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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

RELIABILITY AND PRA SUBCOMMITTEE

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THE INDUSTRY TRENDS PROGRAM AND

PERFORMANCE INDICATORS

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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

NRC STAFF PRESENT:

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

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

and volume, so they may be readily heard.

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

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

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

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

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

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

MR. WALLIS: IIIEI is the same thing, isn't it?

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

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

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

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

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

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

and I would characterize the feedback as no show stoppers.

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

MS. WESTON: We have the final copy.

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

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

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

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

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

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

monitor for that sort of thing.

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

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

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

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

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

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

remarks for the Regulatory Information Conference last month.

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

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

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

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

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

MR. LEITCH: Yes, that's helpful.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN SHACK: All right.

MR. BOYCE: Who picked up on that one?

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

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

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

MR. WALLIS: Is there some reason you draw

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

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

MR. WALLIS: Okay.

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

MR. WALLIS: Okay.

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

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

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

MR. BOYCE: Right.

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

MR. BOYCE: Right.

MR. KRESS: And that's some time.

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

MR. KRESS: At-power, okay.

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

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

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

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

MR. RASMUSON: Right.

MR. WALLIS: From your SPAR monitor?

MR. RASMUSON: From our SPAR monitor, right.

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

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

on that.

MR. BOYCE: Yes.

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

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

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

terms into a single indicator.

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

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

level.

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

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

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

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

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

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

MR. LEITCH: Okay.

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

MR. LEITCH: Okay.

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

MR. LEITCH: Yes.

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

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

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

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

We also developed some example scenarios, which --

MR. RASMUSON: There's the flowchart.

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

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

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

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

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

Was that clear? Perhaps not.

MR. LEITCH: What are the two-tiers?

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

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

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

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

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

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

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

MR. RASMUSON: No.

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

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

CHAIRMAN SHACK: I just take the raw?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Let me just put up here at this point here

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

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

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

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

CHAIRMAN SHACK: Is the fitted trend.

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

CHAIRMAN SHACK: This mean value.

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

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

MR. RASMUSON: That's exactly right.

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

MR. RASMUSON: Right.

CHAIRMAN SHACK: -- with the mean value.

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

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

possibly as early as next year.

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

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

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

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

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

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

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

CHAIRMAN SHACK: It turns out to be equivalent.

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

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

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

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

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

MR. RASMUSON: Right.

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

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

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

MR. BOYCE: Right, right.

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

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

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

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

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

MR. LEITCH: I'm having trouble

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

MR. RASMUSON: Loss of vital --

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

MR. RASMUSON: Vital AC power.

MR. LEITCH: Vital AC power?

MR. RASMUSON: Yes.

MR. LEITCH: Now, why?

MR. RASMUSON: Well, in this case --

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

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

MR. LEITCH: Okay.

MR. RASMUSON: Okay?

MR. LEITCH: Yes.

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

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

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

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

MR. RASMUSON: ROP.

MR. LEITCH: Is that a correct understanding?

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

MR. LEITCH: Okay.

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

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

MR. LEITCH: Yes.

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

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

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

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

MR. RASMUSON: Exactly.

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

MR. RASMUSON: Yes, exactly.

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

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

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

MR. FORD: But if there were industry data

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

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

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

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

But we do have, as Tom mentioned, a task

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

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

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

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

MR. FORD: Okay.

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

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

MR. FORD: The cost?

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

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

MR. BOYCE: Okay.

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

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

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

CHAIRMAN SHACK: Well, but if you look at

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

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

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

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

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

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

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

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

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

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

MR. RASMUSON: Okay.

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

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

CHAIRMAN SHACK: But that's the total sum.

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

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

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

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

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

CHAIRMAN SHACK: I would see spiking, right.

MR. RASMUSON: Right, right.

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

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

you know.

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

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

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

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

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

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

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

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

MR. RASMUSON: No.

CHAIRMAN SHACK: No? Isn't it?

MR. RASMUSON: No.

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

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

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

using Bayesian consistently.

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

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

MR. RASMUSON: I think.

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

CHAIRMAN SHACK: Anymore?

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

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

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

CHAIRMAN SHACK: And that would really --

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

CHAIRMAN SHACK: Yes.

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

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

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

MR. RASMUSON: Yes.

CHAIRMAN SHACK: That was so important.

MR. RASMUSON: Right. Yes, yes.

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

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

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

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

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

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

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

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

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

just with the parameter uncertainty.

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

CHAIRMAN SHACK: Right.

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

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

MR. RASMUSON: On?

CHAIRMAN SHACK: In the SPAR models.

MR. RASMUSON: On one particular one?

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

MR. RASMUSON: Yes, in the report.

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

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

CHAIRMAN SHACK: Page 18 and 19.

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

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

MR. RASMUSON: Yes.

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

MR. RASMUSON: Yes.

CHAIRMAN SHACK: Which seems peculiar.

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

MR. RASMUSON: Yes.

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

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

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

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

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

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

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

MR. RASMUSON: Sort of, but not a real

definitive task in that regard, no.

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

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

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

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

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

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

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

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

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

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

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

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

MR. SIEBER: So today, you have no

thresholds for anything, right?

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

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

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

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

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

MR. SIEBER: That would be my next question.

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

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

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

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

MR. SIEBER: Yes.

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

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

MR. BOYCE: Correct.

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

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

MR. SIEBER: Right.

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

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

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

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

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

MR. BOYCE: Yes.

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

MR. BOYCE: Right, right.

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

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

MR. SIEBER: You haven't formalized it?

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

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

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

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

MR. SIEBER: Well, I can appreciate that.

MR. BOYCE: Yes.

MR. SIEBER: I can appreciate that.

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

MR. SIEBER: Yes, it is.

MR. BOYCE: And it just gets harder.

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

MR. BOYCE: Right.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

really do now?

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

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

MR. BOYCE: Right.

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

MR. BOYCE: Exactly.

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

MR. BOYCE: Agreed.

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

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

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

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

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

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

MR. BOYCE: I agree.

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

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

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

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

MR. RASMUSON: Yes, right.

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

MR. RASMUSON: Yes.

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

MR. RASMUSON: Okay.

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

MR. RASMUSON: Okay.

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

MR. RASMUSON: Okay.

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

MR. RASMUSON: Well, certainly, as we are

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

CHAIRMAN SHACK: Yes.

MR. SIEBER: I think that would be good.

MR. RASMUSON: Okay.

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

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

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

CHAIRMAN SHACK: Okay.

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

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

MS. WESTON: Right, right.

CHAIRMAN SHACK: Not of the ACRS.

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

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

MR. RASMUSON: Right.

MS. WESTON: Right.

CHAIRMAN SHACK: Right.

MR. SIEBER: And to not show up here for

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

CHAIRMAN SHACK: Or not.

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

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

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

MR. SIEBER: We have to work something out.

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

CHAIRMAN SHACK: Okay.

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

MS. WESTON: Yes.

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

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

MR. RASMUSON: That's right.

MR. SIEBER: As opposed to --

MR. RASMUSON: That's right.

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

MR. SIEBER: That's right.

MR. RASMUSON: See, so --

MS. WESTON: Then the comments are not official.

MR. RASMUSON: Right, yes.

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

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

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

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

CHAIRMAN SHACK: Right.

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

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

MS. WESTON: Right.

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

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

MS. WESTON: Yes.

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

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

MR. RASMUSON: No, I agree.

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

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

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

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

the panel.

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

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

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

What we use for measures of regulatory

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

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

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

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

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

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

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

MR. BONACA: Yes.

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

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

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

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

MR. BONACA: Yes.

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

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

but how do you --

MR. BOYCE: A sticking PORV?

MR. LEITCH: Excuse me?

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

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

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

MR. LEITCH: Right.

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

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

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

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

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

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

MR. SIEBER: Right.

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

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

MR. SIEBER: Like scram discharge valves?

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

MR. SIEBER: Right, it would be significant.

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

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

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

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

MR. SIEBER: Okay.

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

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

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

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

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

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

MS. WESTON: They are doing a presentation tomorrow.

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

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

MR. SIEBER: Right, yes.

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

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

MR. SIEBER: A $300,000 man.

