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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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DIGITAL I&C SUBCOMMITTEE

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WEDNESDAY

OCTOBER 7, 2020

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The Subcommittee met via Video Teleconference, at 9:30 a.m. EDT, Charles H. Brown, Jr., Chairman, presiding.

COMMITTEE MEMBERS:

CHARLES H. BROWN, JR., Chairman

WALTER L. KIRCHNER, Member-at-large

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

VESNA B. DIMITRIJEVIC, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

JOY L. REMPE, Member

MATTHEW W. SUNSERI, Member

ACRS CONSULTANT:

MYRON HECHT

DESIGNATED FEDERAL OFFICIAL:

CHRISTINA ANTONESCU

ALSO PRESENT:

MICHAEL EUDY, RES

JEANNE JOHNSTON, NRR

DAVID RAHN, NRR

PAUL REBSTOCK, RES

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

P R O C E E D I N G S

(9:31 a.m.)

CHAIR BROWN: It is 9:31, we'll go ahead and convene the meeting. I'm Charlie Brown, I'm the Chairman of the Digital Instrumentation Control Subcommittee. The meeting will now come order.

ACRS members in attendance are Dennis Bley, Matt Sunseri, Jose March-Leuba, Vesna Dimitrijevic, Joy Rempe, Ron Ballinger, Dave Petti, Walt Kirchner and our consultant Myron Hecht.

Christina Antonescu of the ACRS staff is the designated federal official for this meeting. The purpose of this meeting is for the staff to brief the Subcommittee on the proposed Revision 4 to Regulatory Guide 1.105, Setpoints for Safety Related Instrumentation.

And a tutorial on the philosophy and approach on how Setpoints are established, uncertainties are considered in the addition to another presentation in the afternoon on the nonconcurrence provisions.

Accepting single sided Setpoints and, I love this, temporal extrapolation of time related uncertainties.

The ACRS was established by Statute and is governed by the Federal Advisory Committee Act. That means that the Committee can only speak through its published Letter of Reports.

We hold meetings to gather information to support our deliberations. Interested parties who wish to provide comments can contact our office requesting time.

That said, we set aside 10 minutes for comments for members of the public who are attending or are listening to our meetings. Written comments are also welcome.

The meeting Agenda for today's meeting was published on the NRC's public meeting notice website as well as the ACRS meeting website.

On the Agenda for this meeting and on the ACRS meeting website are instructions as to how the public may participate. No request for making a statement to the Subcommittee has been received from the public. Actually, I'll modify that a little bit at the end.

Due to COVID-19 we are conducting today's meeting virtually. A transcript of the meeting is being kept and will be made available on our website.

Therefore, we request that participants in this meeting first identify themselves and speak with sufficient clarity and volume so that they can be readily heard. All presenters please pause from time to time to allow members to ask questions.

Also, indicate the slide number you are on when moving to the next slide. We have a bridge line established for the public to listen to the meeting. The public line will be kept in a listen only mode until the time for public comment.

To avoid audio interference, request all attendees to make sure they are muted while not speaking. Based on our experience from previous virtual meetings, I would like to remind the speakers and presenters to speak slowly.

We will take a short break after each presentation to allow time for screen sharing as well as the Chairman's discretion during longer presentations.

We do have a backup call in number should Teams go down and has been provided to the ACRS members. If we need to go to this backup number the public line will also be connected to the backup line.

Last thing, please do not use any virtually meeting feature to conduct sidebar technical discussions. Rather contact the DFO if you have any technical questions so we can bring those to the floor.

We have also scheduled a meeting, full Committee meeting in February 2021 based on the outcome of this meeting.

I'm going to make one other, we do have two commenters who sent us emails, Mr. Ted Quinn, who's the President of Technology Resources and a past ANS President who helped develop ISA 67.04.01.

And Wayne Marquino, Managing Director of NLNE LLC, who was Chair of the ISA Committee when ISA 67.04.01 was revised. They asked if they could make a comment at the end of the meeting and we will honor that request during the commenting period at the end of the meeting.

We will now proceed with the meeting. We'll ask Mr. David Rahn to share his screen, which I see he has already done.

And Ms. Jeane Johnston, the Branch Chief for the Instrumentation Controls, Branch A Division of Engineering and External Hazards in the Office of Nuclear Reactor Regulation for any introductory remarks to make before we begin today's presentations. Jeane, it's all yours.

MS. JOHNSTON: Thank you, Member Brown. The purpose of today's briefing is to provide the members an informational overview of the staff's proposed draft guide to revised Reg Guide 1.105 on Setpoints, Procedure Related Instrumentation.

The staff will also present today a history of technical issues explaining how these have been addressed in the past and present the case for why this revision is needed.

The current Reg Guide is 21 years old and is being revised to cleanly endorse the 2018 revision of the American Nationals Standards Institute or ANSI and International Society of Automation, ISA Standard 67.04.01 for Setpoints for safety related instrumentation. This endorsement is made without exception and without further clarification.

In 2014 the staff attempted to revise the Reg Guide and issued a draft guide for public comment known as Draft Guide 1141. That Draft Guide endorsed the 2006 revision of the ISA Standard but with multiple exceptions and clarifications.

After receiving extensive public comment on the Draft Guide 1141 the staff elected to address the concerns by participating in the subsequent revision of the consensus industry standard.

That effort lead to the 2018 revision of the ISA Standard and the staff are now proposing to a clean endorsement with this proposed Reg Guide revision. Today we are looking for feedback from the Subcommittee members regarding the proposed updates to the guidance document.

Today, later in the afternoon, you will also hear from a member of the staff, Mr. Paul Rebstock, who will be presenting a differing view on the staff's proposed Reg Guide revision.

Mr. Rebstock is a Senior Instrumentation and Controls Engineer in the Office of Nuclear Regulatory Research and has been involved in the development of this revision along with the staff's previously proposed revision of the Reg Guide, also known as Draft Guide 1141.

The concerns raised by Mr. Rebstock were addressed under the Office of Enforcement's Nonconcurrence Process. The documentation of his concerns and the resolution are publicly available and have been provided to the members as background information.

After the main presentation, Michael Eudy, our Project Manager from the Office of Research will present a status update and description of the next steps in advancing the development of this Reg Guide.

Our main presenter today is Mr. David

Rahn, Senior Electronics Engineer in the Instrumentation and Controls Branch in NRR. He's also a registered professional engineer.

He has been with the NRC since 2007 and prior to joining the NRC has over 30 years of experience in the nuclear industry as a design engineer and consultant in the area of instrumentation and control systems.

Over his career he has developed plant and fleet wide setpoint control programs, setpoint calculation methodologies and procedures and instrument maintenance and performance monitoring practices.

He is also NRC's voting member on the ISA Nuclear Standard's Committee as well as on the ISA Nuclear Standard's Subcommittee on Safety Related Instrument Setpoints. So, I'll now turn over to David Rahn for the rest of the presentation.

MR. RAHN: Thank you for that introduction, Jeane. Can everyone hear me all right?

CHAIR BROWN: Yes. Can I interrupt you for a minute Dave?

MR. RAHN: Yes, you may.

CHAIR BROWN: As we opened up I see the slides are labeled as Draft Guides 1363 and there was a reference made to 1141. Are those two different things?

MR. RAHN: Yes. So, Draft Guide 1141 was our initial attempt to revise Regulatory Guide 1.105 from Rev 3 to Rev 4 and that attempt was made in the 2014 time frame.

That particular product went out for public comments and we received, as Jeane mentioned, many public comments. I think over 700 comments.

And so, we attempted to resolve those comments and prepare a new version of Reg Guide 1.105 but in doing so, we looked at our final product or our proposed final product and it looked to be quite lengthy and way more than it really needed to be.

So, what we did is that particular version of DG 1141 was made to endorse the 2006 version of the ISA Standard but it still had many, many exceptions and clarifications in it.

So, we thought you know what, this is an industry consensus standard and where possible, you know, the government has said hey, we need to use, if possible, industry consensus standards when available.

So, we thought okay, this is going to be a little too much, why don't we work with the ISA Nuclear Standards Committee and see if we can come to some kind of agreement on the principals and the concerns that the staff has and see if we can adjust our approach to endorsing the ISA Standard.

So, as an outcome of that the ISA Committee produced the 2018 version of the standard and we helped participate in that process and they released that 2018 version to be reviewed by the staff for endorsement.

And that's where we're at now with the issue of Draft Guide 1363. So, it's the replacement of the DG 1141.

CHAIR BROWN: Okay.

MR. RAHN: So, essentially DG 1141 was scrapped and 1363 is taking its place.

CHAIR BROWN: Okay. I hope I didn't preempt out, you had some nibbles on that towards the end of the presentation and I just thought since both numbers were floating around, we ought to just get a little heads up as to the progress.

That was a good description. That's what I kind of gleaned from reading multiple documents in preparation. Okay, thank you very much, Dave. Go ahead.

MR. RAHN: Okay. You are welcome. So, good morning, ACRS members, as Jeane introduced me, I'll be your main NRC presenter for the day and I'm on the team, I'm one of the team members that's working on the production of this new Revision 4 to Reg Guide 1.105.

And we thank you for this opportunity to help present the summary of our activities to date as well as our willing to respond to your request for a little bit of a tutorial.

And how do we handle instrument Setpoints, you know, how do we development them, how do we come up with criteria for maintaining those instrument channels and so forth. We're going to go through all that today.

First, I also want to thank my fellow team members, Dinesh Taneja, Joseph Ashcraft, Paul Rebstock, Yaguang Yang, our Technical Project Manager is Dawn Matthews Kalathiveetil and our former Technical Project Manager Huda Akhavannik.

And also, don't want to be remiss in thanking our Regulatory Guide Process Manager, Mr. Mike Eudy, who you will hear later on today. But they all contributed to this effort along with a few others, probably too numerous to name.

I also want to thank and acknowledge a lot of members that were involved in the industry who participated in the talks that we had throughout 2016, '17, and '18 to produce the newest version of the ISA Standard that we, I think we can come to acceptance of that standard.

So, the other thing I wanted to mention was that we're going to be discussing not only what's in the latest draft version of the Reg Guide but the tutorial will help clarify some of the issues that were brought up and raised within the NRC staff itself when it came time to concurring on the version that we have now of DG 1363.

So, as Jeane mentioned, one of our team members felt it strong enough to prepare a nonconcurrence in two particular areas and I intend to go through those two areas in my presentation today.

MEMBER BLEY: Dave.

MR. RAHN: Yes.

MEMBER BLEY: This is Dennis.

MR. RAHN: Yes.

MEMBER BLEY: This is follow up to what Charlie raised and you and Jeane have touched on it but we've had a number of meetings over many years here that ended up being cancelled and I think you've explained what was going on.

Were the issues that were raised in all

those comments and led to the new revisions of both the Reg Guide and the standard, primarily safety and technical or were they more structural and I think you said you were going to point some of those along the way?

MR. RAHN: Well, the issues that contributed to the delay, Member Bley, were primarily the fact that there's a lot of work. It took a lot longer than we thought and I would say we were not held up by the technical issues.

But we were held up by the fact that there just an awfully lot of material that had to be clarified in a way that most people would be able to pick up this document and understand what we're doing with it.

So, I would say the delays in not having this Subcommittee presentation were just mainly due to the logistics of getting this thing in the status that it is now.

MEMBER BLEY: Okay, thanks. I mean right now I look at these and both the standard and Reg Guide are pretty tight and small so, but I didn't see that whole history, so thanks.

MR. RAHN: Yes. Yes, surprisingly, yes, I agree with you, we tried to make this as concise as possible while still touching on the issues that needed to be resolved.

But I wouldn't say that the resolution of the issues caused the most problem, it was just the process of going through everything that needed to be gone through.

MR. REBSTOCK: If I could --

MR. RAHN: Yes.

MR. REBSTOCK: -- yes, Dave, if I could chime in, this is Paul Rebstock. I was the principal author of 1141. One of the things that happened is that there was a lot of technical material missing from the early version of ISA Standard.

And we tried to accommodate that in 1141 and it wound up being almost a textbook. It was much longer than the previous version of the Reg Guide and had a lot of technical information in it.

And what happened in the meantime, is that the ISA recognized that there was a lot of stuff missing from the standard and so that's when they convened to make the current Revision.

And they incorporated a lot of the stuff from 1141 into the standard. Not everything but a lot of it and that's why the staff has decided then that they'll just go with the standard and that's what the stuff moved from, you know, from the Draft Reg Guide into the revised standard.

But that took some time and it takes time to issue a standard, you know, for the ISA to issue that. So, that's part of what the delay was.

MEMBER BLEY: Thanks. That helps.

MR. RAHN: Okay. If there's no more questions on that let's move on to our first technical slide. Okay so, the agenda we're going to discuss today is we're laying out in these major steps.

What's the regulatory basis for having the Reg Guide, what's its purpose and scope. We're going to go into a little bit of the tutorial per your request on what's Instrument Channel Performance Uncertainty all about and that will be taking up the bulk of this morning's presentation.

We're going to go into more detail on what's in the industry standard and what is available as industry guidance for users. We're going to make a presentation of number of staff regulatory positions that have been made.

First in previous versions of the Reg Guide and then within statements that were made within the Draft Guide 1141 and finally what are the current positions.

We're going to talk a little bit about revisions of the industry standard that were made, that Paul just alluded to and talk about our goals for what we want to have as outcome for a successful Reg Guide 1.105 Revision.

And finally, Mr. Mike Eudy, who's our Administrative Process Manager for handling this particular shepherding the Reg Guide through the Reg Guide development process, will talk to us a little bit about what is that process about and what are the next steps for this particular issuance.

So, today I'm going to start with a little discussion on the Regulatory Basis, later on we're going to be talking about the latest proposed Draft Revision, Reg Guide 1.105, including the historical content.

And efforts that were made by the Industry Standard's development organization responsible for the underlying standard that is endorsed. During this presentation we'll also be presenting a discussion on Instrument Channel Performance and Uncertainty.

Why accounting for instrument channel uncertainty matters, how instrument channel uncertainty is treated from a regulatory perspective and we'll entertain questions at the end from the ACRS

Subcommittee.

So, diving right in we have a main Regulatory Basis and a number of supporting Regulatory Bases for this particular standard, I mean Regulatory Guide. The main one is within 10 CFR 50.36 regarding technical specifications.

The 50.36(c)(1) describes safety limits, limiting safety systems studies and limiting control settings.

But the important paragraph there we focus on is Paragraph 50.30(c)(1)(i)(A) that safety limits for nuclear reactors are limits on important process variables that are found to be necessary to reasonably protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity.

If any safety limits exceeded the reactor must be shut down. So, that's the one main Regulatory Basis. So, basically that guidance that's in Reg Guide 1.105 is principally aimed at establishing appropriate limiting safety system settings and we're going to cover on the next slide.

Limiting safety system setting are chosen so that automatic protective actions will correct an abnormal situation before a safety limit is exceeded.

And those are the key words and Paragraph (c)(1)(ii)(A) is often referenced in many of the license amendment requests, these safety evaluations for license amendment requests and license applications that we receive for review regarding the use of limiting safety systems settings.

The manner in which this is put into practice is made in a more pragmatic way. We don't anticipate ever exceeding a safety limit. We want to make sure that all safety actions are accomplished before any particular safety limit is even encroached upon.

And so, we use the phrase, the setting must be so chosen that the automatic protective action will correct the abnormal situation before the analytical limit is reached, is how we put this phrase into practice.

Also, if you notice, it's as if during operation it is determined that an automatic safety system does not function as required, the licensee shall take appropriate action, which may include shutting down the reactor.

So, we're going to talk about that phrase, function as required, in the succeeding slide as well. So, this is the, you know, the phrase that function as required I was referring to.

Surveillance requirements are also covered in Regulatory Basis. Section 50.36(c)(3) says that safety for surveillance requirements are required to be performed to ensure that the necessary quality of structure, systems and components are not compromised.

And to provide assurance that limiting conditions for operation will be met. Limiting conditions for operation, historically those had been specified in plant technical specifications.

Usually in the form of tables within the Tech Spec sections they're arranged by topic like reactor protection or ECCS Initiation.

And those identify limiting trip setpoints and what we consider or what we are now calling Allowable Values associated with those setpoints. And we're going to talk about those two terms in an upcoming slide.

Now there's some, besides the 50.36 requirements, there are some other related Regulatory Bases for having this particular Regulatory Guide.

The first is GDC 13 in Appendix A of 10 CFR 50 that identifies that instrumentation that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary and the containment and its associated systems need to be capable of monitoring their required ranges for anticipated operational occurrence and accident conditions as needed to assure safety.

So those GDCs particularly talk about the need for maintaining the integrity of the reactor core, the reactor coolant pressure boundary and the containment, which are the physical barriers.

So basically, the requirement is also to incorporate appropriate controls such that these variables insistent are maintained within their prescribed ranges.

Another requirement is in GDC 20, which talks about protection systems and the GDC 20 says that protection systems need to be designed such that they will automatically initiate appropriate plant systems to assure that fuel design limits are not exceeded.

As well as to sense accident conditions and automatically initiate the operation of any structure systems or components needed to accomplish those functions.

So again, this is a need for establishing the initiation of systems that ensure particular fuel design limits are not exceeded. So that falls right in with the requirement in 10 CFR 50.36.

Other Regulatory requirements are the incorporation by reference of IEEE 279-1971 for plants that meet the requirements for having 219 as their protection system design basis.

And also, IEEE 603-1991, which we'll get into in the next slide. But IEEE 279-1971 has some criteria and I don't necessarily have everything in here but this particular slide talks about the need to document the design basis of a protection system.

And that documentation needs to include the margins, you know, the establishment of the margins between operational limits and then level that's considered to be the beginning of unsafe reactor operating conditions.

And also has a requirement to document the levels that when reached will require the initiation of a protective action.

It also has us document the range of transient and steady state conditions, including things like voltage on the power supply, frequency, ambient temperature, humidity and so forth. During which the protection system must perform its functions.

In addition, it talks about documenting

what are the minimum performance requirements, such as system accuracies or response times or ranges of the equipment. So that's 279.

Now 603-1991, which is also incorporated by referencing 50.55(a)(h), states that there's a bunch of clauses that imply that there's a requirement for the analysis of the anticipated performance of protective channels.

So as to account for uncertainties in instrument channel performance using a documented methodology. So, that documented methodology is something that we currently use in the industry and that's some of the basis for what we're going to be talking about today, that methodology.

So, the establishment of settings is one of the main goals of Reg Guide 1.105. It basically has two goals.

One is, that setpoints for safety related instrument channels are established to protect nuclear plant, nuclear power plant safety and analytic limits, which are essentially the limiting safety system settings are there to protect analytical limits.

And also, the other goal is to ensure that any instrument channels that are used to accomplished safety actions are maintained so as to ensure they're continually meeting plant technical specification requirements.

So, here's a figure that we're going to spend some time on today. This figure currently appears in the current version of the industry consensus standard 67.04.01 2018.

And this figure is consistent with the NRC's staff current positions regarding the relationship among these values that are pointed here, that are depicted here.

So the red font on this screen is describing what's within the scope of plant safety analysis versus what's within the scope of Regulatory Guide 1.105.

So, the better we understand this figure, the more we're going to be able to understand the balance of this presentation. So, we're going to spend some time on it today.

So, what I'm going to talk about is, a little bit about each one of these values that are labeled here. Beginning with the value considered at the top of the page, a thing they call the safety limit.

Now, as we said earlier, safety limits are important, limits on important process variables are necessary to reasonably protect the integrity of physical barriers that guard against the uncontrolled release of radioactivity, which we talked about in a previous slide.

An example of a safety limit might be something like a certain value of reactor dome pressure, which is a directly measurable parameter. And that might be based on the design of the reactor vessel or the reactor coolant system piping connected to the vessel.

And it's an indication based upon design codes and possible extremes of hydraulic conditions that could occur of the point at which a reactor coolant system failure likelihood could begin to increase.

But it also, a safety limit might be something that's not directly measurable. It might be a limit like departure from nuclear boiling ratio, which is based on, calculated on properties of the fuel design and the core geometry and it's indication of when inadequate core cooling conditions are present.

And so, to measure something like that, we usually use parameters like reactor coolant system pressure and reactor coolant system temperature or total reactor coolant system flow.

So those, so if we approach a value of those parameters that could indicate that approach to inadequate core cooling, those are considered parameters that we might want to monitor and proposed a limiting safety system setting for them.

And another example might be on a boiling water reactor, maximum transient pressure allowed in the safety, in director pressure vessel, using ASMI code Section 3 or 110 percent of design pressure.

So, there may be a maximum allowable pressure in those piping valves and fittings and so we might set the limiting control system setting on that parameter.

Now the space between the safety limit and the analytic limit. In here, this little area where I'm showing with my red pointer, this area is an allowance that's made for the performance of reactor safety controls or engineered safeguard systems to initiate and perform their protective actions.

And this space includes modeling uncertainties associated with the design basis safety analysis such as the safety analysis used to perform ECCS performance or, you know, using either 50.46 or Appendix K criteria. And the determination of the magnitude of this space is not, it's outside the scope of Reg Guide 1.105.

This next term though, analytical limit, is something which indicates the initiation of where does the scope of Reg Guide 1.105 begin.

And the analytical limit is one of the key results of the design safety basis analysis, which indicates the value of a process parameter at which the design basis safety system is required to initiate its protective action and such that, once initiated that protective action will prevent the safety limit from being exceeded.

So, in the ISA Standard, it's defined to be the limit on the measured or calculated variable that's established by the safety analysis to ensure that a safety limit is not exceeded.

So that value is like the starting point from where do we start determining what are all the uncertainties in an instrument channel, so as to arrive at a limiting trip setpoint.

So yes, so our Reg Guide essentially starts with this analytic limit and talks a lot about the uncertainties and bounding those uncertainties in a way such that they will all happen between the limiting trip setpoint and the analytical limit.

So that space is accounting for all the uncertainties and we're going to spend about maybe, eight or nine slides on determining what goes into this determination of that space requirement.

The next value here is limiting trip setpoint. That's the actual limiting value for setting the instrument channel setpoint. That still ensures that the trip actuation will occur at or before the analytical limit is reached.

And the establishment of the limiting trip setpoint considers all credible instrument errors associated with the instrument channel. Not inclusive of additional margin for conservatism.

The trip, no the term, limiting trip setpoint, is generic terminology for the calculated trip setting value that's calculated by means of the plant specific setpoint methodology documented in a document control that's controlled under 10 CFR 50.59.

The term limiting trip setpoint indicates that no additional margin has been added between the analytical limit and the calculated trip setting. But it does account for all of the uncertainties within the operation of the instrument channel such as calibration uncertainties for example.

And how the channel might actually

perform, such as repeatability or changes in the point of action of the channel over time such as drift. And any other factors that might influence its actual performance.

Like harsh environmental conditions that could occur under accidents. So in this manner the limiting trip setpoint ensures that safety limits are not exceeded. Therefore, the limiting trip setpoint meets the definition of a limiting safety system setting in 10 CFR 50.36.

The next point we'll talk about is the nominal trip setpoint. The nominal trip setpoint is the suggested terminology for the actual setpoint that's implemented in plant surveillance procedures where the margins has been added to the limiting trip setpoint.

The as found and the as-left tolerances applied to the nominal trip setpoint that are implemented in the surveillance procedures to confirm channel performance, the nominal trip setpoint is a predetermined value for actuation of a final setpoint device to initiate a protective action.

The nominal trip setpoint is the setpoint value used in plant operations and it must be equal to or more conservative than the limiting trip setpoint.

Note that when we've reviewed some proprietary vendor instrument setpoint methodologies, there are some that actually include a little bit of margin between the limiting trip setpoint and the analytical.

But for the most part this margin is something that we add between the limiting trip setpoint and the nominal trip setpoint. So there's exceptions that we've approved and I don't know if we'll have time to get into those exceptions today but maybe save that for the advanced class.

Also, another point I want to mention is this normal operating limit or normal operating value. That's the limit of the normal operating range that could occur under normal plant operating conditions.

And it's, this value here represents an expected extreme end of the normal operating parameter that's still considered to be acceptable during normal operations.

CHAIR BROWN: Dave, can I interrupt you for a minute?

MR. RAHN: Yes, you may, Member Brown.

CHAIR BROWN: I would like to calibrate myself on the three. I waited until you got through all three of these. I'm trying to relate this back to my 500 years of Navy and nuclear power plants and adjustments.

I would have viewed the normal operating value that our operators look at as quote, the 100 percent tower. That was their limit when they were operating.

The nominal trip point, I'm trying to calibrate that is that when we did an alignment and set the instrumentation initially, we may set it at 110 percent. That's what I would have referred to as the nominal trip point for adjustment and alignment purposes.

If I segue to the right I see E and when we go back and do an alignment check periodically you may not see the nominal setpoint come up exactly when you put in your test signal at say 110, it might read 111 or 109.

But we would have a tolerance on that nominal trip such that when you did the alignment check, you did not have to fiddle with and readjust back down to the normal trip point.

Am I in the ballpark, I'm thinking as a, you know, the way the plants operate and do period checks?

MR. RAHN: Yes. So, we have established

this little E band that you're describing as -- so what you described is what we call a leave alone zone. So it means if you find the number during a surveillance to be within this band, you would not touch it.

CHAIR BROWN: Okay. That's like an alignment check. Okay, so that's, I wanted to set that up to make sure I understood that's the way you thought of it. I never, until I'd read this I'd never thought of as-left and as-found.

MR. RAHN: Well, I'm going to go further into it so, yes, so I agree that what you described is what we call a leave alone zone. If you were to find it within this limit you wouldn't try to readjust it or recalibrate it.

CHAIR BROWN: Okay.

MR. RAHN: But we go a little bit beyond that for nuclear power plants and we use this band for two purposes. One purpose is yes, you know, if you were to find it within this band you would probably not touch it.

And that doesn't mean you won't touch it, like if you found it like right at the extreme edge here, you know, safety, you know, nuclear safety relayed and qualified instrument technicians would likely attempt to try to recenter this within that band.

But that's a practice and that's a plant specific practice but many plant operators, I'm sorry, plant maintenance technicians, would want to attempt to center that as best they can.

But we use this term as not only as found acceptance criterion, but when we perform an actual calibration, let's say you do this thing and it's clearly outside that band, what we try to do is attempt to set it within this band.

And so, if you were to discover it outside this band but with inside this band that's labeled F, which is an allowed amount of tolerance that is used for saying the channel is still performing normally.

So you find it slightly outside, we're going to try to set it to within the as-left setting and that as-left setting is a means by which you can determine whether the channel seems to be functioning as required.

There goes those words again, functioning as required. What that means is, in your attempt to set it, you might discover that hey, this general behavior is not behaving normally and it gives you a first opportunity to determine that the channel is a little squirrelly.

So we always try to set it within the as-left setting band, this band here is called the, we call it the as-left tolerance band.

CHAIR BROWN: Why wouldn't you reset it back to the nominal trip value of 110 percent?

MR. RAHN: Because you can never precisely set it. If you had calibration equipment that was so precise to the ninth decimal place you can set it but, you know what I mean, there's no way you can actually set it perfectly that's on --

CHAIR BROWN: Well yes, I agree with that but --

MR. RAHN: So we establish an acceptance band for setting it and we would say, if you're within this band you can say it's appropriately set.

MEMBER BLEY: Charlie, this is Dennis. Dave's saying essentially the same thing as you. The middle of that band is generally I think and maybe always the nominal --

CHAIR BROWN: Oh yes, that's correct.

MEMBER BLEY: -- he was trying to get it as close to that, that's all he's saying.

CHAIR BROWN: Yes, I'm just saying we always when we found ourselves out, we always told the reactor technicians to reset it to the nominal setpoint.

And that's obviously your instrumentation will not allow you to achieve, it's normally a voltage or something like that and you may not be able to achieve 10.0000000 volts, you know, although we actually used pretty good meters but we could get to 10.01 volts.

That was always achievable, so we were back but we didn't allow them to, if you had a range of 8 to 12, we did not allow them to set it at 11. They went back to as close to 10 as they could get.

That's all, I mean, just a philosophy issue. I would have, I actually ran into a problem where people, we were about to start a sea trial, one of the cruisers and they were raising the frequency of the pumps in order to be able to go to full power, this was in yard just to make sure they could do it.

And they started raising the pumps, the power flow trip went off as they were raising the pump speed. It's been doing that for about two weeks before we arrived to do the sea trial.

And I was in the instrument alley when that happened. I said, what the hell's going on -- oh yes, that happens every now and then. I said, we can't have it, with Rickover on board we certainly did not want to have that happen on the sea trial.

So they said, well we pass all our alignment checks. So we went off and redid an alignment check and it turns out that your little red dot was right up under the upper number.

MR. RAHN: Yes, right up there.

CHAIR BROWN: In other words, our tolerance, so we deliberately offset another instrument to duplicate that and then ran the same operation. Guess what we got? Another trip.

So, we had to end up reducing the band because of that eventually. Because there was enough, we didn't get it right. Unfortunately, nobody told us that. Fortunately we got it corrected before we went on sea trials, put it back.

And they said, well it was bands so we didn't bother realigning it. I said, you should always go back, that's a training issue, go back to the nominal value as close as you can.

So, that's why I was asking the question. You're probably not as sensitive, the Navy plants are transient plants so, you can momentarily as you're increasing frequency or increasing power, you can momentarily exceed certain potential limits for milliseconds or seconds.

So that it's a little bit different than a plant like the commercial plants are. So, I got it, I understand what you're telling me, Dave.

MEMBER BLEY: Dave, you didn't tell us, is the band E a discretionary band or do you have some --

MR. RAHN: Yes. So, thank you for asking that --

CHAIR BROWN: Good question, Dennis. Thanks.

MR. RAHN: -- Member Bley, yes. So, yes, there are a criteria for establishing as-left tolerances and we have some slides coming up that are going to talk about that criteria.

But just to give you a for instance, plants that we have operating now have a range of vintages of equipment in them. And so, there's plants that have Yarway reactor water level switches, which are mercury switches on a cam that rotates as differential pressure increases.

And the point at which that mercury drops and slides over to make a contact is very sloppy. So that's an instrument accuracy thing. We also have --

CHAIR BROWN: That works well for my heating system.

MR. RAHN: Yes. A lot of times your old house thermostat was sort of like that.

CHAIR BROWN: It works very, very well.

MR. RAHN: Until it gets carboned up. If you got a 24 volt AC home heating system but in a nuclear power plant you're making and breaking 125 volt DC circuits sometimes and you don't easily break a DC circuit with 125 volt HFA relay on the end of it.

CHAIR BROWN: Absolutely.

MR. RAHN: So there's slop that builds up over time as that mercury carbons up and the context carbons up. And so, anyways to make a long story short, we also have precise, you know, very high precision devices.

We have a lot of Rosemount transmitters for example, would point like a quarter percent accuracy in driving loops that are electronic also with high accuracies.

So, it seems like this function, that leave alone tolerance is largely based upon accuracy of the device as well as your ability to read the value you're applying to it, which we call calibration uncertainty, which could include things like, measurement and test equipment accuracy.

Or your readability of the measurement and test equipment. So, there are criteria that go into establishing that E band.

And that's to differentiate it from this F band over here, which is where, if you find it during a surveillance and it is tending to be outside the E band but still within this F band, how much deviation are you allowed to have between successive surveillances before we determine that the channel is not functioning as required.

And there are criteria associated with this F band as well. Obviously, it includes things like accuracy and calibration uncertainties. But it also includes the term we call drift, which we're going to spend some time on today during this discussion.

But this band here, you can see it's wider than this E band here and it's there and its basis is primarily to say okay, the instrument, its channel is still functioning as required as long as I'm within this deviation during successive surveillances.

If I start to find myself outside this in either direction, either the conservative or the non-conservative direction that's a clue to right away say hey, I don't believe this channel is functioning as required.

And I might need to do more evaluation of what that channel's doing. If it happens once and never happens again, okay.

Maybe that's one thing but if it happens continually and it's found beyond this band then we need to say either the band is not correct or the channel might be broken.

CHAIR BROWN: So if they find during a surveillance that you've exceeded the upper limit of the E band, they do not have to do a realignment?

MR. RAHN: You are --

CHAIR BROWN: As long as they're within the F band?

MR. RAHN: No. Not exactly. So, if you're outside the E band, we have reestablished the setting to within the E band. Right? If you're within the E band no, you don't have to.

CHAIR BROWN: Yes. But if you're outside the upper limit of the E band but less than the upper limit of the F band --

MR. RAHN: Yes.

CHAIR BROWN: -- on surveillance, you don't have to readjust?

MR. RAHN: No, you do. You do have readjust.

CHAIR BROWN: Then what good is the F band if you have to readjust?

MR. RAHN: The F band tells you how much are you allowed to deviate outside the E band and still be considered to be normal behavior of the --

CHAIR BROWN: Okay. So that's a funny definition because you're not declaring the instrument unreliable, you're just saying something occurred but if it doesn't happen again after we realign it -- so you're telling me if they make a surveillance and they're right below the upper, they're within the F band but outside the E band, they have to realign?

MR. RAHN: Yes. So you would say at this point if you're within this band you would say, okay the channel is functioning as required per the Tech Spec requirements.

But at the conclusion of my calibration, I always want to bring it to back within this E band.

CHAIR BROWN: Okay. I got that. Now I guess where you use the as found, you record that and then at the next surveillance, if you've gone outside the E band.

But you're less than, you're up at the upper part of the F band again then you say, hold it I'm, this is happening too frequently, what's wrong with the instrument.

MR. RAHN: Yes. So, but again, as long as you're inside the F band --

CHAIR BROWN: Yes, I got it.

MR. RAHN: -- it's still functioning as recorded but you're right. This information is recorded and trended and it's part of a plant specific procedure to evaluate instrument channel performance of this type.

CHAIR BROWN: Okay. That's consistent if we, the Navy guys did their alignment check and found it outside the E band. They would record that and then they would realign.

MR. RAHN: Yes.

CHAIR BROWN: So that's what you're saying they do. But we had a record, so you're really doing the same thing we did.

MR. RAHN: Yes. You're recording the as found condition.

CHAIR BROWN: Yes. Okay. All right, I got it. Trying to calibrate myself.

MR. RAHN: Yes. And so, at the conclusion of a surveillance we also record the as-left condition and we always try to have the as-left condition at the conclusion of a calibration within this E band.

CHAIR BROWN: Or preferably right at the nominal trip set setting or as close as you can.

MR. RAHN: Yes.

CHAIR BROWN: Okay.

MR. RAHN: Now the other interesting thing is depending upon the type of equipment that you're actually calibrating, we've, you know, over the years we've seen studies of instrument maintenance practices.

You know, we found that a very high percentage, probably like in the 90s of instrument calibration technicians will tend to leave this thing as pretty darn close to the center of that E band. But it's not required.

So, if you look at a shape of a curve of settings for this as-left condition you find it's sort of like a truncated normal distribution. Most people set it to close to within the middle of the band.

CHAIR BROWN: Yes, I would think that would be the case with the technicians.

MR. RAHN: Right. But there are studies that show if you set these as-left tolerance bands correctly you may find it always acceptable as long as you're inside this band.

So it depends on what type of analysis you did but it's true that some studies show that you don't have to tweak it as long as you're within that band.

CHAIR BROWN: Okay, thank you.

MR. RAHN: Okay, your welcome. Now --

MS. REMPE: David. This is Joy, and I don't know if this is the best time to ask this question or you can answer it later but when I looked through the Reg Guide it does talk about that most of the Reg Guide is focused on existing or it seems to imply it's for existing instrumentation.

Where you understand how it's going to perform, you've got some operational experience for it but it does at the beginning of the Reg Guide talk about that, it mentions the GDCs and that they're generally applicable to other reactor types.

And even if you stay within the LWR framework we're getting new sensors in some of the smaller modular LWRs.

And when you guys were doing this work and coming up with these different ranges, did you think about what you'd do when there's not much operational experience with some of these sensors that we're seeing?

MR. RAHN: Yes, Member Rempe. We do have

this covered in the ISA Standard and the recommended practice for that.

What happens is, if you've got a relatively new instrument that doesn't have a lot of years of operating history associated with it, we have to rely on what the vendor of that instrument has said how it's going to perform.

And we would generally not use an instrument if it has no manufacturers performance data associated with it. Now the manufacturer of that instrument will likely have performed numerous tests in his own laboratory.

And typically under a range of operating conditions or a range of ambient conditions such that he will have confidence that that accuracy that he specifies on his datasheet has got a good basis for it.

In other words, he got some kind of performance data either in a laboratory environment or within a pilot plant of some type such that he's got high confidence that the accuracy value he's specifying on his datasheet is actually representing what that instrument is capable of doing.

And if he doesn't do that, he runs the risk from an economic standpoint of having to deal with a lot of returns of that device back to his shop for a rework.

Because licensees are required to record the performance of these things in operation and under a range of ambient conditions like from summer to winter for example, you're out in the plant.

And it needs to perform well under all of those conditions and if it's found many times over and over again outside, if the channel reading is outside this as found tolerance value, they're going to think something's wrong with the instrument and they're going to be sending it back to the manufacturer for warranty work. So --

(Simultaneous speaking.)

MS. REMPE: -- the ITAAC for that are usually are the requirements for a sensor when again they may not know what they're going to use that -- but they're proposing maybe we're going to use a new widget.

And they say okay, the NRC will say okay, you've got to prove that it can operate for these range of temperatures, pressures and they might cite effluents.

I don't recall them ever saying how much data you've got to have with respect to the confidence.

MR. RAHN: Mm-hmm. So we, that's why have the standard. So our concern in the past was that we never specified the acceptance criteria for that range of accuracy performance so, the confidence in knowing that value.

So, the new ISA Standard now establishes a confidence level and that's one reason we're endorsing this particular version of the standard.

MS. REMPE: So if we have a, right now if there's a plant, hypothetically speaking, that was going to go through a DCA, is it just that they are aware that now in order for them to meet their ITAAC or whatever, they've got to meet these requirements with this much data too?

And that's understood? I'm not quite sure how this would be imposed and when it would be imposed so you don't have back fitting issues.

MR. RAHN: Yes. So, the criteria you have to meet, you know, that's one thing. So you say I'm going to meet, the licensee might say hey, I'm going to be using Regulatory Guide 1.105 Revision 4, for example, for my establishment of settings.

Or they may have a DC specific criteria that was made but it's basically something very similar to what's in Reg Guide 1.105, which endorses ISA Standard 67.04.

So if you say I'm committing to that then, you know, inspectors would then have the opportunity to go back and look and see how did, what kind of allowances have they made in their setpoints.

In their establishing of settings for things like instrument accuracy of newly installed devices or newly developed devices that have no operating history with them.

So, the licensee setpoint control methodology, the setpoint methodology is an actual calculation of setpoints, something that a NRC inspector can ask for and to look at that to see how well they've accompanied, they've embodied the vendor's specifications associated with that device.

Now obviously, as time goes on and you do several surveillances, you might find that hey, I've established too tight of a band for that particular device. So I might have to reassess the method that I used for determining that band for that particular instrument.

