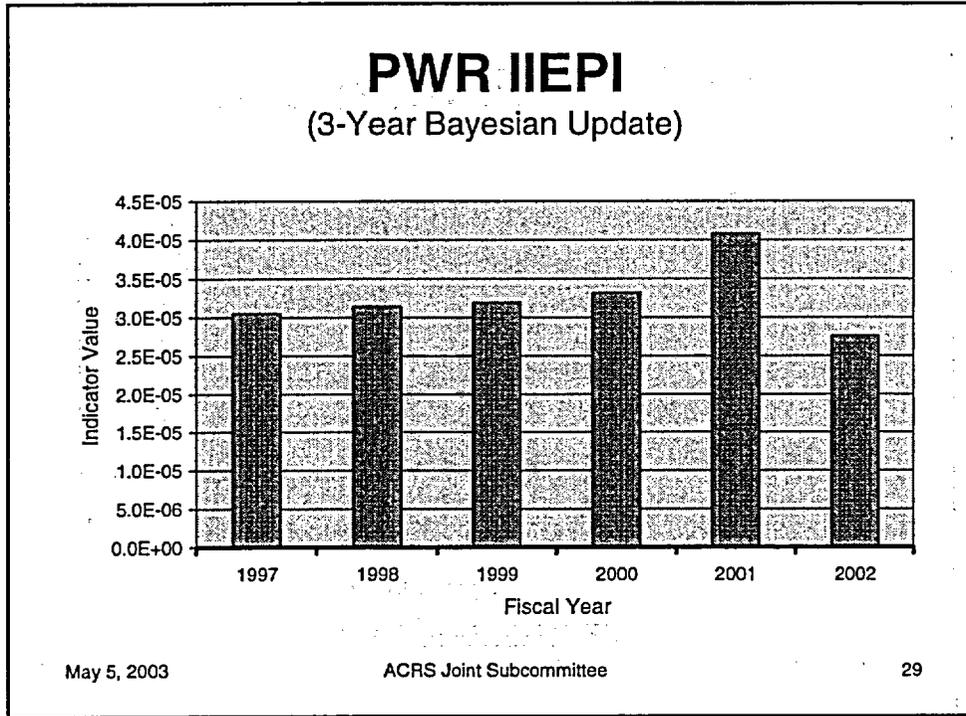
BWR IIEPI (3-Year Bayesian Update)

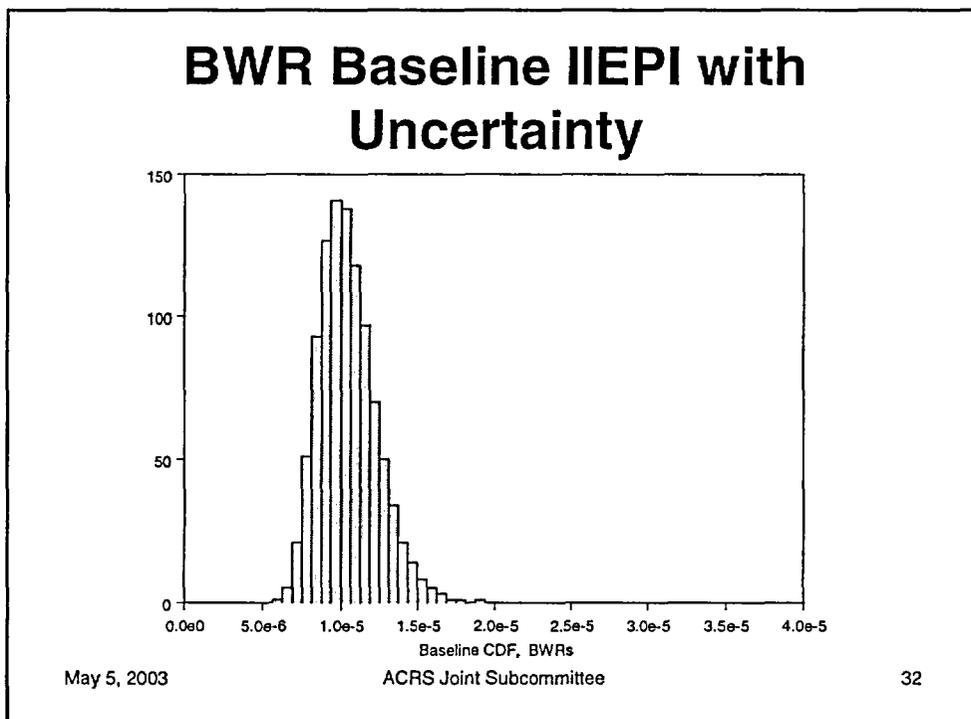
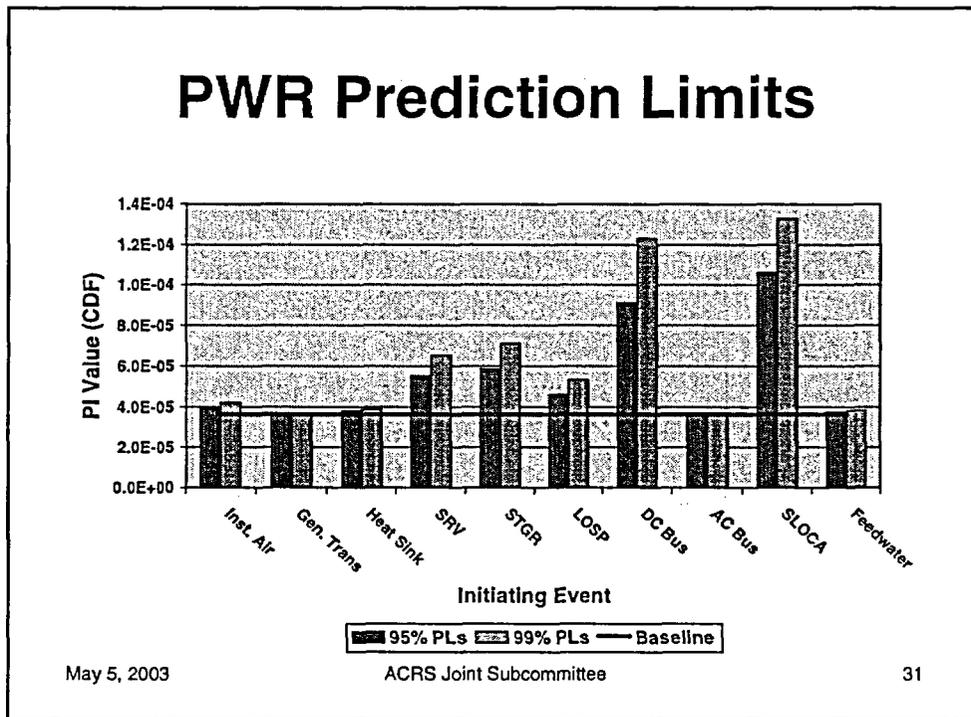


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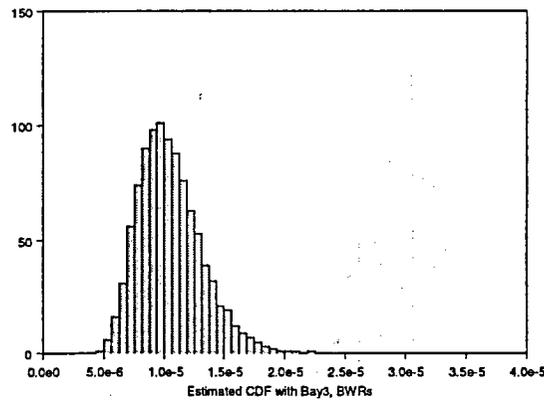
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BWR IIEPI (3-Year Bayes)