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

MR. SIEBER: Okay.

CHAIRMAN SHACK: Any other comments or questions?

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

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

MR. SIEBER: Very timely.

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

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

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

MR. RASMUSON: Yes.

MR. WALLIS: Although, nothing is happening?

MR. RASMUSON: Yes.

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

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

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

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

MR. RASMUSON: We are doing points on regression.

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

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

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

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

MR. BOYCE: Please, step to the mike.

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

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

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

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

MR. ATWOOD: I believe that's possible.

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

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

MR. SIEBER: Yes, that's right.

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

MR. WALLIS: The curve will change, yes.

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

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

MR. WALLIS: It still looks weird.

CHAIRMAN SHACK: I know.

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

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

MR. ATWOOD: Or a median.

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

MR. WALLIS: Okay.

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

(Whereupon, the meeting was adjourned at 3:51 p.m.)

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

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

Outline of Presentation

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

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

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

ITP Process

Identify Adverse Trends
- Apply statistically significant trendline
  Degrading slope => adverse
- Exceed thresholds

Identify Short Term Issues
- Exceed prediction limits

Collect Indicator Data

Current PIs (7)	ROP PIs (18)	IIEPI (2)
• LERs • MORs • 50.72s	• PI submittals In all 7 cornerstones Of safety	• LERs •Other data • SPAR
ASP (1) • Various data • SPAR models		

Analyses of Issues
- Few plants => No adverse trend
- Plant comparison groups
- Examine agency databases
- Attempt to establish causes
- NRR Technical branch review

Agency Response
- No action/continue to monitor
- Engage Industry
- Generic communications
- Generic safety inspection
- Generic safety issue

Report to Congress
- NRC Performance & Accountability Report
- Green/Blue Books
- Oversight Committees

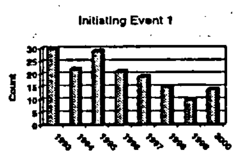
Communications
- NRC web page for ITP
- Annual report to Commission
- NRC Info Digest
- Industry conferences

Senior Management Review
Agency Action Review Meeting

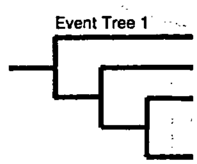
May 5, 2003 ACRS Joint Subcommittee 5

IIEPI Concept

Operating Experience



PRA Information



Industry Initiating Event Performance Indicator

May 5, 2003 ACRS Joint Subcommittee 6

IIEPI Equation

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

where

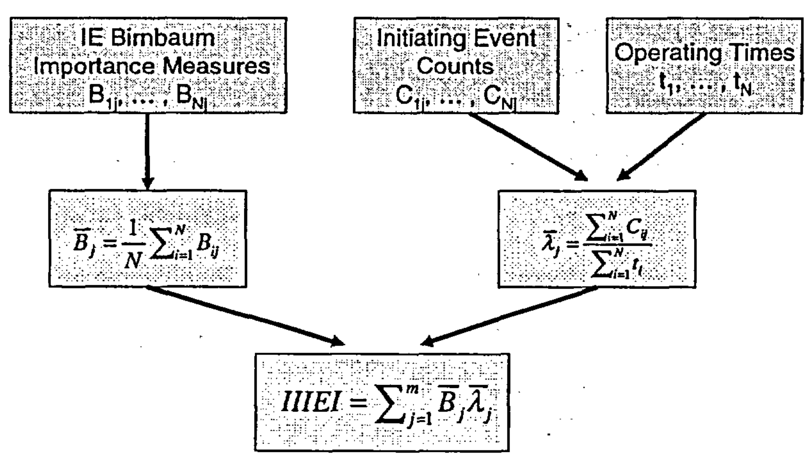
B_i = industry average risk weighting factor (Birnbaum importance measure) for initiating event i