MR. TANEJA: Hey, Dave. This is Dinesh.

MR. RAHN: Yes, Dinesh.

MR. TANEJA: Maybe, you know, maybe I can give an example that might illustrate the point. So, Member Rempe, the NuScale design that we just finished reviewing, you know, they followed, their setpoint methodology document is based on Rev 3 of Reg Guide 1.105.

However, they commit to meeting the 95-95 criteria for all the instruments that they are proposing to use in their safety application and so, what we approve there is a, you know, a setpoint, limiting setpoint that they have provided.

And the as-left and as-found tolerances they have provided are based on certain assumptions. So those assumptions would have to be validated when they do the ITAAC closures, okay?

So, really it's now up to the, you know, the owner of the plant to specify those requirements to the vendors that these performance criterias must be met for them to use those instruments in their plant.

Because their license is right now based on those assumed as found, as-left tolerances and those performance criterias. I think that's how we are addressing that thing, you know, for the new reactors.

That they are essentially laying out the requirements up front on performance requirements for the instruments and they have specified those in their purchase orders to their vendors.

And when they perform EQ testing or whether they perform all these things, that those parameters are well within the, you know, their licensed conditions.

MS. REMPE: Okay. Thanks.

MR. BALLINGER: This is Ron Ballinger. That is pretty well covered in Section 4.6 and Section 6 of the 67.04. I went through that the other day and it's, if I can understand it, pretty much anybody can.

MS. REMPE: Thank you.

MR. RAHN: Okay. Let's see, moving on. I think we're going on to the next slide. So, just to give you, this is going to come up later, so I've injected a slide in here that talks a little bit about the way we used to do things.

So, in the old days, you know, I would say old days being pre-2006, the Tech Spec model that we used was to have an analytical limit upon which we determined what's an instrument's total loop uncertainty and established the limiting trip setpoint. So that part's the same.

But within the Tech Specs, we used to

have, we relied on a thing that we called Tech Spec Allowable Value and that's a number that may have already been inserted into the Tech Spec.

So, historically, I believe it was in the 1974 time frame, a version of the Tech Spec, Standardized Tech Spec was initiated and talked about, they having documented a value that's considered an Allowable Value the channel may have when it's tested under a surveillance condition.

And if it's found beyond that Allowable Value it's considered to be inoperable and under that condition you had to write a Licensee Event Report saying that the channel is found to be inoperable during a surveillance.

And so, even though you may have had a procedural limit that says, I would, here's my ideal as-left setting band and if I set it and I discover at the end of the surveillance to exceed my as-found procedural limit and not only that I may have exceeded my limiting trip setpoint value.

But if exceed also this Tech Spec Allowable Value then I need to declare the channel inoperable and write a Licensee Event Report. And so, I'll talk about it in a couple of slides later.

The staff was inundated with Licensee

Event Reports because many times that Tech Spec Allowable Value that was selected for placement into the Tech Specs didn't have the right evaluation associated with it with regard to the limiting trip setpoint and they didn't leave enough allowances.

And in some cases the Allowable Value was like right on top of the limiting setpoint, didn't leave any room for drift and things like that. So, we're going to talk about that later.

But I just wanted to mention that the old days we used this methodology and that's going to come up later. Then exceeding, so yes, I believe it was in 1980 --

CHAIR BROWN: Dave, Dave, Dave, Dave.

MR. RAHN: Yes.

CHAIR BROWN: If I flip back to your previous chart, your F, I'm looking at, let me get both of them up here. Your Allowable Value is shown as being above the Tech Spec limiting trip setpoint.

MR. RAHN: After you, if you look at this slide here --

CHAIR BROWN: Hold on, hold on. Let me finish.

MR. RAHN: Okay, which one are you looking at first of all?

CHAIR BROWN: I'm looking at slide 15.

MR. RAHN: Slide 15, okay. I'm sorry.

CHAIR BROWN: The one you had up.

MR. RAHN: Thank you.

CHAIR BROWN: Now when I go back, and you don't have to do this but if I go back to the previous -- so, the Allowable Value is above the TS limiting trip setpoint.

If I go back to the other slide, you show the upper part of the as-found thing is above the limiting trip setpoint. So, I'm trying to figure out why --

MR. RAHN: If you let me go on, I could explain it.

CHAIR BROWN: Go ahead now.

MR. RAHN: Yes. So, first of all I want you to, let's go back on 14 for a second here. If you notice the name, Allowable Value, doesn't appear on this screen.

CHAIR BROWN: I got that.

MR. RAHN: Okay. Now going on to the next slide. Where we used to have an Allowable Value and we found that many times a single channel during a surveillance was found to exceed the Allowable Value.

We determined that using this discussion of Allowable Value, unless it was scientifically determined properly, you run the risk of having lots of LERs. So we said okay, what's a better way of doing this.

So, I'd like to show you the next slide, 16, which is something that we covered in a Regulatory Information Summary, Regulatory Issue Summary 2006-17.

And in addition, we worked with the owners groups to develop a Tech Spec Task Force issue that covers this issue that you're about to ask about, which is called TSTF-493.

And so, in the new way of looking at it we still have this as-left setting band that I'm showing you with my cursor here and you can set it within this number and you say it's good enough.

And then we have acceptance criteria called an as-found tolerance and it has both an upper limit and a lower limit. So we're looking at adverse performance of the instrument channel not only in the non-conservative direction but also in the conservative direction.

Because if you find this thing operating way over here lower than the as-found lower limit, that's not operating correctly either. You don't want that because you run the risk of spurious actuation.

So, what we did is we said okay, the risk clarified establishing, having criteria for establishing the setting tolerance or the as-left tolerance and an as-found tolerance.

So as to encompass what is considered to be normal performance for the instrument, as long as it's always within this as-found upper and lower band over the course of surveillance, during a surveillance, you know, after the surveillance interval has expired then this instrument channel is said to be functioning as required.

But if you see that this channel has gone beyond what might be within the Tech Spec Allowable Value that's published in the Tech Spec for those plants that still have the Allowable Value in the Tech Spec, it is still declared inoperable if it's beyond this Allowable Value.

But in the space between the as-found upper limit and the Allowable Value, you have the opportunity to perform an engineering evaluation and determine is it really functioning as required before I have to declare inoperable.

Or is it in operable, you know, so there's tests and things that you can do while you've still got the instrument channel valve out of service that you can perform to determine whether it's operating properly.

So, the model that we're favoring is one that's, we covered in this Regulatory Issue Summary back in 2006.

And we don't want that as-found upper limit ever, you know, if you find a device beyond that as-found upper limit into the Tech Spec Allowable range, you definitely can say it's inoperable at that point.

But here there's an opportunity in this band between the as-found upper limit and the Tech Spec Allowable Value to perform an engineering evaluation and determine was that a one shot deal or, you know, was there a broken instrument or a bad calibration device.

So, you know, so there's a lot of reasons why you might find it beyond the as-found upper limit. You want to make sure that your only worried about reporting the ones that are because the instrument channel itself is not functioning properly.

CHAIR BROWN: But you will still allow the as-found upper limit to be above the Tech Spec limiting trip setpoint?

MR. RAHN: It can be. On the plants that

have Allowable Values, it's possible that you would find yourself outside the as-found upper limit and it might just be a one shot deal.

It happened once, on the next interval it never happened again. But if it happens two in a row or more then you say okay, since I'm trending this information, I have an opportunity to say hey, if it happened twice in a row there's got to be something wrong.

Either I established this as-found upper limit too tightly or the instrument channel is really not working the way we expect it to. So you don't have to write an LER if you're in this band, right?

The LER is written when you're above the Allowable Value.

CHAIR BROWN: I understand what you're saying, it's just that you're saying that's for the older plants that still have a Tech Spec Allowable Value as a metric they have to meet.

MR. RAHN: Exactly.

CHAIR BROWN: But the ISA doesn't recognize an Allowable Value. Your, I'm trying to remember whether your Reg Guide covers that or not. Is that the last --

MR. RAHN: Yes. We have a paragraph in

the Reg Guide that talks about what do you do if you have the plants that have Allowable Values in them.

One thing I think we probably should have mentioned in the beginning of this presentation is that the Revision 4 of the Reg Guide is really aimed at new plants, you know, new applications or voluntary adoption of this methodology by existing plants, by operating plants.

It's kind of a forward looking document and in the future we don't expect that we will have Allowable Values published in the new Tech Specs.

MR. REBSTOCK: Dave, if I can interject something. This is Paul Rebstock.

MR. RAHN: Yes, Paul.

MR. REBSTOCK: I think some of the confusion may be the Tech Spec limiting trip setpoint, that's not an absolute limit. That's a limit on what the nominal is allowed to be.

MR. RAHN: Right.

MR. REBSTOCK: It is okay to exceed that later in the game, like toward the end of the calibration after drift has occurred and environmental conditions have changed and whatnot.

So, that might be part of the confusion. That's not an absolute limit, it's just a limit on the nominal. And then the question between the as-found upper limit and the Allowable Value, which you have right now, you kind of look into is this particular deviation acute or chronic?

We talked about that a little bit in 1141 and you make an engineering judgment. You expect the deviation to be a little more than you expected occasionally because it's, you know, we assume everything is Gaussian.

You got 95-95, no pump, you know, probabilities are never zero. So that's part of the assessment you make. But what we decided when we wrote the RIS was that the Allowable Value had to be a hard limit.

And if you exceeded it that you have to declare the instrument inoperable. But if you're between the as-found upper limit and the Allowable Value if that exists, then you have the opportunity to make an assessment as to whether this is actually a significant deviation or whether it is just something that happens occasionally and is not important.

CHAIR BROWN: Okay. Well the ISA does enforce sentences on Page 23, talk about some Tech Spec have the Allowable Value.

And then, but when you talk about 493,

which I'll have a different question for that later, it was just the inconsistency in terms of where the quote, as, your definitions of as-found and how the two graphs don't correspond. That's all.

MR. RAHN: So, I think Paul hit the nail on the head. He said, you know, this limiting trip setpoint is a calculated value that you are sure has the uncertainties associated with performance of the instrumental channel.

And it's a limiting value at which your nominal setpoint can be established. It's not an acceptance criteria for calibrations.

CHAIR BROWN: So what, well, so if you're initially calibrating the -- aligning your setpoint, say you had 110 percent nominal trip setpoint --

MR. RAHN: Yes, right here.

CHAIR BROWN: -- the limiting trip point of 113 percent, could they set it at 113? That's what you just said a minute ago.

MR. RAHN: No. You can only set it to within the as-left band and as-left tolerance. So you set it at the nominal value.

CHAIR BROWN: Okay.

MR. RAHN: And it has to be within this setting tolerance.

CHAIR BROWN: All right.

MR. REBSTOCK: But the nominal value can be the limiting trip setpoint.

CHAIR BROWN: Pardon?

MR. REBSTOCK: The operator may choose to do that.

CHAIR BROWN: May do what? Say the whole thing again, say the whole thing again.

MR. REBSTOCK: Okay. This is Paul Rebstock. What I said is that the plant operators or the, you know, the institution, the licensee may choose to make the nominal trip setpoint equal to the limiting trip setpoint or they may choose to make it lower. That's discretionary.

(Simultaneous speaking.)

CHAIR BROWN: If you used a limiting trip setpoint then your E band would then bound itself around the limiting trip setpoint?

MR. RAHN: Yes.

MR. REBSTOCK: Yes. That could happen and the decision has been made that we won't actually let that be. You could make a case, we did in the previous version.

You could make a case that says that, you know, depending on how you do the calculation, E could intrude into that a little bit. But it gets kind of complicated and messy.

So, I think what we decided is we're just not going to go there and we'll just say okay, take the nominal low end off the E doesn't cross it, so it's the upper edge of E that would have to hit the limiting setpoint.

CHAIR BROWN: So, even if you've got an older Tech Spec with the Allowable Value specified you expect them to conform to your Slide 14?

MR. REBSTOCK: Absolutely.

CHAIR BROWN: Okay.

MR. REBSTOCK: And that upper, that Allowable Value will generally correspond to the upper edge of F, although the way of calculating the Allowable Value, as Dave said, is a little bit, has not in the past been well controlled.

So it may or may not actually be there, but in principal, in theory, it should be the upper edge of F.

CHAIR BROWN: Okay, thank you. I may even remember this if I read the transcript again.

MR. RAHN: Essentially the Allowable Value accounts for the applicable instrument measurement areas that are consistent with the plant's setpoint methodology and so, as Paul alluded to, you could say programmatically, I'm going to determine my nominal setpoint to be the same as my limiting trip setpoint.

But it's, as he said, it's messy. You're always better off having extra margin between the limiting trip setpoint and the nominal value.

CHAIR BROWN: Okay. I think I've beat that one to death enough right now. I'll save my 493 question for later.

MR. RAHN: Okay. So what I want to do is just refresh everybody's memory now that I put two other slides about levels and stuff.

But this is the figure that's currently in the endorsed standard and which we are signing onto as the workable method that the staff believes is good for both establishing the setpoint and maintaining the calibration of that setpoint within an acceptable tolerance band. And so, that's --

CHAIR BROWN: That's the same as Slide 14 right?

MR. RAHN: Yes. It's exactly the same as Slide 14.

CHAIR BROWN: Okay. All right, thank you.

MR. RAHN: Okay. Now --

MR. HECHT: This is Myron Hecht, just a

clarifying question. What you're basically saying is that if you have a transient above the LTSP you now have to write an LER?

MR. RAHN: No. You don't know it, you know, the LTSP is a programmatic value that you establish to ensure that accounted for uncertainties between the analytical and the nominal setting.

So, yes, you could have a transient and it go beyond a limiting trip setpoint value. But again, what you got to remember and I'm going to have a slide on this later, this figure on the left represents the way an instrument channel is expected to behave when it's connected to the process.

And is subjected to environmental conditions and other uncertainties that can occur during normal operations and an accident. Whereas, on the right hand, these are things that are only seen during a calibration.

And it depends on what you're calibrating but essentially these are the terms that you're concerned about for the portion of the instrument channel that initiates the protective action.

And these are seen under calibration conditions, not operating conditions. So, and that's the only way we can calibrate instruments right now.

I mean, some day in the future, well we'll be able to have online calibrations I suppose.

But for now everything is offline, it's out of service when this calibration is performed.

CHAIR BROWN: Can the plants perform a realignment of an individual division or an individual setpoint in one division while they're in operation?

MR. RAHN: Yes. Yes, Member Brown.

CHAIR BROWN: Okay.

MR. RAHN: So, that's why we have four instrument channels or two, one out of two twice or two out of four logic. So as to be able to take one channel out of service for calibration.

CHAIR BROWN: Okay. That's good. All right, I just was trying to make sure I understood the consistency between my past experience and the commercial plants.

MR. RAHN: Yes.

CHAIR BROWN: Thank you.

MR. RAHN: Okay. Okay, so now I just want to ask if everybody's comfort levels, are we okay moving on? This next section is a lengthy section, so do you want to, do you want to take a break or keep going?

Okay, hearing none, I will keep going.

Okay, so the next section I want to cover is how do instrument channels perform and why do we need to worry about uncertainties.

So, remember 50.36(c)(1)(ii)(A) says, the setting has to be chosen so automatic protective actions will correct the abnormal situation before safety limits exceeded.

CHAIR BROWN: Actually, Dave.

MR. RAHN: Yes.

CHAIR BROWN: About how long do you think this next section will take?

MR. RAHN: I will say a minimum of a half an hour. Depends on how many questions we get I guess.

CHAIR BROWN: Okay. Let me, I'll make a, we've been on for an hour and a half so, before we start the next section why don't we take a, go ahead and take a 15 minute break. Walt and I probably will appreciate that.

MR. RAHN: Me too.

MEMBER KIRCHNER: Thank you, Charlie, yes.

CHAIR BROWN: Pardon? Was that Walt?

MEMBER KIRCHNER: Yes. I said thank you.

And turn to calibration about time, how about we reconvene at 11:15?

CHAIR BROWN: Let's see it's 10:57, 11:15 will be fine. Is that satisfactory with everybody? Okay. We'll reconvene at 11:15 according to my computer time. Supposedly, mine's at 10:57 right now, almost 10:58. All right, 11:15.

(Whereupon, the above-entitled matter went off the record at 10:57 a.m. and resumed at 11:17 a.m.)

CHAIR BROWN: Okay. We will leave our recess and we'll reconvene and get started again. Dave, what slide are we on?

MR. RAHN: We're on Slide 19 right now. And we're only going to spend a minute, or less than a minute on this slide. Basically, it's there primarily to remind everyone that plant safety analyses are used to cover plant level thermal, hydraulic, and dynamic, and mechanical system performance responses when you're determining an analytical limit as part of the safety analysis.

Whereas, total instrument loop, or instrument channel uncertainty analyses cover instrument channel performance responses when establishing setpoints.

So they have different scope, different requirements, different regulatory bases cover them.

But essentially, all of them are used to determine total uncertainty in initiating a protective action to correct an abnormal situation before a safety limit can be exceeded.

Slide 20, okay. So the other thing, we touched on this briefly, but now I actually have a slide to show you. On the left hand side of the screen, these terms that we are showing you are terms that describe the instrument channel performance when it's in service. When it's connected to the process. That's its behavior while connected to a process.

So we call this, the blue bracket here, an allowance for channel performance uncertainties that are not observable during the calibration process.

Whereas over here on the right hand side of the screen, these are parameters that we can observe regarding an instrument channels performance as it's measured during a tech spec surveillance. And we use it to determine whether an instrument channel is within its as found limits.

And at the conclusion, as it's set to within its as left allowance limits. And we use this function to determine whether an instrument is performing as required.

So with that in mind, some people, you

know, get confused, you know, because some plans, some instrumentation terminology is something that is actually not observable while the channel is connected into the process.

A lot happens to an instrument channel, especially something like a pressure related, or differential pressure, even better. Differential pressure transmitter connected to a high pressure system, to measure something level, or a flow, can change significantly just by opening the isolation valves for that transmitter and, you know, valving it into service.

So you calibrate it for one particular setting, but its performance will change as you valve it into service. And we'll talk about some of those things that affect that in the next few slides.

CHAIR BROWN: Can I ask you a question?

MR. RAHN: Yes.

CHAIR BROWN: Recognizing that we had the same difficulty, and we actually developed some noninvasive plant check procedures where you could use plant parameters based on reading instrumentation that you had in operation.

MR. RAHN: Yes.

CHAIR BROWN: To see if you were in -- do the commercial plants do anything like that?

MR. RAHN: Commercial plants will do something like that if you're trying to diagnose a problem.

CHAIR BROWN: Okay.

MR. RAHN: Associated with the performance of an instrument channel. But it's not something the operators would always do. You know, it's something an operator might be requested to do by the engineering manager, or a technical, you know, maintenance manager for the instrumentation department. But it's not a regular practice for operators. It's something that would only be requested by either a special procedure or special request.

CHAIR BROWN: Yes. Well, for pressure detectors, we developed a procedure where we used a high accuracy instrument that we connected into the loop, and then we could reduce, raise and lower the pressure with the pressurizer, and check all of our instrumentation calibration without breaking, opening and closing isolation valves.

MR. RAHN: Yes.

CHAIR BROWN: And cycling them. It worked really well.

MR. RAHN: Yes. And here --

(Simultaneous speaking.)

CHAIR BROWN: I was just curious. That's just a --

MR. RAHN: Yes. When you're several hundred feet under water, you're allowed to do what you need to do. When you're operating on nuclear power plant, you don't always have the luxury of grabbing a, you know, a measurement and test equipment device and just valving it into service.

CHAIR BROWN: Yes.

MR. RAHN: Yes. So you, that's a special act, you know -- we used to call them temporary alteration, but essentially, they have special requirements associated with them. So you are considered to be in a test or experimental mode, you know, and you've got to perform a 50-59 and every associated with doing that.

So it's not ordinarily done. You could have something permanently, if you qualify the device to say it's qualified to be connected permanently, and you've done that analysis, then yes, you could probably do that.

CHAIR BROWN: okay. All right. Thank you.

MR. RAHN: Yes. Okay. Moving on. So this is like a typical model of an instrument loop. We've used this diagram in presentations in the past. It's a piece of a figure that's contained in what we call the ISA Recommended Practice Document, which we're going to talk about a little bit later.

But basically, it models the pathway from the process connection through some kind of a process device, or interface device. Some kind of a transmitter or sensor, interface signal to a signal conditioning device, and maybe another signal conditioning device. And finally, to the device that performs an actual initiation of a protective action, like a bistable device.

And a portion of this loop might be in one environment, and a portion of the loop might be in another environment. And all the way along the way, there are several effects that could deteriorate the performance of the measurement of the process. And they all have to be taken into account when you model the channel uncertainty.

These little numbers down below here in the circles represent the different types of effects. So just a for instance, this process here might be a pipe, let's say a reactor coolant pressure boundary pipe, for example. And it might have a tap on the pipe and some kind of a sensing light in between.

And then that sensing light might go to an instrument rack, and on the rack there's a transmitter. The transmitter might be connected electrically to some kind of a signal conditioning device. And then it might go through, let's say, containment penetration or something.

And then outside the containment might be some other, a retransmitter of some type. Anyway, so it just, this thing just goes on and sometimes we call this an instrument channel, and sometimes we refer to it as instrument loops. So if I switch between those, don't be too surprised that I just revert to calling it an instrument loop. But basically, this is a typical model of an instrument channel.

So yes, so there's process measurement effects affecting this area up in the front end and calibration uncertainties. Depending on how this channel is calibrated, you could have other effects due to the measurement and test equipment that you're applying to the device.

In some cases, you might actually break a loop. Let's say here, at this point, before the signal conditioner, and you might be running the output of the transmitter using some kind of a test pressure, test signal into the transmitter, and measuring its output. And then reconnect it to the rest of the channel, and then measure the channels bistable trip condition, how accurately that's conforming to the as found tolerance limit.

So depending on the channel, there's different ways of calibrating it. So a lot depends on the configuration. So this is a just a rough model.

So these are, the other thing that we have to contend with in instrument world is that not all instrument errors are specified by manufacturers exactly the same way for every type of device. We might have to contend with the specification that talks about a percent of span her 100 degree change from some reference conditions, or a 50 degree change.

You know, so the vendor might say, okay, this instrument's good for 70 to 104 Fahrenheit, but if you go, and we'll say here, accuracy is 0.5 percent of span per 100 degree change from those conditions. If I go beyond 104, which is my reference condition, I have to add an additional half percent of span per 100 degree change.

And the way it's done is also, you know, kind of the well model. It could be done linearly, or proportionately, or sometimes you have to add the whole thing. So it all depends on, the more you know about that instrument channel's performance, the better.

Another way of specifying is a percent of calibrated span. And the vendor might actually come right out and say, hey, my performance accuracy specification includes the effects of linearity hysteresis and repeatability. Or he may say, well, it includes linearity and repeatability, but not hysteresis. I mean, you have to read the manufacturer's specifications very carefully so you really understand how much of the term is encompassed under the term, and accuracy, and how much you might have to add or derate the device because of other factors.

Here's 0.1 percent of calibrated span, or upper range limit, whichever's greater. That's another way we might see. By upper range limit, we might mean the rangeability of that particular device. It might be capable of being calibrated, let's say zero to 100 inches of water column, might be its nominal range. But it might be capable of being calibrated up to 200 inches of water column. So the upper range limit is 200 inches of water column instead of the calibrated span, which is 100.

Another way is 0.2 percent of upper range limit for so many months from the date of calibration. We don't have too many of those but, I mean, we've seen some like that.

Another one could be percent of reading. And that's something like that could be typical of the specification for a piece of measurement and test equipment. Or here's another one, plus or minus least significant digit. So there might be some kind of a digital readout on a piece of equipment and it's accuracy might be specified as the plus or minus one of the lowest significant digit on that reading.

Or something real simple, like plus or minus 0.1 percent Fahrenheit. You know, it might be a precision RTD or something might be specified like that. So that would be in comparison to a, you know, a reference or some traceable standard of some type.

Other things that can happen to an instrument loop. Here's a typical diagram of a, let's say, a differential pressure measurement device that's being used as a level transmitter for measuring reactor water level.

So in this, this is a typical BWR representation. There might be some kind of a condensing chamber. So steam from the vessel is allowed to go into this condensing chamber, which is not insulated, and it will condense and keep this reference chamber full of water, so you have a continuous head of water on the high side of the transmitter.

And then the mass of water above the lower tap for that transmitter, so the reactor water sitting on top of it is used to measure reactor water level. And so as this differential pressure increases from this transmitter having its reactor water levels decreasing.

So this is a case where some of the instrument loop, pieces are inside the containment, which might be considerably hotter under normal operating conditions than outside the containment. There might be, oh, I'll just throw out some numbers. It might be 120 degrees, let's say, inside the containment or the dry well, and only 88 degrees, or 75 degrees out here.

So you know, so there's differences that have to be accounted for in the scaling equation for this transmitter, including things like what's the density of the fluid inside this particular piece of pipe, versus the density outside. And similarly on the other leg. So you could have a normal scaling equation for this transmitter that accounts for the density of the fluids in this instrument sensing line system, under 100 percent power operating conditions, let's say.

So none of these devices are calibrated for the 100 percent power operations condition. But if those conditions change, then there's an error introduced into the measurement of the device. But the device doesn't know what the transmitter differences are, you know. It's just sitting there measuring differential pressure.

So the value that might correspond to reactor water level for a device calibrated under hot conditions might be one number. But if you have some kind of an accident that occurs, such as the stem break somewhere inside the containment near this condensing chamber, that might affect the temperature increase in this area, changing the density of the fluid.

You know, so you're uncertainty calculation has to account for that affect. So you might have, the instrument might be putting out, let's say ten milliamps at the normal operating condition, and it might change to 12 milliamps when that kind of condition occurs.

So you have to make sure you've accounted for changes in ambient conditions that could occur under the accident conditions, you're trying to protect, or to initiate a protective action against.

Additionally, something I mentioned, yes, there's also a head correction. Normally this transmitter is located way down below the point of measurement in the vessel. So there's head correction to be considered too. But typically, head correction is not something that changes because the level of the actual elevation of the transmitter doesn't change, usually, with respect to the condensing chamber, except when the vessel is heating up from cold conditions to hot conditions. You would normally calibrate it for the hot condition.

But these are just examples of things that have to be considered when you come up with total instrument channel uncertainty.

MR. HECHT: This is Myron Hecht, I'm just wondering if I can ask another question.

MR. RAHN: Yes.

MR. HECHT: You were speaking about that uncertainty and before you were using the term 95/95. I'm just wondering if now might be a good time for you to explain when one speaks about uncertainty or error, what does that mean and how does that relate to this 95/95 phrase that you were using?

MR. RAHN: Yes. Thank you for that question, Myron. We're actually going to spend a considerable amount of time in upcoming slides on that very subject.

(Simultaneous speaking.)

MR. RAHN: I'd prefer to move on until we get to that particular slide.

CHAIR BROWN: Okay, Dave? We've completed almost two hours, we're 23 slides --

MR. RAHN: Yes.

CHAIR BROWN: Into your 80 slides or so.

MR. RAHN: Yes.

CHAIR BROWN: So we need to maintain some cognizance of time. We haven't helped you any at all in these first slides.

MR. RAHN: Yes. That's okay.

CHAIR BROWN: We're not blaming you. This is all our fault from that standpoint.

MR. RAHN: But that's okay. We actually dry ran this thing last week and we did it in two and a half hours.

CHAIR BROWN: Okay.

MR. RAHN: So if we're beyond that, you know --

CHAIR BROWN: You mean the whole presentation?

MR. RAHN: Yes. We managed to do the entire presentation.

CHAIR BROWN: Oh, good. We've got all day for it. I don't trust the members.

MR. RAHN: That's okay. We're --

CHAIR BROWN: Including myself.

MR. RAHN: Yes. But I do appreciate the questions and I'll let you know whether we are covering it later or not.

CHAIR BROWN: Okay.

MR. RAHN: And then when you ask the question, I can try to answer it if I know we're not covering it later.

Okay, now moving on. So these are examples, I talked a lot about some of this process measurement uncertainty that affects in situ connected instruments, as well as sensing lines. You know, things like, you know, even things like changes in the fluid density of the process itself can change under accident conditions.

So there is a number of things that you

have to consider. Also, the actual what we call a primary element, you know, that's the things that are, you know, like differential across a thermal well, or we might have flow, let's say an orifice plate or a venturi that has its own uncertainties. You know, there's manufacturing tolerances associated with flow elements and venturis that need to be considered.

Obviously, as we talked about earlier, transmitter or sensors have their own reference accuracy and unless the vendor specifies otherwise, they usually encompass the effect of linearity hysteresis and repeatability.

Also as I mentioned, effects on transmitters due to the changes in the processes, such as the static pressure effect on a device once it's connected to the process versus the way it behaves under calibration conditions.

The calibration accuracy itself, you might be using some high precision measurement and test equipment, but even that equipment has an uncertainty of its own, and it also has, some of them have a reading error associated with them.

Then the rest of the calibration of the devices in the loop, they all have uncertainties associated with them. Some of which you can kind of minimize by performing what we call a string calibration. We might be able to calibrate a whole -- you know, once you get a bunch of devices in series within their ballpark ranges, and then you connect them together and calibrate them as a loop, you can minimize some of that total uncertainty.

As I mentioned, measurement test equipment accuracy, ambient temperature affects, both under normal operating conditions and under accident conditions, one thing that we have to factor is devices which have electrical connections that might be somewhat exposed to humidity or steam conditions inside a dry well. Might cause some insulation resistance changes in the wiring that goes between the transmitter and the devices outside the containment.

Also we try to factor in the amount of expected drift that could occur over the designated surveillance interval. We're going to spend some time later on about drift.

Also sometimes you need to identify which devices you might have that are in the series of, in the loop that are nonlinear and sometimes the error that's propagated through those nonlinear devices can be magnified. But it also can be, you know, diminished too. Depending on the nonlineary characteristics of the device.

And then finally, if it's necessary to account for allowances to account for dynamic effects, if that hasn't already been accounted for in the modeling that determined the analytical limit.

So those are the, timing or not, that's not an all-inclusive list, but it's the type of things that keep an instrument engineer up late at night sometimes.

Okay. So it's important to determine how these uncertainty values affect the instrument channel. So in some cases, some of these effects can be modeled as a random independent variable. And other cases, it might be a dependent variable.

I'll give you an example. Sometimes a vendor's specification, as I mentioned earlier, they might give a specification about accuracy of the device, you know, up to a very wide range of temperature conditions. But in other cases, and in such a case you could treat accuracy as an independent variable. But in other cases, the vendor specification for that device might be something that is much smaller than your expected ambient conditions for that device. In which case, you have to amplify the specification for accuracy dependent upon that temperature condition. So that might be a dependent variable.

In other cases, you might have an error affect that is in the form of a bias and a good example is there might be some shifting of the span, or the zero of an instrument, depending upon the elevated static pressure that's applied to it. So those are kind of a bias term.

Sometimes a vendor may specify that term as a bias, and sometimes they may say it's random, but within a certain range. Or they may say, oh, it's always in the positive direction. But they also might say, oh, its direction cannot be predicted for the entire main structure so you have to test the device individually. Determine what it is for your device.

So now we talk a little bit about what's the distribution of that term. So this is something, this is, now we're kind of like into the art part. So a setpoint uncertainty methodology analysis is kind of part science and part art. And the art is somewhat based upon many, many observations of instrument channel performance that you need to make some engineering judgments about in order to simplify your uncertainty analysis.

But it so happens that after observing

lots of instrument channel performance over many years, a lot of these random uncertainty terms do appear to be, at least approximately, normally distributed.

So to assist in performing the uncertainly analysis, it's helpful to represent that variation as a normal distribution. And if you do that, it makes your analysis much simpler. But it still behooves you to verify if there's something that performs way different from that, then1 you can't really use this normal distribution. So you need to understand it as best as you can.

So what are the steps in performing instrument channel uncertainty? Basically, there's four major steps. Each one of these major steps, though, is fraught with different ways of doing it. So you have to keep this with a grain of salt.

But basically, this is the process you use. The first is to model and evaluate the channel. Similar to what I had in that figure, which might be a string of devices. And you have to, from a practical perspective, identify what are the critical sources of uncertainty that could occur within each portion of that channel.

The second step would be to determine

whether each uncertainty term could be appropriately modeled as a random independent, a dependent, or a bias term. The third step is to use appropriate data sources and methods to develop a reasonable estimate of the magnitude of each uncertainty term. And then you justify and document those estimates.

And then finally, you combine those terms together using appropriate methods to arrive at total instrument channel uncertainty. Now each one of these steps, as I mentioned, there's kind of a science and an art to them as well.

So this determination of whether an instrument loop could be randomly dependent, dependent, or bias is based upon knowledge of the performance specifications for that instrument.

Or it might be something that you may have done some special modeling yourself. Let's say in the laboratory condition. So you might be using a vendor's specification, but if you didn't really understand that, you might have tested in a laboratory condition and found that it could be modeled slightly differently.

The other thing is this appropriate data sources and methods. The current version of the endorsed standard has a section regarding what to do if you cannot apply this normal uncertainty methodologies. And so we're going to talk about that later when we get into that particular standard.

And combining using appropriate methods. So the appropriate methods are things that are also covered in the industry standard that we're endorsing.

So here's that slide that we talked about earlier. And it's basically the same slide, I've just repeated it to show these are -- do you see that -- figure out what are the uncertainties in each portion of this loop, and combine them appropriately.

So combining uncertainties. So typically, the ISA standard indicates that bias terms should be added algebraically. And you have to, it's best if you combine all the positive terms together with other positive terms, and negative terms with other negative terms.

Random independent terms using the central limit theorem, you could combine those random independent terms with Gaussian distributions as SRSS competitory methods.

The random dependent uncertainty terms are first added together algebraically with their dependent co-term. And then added by SRSS methods.

And total uncertainty is the sum of all

the terms added together, such that all of the uncertainties that would impact total measurement and trip performance in the non-conservative direction accounted for with margin, if possible.

Now this with margin is somewhat dependent upon the specific, plant specific setpoint methodology that's used, that's applied. Some plants do not apply the margin here. They rather apply it between the limiting trip setpoint and the nominal setpoint. So this is somewhat variable.

So how do we estimate each uncertainty term? Well, for a random distributions, if a term fits that category, we use what we call a tolerance interval estimation process. And that's just, just to remind people, that's different from a confidence interval.

In a confidence interval, we usually are predicting the mean value of a population that might fall between one value and another. And if you repeat the sampling for that value many times over, X percent of the time, like 95 percent of the time, whatever your criterion is for that acceptance criteria, 95 percent of the time, the mean will fall between those two values. So that gives you a leg up on a parameter for describing that population with some kind of confidence.

Whereas a tolerance interval is used to estimate a proportion of a population of interest that falls between two values of that population with associated confidence level. And the end points of that confidence level are the part that's uncertain, and you might have figured out to a certain confidence level, you would like to know the end points, or the tolerance limits for that tolerance interval.

So that's the process we use if it's a Gaussian distribution.

So here's an illustration. So a confidence interval estimation, you're answering a question, I think the mean lies between this lower limit and this upper limit. So that's what I'm doing. I'm estimating a characteristic about that population, and I'm estimating that it probably lies between these two limits.

Whereas in a tolerance interval, I'd like to capture X percent, or a lot of times we use 95 percent, of the population of interest, and I don't know specifically the end points, but I'm going to use a certain confident, I'm going to determine those end points to within a certain confidence level. So that's what makes these two different.

So the end points of a two side tolerance interval are determined by the equation like Y bar plus or minus kS, where Y bar is the mean and S is the sample standard deviation. And k is represented by a tolerance limit factor. And this factor is based on the sample size that you have associated with the sample standard, and a desired proportion. Sometimes I use this term pi, or pie of the population to be contained within that tolerance interval. And you're estimating it to be within a certain confidence level, or gamma.

So to calculate these limits, it's necessary to specify distribution of the population but these tolerance limits that are based on a factor of k, are called tolerance limit factors. And as I mentioned, they're based upon the sample size, the confidence level, and the desired population proportioned to be encompassed within them.

So it's important to know that whenever you specify a particular tolerance interval width, you need to specify it to within a specified desired proportion and a confidence level.

So for example, an instrument error in most cases is specified as, let's say, plus or minus two PSIG. Well, essentially, the factors that are used to achieve this, and you want to know that to 95/95. We have to be consistent using the proper k factors to do that with. So we're going to talk a little bit about this 95/95 in a minute here.

So what do we use for acceptance criteria for judging whether we've encompassed the total uncertainty that's of interest. And so one thing that we do is we've been using a handbook, NUREG-1475 is one, but there's many statistics handbooks that have similar information in them.

But in NUREG-1475, we say that the 95/95 specification is the most common specification for tolerance intervals that's used at the NRC, and it's usually regarded as the default tolerance interval specification. It's important to remember because it's talking about the degree to which we know the end points of that tolerance interval.

And we like to do it so as to encompass 95 percent of the population of interest at a 95 percent confidence level. Let's see, let me ask you, I think at this point, yes, so going back to Member Hecht, do you want to ask something else about this?

MR. HECHT: No. I think you answered it. I didn't understand what 95 and 95 meant, and it was with respect to establishing those bands that we were talking about before.

MR. RAHN: Yes.

MR. HECHT: And so you covered it very nicely. It's relayed it should be --

(Simultaneous speaking.)

MR. RAHN: The way this is written, typically this first number is the population percentage of interest that you have, and the second number is the confidence level to which you know the end points of that tolerance interval.

Okay. So when you start to combine these random uncertainty terms -- you know what, I -- just to say it, I do hear some clicking in the background, so if you're not speaking, could you mute?

Okay. So, yes. So when you come down to combining the random uncertainty terms, you add them by SRSS methods and I also mentioned earlier, we add together algebraically any dependent terms before combining them with SRSS methods.

But the important thing to remember though, is that when you combine all these random uncertainties, you have to use the same number of sample standard deviations and you normalize them all to the envelope conditions. So like 95/95 conditions.

The bias terms typically, if you know the direction, you retain their sine of application. But if you have an unknown sine associated, you don't know the direction that the bias term can occur on, we usually typically use the absolute value and because it's direction is unknown, we have to assume that it could be occurring in the way you don't want it to. So it has to be added to the non-conservative direction.

So the expression that's been used in the ISA standard is this one, which is Z as plus or minus square root of A squared, plus B squared, plus C squared, the square root of that, plus or minus the absolute value of abnormally distributed uncertainties with unknown sines. Just the positive bias terms minus the negative bias terms.

And that's like an equation that, I'd have to say, although it looks like a science, again, it's an art, but it seems to work. So this is what we've standardized in the industry as described in the ISA standard.

Again, this is all, remember, it's all an estimate and it's a reasonable estimate. That's what we're shooting for. It's not with absolute certainty, but it does provide a high confidence that we've bounded all the uncertainties that we're concerned about and they would capture those between the limiting trip setpoint and the analytical limit.