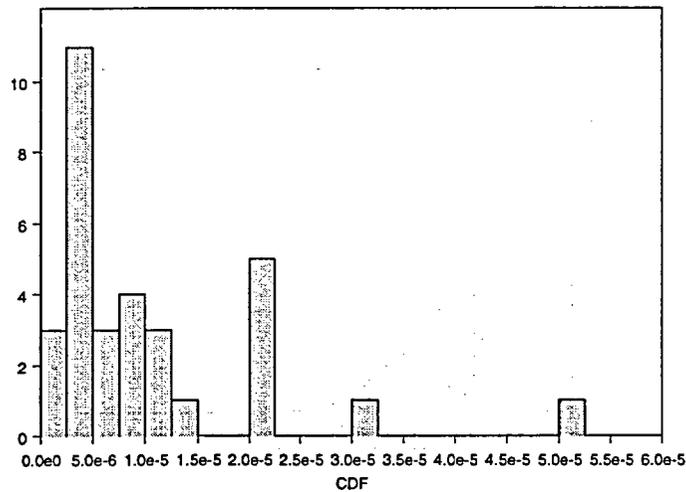


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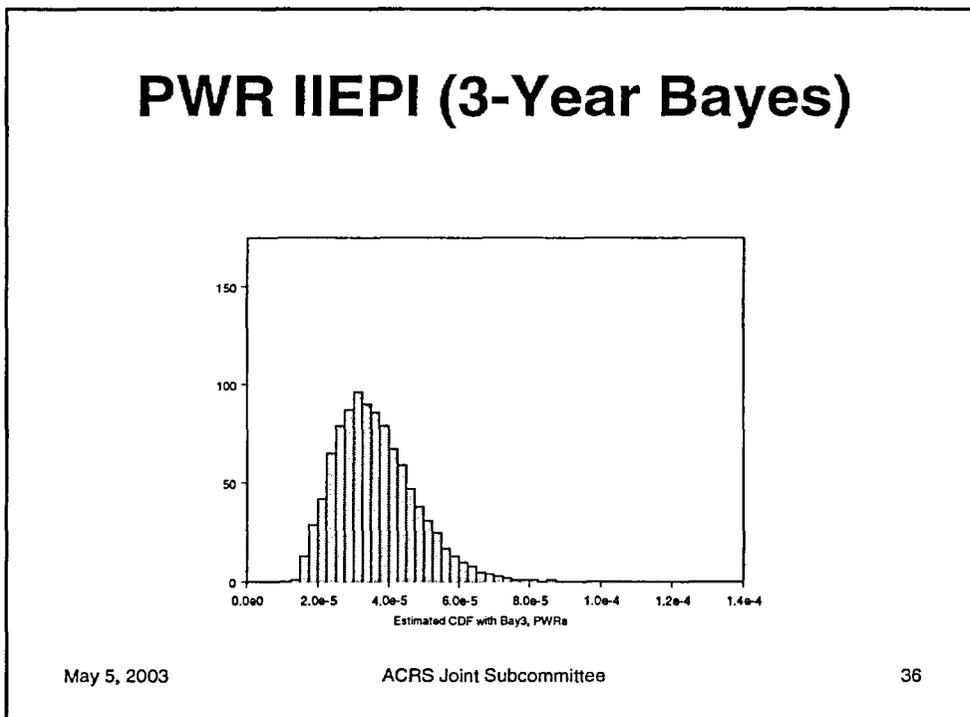
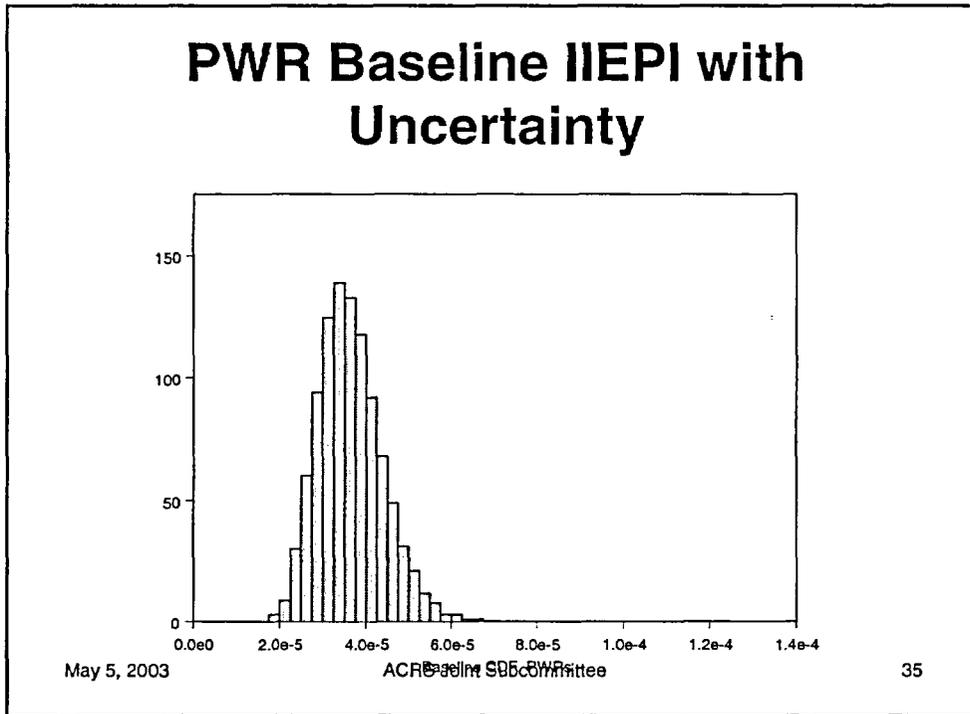
BWR Plant-Specific Baseline CDF



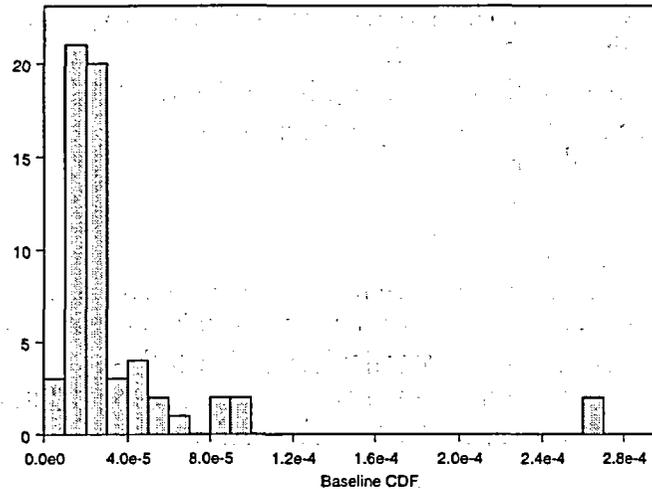
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PWR Plant-Specific Baseline CDF



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5. Thresholds

- ACRS Comments
 - Thresholds tell us about safety, trends about performance
 - Have to establish that there has been a change before you start looking for it
- Response
 - Two-tiered approach addresses safety and performance
 - Use thresholds, anchored to the safety goal for the integrated indicator (safety)
 - Use prediction limits for the individual trends (performance)
 - Prediction limits help us assess if there has been a change in performance

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Thresholds for the IIEPI

- Thresholds may be established using the following information
 - Safety Goal and/or Regulatory Guide 1.174
 - Behavior of the integrated indicator
 - Simulations
 - Uncertainty
 - Prediction limit values
 - Major contributors
 - Distributions of the Birnbaum importance measures
 - Past operating experience trends for initiating events
- An expert panel would be established to propose threshold values that satisfy policy and operational needs and objectives

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Predictive Distributions

- Predictive distributions are concerned with predicting observables (no parameters are involved)
- Bayesian predictive inference focuses on calculating inferences for the unseen part of the population, sometimes termed future observations, given sample data from that population
- Focus is on attempting to predict the outcome of future observations, based on the data previously collected
- From the predictive distribution of $y | x$, many features of the unseen population can be predicted, e.g., predictive probabilities of events

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6. Subset of Plants

- ACRS Comments
 - Need to look for subset of bad performers
- Response
 - One part of the two-tier approach in ITP is to look for subset of plants as well as other factors that might be important when a prediction limit is exceeded.

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Future Efforts

- Receive comments from draft report review
- Hold a public workshop on the integrated indicator
- Develop guidance for setting thresholds for the integrated indicator
- Perform a “proof of principle” exercise, including setting thresholds by an expert panel
- Update report with lessons learned
- Brief ACRS
- Issue a Commission paper

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Schedule

- Review of the draft report and comment resolution – June 2003
- Public Workshop – July 2003
- Proof of Concept Exercise – July 2003
- Final Report –September 2003
- ACRS Briefing – Sept/Oct. 2003
- Commission Paper – January 2004

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POLICY ISSUE **(Information)**

April 17, 2003

SECY-03-0057

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: FY 2002 RESULTS OF THE INDUSTRY TRENDS PROGRAM FOR
OPERATING POWER REACTORS AND STATUS OF ONGOING
DEVELOPMENT

PURPOSE:

To inform the Commission of the results of the Nuclear Regulatory Commission's (NRC) Industry Trends Program (ITP) for FY 2002, and the status of ongoing development. The ITP supports the NRC's performance goals of maintaining safety and enhancing public confidence in the agency's regulatory processes.

SUMMARY:

The NRC staff implemented the ITP in 2001, and is continuing to develop the program as a means to confirm that the nuclear industry is maintaining the safety of operating power plants and to increase public confidence in the efficacy of the NRC's processes. The NRC uses industry-level indicators to identify adverse trends, evaluate them using agency databases, and take appropriate actions. One important output of this program is to report to Congress each year on the performance goal measure of "no statistically significant adverse industry trends in safety performance" as part of the NRC's Performance and Accountability Report. Based on the information currently available from the industry-level indicators originally developed by the former Office for Analysis and Evaluation of Operational Data (AEOD) and the Accident Sequence Precursor (ASP) Program implemented by the Office of Nuclear Regulatory Research (RES), no statistically significant adverse industry trends have been identified through FY 2002.

CONTACT: Tom Boyce, NRR/DIPM
301-415-1130

The staff is continuing to use the AEOD and ASP indicators while it develops additional industry-level indicators that are more risk-informed and better aligned with the cornerstones of safety in the Reactor Oversight Process (ROP). These additional indicators will be developed in phases and qualified for use in the ITP and the annual Performance and Accountability Report to Congress. The results of this program, along with any actions taken or planned, are reviewed annually during the Agency Action Review Meeting (AARM) and reported to the Commission.

BACKGROUND:

This paper is the third annual report to the Commission on the ITP. The previous Commission reports were SECY-01-0111, "Development of an Industry Trends Program for Operating Power Reactors," and SECY-02-0058, "Results of the Industry Trends Program for Operating Power Reactors and Status of Ongoing Development." Additional information on the ITP program and the process for identifying and addressing adverse trends is in Attachment 1.

The NRC provides oversight of plant safety performance on a plant-specific basis as part of implementing the ROP. The ROP uses both plant-level performance indicators (PIs) and inspections. The ITP provides a means to assess overall industry performance using industry-level indicators. Issues that are identified from either the ROP or the ITP are evaluated using information from agency databases, and those assessed as having generic safety significance are addressed using existing NRC processes, including generic safety inspections in the ROP, the generic communications process, and the generic safety issue process.

The purposes of the ITP are to provide a means to assess whether the nuclear industry is maintaining the safety performance of operating reactors and, by clearly communicating that performance, to enhance stakeholder confidence in the efficacy of the NRC's processes. The specific objectives of the ITP are as follows:

- (1) Collect and monitor industry-wide data that can be used to assess whether the nuclear industry is maintaining the safety performance of operating plants and to provide feedback on the ROP.
- (2) Assess the safety significance and causes of any statistically significant adverse industry trends, determine if the trends represent an actual degradation in overall industry safety performance, and respond appropriately to any safety issues that may be identified.
- (3) Communicate industry-level information to Congress and other stakeholders in an effective and timely manner.

The NRC currently uses the results of the ITP in the following ways.

- (1) The NRC reports the industry indicators to Congress annually in the NRC's "Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series) and in the NRC's "Budget Estimates and Performance Plan Fiscal Year 200X" (NUREG-1100 series). The indicators demonstrate how the agency has met the measure of "no

statistically significant adverse industry trends in safety performance" for the performance goal of maintaining safety.