λ_i = industry initiating event frequency

m = number of kinds of initiating events

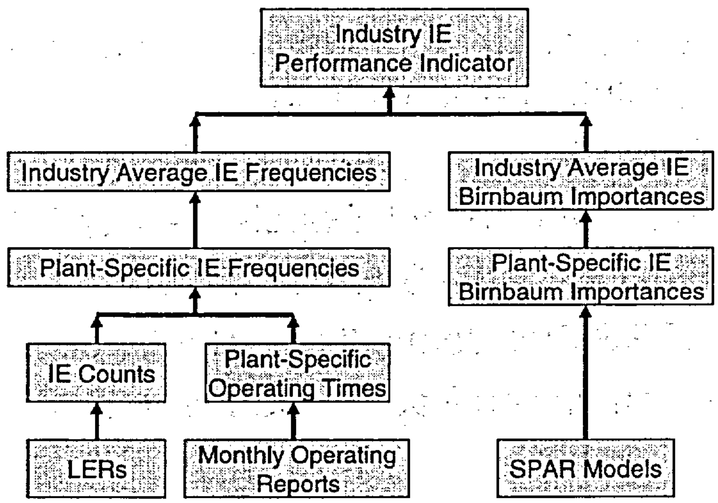
May 5, 2003 ACRS Joint Subcommittee 7

IIEPI Calculations



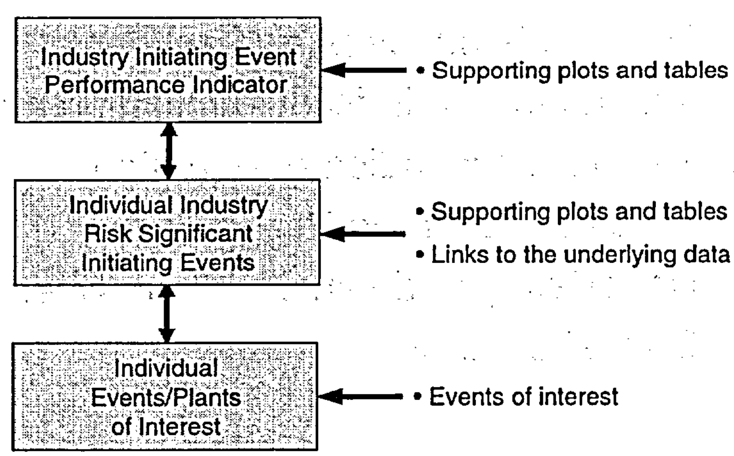
May 5, 2003 ACRS Joint Subcommittee 8

IIEPI Data Sources



May 5, 2003 ACRS Joint Subcommittee 9

Indicator Hierarchy



May 5, 2003 ACRS Joint Subcommittee 10

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

May 5, 2003 ACRS Joint Subcommittee 11

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

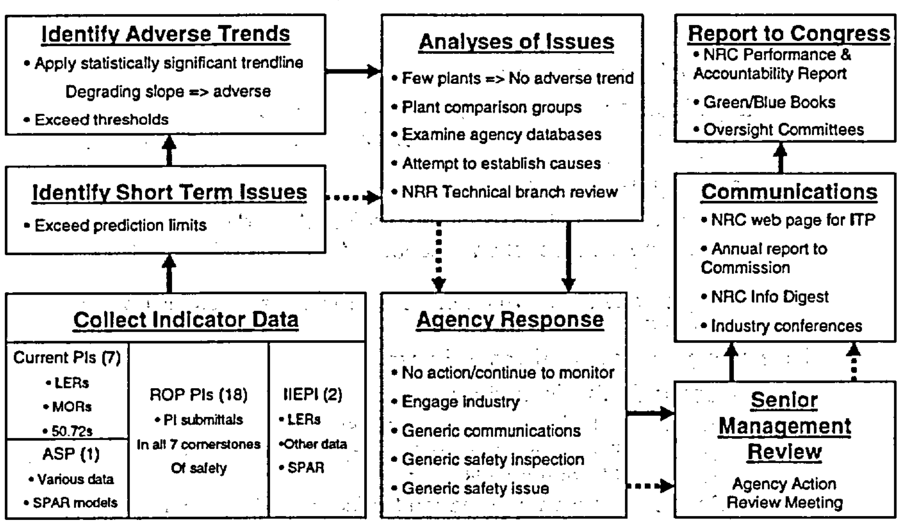
May 5, 2003 ACRS Joint Subcommittee 12

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

May 5, 2003 ACRS Joint Subcommittee 13

ITP Process



May 5, 2003 ACRS Joint Subcommittee 14

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

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

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

May 5, 2003 ACRS Joint Subcommittee 17

Definitions of Trend

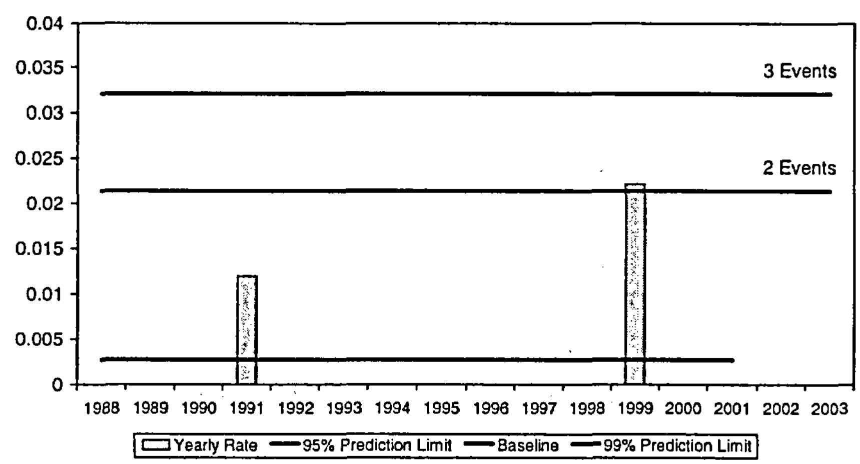
- Trend
  - The general movement in the course of time corresponding to a statistically detectable change
  - Also, a statistical curve reflecting such a change
- Statistically Significant Trend
  - A trend in which the p-value of the trend parameter is less than 5%
- Adverse Trend
  - A statistically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

May 5, 2003 ACRS Joint Subcommittee 18

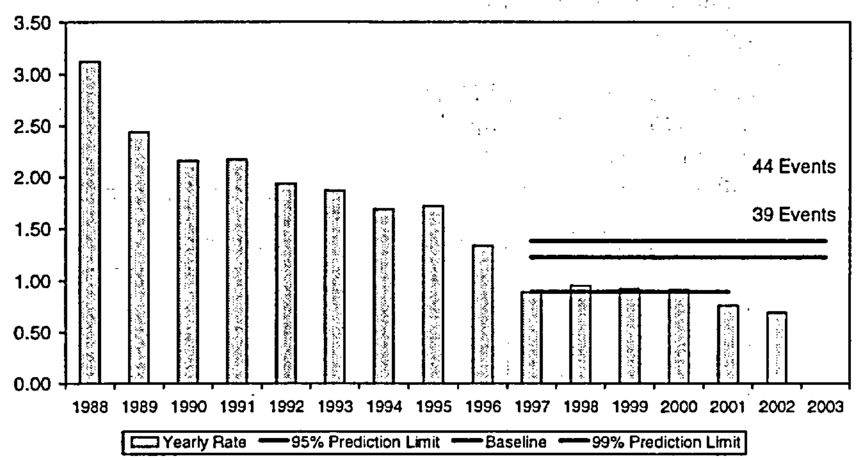
Flat Trend