MEMBER MARCH-LEUBA: Dave, since you mentioned this, here's a question on the 95/95. Would you say 95/95 is the criteria that we have customarily used as more like a guideline, or is there any (telephonic interference) is there a proven for success to choose 95 percent?

MR. RAHN: You know, that's a very good question, Member --

MEMBER MARCH-LEUBA: March.

MR. RAHN: -- March-Leuba. So I've wondered that question myself and not just recently. I mean, I'm talking about for the last 20 years or so. I cannot find a hard and fast specification that forces this to be a requirement. But I do find many, many references throughout engineering texts, as well as USNRC, SECY, and criteria for designing fuel, and showing that a particular fuel reload has a certain performance associated with it. All of which make a recommendation that they be estimated, that uncertainties be accounted for at the 95/95 level.

So even though it's not a requirement that I can find, I find it's over and over used and accepted as a generally accepted reasonable estimate and with a high confidence.

MEMBER MARCH-LEUBA: You're knowledgeable in that, that I'm trying to go to the single sided versus double sided acceptance criteria.

MR. RAHN: Yes.

MEMBER MARCH-LEUBA: So are we applying 95 or are we applying 97.5?

MR. RAHN: Yes. So we're --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: This thing has been going on for 20 years.

(Simultaneous speaking.)

MR. REBSTOCK: Paul Rebstock here. I will address that in the nonconcurrence evaluation. That's what the, one of the primary basis of nonconcurrence. I'll go into that.

MEMBER MARCH-LEUBA: So as background while we wait for it to calm, it is customary to use 95's double sided, as opposed to these rules forcing you to do it.

MR. REBSTOCK: Back when we were trying to figure out about single sided versus double sided setpoints, I went to, not just me, several of us, went to quite a bit of effort looking for the criteria for this statistical criteria to use for that. And there is no regulatory criterion, there is a tradition that seems to show up all through statistics of 95 percent likelihood, or 95/95. It just keeps showing up. It's more a traditional way of doing things.

(Simultaneous speaking.)

MR. REBSTOCK: 95, 97.5 to something else. I'll go into that later.

MEMBER MARCH-LEUBA: And I can show you criteria that says 99.9 percent of them must not fail.

MR. RAHN: Yes. I've seen that one too.

MEMBER MARCH-LEUBA: So those are, yes, that was my point. I can't wait for the other discussion.

MR. RAHN: Yes. So you know, throughout the rest of this slide presentation, we'll be demonstrating that we have, as long as you ensure that when you estimate the width of any particular uncertainty interval, not, you know, for determining what a particular channel uncertainty effect is, as long as you estimate the width of that interval using the 95/95 parameters, regardless of whether they're one sided or two sided, you are bounding the population of interest.

And so that's for estimating an individual uncertainty term. Later on, we're also going to be talking about what's the probability of a channel tripping. But when you set it at the limiting trip setpoint, or more conservative to that, before reaching the analytical limit. And we're going to be showing that there's a lot of history and performance operations which says that a 95 percent acceptance rate seems to be adequate based on observed performance. So we'll be talking about that an upcoming slide.

So here's a good point to start looking at that issue. So remember that between the total uncertainty, you have an analytical limit and a limiting trip setpoint. And if you've accounted for all of those uncertainties that are expected to occur between them, then by adding additional margin, you are actually increasing the likelihood that that channel will trip before the safety, before the analytical limit is reached. That's the number one thing.

So we're adding margin between the limiting trip setpoint, and the analytical limit. Then, if you maintain that setpoint within the as found tolerance band, you are going to always have a nominal trip setpoint performing within a value that is expected to occur. And the instrument channels can deemed to be performing within normal conditions.

So now the problem that we run into is between the lower edge of this as found condition, and the range of normal operating conditions, you run the risk of encroaching upon this, what we call, the spurious trip avoidance margin.

And so what we are looking for is, we're looking for a way of not causing a spurious trip to occur. If you overestimate the allowance needed to accommodate total channel uncertainty, that could be problematic in that it increases the probability of spurious situation, such as either a reactor trip, or an SFAS initiation when it's not necessary.

Spurious operations could put the plant through unnecessary thermal cycling and it challenges plant systems, and plant operator performance, when no actual adverse condition really exists.

This affects not only the overestimation of total instrument channel uncertainty, but also the establishment of the as found and as left tolerance intervals, which are used to maintain the instrument during surveillances. And which so, if you overestimate this as found tolerance limit, you also run the risk of masking the detection of a channel that's not performing properly.

If you make these acceptance bands too wide, for example, you could have a poorly performing instrument and you won't be able to detect it because it's always falling within that wide band.

So here's, this is a key factor that influences how we're addressing the concerns that were raised in the nonconcurrence. For total loop uncertainty, it was found that a 95 percent probability of channel trip, before the analytical limit is reached or exceeded, and it already includes all of the other known bias terms, and all the other uncertainties in the loop, plus most times has additional margin, plus the analytical limit itself has margin in it before the safety limit is reached.

You know, you can't limit yourselves to all these, you can't waste all this space that you have here. You need to ensure that you've accounted for known effects in your uncertainty estimate analysis. And not more than that because if you do that, you run the risk of spurious trips.

What we found is that if we use the 95 percent probability of a channel trip before the analytical limit is reached, it seemed an acceptable bound for estimating total uncertainty based on several factors.

One is plants that have used this acceptance criteria in their setpoint methodologies, don't seem to have any recorded instances of plant trips not occurring when they should have. Also, it's highly unlikely that the values of uncertainty during accident conditions are all going to be simultaneously at or near the tails of their distribution, the random uncertainty distribution.

And finally, overestimation of allocations for channel uncertainty can reach a higher probability of spurious reactor trips, or spurious ESF actuations, when no actual condition really exists. So that's an area that we're using in several plant methodologies right now is 95 percent probability of a channel trip, and it seems to be working well.

Several plants use, for example, we have what GE has submitted as a BWR plant approach for estimating total loop uncertainty. And their approach incorporates a 95 percent probability of a channel trip, as well as looks at to make sure that there's a positive margin between the spurious trip avoidance -- I mean, between the normal operating limit and the lower band of the as found tolerance limit.

So that's one area that we're probably going to talk about more later today. Okay. Another item that we're going to be talking about is allowance for the uncertainty term of drift.

So this is an interesting one. First of all, as it says on this slide, it's very difficult to come up with a characteristic mathematical expression that could be generally used or applied across the board to estimate what is the expected performance of a channel for drift between successive surveillance intervals.

What we're finding is that it's highly dependent on the design of the actual instrument, the specific application that it's in, as well as some other factors, which we'll talk about in a little bit.

The best way to account for drift is to use actual data. You know, looking at historical as found and as left recorded trend data when that's available for each application and rather than trying to apply some kind of a global assessment, or X percent of span, for example. You know, per month of service. So that's, it's a difficult way, a difficult proposition for someone to do.

However, there are practical methods that can be used for coming up with estimated drift, and so what we're going to talk a little bit about is what are those methods, and where could we refer to guidance for performing that.

MEMBER REMPE: So, David?

MR. RAHN: Yes.

MEMBER REMPE: This is where my question earlier was kind of one of the slides that prompted my question earlier, because I know earlier, we saw an earlier version of these slides, where you actually in the last bullet said something about the manufactured specified drift characteristics, along with engineering judgment. But when you don't have operational data, you may have some initial testing, and you're doing a new widget --

MR. RAHN: Yes.

MEMBER REMPE: -- almost like a thermal hydraulics analysis, we applied penalties when we don't have much data to go on, and it just seems like you need to have some sort of penalty or increased uncertainty when you don't have something that's operated for ten years, or 20 years, in a plant.

MR. RAHN: Yes. I agree, Member Rempe. You have to have something to start with, especially if you've never used that particular component in operations in the past.

So what we're going to talk about later on is that you would use the vendor specification as your starting point. And then there's, and a lot of times that vendor specification is over a drift interval that might be less than what a plant instrument calibration surveillance interval is.

So for example, a vendor may specify X percent of calibrated span over a six month period, for example. And you're going to perform your calibration over a 24 month surveillance interval. And so how do I extrapolate the vendor's specification to accommodate the 24 month interval.

And so this is an area where we're going to discuss later, but I could give you just a little heads up. Someone might say the best way for you to do that is to add them algebraically. So let's say if it's a half percent over six months, and you're going to calibrate it over 24 months, add them together. So at six months, plus six months, plus six months, plus six months, half percent, half percent, half percent, half percent. That comes up to 2 percent. So use 2 percent and you're safe. That might be what someone might do.

Well, we're going to show later on that instrument channels really don't perform that way. What we're finding about drift is that the longer one observes the capability and performance of the same device over many different drift intervals, we find the drift actually does not continue to increase with time. It actually returns, many times returns and sometimes goes the other direction.

So we have lots of observed history that says that drift specifications using algebraic methods is fraught with problems. One way is that, the worst case problem is that the as found tolerance, which is based upon the amount of drift over a surveillance interval, would be overestimated and you would then mask the actual performance of the, you know, a poorly performing instrument channel because you would always find yourself to be within that limit.

So what we're trying to come up with ways in which might be more practical than trying to algebraically add these terms together. And we do have a way that's in the recommended practice document currently, which we're going to talk about a little later.

MEMBER REMPE: I get it with things that you know about and you've been using for a while. But when you start talking about a new widget, that's where I'm just kind of wondering if maybe -- most of the Reg Guide focused on things that are regularly used in the industry, but I'm just wondering if maybe something ought to be thought about for ones that we don't have much operational experience with. Because we're seeing it not just with one that was mentioned earlier, but with another one that's coming down the pike. And then who knows what they're going to do with some of these non-LWRs.

MR. RAHN: Yes. Well, I would recommend you stay tuned because we have a slide coming up that --

MEMBER REMPE: Okay.

MR. RAHN: -- talks about that very thing.

MEMBER REMPE: Okay.

MR. RAHN: Okay, so -- yes?

MEMBER BLEY: Bley. I'm sorry. I was gone for a while. I was having my own setpoints checked. So what you're saying is that instrument drift on the instruments we're familiar with, behaves more like a random lock.

MR. RAHN: Yes.

MEMBER BLEY: And that's interesting and I look forward to seeing how you're handling that. I apologize for having had to slip out for a little while. Can I ask you two questions, if you've already discussed it, I'll just wait and read the transcript because we're not in a big hurry.

(Simultaneous speaking.)

MR. RAHN: Yes. Go ahead, Member Bley.

MEMBER BLEY: So there were two paragraphs in the Reg Guide that left me curious. And it seems like you're talking pretty close to these. One is 226, which is graded approach based on safety significance, which talks about that is the standard all the way back to '94, has stated the safety significance can be used to determine, you know, how much you should focus on one or another. But you say the NRC staff has not identified a specific position. Do you look through what people submit? Or you just not consider the safety significance issue? That's the first question and go ahead on that one. If you've already talked about it, tell me.

MR. RAHN: No, we have not talked about that and I could address it. So first of all, you're talking about 226 in the ISA standard?

MEMBER BLEY: No, in the Reg Guide.

MR. RAHN: Oh. In the Regulatory Guide. Okay. So, yes. So in the Regulatory Guide, we make a position that the staff does not specify a way of applying a graded approach. So what we say is that this Reg Guide is directed to address limiting safety system settings as defined in the technical specifications.

So those particular limiting safety system settings are the ones that initiate protective actions, so as to allow a safety system or structure or component to perform its action before reaching any safety limits. And not only that, but before reaching an analytical limit.

So that's what the Regulatory Guide is aimed at. I don't think we make any specification as to how it should be determined, other than saying you may use risk informed methods for applying a graded approach.

MEMBER BLEY: Okay. So you'd have to review those separately.

MR. RAHN: Yes.

MEMBER BLEY: The answer's probably the same on my second question, which is the next paragraph, 227. On measurement and test equipment uncertainties, and there are two statements there. The standard, it says in the Reg Guide, provides for the accounting of measurement in test equipment uncertainties, but does not specifically identify acceptance criteria. And then you go on to say, you, the staff, does not endorse any version but you believe there's useful information contained there.

This issue of acceptance criteria on the uncertainties, I think you were just talking about that with Jose a little bit.

MR. RAHN: Yes. So we say that we should be estimating all uncertainties to the 95/95 tolerance interval specification. And as long as you do that, you have performed a reasonable estimate of that uncertainty, which when combined with all the other uncertainties, provide you a confidence that that channel will perform its trip function before the analytical limit is reached.

And so what we're saying is that as long as we specify the use of that acceptance criteria of 95/95 for all the uncertainties, we are within a high confidence that once you combine them together, they will allow that channel to perform it's protective action before breaching the analytical limit.

MEMBER BLEY: That's not colored out specifically in the Reg Guide. Is that in the RIS or somewhere else?

MR. RAHN: I believe it is. What's happening is that we say we are endorsing the ISA standard, and the ISA standard says this is the acceptance criterion to use for uncertainties.

MEMBER BLEY: Well, okay. Then maybe

there's something wrong in the text because the first sentence under 227 says the standard, the 2018 standard does not specifically identify acceptance criteria. Anyway, think about that. Take a look at it.

MR. RAHN: Yes. That could be, that could be a typo. That's a good observation.

MEMBER BLEY: Okay.

MR. RAHN: Because it does. It does specify acceptance criteria for all uncertainties.

(Simultaneous speaking.)

MR. RAHN: That's a good observation. Thank you.

Okay. So moving, let's see, where did we, so I was addressing Member Rempe's comment about what do you use. And so, again, new plants that are coming up are typically using commercial equipment. You know, so we have vendor specification and history on commercial equipment. On the other hand, Member Rempe suggests that there may be some new equipment that's going to be designed for an advanced reactor, that's not commercial, or not commercially available. Maybe custom for a particular non-light water reactor application.

So you know, in those cases, it's hard to believe we would enable, allow someone to operate using a piece of equipment that they know nothing about. You know, typically, the vendor of that piece of equipment would have performed a number of tests on that device before we would actually say that we know enough about it to have a 95/95 confidence in any particular uncertainty performance.

Typically, we would rely on a vendor test, for example, that they might have performed prior to furnishing the equipment as a, you know, as an Appendix B device. So typically, you would then use that vendor information to extract the information that you're looking for to characterize a particular uncertainty effect that you're trying to characterize.

I think I just talked in a circular reference there, but I mean, what I'm saying is that you have some vendor information, and if you don't, if it's not published information, it behooves the applicant to work with the vendor of that piece of equipment to determine what is the effect and how could it be characterized.

MEMBER REMPE: So again, thinking about how to get the radiation exposure data with the desired confidence, and I think it would be very hard. Especially when the configuration where it's deployed in is going to be hard to ever test in a test reactor, for example. And so you just need to learn by experience because even if they've agreed to come to this, to meet the standard, as mentioned earlier, I just don't think you're going to get that amount of statistical data, or data to meet the statistical requirements.

And so you're going to have to use engineering judgment as indicated here, but I think you almost need to be, have some conservative engineering judgment in there when you have something for which there is little data. And it's not just the non-LWR's, it's some of the small module LWR's.

MR. RAHN: Right. I agree. And definitely, test reactor data is important as well. So we think that if a vendor --

MEMBER REMPE: So is that put somewhere in this Reg Guide, or in the standard? I did not see it.

(Simultaneous speaking.)

MR. RAHN: Yes. So we're covering this in a later slide.

MEMBER REMPE: Okay.

MR. RAHN: There is guidance and an industry standard recommended, I'm sorry, industry recommended practice document and I have a quote from that document on a slide coming up, which talks about one way in which you could come up with a conservative estimate that is not overly conservative, like the algebraic addition of vendor specific test interval.

MEMBER REMPE: And again, you have -- I wasn't aware of this best practices things, but is there something in the Reg Guide that gives some of these folks coming in the insight that they're going to have to be a little more conservative or accept conservatism?

MR. RAHN: Yes. I believe we have a --

MEMBER REMPE: Okay.

MR. RAHN: -- description in the Reg Guide that talks about drift.

MEMBER REMPE: Yes. It tells them they need to be a little more conservative. Even though it says something about drift. That's where I'm coming from. Is there something that points to --

(Simultaneous speaking.)

MR. RAHN: So what we say is the licensees should be using ISA standard 67.04.01. And in that standard, there are some pointers to the Recommended Practice document that describes this methodology.

MEMBER REMPE: Okay. Well, I hope that they can follow that trail and that the staff evaluating their ability to meet the ITAAC will know that they have to follow that trail. And I guess I wish it was a little more visible in the Reg Guide, is where I'm going with all my questions.

MR. RAHN: Yes, okay. Okay. Thank you for that comment. I think it's --

(Simultaneous speaking.)

MR. TANEJA: This is Dinesh. So what we are seeing, some of these new reactor designs that are using highly integrated digital I&C systems. That they are implementing self-diagnostic features that would continuously monitor drift. So it is not something that it would only be known when we do periodic surveillance. You're actually monitoring that on an ongoing basis and you are aware of the performance of each instrument loop in --

(Simultaneous speaking.)

MEMBER REMPE: Some of those instruments, as you know -- sorry. I didn't mean to interrupt you. But some of those instruments really aren't called upon unless there's an accident condition where you have something that would suddenly, for example, trigger a water level. I mean, there's nothing in there at first, and then suddenly they'll fill up and the water level --

(Simultaneous speaking.)

MR. TANEJA: I agree with you. But those are still, you know, there are diagnostic features that are looking at the health of that instrument. Even though they may not be actually measuring that level. But the performance of the instrument, there are, you know, techniques being utilized where they are assuring the availability and performance of those instruments on a regular basis.

So I think some of those areas which are inaccessible or which are -- they are implementing these features where they are, you know, not just waiting until, you know, the demand is place on them to see if they work or not. They're actually continuously being exercised.

You know, as compared to, you know, some of these old analog plants where the safety instruments really were silent. I mean, they did not do anything unless and until the event and did surveillance on them to see if they were working. Right? I mean there was no means for us to detect their operability. And so therefore, we, you know, use the tech specs on the surveillance frequencies to assure their availability, you know, on a periodic basis.

And now, you know, you have technology available where you can actually look at them on a continuous basis rather than just periodically going and poking them. So you know, we are seeing that I think those are the areas where, you know, these concerns are being addressed also, using the technology.

MEMBER REMPE: Well I hope so, but we've learned a lot over the years, and I guess I just was hoping to see some caution in the actual Reg Guide without to follow a tortuous path that would give people a heads up, is all I wanted to say. But thank you.

MR. TAPPERT: Right.

MEMBER MARCH-LEUBA: This is Jose. That trigger, I think your comment was excellent. I mean, the fact that we're using technology to have continuous monitoring as opposed to once every three months. That's a considerable improvement. The question is, is this something a licensee will do out of the goodness of his heart? Or is this a requirement? Do they get credit for doing it?

(Simultaneous speaking.)

MR. TANEJA: Yes. There is a carrot. I'll give you a good example. For AP1000, mobile unit three and four, they came in with a license amendment request where they wanted to take credit for self-diagnostics during this construction. And the rationale that they provided is that that will eliminate a lot of the work, and I think they put millions of dollar value to the periodic surveillance activity that they would not have to perform, if they are doing continuous surveillance.

MEMBER MARCH-LEUBA: So we handle it via the carrot, which is the best way to do.

MR. TANEJA: The carrot is that they are saying that the maintenance cost is reduced considerably if they use technology. And that's why, I think, I am seeing a big push in that direction by most of these, you know, even operating reactors wanting to use that features to minimize their cost of operating these plants.

CHAIR BROWN: Can I make a comment on that?

MR. TANEJA: Yes.

CHAIR BROWN: To address Jose's question. When in the program that I administered back in the 80's, late 70's and 80's, and started with the self-diagnostics on all of the stuff with the use of microprocessors. You can check virtually everything except the actual detector itself, you know, by going in and putting DP's, you know, pressures on them and stuff like that.

But we found, as we implemented those in a number of shifts, either in individual instruments or in integrated systems, where we used to do weekly checks, calibration checks. The reactor technician would go and do those every week, on every instrument. We almost virtually eliminated those based on actual data that we took because the digital nature of the thing, once you get up past the analog digital conversion, it's all digital. And you can check throughout the entire range, including whether your setpoint has changed. You don't have to trip anything to do that, but you can check to see what your setpoint is.

So that has proved very, from a manpower standpoint, that was used by us in some of the, like in the Ford and some other plants, where we could advertise that we did not need quite the manpower to be performing all these manual checks all the time. Only a longer period where you go out and check the checkers. So I'm just passing that on as a -- it's worked very, very well for reducing manpower in the Navy, on the Navy side, or at least up until the time

I retired. So we ought to move on.

MR. RAHN: Okay. So yes. So this is kind of geared toward new plants going forward and Member Rempe has a very important consideration. You know, how can you, if you're not sure about a performance, the drift performance of a brand new device, what can you do. So we're going to talk about that in a little bit.

So here's an example. It kind of summarizes what we talked about. The Recommended Practice document currently says one good rule of thumb might be look at these different ways of determining either linearly or via some other method, an estimate of drift.

And so for example, if you linearly extrapolate a vendor specification of one percent calibrated fan for six months, you end up with an expected drift allowance you need to put in there on four percent. And what we're going to show in the next few slides is that they don't behave that way. Instrument channels don't continually drift forever if, you know, unabated.

So but another rule of thumb might be to combine them using SRSS methods, so one percent over four calibration surveillance intervals, you might come up with a two percent, which is greater than one percent but less than four percent, and it's still somewhat bounding of anticipated performance, but not overly conservative that it would tend to mask the poorly performing instrument channel during a surveillance, when it's compared to the as found tolerance limits that were developed based on this drift interval.

So the idea, though, is to ensure that you use caution so as to prevent the as found tolerance interval to not be overly conservative. In most cases, the drift value provided by the vendor has to be adjusted to cover that time interval of interest. And the evidence to date says that drift performance is not continuously linear.

And even Member Bley mentioned it's like a, you know, a random walk type thing. But nevertheless, the SRSS method might be a useful way of bounding it, while still performing some conservatism so as to account for the fact you don't know it precisely.

The best way of estimating drift is having lots of data, which means, you've got the device in service somewhere else, or you've used it in this particular application and you've got as found and as left data over many periods. Therefore, you could actually compute a number that's reasonable. And we have some guidance documents to talk about how to do that.

So during calibration of a particular module, you record as found as left data over many surveillance intervals and with enough data regarding the same type of device and the same application, we could use that data to combine the data in a way that seems to envelope statistically the actual performance in service.

So that brings me to, okay, how do I know instruments don't continuously increase over time? That the drift doesn't continuously increase over time. So there's been a few studies that have been done, but one of them I wanted to mention is this EPRI Technical Report, 111 348, and it was a report that was performed for the industry but using the Ontario Hydro Bruce Nuclear Generating Plant data.

And the report actually concludes that it is difficult to make any kind of global conclusion regarding the interpolation or the extrapolation I mean, of how many drift intervals have to be combined to come up with a reasonable estimate.

But the report actually shows that active devices in the loop, like transmitters in the field, exhibit more drift on the average than devices that are in controlled environments. And that's relative, relative drift to its calibrated span.

Also it seems to be not only dependent on a particular manufacturer or model number, but also on a particular range code for that instrument, and the specific application of that device. Because number one, the range code has to do with, for example, a transmitter might be useful in a service that measures differential pressure in inches of water column, for example. But it also might be able to measure differential pressure in pounds per square inch. And maybe thousands of pounds per square inch.

So they have different range codes that a vendor will develop so as to be able to measure that difference. And just due to the design characteristics of those devices that have higher pressure ratings, for example, they have some physical characteristics that has a tendency to influence the magnitude of drift that can occur over a particular surveillance interval.

But also, it also might seem to be based upon the actual applications because some process dynamics influence the amount of drift too. The amount of noise, for example, in a process system, or the amount of transient, you know, what percentage of a transient might be, you know, less than needed to accomplish a trip function but still keeps the device moving continuously.

So there's a lot of factors that influence the amount of drift. So what they did is they tried to characterize the performance of those devices, and they broke them down by the type of device it is and the range code, and the variation in ranges of drift intervals.

Some devices at Bruce plant were calibrated, let's say quarterly. Some were annually. Some were one and half years. Some were two years. Some were two and a half years. So they had a range of drift intervals to use for comparative data. But the same transmitter model number was used in many of those different surveillance intervals.

So it was an interesting study because it covered a lot of these factors that have a tendency to influence drift.

So here's an example of something out of the Appendix in that report. And it shows for devices that are calibrated, let's say the horizontal is interval in months between successive calibrations and the rest shows drift in terms of percent of calibrated span for that device.

And if you notice that the vast majority, a lot of these devices were things that were calibrated at about the 30, 36 month range. Some were calibrated more frequently. Some applications more and more frequently. A couple of them calibrated over several, you know, more than 100 months, 125 months. So this was, they called this Pressure Transmitter Six, just to not have to keep the manufacturer and model number.

So this is data collected between 1980 and 1998, and just to show you, the majority of the drift was found in the center of this curve, Gaussian curve. So nearly 40 percent fell near the peak, and then it's hard to read these numbers on this side, but basically the majority of them were less than two percent, I'm sorry, less than two standard deviations, either side of the mean. So the vast majority of the data that was collected fell within this distribution.

And here's another example. This one happens to be, it's either the same transmitter with a different range category, or a slightly different model. But essentially, it's a bunch of data scattered that goes -- with a drift measured between one and minus one and a half percent, and plus one and half percent of calibrated span. Multiple drift intervals were accounted for, and if you look at the average, the amount of drift, we find that it's distributed typically between a plus or minus two sample standard deviations scatter.

So regardless of the, you know, the way you -- these are actually measured drift characteristics and you can see that rather than drift steadily increasing over time forever, which would be something that you would use if you estimated algebraically, you would have a tendency to way overestimate the amount of drift that actually does occur.

Now again, this is not real science. And this is observed data. You know, looking at data. But you know, another way to do this, which I had the opportunity to do in my early career, is we looked at the, we looked at a brand new device that was developed by a company, it was a pressure switch and differential pressure switch that was developed for the nuclear industry to serve in EQ related, environmental qualification related applications.

And because we had some unknown knowledge of the amount of drift, we asked the vendor to perform these tests for us where they pressurized, I think it was 50, a sample of 50 transmitters of the same manufacturer model number, and they calibrated some at three-month -- I think we went down to one month. We went to a one-month interval, three months, six months, one year, and I think we went up to two years.

And we measured data that looks similar to this curve. So a lot of the drift value was actually captured within the vendor's specified limits. Even the ones that were over a two year period.

MR. HECHT: This is Myron Hecht.

MR. RAHN: Yes.

MR. HECHT: Just to clarify again, this is for instruments without built-in tests that Dinesh was talking about earlier?

MR. RAHN: Yes. That's correct. This is for older devices that do not have automatic reporting or diagnostics that you could ping to see how it's performing. These are -- so every time this was, these tests were measured by taking the instrument out of service, you know, valving it out, performing the typical as found condition for the instrument, and then recording it.

MR. HECHT: So does that mean, I'm just -- you have some data points out there which are 50 or even 120 months.

(Simultaneous speaking.)

MR. HECHT: Does it seem that then the instrument was not calibrated for four or five --

MR. RAHN: Yes. Yes.

MR. HECHT: -- years?

MR. RAHN: Yes. Yes it means -- these are some applications at the Bruce plant that did not have a calibration, except for up to five years. So these are not all safety related. Some of these are critical, but not safety related.

So what we were concluding regarding drift is that total channel uncertainty, when you're accounting for drift, it's better to have a tendency to come up with an overestimate, because that way, you've got a bigger margin between the limiting trip setpoint and the analytical limit.

But on the other hand, if you're using drift to account for your -- to develop an as found tolerance limit for acceptance of performance during a calibration, it's almost better to underestimate it, or at least have a tendency to underestimate to ensure that you don't set a tolerance interval that's so wide that the acceptance criteria that you're using would tend to mask the adverse performance of a channel.

So now, the way this is handled in the ISA Standard, I believe it's a footnote within the ISA Standard that talks about this use of a tendency to overestimate versus underestimate, and a pointer to a place within the Recommended Practice document that describes, you know, rules of thumb that you could use to come up with these estimates that are more representative of actual performance.

Okay. Now, it's now 12:44, I want to ask Member Brown, does he want to continue or take a break? What would you like to do?

CHAIR BROWN: Now that I've got my phone unmuted. We were scheduled to go, do our lunch break at 1:00. The next group of slides, there's five or six slides in this upcoming group. I was going to suggest that we go ahead and take our lunch now and return at 1:45.

MR. RAHN: Yes.

CHAIR BROWN: Any objections to that?

MS. ANTONESCU: Maybe we should wait till 2:00 because others might not be aware that we start early.

CHAIR BROWN: Oh. Is that what the schedule says?

MS. ANTONESCU: Yes.

MR. RAHN: Okay. Say again, Christina? Did you say the schedule shows lunch at 2:00?

CHAIR BROWN: No. It shows lunch at 1:00 and coming back at 2:00.

MR. RAHN: Oh, okay. So I can go on for 15 minutes.

CHAIR BROWN: Okay. Why don't you go ahead and give us 15 -- finish this in 15 minutes.

MR. RAHN: Okay.

CHAIR BROWN: Last five. Okay? There's not much complexity in these. I took a look at them.

MR. RAHN: There isn't. Right.

CHAIR BROWN: Okay. So how about zipping through these in 15 minutes, so about 1:00. Okay?

MR. RAHN: Okay.

CHAIR BROWN: Take off.

MR. RAHN: Okay. So this is a section that is describing what is the industry standard and what kind of guidance is there for using that industry standard. And so, I'm introducing the standard that we're endorsing, it's ISA 67.04.01, and this is the 2018 version. And this standard sets forth the framework for how to identify, estimate, and combine uncertainties for instrument channels performing safety related functions.

So it has to ensure the setpoint has enough margin to enable an automatic protective action to initiate and correct a most severe abnormal situation, anticipated before a safety limit is exceeded.

And secondly, we -- this particular ISA standard, historically, even its previous editions, which were not numbered the same, but I'll get into that in the next couple slides. But this standard is actually recognized and used, not only in the U.S. nuclear industry, but it's also recognized and referenced by other nuclear regulators, nuclear vendors, and international standards bodies. I even found a reference to it in the Canadian Standards Association, standard, and so.

And there's others. So it's referencing other standards as well. And I wanted to make sure you recognize, it's an ANSI recognized standard, so it's a recorded standard in the ANSI standard system.

So it's actually the ISA Committee was actually formed in the mid 70's timeframe, and developed into initially it was called ISA Standard 67.04. And it's purpose was initially set up to address concerns that were observed in the performance of nuclear power plants during the 70's and 80's, concerning excessive drift of an instrument channel setpoint, resulting in a performance of the channel outside its required technical specification limits, which contributed to the development of a significant number of licensee event reports.

Essentially, I think it was, I mentioned in the 1974 timeframe, I think it was, the version of the tech specs that were made public included the use of the term of allowable value. And so if you exceeded the allowable value, you were required to, even on one channel, you were required to report a licensee even, submit a licensee event report.

So essentially, when we say excessive drift, that's a relative term. It would may in fact be the case is that the allowance for drift was underestimated, and that's what caused the required reporting of LER's.

But what we found in that timeframe was that in some cases, the setpoint that was selected was actually numerically equal to the tech spec limit that left no margin for uncertainties. And other cases, the setpoint drift placed the setpoint beyond where its measurement instrument range was, and that jeopardized even the capability of performing the trip function.

Those things were corrected over time in seceding versions of the ISA Standards. The other thing is early versions of the Reg Guide 1.105 made the point that you should not be setting instruments near or close to the end of their instrument measurement range. They have to be set within a range capable of maximum efficiency and performance of that instrument. So that bottom, that second bullet would not happen again.

And also the ISA -- the Reg Guide that we endorsed, used to endorse the standard, said you need to establish adequate margin between the setpoint and the tech spec limits.

So usury consensus standard was revised several times. In 1987, for example, revision was made to provide clarification and to reflect current industry practice at that time. The term trip setpoint was made to be consistent with the terminology used in the NRC Standard tech specs, which previously was referred to as an upper setpoint limit.

Also, changes that occurred in the 1994 revision of the ISA Standard reflected the incorporation of the improved tech spec program, which happened in the early 90's. So with the issuance of Recommended Practice document, ISA Recommended

Practice 67.04 Part 2, it was called. And it's labeled methodologies for the determination of setpoints for nuclear safety rated instrument channels.

This version, the ISA Standard, became Part I. ISA 67.04 Part I. Other changes that were made to reflect the inclusion of the recommended practice into the standard, but due to changes in ISA policy and nomenclature, this ISA 67.04 Part I was eventually renumbered to ANSI ISA 67.04.01, and the Recommended Practice document was referred to as ISA-RP67.04.02.

In 2006, another revision was made to the standard that addressed a concern regarding the basic concept of determining a single allowable value as an acceptance criteria. And we talked about this earlier on our slides before where we said we only measured adverse performance of a channel in the non-conservative direction. But with the concept of using an as found tolerance limit, we recognize that adverse performance can be both in the conservative direction, or the non-conservative direction. And therefore, the ISA, I'm sorry, yes, ISA Standard was revised to address the fact that you could have a positive and negative as found tolerance.

Also, there was questions regarding the appropriateness of using statistical combinatory methods when actual uncertainties had been measured in the field. So as a result, the 2006 version of the ISA Standard recommended one or more different types of performance tests, whose results would then have to support the tech spec requirements.

So the concept was to adopt the NRC concepts that were being discussed in the early 2000 timeframe. But the 2011 reaffirmation of that standard also confirmed the use of that as found tolerance specification, but also corrected some other minor editorial errors that were in it.

So during inspections of plant activities, it was noted that early in the 90's timeframe, the staff performed what they called system based instrumentation and control inspections, or SBICI's. and what they did is they took systems like reactor protection or maybe one particular type of ECCS initiation, and decided to, when they did a design control evaluation of that system design, they also asked to look at the setpoint control methodology, and the setpoint practices, and examples of how those setpoints are implemented in calibration procedures.

And so as part of the performance on those types of inspections, the staff got a firsthand look at how people are treating instrument uncertainties and how they're combining those to come up with a overall total channel uncertainty. And they also looked to see how well the performed design control associated with the data that's within those calibration and calculations.

So the content of the standard covers key definitions, establishments of setpoints, and then describes a framework for addressing safety limits, analytical limits, and trip setpoints. And then I haven in red fonts, three of these topics: Relationship among setpoint terms, determining total loops uncertainty, and performance to scope and acceptance criteria.

These three red highlighted topics are the ones that have changed the most during the 2018 revision of the ISA Standard, which did the most to try to come to address a lot of the concerns that were announced by the NRC staff when they issued DG-1141 to try to address the 2006 version of the ISA Standard.

In addition, there's an industry recommended practice guidance document. So in 1994, that was the first edition. As I mentioned earlier, that was referred to as the RP67.04 Part II document.

Now it's renumbered to RP67.04.02. This document has a lot of guidelines regarding methods for determining lots of different types of uncertainties, how to identify which uncertainties need to be addressed, and methods for determining whether it's considered acceptable to treat it as a random or a bias term.

And it goes into great detail. Just to give you a for instance, the ISA Standard is roughly 25 pages, but the Recommended Practice document is nearly 200 pages, or in that ballpark. So there's quite a lot more detail regarding the methods that one might use for evaluating the individual uncertainty terms and combining them.

And there's many examples that are included within appendices, I guess we call them annexes to that particular document.

So these are a summary of the kinds of topics that occur within that Recommended Practice document. I won't read each one but essentially, you can see there's a long list of topics that are covered, and plus several others.

And that brings us to our next topic. We're going to talk about NRC staff positions. So at this point, maybe it will -- unless I'm ready to answer any questions the members might have before we break for lunch.

CHAIR BROWN: Hearing none, it is now 12:57 on my computer. So we will go ahead and take our break until 2:00, lunch break. So you now have 63 minutes to consume something. We'll be back at 2:00.

(Whereupon, the above-entitled matter went off the record at 12:58 p.m. and resumed at 2:05 p.m.)

CHAIR BROWN: Okay. It's 2:04. Sorry for the delay. Dave?

MR. RAHN: Yes.

CHAIR BROWN: Are you ready to pick up with the next section?

MR. RAHN: I am.

CHAIR BROWN: Okay. Proceed.

MR. RAHN: Thank you, Chairman Brown. So the next few slides I was intending to go through, the NRC staff positions that have been made within Reg Guide 1.105 over the past history of the document. And also discuss some regulatory positions that were taken in the RIS 2006-17, as well as the intended positions that would have been made if DG-1141 were to have proceeded to its ultimate goal of a revision 4 of the Reg Guide.

And then finally, capping off with the position we're taking in the current version. Okay.

So with that in mind, let's start with -- actually, I want to start with Rev 1. There was a Rev 0, by the way. Rev 0 of the document, unfortunately, is not on a public document anymore. It's not retrievable, you know, through the normal means. So I'm going to start with Rev 1 because it's something that's still retrievable.

Rev 1 was a document issued in 1976 timeframe and it endorsed the -- no, that's not possible. I have a typo on here. 1982. There's something wrong with my slide. Sorry.

MR. REBSTOCK: Excuse me, Dave?

MR. RAHN: Yes?

MR. REBSTOCK: This is Paul Rebstock. I can help you with that.

MR. RAHN: Yes.

MR. REBSTOCK: I attended the ACRS meeting when they talked about the initial issue of Reg Guide 1.105, way back in the mid 70's.

MR. RAHN: Okay.

MR. REBSTOCK: That issue of the Reg Guide cited a draft version of the ISA Standard. The ISA Standard hadn't actually been published yet.

MR. RAHN: Okay. Thank you. Now I remember. Yes.

MR. REBSTOCK: Yes. I don't remember about a Rev 0, I think that was just the initial one. And it couldn't have been much earlier than '76 because I joined the nuclear industry in '74, and, you know, this was fairly early on.

MR. RAHN: Yes. As I said, I thank you, Paul.

MR. REBSTOCK: Okay. Sure.

MR. RAHN: Yes. So essentially, what the Reg Guide used as it's regulatory basis was GDC-13, and it basically, it focused in on the fact that instrumentations required to monitor variables, controls, and controls are required to maintain those variables within prescribed operating ranges.

And it also used the tech spec section 50.36(c)(1)(ii)(A), which is the same one we discussed earlier, the one on limiting setpoint is specified for safety limits. That setting has to be chosen so that automatic protective actions will correct the most severe abnormal situation anticipated before exceeding a safety limit.

It also, in the front section, talked about the fact that there were a large number of reported instances where instrument setpoints drifted outside the limits specified in the tech specs. And it gave reasons for that, is that there wasn't enough margin established between the setpoint and the tech spec limits to account for instrument accuracy.

And in those days, vibration was an issue. Apparently, there may have been a series of mechanical types, which is that experienced vibration and as a result of that, their setpoints, less their screw adjustments, or potentiometer adjustments were able to loosen up and the setpoint actually changed.