- (2) The NRC communicates overall industry performance to stakeholders by publishing the ITP indicators on the Nuclear Reactors portion of the agency's public Web site at <http://www.nrc.gov/reactors/operating/oversight/industry-trends.html>. The staff believes that communication of the industry-level indicators, when added to the information on individual plants from the ROP, enhances stakeholder confidence in the efficacy of the NRC's oversight of the nuclear industry.
- (3) The results of the ITP are a key element of the review by senior NRC managers of the agency's oversight of operating facilities in the annual AARM.
- (4) The staff informs the Commission of the results of the ITP in an annual report in the same timeframe as the AARM.
- (5) The Commission uses the ITP indicators when presenting the status of industry performance to the NRC's oversight committees and at major conferences with industry.
- (6) NRC managers use the ITP indicators to provide an overview of industry performance at various conferences with industry, such as the NRC's Regulatory Information Conference.

DISCUSSION:

The ITP is intended to monitor trends in industry safety performance so that the staff can identify and address adverse industry trends. The ITP accomplishes this using indicators of known conditions and issues that are compiled from the best available data. The staff monitors a comprehensive set of indicators; however, the staff recognizes that the ITP has limits as to what can be tracked and trended. Oversight of plant-specific conditions and events is provided by the ROP. The staff's approach recognizes that new and unforeseen events will inevitably occur, such as the significant erosion of the reactor vessel head at Davis-Besse. The staff is mindful of the need to respond promptly to these events, as well as the need to review its regulatory processes in light of the issues revealed by these events.

RESULTS OF FY 2002 TREND ANALYSES

A key output of the ITP is that it provides the basis for agency monitoring and reporting to Congress against the performance goal measure of "no statistically significant adverse industry trends in safety performance," as established by the NRC's Strategic Plan. In early FY 2001, NRR assumed responsibility from RES for reporting on this measure as part of NRR's overall responsibilities in the Reactor Safety arena. The current bases for assessing performance against this measure are trends in the industry indicators developed by the former AEOD (henceforth referred to as the "AEOD indicators") and trends identified by the ASP Program. Notably, these indicators were among those cited as demonstrating improvements in industry safety performance that contributed to the agency's decision to revise the oversight process for operating power reactors.

Based on the AEOD indicators and the ASP Program results, no statistically significant adverse trends in industry safety performance were identified through the end of FY 2002. Graphs of the trends for each of these indicators are presented in Attachment 2. The results and graphs were also included in the NRC's Performance and Accountability Report for FY 2002.

In addition, as discussed in SECY-01-0111, the staff adopted a statistical approach using "prediction limits" to provide a consistent method to identify potential short-term year-to-year emergent issues before they manifest themselves as long-term trends. Although the ASP indicator in Figure A2-8 did not cross a prediction limit, there appears to be a relatively low number of precursors between 1997 and 1999 and an increasing number of potential precursors in 2000 and 2001. For 2000 and 2001, the staff's analyses are only preliminary and the number of ASP events may decrease as the analyses are finalized. Nonetheless, the staff intends to follow the ITP process discussed in Attachment 1 to analyze these short-term variations in the number of ASP events. The evaluation will be a joint project between NRR and RES as part of the ITP. The evaluation may include a review of the risk significance of the events, types of facilities involved, a categorization of causes and factors for analyzed events and conditions, the time period for analysis, and whether any additional actions are appropriate.

In SECY-02-0058, the staff analyzed two indicators that had exceeded their prediction limits for FY 2001, but did not identify any safety issues associated with exceeding those limits. In early FY 2002, the staff reviewed its methods for setting prediction limits and modified them to use data starting in about 1996 instead of 1988, since this more recent timeframe was assessed to be more representative of current industry performance. In general, the modification had the effect of raising the prediction limits for FY 2002 to about the level of industry performance in 1996. No AEOD indicators exceeded their prediction limits during FY 2002.

ITP PROGRAM DEVELOPMENT

1. Incorporation of Additional Industry Operating Experience

The NRC's Davis-Besse Lessons Learned Task Force (DBLLTF) provided a number of recommendations to improve NRC utilization of operating experience information. The staff is currently assessing its processes for handling this information, including the ITP, to determine what changes or enhancements may be appropriate, and will highlight any necessary changes to the ITP in the next annual report to the Commission.

For example, the staff is assessing whether operating experience information from various agency databases can be used to develop additional indicators that can provide improved feedback to the ROP, particularly the inspection program. The staff is updating the data that have been published in various NUREG-series reports for system reliability studies, component reliability studies, common-cause failure studies, and other special studies for which industry-wide trends were reported. This work is anticipated to be completed over the next 1-2 years. In addition, as a means of providing greater stakeholder access to this information, the staff is developing a Web-based system to replace the current paper-based system of NUREG-series reports.

In addition, partly in response to a recommendation by the DBLLTF, the staff intends to assess how to more effectively incorporate foreign operating experience information into the ITP. The

staff will build on the international work on PIs described in SECY-02-0030, "Summary Report on NRC's Historical Efforts To Develop and Use Performance Indicators." This would include enhanced participation with efforts of the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, principally through its Committee on the Safety of Nuclear Installations and its Committee of Nuclear Regulatory Authorities.

2. Development of Additional, More Risk-informed Indicators

The staff has continued to develop additional indicators that are more risk-informed and better aligned with the cornerstones of safety in the ROP. For example, the staff has continued development of industry-level indicators from the data that licensees submit for the plant-level ROP PIs. However, since the ROP was only implemented in April 2000, there is still insufficient data for reliable long-term trending (<4 years) of these indicators. Nonetheless, based on a review of the indicator data submitted to date, no significant short-term trends have emerged.

As discussed in SECY-02-0058, the staff developed additional risk-informed indicators for the initiating events cornerstone, consisting of multiple indicators of initiating events for both pressurized water reactors (PWRs) and boiling water reactors (BWRs). This effort involved updating the data that was most recently published in NUREG-5750, "Initiating Events at U.S. Nuclear Power Plants: 1987-1995." In general, the number of initiating events has continued to decline over the past decade. During FY 2002, the staff built on this work in developing an overall industry-level indicator for the initiating events cornerstone. An overall indicator can provide a better representation of the overall risk from initiating events than multiple individual indicators of initiating events with varying degrees of risk significance. For example, it is possible that there could be an increase in loss of feedwater events in any given year, but the overall risk from all initiating events may actually have declined if the contribution to risk from that single indicator is low and the contribution to risk from all other initiating events has declined.

This overall indicator of initiating events, called the Industry Initiating Events Performance Indicator (IIEPI), consists of an index of the most risk significant industry initiating events. This set of events is defined in NUREG-1753, "Risk-Based Performance Indicators: Results of Phase 1 Development," as those events that contribute >1 percent to industry core damage frequency and that have occurred at least once during the period 1987-1995. An index was developed for BWRs that has 9 risk-significant initiating events, and a similar index was developed for PWRs that has 10 events (the additional category of events is steam generator tube ruptures). Each initiating event is weighted in the index based on its relative contribution to industry core damage frequency. Although the indicator is being developed to monitor industry-level performance, it could potentially be adapted to monitor plant-level performance as well, similar to the Mitigating Systems Performance Index (MSPI) that is currently being assessed in a pilot program as part of the ROP PIs. The IIEPI is discussed in more detail in Attachment 3.

The staff has given briefings on the IIEPI concept during periodic ROP working group public meetings, and has briefed two subcommittees of the Advisory Committee on Reactor Safeguards (ACRS). The staff has received valuable feedback during these meetings, and no major concerns have been identified to date. The staff intends to increase its interactions with

stakeholders on the IIEPI during this fiscal year, working towards a pilot program and possible implementation within 1–2 years.

3. Risk-Informed Response Thresholds

In SECY-01-0111, the staff stated that it was developing risk-informed thresholds, to the extent practicable, which would be used to determine the appropriate agency response to trends in indicator data. This could enable the staff to establish a more objective and predictable agency response in a manner analogous to the ROP's Action Matrix. The use of thresholds would also preclude a scenario in which the improving trends in indicators have leveled off, presumably when the practical performance limits of operating plants have been reached, and then a small decline in performance results in an adverse trend that would necessitate a report to Congress as an adverse trend, notwithstanding the fact that industry performance is better than it was before the trends leveled. In the staff requirements memorandum (SRM) related to SECY-01-0111 dated August 2, 2001, the Commission directed the staff to develop risk-informed thresholds for the industry-level indicators "as soon as practicable."

The staff formed an interoffice working group to examine the feasibility of developing thresholds for indicators in all cornerstones of safety. For the initiating events and mitigating systems cornerstones, risk-informed thresholds appeared to be possible since NRC risk analysis tools, such as the Standardized Plant Analysis Risk (SPAR) models, were available. However, in light of the development of more risk-informed indicators for the initiating events cornerstone (e.g., the IIEPI) and the mitigating systems cornerstone (e.g., the MSPI as part of the plant-specific ROP PIs), the staff prioritized its resources on developing those potential replacement indicators rather than on developing risk-informed thresholds for the current set of ITP indicators.

In addition, the working group examined development of thresholds for indicators in other cornerstones of safety and for the AEOD indicators, which do not lend themselves to development of risk-informed thresholds due to lack of risk models. The working group used a statistical approach based on prediction limits for ITP indicators to explore whether thresholds could be established. Although thresholds using a statistical approach were developed, the staff encountered some difficulty in determining the appropriate level for regulatory action. For example, a statistical approach to setting the threshold for the alert notification system reliability indicator in the emergency protection cornerstone resulted in a threshold of about 97 percent, compared to the current actual industry performance of about 99 percent. However, if the reliability dropped below the threshold to 96 percent, the staff would likely not take regulatory action on an industry-wide basis because the reliability is still high and appears acceptable. The staff intends to seek stakeholder input, including input from the ACRS, while continuing staff actions to develop thresholds.

4. Potential Single Integrated Indicator of Industry Performance

Attachment 4 shows an integrated indicator, known as the Action Matrix Summary. It is a histogram that shows the number of plants in each column of the NRC's Action Matrix since initial implementation of the revised ROP. This single indicator provides a representative picture of industry performance because it effectively rolls up both performance indicators and inspection findings from the ROP in all cornerstones of safety.