- 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

Loss of Vital DC Bus



BWR General Transients



May 5, 2003 ACRS Joint Subcommittee 21

Industry vs. Plant Specific

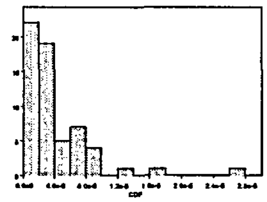
- Can estimate plant-specific frequencies for Initiating events that are not major contributors to CDF
- For those IEs that are major contributors, very little difference in IE frequency
  - Variation in CDF contribution is the variation in the Birnbaum importance measure

May 5, 2003 ACRS Joint Subcommittee 22

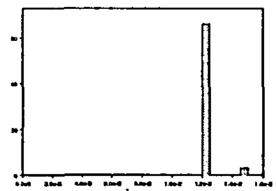
PWR Plant-Specific Example

- 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

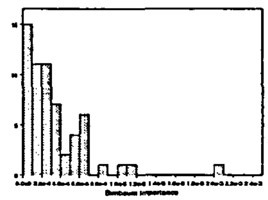
LOSP CDF Contribution



Plant-Specific LOSP Frequencies



Birnbaum Importances



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

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

BWR IIEPI Summary

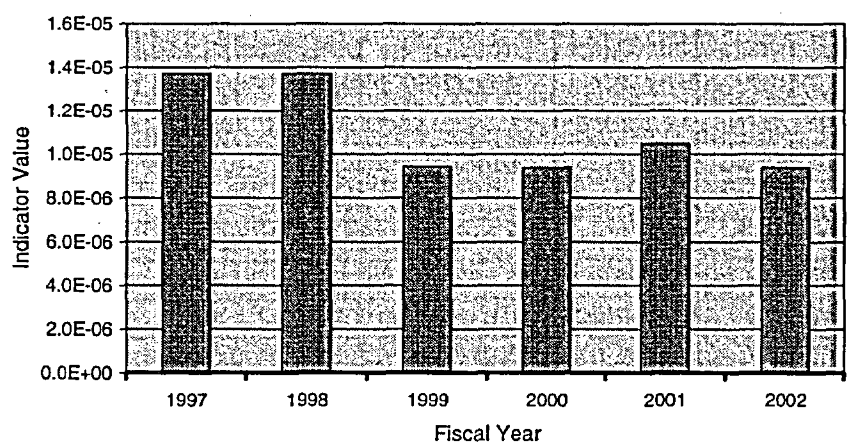
Initiating Event	Average Importance	Baseline Frequency	Baseline CDF	Percent of Mean	N_{Mean}	N_{95}
IE-LOCA	5.62E-05	0.0047	2.62E-07	2.5%	0.4	21.3
IE-TRANS	1.36E-06	0.8950	1.22E-06	11.6%	28.6	167.0
IE-LOHS	8.44E-06	0.1900	1.60E-06	15.3%	6.1	29.9
IE-LOFW	1.45E-05	0.1020	1.49E-06	14.2%	9.7	49.5
IE-LOSP	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%	–	–

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%	–	–

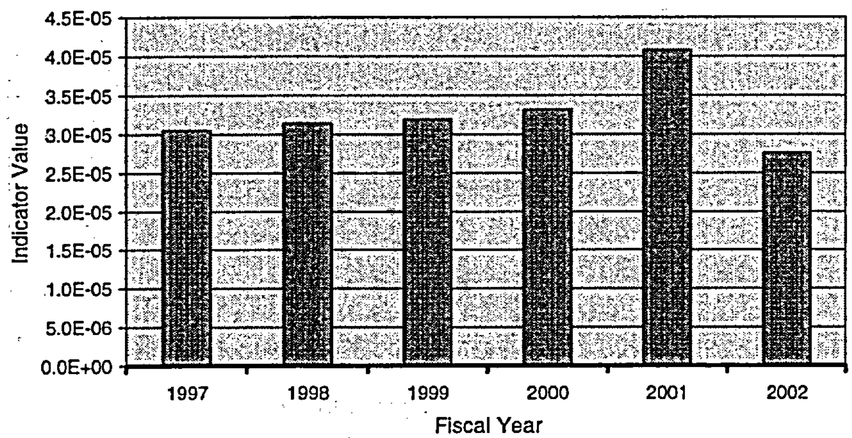
BWR IIEPI

(3-Year Bayesian Update)



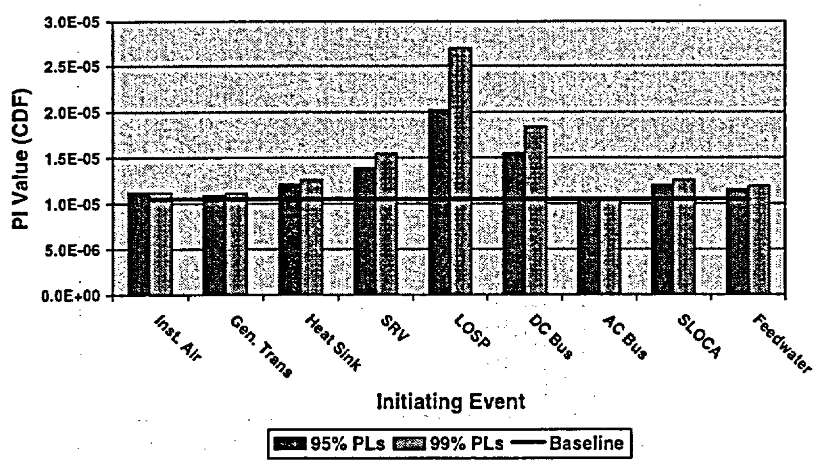
PWR IIEPI

(3-Year Bayesian Update)