But in any case, it pointed out the fact that the setpoint has to be established with sufficient margin between the nominal setting and the tech spec limit to account for those kinds of uncertainties. And as I discussed before, sometimes the setpoint was chosen to be numerically equal to the tech spec limit, and so leaving no room for margin.

And in other cases, it was too close to the upper range limit of the instrument. Other times, it was out of conformity with the tech spec, due to some design inadequacies, and in some cases, calibration practices were not considered ideal.

The positions that were taken in that version said that the setpoints should be established with sufficient margin to allow for instrument accuracy, calibration uncertainty, and drift over the interval between successive calibrations.

So essentially, the concern there was looking at surveillance information, setpoints have to have enough margin to allow for things like drift to occur between successive calibrations. The had to be selected -- the setpoint has to be within the portion of the instrument channel where it's deemed to be most accurate. And consider factors like vibration and other environmental conditions.

At that time, we said they should be secured with a locking device, and probably nowadays, well, it's true. The instrument vendors did essentially begin to comply with that and they had ways of ensuring that the sub point adjustment screw would not back out due to things like vibration, if that was deemed to be a problem with those instruments.

Also any assumptions that are made regarding how the setpoint was determined on what is the minimum margin between the setting and the limiting safety system setting, and the drift rate should be documented. But there was no staff position taken in Rev 1, regarding acceptance criteria for bounding any of the uncertainty estimates. It just said you need to have a sufficient margin.

Rev 2 of the Reg Guide endorsed the 1982 version of 6704 and it used as its basis three items from the 10 CFR 51 is GDC 13, which we mentioned earlier, but it introduced GDC 20 for the first time. And in specifically saying that the protection system should be designed to initiate operation of appropriate systems to ensure that specified acceptable field assignments are not exceeded.

And those, that wording is the currently used wording in GDC 20. It also recorded 50.36(c)(1)(ii)(A) about whether -- where a specified limit is selected, it should correct the most severe abnormal situation before a safety limit is exceeded.

It describes some concerns in the body of the document that talked about a large number of LER's still occurring and it identified the 1982 standard as having been developed to contain minimum requirements for both accepting and maintaining setpoints. And it identified that the ISA term, allowable value, that was introduced in that version, is consistent with the usage in the newest version of the standardized tech specs.

And I believe that version, allowable value, I believe it came about in the late 70's timeframe.

Another item it talked about was within the standard itself, it said, the paragraph that's talking about the methods for combining uncertainties specified the methods for combining those uncertainties. But it mentioned that the staff has accepted 95 percent as a probability limit for errors. That is on the absorbed distribution of values for a particular error component, 95 percent of data points would be bounded by that value selected. And if the database is following a normal distribution process, that would correspond to an error in distribution approximately equal to two sigma value.

So that's the first introduction of something talking about 95 and considering it to be a high confidence by choosing a two sigma limit. But again, it's not necessarily a probability of the channel tripping the way it's worded, it's more about identification of the uncertainty tolerance, you know, bounding the uncertainty value to a two sigma value.

Another idea it talked about was the fact that there's a section on software qualification that was in that ISA Standard, and pointing to IEEE-7432 for more guidance on that. But as a document, it referred to Reg Guide 1.152 for information about the staff's position on that guidance.

In addition, there were some considerations regarding key documentation of information you need to include whenever you evaluate drift. And those seven criteria that it described pertained to things like the redundancy, you know, how many channels are there? How many redundant channels are there? What kind of instruments that are doing the job? What was their accuracy, their function, and what's the allowable value specified in the tech specs?

What was the as left setpoint from the prior surveillance and the current measured setpoint? And how much adjustment in the recorded occurrence was there for the current -- between the current value and the previous as left setpoint? And also, what transmitted in the history of previous testing and any factors associated with drift?

So it talked about those seven items to be considered whenever you determine what magnitude of drift needs to be considered when you establish and maintain the setpoints.

It made the position that the staff would endorse the 1982 version of the ISA 67.02 standard. But it also pointed out that referenced standards that are within that document, while not endorsed by the

Reg Guide, but they do contain valuable information. And if you do use them, that information should be used in a manner consistent with current regulations.

Rev 3 of Reg Guide came out in 1999, and it endorsed, with several exceptions and clarifications, the 1994 version of the ISA Standard. It also used its regulatory basis, GDC 13, GDC 20, and 50.36(c)(1)(ii)(A).

It also introduced an acceptance criterion for bounding estimates of uncertainties. And it mentioned that within Section 4 of the ISA Standard, it talked about the methods for combining uncertainties, but not the criterion to be used, any kind of acceptance criterion, in determining a trip setpoint, or its allowable values.

So the staff made the position that the 95/95 tolerance limit is an acceptable criterion for uncertainties. And then it went on to state a little bit of more clarification. There's a 95 percent probability that the constructed limits contained 95 percent of the population of interest for the surveillance interval selected.

Another exception was made. They said that section 4.3 talked about limiting safety system settings being maintained in tech specs, and plant --

but versus plan procedures. It mentioned specifically that 50.36 as the tech specs need to include items that are considered among the categories of safety limits, limiting safety systems, and control settings.

So limiting safety system settings are not something that should be maintained within plant procedures, like a calibration procedure, for example. Instead, the limiting safety system settings should be specified as tech specs, tech spec defined limits in order to satisfy 50.36.

And that needed to be developed in accordance with a setpoint methodology that is identified in the ISA Standard, with the limiting safety system settings being listed in the tech specs.

So it's -- part of it is a document control issue and some of it is a practicality issue, which we're going to talk a little bit about in a minute.

The other aspect of Rev 3, it said that allowable values are the limiting value that a trip setpoint can have when tested periodically, beyond which the instrument channels considered inoperable and corrective actions must be taken in accordance with the tech specs. And the allowable value relationship to the setpoint in the tech specs has to be documented.

Now, the term when tested periodically has come up. Sorry, went too fast. The when tested periodically issue has to do with, it was intended to be describing what happens when, during a surveillance, when they say when tested periodically.

But since that time that language was used, it's also been determined that the allowable value is something that needs to be maintained continuously. So certainly, if you discover that during a surveillance interval, during a surveillance test, I'm sorry. While you're doing a calibration, if the device is drifted beyond the allowable value, it would be considered inoperable.

But the intent of the tech specs and most individual plant tech specs introduction sections describe the tech spec allowable value as something to be maintained continuously while the plant is considered in operation.

So when you do operability determinations, many times the channels' ability to really perform its function, as intended in the tech specs, is something that is to be evaluated regardless of whether you can tell, you know, during its performance during a calibration.

CHAIR BROWN: Did we lose Dave?

MS. ANTONESCU: Yes. We lost Dave. Let me reach out to him.

CHAIR BROWN: See if he comes back in.

MS. ANTONESCU: Dave, if you hear us, please sign out and reboot. That would be the best way. I'll try to reach you by email.

CHAIRMAN BROWN: Okay. I'm at slide 64. Can you see slide 64?

MR. RAHN: Yes. Let's start there.

CHAIRMAN BROWN: Okay --

MR. RAHN: I think you just about finished it. You were on the allowable value discussion.

CHAIRMAN BROWN: Yes. Yes, and I described a little bit about this phrase about when tested periodically.

MR. RAHN: Yes.

CHAIR BROWN: And yeas, so from the subject matter of setpoints that's something that we adjust, and actually we observe the performance of a channel and make adjustments when necessary during channel surveillances, but I was going to mention that individual plant tech specs have you, you know, ensure that you're within the allowable value throughout operations of the plant not just during, not just when tested periodically.

So all I'm mentioning, you know, from the standpoint of those words when tested periodically it has kind of a double meaning, but for setpoints the meaning we use is during a surveillance. Okay, I'm advancing to slide 65 and I am talking about RIS 2006-17, which is a regulatory issue summary that was develop to address items that were being discussed in the early 2000 period regarding whether or not allowable value is really the right, the way to determine whether a channel is functioning as required prior to determining whether the channel is inoperable or not.

So the terms inoperable and allowable value is used for determining whether something is inoperable, that's a function within tech spec's adherence. So plant operations would make that determination, whereas to determine whether a channel is functioning as required that's something that's determined during instrument maintenance technicians.

And after discussions with engineering and operations if they believe that a device is not functioning as required, they also may determine that the channel is inoperable. And after consulting with the engineering branch and the operations department they may collectively make a determination that it's in operable.

MS. ANTONESCU: Dave, we lost you for a minute again and --

CHAIR BROWN: We just lost a voice, I guess.

MR. RAHN: Okay. And this is not a point that's that serious, so I think I'll move on. It's not -- it doesn't affect how we address setpoints, I just, I was just using the -- trying to determine -- provide some criteria of what's the difference between determining a channel is inoperable versus a channel is not performing as required.

MR. RAHN: Okay. Yes, Dennis?

MEMBER BLEY: Is this going to stay in place, or is it superseded by the new guidance?

MR. RAHN: Currently, it is still in place. And I think after we get some mileage under our belts with regard to the new guidance, we may sunset it, but that would have to occur only first determining everything that's covered within that RIS got addressed in this particular Reg Guide.

My suspicion is that there are things that are in that RIS that are associated with tech spec maintenance, in which case I believe that if those are not covered in this Reg Guide, you know, the Reg Guide was -- the issue about tech specs was considered out of scope for this Reg Guide. So under that circumstance, it's possible the RIS could hang around longer.

MR. REBSTOCK: Excuse me, Dave?

MR. RAHN: Yes.

MR. REBSTOCK: Paul Rebstock here. Yeah, I looked into that back when we were getting started on all this stuff. The deal is the RIS -- you're correct. The RIS includes both tech spec related stuff and Reg Guide related stuff.

And the intention is to get all the Reg Guide related stuff into the Reg Guide and leave nothing behind except for the tech spec stuff. The tech spec people will have to address that. And once that's done, the RIS will be disappear. But the intent is that the RIS will disappear eventually. A RIS is only a temporary thing. It's not -- they're not supposed to be permanent.

MEMBER BLEY: They last a long time though, sometimes which creates some --

MR. REBSTOCK: Sometimes temporary can be a long time. We're trying to get out of that.

MR. RAHN: Yes. Thank you, Paul. That's

a good clarification. So I don't know if I lost you in this slide, so I'll go through it quickly. And basically, we're saying the RIS clarified that the limiting trip setpoint is the most limiting value to which a channel should be reset at the conclusion of a periodic test to ensure the safety limit won't be exceeded if you have a design basis event, whereas the nominal trip setpoint is the value that's selected by the licensee for plant operations, usually controlled under surveillance procedures. And the -- but the NTSP must always be equal to or more conservative than the limiting trip setpoint.

CHAIR BROWN: Just an --

MR. RAHN: Yes.

CHAIR BROWN: Before you go on, Dave, the RIS is actually still referenced in the new Reg Guide indirectly that in 221 it says RIS 2006-17 and 493, that TSTF address concerns relative to tech specs allowable values.

MR. RAHN: Yes.

CHAIR BROWN: And then they're further referred to a little way farther down as well as in the next paragraph. So there are some references to information relative to as found and as left tolerances also in the second paragraph. So there's got to be a little mucking around somewhere if you're going to delete the RIS, then --

MR. RAHN: Yeah. Then we'd have to revise the Reg Guide at that time.

CHAIR BROWN: Yeah, even if it's just editorially you'd have to revise. So they're not totally separated even now. That's my only point.

MR. RAHN: Yeah, that's a good point. So at present, we don't have plans to sunset the RIS.

CHAIR BROWN: The RIS is also referred to in the TSTF 493 --

MR. RAHN: It is.

CHAIR BROWN: -- or a combination of the two.

MR. RAHN: Yes. That's another good point. Yes, so yeah, again, the allowable value being used for determination of whether a channel is functioning as required is not the best thing. It should -- we should be usually as found tolerance limits for -- back on slide -- I showed you back on slide 14 was that, the one with that main figure showing all the relationships.

And it should be a double sided inspection. Look at performance of the channel both in the conservative end and non-conservative direction, not just a single side allowable value. And like I said, if it should -- if the as-found value exceeds the as-found limit, you need to evaluate that channel for operability.

So yeah, so we'll talk a little bit about the TSTF. So as I mentioned earlier for those who could hear me, the NRC staff worked with the owners' groups for PWR and BWR plants and developed a tech spec task force issue that would put into action the principles that were described in RIS 2006-17.

And primarily, it was broken into two pieces, one which was called Option A and the other was called Option B. Option A provided a methodology that would be used for evaluating license applications or amendments that proposed changes to values in the tech specs.

If the setpoint or allowable value were to be changed in a plant's tech specs, which basically changes the licensing basis for the plant, that's something that would be evaluated as a license amendment request by the staff.

And the Option A would solve the RIS issue by the insertion of two footnotes in the table that were associated with the instruments that are being modified, the instrument settings that were being modified.

And the first footnote said that if the as-found channel setpoint is found to be outside it's predefined as-found tolerance limit, then the channel should be evaluated to verify that it's functioning as required before returning the channel to service. Again, those words functioning as required are being highlighted here.

The second item was that the channel setpoint should always be reset to a value within the as-left tolerance limits about the limiting trip setpoint or the nominal trip setpoint if that's the appropriate way the plant is using it. Otherwise, the channel should be declared inoperable.

If you cannot set it to within the reset value, there might be a reason why you can't set it to that value. It might be broken. So otherwise, any setpoints that are more conservative than the limiting trip setpoint are acceptable provided that you use the as-found and as-left tolerance bands about that actual setpoint that's implemented in the surveillance procedures.

The limiting trip setpoint and the methodologies used to determine the as-found and the as-left tolerance are to be specified in the particular document that the licensee has identified as the control document to contain that information. Usually, that's a document that would be named in the -- within the tech spec footnote. So that's Option A.

Now Option B, licensees were pretty well identifying that the use of these footnotes on tech spec pages for channels, for instrument channels where setpoints are being changed, it's kind of cumbersome.

And so they also wanted to explore the opportunity to be able to revise limiting trip setpoints in allowable values in a licensee controlled document that did not have a requirement for the NRC staff to perform an evaluation for every little setpoint change that's being made over the course of time.

And so the staff thought, okay, if we want to do something like that, what we do have to do is agree to a set of ground rules that would be followed every time a setpoint changes to be -- is proposed to be made. So that identified what we called a setpoint control program, which would be a program identified within the administrative tech spec section, which is usually Section 5 for most plants.

And that program would be, there would be a new subsection within the administrative tech specs that identify that existence of that program and the document that specifies the rules that would be followed when maintaining or changing instrument setpoint values or allowable values.

And so in order to get approval for this Option B, the staff requested submittal of the setpoint determination methodology that the licensee will be using, also, a setpoint control program that would be followed. And so what would happen first is the staff would first approve the setpoint methodology and then going forward, the licensee would use that methodology for changes.

And the setpoint control program would also keep track of things like where is the source document for things like analytical limits. Where are the setpoint calculations maintained? You know, what plant program or plant document section maintains the information that's in the setpoint calculations, for example?

So there's a lot of description in their Option B part of the TSTF that talks about the ways the staff would first evaluate the licensees proposed setpoint control program and then once it's approved, they would allow the licensees to make actual changes to the values that are in the tech spec tables using that program.

MR. HECHT: Okay. Excuse me. This is Myron Hecht.

MR. RAHN: Yes.

MR. HECHT: We're not seeing your slides, so could you please tell us which slide number you're on?

MR. RAHN: Yes. Currently, I'm on slide 68. And so tell me what's visible and what's not visible?

CHAIR BROWN: Well, I see them okay. I don't know about others.

MEMBER BLEY: Yeah, I'm 68, too.

MEMBER DIMITRIJEVIC: Yeah, I'm now on 68. I was on the first page.

MR. HECHT: I'm not seeing that, but that doesn't matter if you can just call out the slide numbers.

MR. RAHN: Yes. So I'm about to move on to slide 69.

CHAIR BROWN: Don't do that yet.

MR. RAHN: Oh, okay. I will go back.

CHAIR BROWN: Yeah, I had questions on 493.

MR. RAHN: Oh, sure. I'm sorry. Go

ahead, sir.

CHAIR BROWN: I've got a 1268-page document. That's the only one I could find within -- well, actually Christina sent it to me in the document files. And then a traveler that was signed in April -- let me get the document.

MR. RAHN: 2011 or something?

CHAIR BROWN: No, it was signed on by Eric -- no, who? Eric Bowman on the 30th day of April 2010.

MR. RAHN: 2010, okay.

CHAIR BROWN: Yes.

MR. RAHN: That's the revision for?

CHAIR BROWN: That's, yeah, the very top of this page says notice of availability, the models for plant specific adoption of tech specs, task force traveler TSTF 493 rev 4 clarifying application of setpoint methodology for LSS function, NRC-2009-4087.

The upper -- there's a number up at the top which says in brackets 7590-01-T. And the only dates I could find that says what gave people the authority to do this are the program, which is in Section 5518 of your 493 document.

MR. RAHN: Yes. That's the right document.

CHAIR BROWN: Okay. This was the one signed by Eric Bowman.

MR. RAHN: Okay.

CHAIR BROWN: So I presume that's the authority. Now 10-CFR-5090 says that the licensee can submit an LER and ask you for permission to do something at any time. It doesn't say anything about tech specs. It's just for any reason they can select, they can submit something and ask for a modification to their license.

MR. RAHN: That's true.

CHAIR BROWN: So in this case, what I got out of this TSTF and that procedure is that they have to submit an LER, didn't say anything about a methodology. It said something a setpoint control program, okay, which once the NRC -- they did say what was supposed to be contained within that program.

And I think it controlled the methodology as well. But once they got the approval of the LER, that meant now the tech specs were no longer controlled by the licensing based tech specs but by the -- their ability to use their approved methodology within the plant itself. Is that correct?

MR. RAHN: Yes, that's exactly correct.

CHAIR BROWN: Okay. I'm not disagreeing.

I'm just trying to make sure I understand. My question is, this was signed by -- did anybody else look at this. I don't -- this was 2010. I was on the committee in 2008. I don't remember this licensing change coming out, and I don't remember us seeing it. Dennis, do you remember anything?

MEMBER BLEY: I do not remember. I'm pretty sure it did not come to us. I don't remember.

MR. RAHN: Yes, so --

CHAIR BROWN: This --

MR. RAHN: Go ahead.

CHAIR BROWN: -- TSTF has got -- it's got 1,000 pages of almost, you know, one-line line items for all kinds of stuff until you finally get to this 5518 part.

CHAIR BROWN: Yeah, so essentially there are multiple sections within that TSTF. And the one that's the most meaty section is the one that contains marked up standardized plant technical specifications. And those plant technical specifications are marked to identify what are considered to be the limiting safety system settings that would fall under the scope of this program as well as a markup of the technical specification basis sections that are associated with those standardized tech specs.

And those basis sections describe either for Option A, this footnote issue, or for Option B, the fact that a licensee may be using a setpoint control program that was approved by the staff in order to perform changes. And those changes are being performed under an administrative tech spec section. At that time, it like Section 5.5 of the administrative section of the tech specs.

So those were options that were made available to licensees. My understanding is that several licensees were initially interested in that, and certainly new applications were also interested in that.

And what I've come to learn is that the licensees who have already a program that uses Option A methodology would find it not necessarily economically viable to go through the steps needed to develop the setpoint control program and have it approved as compared with maintaining setpoints using the footnotes and the tech spec tables. So we haven't had a lot of takers from operating reactors. However --

CHAIR BROWN: On Option B?

MR. RAHN: On Option B. We did have one licensee come in in 2012 timeframe I think it was. It was a licensee that was in the process of converting their plant tech specs to the improved tech spec program tech specs. And at the same time, they were going to propose doing an Option B adoption.

And so the staff evaluated their improved tech specs, and I think they found the improved tech specs to be, you know, useful and correct. But when it came time to evaluating their Option B submittal, it was determined that they didn't quite have enough information in the description of their setpoint control program to be approved by the staff.

But, however, there was sufficient information to meet the criteria that was specified for Option A. In other words, they're using the methodology of using as-found and as-left tolerance limits and adjusting the setpoint to within the as-left value. So that plant was approved for Option A.

CHAIR BROWN: But in Option A they can't change --

MR. RAHN: No.

CHAIR BROWN: They cannot change the range of acceptable numbers if they've -- like the limiting trip setting and all that kind of stuff.

MR. RAHN: Correct, without staff approval.

CHAIR BROWN: So they have to stay within the boundaries of your -- this chart that you showed us in the beginning?

MR. RAHN: Yes, exactly.

CHAIR BROWN: Okay. But now if you had Option B, you could move the limiting trip setting and/or the analytical limit around?

MR. RAHN: Yeah. So if you -- you may use -- you may change the values of the, not the analytical limit, no, never --

CHAIR BROWN: Yeah, that was --

MR. RAHN: Yeah, that's okay. You meant the allowable value.

CHAIR BROWN: Yeah.

MR. RAHN: And the answer is yes. You may make changes to the specified allowable value and also the limiting trip setpoint dependent upon your needs and also accounting for the uncertainties that could be present.

CHAIR BROWN: Okay. And they may be higher. For instance, you could change your trip setpoint, nominal trip setpoint, whatever the phrase is to if it was 110 you could change to 112 if you had this Option B and the methodology that you conformed within.

MR. RAHN: Yes, that's correct. They could make those changes and provided they justify them. But yes, the answer is --

CHAIR BROWN: Yeah, but they didn't have to submit an LER, and they didn't have to get NRC approval.

MR. RAHN: Correct. As long as they are referencing the section within the tech specs that say they got approval for that program.

CHAIR BROWN: Yes, that's explicitly stated in the new -- in the Reg Guide.

MR. RAHN: Right.

CHAIR BROWN: That they don't have to get NRC approval. The other question I had was if this was signed by -- I thought licensing changes had to be approved by the Commission. Is that right or wrong?

MR. RAHN: You know what, so I guess there are certain topics that fall under the Commission's purview. You know, the Office of Director of NRR has quite a little bit of, you know, subject matter over which he is the authority.

CHAIR BROWN: So he can make a change to the licensing basis for the plant without getting the Commission involved in some circumstances?

MR. RAHN: Yes, in some circumstances.

So, now the other interesting thing, which we haven't talked about, we talked a little bit about operating reactors. However, in new reactors, it might pay for them to have a setpoint control program because they're just getting started.

They don't have a lot of infrastructure that has to be changed in order to implement a new setpoint control program. So for several new reactor's applications, they have submitted setpoint methodologies and setpoint control programs for staff approval as part of either a design certification or final implementation with a COL.

As an example, some plants that have already submitted, as the design certification for new scale, the Westinghouse AP1000, KHNP's APR1400. I believe there's others. All of those folks have as part of their application to get approval for design certification submitted, setpoint control programs and setpoint methodologies for staff evaluation so that things like this could take place.

CHAIR BROWN: Well, they should've -- it's part of their design certification. You all probably would've been gone through their methodologies for their setpoints in the first place. Wouldn't you?

MR. RAHN: Yes, we would have.

CHAIR BROWN: They already had those methods in place and already had the Betty Crocker, Good Housekeeping Seal of Approval on them. So they could incorporate them into their setpoint control program.

MR. RAHN: Yes. That's the case.

MR. ASHCRAFT: This is Joe Ashcraft. Can I say just a word or two?

CHAIR BROWN: Sure.

MR. ASHCRAFT: So yeah, so for new reactors going forward IEEE 603, Section 6.8 or something requires them to submit and get approval for a methodology. So since they had to go through that, then they, you know, why wouldn't they use a setpoint control program?

CHAIR BROWN: Okay.

MR. ASHCRAFT: And for all the, you know, AP1000, APR1400 NuScale, they all submitted a methodology, which we reviewed either as a topical report or within the SE itself.

And the setpoint control program typically is in Section 5, which was, you know, evaluated by tech specs. But they didn't have to, you know, we didn't review it. It's just a paragraph that sort of highlights what they have to have within their setpoint control program.

CHAIR BROWN: Okay. All right. I just wanted to understand how this -- it just seemed to be something outside the bounds of what at least I was unfamiliar with over the last four design certification operations from ESBWR. But those had got completed, ESBWR up through NuScale.

MR. ASHCRAFT: Yeah, and like I say, even AP1000, the setpoint methodology was reviewed and approved either via topical report and/or the SE.

CHAIR BROWN: Well, have they -- those projects gotten approval of quote an Option B setpoint control program under their existing license approval?

MR. ASHCRAFT: Typically, yeah. You would see that in their tech specs, you know, like I say in Section 5. And I believe all of them, yeah, opted for the setpoint control program. But that's not something the INC or Chapter 7 would have reviewed. We only review the methodology.

CHAIR BROWN: I got that. Okay. Yeah, the other part's administrative.

MR. ASHCRAFT: Yes.

CHAIR BROWN: Okay. Dennis, are you there?

MEMBER BLEY: Yes, Charlie.

CHAIR BROWN: You've got more experience with the commercial plants than I do. I've only got the 12 years that I've been on the committee. Did I miss any questions that I should have asked?

MEMBER BLEY: No, I don't think so, none that come to me. The historical thing we got from Dave took me back to a long time ago.

CHAIR BROWN: Yeah, I just know you've been involved with plants for a long time, and I haven't. So my first experience was May 2008.

MEMBER BLEY: Yeah, I haven't been involved hands on with the people dealing with setpoints in the plant.

CHAIR BROWN: Too bad John's not here then.

MEMBER BLEY: Yeah, I don't think he has been either.

CHAIR BROWN: He was a reactor operator. Wasn't he?

MEMBER BLEY: He was, but 30 years ago.

CHAIR BROWN: Well, that's true. He was back -- they didn't have -- okay.

MEMBER KIRCHNER: Charlie, this is Walt. You don't let the reactor operators in instrumentation and control cabinets. Trust me. We get different people to do that.

CHAIR BROWN: You don't like the INC guys touch anything when you're operating unless you --

MEMBER BLEY: No. Well, I don't know if you heard my sea tale, but yeah, our guys on the Savannah they had bankers' hours. So fortunately, when they tripped the plant in advertently, it was during a, you know, daytime. It wasn't 0-dark-hundred. But yeah, it was separate silos for each function.

CHAIR BROWN: I've got another question for Dave or Paul or somebody else spoke up a minute ago, and I didn't get the name. So the other question was, in real world out in the operating plants, if you determine to need -- well, whether you're doing -- when you're doing surveillance or doing, which I presume that means checking where your setpoints, where your calibrations exist, right. That's a surveillance operation.

MR. RAHN: Yes, Chairman.

CHAIR BROWN: Or if you're realigning something. Is that a one-man or a two-man operation? With our guys in the Navy, at least when I was there, there was one guy normally doing it. Somebody was writing, and somebody was adjusting, but they were double checking other.

MR. RAHN: Yes, so --

CHAIR BROWN: There's two guys that do it in the operating plants.

MR. RAHN: Yeah, but my experience is that there's always two people. So I have observed probably several hundred surveillances that have been performed on safety-related instrument channels over the years. And there was always two people.

CHAIR BROWN: So that's a defense-in-depth relative to control of access. Did somebody want to --

MEMBER KIRCHNER: Charlie, that was my experience on the Savannah. They always had two technicians or engineers doing the instrumentation and control. Yeah, especially for the protection system.

MEMBER BLEY: Prior to that, and I saw it both in the Navy and in commercial plants, is that we get a sense of security. In the commercial plants, the lawyers are convinced you have two people. You can't possibly go wrong. But we've seen cases where even with a check you screw things up.

CHAIR BROWN: I'm not worried about screwing things up. I'm thinking more about malicious invasiveness if you only have one guy. If you have two, you've got to have two guys in collusion. Obviously, you can --

MEMBER BLEY: That's an issue, Charlie.

CHAIR BROWN: Pardon?

MEMBER BLEY: That would true if somebody wants to be malicious while they're doing a check or something, but if you want to be malicious, you don't always have two guys around.

CHAIR BROWN: If they can get in the cabinets and if they have the key, which they have to get from the operators in the main control room, I guess.

MEMBER BLEY: I'm not sure of that.

MR. RAHN: That's a general practice. I'm not sure that's always true in every single cabinet style.

CHAIR BROWN: I can't see anybody running down to the cabinets who've been able to get into a locked cabinet without control through the main control room, but it's -- all the projects we've looked at, they had locked people out of getting into the cabinets and making adjustments without having approval from the control room.

MR. RAHN: Right.

CHAIR BROWN: Getting authorization to go into wherever they are and do it.

MEMBER BLEY: That's certainly how it's supposed to work. It's different now that we have connectivity via the Internet into the plant. We've lost our defense-in-depth, so.

MR. RAHN: Yeah, I don't think we have, to be honest. I think we still have it.

CHAIR BROWN: Well, as long as you have one-way communications electronically, like we've insisted on, on all the new design certs, but if you go to bidirectional software control, bidirectional selection, then you're toast. All a guy's got to do is hack into it, so I'm a skeptic.

MR. RAHN: Okay. It's always good to be skeptical.

CHAIR BROWN: Well, we had a big fight getting in the hardware based, non-software-controlled unidirectional outputs from the networks in a couple of the plants out to the business plant, business buildings, and after the Internet. We finally got it. It was just difficult.

MR. RAHN: Yes.

CHAIR BROWN: As long as you have that air gap, you've kind of gotten yourself back to the same condition you're in with the current plants. If somebody wants to be malicious but you've got the -- but you've got the main control room and two guys. And that's the way it is in the existing plant without the computer based stuff. Anyway, I'm just trying to make sure I understand the details. So thank you very much. We can go on Dave.

MR. RAHN: Okay.

CHAIR BROWN: Unless somebody else has got a comment. Go on.

MR. RAHN: Okay. I will move on to --

MEMBER KIRCHNER: Charlie, this is Walt.

CHAIR BROWN: Yeah.

MEMBER KIRCHNER: Somebody's having lunch with their microphone open, so --

CHAIR BROWN: Yeah, I just noticed that.

MR. RAHN: Yeah, we should --

MEMBER KIRCHNER: It's not me.

CHAIR BROWN: Whoever's got their microphone open and doing something needs to mute it, whether it's a participant or a listener.

MS. ANTONESCU: I think they did already.

CHAIR BROWN: Okay. Thank you.

MR. RAHN: Okay. Moving on, there were some staff positions that were presented in -- I guess I still have noise on the line.

CHAIR BROWN: It's still -- somebody's still doing something.

MS. ANTONESCU: Yes. Mr. Marquino, could you please mute your mic.

CHAIR BROWN: Got birds in the background.

MR. WANG: I can mute all and then speaker, you have to unmute yourself. Can you do that?

CHAIR BROWN: Sure.

MR. RAHN: Let's try it.

MR. WANG: Okay. I'm going to mute all. Then the speaker have to unmute. Okay. I cannot unmute you.

MR. RAHN: Okay. Can you hear me?

CHAIR BROWN: Yes, I can hear Dave.

MR. RAHN: Okay.

CHAIR BROWN: I am not muted yet, so I'm muting myself now.

MR. WANG: I haven't muted. Okay. I haven't -- okay.

MR. RAHN: Okay. I've unmuted myself.

MR. WANG: Yes. Good.

CHAIR BROWN: Okay, Dave. Get moving. I'll re-mute.

MR. RAHN: Okay. So I also wanted to

identify there were a few staff positions that were presented in draft guide 1141 when we were initially contemplating the revision 4 to Reg Guide 1.105. So in 2014, we identified that the rev 3, which was by that point 15 years old, needed to be updated for several reasons.

The first was that it endorsed the 1994 version of 6704. But that document had since been updated by the ISA committee in 2006 and then reaffirmed in 2011. And it talked about the issue about the allowable values, the revised staff position on allowable values. So it was important to get that thought put into the current revision of Reg Guide 1.105.

It also was recognized by the staff that there was still no ISA specified acceptance criteria, such as 9595 limits for estimating tolerance intervals to determine the magnitude of uncertainty terms that was considered an acceptable criterion.

They also, there was a proposal by the staff to clarify that a 97 and ½ percent probability of the instrument channel tripping may be needed for conservatism before the analytical limit was reached rather than a 95 percent probability. And we may get into this later. I think Paul Rebstock will help us evaluate that subject matter.

It was also criterion on the figure that was in the ISA standard in 2011. It hadn't really been updated sufficiently to show that -- how you would use the as-left and the as-found tolerances and showing that the as-found tolerance was to be a two-sided value rather than a single direction determination.

Also, criterion regarding the determination of the magnitude of the as-found tolerance should include consideration of the anticipated error in the actual trip point over the period between measurements primarily the issue about drift but other terms as well.

The staff proposed that estimates of drift over a surveillance interval should be based on a linear extrapolation using algebraic additions. Vendors specified drift over a specified interval and not based on SRSS limits of drift that's described in this procedure. Yeah, so -- yeah.

MEMBER KIRCHNER: David. This is Walt Kirchner.

MR. RAHN: Yes, Member Kirchner.

MEMBER KIRCHNER: Yeah, I don't want you to go back on your slides, but I'm just thinking through. You're going to do later in this presentation talk about the tightening, if you will, of the confidence level and such.

MR. RAHN: Yeah.

MEMBER KIRCHNER: I'm just struck by -- let me make an observation not a question.

MR. RAHN: Yes.

MEMBER KIRCHNER: Just quickly. We're dealing with physical systems now. My background is thermal hydraulics and numerical methods and so on, and for numerical methods, tightening the criteria, it's all done on paper so to speak. But we're dealing with real physical systems.

And I'm thinking. I'm trying to think through, you know, for example like Jose, my colleague, referenced some things earlier that are related. You know, for critical heat flux correlations and such we really demand pretty tight bounds, partly based on experimental data, but a lot of it is numerical -- I don't want to say manipulation, but statistical analysis and other uncertainty techniques.

But here we're dealing with physical systems, and I just don't -- on the preceding slide when it went to -- from 95 to 97.5 or whatever it was, I'm thinking, is that really --

MR. RAHN: Achievable.

MEMBER KIRCHNER: To be blunt, is it realistic for instrumentation systems that are actually deployed, not for numerical methods that are deployed on computers, but for actual physical systems in plants. That's my musing or my observation.

MR. RAHN: Yeah. Thank you for that observation, Member Kirchner. One thing to consider is what we're really talking about is an estimate of uncertainty performance. It's not a specification, for example, that someone must achieve.

You know, it's -- what we're doing is we're estimating that amount of uncertainty which could occur during the operation of an instrument channel and trying to ensure that if you set a limiting system setting at a certain value, you've got enough margin to accommodate that instrument channel uncertainty such that you don't exceed an analytical limit. And really, you're trying not to exceed a safety limit, but we're using --

MEMBER KIRCHNER: Yeah.

MR. RAHN: -- the analytical limit.

MEMBER KIRCHNER: But my point is that the analytical limits and the safety limits are almost all done numerically.

MR. RAHN: Right.

MEMBER KIRCHNER: Whereas we're talking now about a physical system that's intended to provide margin or cushion --

MR. RAHN: Right.

MEMBER KIRCHNER: -- before we challenge those limits. And that's where I'm struggling a little about --

MR. RAHN: Yeah.

MEMBER KIRCHNER: -- how much precision is needed for something that's a physical system when if you go back to your analytical and safety limits, those have already been calculated out to 9595 or beyond in numerical space.

MR. RAHN: Yes. Yeah, so your point is taken. I mean I agree that this is not just a science, but it's part science and part art or state of the art. And so what we try to do is identify a bounding value, a reasonably bounding value for uncertainty within that channel and offsetting it from the analytical limit to establish a limiting trip setting knowing that there are other places where there is some margin still there, for example, the margin between the analytical limit and the ultimate safety limit.

That estimate has some assumptions and some margins within it as well as the fact that we know we have to be careful not to encroach upon the normal operating range of the system as well. And also, most plants have adopted the nominal trip setpoint that's more conservative than the limiting trip setpoint.

So there is always some margin between the limiting trip setpoint and the nominal trip setpoint that's adjusted to within the plant procedures. So knowing that we have some places for cushion, we try to identify what's a pragmatic bounding assumption that we could use to allow for --

MEMBER KIRCHNER: Yeah, that was the thing that I was pondering as you went through the history. By the way, thank you. But as you went through it, I'm just pondering your early view graph from hours ago this morning about how we come to establish safety limits and analytical limits.

And those are, you know, using uncertainty techniques and best estimate calculations, et cetera, et cetera. You know, how much compounding on compounding are we doing. And that's my observation, and it seems to me that in the physical world of instrumentation, which is not my field. It's Member Brown's field, Chairman Brown's.

But driving to a level of accuracy that I'm thinking back to one of your slides. You know, you mentioned -- I don't know. While you were offline, I was doing a sea story, but vibration was a real issue for the Savannah for all the instrumentation calibrations and such. It was a real issue.

And what's practicable for real physical systems versus what is demanded of numerical simulations are two different things. That's my observation.

MR. RAHN: Yeah. It's a good observation. I know the ISA committee members also agree that there are limits to what you can do and still be able to operate the plant. So the Committee made some determinations which were not in accordance with this particular staff position.

MR. REBSTOCK: This is Paul Rebstock. If I could intervene, this is the main substance of my nonconcurrence. And I'll be talking about that. This 95 versus 97 and ½, that's not a tightening of the requirements. I'll explain that in my presentation. That's the requirements as I see that they already exist, but we'll get into that later.

MEMBER KIRCHNER: Okay. Thank you, Paul.

MR. RAHN: Yeah, that's a good point, and that needs to be discussed as well. As he said, yeah, you're not tightening something. You're just -- what is a reasonable, practical bounding of the uncertainty that can be used to accommodate instrument channel performance and still operate the plant.

MEMBER KIRCHNER: You know, part of it might be -- boy, I'm out of my field here, David and Paul, but you know, maybe part of what helps this is more and more we're going to digital systems from analog.

And I'd be interested in your perspectives of that development as well with regard to these kind of requirements. But certainly, you know, going back to the Savannah -- I'm dating myself. That's 50 years ago, you know, most everything was quote unquote analog.

MR. RAHN: Yeah, so just on the subject of digital, digital equipment has been introduced into operating nuclear plants since the mid -- since the early '80s and in safety-related implications probably from the late '80s onward.

So there are a number of techniques and

methods for estimating uncertainties in the performance of digital equipment just like there is for analog equipment. And a lot of that -- a lot of those uncertainties are described in this recommended practice document that I pointed to earlier and talks about how to handle antialiasing effects or averaging effects or, you know, some other dynamic effects.

So we are -- I have some noise here. So, but essentially, there are methods for identifying what should be the uncertainty associated with digital equipment performance just like there is analog equipment performance. Yeah, and we do recognize that.

MEMBER KIRCHNER: You know, but again, you know, so my point would be your earlier illustration of a delta P level sensor, you know, pretty much everything in that picture until you got to the actual sensor was analog in my mind.

MR. RAHN: Yes.

MEMBER KIRCHNER: And what you expect on that end of -- the uncertainties are going to be much larger there than what comes after you start processing downstream the signal from that delta P sensor. And so that's what I'm musing about when I hear what you're saying about, you know, changing the tolerances.

MR. RAHN: Yeah, so I think --

CHAIR BROWN: Let's move on.