The staff is considering establishing a new strategic plan performance goal measure that would count the number of plants with significant performance issues, and would use the Action Matrix Summary indicator for reporting against the measure. For example, the measure could be "no more than 5 plants in the multiple/degraded cornerstone column or above." Consistent with the intent of the Government and Performance Results Act to tie agency actions to performance measures, this measure has the advantage that the staff is already taking actions to address safety issues for these plants in an objective and predictable manner in accordance with the Action Matrix for the ROP.

This measure is in addition to the existing performance goal measure of "no adverse industry trends." The staff is pursuing this performance goal measure for use in the NRC's Budget Estimates and Performance Plan for FY 2005 (also known as the Blue Book and Green Book). However, in accordance with reporting guidelines from the NRC's Office of the Chief Financial Officer (OCFO), reporting for this measure would commence in the NRC's Performance and Accountability Report for FY 2004.

5. Improved Data Collection and Reporting

Licensees report operating experience data to the NRC, including data for the ROP plant-level indicators, licensee event reports (LERs), and monthly operating reports. Licensees also report additional data to other organizations such as the Institute of Nuclear Power Operations (INPO). The staff uses all of these reports as data sources for the indicators used in the ITP, and the databases are essential to investigating safety issues when trends in the ITP indicators are identified. The databases are also used as part of the bases for changes to ROP PIs and inspection procedures.

The staff continues to seek improvements and efficiencies in data collection and reporting by industry for both the ITP and the ROP. For example, RES coordinated with NRR to consolidate coding of LERs by two Department of Energy laboratories into one laboratory, thereby saving the agency about \$500K per year. In addition, the staff is currently working extensively with industry to develop a consistent set of data elements, definitions, and reporting guidelines for reliability and unavailability data that would encompass the needs of all stakeholders. Finally, the staff is working with the industry Consolidated Data Advisory Committee of INPO to develop a common collection system for industry operating experience data that can be used by both the NRC and INPO. These development efforts are expected to continue over the next several years.

RESOURCES:

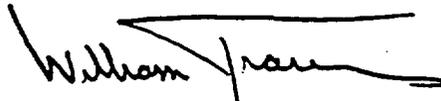
For FY 2003, NRR has budgeted 1.5 full-time equivalent (FTE) and \$254K for the continued development and implementation of the ITP. For FYs 2004 through 2006, NRR estimates resource requirements of 1.5 FTE per year, with estimated contract assistance funding requirements of about \$254K per year. NRR has included these requirements in its budget request submittals. For FY 2003, RES has budgeted 0.5 FTE and \$270K for the development of risk-informed thresholds for indicators in the ITP. For FY 2004, RES budgeted 0.5 FTE and \$240K, and for FY 2005 and FY 2006 estimates 0.5 FTE and \$50-100K will be required. RES is developing the operational experience data and risk models as part of existing programs that are currently budgeted. Should additional resources be needed to accomplish these tasks,

the staff will reprogram the resources from within the current budget using the NRC's Planning, Budgeting, and Performance Management process.

COORDINATION:

The Office of the Chief Financial Officer has reviewed this paper and concurs with the resource estimates.

The Office of the General Counsel has reviewed this paper and has no legal objection.



William D. Travers
Executive Director
for Operations

- Attachments:
1. Description of the ITP process
 2. FY 2002 Trend Results Based on AEOD and ASP Indicators
 3. Description of the Industry Initiating Events Performance Indicator
 4. Action Matrix Summary

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Description of the Industry Trends Program (ITP) Process

1. Background

The U.S. Nuclear Regulatory Commission (NRC) provides oversight of plant safety performance on a plant-specific basis using both inspection findings and plant-level performance indicators (PIs) as part of its Reactor Oversight Process (ROP). Individual issues that are identified as having generic safety significance are addressed using other NRC processes, including the generic communications process and the generic safety issue process. As discussed in SECY-01-0111, "Development of an Industry Trends Program for Operating Power Reactors," the NRC's Office of Nuclear Reactor Regulation (NRR) initiated the ITP to complement these processes by monitoring and assessing industry-level trends in safety performance.

The purposes of the ITP are to provide a means to confirm that the nuclear industry is maintaining the safety performance of operating reactors and, by clearly demonstrating that performance, to enhance stakeholder confidence in the efficacy of the NRC's processes. The objectives of the ITP are as follows:

- Collect and monitor industry-wide data that can be used to assess whether the nuclear industry is maintaining the safety performance of operating plants and to provide feedback on the ROP.
- Assess the safety significance and causes of any statistically significant adverse industry trends, determine if the trends represent an actual degradation in overall industry safety performance, and respond appropriately to any safety issues that may be identified.
- Communicate industry-level information to Congress and other stakeholders in an effective and timely manner.

A key output of the ITP is that it provides the basis for agency monitoring and reporting in the Nuclear Reactor Safety arena against the performance goal measure of "no statistically significant adverse industry trends in safety performance," as defined by the NRC's Strategic Plan. The agency reports these results annually to Congress in the Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series). In early FY 2001, NRR assumed responsibility from the NRC's Office of Nuclear Regulatory Research (RES) for reporting on this measure as part of NRR's overall responsibilities in the Reactor Safety arena. The current bases for assessing performance against this measure are trends in the industry indicators developed by the former NRC Office of Evaluation of Operational Data (AEOD) and trends identified by the ASP Program. Notably, these indicators were among those cited as demonstrating improvements in industry safety performance that contributed to the agency's decision to revise the ROP.

In developing the ITP, the staff used the following general concepts for its approach:

- The indicators were developed using information available from current NRC programs. In the future, indicators will be developed in stages, and will provide information for each ROP cornerstone of safety.
- Industry trend information is derived from quantitative, industry-wide data.
- Trends are identified on the basis of long-term data, rather than short-term data. This minimizes the impact of short-term variations in data, which may be attributable to such factors as operating cycle phase, seasonal variations, and random fluctuations.
- Trends and contributing factors are assessed for safety significance. The results of inspections, analyses of significant events and abnormal occurrences, and other analyses may be used to facilitate an evaluation of the trends. The agency's response is commensurate with the safety significance.
- While additional indicators are being developed, a subset of high-level indicators may be used for the report on adverse trends to Congress in the NRC's Performance and Accountability Report. For reporting on the performance measure of "no statistically significant adverse industry trends in safety performance," indicators will be qualified for use in phases. Until they are qualified, the staff will continue to use the AEOD indicators and ASP results. Additional indicators from the ITP will be incorporated for use in accordance with a controlled process for making such changes to the NRC's Performance Plan. In addition, the staff intends to consider refinements to the performance measure as the indicators and more risk-informed methods of assessing their safety significance are developed.

2. ITP Process

A flowchart of the ITP process is shown below

Industry Trends Program

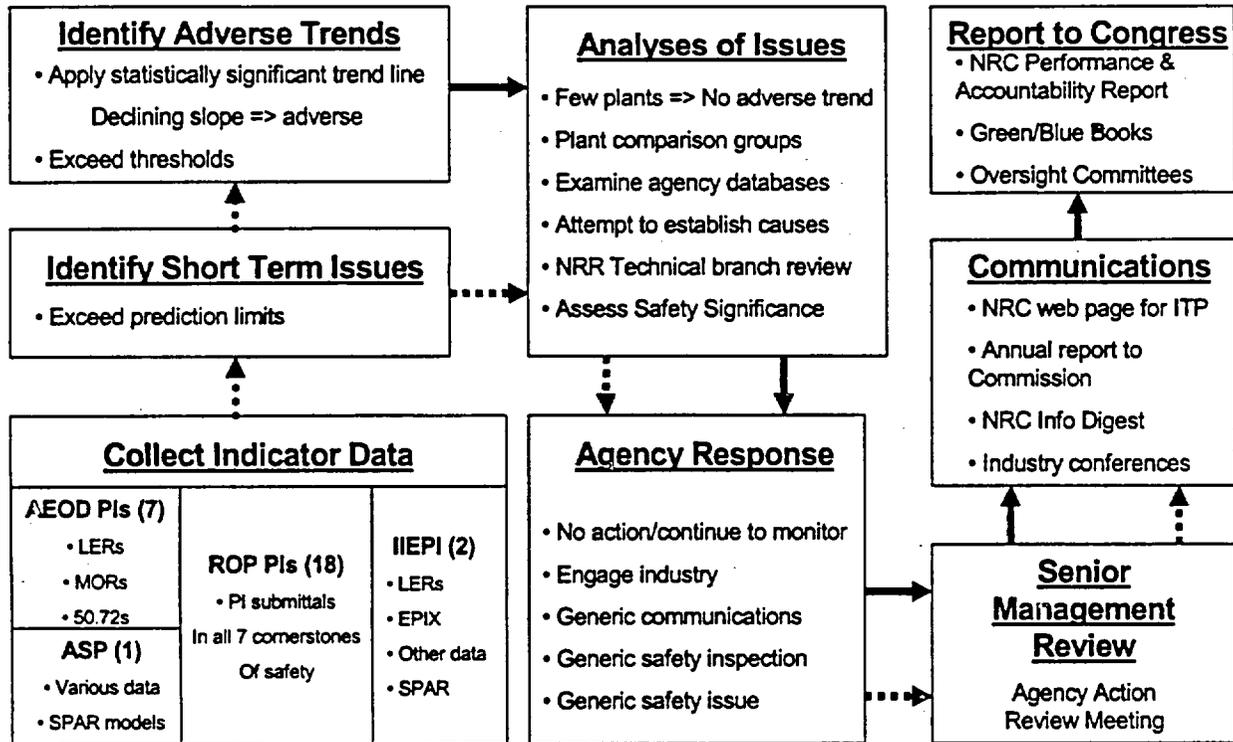


Figure 1-1 Industry Trends Program process flowchart

Collect Indicator Data

In developing the ITP, the staff used information currently available from existing NRC programs to develop an initial set of indicators for identifying adverse industry trends. The indicators consisted of the 7 indicators in the AEOD indicator program and the results of the ASP program. In addition, the staff is developing more risk-informed industry-wide indicators using data from the 18 plant-level indicators submitted by licensees for the ROP PI program. The staff also identified potential indicators for initiating events that are anticipated to be available from RES operating experience data. These indicators are being consolidated into an Industry Initiating Events Performance Indicator (IIEPI).