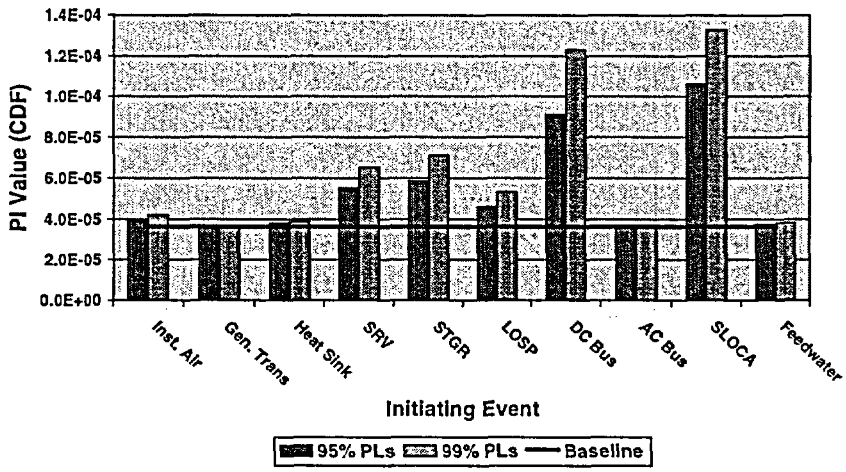
May 5, 2003 ACRS Joint Subcommittee 29

BWR Prediction Limits



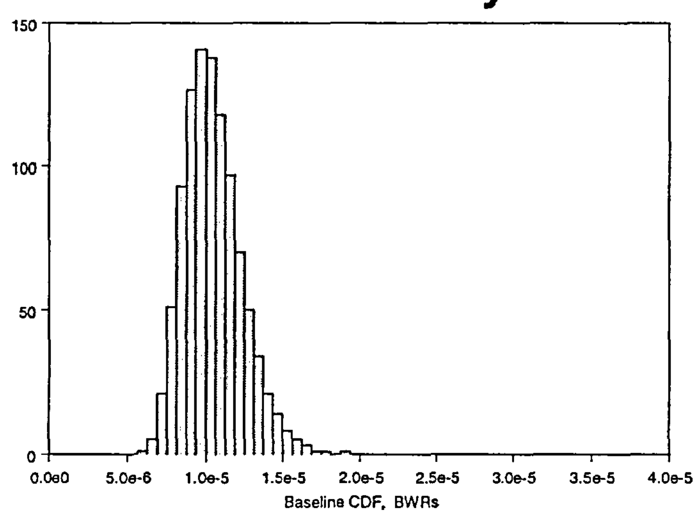
May 5, 2003 ACRS Joint Subcommittee 30

PWR Prediction Limits



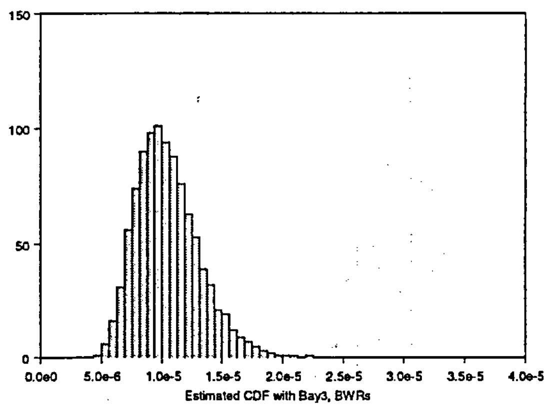
May 5, 2003 ACRS Joint Subcommittee 31

BWR Baseline IIEPI with Uncertainty



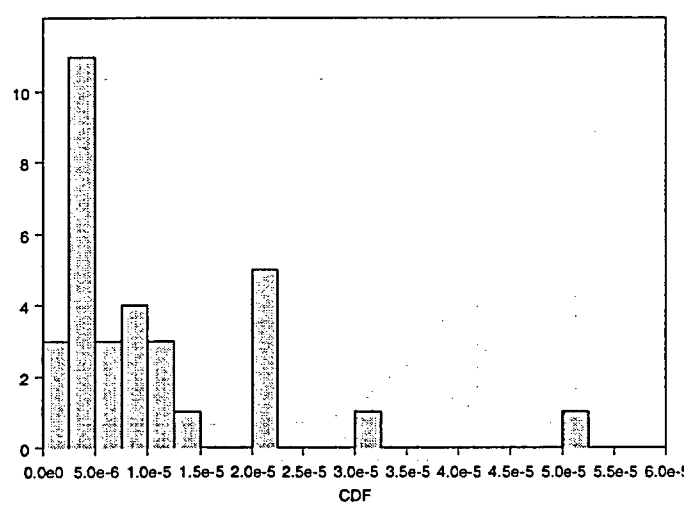
May 5, 2003 ACRS Joint Subcommittee 32

BWR IIEPI (3-Year Bayes)



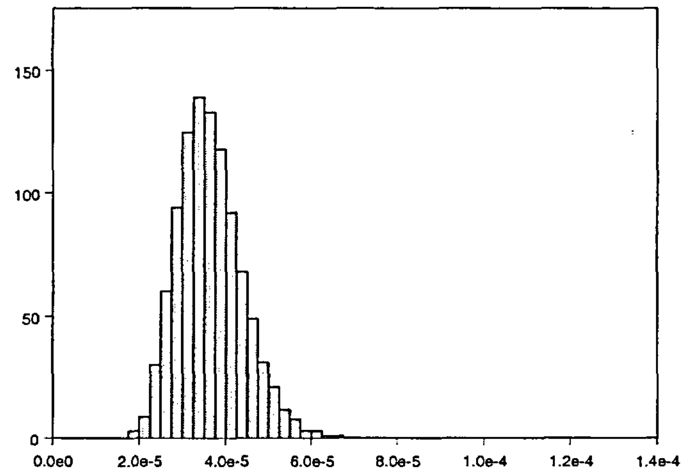
May 5, 2003 ACRS Joint Subcommittee 33

BWR Plant-Specific Baseline CDF



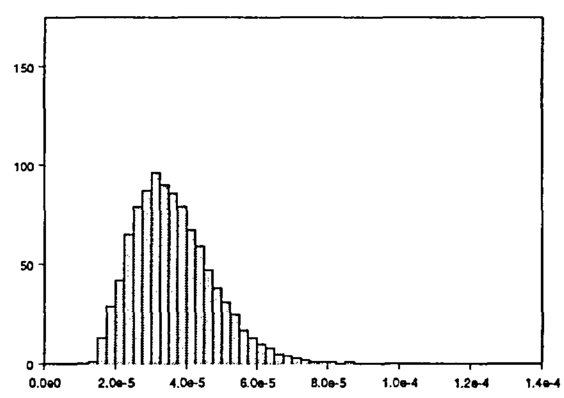
May 5, 2003 ACRS Joint Subcommittee 34

PWR Baseline IIEPI with Uncertainty



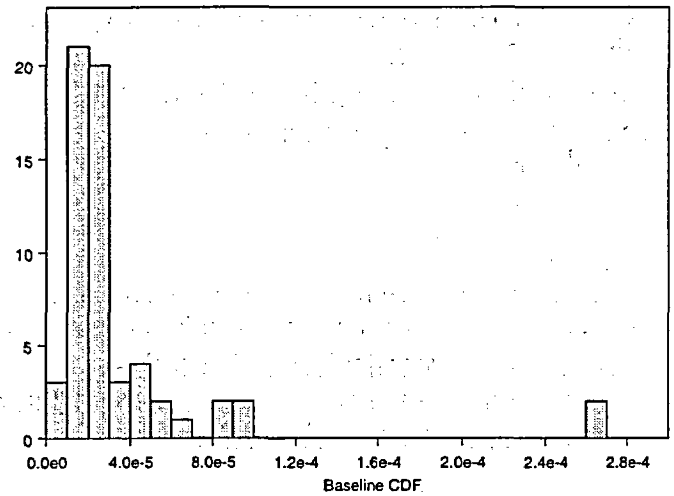
May 5, 2003 ACRS Joint Subcommittee 35

PWR IIEPI (3-Year Bayes)



May 5, 2003 ACRS Joint Subcommittee 36

PWR Plant-Specific Baseline CDF



5. Thresholds

- <u>ACRS Comments</u>
  - Thresholds tell us about safety, trends about performance
  - Have to establish that there has been a change before you start looking for it
- <u>Response</u>
  - 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

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

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 $y \mid x$, many features of the unseen population can be predicted, e.g., predictive probabilities of events

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.