MR. RAHN: Yeah. So yeah, the other point I was going to make here is that another thing that the staff proposed in DG 1141 was the use of the algebraic addition of drift. And I think we described that. We talked a little bit about that earlier whereas the recommended practice document allowed one to come up with an estimate if you're trying to estimate on a conservative but still low side, use of SRSS methods rather than algebraic addition methods.

So those are things that were all described -- discussed by the ISA Committee when they put the last version of the standard together. I'm ready to move on to the next topic if there are no more questions from the members.

CHAIR BROWN: Yes. Get moving.

MR. RAHN: Okay. The next topic is how the staff and the committee worked together to develop the latest version. So in the 2016 timeframe, the ISA Committee had already received the 2014 DG 1141 document and submitted numerous comments of I don't remember how many exactly they submitted.

But it was in total approaching 700

comments on that particular version. In many cases, you know, they were favorable in many cases. They were unfavorable in thinking that we went a little bit too specific in some areas.

So what they decided to do was to get together and see whether or not there was room for improvement in the 2011 confirmed version, reconfirmed or reaffirmed version of the ISA standard. And so what they did is they got together and looked at first starting at step zero, look at all the definitions that are in that document.

And are there any which would be affected by the implementation of the TSTF 493 or a RIS and anything that came out of this draft guide 1141 that warranted consideration as part of the standard. Another area they looked at was using the criterion of 9595 for establishment of the probability confidence levels estimates for tolerance intervals that bound each uncertainty term.

Another area they looked at was where they could improve guidance for addressing tech specs that were described within the RIS and the TSTF. They also talked about areas for evaluating criteria within BTP -- I'm sorry, within -- yeah, BTP-7-12. That's an internal NRC staff guidance document that described how a staff reviewer would review, for example, a setpoint methodology.

Also, they wanted to cover whether there was any improved guidance methods or conclusions within any of the EPRI reports that have been issued over the years regarding instrument calibration surveillance interval extensions, including things like drift studies like I showed some slides from earlier.

So in order to accomplish this, the committee organized several subcommittee teams to research and develop criteria associated with each of their assigned areas. And that work continued through 2017 and '18 with each group presenting its ideas for discussion among the broader committee members.

There we go. I want to make sure I'm advancing the screen. We should now be on slide 74 for everyone who is listening on the phone. So we wanted to update -- the committee updated the standard and including areas where they agreed with or disagreed with DG 1141.

As Paul mentioned earlier, not everything that was covered in DG 1141 was accepted for incorporating into the revised ISA standard. Originally, the committee felt that the stipulation of an acceptance tolerance of 9595 for tolerance interval estimation was too restrictive for a standard.

And plus, it was many uncertainties that where there usually wasn't enough statistical data that would support an accurate determination of 9595. However, the committee did recognize that there was a utility in having a standardized way of enveloping those uncertainties, so they elected to adopt a 9595 criteria with certain caveats for when you cannot have -- when there is not enough data to appropriately estimate a tolerance interval at the 9595 level.

Also, the committee did not agree with the DG 1141 criteria regarding bounding 97 and ½ percent of all the uncertainties between the analytical limit and the limiting trip setting. And they believed that that criterion was unnecessarily conservative for many reactor types, especially for operating reactors.

When you're operating in the tails of those distributions, the likelihood of a trip occurring in the tail is so small and there were really not likely to have a trip with all the uncertainties and details aligned at the same level, at the same direction.

So they acknowledge that, you know, with the reactor type or the specific application within the reactor type allowed for a 97 and ½ percent margin, you could use that. But the expectation was that 95 percent was the bare minimum. The --

MEMBER MARCH-LEUBA: Hey Dave?

MR. RAHN: Yes.

MEMBER MARCH-LEUBA: This is Jose March-Leuba.

MR. RAHN: Yes.

MEMBER MARCH-LEUBA: Are you talking now about double sided or single sided?

MR. RAHN: Yeah. We are touching on the use of statistical distributions where the interest is whether or not something gets accomplished above a certain level or below a certain level. And in some cases, the use of what I think they call one sided or one tailed functions versus two tailed functions, that's the question I think you're looking at. Correct?

MEMBER MARCH-LEUBA: It's a 95 or a 97.5.

MR. RAHN: Yes.

MEMBER MARCH-LEUBA: That's what you're talking about?

MR. RAHN: Yes, it is.

MEMBER MARCH-LEUBA: Okay. So what are you saying, that you want to use the most beneficial one, which is the one sided 95 percent?

MR. RAHN: We're not saying we want to use it. What we're saying is that if you're estimating the probability of a channel trip between the limiting setpoint and the analytical limit, that channel trip estimate has to bound at least 95 percent of the uncertainty within that interval.

MEMBER MARCH-LEUBA: And since your analytical limit is going to be to one side of your setpoint, be up or down but not both.

MR. RAHN: Yes. So --

MEMBER MARCH-LEUBA: It's one sided.

MR. RAHN: Yes. So typically most instrument channels are there to detect deviations in a direction away from normal operations and toward a value that's considered encroaching upon a limiting system setting.

MEMBER MARCH-LEUBA: I understand the topic. I want to know what you said. This is very confusing.

MR. RAHN: Yes.

MEMBER MARCH-LEUBA: I don't know what you're saying.

MR. RAHN: Yeah. So what we're saying is that the committee identified that 95 percent probability of a channel drift was considered the bare minimum. Let's see here. I might be able to --

MEMBER MARCH-LEUBA: I say that I mean unless you want to tell the rest of the people in the -- I understand the topic very well. I want to know what you're saying. My position is that the 95 percent is an arbitrary number, which is not based in law. It's a customary number. We just picked 95 50 years ago, and we stuck with it. But when we picked 95, it was a double sided 95, so we really were picking 97.5 to be more honest. I just want to know what you guys have said.

MR. RAHN: Yes.

MR. REBSTOCK: If I can intervene -- this is Paul Rebstock again. I have a figure in my presentation that shows exactly how that works.

MEMBER MARCH-LEUBA: Okay. We'll wait.

MEMBER KIRCHNER: But again, just for clarification on Jose's point, David, this is on both ends of the population because you don't want to be on -- you don't want to be off the mark on the low end either because that's going to tell you that there's something not right with the instrumentation or its calibration or et cetera, right?

Most protection functions are on high

pressure, high flux, high vis, high temperature, high whatever. But you also -- you don't -- you want to look at the other side of the population, too, because it tells you something about how the instrument is performing.

MR. REBSTOCK: That is true, but that's not related to the 9595. That's a different thing. I'll cover that also.

MEMBER MARCH-LEUBA: Yeah, and I agree with that. I mean what we're asking is whether you have to use twice uncertainty or only one uncertainty.

CHAIR BROWN: Excuse me. I'm going to interrupt, Jose. Can we save this for his presentation? I don't want to do it twice.

MEMBER MARCH-LEUBA: Okay. I just don't know what we're -- we're wasting time with this slide then.

CHAIR BROWN: Yeah, but he's going to have -- he's got about a 13-page presentation or 12 pages on this issue. So I would appreciate -- we need to -- let's get this finished, and then we'll head into that. Is that okay? Thank you. Go on, Dave.

MR. RAHN: Yeah, so I actually also have a backup slide on this, so we could come back to it. But essentially, the committee elected to develop the

ISA standard to adopt the changes that we were describing earlier and managed to get that standard voted on.

It was actually unanimously approved and sent to the Standards and Practices Board which then approved it in November, and ANSI recorded it in December of 2018. The ISA standard committee made it public and available the beginning of January.

Now here's maybe what I'd like to do before we move on to the next topic -- I don't think I have a go to function here. Yeah, I think we might have to wait for Paul's -- let's see. Just to give you an example of what we're talking about, this is an illustration that Jose was referring to.

When is it appropriate to use one-tailed and two-tailed tests? And so, this is an example of if you're looking at what is the probability of occurrence above a certain value, and you use a one-tailed function. But if you're looking at a probability of occurrence between two values, you use a two sided distribution.

We use two sided distributions when computing the individual tolerances, and we use a one sided distribution when we're ever interested in knowing the probability of something occurring at one end of a distribution or above or below.

And so those distribution values are different. The areas under the curve are different depending upon whether you're talking about something occurring before a certain limit is reached where it says between two limits. And so when you've got an instrument channel set at a value somewhere near the mean of this thing, normally you're approaching, the process is decreasing, and the instrument channel might go off early in this right hand into the tail.

But once it reaches the left hand into the tail, you want to make sure that 95 percent of the uncertainty is bounded before you get to that limit, whereas, you know, if you're setting in the middle and you have a high and a low setting for that instrument, you definitely need to use the two-tailed side.

Now this is illustrated with this figure here. If I have a -- if I want to make sure I've bounded 95 percent of my uncertainty above a certain limit, like the analytical limit, and I have a normal operating range that's way over here, and I have a transient that causes a process value to decrease below that, looking at range. It's a low reactor water level setpoint, for example.

I would not want to be -- and have the

trip go off above these, the high end of the tail because it will encroach upon my spurious trip avoidance range. But I want to make sure, for sure, that it's going to trip by the time I encompass 95 percent of that curve, whereas in the two-tailed function, if I bound 97 and ½ percent of that function, I'm going to have to shift my curve to the point.

And I've only got 2 and ½ percent on the other side of the analytical limit. That shifts my limiting trip setpoint higher and the entire curve closer to the spurious trip avoidance range. So that's in practice. Both of these are very conservative estimates, right. I mean --

MEMBER KIRCHNER: Yeah, so Dave? This is --

MR. RAHN: Yes.

MEMBER KIRCHNER: So this is Walt Kirchner. So this is a great view graph. So now I want to ask my question. So for most protection system functions, we rely on multiple sensors. So, and this is where I make the distinction between my, you know, our analytical, numerical methods for calculating safety limits and so on and so forth. Where we might use the more conservative lower picture, but you are doing usually for all the reactor protection trip signals, you're using a boating logic.

MR. RAHN: Yes.

MEMBER KIRCHNER: And the boating logic then admits to yet another probability aspect. And so, that's why I was leaning with my observations to the upper view graph. But I'll wait for Paul's presentation to hear why we might use the lower.

MR. RAHN: Yeah. So I mean that's the argument.

MEMBER KIRCHNER: There's a probability of the sensors, you know, if you have multiple sensors doing the same protection function, then you've got the upper view graphic times the number and Dennis or someone else or Vesna can help me here because I'm not sure when you add and when you multiply.

But then you're relying on the redundancy and diversity to actually get you to the trip function that you need to protect the reactor.

MEMBER MARCH-LEUBA: Hey, Charlie, can I bring my point here, or should I wait? Let me go --

CHAIR BROWN: Jose, I have lost control of this subject. Go ahead.

MEMBER MARCH-LEUBA: All right. See, this topic has been going on forever since I -- ever. And the reason is there is no statistic. All four sensors are going to have to be set at the lower setpoint if you use double sided and not 9595. So it's not that one sensor would trip earlier or later.

If you want to guarantee that it works, all four sensors are penalized. This is the reason why the industry wants to use the single sided, the one top because they get margin without doing anything, just by doing a completely thorough analysis.

And the staff is reluctant to even that over the last ever because given the industry margin that we don't have now -- right now, we have some experience with double sided. Is it working forever ? It's been safe. The industry says well, we can change margin just by doing different math without touching anything.

And this is the conflict that we've been having forever, at least 20 years that I know. And the whole thing is -- has no sense, has no physics. The 95 percent threshold is completely arbitrary. Somebody picked it out of the air. And when they picked it out of the air, they said it's 95 percent double sided. And that's how they picked it up.

And now changing, we're changing the rules if we go to single side. Is the reactor safe? Is it just as safe with one as the other because there are so many concerned about this thrown into those setpoints that you can be one or the other. It makes absolutely no difference in the sake of the reactor.

But that's where we are. The 95 percent goal yes was picked out of the year, and it meant double sided. And if you want to change it now to a different number, fine with me. It won't make any difference. The Agency will be very happy. It's an arbitrary thing. Sorry for wasting your time, Charlie.

MR. RAHN: You haven't wasted your time.

CHAIR BROWN: No, you didn't waste my time. We ought to stick with 9595. It's not going to change much. We ought to get moving.

MR. RAHN: Okay.

MEMBER MARCH-LEUBA: Yeah, but look if it's double sided or single sided because if you go single sided, you're really talking 97.5, for example in 9595.

MR. RAHN: Okay. We're on to the next section. Just want to make sure I didn't skip anything. No, I didn't. Okay. So the next section is what are we hoping to get out of finalizing the development of revision 4. It's Reg Guide 1.105.

So there's a regulatory reason, which is we want to provide licensees and applicants with one acceptable way for them to meet current regulatory requirements and staff concerns that were identified in RIS 2006-17.

But organizationally, what we're interested in is to have a definitely document that has the guidance one needs for addressing both the regulatory and industry standard, two weeks that have been taking place since the last revision of Reg Guide 1.105 was issued 21 years ago.

So essentially, we are aiming to endorse with a clean endorsement an industry standards development organization document that represents a consensus of the industry but ensure that it provides the safety that we would still need to ensure that we have for protecting the health and safety of the public.

So to me, you know, the issue of 97 and 1/2 versus 95, you know, to me it's like a glass half full, half empty or actually 97.5 full versus 95 percent full. You know, 95 percent is a lot, and yes, you do have to have four channels, all of which have to achieve 95 percent probability of trip.

But functionally and operationally, we find that it seems to work. So we don't have instances of channels not tripping when they should have. So because a lot of this has to do with the fact that you first have identified all the uncertainties and accounted for them.

And just in doing that alone, there's a, you know, you get a higher confidence that the channel is going to have accounted for uncertainties that you might not have been aware of. So what we're trying to do is issue a guidance document, and we're focusing on primarily on new applications by possible voluntary adoption by existing licensees for currently operating reactors.

The likelihood is that we will have the interest of new actor applicants, but it remains to be seen whether or not we would have any people willing to change anything in the way they do business and operate their setpoints currently.

CHAIR BROWN: Dave, the other point I got out of this, by using the international standard, you really didn't give up anything. They effectively incorporated the NRC desires into that new, the 2018. It seems like everything you all particularly wanted or had disagreements with, they incorporated so that effectively, we've got their consensus and your consensus is really doing what you would like to see in the first place and having one document as opposed to, you know, another international document and another one. And we say well, that's fine with you, but we're going to do it our way.

MR. RAHN: Yeah, or we like it except for this, you know.

CHAIR BROWN: Yeah. And particularly because they incorporated you all's major concerns. So that's another way I've looked at it when I was going through this thing. That's just my personal opinion. I'll let you get with the last.

MR. RAHN: Yeah, so moving on. Yeah, so ideally we're trying to achieve alignment among all the stakeholders in the nuclear industry, which includes plant operators, architect engineers who help the plant operators establish setpoints, instrument vendors.

We have cooperation on our ISA committee from instrument vendors, government stakeholders and others that can align on a set of principles that everyone can understand and use. And specifically, we're hoping to use appropriate science and art together for coming up with a principle for establishing and maintaining safety related setpoints to meet the regulatory requirements identified primarily for technical specifications.

And at this point, if you don't have any further questions, I would like to introduce Mr. Mike Eudy to talk about what we plan to do to finish up this particular regulatory guide and say a little bit of word about how regulatory guides are developed.

MR. RAHN: Okay. Go ahead.

MR. EUDY: Yeah, sure. Hello everybody. This is Mike Eudy, a project manager for Office of Research, Division of Engineering, the Regulatory Guidance and Generic Issues Branch. I had asked Christina. We had looks like a couple of my slides weren't correct, so I was hoping we could take a quick break, if anyone didn't mind, and then I can finish up so we can get that sorted out if that's okay. Otherwise --

MS. ANTONESCU: We can take a break, come back. There are some slides that need to -- he needs to share his own slides now.

MR. RAHN: Oh, okay. So I'll stop sharing.

MR. EUDY: Yeah, Dave. I uploaded it like to the SharePoint site, and I think if you reload they'll probably be there.

MR. RAHN: Okay.

MR. EUDY: But, you know, I apologize for the inconvenience.

CHAIR BROWN: How long do you want?

MR. EUDY: I mean, well, it's been --

CHAIR BROWN: Five minutes?

MR. EUDY: Yeah, I think five minutes. It's going to be a pretty quick presentation for me.

CHAIR BROWN: What do you want, Walt? Walt? Walt, are you there?

MEMBER MARCH-LEUBA: I'll be Walt. Let's come back at 3:55. Just do a 10-minute break.

CHAIR BROWN: Okay, 10-minute break, 3:55.

MR. EUDY: Great. Thank you, everybody.

(Whereupon, the above-entitled matter went off the record at 3:45 p.m. and resumed at 3:58 p.m.)

CHAIR BROWN: Yes, sir.

MR. EUDY: Can everyone hear me okay?

CHAIR BROWN: Yes.

MR. EUDY: Okay, good. Okay, Topic 9. So I'm going to talk about -- Again, my name is Michael Eudy. I'm a project manager in the Regulatory Guidance, the Generic Issues Branch for the Office of Research. And I'm going to talk about the next steps for completing this Reg Guide revision. And then also have a slide on some of the things that we do for the Agency in Reg Guides.

So I'll go to the next slide. So the next steps, so we issued this Reg Guide revision back on August 14th and we had a 30-day comment period. Typically we default to 60 days, but the staff had a justification to believe that it was a clean endorsement of the 2018 standard. The NRC was assisted in the development of that standard. And they did not expect that there would be any significant impacts on operating fleets. So we didn't anticipate that there would be a deluge of comments.

And during that time, it closed on September 14th. We actually got 24 comments. And within those comments, we have 28 total comments. And the staff has reviewed those comments and believe that there will only be very minor editorial changes and nothing significant changed to the draft guide. So from this point on, we'll be putting together a public comment disposition table, which will list all the comments, who commented, and what is the NRC's disposition on the comment. Do we agree? We don't agree. Are there any changes warranted? So that's our next step that we'll be working on later this week.

We anticipate that the final Reg Guide package would be ready for review by the ACRS in December. And since the ACRS has interest in this draft guide and we're going to have a full committee meeting, I believe that's scheduled for sometime in February -- I don't believe we have an exact date yet -- but we're going to try to have all concurrences and OGC NLO of the entire package before you get it in time for Christmas. So that's my goal and that's what we plan to do. And like I said, we're going to be meeting in February to go over that package. And there shouldn't be major changes. Any questions on that?

Okay, I'm going to move forward. All right, so this is a little PR for my branch. We basically are somewhat unique to the Agency in terms of handling guidance documents, in particular Reg Guides. My branch actually manages all the NRC Reg Guides. We have a new branch chief. His name is Meraj Rahimi. And he's bringing in some new perspectives on how we can try to streamline our process and better serve our stakeholders.

And just to put it in perspective, we did a database search last week. And we came up with --

we have approximately 343 Reg Guides that are currently active and in use. And they're across what we call ten divisions. And as you can see, the bulk of them are in power reactors. We have 176 active by my count last week. But there's also other divisions. For example, Research and Test Reactors, Fuels, Material Facilities, Materials and Plants Protection, Transportation, Occupational Health, et cetera. So I can go into more detail if anyone needs to. But that just represents, you know, that we handle quite a few Reg Guides.

So basically our job is to manage the development of them, the issuance, and basically go through the life cycle. The technical program offices will do the technical development, but we assist them administratively and regulatorily to make sure that they're accurate on their good products. And we're typically issuing an average of about 25 Reg Guides a year. And most of those are revisions to existing guidance, just like the one we're talking about today. And occasionally we have approximately one to three new Reg Guides that are going out that will be brand new for the Agency.

And another thing that we do that's fairly unique for the entire Agency is we actually have periodic reviews that are done every ten years for all Reg Guides. And that's a minimum of ten -- well maximum of ten years. They need to have been reviewed. And we have a template for a review that basically would outline what are the technical or regulatory issues that currently involve with the use of the Reg Guide? And do those issues have a significant impact that could warrant a revision to the Reg Guide. And we actually publish these reviews, which is unique to the Agency.

So that way all interior and external stakeholders can see what we're currently thinking about a Reg Guide. And basically it's a good knowledge management tool. And it helps us plan because within that periodic review, the staff is supposed to propose a schedule for when -- if they choose to revise a Reg Guide -- when do we think we'll have it developed. And it's good for transparency for the Agency and for all stakeholders.

And we issue about 20 of these reviews per year and the decisions are do we leave it as is? Are there issues that should be considered by someone who might pick up the Reg Guide in a few years? So it's good for knowledge management. Are the issues significant enough that we should revise or should we withdraw one -- withdraw the Reg Guide?

So for this Reg Guide, 1.105, we actually did issue a periodic review, indicating we were going to pursue a revision in late, I believe it was, 2018. So in 2019, the staff technically developed the draft guide that you're seeing it today. And here it is in front of you. So that just -- I just wanted to give a little perspective to the ACRS about what my branch is doing. And we have about eight PMs -- project managers that are managing all the Reg Guides.

So that's the end of my presentation. And if anyone has any questions or comments?

MEMBER BLEY: Yeah, Michael. This is Dennis Bley. Earlier we had a little discussion and Dave and Paul explained that the old RIS 2006-17, the things that apply to this Reg Guide were all picked up now, except in that RIS, there were a number of things dealing with tech specs. And those guys said the tech spec people will have to deal with that before the RIS can be retired. Does that come through you folks? Is that in one of your (telephonic interference) or does that fit somewhere else?

MR. EUDY: Well I think that the fact that we picked up that document in the review of this draft guide and that we would need to outreach to the people that would handle that RIS and see if they wanted to actually delete it. So that would be like a homework item for us, but we don't manage that. But as you know, Reg Guides can encompass a lot of guidance and you know, the less guidance we have out there, you know, potentially the better if we can try to put them in one place.

So I think -- I think what you're suggesting is definitely the ideal. But we did have some discussions while developing the draft guide that talked about that. And we didn't think that we would be able to adequately say that, you know, we can delete this RIS based on this Reg Guide. So it's going to require further follow-up on our part with the folks that have control of that document to see if we can actually sunset it accordingly.

MEMBER BLEY: I hate to see these things laying around. So the tech spec stuff would not come under a Reg Guide. That would be somewhere else -- (telephonic interference).

MR. RAHN: This is David Rahn. I might be able to shed some light on that. So the RIS itself is managed under a process that falls under the generic communications nomenclature. And generic communications are actually managed out of the

Division of Reactor Oversight, I guess it is DRO. And so there's a branch within that division that handles decision making associated with issuance of things like RIS's or information notices and so forth. So anything that falls under generic communications. So we would first have to work with a project manager assigned within that division to determine whether or not we want to retain or to sunset this particular RIS at this time.

MEMBER BLEY: Okay. This is just a little tough for me. We see ISGs that also shouldn't stay around long -- stand around for years and years and years.

MR. EUDY: Yeah, it's funny you mention that because I just worked on a SECY to the Commission that talk about how often do we update our guidance. And you know, there is temporary guidance. We actually have 104 -- I believe by the last count -- 104 ISGs out there. And you know -- And actually in Generic Communications, we have over 5,000 -- I hand-counted across the different types of Generic Communications that are all out there and still active. So it's a big -- there's a lot out there.

MEMBER BLEY: Yes and it's hard to keep track of that stuff.

MR. EUDY: Yes, sir. I wouldn't want to have to be an applicant.

CHAIR BROWN: Let me -- It's Charlie Brown. We discussed this a little bit before as Dennis noted. But this RIS is mentioned in a number of different places, not only the Reg Guide, but it's also listed under the TSTF in that April 30th, 2010 document signed by Eric Bowman. And it specifically says, discussion is part of the setpoint control program. And everything else needs to include the plant licensing basis meets the guidance in the RIS, as well as other requirements. So you're going to have be careful that you don't throw the -- some part of the baby out with the bath water.

MR. EUDY: That's a very good point. There's tentacles -- you know who -- Yes. Do we know where all the tentacles reach? That's correct.

CHAIR BROWN: And the fact that the RIS is quoted a couple of different -- two or three different places.

MR. EUDY: Well I think that -- So like for example when we withdraw a Reg Guide -- I've actually looked at this. People are like oh, well you can't use it anymore. But that's actually not the case. You know and I looked at what a withdraw for a

Reg Guide looks like. And it basically says we don't recommend its future use. However if you want to, you certainly can still use it. And if it's part of your licensing basis, you can still use it.

So I think even though it's withdrawn -- maybe it's a stigma. Oh, it's withdrawn. We can't use it. But I think people still can use, you know, previous guidance as much as they want even if it's withdrawn. Unless of course, there's a safety concern with using that particular guidance.

CHAIR BROWN: Well in this Reg Guide, Section 221, talks about the RIS and TSTF 93, 493, Reg 4 and the use of AFT and ALT and allowable values and all that kind of stuff. So there's a lot of -- you've got a lot of stuff even in the Reg Guide that says hey, remember we've got plants out there that are still working with the allowable value end of this business. And the RIS apparently has some tentacles in that as well. So I just don't want to see somebody jumping the gun. That was my observation on that.

MR. EUDY: That's a good point. When we were developing the -- the working group did do, I believe the correct technical outreach to have those people that would be involved in the -- you know, the particular knowledge about the RIS and the TSTF if they did actually read. You know, they went through and helped us make sure that what we had in here was accurate. Would you say that's the case, David? David?

MR. RAHN: I'm sorry. Yes, I would say that's the case. We did touch base with them. And basically we all recognized that there's something to be dealt with yet as a future item.

MEMBER KIRCHNER: Chairman Brown -- Charlie?

CHAIR BROWN: Yes.

MEMBER KIRCHNER: This is Walt.

CHAIR BROWN: Yes?

MEMBER KIRCHNER: May I ask a question that's not directly related to this Reg Guide, but a recent one since we have Mike on the line who's the expert?

CHAIR BROWN: Sure. Go ahead.

MEMBER KIRCHNER: Mike, this is Walt Kirchner. This is in regards to 1.236. That's the old -- you know, the rod ejection, rod drop Reg Guide that was recently revised.

MR. EUDY: Okay.

MEMBER KIRCHNER: I just wanted to ask you a question. When we got a staff response, it was clear in the Reg Guide that they would apply it on a case by case basis as changes were made to LWR fuel types. In the staff response, they said they agreed with us. However, the staff does not intend to use such guidance to support NRC staff actions in a manner that would constitute either forward fitting or back fitting, blah, blah, blah. What do I -- What does one make of that? What does that mean?

MR. EUDY: Did someone want to answer that?

CHAIR BROWN: Yeah. Hold it, hold it, hold it, hold it. Walt, I didn't realize the nature of this. I hesitate to try to go through --

MEMBER KIRCHNER: No, I just wanted -- if Mike could give a short answer. If not, I'll drop it and I don't want to interfere with the meeting. But it kind of applies actually to the Reg Guide that we're talking about. I just didn't quite understand what that meant in staff parlance.

MR. EUDY: Yeah, this is Mike. I'll try to address it. We have a section -- Section D in our Reg Guides. We actually have re-vamped the template that we use with the advice from the Office of General Council based on, you know, a lot of the issues that came to light in the last couple of years about you know, forward fitting. And I believe traditionally that we considered Reg Guides as nationally being a forward fit such that if you look in --

MEMBER KIRCHNER: Well like this Reg Guide. It's really more forward looking, than backward.

MR. EUDY: Right, it is. But I believe that we -- an applicant still could come in -- We had this conversation yesterday on another Reg Guide -- An applicant still could come in and reference a previous version --

MEMBER KIRCHNER: Yeah, okay.

MR. EUDY: -- and the staff, you know, would have to say well, you're not using the current versions. If there's not a significant safety concern, you know, just justify you know, why you're going to stick with this -- the older version.

MEMBER KIRCHNER: Okay. So they could come in with like 1.105, the one we've been spending today on and use a previous version rather than the one you're working on issuing later this year.

MR. EUDY: Yes, I believe that they could. They would need to justify it. It depends on the technical -- you know, what the technical concern is with using a previous version. But we do basically say in there that, you know, we don't intend this to be a forward fit, back fit, or something that would challenge issue finality. So essentially we're recommending its use.

MEMBER KIRCHNER: Okay.

MR. EUDY: But we're not mandating the use. Reg guides are recommendations. They're not requirements.

MEMBER KIRCHNER: Okay. Thank you, Charlie. I just wanted to -- from an expert to understand the bureaucratic speak.

(Simultaneous speaking.)

CHAIR BROWN: So what's a little more? All right, Dave, do we want to get on with the next -- the nonconcurrence?

MR. REBSTOCK: Yes, I recommend we proceed.

(Simultaneous speaking.)

MR. EUDY: Okay. So I will -- I think that Paul, you're going to need to go into your frame and request control.

MR. REBSTOCK: Yeah, I'll do that. I thought you were going to collect actions on --

(Simultaneous speaking.)

MR. EUDY: Okay.

MR. REBSTOCK: I think we had some reactions to it.

MR. EUDY: So yeah, I guess what I wanted to do for the group is to -- you know and what we've heard so far that since we're going to be working on the draft guide and making any revisions, I believe that we have three issues to identify that may (telephonic interference) -- Based on what the ACRS has told us today, we are going to go back and we might make some changes to the draft guide, mostly in the history section, Section B, to clarify some of the issues. And one of the items I had was the discussion about Section 2.27 and the 2018 standard actually having identified acceptance criteria. I believe that we believe that there was an error there. That's one of the issues I'm tracking.

CHAIR BROWN: Is that in the Reg Guide?

MR. EUDY: Yes. That is in the Reg Guide, Section 2.27 of Section B, Subsection 2.27.

CHAIR BROWN: Yes.

MR. EUDY: That a member brought up that wait a second, there is acceptance criteria there. And I believe Dave Rahn agreed and that we should take a look at that. So I'm tracking that as something that we're going to have to fix or at least look at.

And I believe there's two other issues as well that maybe Paul and Dave could speak to.

MR. MOORE: Chairman Brown, this is Scott Moore. Can I make a statement?

CHAIR BROWN: Yeah, go ahead.

MR. MOORE: So I just want to remind the staff that this is a subcommittee and the full committee only speaks through its letter reports. And what you're hearing today from all the members are their own thoughts and views. And so you should take them in that manner. And if you choose to make any changes now to the documents, then that's the staff's position. But that would be what you decide to do. And you should take the feedback from, you know, what you're hearing today. But that would be a staff decision to make that. Okay?

MR. EUDY: Yeah. Thanks for clarifying that, Scott. You're right.

CHAIR BROWN: Thanks, Scott. I was going there, but you beat me to it.

MR. MOORE: Okay, thank you.

CHAIR BROWN: To go through that drill just to make it clear. We provide observations. You do with them what you're going to do. But it is -- if you've got some thoughts, you can tell us. I just looked at 2.27 and I was trying to find where there's any of the version you all gave us, RIS 4. And I could not find any acceptance.

MR. RAHN: Chairman Brown, this is David Rahn. So I just re-looked at this and I believe that it was referring to a section regarding measurement and test equipment uncertainty. And I think it's talking about a change from a previous revision. But there used to be some criteria as to whether measurement and test equipment uncertainty needed to be so much more accurate than -- you know, then the equipment that's being tested. So I think that wording, it needs to be adjusted because there really are acceptance criteria for measurement and test equipment uncertainty.

MR. RAHN: In Section 2.27 -- 2.2.7?

CHAIR BROWN: Correct, 2.2.7.

MR. RAHN: That's Page 8. I'm looking at it.

CHAIR BROWN: I see it and the statement is made --

MR. RAHN: Oh, okay. Additional information for determining measurement --

CHAIR BROWN: Yes, right.

(Simultaneous speaking.)

MEMBER BLEY: -- says there's nothing in the standard that provides it and there is.

CHAIR BROWN: Right.

MR. RAHN: So but you just said you -- Yeah, you just said you do not endorse any version of RP67. But they contain useful information.

CHAIR BROWN: Yeah, so I think the words "but does not specifically identify acceptance criteria" can be confusing. So I think there's probably a reason to re-look at that sentence.

MR. RAHN: Okay, that's fine. You all can deal with that. The other thing -- Go ahead whoever had the other two items just to make sure you didn't pick up something that we don't -- don't really think is one.

CHAIR BROWN: Yeah, so I heard that -- Member Rempe pointed out that it would be helpful if the Reg Guide did not, you know, provide insufficient pointers regarding Drift analysis such that, you know, users of the Reg Guide can find it, you know, and not do something that's not warranted. And so there's a section -- an evaluation of the allowance for Drift, which is 2.2.3. So what we'll do is we'll take a look at that and see if we believe there are sufficient pointers to guidance so that you would apply the right guidance when you're assessing the allowance for Drift.

MR. RAHN: Okay, what's the third item?

MR. EUDY: I think (simultaneous speaking) you brought about the RIS.

MR. REBSTOCK: Yeah, that was the caution about the RIS and the fact -- the way that the Reg Guide addresses the RIS. If the RIS is going to go away, it shouldn't be cited as a resource. But it can be cited as historical information.

MR. EUDY: Yes.

MR. REBSTOCK: So we just need to take a look and make sure we cite it properly.

CHAIR BROWN: But all I was trying to do was make an observation that it's embedded and you guys can figure out whether it's okay or not. Okay?

MR. REBSTOCK: It's all over the place so that's why we will be very careful about that.

CHAIR BROWN: Okay. I don't have a stake in that, so all right. I mean I wasn't trying to tell you what to do, just that it's an observation.

MR. REBSTOCK: Appreciate the observation. Thank you.

CHAIR BROWN: Okay.

MR. EUDY: This is Mike. I have one more

issue. The question about Reg Guide 1.263, I know who the project manager is so I can -- you know, if you have any questions, I could go through Christina just to introduce you to Ed O'Donnell who basically is the lead PM in my branch for that Reg Guide. So he would be able to get into any more specifics you may have about the public comments, the resolution because he --

(Simultaneous speaking.)

CHAIR BROWN: Because that would not -- that would not be Christina. I don't know who -- I don't know which of the staff measures does 1.236 or whatever that reg out is. Is that you?

MR. EUDY: I was trying to be helpful to --

(Simultaneous speaking.)

CHAIR BROWN: No, that's fine. She's not just the right staff member, I don't think.

MR. EUDY: Okay.

MEMBER KIRCHNER: Charlie, this is Walt. That would be Zena.

CHAIR BROWN: Okay, that's what I thought. Zena, okay.

MR. EUDY: Zena.

CHAIR BROWN: Yeah. I'll get him in touch with her about the question.

MR. EUDY: All right, thank you.

CHAIR BROWN: All right, thank you. Can we get on to the other one now?

MR. EUDY: Yes, I'm done. I appreciate the opportunity to present to you all.

CHAIR BROWN: Okay. Looking forward to it. Go ahead.

MR. REBSTOCK: Okay, can you see my screen? There should be a --

(Simultaneous speaking.)

CHAIR BROWN: Yes. Yes, I can.

MR. REBSTOCK: Okay. What was that?

MEMBER BLEY: This is Dennis Bley. I don't have your screen up yet.

MR. REBSTOCK: So some people can see it and some people can't?

MEMBER REMPE: I can see it.

MEMBER KIRCHNER: This is Walt. I can see it, but I'm on my NRC computer, Dennis.

CHAIR BROWN: So am I.

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: -- take control to presenter. You may not have control. Can you see the one on the left right -- left bottom, Slide 2 of 13, Take Control?

CHAIR BROWN: Yeah, I keep seeing -- I'm like -- Jose, I keep seeing that pop up also.

MEMBER MARCH-LEUBA: Yeah, there's something strange.

MEMBER REMPE: I am --

CHAIR BROWN: Go ahead.

MEMBER REMPE: Well I'm going to my own computer, Dennis. But you're coming through as a guest.

MEMBER DIMITRIJEVIC: I can see it as a guest. I can see it on my own computer.

MEMBER REMPE: Okay.

MEMBER DIMITRIJEVIC: And I see also, take control. So I see it exactly as the people in the NRC see it.

MEMBER BLEY: I've got the slide, so go ahead.

MR. REBSTOCK: Okay. These are slightly different from the draft slides that I sent Christina earlier. I sent her these yesterday. So the one set is labeled draft, the other set just doesn't say draft if you're following off line.

MEMBER BLEY: I will be. Let me sneak a question in before you start, Paul.

MR. REBSTOCK: Okay.

MEMBER BLEY: I always get confused on these. You're going to tell us about your nonconcurrence.

MR. REBSTOCK: Correct.

MEMBER BLEY: Then Management has already addressed it in the way they've decided to address it.

MR. REBSTOCK: Right.

MEMBER BLEY: Are you going to say anything about what you think of what's been done with it or are you just going to say this is my nonconcurrence and I --

MR. REBSTOCK: No, I presented my nonconcurrence. Management has spoken what they think about it. I disagree with them, but that's the whole point of the nonconcurrence. We move on.

MEMBER BLEY: That's good. So you still stand by everything you have here?

MR. REBSTOCK: Yeah, I haven't heard anything that tells me that this is wrong. Besides, I think it's a Management type decision anyway. And you'll see that as we get a little bit later on.

MEMBER BLEY: That's great. Go with that.

MR. REBSTOCK: Okay. Now if I can figure out how to change the slide, we're in good shape. Why won't it change? There we are. Okay, we've already done a lot of the background. We've talked a lot about DG-1141 that refers to the old standard. The old standard didn't have any technical information in it. So as a result of the extensive discussions about setpoints from 2004 to 2006, we thought that there was a lot of additional information needed. And that's why DG-1141 had so much technical detail in it.

It was concurred by everybody that needed to concur with it. Released for public comment. We got a lot of comments -- something on the order of 700. But it depends on how you count them, whether it was a little more or a little less. I wrote draft responses. The draft response document is 124 pages that addresses all of those comments. Updated the Reg Guide.

And then we decided -- we saw that the ISA was also working on the standard. And so our Management decided to hold off on the Reg Guide and see what happened with the ISA. So it went dormant for a little while and then 1363 was produced based on the 2018 version of the standard. The 2018 version of the standard incorporates many of the provisions of 1141, but it doesn't -- it doesn't incorporate everything. Somebody had said earlier about it did everything we want. Well, I guess it depends on who "we" is. But I don't think it adequately addressed everything that was in there. And 1363 is now to address the standard without any comment and this has been said.

CHAIR BROWN: Paul, have you changed slides yet? I've still got your introductory slide. Did you go to your second slide yet?

MR. REBSTOCK: I just spoke to Slide 2 and just moved to Slide 3.

CHAIR BROWN: Okay, well mine's not changing. I have the slide, so --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: I can switch through my slides on my computer. I can go to Slides 3 and 4 and 5.

CHAIR BROWN: Yep, I'm doing the same thing you are, Jose. I now went to Slide 2 with the little take control tab.

MEMBER MARCH-LEUBA: Yeah.

CHAIR BROWN: It's the left arrow and the right arrow, so I'm good. I can get your slides now.

MR. REBSTOCK: Okay, I'll --

MEMBER MARCH-LEUBA: Can you tell us which slide you're on?

MR. REBSTOCK: I'll try to be careful to say which slide I'm on. Now I'm going to Slide 3.

MEMBER MARCH-LEUBA: Now all of them are gone.