Identify Short-Term Issues

In addition, as discussed in SECY-01-0111, in FY 2001 NRR adopted a statistical approach using "prediction limits" to provide a consistent method to identify potential short-term emergent issues before they manifest themselves as long-term trends. The prediction limits are values established at the beginning of a FY that set an upper bound on expected performance for that year for each indicator. Actual indicator values during the year can then be monitored and compared to the prediction limits. Indicators that cross the prediction limits are investigated to determine the factors contributing to the data. These factors are assessed for their safety significance and used to determine an appropriate agency response. However, should very obvious adverse trends emerge in the short-term data, the staff does not wait until the end of the annual reporting period to initiate a review.

Identify Adverse Trends

For purposes of assessing whether there are any statistically significant adverse industry trends, only long-term data is used. The trending of long-term data minimizes reacting to potential "false positive" indications that may emerge in short-term data. "Short-term" was defined to be less than four years to ensure that sufficient data (i.e., data for at least two typical nuclear plant operating cycles) is available so that valid trends can be distinguished from operating cycle effects such as refueling outages and from random fluctuations in the data and to allow sufficient data for the use of statistical methods. The staff expects that any variations beyond these will result from plant-specific issues which can be addressed under the ROP.

The staff applies common statistical techniques to the long-term indicator data to identify trends. These techniques have been previously adapted and used extensively by the former AEOD and by RES in reactor operating experience analyses over the past several years. In general terms, a trendline is fitted to each indicator using regression techniques. Once a statistically significant fit of a trendline is made to each indicator, the slope of the trendlines is examined. Improving or flat trendlines are not considered adverse and need not be investigated further. Degrading trendlines are considered adverse.

Analyses of Issues

Once an adverse trend is identified, the staff conducts an initial analysis of information readily available in the databases used to compile the indicator data to determine whether the trend is unduly influenced by a small number of outliers and to identify any contributing factors. If the

trend is the result of outliers, then it is not considered a trend requiring generic actions, and the agency will consider any appropriate plant-specific actions using the ROP. For example, the affected plants unduly influencing the adverse trend may have already exceeded plant-level thresholds under the ROP, and the NRC regional offices would conduct supplemental inspections at these plants to ensure the appropriate corrective actions have been taken. If the plants did not exceed any thresholds, while the NRC would not take regulatory actions beyond the ROP, the NRC would gather additional information on the issue within the scope of the ROP using risk-informed baseline inspections. The results of these inspections would be examined to determine if a generic issue existed requiring additional NRC review or generic inspections.

If no outliers are identified, the staff conducts a broader review to assess whether larger groups of facilities are contributing to the decline and to assess any contributing factors and causes. For example, the data review is expanded to include a review of various plant comparison groups, contributing factors such as the operational cycle stage of the facilities (shutdown, at-power, startup from refueling, etc.), and the apparent causes for the data (equipment failures, procedure problems, etc.). The staff will also conduct a more detailed review of applicable licensee event reports. Should a group of plants be identified, the staff will examine the results of previously conducted inspections at these plants, including any root causes and the extent of the conditions.

Once this information is reviewed, the staff assesses the safety significance of the underlying issues. The staff is mindful that trends in individual indicators must be considered in the larger context of their overall risk significance. For example, a hypothetical increase in automatic scrams from 0.4 to 0.7 per plant per year over several years may be a statistically significant trend in an adverse direction. However, it may not represent a significant increase in overall risk since the contribution of a small number of scrams is relatively low, and it is possible that overall risk may actually have declined if there were reductions in the frequency of more risk-significant initiating events or the reliability and availability of safety systems had improved. Depending on the issues, the staff may perform an additional evaluation using the most current risk analysis tools or an evaluation by the ASP Program.

Agency Response

Until thresholds for ITP indicators are developed to establish the significance of indicator data, should a statistically significant adverse trend in safety performance be identified or an indicator cross a prediction limit, the staff will determine the appropriate response using the NRC's established processes for addressing and communicating generic issues. These processes are described in SECY-99-143, "Revisions to Generic Communications Program."

In general, the issues will be assigned to the appropriate branch of NRR for initial review. The branch will engage NRC senior management and initiate early interaction with the nuclear power industry. Depending on the issue, the process could include requesting industry groups such as NEI or various owners groups to provide utility information. As discussed in SECY-00-0116, "Industry Initiatives in the Regulatory Process," industry initiatives, such as the formation of specialized working groups to address technical issues, may be used in lieu of, or to complement, regulatory actions. This can benefit both the NRC and the industry by identifying mutually satisfactory resolution approaches and reducing resource burdens.

Depending on the issues, the NRC may consider generic safety inspections at plants. In addition, the issues underlying the adverse trend may also be addressed as part of the generic safety issue process by RES. After this interaction, the NRC may consider additional regulatory actions as appropriate, such as issuing generic correspondence to disseminate or gather information, or conducting special inspections for generic issues. The process also includes consideration of whether any actions proposed by the NRC to address the issues constitute a backfit.

Senior Management Review

The industry trends program, results, and agency response are reviewed annually during the Agency Action Review Meeting (AARM). In general, the AARM is intended to review the appropriateness and effectiveness of staff actions already taken, rather than to make decisions on agency actions. NRC senior managers review the industry trends information and, if appropriate, recommend any additional actions beyond those implemented by the staff.

Communications With Stakeholders

The NRC communicates overall industry performance to stakeholders by publishing the ITP indicators on the Nuclear Reactors portion of the agency's public Web site at <http://www.nrc.gov/reactors/operating/oversight/industry-trends.html>. The staff believes that communication of the industry-level indicators, when added to the information on individual plants from the ROP, enhances stakeholder confidence in the efficacy of the NRC's oversight of the nuclear industry.

The staff informs the Commission of the results of the ITP in an annual report in the same timeframe as the AARM. The indicators are also published annually in the NRC's "Information Digest 200X" (NUREG-1350 series). In addition, NRC managers have historically presented industry indicators and trends at major conferences with industry.

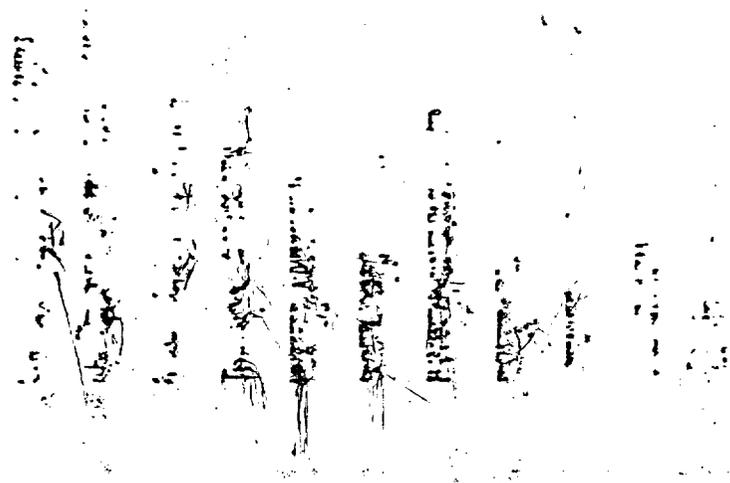
Reports to Congress

The NRC reports the industry indicators to Congress annually in the NRC's "Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series), and in the NRC's "Budget Estimates and Performance Plan Fiscal Year 200X" (NUREG-1100 series). The indicators demonstrate how the agency has met the measure of "no statistically significant adverse industry trends in safety performance" for the performance goal of maintain safety. Adverse trends would be reported, but indicators that exceeded prediction limits need not be included in these reports since these are tools to monitor industry performance rather than desired thresholds of performance.

In addition, the Commission has historically used the ITP indicators when presenting the status of industry performance to the NRC's oversight committees.