May 5, 2003 ACRS Joint Subcommittee 41

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

May 5, 2003 ACRS Joint Subcommittee 42

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

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 unforseen 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.

<u>RESOURCES:</u>

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

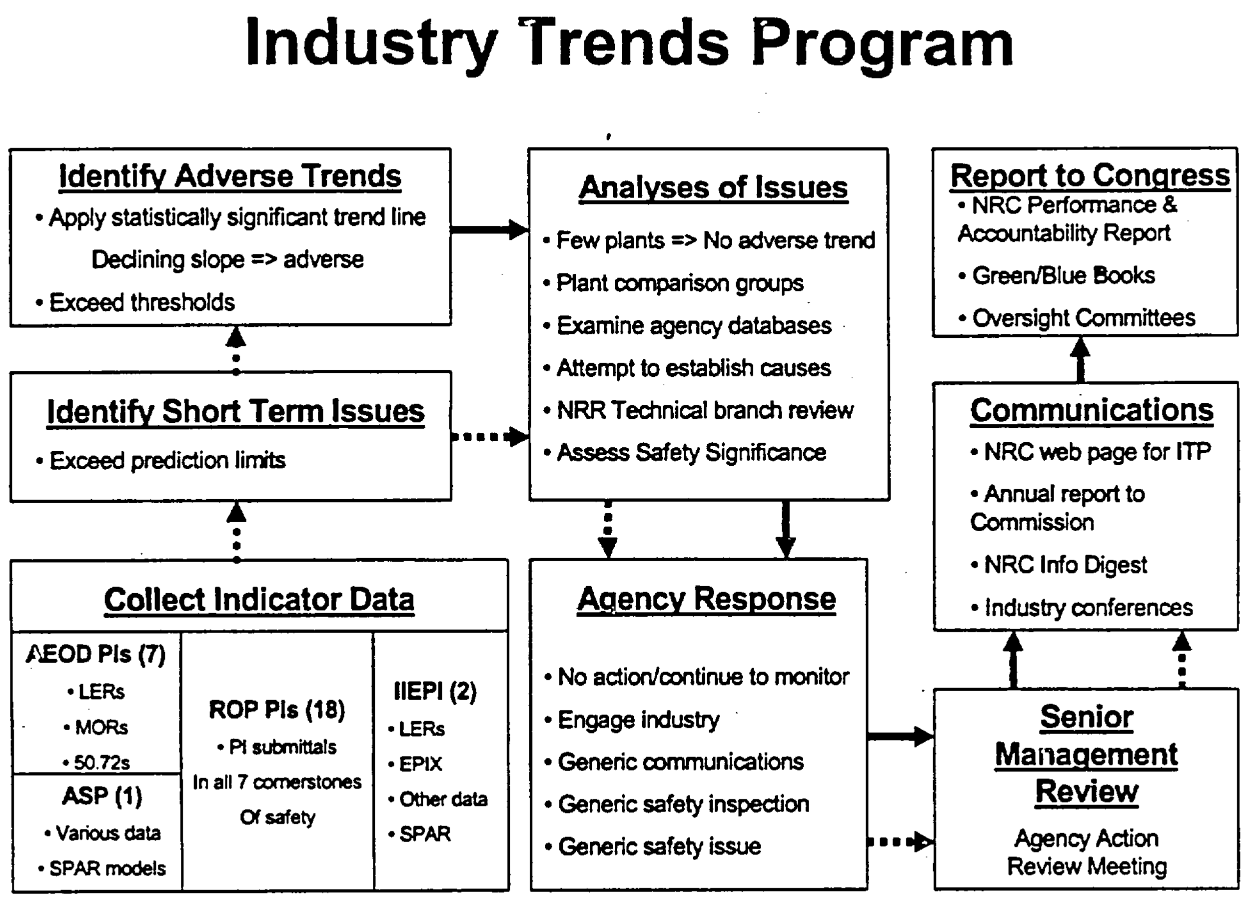


Figure 1-1 Industry Trends Program process flowchart

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

ATTACHMENT 2

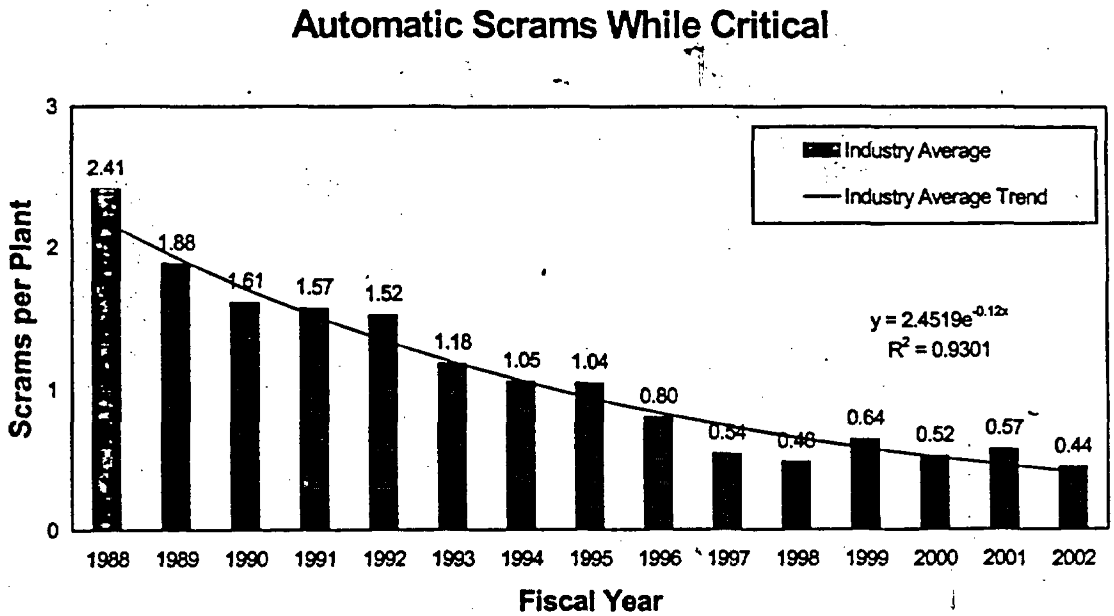


Figure A2-1

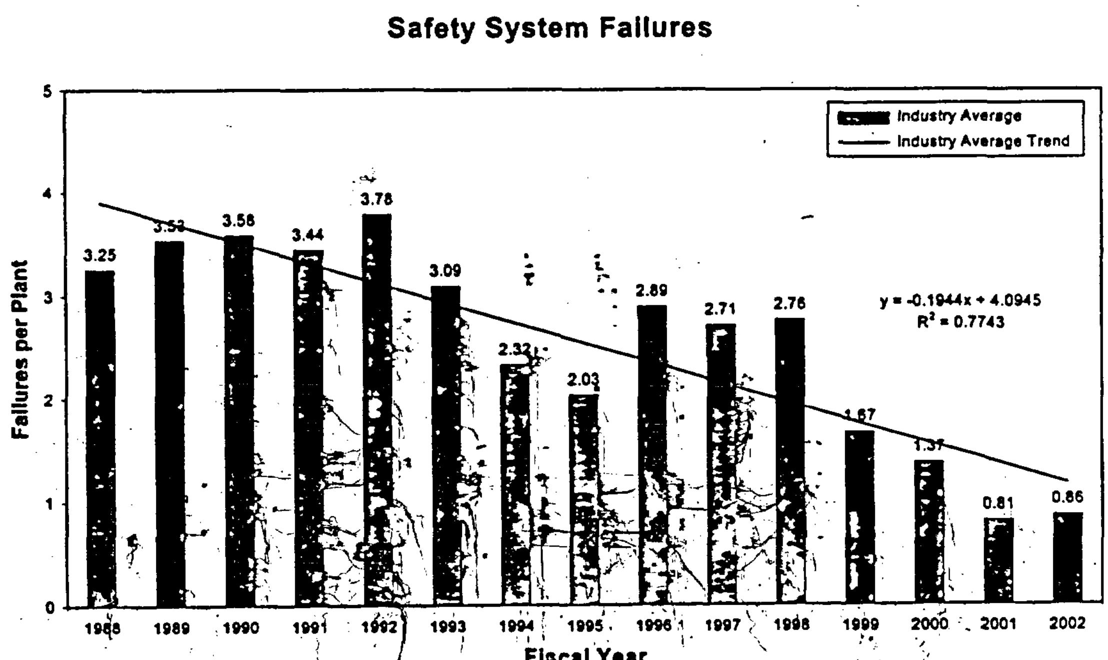


Figure A2-2

Safety System Actuations

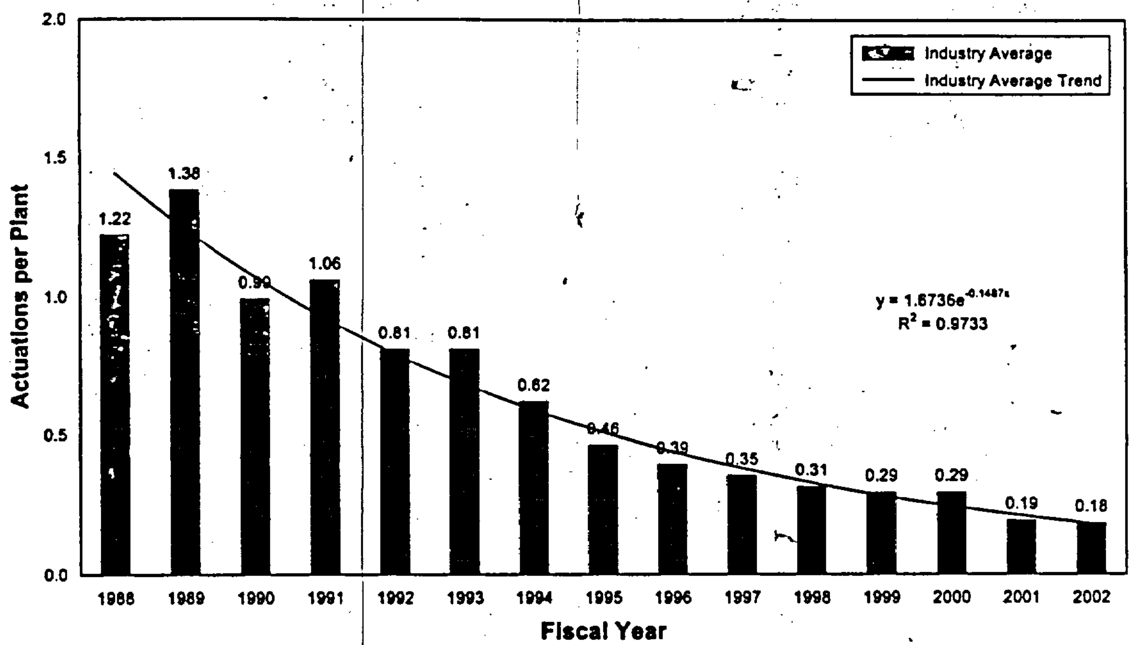


Figure A2-3

Forced Outage Rate (%)