CHAIR BROWN: Yep, they all disappeared.

MEMBER MARCH-LEUBA: I don't believe I would say this, but I actually like Skype. I knew how it worked.

MR. REBSTOCK: Yeah, we've been some having trouble with this. Do you have copies of the slides?

MEMBER MARCH-LEUBA: I don't.

CHAIR BROWN: I do.

MEMBER MARCH-LEUBA: I think it was working before. Whatever you were doing before, it was working.

(Simultaneous speaking.)

MEMBER BLEY: This is Dennis. I have the draft slides, but I don't have the latest version. How much difference is there?

MR. REBSTOCK: There's let's see -- I added some information.

MEMBER KIRCHNER: Charlie, this is Walt. Could we have Christina take -- Christina take control and have her put them up? And then Paul can just tell her which slide to be on.

CHAIR BROWN: I don't know.

MS. ANTONESCU: Just a moment. What would you like me to do? I'm sorry.

MEMBER KIRCHNER: Christina, if you put up the slides --

MS. ANTONESCU: Okay, I'll try to do that.

MEMBER KIRCHNER: -- that's beyond my capability with Teams at this point. And then Paul can tell you which slide. And you can -- you can show his presentation.

MS. ANTONESCU: Okay. I need a couple of minutes because I wasn't set up for it. Sorry.

MR. REBSTOCK: Okay. Make sure you use the ones I sent you yesterday, Christina. They do not say draft in the file name.

MEMBER MARCH-LEUBA: Christina, I have opened the slides. Do you want me to try to share?

CHAIR BROWN: Christina, did you hear? We don't --

MS. ANTONESCU: I'm trying to do the same thing. So if he wants to do it, that's fine. I was just doing it now. That's fine.

MEMBER REMPE: So I can re-forward the email that Christina sent us yesterday with this presentation. I just sent it to Ron and to Jose. Are there other members who need it?

CHAIR BROWN: Oh Christina just got them up, I guess.

MEMBER REMPE: Okay. But if people need a copy of the slides, I can forward them to you.

MEMBER MARCH-LEUBA: Okay. Christina just put them on the screen and she can move them.

MS. ANTONESCU: Okay.

MEMBER MARCH-LEUBA: Christina, we need to be on Slide 2, I believe. Can you move it? There, perfect. Thank you. It's working for me.

MR. REBSTOCK: Thank you, Christina.

CHAIR BROWN: I've got them also.

PARTICIPANT: Yep, me too.

CHAIR BROWN: -- without the take control sign. Did you want to go to Slide 3, Paul?

MR. REBSTOCK: Yeah, let's go to Slide 3. I can't see the bottoms of the slides for some reason. There's an extra banner across the bottom of my screen, but I think I know them well enough that we'll work it out.

CHAIR BROWN: That's Slide 3, I can see it. It's down in the lower right-hand corner barely.

MR. REBSTOCK: Yeah. Oh actually -- no,

I've got the whole slide here. This is fine. Okay, this is just to identify the specific -- the specific points. One is an interpretation of 95/95 criteria that leads to this discussion that we've been having all along about 95 percent versus 97.5 percent. The significance of that is that the use of 95, instead of 97.5 increases the probability that the plant will be operating in an unanalyzed condition. It doesn't say that there will be a catastrophe, but it says that you'll be operating in a way that you haven't evaluated.

And then the temporal extrapolation we've also talked about. It affects the adequacy of the uncertainty estimate for the channel uncertainty estimate.

MEMBER MARCH-LEUBA: Paul, this is Jose. I think this is important that you tell us exactly what you mean at the first bullet, analyzed condition.

MR. REBSTOCK: Well that's what I'm going to do. This is a summary. And then the next slides will go into the details on it.

MEMBER MARCH-LEUBA: Okay, I'll wait.

MR. REBSTOCK: Okay. So we can go to 4. Okay and I thought a terminology slide is important because one of the problems that we have is the way we talk about these things. And the most important thing, I think, is that we always talk about setpoints. And that's not really the point. There's another term that I would use is the second line on this slide, the actual trip point. It helps a lot if we see the situation as being where the trip point is a random variable, which is the point at which the channel actually trips as opposed to the setpoint, which is a fixed number, which is where you think it's going to trip or where you measure it's going to trip.

Then I included some other definitions that will come in handy later in the discussion. We talked about as-found, as-left. Drift and deviation are similar, but they're not the same thing. Drift is the change with time and instrument calibration that's not attributable to anything. Deviation is the difference in measurements that's partly due to drift, but it's also partly due to change in ambient temperature and change in the process and other stuff.

Limiting setpoint is what goes into the (telephonic interference) specifications. That's what the whole point of this regulatory guide is to figure out what the limiting setpoints should be. The nominal setpoint is what goes in the calibration procedures. That's the target value that the technician is going to try to get. And it might be equal to the limiting setpoint or it might be more conservative, but that's an issue that would be developed as the procedures are developed.

MEMBER BLEY: Paul?

MR. REBSTOCK: Yes?

MEMBER BLEY: This is helpful, I think for most of us. However, I mentioned that the two you've designated as random, they're random, but they're not independent.

MR. REBSTOCK: That is -- Oh, yeah. Yeah, yeah, of course. Yeah. No, I just wanted to make the point that some of what we're talking about is random variables and some of what we're talking about are fixed variables. You're right. They're not independent, but that's okay. That won't affect the remainder of the discussion.

MEMBER KIRCHNER: Paul, before you go on just could you calibrate me -- This is Walt Kirchner. What is the standard practice in the fleet? Do they typically set a nominal trip setpoint with their tolerance as-left such that the high end is below the limiting setpoint? I would expect that.

MR. REBSTOCK: I believe -- I believe that is the practice. In point of fact, depending on how you calculate the total loop uncertainty, you could have the upper limit of the as-left band up above the --

(Simultaneous speaking.)

MEMBER KIRCHNER: Yeah, I could see that. And you introduced something else here called error.

MR. REBSTOCK: Yes.

MEMBER KIRCHNER: But in general, wouldn't that be the practice? I would assume that, but this is not my field.

MR. REBSTOCK: Yeah. I think usually -- that was something that I stumbled on to and I had some discussion of that in an early draft of 1141. I don't remember whether it made it in the final version or not. And I think that the idea was that it was such a fine point and such a minor advantage to the plant operators in terms of additional margin that it just wasn't really worth going into. If somebody wanted to do that, they could write up a justification and show how it all works and why that's still safe. And we could review it and accept it. But I don't expect that, that would happen very often.

MEMBER KIRCHNER: Then you're saying that often the nominal setpoint is the limiting setpoint?

MR. REBSTOCK: Well it would be lower than the limiting setpoint.

MEMBER KIRCHNER: Yeah, that's what I would expect. Plus your margin that was in your -- you know, as your as-left tolerance, that's what I'm trying to understand. I would expect that, you know, going back to Paul's view graph from early this morning, that you would not have your as-left tolerance above the limiting trip setpoint.

MR. REBSTOCK: Yeah, that was the graph. But yeah, usually you wouldn't.

MEMBER KIRCHNER: Okay.

MR. REBSTOCK: Like I said, there are ways that you could, but you have to get into the weeds of the analysis in order to show that it would be okay.

MEMBER KIRCHNER: Okay, all right.

MR. REBSTOCK: So we just say -- just that's not part of our recommendation. So you want to go to Slide 5?

Okay, now we're talking about -- So there's two issues. There's the 95/95 issue and then there is the temporal extrapolation issue. So now we're talking about the 95/95 issue. So increased likelihood of unanalyzed operation and what do we mean by that? The actual trip point, like I said is a random variable. It cannot be known. You can measure where you think it might be, but all measurements contain errors so you can't actually know it. But you can characterize it statistically. And so the probability that the actual trip points is in excess of the analytical limit can never be zero. That's just a fact of life.

The limiting setpoint affects the probability that the ATP might exceed the analytical limit -- the actual trip point might exceed the analytical limit. But how affective it is depends on how well you adhere to the 95/95 criteria and other stuff. And failure to meet 95/95 increases the likelihood that the actual trip point will be nonconservative. Nonconservative ATP means that you've exceeded the analyzed limit. And if you've exceeded the analyzed limit, then you're in an unanalyzed condition. You might be okay, but you don't know. And I think the next slide has the figure --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: Hold it. Hold it. Hold it. Go back to that slide. So basically what you're saying is that the requirement or the law or what we're trying to achieve is that only 5 percent of the trips will exceed the analytical limit. For 95 percent of the trips that we have, when you sample 1,000 different plants with a 1,000 different digs with the screwdriver (telephonic interference), 95 percent with trips below their analytical limit and 5 percent will do it above.

MR. REBSTOCK: No.

MEMBER MARCH-LEUBA: How do you -- No?

MR. REBSTOCK: No. No because what that measure that you took includes error. The question is where does the trip actually happen? And you don't know that. You might measure it and your measurements might show you that it happens in one value, but because of errors in the measurements, it might actually be happening somewhere else. And that's what the next slide was trying to show.

MEMBER MARCH-LEUBA: Okay, go for it.

MR. REBSTOCK: Okay. So a couple of -- before we get into the graph, a couple of points. We're assuming that the distribution of actual trip points is Gaussian. And it's about the as-left setting plus the bias. And what we're going to assume -- In this particular case, we're going to assume the limiting condition that the as-left setting is the limiting setpoint.

So if you look at the L-shaped part of

this graph, the ATP distribution and you see it's normal about the bias. And you set the 95/95 criteria in such that you are interested in the band that's plus or minus 1.96 standard deviations from the mean -- a lot of people round that off to two. And if you do that, then you'll find that 5 percent of the actual trip points are outside that band. And that's where the 95 percent comes from. But the thing is that half of those are conservative. Only half of those are nonconservative. So there's only 2.5 percent of them that are in excess of the analytical limit. So the probability that you've exceeded the analytical limit is 97.5 percent, not 95.

This has been -- as somebody pointed out -- beaten into the ground quite a bit for a long time in the arguments over single-sided setpoints and double-sided setpoints. The standard simply asserts without giving any reasoning -- it simply says 95 percent is good enough. That terminates the discussion. That eliminates any further consideration of this issue. And it declares by fiat that, that's the case. So case closed. We would be accepting single-sided setpoints. No more talk about it. And I think that's a problem.

And if we go to the next slide, I can talk about why that's a problem. Successful operation means that you're within the analyzed conditions. If you look at a 2 out of 4 system -- and I analyzed 2 out of 4, 2 out of 2 taken -- 1 out of 2 taken twice and 2 out of three systems. And the most conservative for the rest of the analysis was 2 out of 4. So that's what I'll talk about.

And you look at the boding logic and you look at the likelihood of failures within the mechanical and electrical equipment and within the digital -- within the instrumentation equipment itself. You can look at the failure rate or the likelihood of failing to trip before the analytical limits exceeded. If you ignore the mechanical failures and look only at the setpoint itself, you have an almost eight times increase in the likelihood of exceeding the analytical limit if you use 95 percent probability of trip, instead of 97.5.

And the point of that slide before was to say if you're using 95/95 correctly, 97.5 is what we have always been asking for. And then if you add in failure rates for the mechanical equipment and you assume a two train system with 50 -- you know, 100 percent backup in the mechanical and electrical equipment, plus reasonable failure rates in all the --

in all of the I&C equipment -- if you assume that the equipment failure rates are all ten to the minus third, the increase in likelihood of exceeding the analytical limit seven times. And if you assume the stuff is really crummy and it's got a 1 percent chance of failure, you're still increasing -- you're still almost doubling the likelihood of failing to trip at the analytical limit.

MEMBER BLEY: Paul, I haven't thought about this much. I'm going to go back and think about it some more when you're done. But it appears to me that you're assuming that all your channels are going to be off in the same direction.

MR. REBSTOCK: No. No, that's the whole point. That's why I said we should look at this as a random variable. The random variable has this normal distribution that's got a certain mean and a certain standard deviation. And within that mean and standard deviation, the variable may take on whatever the distribution says it might take on. I'm not making any assumption about which way it goes.

MEMBER BLEY: And all of those channels behave independently of each other in this respect?

MR. REBSTOCK: Yes. Yes. Yes.

MEMBER DIMITRIJEVIC: So can you use --

can you use Monte Carlo for this collection? I mean if you are using it randomly, how did you -- or you used Excel multiplication or --

(Simultaneous speaking.)

MR. REBSTOCK: I did it analytically and then I did Monte Carlo simulations to make sure the analytical was right and they agreed.

MEMBER DIMITRIJEVIC: When you say you did analytically, what do you mean by this? I mean how can you do analytically? You mean you selected certain points and then randomly or --

MR. REBSTOCK: No, no. I mean you (telephonic interference) distribution. You say what's the accumulative distribution? What's the cumulative probability of exceeding this value? There's a paper that I provided, it's called "95/95 and SSS as backup." That's the informal analysis that I used. That's where all these numbers came from. That presents this analysis.

MEMBER DIMITRIJEVIC: But when you choose the value from the one function, did you choose the same value? I mean, you know, if you are looking like -- looking the same in all four of the instruments?

MR. REBSTOCK: No, you don't -- you don't choose a value. You say -- you've got these four instruments. Each one of them has a probability of something of succeeding of operating successfully. And then you look at two out of four logic and you work out the Boolean and calculation as to what's the net probability of successful operation of that two out of four system? And then you feed in the probabilities and then that's the answer you get. You're not making -- the only assumptions you're making about the channels is that they have a particular standard deviation and mean -- particular mean --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: That's what I'm trying to -- Yeah, that's what I'm trying to discuss with you. If you have four channels with this distribution, if you choose -- value, I mean what percentile? If values, you're looking -- value exceeding, you know, 60 percent, is that the one you can -- value of the 40 percent? If you're looking at the same point in distribution, you will have a fact of combining distribution known as the state of knowledge effect --

(Simultaneous speaking.)

MR. REBSTOCK: Yeah --

MEMBER MARCH-LEUBA: So that's why I was

sort of wondering how did you do the random -- I mean I assumed every instrument, it's independent of each other. That's very important actually.

MR. REBSTOCK: Oh, yeah. Yeah. It does assume that they're independent. And what I did is I said okay, what is -- Let's forget about equipment failures for right now and just look at the -- at the --

(Simultaneous speaking.)

MR. REBSTOCK: So we say okay, if everything has -- if the probability of success is 97.5 percent for a single channel, then you can do a simple calculation to figure out what the probably of success is for two out of four logic.

MEMBER MARCH-LEUBA: Right.

(Simultaneous speaking.)

MR. REBSTOCK: -- number.

MEMBER MARCH-LEUBA: And then easy. But if you can run out of two, then you have multiplied those. Right?

MR. REBSTOCK: Yeah.

MEMBER MARCH-LEUBA: Okay.

MR. REBSTOCK: There's multiplication and sums. It's not trivial. And then you -- And so you do that for assuming 95 percent probability of success. And you do it again assuming that --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: Ninety-seven percent success for which channel?

MR. REBSTOCK: For each channel.

MEMBER MARCH-LEUBA: You have -- you assume the same for both, that's what that means.

MR. REBSTOCK: For all four of them, yes. For all four of them.

MEMBER MARCH-LEUBA: You know that's something really -- okay, I mean --

MEMBER BLEY: I'm going to interrupt. This is --

MR. REBSTOCK: I've got four channels. If two of them succeed, then I have success. Each one of those --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: -- I'm just wondering how did you consider uncertainty? It's an easy Boolean combination. That's not the issue. The issue is how do you sample from those distributions? Because here we are mixing a lot of things -- limits with probabilities. And so this is where a lot of, you know, confusion related to this is coming from.

MEMBER BLEY: I want to interrupt for just a second. This is Dennis Bley. Christina?

MS. ANTONESCU: Yes?

MEMBER BLEY: He mentioned that he submitted a paper with this. I think you just gave us the slides. Did you give us that paper? And if you did --

MS. ANTONESCU: Yes, I sent you the paper too.

MEMBER BLEY: You did send it?

MS. ANTONESCU: Yes.

MR. REBSTOCK: It's at the bottom of the slide.

MEMBER BLEY: Oh, okay. Good. Okay because I haven't studied that. Go ahead. I need to look at that. I mean everything you say sounds right. Something smells funny in your answers. And I've just got to go through what you did.

MR. REBSTOCK: Okay. And you know, this is my stuff too. This has not been checked. This is not peer reviewed. So if something smells funny, I would be delighted to hear about it and to know what exactly that is. Because you know, I don't necessarily want this to be right. This is just the way I see it.

MEMBER MARCH-LEUBA: No, I see mathematics now because it's really easy to fall into mathematics --

MR. REBSTOCK: Yeah.

MEMBER MARCH-LEUBA: -- because that's the easy problem. In reality, you define "failure rate" if 95.1 percent is your result. And therefore 97.5 would fail it. Right?

MR. REBSTOCK: No. What I did is looked at -- is I compared the situations if the failure rate is 5 percent versus if the failure rate is 2.5 percent. And I took the ratio of those two failure rates. That's what that 8 percent increase or 7 percent increase or 1.7 percent increase is.

MEMBER MARCH-LEUBA: 800 percent increase -- you're saying 800 percent increase.

MR. REBSTOCK: Eight times -- eight times increase. Yes, sorry. Yeah.

MEMBER MARCH-LEUBA: So if you're running them on the Carlo situation, you will have 800 times more -- 800 percent more cases that fall above your criteria, which is either 95 or 97.5. But in reality -- and this is the problem -- I want to repeat it at the end of the presentation -- But the problem is we tend -- This is the same problem I have with risk analysis is that we tend to concentrate on the subset of the problem, which we can handle, which is the mathematics. So everybody's going to be arguing with you about the statistics and what is the normal -- it's another normal or how many --

But you forget that the analytical limit is a calculation, follow it by a complex code that is a calculation of an AOO that we decide whether a SAFDL is -- And a SAFDL -- which is a surrogate for failure. I mean if you fail in CBR, you don't fail nothing. I mean the -- by 50 degrees and nothing will happen.

So when you say "failure rate", you're saying I did not meet my analytical limit. But analytical limit compounded with the fact that you were analyzing an AOO with a complex code that we might -- my colleague's best estimate, but, we are putting all kinds of conservative others to it to make sure we don't mess up. So sure, you get eight times more number trials here than there. But does it make any difference safety wise? I don't think so.

MR. REBSTOCK: That argument that you just made is one that I have made to myself many times and spent a lot of time thinking about. And the conclusion that I finally came to is that yes, it's probably true that if you exceed the limit by a little bit, everything's going to be fine and there's not going to be a problem. The problem is that you don't really -- you're not really saying what a little bit is. Some of these things can be highly nonlinear and you don't know where the knee is in the curve to where it transitions into something truly nasty. You're in an unanalyzed condition. If you analyzed it, then it would be analyzed and then you're analytical limit would be different. The problem is --

MEMBER MARCH-LEUBA: Let me -- Let me calculate --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: I am with you that somebody 50 years ago, they pick as the criteria 95/95, that will fight it. And it had absolutely no basis. It was just picked out of the air because he liked it. Okay? I don't know who picked it. I don't know why he did it. But please show me the -- that there is some basis for the 95/95. But whatever we've been using for the last 50 years is. And now we're changing it to something that is less conservative. And so I'm with you, we should keep what has worked. I don't see why we're changing it.

MR. REBSTOCK: That was the point of my slide is to say what difference does it make? Well this is the difference it makes.

(Simultaneous speaking.)

CHAIR BROWN: Okay, guys. Hey hold it, everybody. This is the Chairman again. We can go back and forth on this. We ought to just go ahead and finish the presentation as opposed to continuing this. We're not going to solve this particular issue here in this meeting.

MR. REBSTOCK: Yeah.

CHAIR BROWN: So I would appreciate it if we could get on and finish the slides as opposed to going back and forth on the nuances that we are presently going through.

MR. REBSTOCK: And I don't have my slides showing anymore, so I don't know if anyone --

MR. REBSTOCK: Yeah, our slides disappeared. Are you there, Christina?

MS. ANTONESCU: Yes, I have them now. I'm just trying to find something for Member Bley and I have this bubble with Paul Rebstock in front of my cursor and I cannot move it. So it's very difficult to operate something that we're not yet familiar how to use. So are they back now?

CHAIR BROWN: No.

MS. ANTONESCU: The slides, no? Okay, I'm sorry.

CHAIR BROWN: That's probably not your fault. It's the Teams that's helping us out.

MR. REBSTOCK: We've had problems in other areas in Teams too, so I'm going less condensed there -- I'm less impressed by them.

CHAIR BROWN: Okay, they're back now. Thank you, Christina.

MR. REBSTOCK: You got it, Christina.

MS. ANTONESCU: Okay, thanks.

MR. REBSTOCK: Okay, let's move off of this one before we start talking --

CHAIR BROWN: Which one? Okay, Paul?

MR. REBSTOCK: Yeah.

CHAIR BROWN: Let's get this finished.

MR. REBSTOCK: Yeah. Yeah. Okay, let's go to eight. There we go. Okay, setpoint deviation. You measure the as-found value at the beginning calibration. And then deviation is from the -- I'm sorry, let me start again. You measure the as-found value at the beginning of a calibration. And then calculate what the deviation from the previous calibration was. And when you're talking about Channel Health, deviation in a conservative direction is just as important as deviation in the nonconservative direction, which is the reason that allowable value isn't good enough.

The reference value could be either the nominal or the previous as-left. My preference is the previous as-left. A lot of people like to use the nominal. If you use the nominal, then the difference between the nominal and the previous as-left version could partially mask the deviation. But it's probably a small amount, so I'm not sure it's worth getting too excited about.

An important point is chronic versus acute deviation. We're in the realm of statistics. So we're in the realm, whether it's 95 percent or 97.5 percent or whatever percent you want it to be, it's less than 100 percent that you're going -- that you're going to be within the analytical limit. So occasionally based on whatever statistics you use, occasionally you're going to exceed the analytical limit when there's nothing wrong with the channel. So that would be an -- that would be okay.

A significant difference -- a significant exceedance of the analytical limit should be rare. So we can look at it in terms of chronic or acute. If you exceed a little bit but you do it too often or if you exceed by a whole bunch, so it's an acute amount, then that tells you there's something wrong and you have to do something about it. But in order to make any judgment of that, you have to know what you expect the deviation to be. And as I said earlier, deviation is what you measure what it is today versus what it was -- whatever it was in the past that you calibrated this before. That includes drift, which can only be measured under laboratory conditions. But it also includes things like environmental factors and power supply and process conditions and so on. That's just to set the framework of why we care about deviation.

If we can go to nine. I believe this is Member Brown's favorite word here, "temporal extrapolation". You mentioned that before. The issue is how do you determine -- and we talked about that a little bit earlier too. I'll just skip to the second bullet. We already talked about the drift confused with deviation.

So the drift allowance is given as so many percent for so many months. And the expected operation is going to be for some different number of months. So how do you figure out what to allow? And I will concede that, that is a nontrivial -- a nontrivial thing.

If we go to Slide 10. 1363 references the standard. The standard reference is an as-found, as

-left analysis. The as-found, as-left analysis is defined in the recommended practice, which we don't endorse. In the recommended practice -- just for clarity, I will -- I said the recommended practice does recognize that it's talking about deviation. It's not talking about drift. 1363 explicitly cites the part in the standard that cites the as-found, as-left analysis. That seems to me that we're actually endorsing part of the recommended practice that we say we don't endorse. I think that is potentially -- I don't know exactly a legal problem. It seems to me to be an administrative area that we don't want to get into.

If we can go to eleven. One of the things to consider, whether you use the as-found, as-left analysis in the recommended practice or if you use something else, you'd need to use some way of extrapolating what to allow for drift. The way you do that needs to be justified. And Dave mentioned the study that was done a long time ago by EPRI where they looked into a lot of it. There's been talk about the deviations being a random walk. I've seen claims that says that actually the drift goes a certain amount in a certain time and then stays put and doesn't move around again. All those things are on the table and whoever's doing the analysis needs to figure out which one they want to use.

But one in particular concerns me. 1363 mentions but does not preclude the use of square root of some of the squares. The problem is that the specification interval that the manufacturer said is arbitrary as compared with the calibration interval that is being used at the plant. So the example there shows if the specification interval happens to be half of the surveillance interval, SRSS tells you to use 0.707. If it happens to be a quarter of this surveillance interval, SRSS says use 0.5. And it seems to me whatever -- whatever it is that you think about how instruments drift, this is not an acceptable way to do it because it's arbitrary and it's not actually connected to any scientific or mathematical basis. It just happens to be -- I mean it's just based on whatever the relationship happens to be between the manufacturer's specification and the calibration procedure.

MEMBER BALLINGER: This is Ron Ballinger. Doesn't this in effect fix itself with time? Why would you --

(Simultaneous speaking.)

MR. REBSTOCK: Well, I'm not sure --

(Simultaneous speaking.)

MEMBER BALLINGER: You're doing calibrations with time. And over a length of time, you'll find out what the drift is.

MR. REBSTOCK: That's what I said, yes. You will gather information and you'll figure out how to do it and you'll make your case.

MEMBER BALLINGER: Yeah.

MR. REBSTOCK: And that's the appropriate way to do it, yeah.

(Simultaneous speaking.)

MEMBER BALLINGER: You've got to have a starting point, I suppose.

MR. REBSTOCK: Yeah. Yeah, it seems to me that absent any other information, you should use linear extrapolation. But I can see what the problems with linear extrapolation are too. So I'm not saying that, that's what you've got to use, but I think SRSS is just a really bad way to do it. And I think that the standard should preclude that. I've heard people refer to using SRSS for years in many different venues and that's what has me concerned. Whatever it is should be justified, but I think --

(Simultaneous speaking.)

MEMBER PETTI: So I thought that some of

the squares was justified from that EPRI data. Are you saying that's just for one specific type of instrument and so it's not applicable more broadly?

MR. REBSTOCK: Well I'm not real familiar with that report. But the thing is, you know, different -- a manufacturer is going to create the specifications based on whatever criteria the manufacturer think is important. And if the manufacturer thinks that a three month interval is what matters and another manufacturer thinks that a six month interval is what matters, that choice feeds into what the ultimate result is going to be if you're using square root of some of the squares. So you're depending on an arbitrary decision made by somebody that has nothing to do with your plan. That's where I think the problem is.

MEMBER KIRCHNER: Paul, in general for different classes of instrumentation -- this is Walt Kirchner -- I would expect that the interval that comes with the specification often is related to the type of instrumentation.

MR. REBSTOCK: Sure.

MEMBER KIRCHNER: And I would think that Industry experience say whether it's a pressure sensor versus a thermocouple could probably inform this particular aspect reasonably well.

MR. REBSTOCK: That might be -- That might be true, but how much are you willing to bet on that? How confident are you that, that's going to just all work out okay? I think that we need something more solid. If somebody does an analysis, provides some data, demonstrates that for this instrument under these circumstances in this situation, SRSS works, then fine. More power to them. But you need that extra stuff. That's where my concern is.

And I think that's probably pretty close, so what's on Slide 12? Yeah, just the -- that's what I thought, the conclusions. So I think that the single-sided setpoints significantly increases the likelihood of operation analyzed condition. And the temporal extrapolation can produce arbitrary results. And I should have written on here -- I'm sorry I didn't -- it should say can produce arbitrary results under square root of some of the squares. The thing is that whatever it is that's used may be very solid. It just needs to be defended.

And then the last page, I think is just some references on 13. Yeah.

MEMBER MARCH-LEUBA: Paul, this is Jose again.

MR. REBSTOCK: Yes?

MEMBER MARCH-LEUBA: When you say the probability conditions brings chills to any regulatory --

MR. REBSTOCK: Right.

MEMBER MARCH-LEUBA: --, you know, because -- But when you say it's eight times larger, it's -- I mean is it -- Have you run the numbers? I mean is it, you will fail 2 percent of the time or 16 percent of the time?

MEMBER PETTI: So Jose -- Jose, I just did the numbers because I had the same question. This is Dave. And if I did them right, I can get a factor of eight. And it says that using the 97.5 percent, the failure in two out of four involving logic is 3 -- a little over 310 minus 5. Whereas using 95 percent is almost 2.5 ten minus four.

MEMBER MARCH-LEUBA: So my engineering is irrelevant?

MEMBER PETTI: I'm not an expert, but I was going to send the little spread sheet to Vesna and Dennis to see if I --

MR. REBSTOCK: Those numbers are in that calculation.

MEMBER PETTI: Yeah, I'm sure it's in that document.

MR. REBSTOCK: It seems to me that they're in that ballpark of what you just said, but I don't have those memorized.

MEMBER PETTI: Yeah.

(Simultaneous speaking.)

MR. REBSTOCK: I think what I hear is another statement. It's like okay, you're increasing it by a factor of eight, but it's so low. Who cares anyway? And that's a legitimate question. But --

MEMBER KIRCHNER: Paul, this is Walt again. So I appreciate the rigor that you've approached this problem from a mathematical standpoint. So now I go back to what I was asking earlier. Assuming that one uses both the uncertainty and margin -- and by that, I mean sets the nominal trip point with the as-left tolerance so that the upper band of the as-left tolerance is below the nominal trip setpoint, how big a factor then would this be?

MR. REBSTOCK: Oh this wouldn't be a factor at all because you're adding in that margin. This is --

(Simultaneous speaking.)

MEMBER KIRCHNER: And so is there anything

-- So I guess my question now goes perhaps not to you, but to David. Is there anything in the guidance that suggests that the expectation is such that the nominal trip setpoint plus the as-left tolerance is below the limiting trip setpoint as a standard practice?

MR. RAHN: My answer to that is I don't believe it's explicit to say that. And the way this is implemented is that a licensee will present to us a licensee-specific methodology. In many cases, he may adopt a vendor methodology. And we find that different vendors have different criteria for that particular issue. So there isn't a fixed response that I can give you other than the fact that the general expectation is that the nominal trip setpoint is a margin that's offset from the limiting trip setpoint. And different vendor methodologies evaluate that difference and the staff looks at that and then will make a judgment.

MEMBER KIRCHNER: Well but going back to Jose's point, we both come out of the thermohydraulic systems analysis area, I have more confidence in you hitting a reactor trip than I have confidence in the air band on that analytical limit for what it's worth. I'm just being pragmatic.

MR. RAHN: Yes, so it all depends on what criteria, how closely you scrutinize. And also the fact that you would need to recognize that a lot of these uncertainties are not perfect Gaussian distributions, yet we treat them like that. So I think there's a lot of slop already in it. And so --

(Simultaneous speaking.)

MEMBER KIRCHNER: Yeah, there's a lot of nonlinearity in the problem so to speak. Yeah.

MEMBER MARCH-LEUBA: Let me rephrase what Walt is saying. The probability of it is counted on the happening. One can't assume it to be random. It probably won't be. But there's a possibility that I can be random. The analytical limit is guaranteed to be conservative. We've put conservatism, conservatism, conservatism from those calculations. So true, you can have a chance of keeping the AL. But that AL is conservative. I wouldn't say five plus two. But much larger than anything this is going to do -- with Paul. If we have been using 95 for 60 years and it has worked, why are we changing it now? That's what I'm asking.

MR. RAHN: Yeah. So first of all, I don't believe we specified what our clear expectations were regarding this. If you look back historically at previous Reg Guides, it's not clear what is meant by "probability of trip." There was an initial version of a Reg Guide that said -- they were looking for high probability or with high confidence that it will trip before the analytical limit's reached. But I don't believe we've ever clearly specified what should be the calculated probability of trip before the analytical limit's reached. We're not giving up anything. We're just failing to making it more clear in one form or another.

The other thing I have to mention is that even when we estimate these uncertainty terms, as Jose just mentioned, there's overconservatism built into these terms as well. For example, I mentioned earlier about the as-left setting. Ninety-nine percent of the time, you're within less than half sigma of the actual setpoint, yet we've allowed for -- to go beyond to the full amount of that as-left tolerance in our calculation just on the off chance that it might be set right at the ragged edge.

And there's other conservatism built into estimates of each of those uncertainty terms. As a matter of fact, if you look at a specification for something like static pressure shift -- elevated static pressure shift, a vendor might say it can be as much as this number. And then our calculations use that number -- you know, it's a big number. But most of the time, it's less than that number. So there's conservatism built all the way along into this document. The more conservatism and overconservatism you have for those plants that have a limited margin between the analytical limit and the range of normal operating conditions, run the risk of increased spurious trips occurring. So there's good reason not to try to overestimate the uncertainty allowance.

CHAIR BROWN: Are we ready to wrap up? I hate to press everybody --

MR. REBSTOCK: That's fine. I needed to say this. I needed to get -- I would be delighted to get some experts feedback on it. If somebody said that they thought the numbers looked fishy, I'd be delighted to hear why and hear what they have to say about it. This is a concern that I thought was important and I thought I needed to raise, so now I've done that and thank you.

CHAIR BROWN: That's fine. Thank you very much. I wasn't trying to imply that. I'm not sure -- if you're going to get some expert opinion, I don't see us putting it in this particular response to the full committee meeting.

MR. REBSTOCK: I wouldn't expect that, no.

CHAIR BROWN: Okay. I just wanted to --

MR. REBSTOCK: I'm talking informal.

CHAIR BROWN: Okay --

(Simultaneous speaking.)

MR. REBSTOCK: -- or whatever you feel like doing.

CHAIR BROWN: Does anybody have any additional questions or should I go to public comments right now? Hearing no objection, Christina, do we confirm that the phone line is open?

MS. ANTONESCU: Yeah. Thomas, can you open the bridge line?

MR. DASHIELL: The public bridge line is open for comment.

CHAIR BROWN: Okay. Can somebody say something to make sure we know it's open?

MR. MARQUINO: Yeah, this is Wayne Marquino. Can you hear me?

CHAIR BROWN: Yes. I will call on you first --

MR. MARQUINO: Okay.

CHAIR BROWN: -- since I promised you a shot.

MR. MARQUINO: Okay. I'm not on the bridge line. I'm on Teams. I have a short statement

I'd like to make. I appreciate the NRC's engagement in changing the ISA standard, updating it. And issuing DG 1363.

MS. ANTONESCU: Excuse me. Can you turn off your camera?

MR. MARQUINO: Yes, ma'am.

MS. ANTONESCU: Yes, thank you.

MR. MARQUINO: So the existing Reg Guide -- Reg 3 applies 95/95. The NRCs accepted 95 percent probability of success using 95 percent confidence level statistical factors in other applications like the determination of thermal operating limits in BWRs as Jose March-Leuba said. Industry is 95 percent probability in setpoint calculations previously, but the confidence level is undefined. NRC accepted 95 percent probability single-sided in the GE setpoint methodology.

And then in the mid-nineties, NRC issued HICB-12 Draft Rev 4, which had 95 percent probability, but specified 95 percent confidence level. That higher confidence level, 95 percent was applied in the Longmen ABWR setpoint uncertainties. It involved a higher cost to obtain the inputs, but GE was able to work through that. The 95 probability in the ISA standard is applied to one channel. So as you've noted in any practical I&C system, two out of four say you'll have a higher probability of a successful trip.

Additionally, there are other conservatisms applied in the analytical limit. And in determining -- practically in determining the uncertainties at 95 percent confidence level, there's going to be a lot of cases where you are bounding them and that will insert additional conservatism. As David Rahn's presentation showed, increasing the probability reduces furious trip avoidance, so you are increasing the chance of initiating events if you force a chance to 97.5 percent.

So in conclusion, I'm trying to point out that 97.5 percent probability is a change. The existing standard and practice at least in some vendors is 95 percent probability. Thanks for your time.

CHAIR BROWN: Okay. Thank you very much, Wayne. Let me see, before I go general is Ted Quinn on the line still? Ted?

MR. MARQUINO: I think Ted's on the bridge line.

MS. ANTONESCU: The bridge line is open.

MR. QUINN: Hi, this is Ted. Do you hear me okay?

CHAIR BROWN: Yeah. I hear you now. Go ahead.

MR. QUINN: Very good. Okay, thank you. Yeah, my name's Ted Quinn. I'm a member of the ISA 6704 Committee similar to -- Wayne was our Chair during this time of the revision process. I'm also the instructor for the Inforcourse. I wrote the Inforcourse on setpoints. And over a 30-year period, we performed over 4,000 calculations in the teams that I've worked on.

I wanted to recognize the NRC staff for all the work that they've done as part of the ISA Committee, which I've been on for 30 years. Dave, Dinesh, Jo, Paul, they've all participated particularly in the last four years, but also much before on ensuring that, you know, the real consensus building on the standard was done in a way that the regulator was involved. If the regulator had not been involved, we would not have had as good of standard as it came up to be. So I just wanted to recognize them and thank you for participating.

CHAIR BROWN: Okay. Does that conclude your statement, Ted?

MR. QUINN: Yes, sir.

CHAIR BROWN: Okay. Well, thank you very

much also for participating today. Is there anyone else on the bridge line that would like to make a comment? Ted, you were on the bridge line. Weren't you?

MR. QUINN: Yeah, I'm on the phone line.

CHAIR BROWN: Oh, you're on the phone line, okay. Is that the bridge line, Christina?

MS. ANTONESCU: I'm sorry, I was reading the chat box.

CHAIR BROWN: Yeah, is phone line --

MEMBER BLEY: Yes.

CHAIR BROWN: That is the -- okay, thank you. I just wanted to make sure I hadn't forgotten something. Okay. Thank you, Ted. I'll give it another shot. Is there anybody else on the bridge line, the phone line that would like to make a comment? Hearing none, I will confine the participants again. Before I make a concluding statement, I'll work through the members starting with Ron.

MEMBER BALLINGER: Yeah, I mean I think the presentation was actually outstanding. But I think I'm in the Jose box maybe in the sense that we're comparing a little bit apples and oranges. When you compare the uncertainties and instrument measurements and things like that with the uncertainty and the analytically calculated limit, they're two very different things. And you know, I'm a meddler so that actually makes me worse than the thermal hydraulics people in terms of uncertainty. But that's what I'm saying -- I mean whether we worry about 95 or 97 or whatever it is, compared to the uncertainty in the calculated analytical limit, I just wonder whether there's a heck of a lot of difference.

CHAIR BROWN: Okay. Is that it?

MEMBER BALLINGER: Yes, thank you.

CHAIR BROWN: Okay. Since I don't have them alphabetically here, I will -- actually I do partly. Dennis?

MEMBER BLEY: Yeah, thanks. I too would like to thank Dave. It was a very good tutorial and long awaited and we appreciate it. And I wouldn't have any comments except I found Paul's paper and I want to go through it and understand what he was really doing and if I see anything funny there. If I do, I'll pass it on through Christina. But thanks for that presentation as well, Paul.

CHAIR BROWN: Okay, I'll go to Jose.

MEMBER MARCH-LEUBA: Bluetooth mouse. Two things, first compare to the not conservative, but conservative bias.

CHAIR BROWN: Yeah, I'm sorry. I meant conservatism.