**FY 2002 Trend Results
Based on AEOD and ASP Indicators**

**Indicators Originally Developed by the Former Office of AEOD and
Accident Sequence Precursor (ASP) Indicators**



Automatic Scrams While Critical

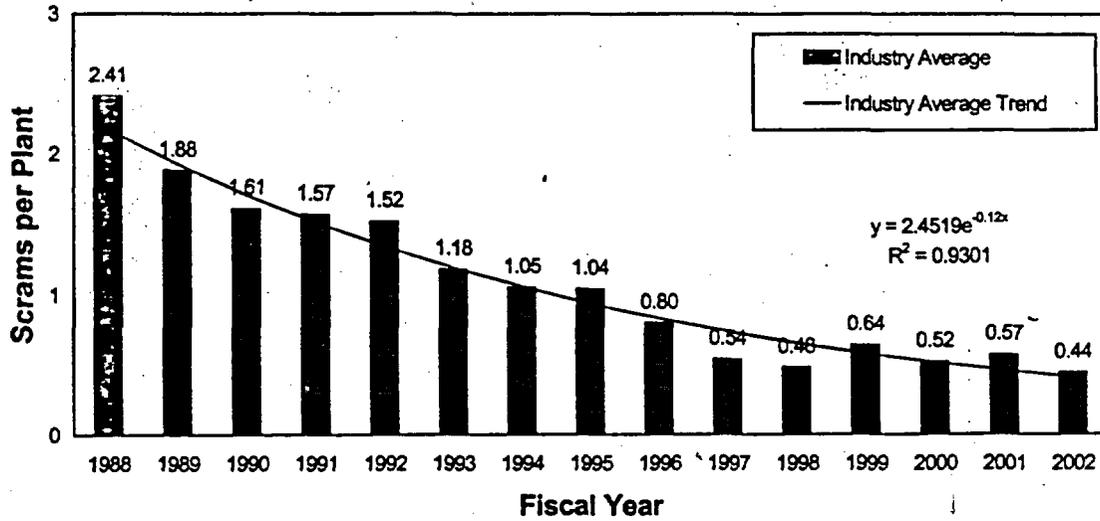


Figure A2-1

Safety System Failures

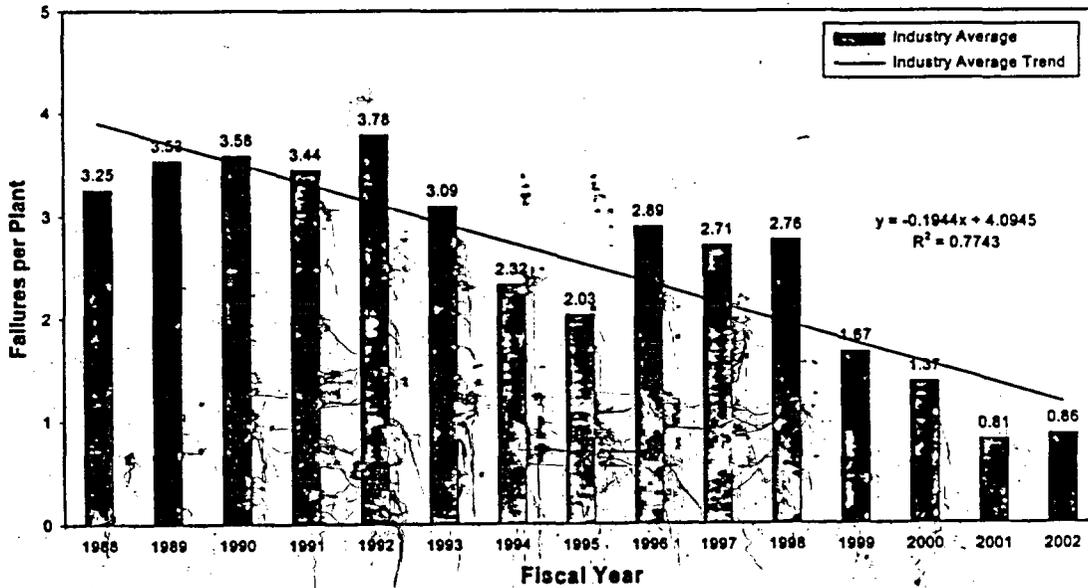


Figure A2-2

Safety System Actuations

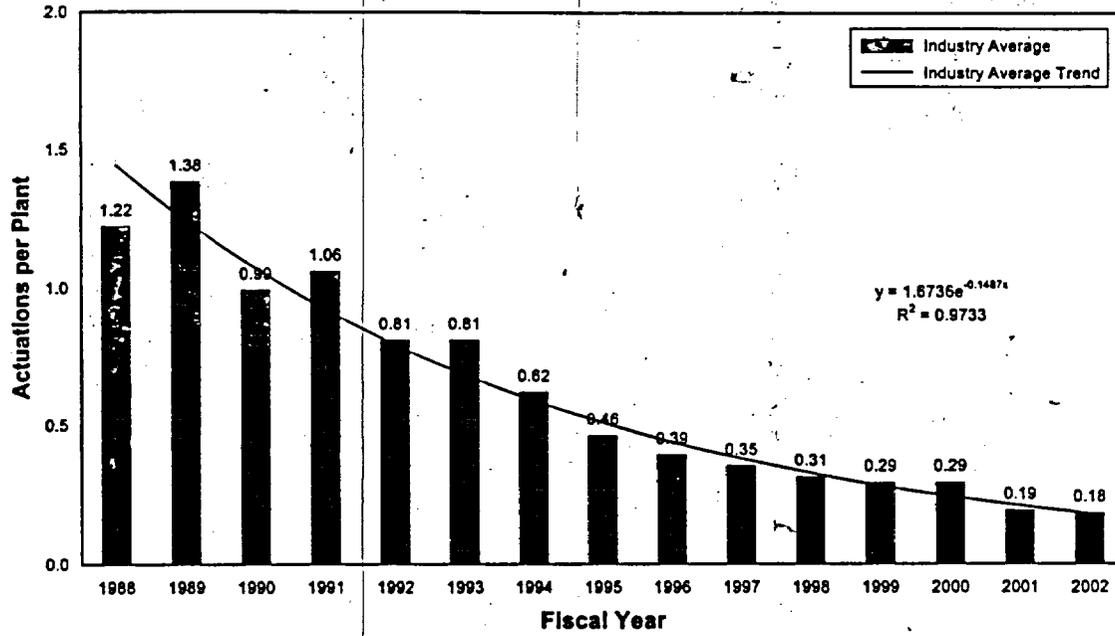


Figure A2-3

Forced Outage Rate (%)