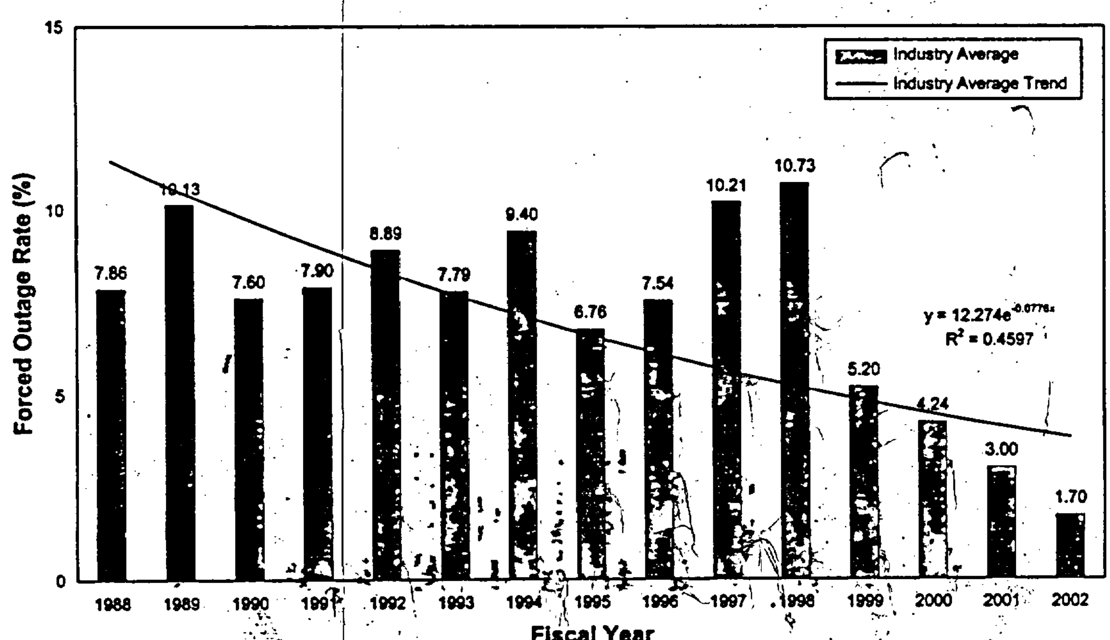


Figure A2-4

Equipment Forccd Outages/ 1000 Commercial Critical Hours

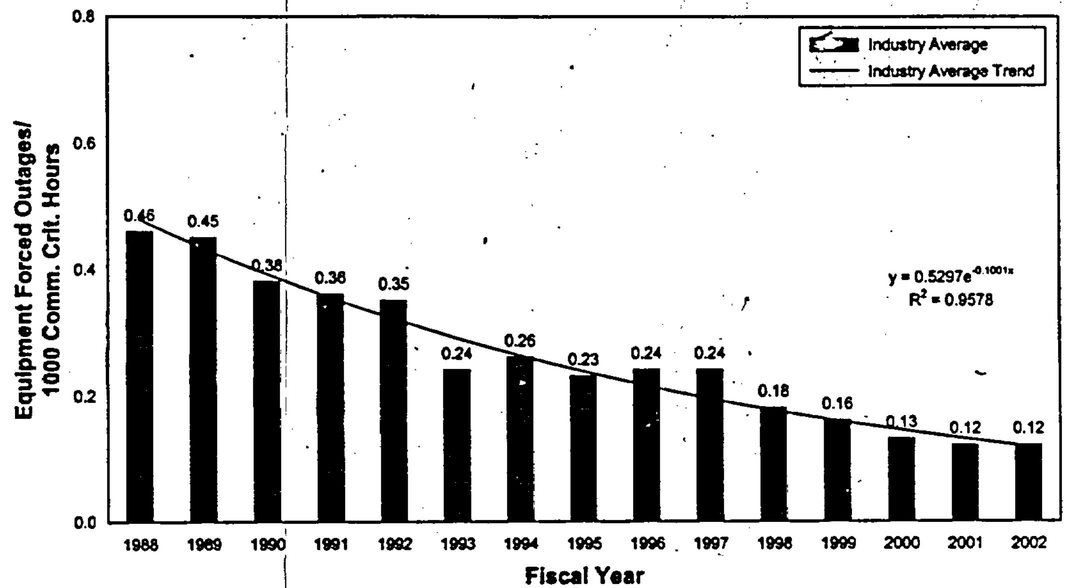


Figure A2-5

Collective Radiation Exposure

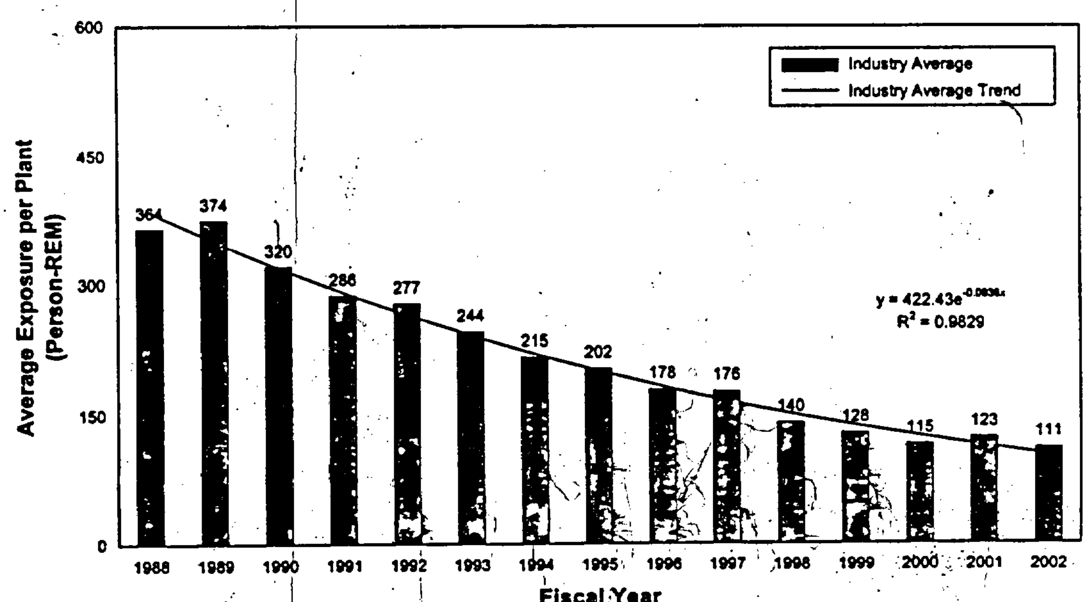


Figure A2-6

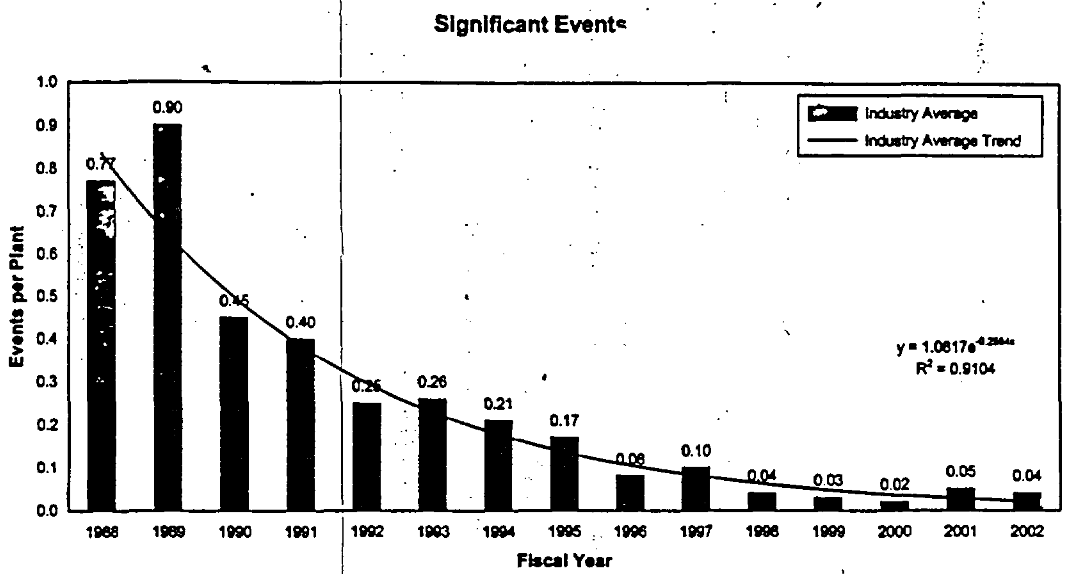

Significant Events
Industry Average
Industry Average Trend
Events per Plant
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.77
0.90
0.45
0.40
0.25
0.26
0.21
0.17
0.08
0.10
0.04
0.03
0.02
0.05
0.04
R² = 0.9104
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Fiscal Year

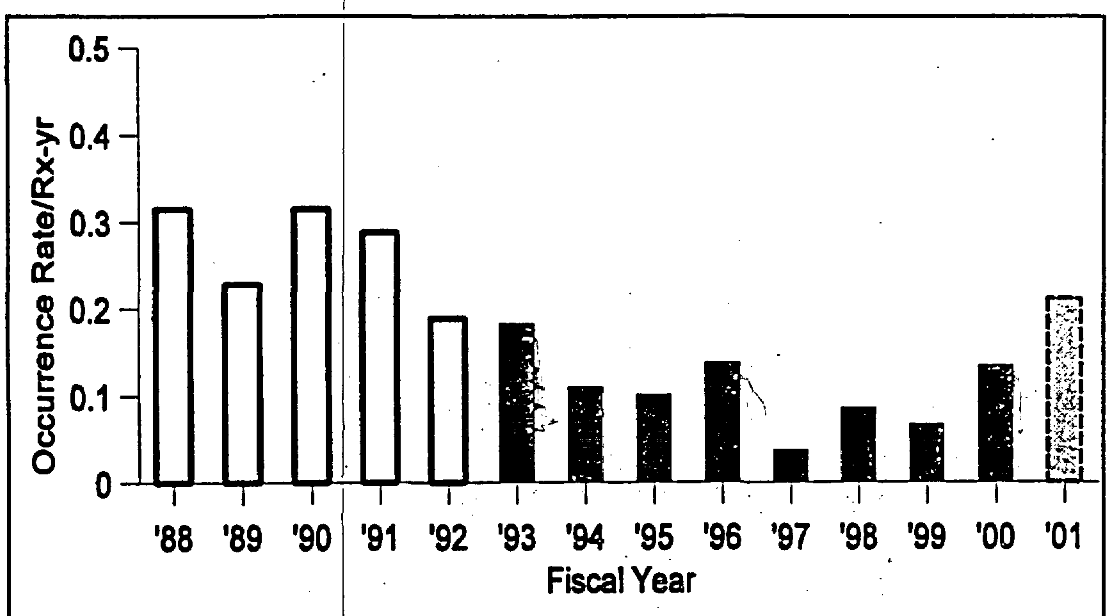
Figure A2-7

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 ΔCDP $\geq 10^{-6}$) 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:

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

where the risk weighting factor is represented by B_i, and the initiating event frequency is represented by λ_i. 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.

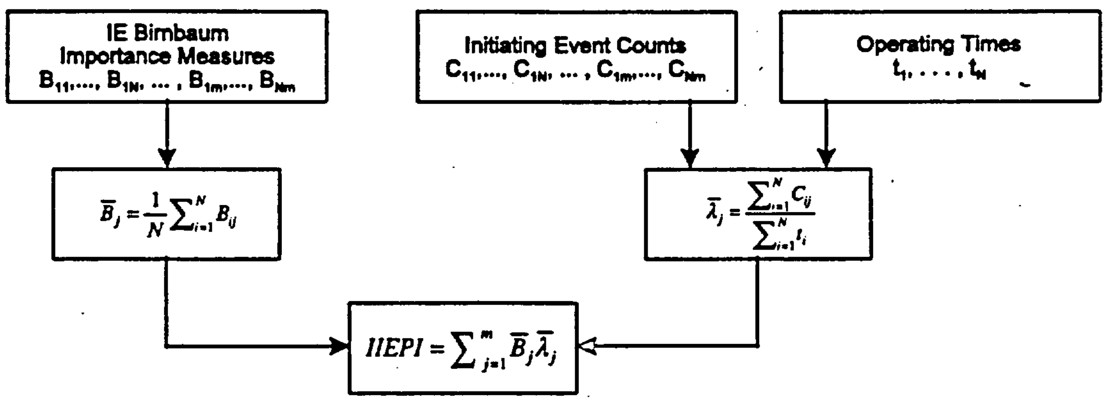


Figure A3-1 Integrated initiating event performance indicator calculations

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.