MEMBER MARCH-LEUBA: Yeah. Yeah, it's a conservative bias, that bias is outrageous. It's 20, 30, 40, 50 percent, maybe to 100 percent, very large. Compared to that, worrying about difference in the statistic calculations, it really -- it's not worth wasting our time. And in that sense -- and as you guys know, I'm the bad guy. So I want to be the bad guy again. If you look at the ACRS transcripts, the phrase it most often repeats is "I am not an expert on this, but". Well I am an -- I won't call me an expert on this, but I have. I understand it. I just don't know how we're going to spend eight hours talking about this. This, you should not have to define 12 different concepts to make sure that there's a setpoint before the analytical limit.

We should be able to simplify this and make it simpler. Consider the margin we have on the analytical limit. So yes, everything is fine. Whatever you want to do; 95, 97.5, anything you want to make, it makes no difference whatsoever because of the margin we have on the analytical limit. And let's not complicate our lives. We're just trying to do the math because as scientists and physicists, we like to solve the problem that can be solved with an exact science and get exact solution. But okay, I said enough. Thank you, Charlie. Go for it.

CHAIR BROWN: Okay. Thank you, Jose. Walt?

MEMBER KIRCHNER: Thank you, Mr. Chairman. Thank you, David for the presentations and for the insight on spurious scrams. While you were offline, I was doing sea stories about spurious scram on the Savannah doing calibrations. So thank you. I appreciated the thoroughness of the presentations. That's it, Charlie.

CHAIR BROWN: Okay. Thank you, Walt. David?

MEMBER PETTI: Yeah, since I am not an expert as Jose said, I don't have any substantive comments beyond what others have offered. I thought it was good presentations.

CHAIR BROWN: All right, thank you. Joy?

MEMBER REMPE: Thank you. I don't have any additional comments, but I also appreciated the presentations. And I think I've mentioned in prior meetings that I really do like the fact that the staff has this process for nonconcurrence and offers different opinions in the respectful way that the situation is handled. And I think it's a nice aspect about the Agency. Thank you.

CHAIR BROWN: Matt?

MEMBER SUNSERI: I don't have any additional comments. Thank you.

CHAIR BROWN: Okay. A notification just popped out. I've got to clear it out. Okay. Vesna?

(Simultaneous speaking.)

CHAIR BROWN: Vesna?

MEMBER DIMITRIJEVIC: Yeah. Hi, Charlie. Okay, so I am relatively new like David and I wasn't following this from the beginning and I really didn't want to be jumping on the wagon at this time. I'm not expert in this area. I thought presentation was fantastic. I really enjoyed very much. However like Dennis, I'm a lot about uncertainties. And a lot of things here are different. I mean basically while in here, there is a lot of confusion about mixing and probability because they're both 95. Maybe in this case, when you're looking in distribution of the setpoint, you sort of like probabilities are the same. I have to think about that.

And I would also like to look very much in these two articles. And I also would like to -- Also in distribution standard deviation. So for me from the certainty point of view, I would like to look in these two articles and maybe think a little about that. But this is like really late in the game. So I mean would that contribute to anything? I'm not sure. I will talk with Dennis and Charlie about that. But thank you, it was really nice presentation.

CHAIR BROWN: Thank you, Vesna. Myron, that's our consultant.

MR. HECHT: Can a consultant say that he learned something?

CHAIR BROWN: Yes.

MR. HECHT: Okay. I just found the -- I appreciated the presentation. I appreciated the discussion of the nonconcurrence and the issues raised. And I have nothing technically substantive to add except -- no, I don't have anything technically substantive to add. And just -- it was my pleasure being on and listening today.

CHAIR BROWN: Okay, thank you.

MEMBER MARCH-LEUBA: Charlie, can I say something else?

CHAIR BROWN: Of course, Jose.

MEMBER MARCH-LEUBA: All right, so this is Jose. I wanted to emphasize what Joy said that the process, it is a really, really good process NRC has. And it should be encouraged. It should be recommended. And the people take the effort and risk honestly to issue the different opinions should be encouraged. Okay? So I think it's good and I hope management continues to approve it, which I've seen they have done. Okay, I just wanted to say that. Thank you.

CHAIR BROWN: Okay, thank you. Before I make a closing comment, we are going to have a full committee meeting in February. We obviously will not have eight hours. So Dave, you are going to have to work to get this condensed down to -- Have we identified the time yet, Christina? Is it an hour and a half or two?

MS. ANTONESCU: Probably two or two and a half hours. Dave will let us know how much time he needs.

CHAIR BROWN: Okay.

MS. ANTONESCU: A shorter version of today's meeting.

CHAIR BROWN: Some of the stuff -- Some of the -- Almost everybody's here except Pete, one of our other members. So I think the details and the tutorial can be considerably reduced. Just do a little bit summary of it and then hit the meat and potatoes of the standard revisions and what you incorporated in that part of the meat and potatoes part of the presentation. You can give us a hint as to what you want to cover and we'll provide some feedback if you would like.

MR. RAHN: Okay.

CHAIR BROWN: All right. And in closing, I guess I would like to say this. Like Myron, I learned a lot in listening to this. I'm not sure I learned so much listening to the last 95/95 and single-sided, double-sided since I'm not a statistician. So I have a somewhat simpler approach to doing that. Select a trip point. Determine how good your instruments are. Pick the air and then go from there for your checks. So this is very complex, but I did learn a lot as I was reviewing this. And I think the time between the last revision and this one, I think it was a good data point to bring people up to date on how this is done because we have not seen this in any of our deliberations on the design certifications that we've -- at least the four major ones that we've had over the last 12 years. It's kind of in the background.

So I can't think of anything else other

than I thought you guys did an outstanding job. Dave, you were patient. And Paul, you were succinct and clear on your presentation as well. And I think Mike popped in at the end and I think Dinesh did also. You all just did a very good job on this presentation. Very well organized. And I do appreciate the extra work you did to bring us up to speed and explain exactly how all this is done and the process from years ago.

So with that in mind, Jeane, do you have any closing comments you'd like to make? Are you still there? Dave, do you want to fill in for her? Do you have any --

MR. RAHN: Yes, I'll fill in. First of all, I definitely want to thank all the members of the Committee. It was a good exchange that we had. And several of you have raised some good points that we are definitely going to consider as we finely edit the document. And the chance to participate, two sides of the coin was helpful as well. And I appreciate Jose March-Leuba's comments regarding this thing. To me, it's looking at the differences in small things when compared with big uncertainties and other things. And the question that we need to consider for the long term is, is there a way of risk informing this process to make it simpler?

CHAIR BROWN: Okay. Thank you very much. And with that, if I hear no other objections, I don't think I've forgotten anything else. We will adjourn the meeting. Thank you to all of you.

(Whereupon, the above-entitled matter went off the record at 5:37 p.m.)

Topic I
ACRS Opening Remarks

Charles Brown, Chairman
ACRS Subcommittee on
Instrumentation and Controls

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

October 7, 2020

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Topic II
NRC Staff Introductory Remarks

Jeanne Johnston, Chief, I&C Branch A
Division of Engineering and External Hazards, Office of Nuclear Reactor Regulation

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

NRC Staff Presentation

October 7, 2020

Draft Rev. 4 to Reg Guide 1.105 (DG-1363)

David Rahn, P.E., Sr. Electronics Engineer

Division of Engineering and External Hazards

Office of Nuclear Reactor Regulation

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

NRC Staff Presentation

October 7, 2020

Agenda

- Regulatory Basis, Purpose, and Scope
- Instrument Channel Performance Uncertainty
- Industry Standard and Guidance
- Staff Regulatory Positions
- Revisions to the Industry Standard
- Goals for RG 1.105 Revisions
- Status of Revisions and Next Steps

Topic III
Regulatory Basis, Purpose, and Scope of RG 1.105

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

NRC Staff Presentation

October 7, 2020

Regulatory Basis

- 10 CFR 50.36 Technical Specifications

  . . .will include items in the following categories:

  50.36(c)(1) **Safety Limits**, **Limiting Safety System Settings**, and **limiting control settings**:

  50.36(c)(1)(i)(A): **Safety limits** for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. If any safety limit is exceeded, the reactor must be shut down.

Regulatory Basis (cont'd)

10 CFR50.36(c)(1)(ii)(A): Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions.

> Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, **the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded. If,** during operation, **it is determined that the automatic safety system does not *function as required*, the licensee shall take appropriate action, which may include shutting down the reactor.**

Regulatory Basis (cont'd)

10 CFR 50.36(c)(3) states:

Surveillance Requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

Regulatory Basis (cont'd)

Related Requirements:

10 CFR 50 Appendix A, **GDC 13** states that **Instrumentation** shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can **affect the fission process**, the **integrity of the reactor core**, the **reactor coolant pressure boundary**, and the **containment** and its associated systems.

Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

Regulatory Basis (cont'd)

Related Requirements:

10 CFR 50 Appendix A, **GDC 20** states that the protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, **to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences** and (2) to sense accident conditions and to **initiate the operation of systems** and components important to safety.

Regulatory Basis (cont’d)

Related Requirements:

10 CFR 50.55a(h) Standards Incorporated by Reference:

IEEE 279-1971 Section 3 (Design Basis) states that the design basis of protection systems shall document:

(5) the **margin between each operational limit and the level considered to mark the onset of unsafe** conditions

(6) the **levels that when reached will require protective action**;

(7) **the range of transient and steady-state conditions** of both the energy supply and the environment (for example. voltage, frequency, temperature. humidity, pressure, vibration, (etc.) during normal, abnormal, and accident circumstances throughout which the system must perform

(9) minimum performance requirements, including . . . **b) system accuracies**

Regulatory Basis (cont'd)

<u>Related Requirements</u>:

10 CFR 50.55a(h) Standards Incorporated by Reference:

IEEE <u>603-1991</u> Section 6.8 (Setpoints) states:

> The allowance for uncertainties between the process analytical limit and the device setpoint **shall be determined using a documented methodology.**

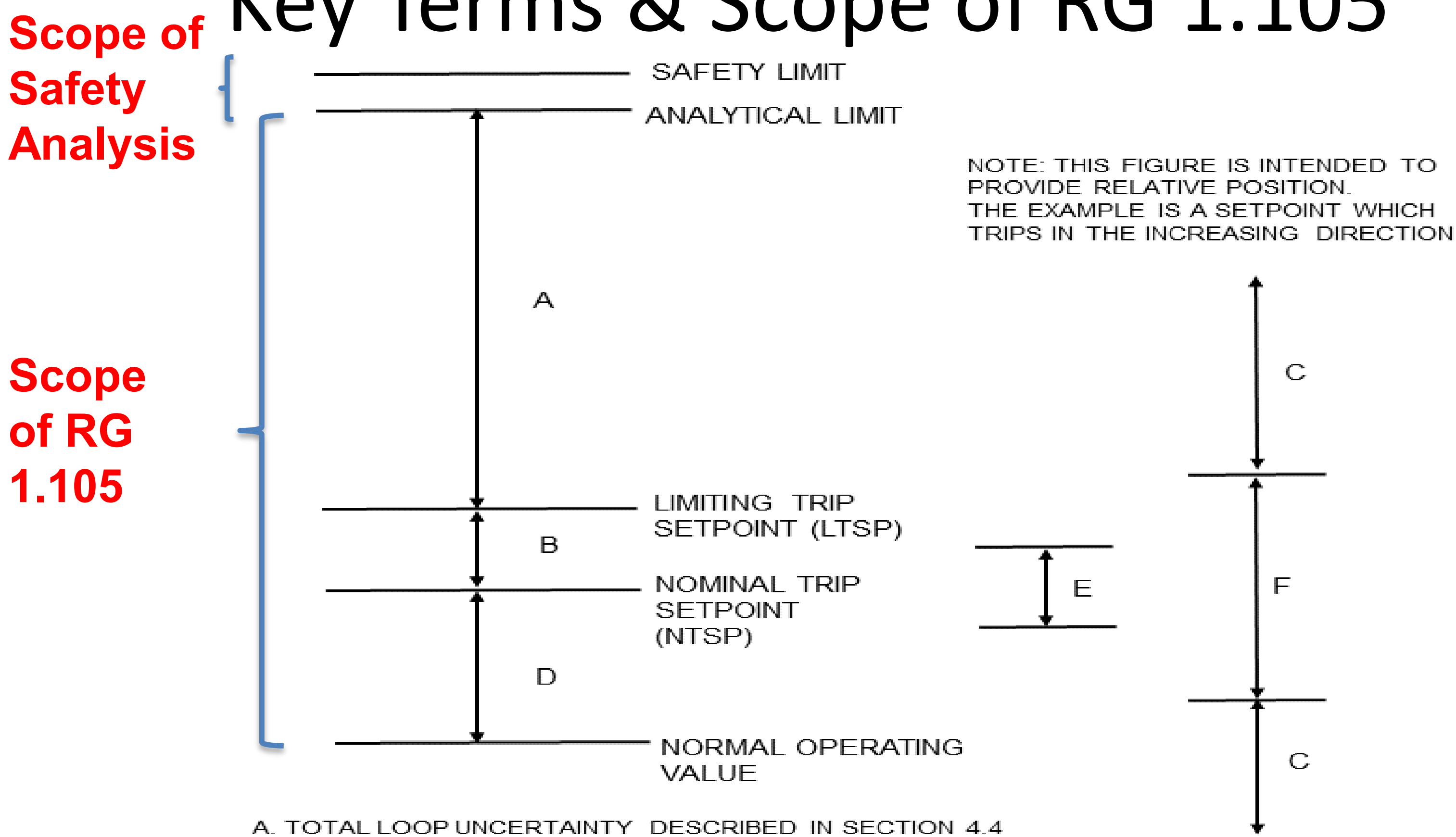
Purpose of RG 1.105

RG 1.105 provides guidance for meeting regulatory requirements to ensure that:

a) setpoints for safety-related instrumentation are **established** to protect nuclear power plant safety and analytical limits, and

b) the **maintenance** of instrument channels implementing these setpoints ensures they are functioning as required, consistent with the plant technical specifications.

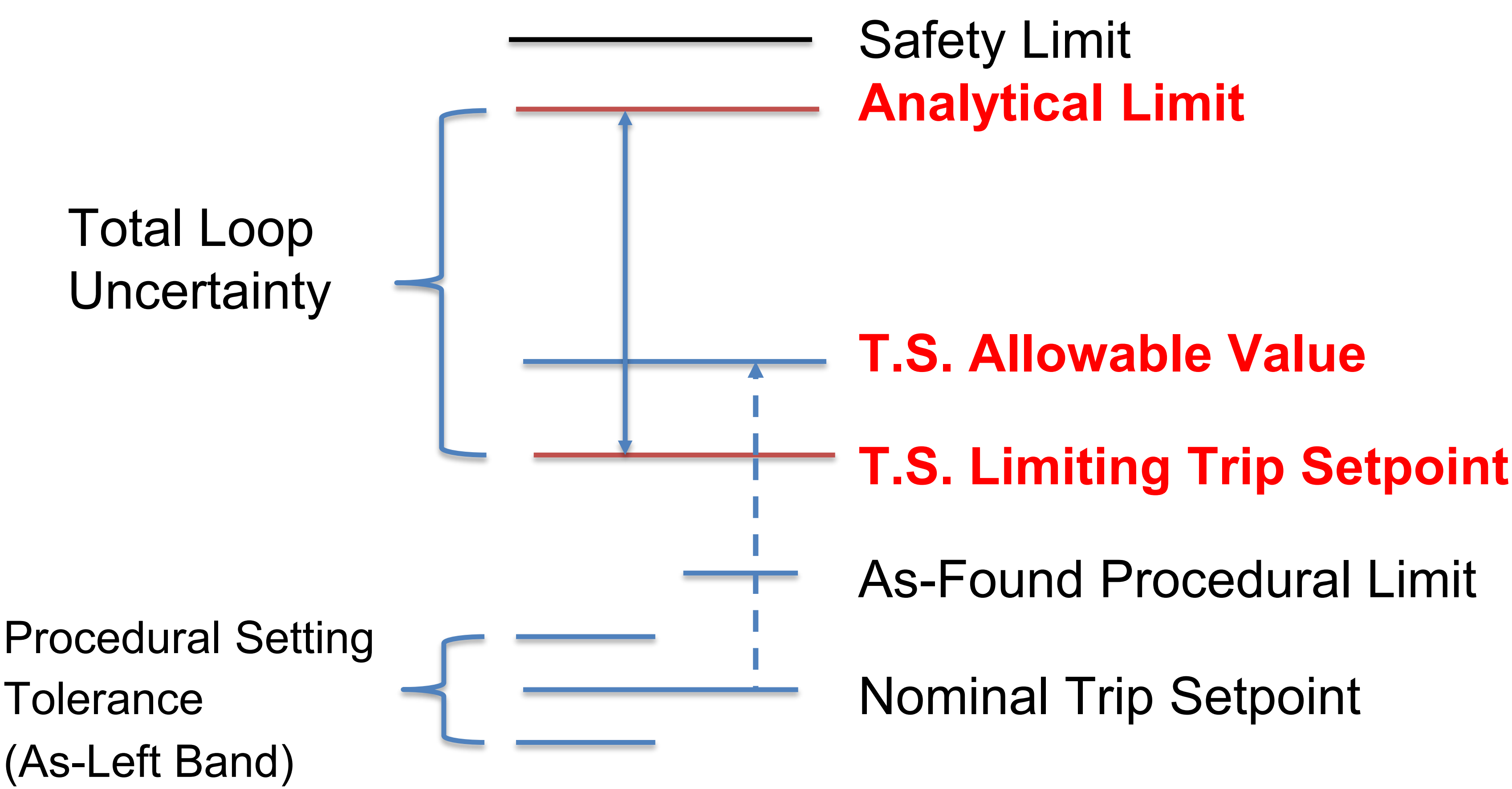
Key Terms & Scope of RG 1.105



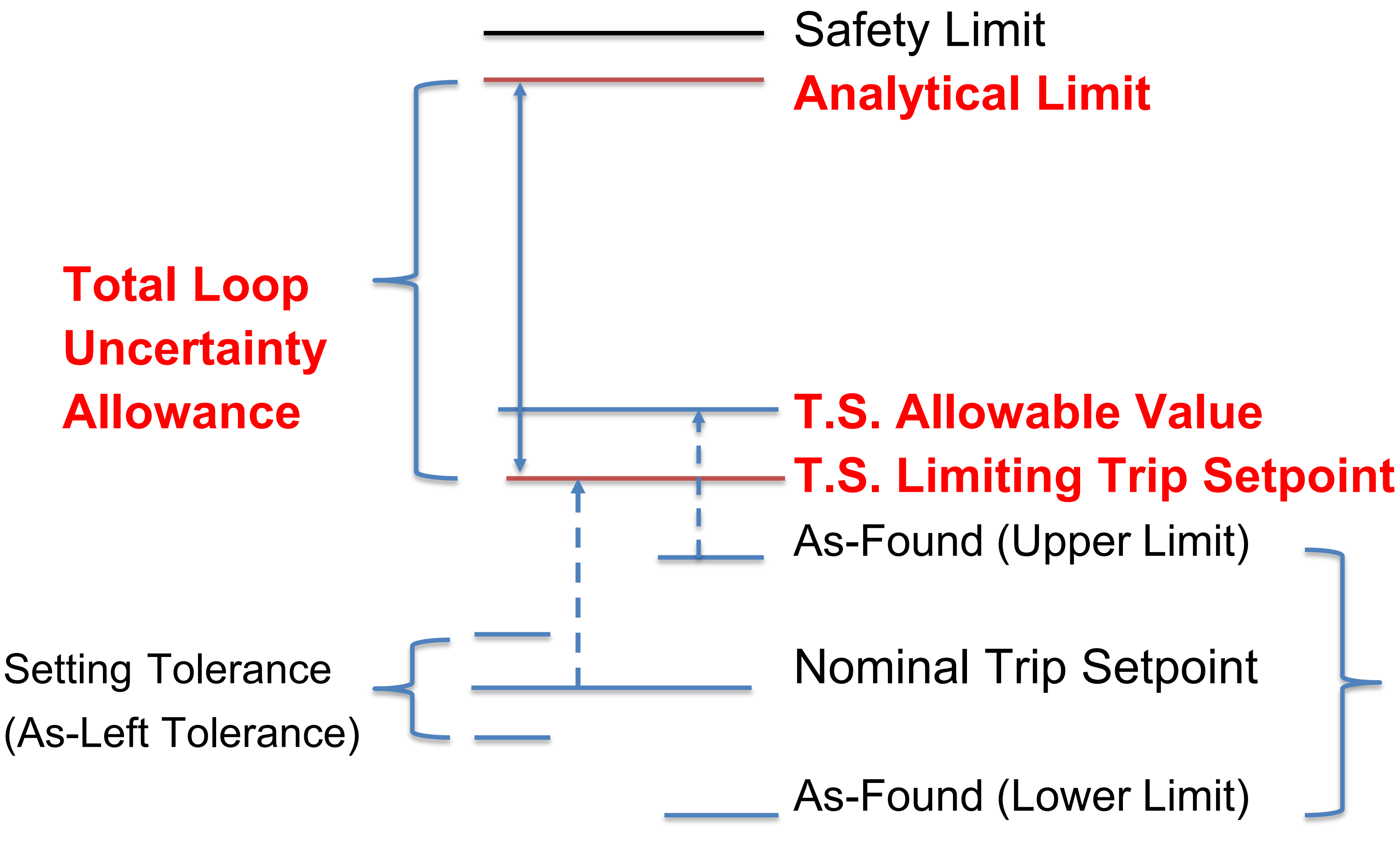
A. TOTAL LOOP UNCERTAINTY DESCRIBED IN SECTION 4.4
B. DISCRETIONARY MARGIN
C. REGION WHERE A CHANNEL MAY BE DETERMINED TO BE NOT FUNCTIONING AS REQUIRED, DUE TO ITS EXCEEDING THE SPECIFIED AS-FOUND TOLERANCE DURING A PERIODIC CHANNEL SURVEILLANCE.
D. PLANT OPERATING MARGIN
E. AS-LEFT-TOLERANCE DESCRIBED IN SECTION 4.5.5
F. AS-FOUND-TOLERANCE DESCRIBED IN SECTION 4.6

Source: ANSI/ISA Standard 67.04.01-2018

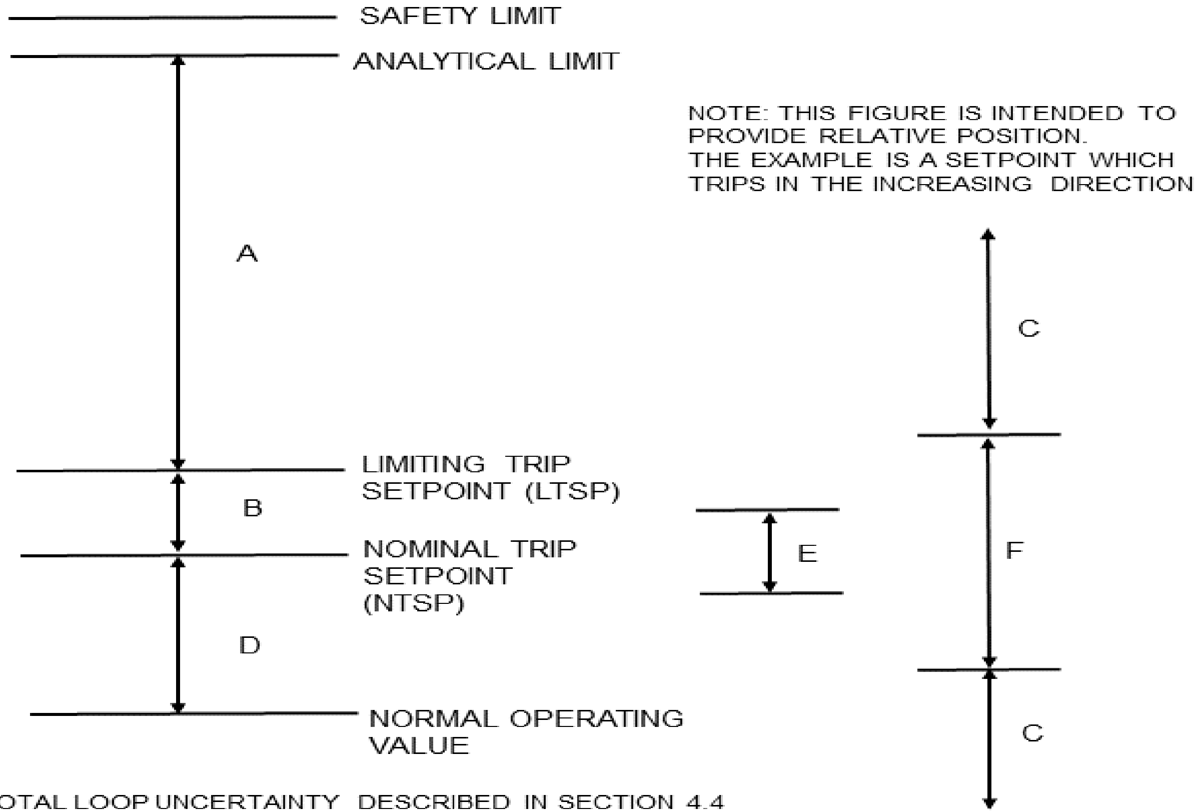
Historical (Pre-2006) Tech Spec Model



RIS 2006-17/TSTF-493 Model



Relationship Among Setpoint Terms



A. TOTAL LOOP UNCERTAINTY DESCRIBED IN SECTION 4.4
B. DISCRETIONARY MARGIN
C. REGION WHERE A CHANNEL MAY BE DETERMINED TO BE NOT FUNCTIONING AS REQUIRED, DUE TO ITS EXCEEDING THE SPECIFIED AS-FOUND TOLERANCE DURING A PERIODIC CHANNEL SURVEILLANCE.
D. PLANT OPERATING MARGIN
E. AS-LEFT-TOLERANCE DESCRIBED IN SECTION 4.5.5
F. AS-FOUND-TOLERANCE DESCRIBED IN SECTION 4.6

Source: ANSI/ISA Standard 67.04.01-2018

Topic IV
Instrument Channel Behavior and the Need for Uncertainty Allowance Estimation

Advisory Committee on Reactor Safeguards
Subcommittee Meeting
NRC Staff Presentation
October 6, 2020

Recall: Regulatory Basis

10 CFR 50.36(c)(1)(ii)(A):

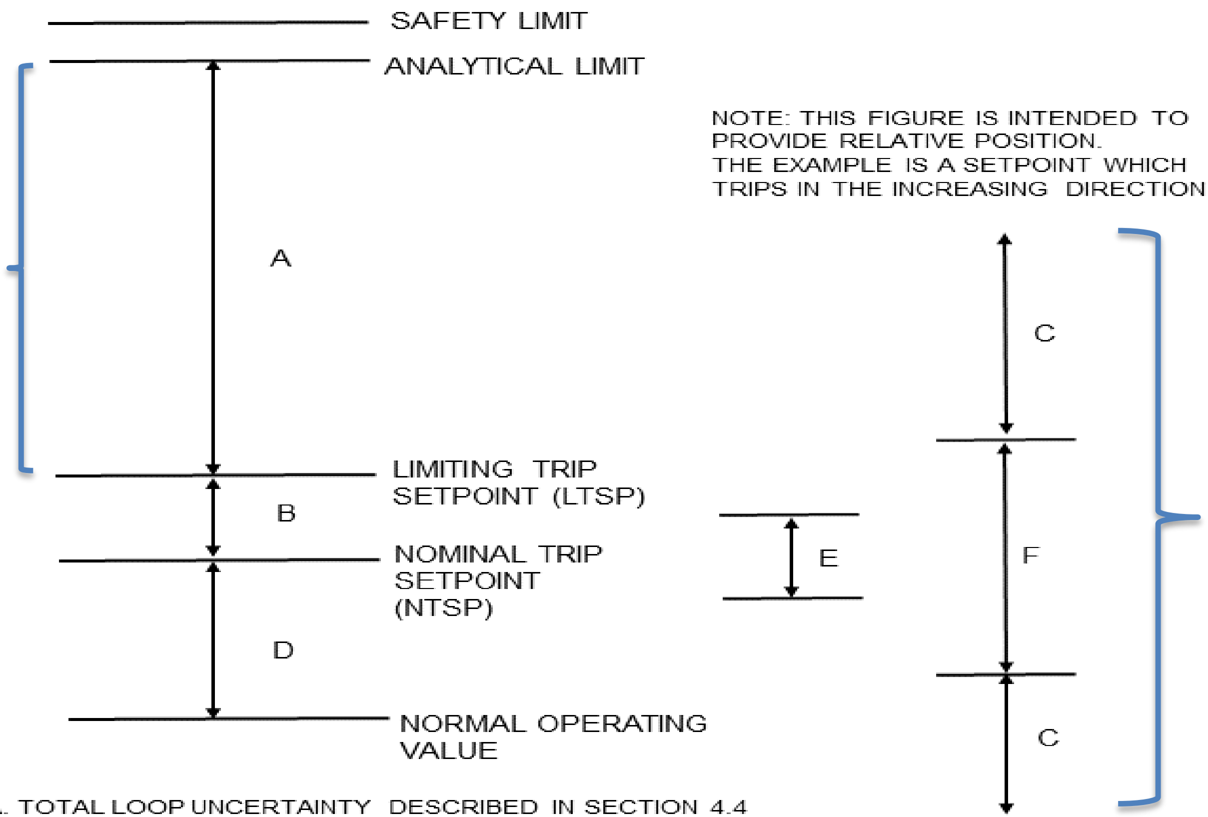
Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, **the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded.**

- **Plant safety analyses cover plant-level thermal, hydraulic, and dynamic mechanical system performance responses when establishing analytical limits**
- **Total channel/loop uncertainty analyses cover instrument channel performance responses when establishing setpoints**

Calibration vs. Operating Conditions

Operating Conditions:

Allowance for Channel Performance Uncertainties that are not observable during calibration



A. TOTAL LOOP UNCERTAINTY DESCRIBED IN SECTION 4.4
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D. PLANT OPERATING MARGIN
E. AS-LEFT-TOLERANCE DESCRIBED IN SECTION 4.5.5
F. AS-FOUND-TOLERANCE DESCRIBED IN SECTION 4.6

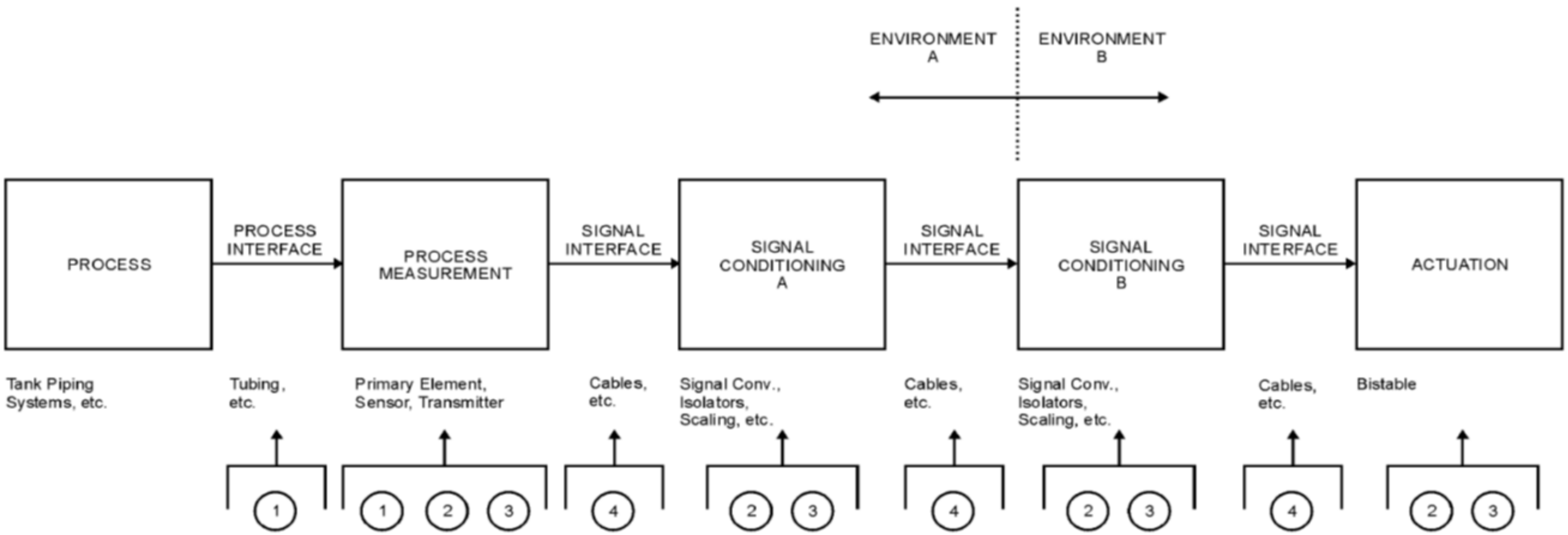
Calibration Conditions:

Channel Performance Monitoring during TS Surveillances to Observe whether the Channel is within As-Found Limits and is reset to within As-Left limits.

Source: ANSI/ISA Standard 67.04.01-2018

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Instrument Channel Uncertainty Modelling



1 Process Measurement Effects
2 Instrument Performance Uncertainty (Linearity, Hysteresis, Static Pressure Effects, etc)
3 Calibration Uncertainties
4 Other Uncertainties (e.g. leakage current, due to steam/ humidity)

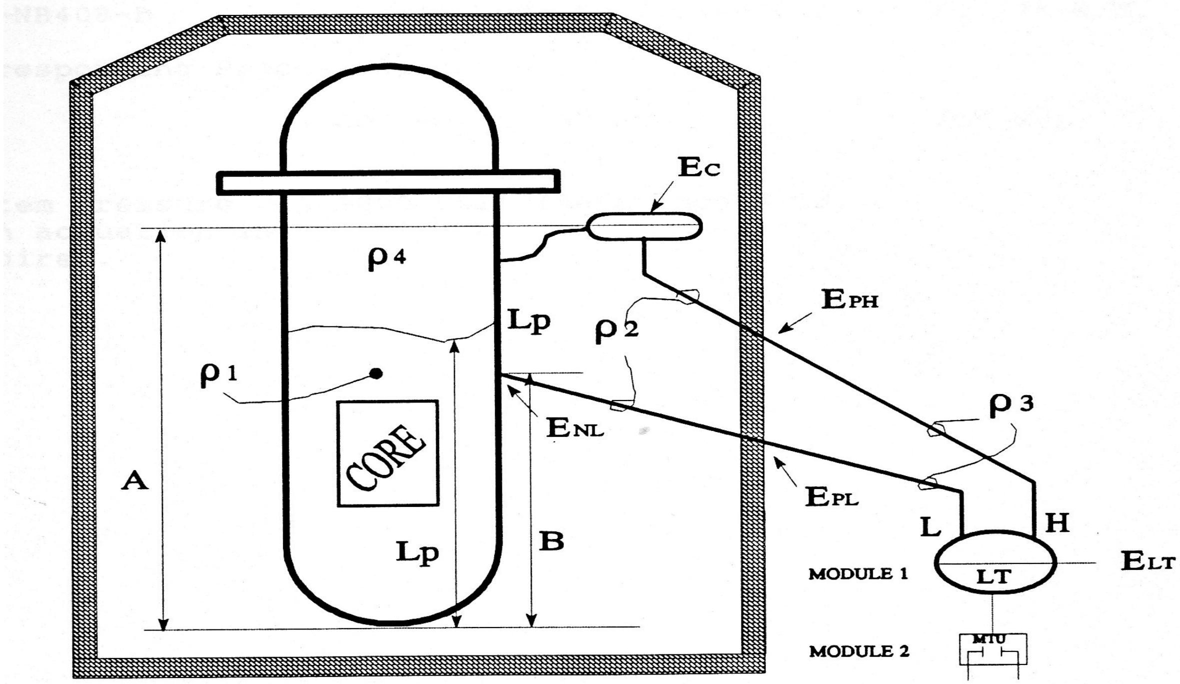
Source: ISA Recommended Practice RP 67.04.02-2000

Typical Instrument Specifications

Instrument errors are not specified by manufacturers exactly the same for every device. For example,

- ± 0.5% of span per 100^{o} F change from reference conditions
- ±0.25% of calibrated span, inclusive of linearity, hysteresis, and repeatability
- ±0.1% of calibrated span or upper range limit, whichever is greater
- ±0.2% of upper range limit for six months from calibration
- ±0.75% of reading
- ±1 least significant digit (LSD)
- ±0.1^{o}F

Influences on Channel due to Changes in Ambient Conditions during Design Basis Accidents



Types of Uncertainties to Account For

(Examples—not all inclusive:)

- Process Measurement Uncertainties (In situ process and sensing lines)
- Primary Element Uncertainty
- Transmitter/Sensor Reference Accuracy (usually encompasses the effects of repeatability, linearity, and hysteresis)
- Effects on Transmitters due to changes in process (e.g., static pressure)
- Transmitter/Sensor Calibration Accuracy
- Balance of Loop Calibration Accuracy
- Measurement and Test Equipment Accuracy—sensor and balance of channel
- Normal Ambient Effects: Temperature, Humidity, etc.
- Accident Ambient Effects: Radiation, Temperature, Humidity, Insulation Resistance
- Device Drift over the designated Surveillance Interval
- Effects of Error Propagation through nonlinear devices
- Allowances to account for dynamic effects (if not accounted for already)

Representation of Uncertainties

Typical modeling of uncertainties:

- Random Independent Variables with no dependencies
- Random Dependent Variables
- Biases (either positive or negative)

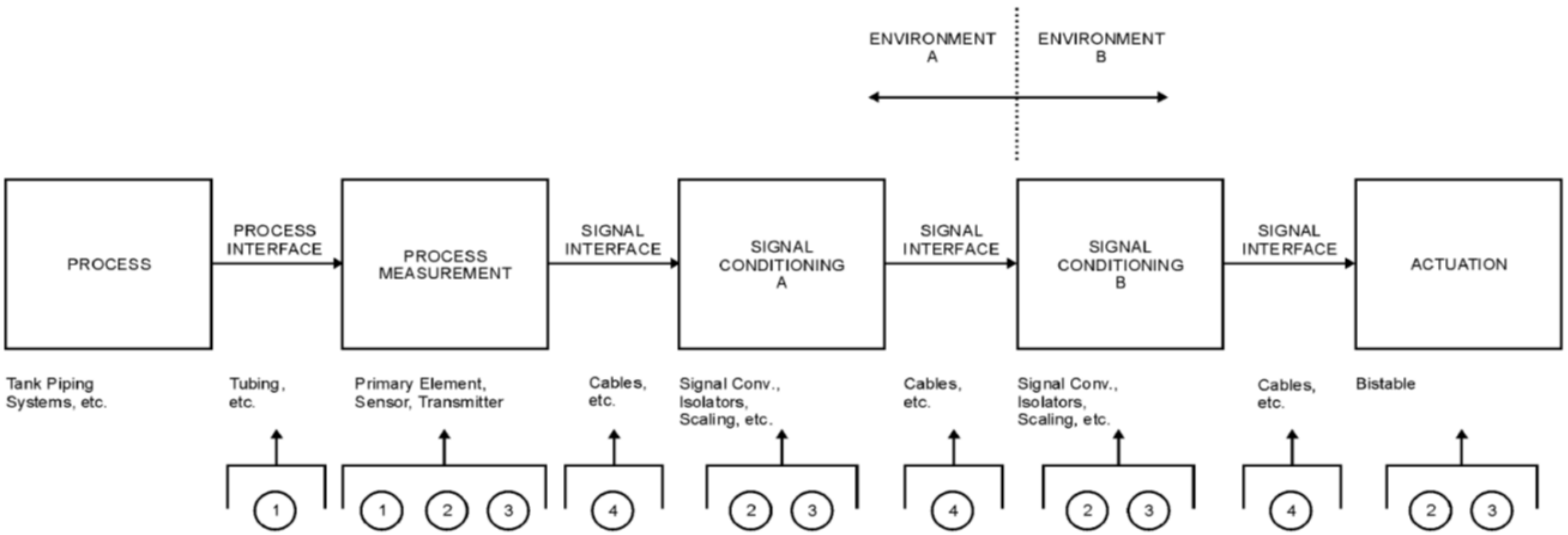
Distribution of random uncertainty terms:

Observation of analog instrument equipment behavior over many years indicates that several of the random uncertainty effects appear to be approximately normally distributed. For instrument channel uncertainty analysis it is helpful to represent the variation of random variable effects as a normal (Gaussian) distribution.