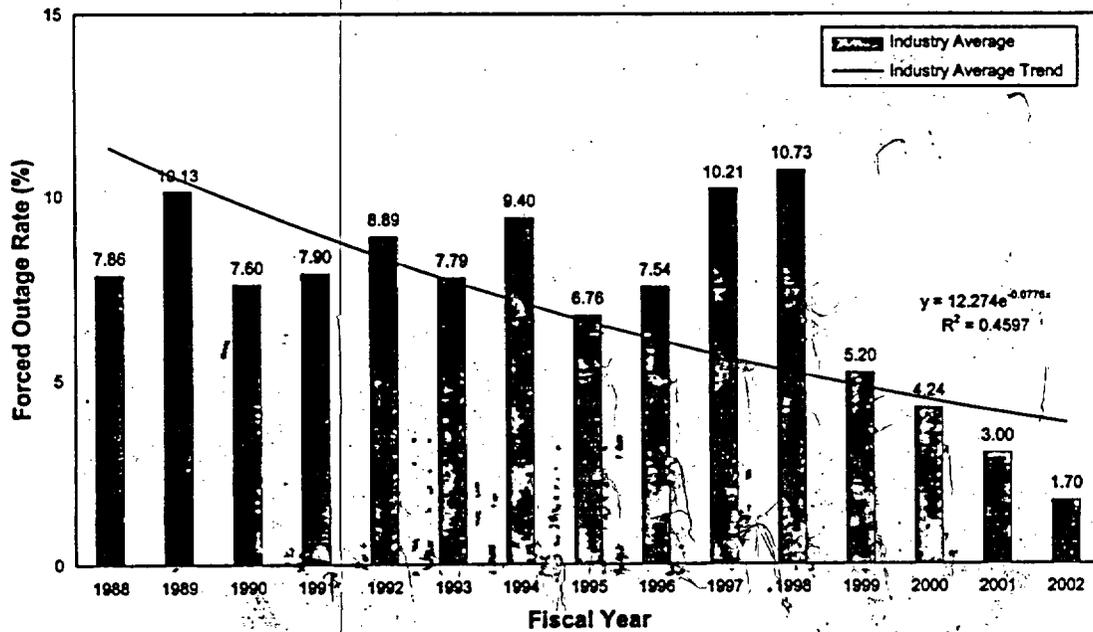


Figure A2-4

Equipment Forced Outages/ 1000 Commercial Critical Hours

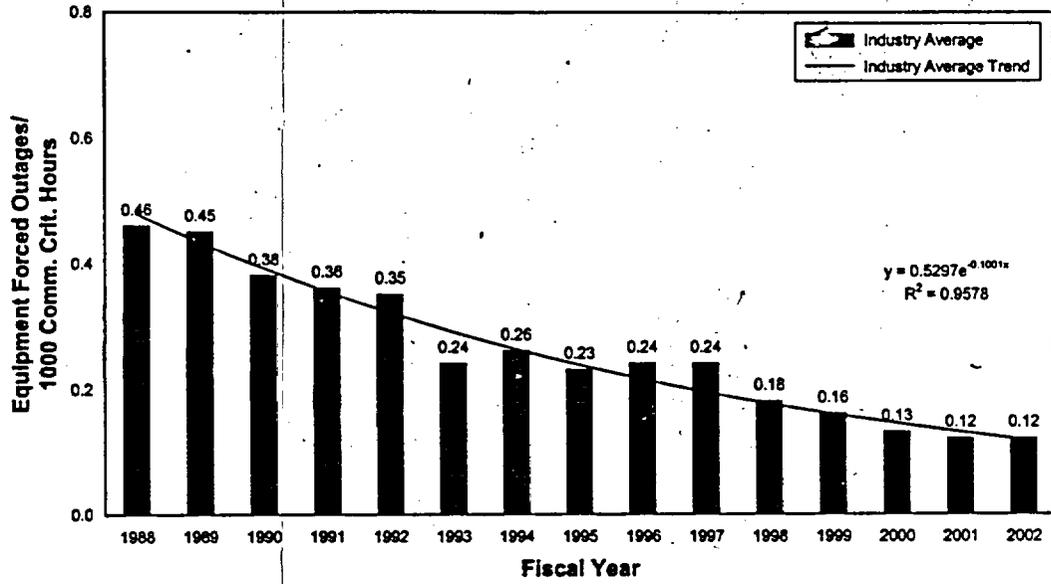


Figure A2-5

Collective Radiation Exposure

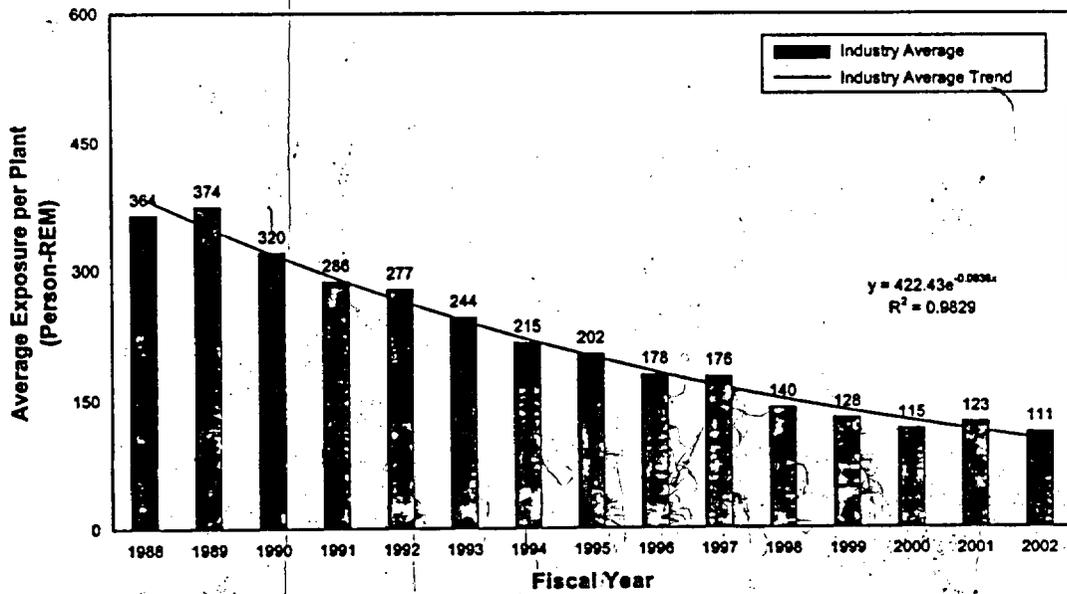


Figure A2-6

Significant Events

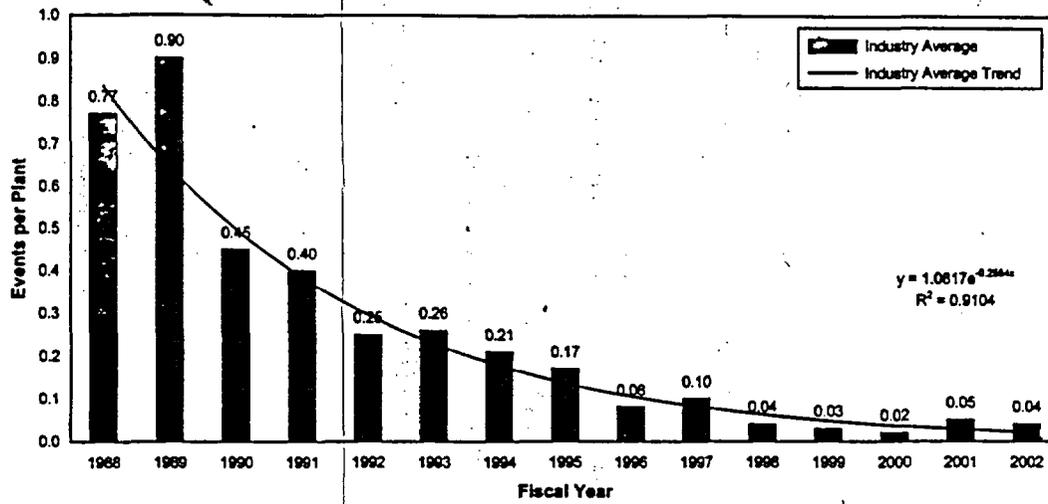


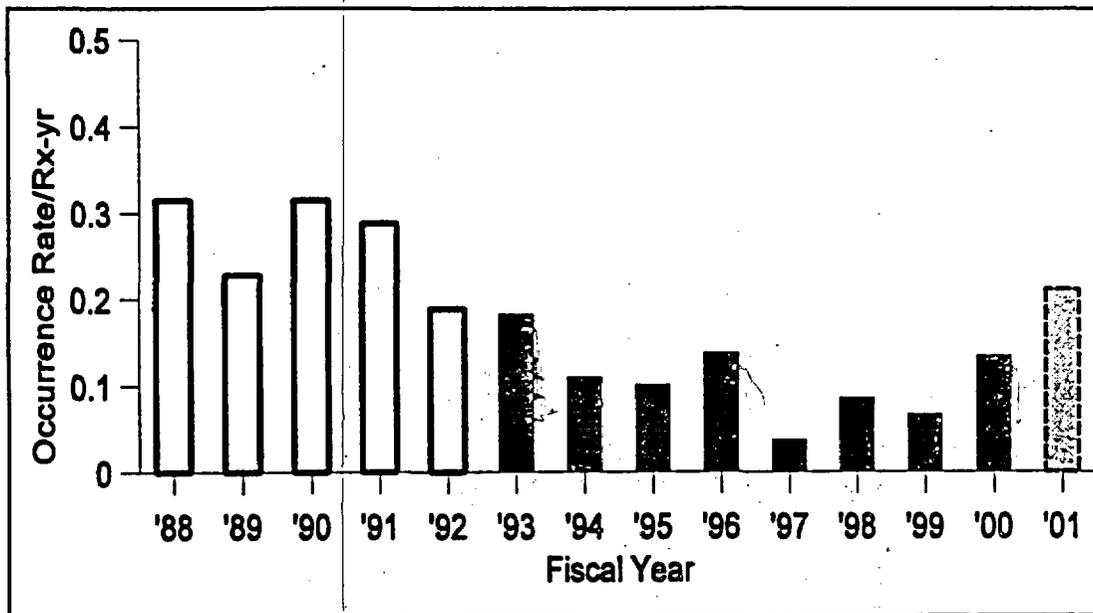
Figure A2-7

Accident Sequence Precursor Trends

Figure A2-8 below shows the occurrence rate per reactor-year for all Accident Sequence Precursor (ASP) events by fiscal year. No statistically significant trend was observed in the occurrence rate for all precursors (CCDP or Δ CCDP $\geq 10^{-6}$) during the 1993–2001 period (shaded bars in the figure).

The trend is based on the number of all precursors starting in FY 1993. Data prior to FY 1993 are shown in the figure to provide historical perspective. Analyses for FY 2000 are preliminary with final analyses nearing completion (pending resolution of peer review comments). The data for FY 2001 are based on ongoing analyses that have undergone internal staff review. The number of ASP events may decrease as the analyses are finalized. RES has provided additional information on the ASP Program in SECY-03-0049, "Status of the Accident Sequence Precursor (ASP) and the Development of Standardized Plant Analysis Risk (SPAR) Models."

Nonetheless, the staff will investigate the nature of the precursors to determine if there is an explanation for the relatively low number of precursors between 1997 and 1999 and the increasing number of potential precursors in 2000 and 2001. This evaluation will occur after RES completion of the preliminary analyses of FY 2001 events. This evaluation will be a joint project between NRR and RES as part of the Industry Trends Program. The evaluation may include a review of the risk significance of the events, types of facilities involved, a categorization of causes and factors for analyzed events and conditions, the time period for analysis, and whether any additional actions are appropriate.



All precursors—occurrence rate per reactor-calendar year, by fiscal year. No trend was identified during the FY 1993–2001 period. The results for 2000 and 2001 are preliminary. A trend line is not shown in the figure because the trend is not statistically significant.

Figure A2-8

Description of the Industry Initiating Events Performance Indicator

As discussed in SECY-02-0058, "Results of the Industry Trends Program for Operating Power Reactors and Status of Ongoing Development," RES developed about 10 additional risk-informed indicators for significant initiating events for both PWRs and BWRs. The staff developed these indicators by updating data that were most recently published in NUREG-5750, "Initiating Events at U.S. Nuclear Power Plants: 1987-1995." These indicators were selected because NUREG-1753, "Risk-Based Performance Indicators: Results of Phase 1 Development," identified them as events that contributed >1% to industry core damage frequency. The list of risk-significant initiating events is provided below.

1. Loss of Offsite Power
2. Loss of Safety-related Vital AC Bus
3. Loss of Safety-related Vital DC Bus
4. Small/Very Small Loss of Coolant Accident
5. Loss of Feedwater
6. Loss of Instrument Air/Control Valve
7. General Transients
8. Stuck Open Safety/Relief Valve
9. Loss of Heat Sink
10. Steam Generator Tube Rupture (PWRs only)

During FY 2002, RES and NRR built on this work by developing an overall industry-level indicator for the initiating events cornerstone. An overall indicator can provide a better representation of the overall risk from initiating events than multiple individual indicators of initiating events with varying degrees of risk significance. For example, it is possible that there could be an increase in loss of general transient events in any given year, but the overall risk from all initiating events may actually have declined if the contribution to risk from that single indicator is low and the contribution to risk from all other initiating events has declined.

This overall initiating events indicator, tentatively called the Industry Initiating Events Performance Indicator (IIEPI), consists of an index of these risk-significant industry initiating events. An index was developed for BWRs that has 9 risk-significant initiating events, and a similar index was developed for PWRs that has 10 events. Each initiating event is weighted in the index based on its contribution to industry core damage frequency (CDF).

The contribution of each initiating event to CDF is determined by multiplying the frequency of occurrence by a risk weighting factor. The contribution of the 9 or 10 terms is then summed to get the overall index for initiating events. Mathematically, this can be shown for an individual plant by the following equation:

$$CDF = \sum_{i=1}^m B_i \lambda_i$$

where the risk weighting factor is represented by B_j , and the initiating event frequency is represented by λ_j . The risk weighting factor is a common measure used in probabilistic risk assessments (PRAs) called the Birnbaum importance measure.

An industry average CDF can be calculated by using average industry values for the Birnbaum importance measures and the initiating event frequencies. This is illustrated in Figure 1.

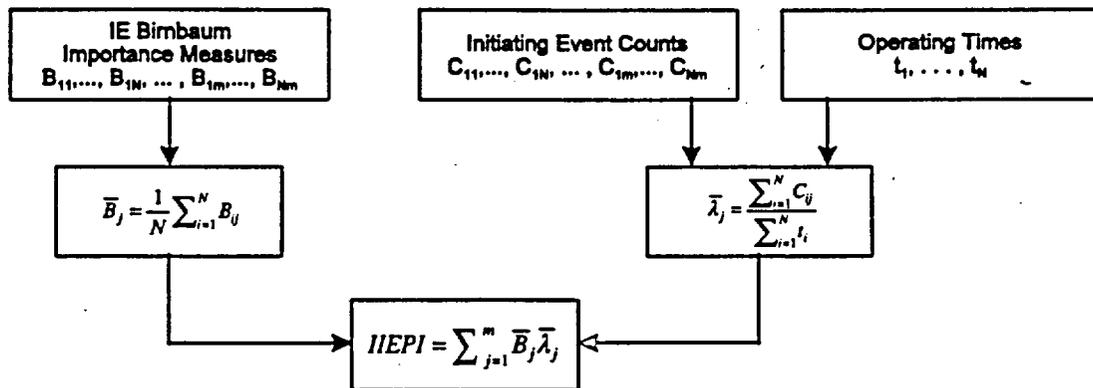


Figure A3-1 Integrated initiating event performance indicator calculations

In addition, should the concept be demonstrated successfully at the industry level, the indicator could potentially be adapted to monitor plant-level performance as well by using plant-specific values for either or both terms in the equation as appropriate. This approach would be similar to the Mitigating Systems Performance Index (MSPI) that is currently being assessed in a pilot program as part of the ROP PIs.