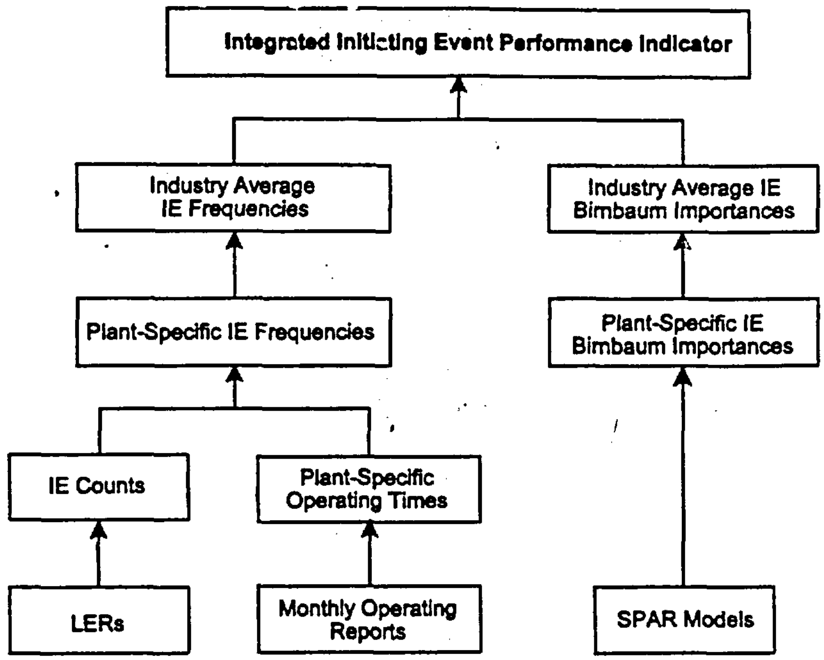


Figure A3-2 IIEPI data sources

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.

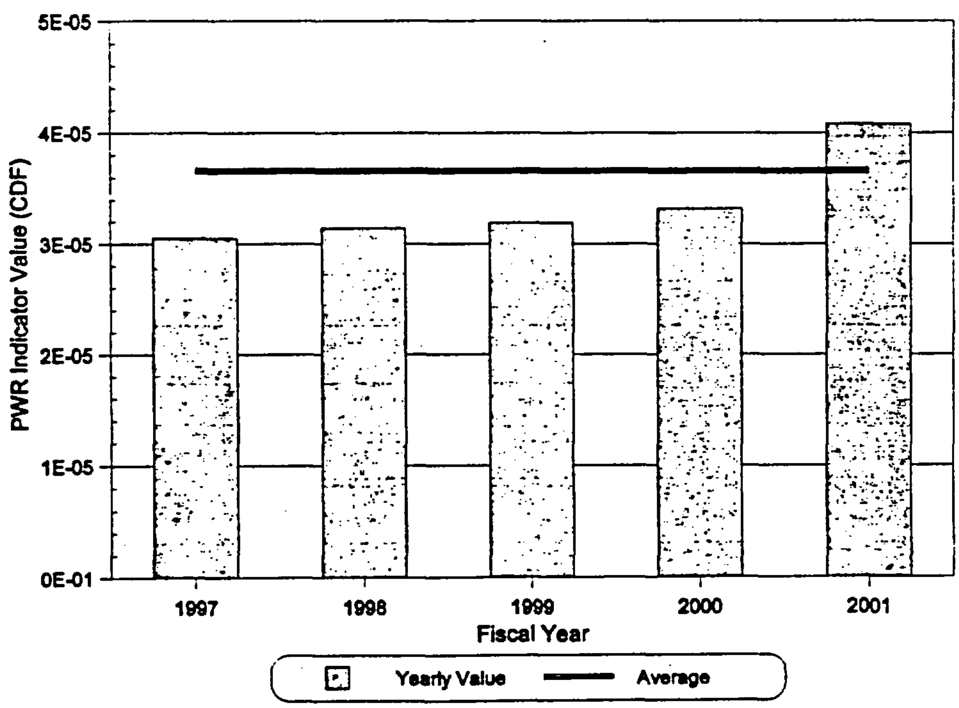


Figure A3-3 Example calculation for the IIEPI for PWRs

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.

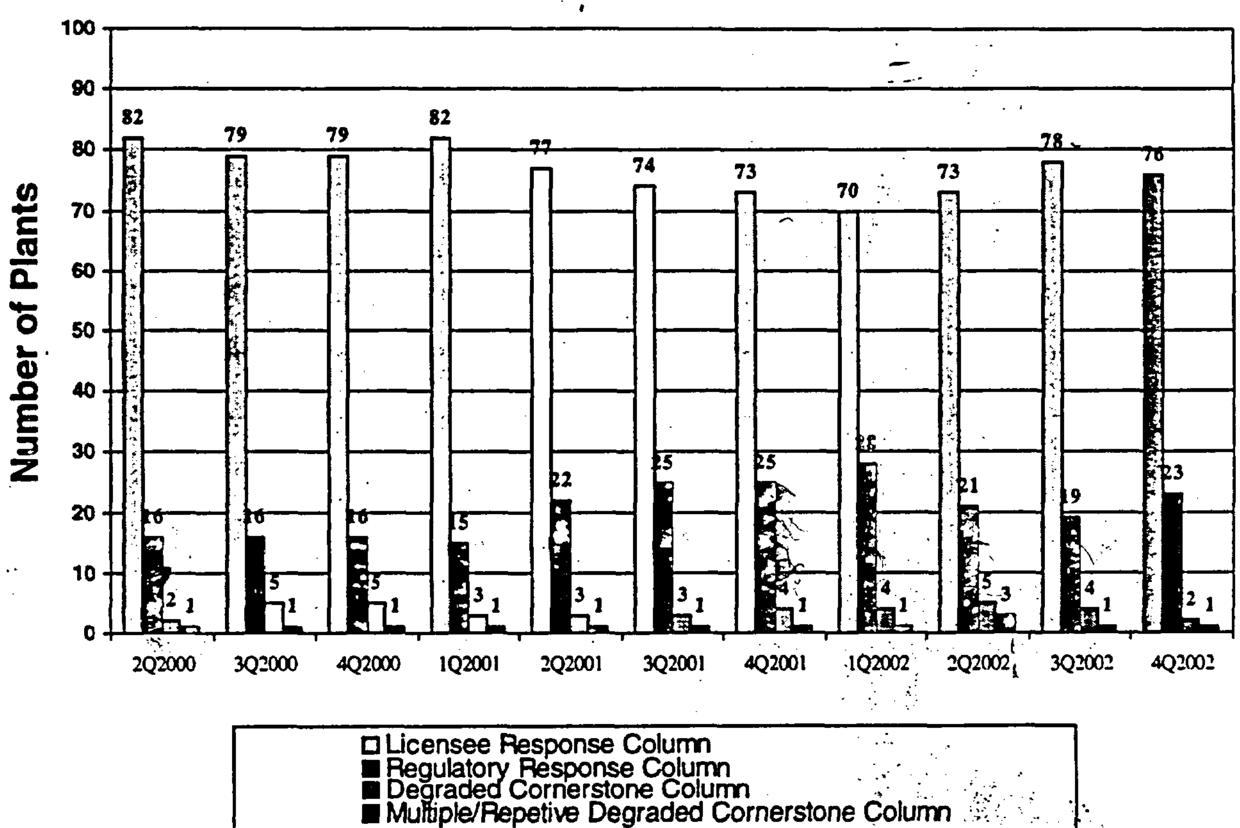


Figure A4-1

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.