An interesting characteristic of the IIEPI is that it need not require any additional submission of data from licensees, even at the plant level. The staff currently receives all required information from existing data, including Licensee Event Reports (LERs) and Monthly Operating Reports (MORs), as shown in Figure 2.

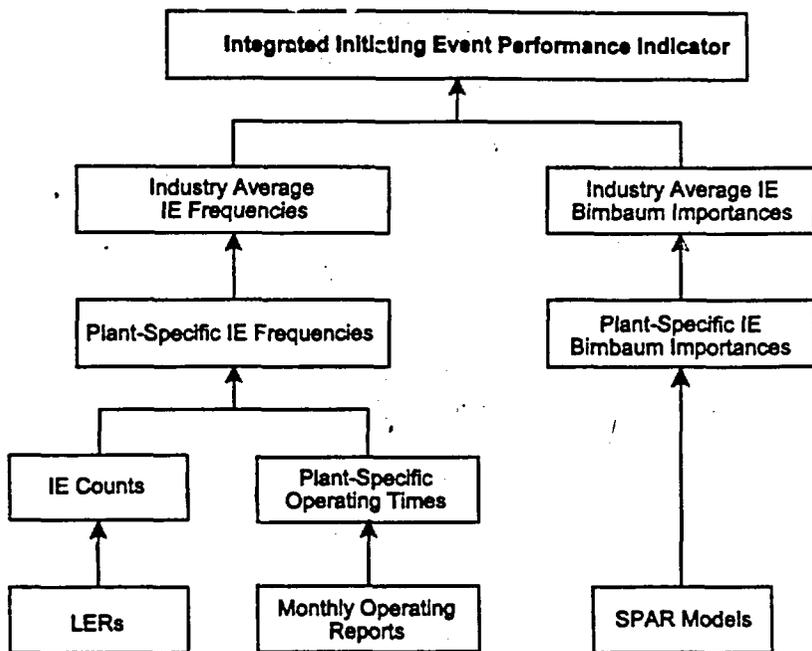


Figure A3-2 IIEPI data sources

An example of the IIEPI for PWRs is shown in Figure 3 for illustration only. These example calculations show the feasibility of the indicator. No attempt has been made to validate or verify these results.

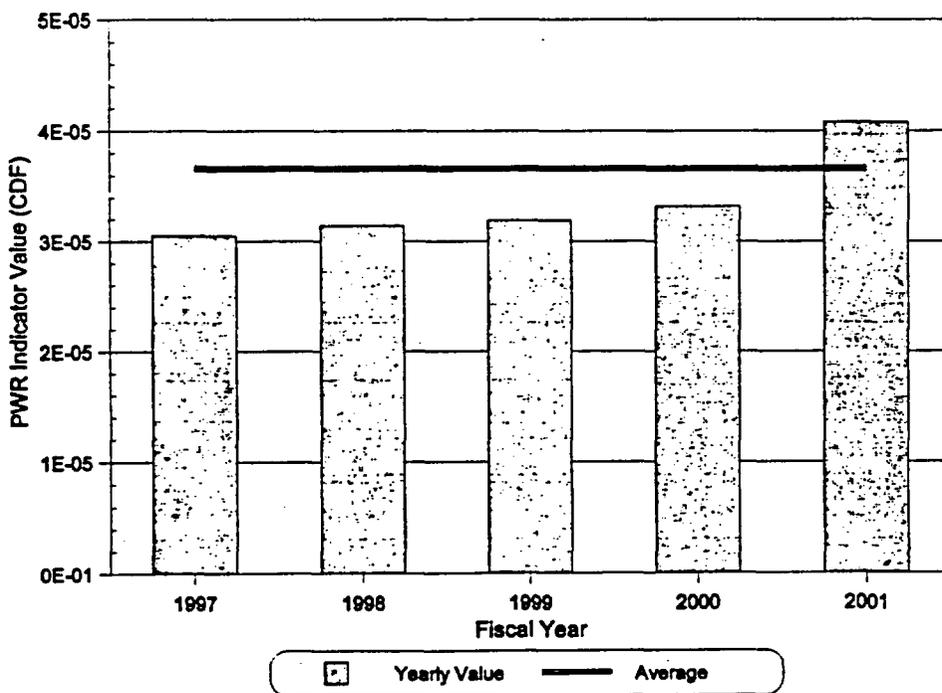


Figure A3-3. Example calculation for the IIEPI for PWRs

Action Matrix Summary

The NRC provided oversight of 103 operating power reactors using the Reactor Oversight Process (ROP). On average, approximately 75% of the plants were listed in the Licensee Response column of the ROP Action Matrix, which corresponds to the baseline level of NRC oversight. The chart below shows trends in the numbers of plants that are listed in the Regulatory Response, Degraded Cornerstone, Multiple/Repetitive Degraded Cornerstone, and Unacceptable Performance columns of the Action Matrix, which correspond to increasing levels of regulatory engagement with the licensee.

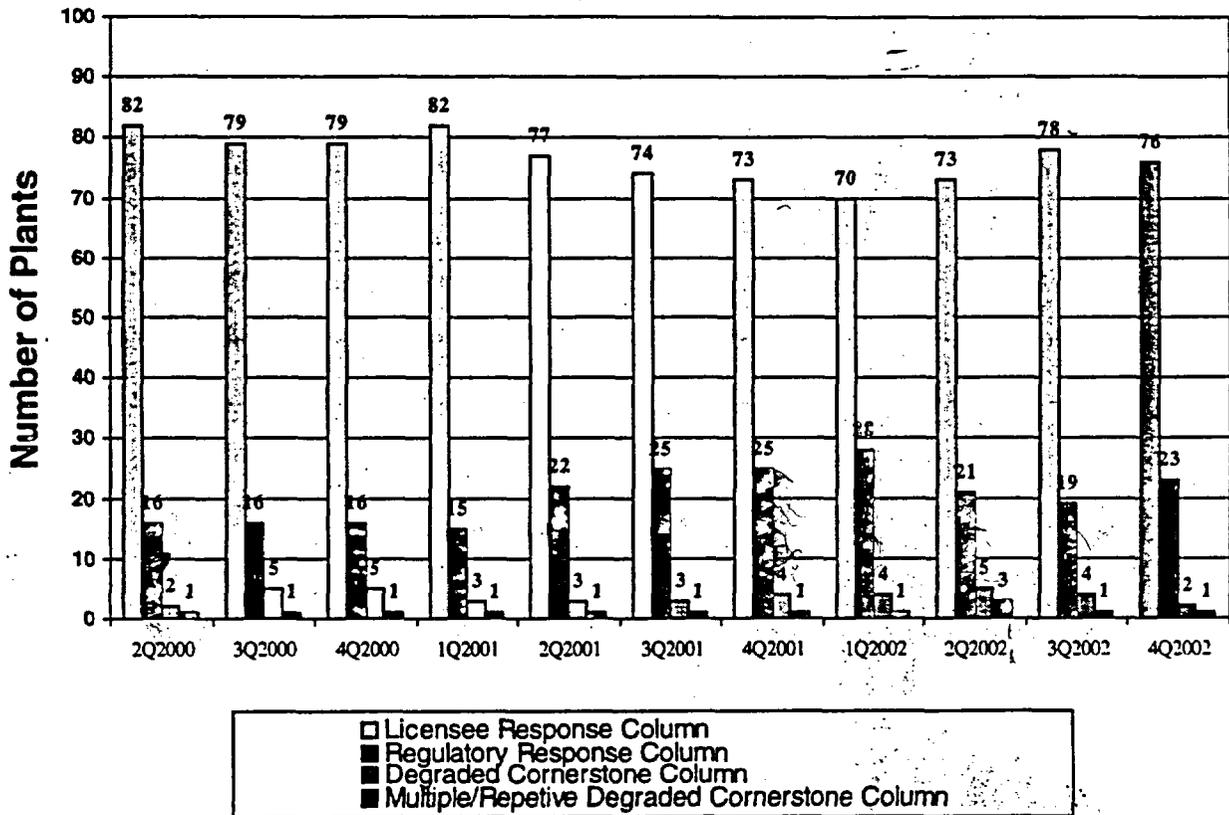


Figure A4-1

Notes for Figure A4-1:

1. This chart includes DC Cook units 1 and 2, beginning in 2Q/2001.
2. Davis-Besse is not included beginning in 2Q/2002 since under IMC 0350.
3. Data current as of January 2003.

The chart appears to show a slight migration of plants from the Licensee Response Column to the other columns in the Action Matrix. This can be attributed to several factors associated with the initial start up of the ROP. First, the staff has continued to work with industry to improve the ROP since initial implementation. These improvements include enhancements to its risk-informed inspection procedures, improved SDP Phase 2 notebooks, and improvements to the guidance for performance indicators. A second factor is that the staff is much more familiar with applying these risk-informed ROP tools and with the ROP processes. These factors have likely enhanced the ability of both the NRC and licensees to identify the most risk-significant aspects of licensee performance.

In addition, inspection findings that are determined to have greater than very low safety significance (green) are counted for 4 quarters when determining the appropriate column of the Action Matrix for licensees. Thus, for at least the first 4 quarters from the date of initial implementation of the ROP on April 2, 2000, the number of plants moving out of the Licensee Response Column has increased as inspection findings are accrued by plants under the ROP.