Instrument Channel Uncertainty Analysis: Key Steps

1. Model and evaluate the channel design (i.e., from a physics perspective) to identify credible sources of uncertainty in each portion of the channel.
2. Determine whether the uncertainty term may be appropriately modeled as a random independent, random dependent, or a bias term.
3. Using appropriate data sources and method, develop a reasonable estimate of the magnitude of each uncer tainty term; justify and document the estimate.
4. Combine terms using appropriate methods to arrive at total instrument channel uncertainty.

Instrument Channel Uncertainty Modelling



1 Process Measurement Effects
2 Instrument Performance Uncertainty (Linearity, Hysteresis, Static Pressure Effects, etc)
3 Calibration Uncertainties
4 Other Uncertainties (e.g. leakage current, due to steam/ humidity)

Source: ISA Recommended Practice RP 67.04.02-2000

Combination of Uncertainties

- Bias Terms are added algebraically. Positive terms added with other positive terms. Negative terms with other negative terms.
- Random Independent terms are added together via SRSS methods.
- Random Dependent Uncertainty Terms are first added together algebraically with their dependent term, then added via square root of the sum of the squares (SRSS) method.
- Total Channel Uncertainty is the sum of the terms added together such that all of the uncertainties that would impact channel measurement and trip performance in the non-conservative direction are accounted for, with margin, if possible.

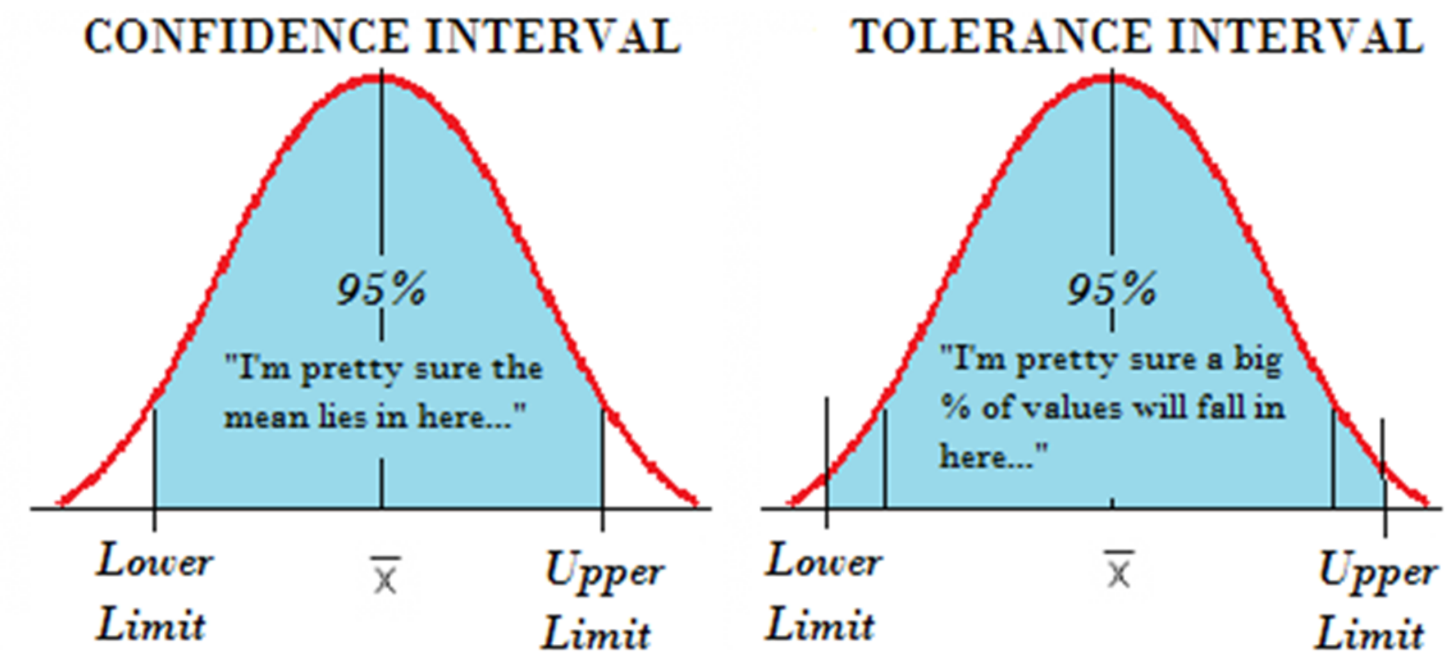
Tolerance Interval Estimation

*The magnitude of an Instrument Channel Uncertainty term is determined using **Tolerance Intervals**, rather than **Confidence Intervals**.*

- One uses a **Confidence Interval** to predict the mean value of a distribution (like a population mean) with a certain confidence level. It describes the likely location for the mean of a population among its distribution.

- A **Tolerance Interval** is used to determine the endpoints of a population distribution encompassing a specified **proportion** of the population, at a given confidence level. A tolerance interval has a minimum value and a maximum value. These endpoints are called **tolerance limits.**

Tolerance vs. Confidence Intervals



Source: https://statisticshowto.com

Tolerance Intervals

Endpoints of a 2-sided tolerance interval are determined by:

$$\bar{Y} \pm kS,$$

where $\bar{Y}$ is the mean, S is the sample standard deviation, and k represents the tolerance limit factor. This factor is based on:

- sample size (n)
- desired proportion (∏) of the population to be contained within the tolerance interval, and
- desired confidence level (γ) in percent.

95/95 Acceptance Criteria

The section of NUREG-1475 pertaining to the use of tolerance intervals states[1]:

> "The 95/95 specification is the most common specification for tolerance intervals at the NRC. **It is usually regarded as the default tolerance interval specification."**

[1] NUREG-1475, Section 9.12, page 184

Combining Random Uncertainty Terms

- Random independent terms are added via SRSS methods.

- Random dependent terms are added algebraically to their dependent partners, and then combined with the other random independent terms using SRSS methods.

Be careful when combining random uncertainty estimates to use the same number of (like) sample standard deviations and normalize them all to "2-sigma" values.

Combining Bias Terms

Bias Terms with known sign (direction):

- Added algebraically, retaining their sign

Bias Terms with unknown sign:

- Absolute value is used and added algebraically to the total non-conservative uncertainty

Total Channel Uncertainty

$$Z = \pm[(A^2 + B^2 + C^2)]^{1/2} \pm |F| + L - M, \text{ where}$$

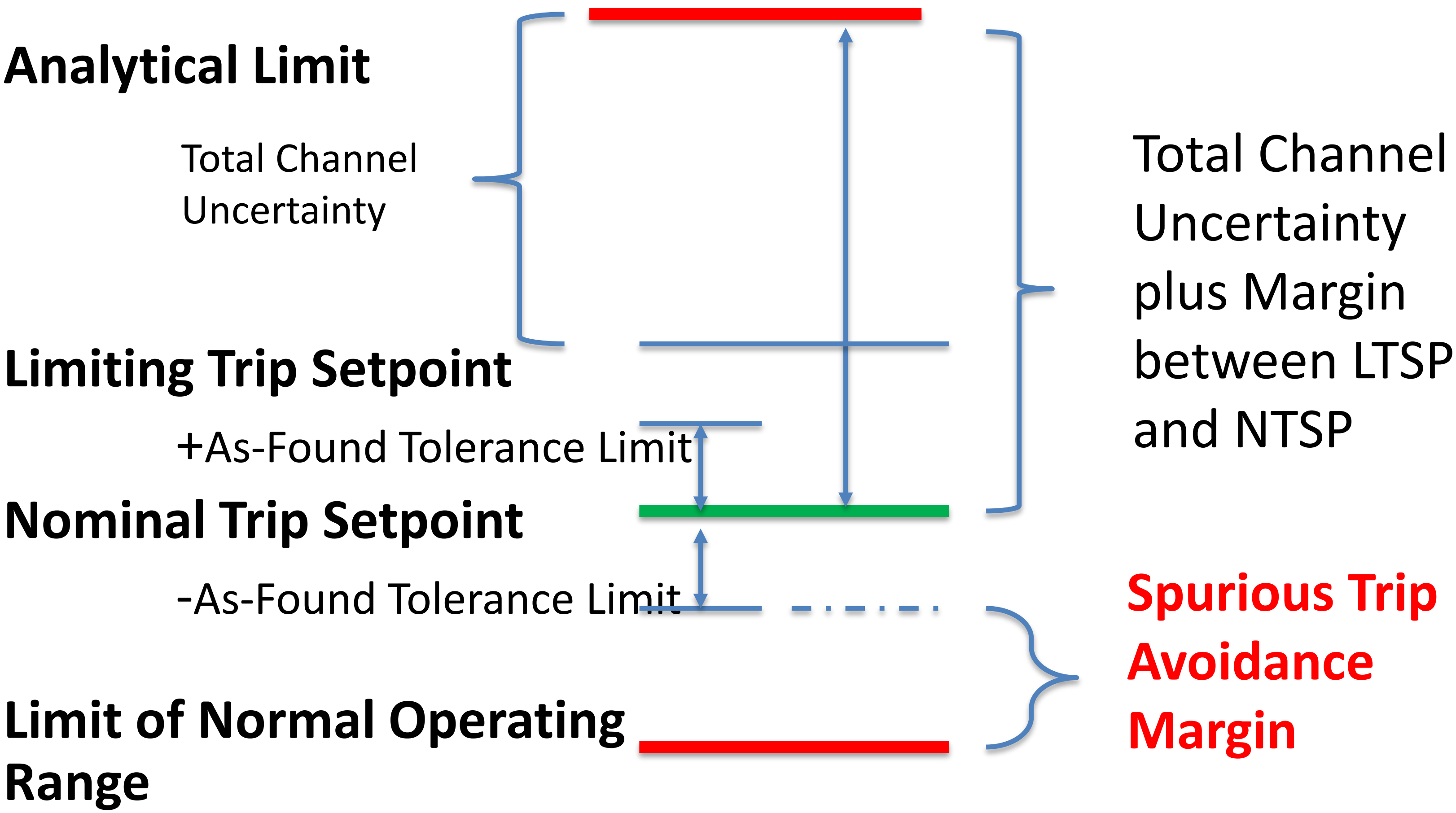
Z = total uncertainty

A, B, C = random independent terms

F = abnormally distributed uncertainties and bias terns with unknown signs

L, M = bias terms with known signs

Important to Avoid Overestimating Total Channel Uncertainty and Tolerance Limits



Estimating Allowances for Instrument Drift

It is difficult to accurately characterize instrument drift using a globally applied rule-of-thumb or fixed method.

- Highly dependent on design of the instrument, the specific application, and other factors.
- Best way to account for drift allowance is to use historical “as-found” and “as-left” drift data, when available, for each application, rather than globally applied rubrics for estimating.
- If no As-left and As-Found data is available, estimate using Mfr.-specified drift characteristic, along with engineering judgment based on the performance of similar equipment.

Estimating Allowances for Instrument Drift

Industry Recommended Practice provides examples of estimating the magnitude of drift, based on a vendor-specified 1% of calibrated span per 6-month surveillance interval:

Linear extrapolation:

4 x 1% = 4% over 24 months.

SRSS extrapolation:

SRSS (1%, 1% 1%, 1%) = 2% over 24 months.

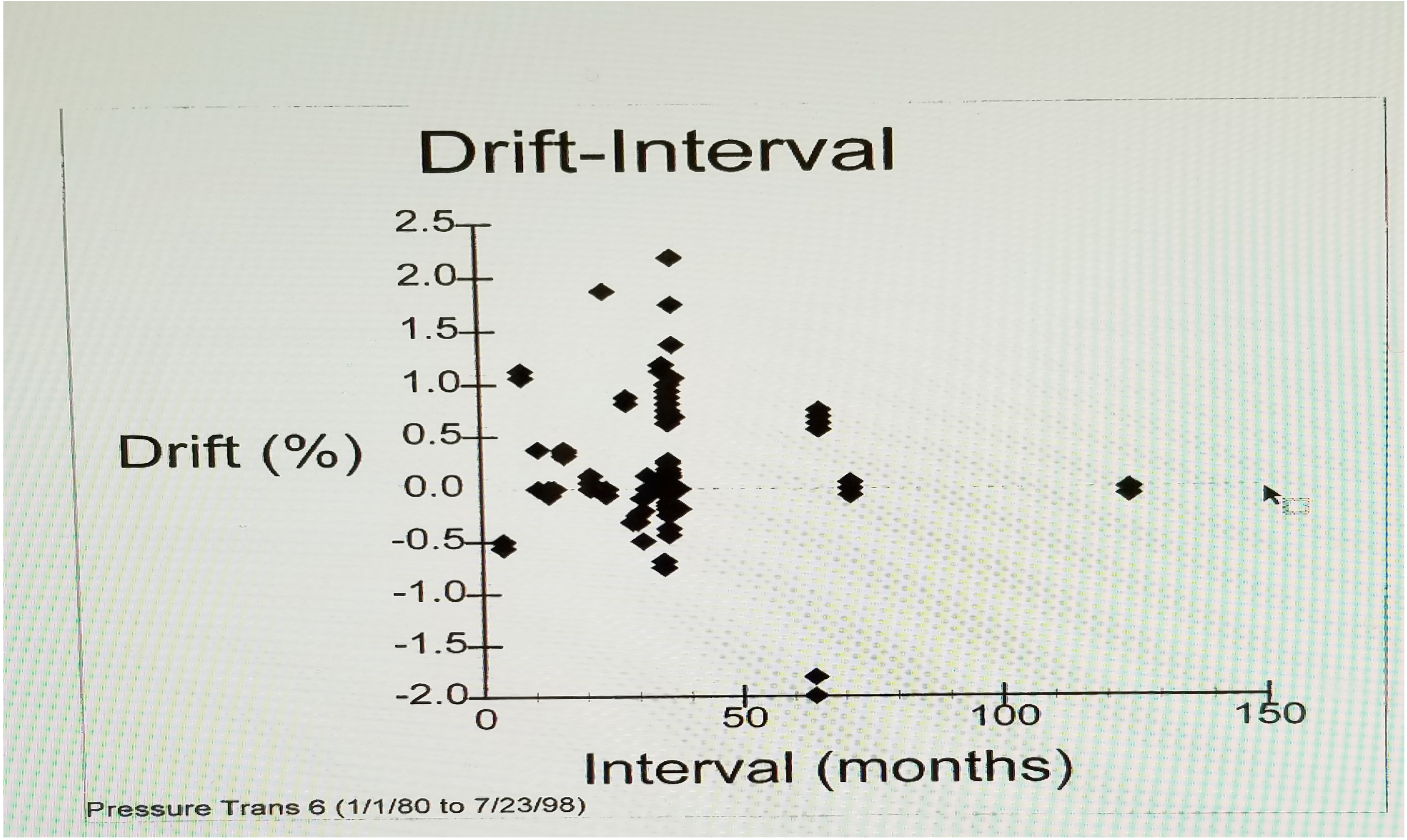
Caution needs to be used to prevent establishing As-Found Tolerance Limits that include an overly conservative estimate of drift. This is because it could result in masking an adverse-performing instrument.

EPRI Instrument Drift Studies

Example: Instrument Drift Study for Ontario Hydro Bruce Nuclear Generating Station EPRI TR-111348 (1998)

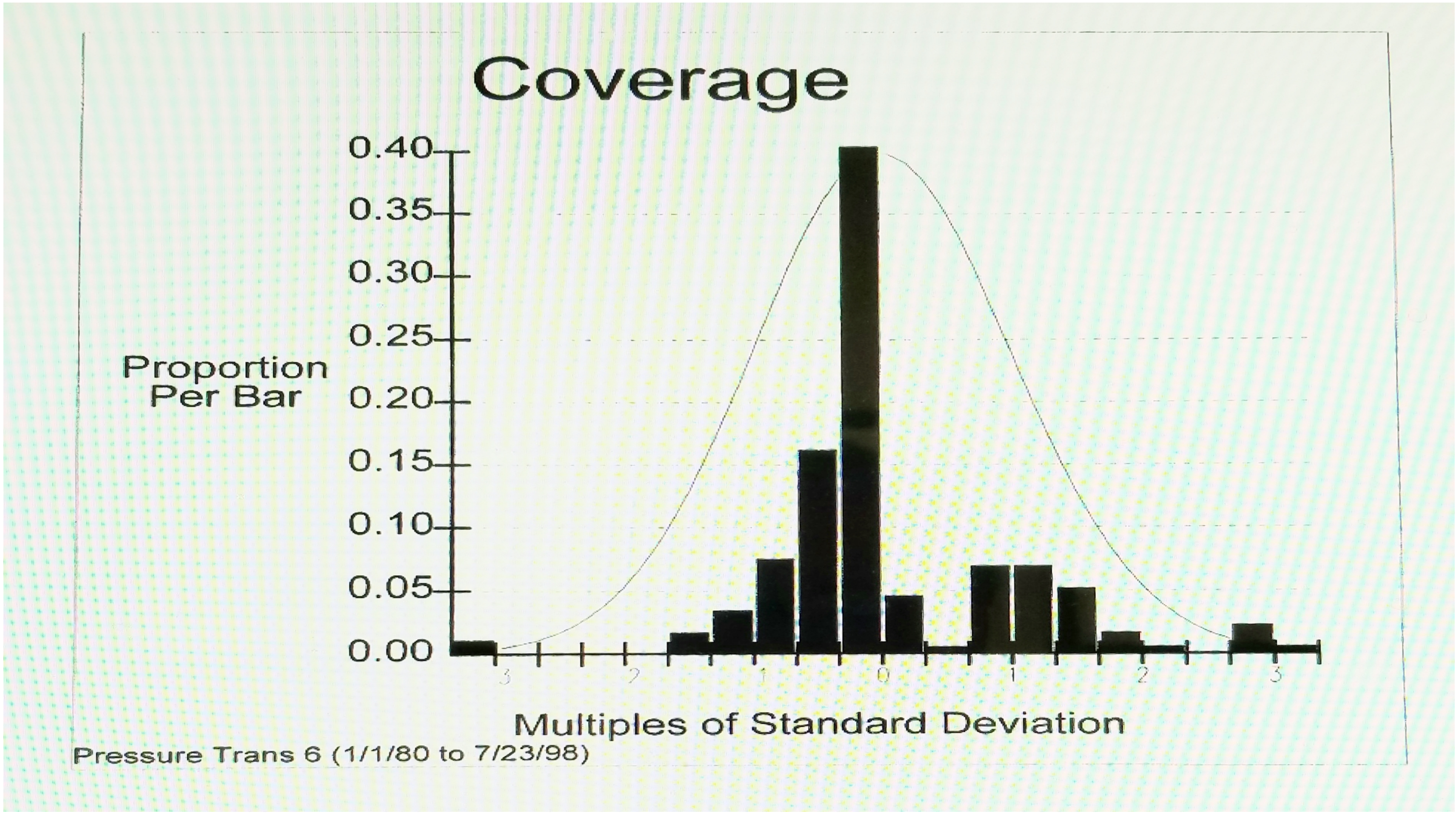
- Shows that it is difficult to make global conclusions regarding Mfr./Model Number performance regarding the magnitude of drift for transmitters and other instruments.
- Shows that active devices like transmitters in the field exhibit more drift on average than devices in controlled environments (e.g., signal converters, bistables, indicators).
- Transmitter drift appears to be dependent on Mfr./Model, but also on Range Code and specific application, because the design features for different range codes have characteristics that influence the degree to which drift affects the operation, and process dynamics and hydraulics also influence drift magnitude.
- Also shows that drift data captured for multiple instrument models and ranges, over a high number of manufacturer specified drift intervals does not exhibit characteristic performance like the algebraic addition of drift/interval would predict.

EPRI Instrument Drift Studies



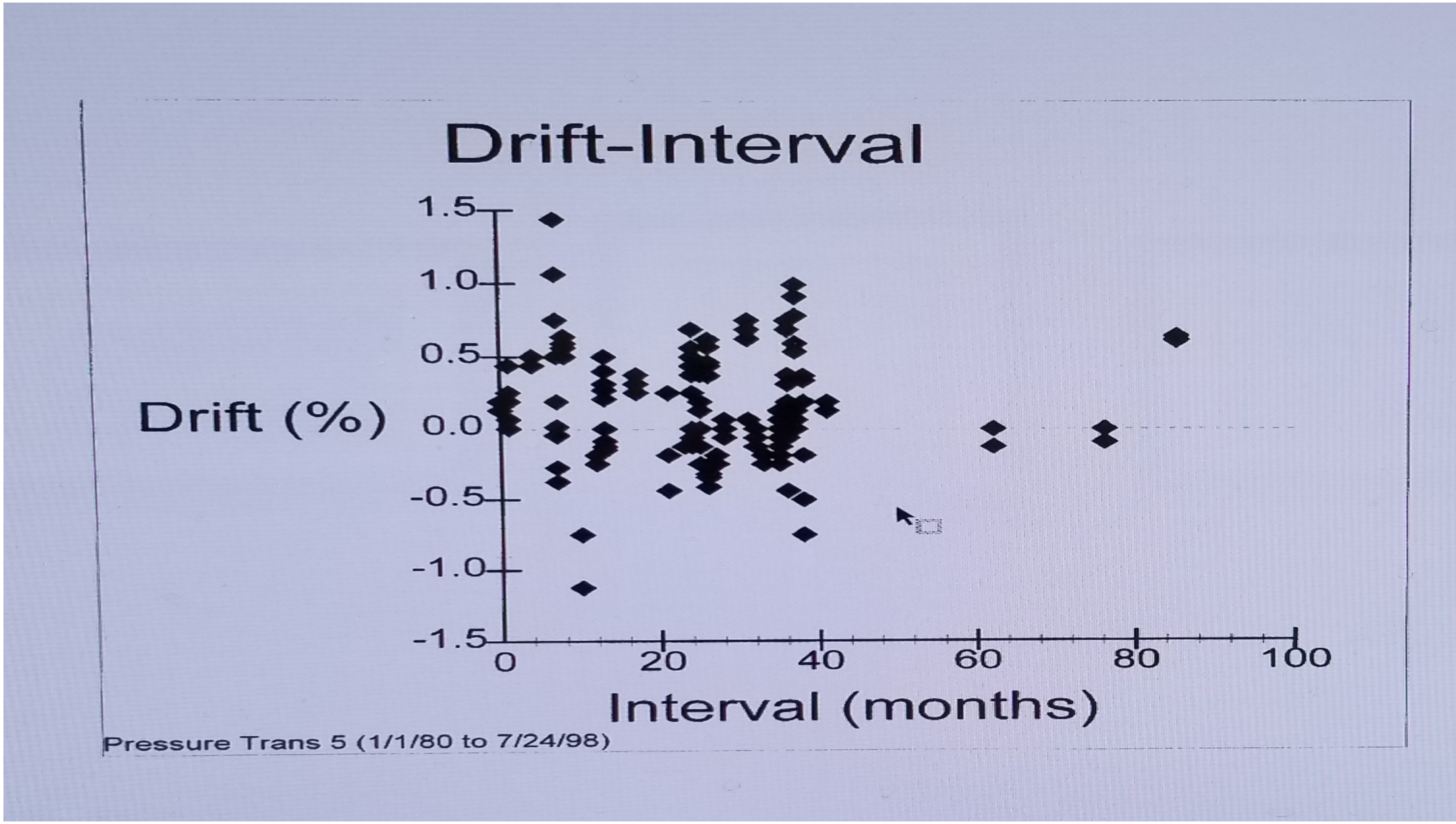
Source: EPRI TR-111348 (1998) Appendix B

EPRI Instrument Drift Studies



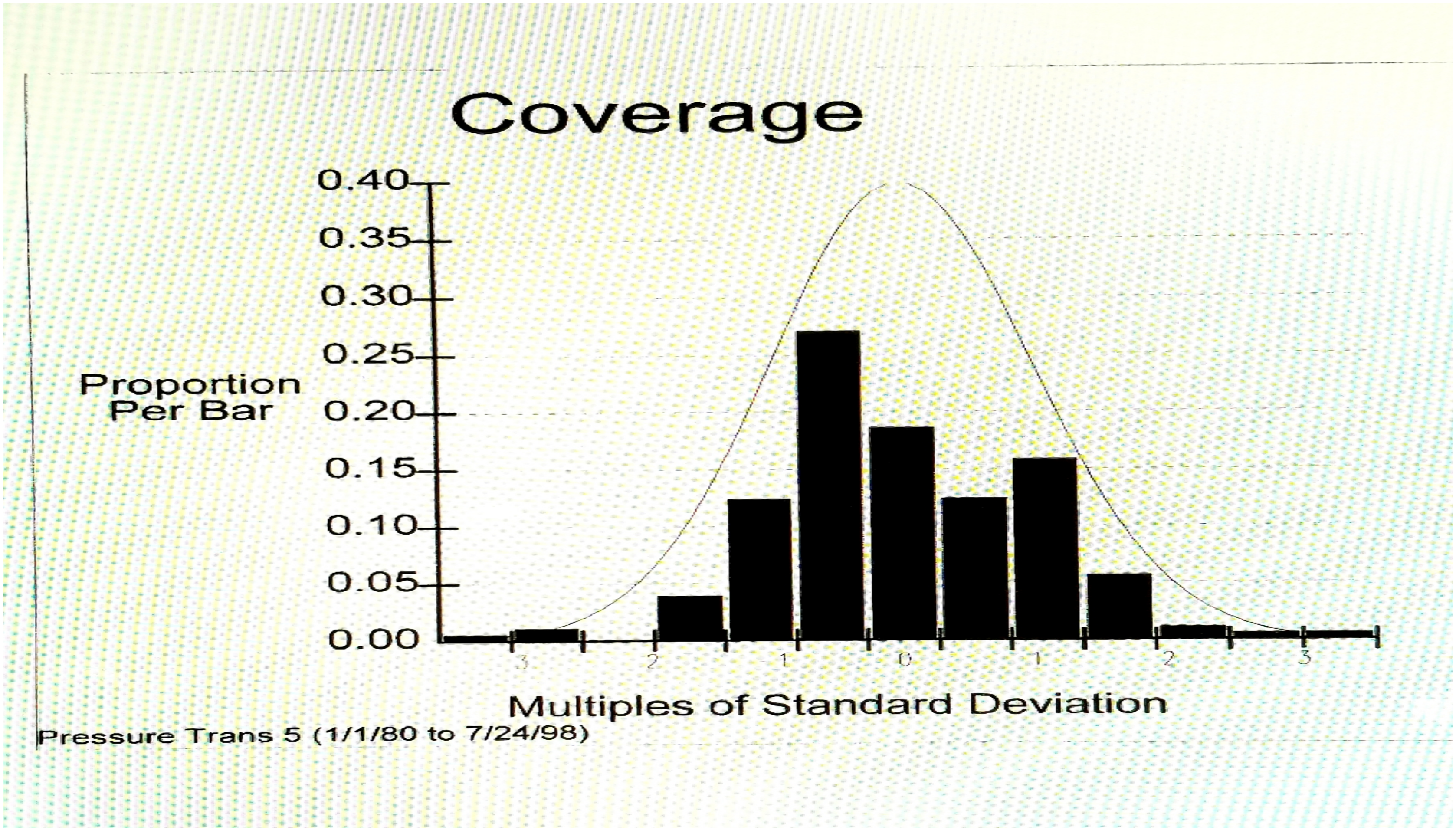
Source: EPRI TR-111348 (1998) Appendix B

EPRI Instrument Drift Studies



Source: EPRI TR-111348 (1998) Appendix B

EPRI Instrument Drift Studies



Source: EPRI TR-111348 (1998) Appendix B

Conclusions Regarding Drift Allowance

Total Channel Uncertainty

- When accounting for drift while estimating Total Channel Uncertainty, it is better to have a tendency to overestimate, within reason, to ensure that adequate margin exists between the LTSP and AL to enable automatic protective actions occur before the AL is reached.

As-Found Tolerance Interval

- When accounting for drift while estimating appropriate limits for As-Found Tolerance, it is better to have a tendency to underestimate, within reason, to ensure that an As-Found Tolerance Limit set too wide does not mask the adverse performance of a component or channel.

Topic V
Key Standard and Guidance for Establishing and Maintaining Safety Related Setpoints

Advisory Committee on Reactor Safeguards
Subcommittee Meeting
NRC Staff Presentation
October 7, 2020

Industry Consensus Standard

ANSI/ISA 67.04.01 "*Setpoints for Nuclear Safety-Related Instrumentation*":

- Sets forth the framework for identifying, estimating, and combining uncertainties occurring within safety related instrument channels to ensure the selected setpoint has sufficient margin to enable the automatic protective action to correct the most severe abnormal situation anticipated before a safety limit is exceeded.
- Is recognized not only in the US nuclear industry, but also is recognized or referenced by nuclear regulators, nuclear vendors, and international standards bodies around the world.

Industry Consensus Standard

- Instrument Setpoint determination was identified as a topic for consideration by the ISA Nuclear Standards Committee in the mid-1970s and was developed into ISA Standard 67.04.

- Purpose was to address concerns that in the 1970s and 1980s, excessive drift of an instrument channel setpoint resulted in performance of the channel outside its required technical specification (TS) limits, contributing to a significant number of Licensee Event Reports (LERs) to be written.

  – In some cases, the setpoint selected was numerically equal to the TS limit, leaving no apparent margin for uncertainties.
  – In other cases, setpoint drift placed the setpoint beyond the instrument range, jeopardizing the capability of the trip function.

Industry Consensus Standard

Revised several times, as needed:

- Address technical concerns in response to identified performance maintenance issues identified by the NRC staff
- Also revised to address concerns raised during inspections of plant activities related to instrument maintenance and design control (via system-based instrumentation and control inspections [SBICIs])

Industry Consensus Standard Content

- Key Definitions
- Establishment of setpoints
- Framework--Safety limits, Analytical limits, Trip setpoints
- Relationships among Setpoint Terms
- Determining Total Loop Uncertainty
- Combining uncertainties
- Performance test scope and test acceptance criteria
- Documentation requirements
- Maintenance of safety-related setpoints
- Testing
- Evaluation of Replacement components
- References—Normative and Informative

Industry Recommended Practice Guidance

- In 1994, the ISA Nuclear Standards Committee published its first version of a guidance document, ISA-RP67.04 Part II, “Methodologies for the Determination of Setpoints for Nuclear Safety Related Instrumentation.”
- Since then, it is renumbered as ISA-RP67.04.02
- This recommended practice document presents guidelines and examples of methods deemed acceptable for performing various aspects of instrument channel setpoint analyses, using the framework of ISA Std. 67.04.01
- Subject to periodic review
- Currently under revision to address topics requiring updated guidance and clarification, including issues raised by the NRC staff.

ISA RP 67.04.02 Topics

Topical Coverage (not all-inclusive)

- Understanding how a channel operates in service and when under calibration
- Identifying design parameters and sources of uncertainty
- Setting up uncertainty calculations
- Obtaining and evaluating appropriate sources of data
- Calculating total uncertainty
- Establishing LTSPs, NTSPs, and Allowable Values
- Use of single-sided population distributions for establishing tolerance intervals
- Documentation of setpoint design basis information
- Vessel reference leg ambient temperature effects
- Flow measurement accuracy
- Insulation Resistance effects
- Evaluation of plant as-found and as-left data
- RTD Accuracy confirmation
- Digital Signal Processing uncertainties
- Understanding statistical analysis
- Effects of propagation of uncertainties

Topic VI
NRC Staff Positions--
Historical and Present

Advisory Committee on Reactor Safeguards
Subcommittee Meeting
NRC Staff Presentation
October 7, 2020

RG 1.105 Rev. 1   Nov. 1976

- Endorses ISA Standard S67.04-1982, Setpoints for Nuclear Safety Related Instrumentation used in NPP’s
- Basis: GDC 13, “Instrumentation and Control”
  - Instruments required to monitor variables, and controls are required to maintain variables within prescribed operating ranges.
- Basis: 50.36 (c)(1)(ii)(A)
  - Where a LSSS is specified for Safety Limits: the setting must be so chosen that automatic protective action will correct the most severe abnormal situation anticipated before a safety limit is exceeded.

RG 1.105 Rev. 1 Nov. 1976 (cont'd)

Concerns:

Large number of reported instances in which instrument setpoints in safety-related systems drifted outside the limits specified in the technical specifications.

The single most prevalent reason for finding settings beyond TS Limits is the selection of a setpoint that does not allow a sufficient margin between the setpoint and the technical specification limit to account for inherent instrument inaccuracy, expected vibration, and minor calibration variations.

- In some cases, the setpoint selected was numerically equal to the technical specification limit and stated as an absolute value, thus leaving no apparent margin for error.
- In other cases, the setpoint was so close to the upper or lower limit of the instrument's range that the instrument drift placed the setpoint beyond the instrument's range, thus nullifying the trip function.
- Other causes for drift of a parameter out of conformity with a technical specification have been instrumentation design inadequacies and questionable calibration procedures.

RG 1.105 Rev. 1 Nov. 1976 (cont'd)

Staff Positions:

- Setpoints should be established with sufficient margin between the tech spec limits and the nominal trip setpoint to allow for instrument accuracy, calibration uncertainty, and drift over the interval between successive calibrations.
- Setpoints should be within the portion of the of the instrument range where they are most accurate, and consider vibration and other environmental conditions.
- Setpoints should be secured with a locking device.
- Assumptions regarding setpoint selection, minimum margin to the LSSSS, and drift rate over the testing interval should be documented.
- No specific Staff Position taken regarding acceptance criteria for bounding uncertainty estimates

RG 1.105 Rev. 2   Feb. 1986

- Endorses, with clarifications, ISA Standard S67.04-1982, “Setpoints for Nuclear Safety Related Instrumentation used in NPP’s”
- Basis: GDC 13, “Instrumentation and Control”
  - Instruments required to monitor variables, and controls are required to maintain variables within prescribed operating ranges.
- Basis: GDC 20, “Protection System Functions” (New citing)
  - The protection system shall be designed to initiate operation of appropriate systems to ensure that specified acceptable fuel design limits are not exceeded.
- Basis: 50.36 (c)(1)(ii)(A)
  - Where a LSSS is specified for Safety Limits: the setting must be so chosen that automatic protective action will correct the most severe abnormal situation anticipated before a safety limit is exceeded.

RG 1.105 Rev. 2 Feb. 1986 (cont'd)

Concerns:

- Restates that a large number of LERs were reported in which the setpoint of safety-related systems were outside TS limits.
- Identifies ISA S67.04-1982 Standard as having been developed to contain minimum requirements for establishing and maintaining setpoints.
- Identifies that the ISA term of "Allowable Value" is consistent with the usage in the Standardized Tech Specs.

RG 1.105 Rev. 2 Feb. 1986 (cont'd)

<u>Concerns</u>:

"Paragraph 4.3 of the standard specifies the methods for combining uncertainties in determining a trip setpoint and its allowable values. Typically, the NRC staff has accepted 95% as a probability limit for errors. That is, **of the observed distribution of values for a particular error component in the empirical data base, 95% of the data points will be bounded by the value selected. If the data base follows a normal distribution, this corresponds to an error distribution approximately equal to a "two sigma" value."**

RG 1.105 Rev. 2   Feb. 1986 (cont'd)

Concerns:

- Identifies that S67.04-1982 has a section on "software qualification", and points to ANSI/IEEE-ANS-7-4.3.2-1982 for standards regarding software validation and verification, and RG 1.152 for guidance.
- Considerations regarding documentation of setpoint drift should include 7 key criteria which can affect the estimate of drift.

RG 1.105 Rev. 2 Feb. 1986 (cont'd)

Staff Position:

- The staff endorsed the use of ISA S67.04-1982 as ensuring that instrument setpoints in safety-related systems are initially within and remain within the technical specification limits.
- Referenced standards within ISA S67.04-1982, while not endorsed by the reg guide, also contain valuable information and, if used, should be used in a manner consistent with current regulations.

RG 1.105 Rev. 3   Feb. 1999

- Endorses, with exceptions and clarifications ISA Standard S67.04-1994, “Setpoints for Nuclear Safety Related Instrumentation used in NPP’s”
- Basis: GDC 13, “Instrumentation and Control”
- Basis: GDC 20, “Protection System Functions”
- Basis: 50.36 (c)(1)(ii)(A)

RG 1.105 Rev. 3 Feb. 1999 (cont'd)

Acceptance Criterion for bounding the estimate of uncertainties:

Staff Position 1 states:

> Section 4 of ISA-S67.04-1994 specifies the methods, but not the criterion, for combining uncertainties in determining a trip setpoint and its allowable values. The 95/95 tolerance limit is an acceptable criterion for uncertainties. That is, there is a 95% probability that the constructed limits contain 95% of the population of interest for the surveillance interval selected.

RG 1.105 Rev. 3   Feb. 1999 (cont'd)

Exception/Clarification made regarding where LSSS may be maintained. Staff Position 3 states:

- Section 4.3 of ISA-S67.04-1994 states that the limiting safety system setting (LSSS) may be maintained in technical specifications or appropriate plant procedures. However, 10 CFR 50.36 states that the technical specifications will include items in the categories of safety limits, limiting safety system settings, and limiting control settings. Thus, the LSSS may not be maintained in plant procedures.
- Rather, the LSSS must be specified as a technical-specification-defined limit in order to satisfy the requirements of 10 CFR 50.36. The LSSS should be developed in accordance with the setpoint methodology set forth in the standard, with the LSSS listed in the technical specifications.

RG 1.105 Rev. 3 Feb. 1999 (cont'd)

Clarification made regarding the purpose and application of the Allowable Value. Staff Position 4 states:

- The allowable value is the limiting value that the trip setpoint can have when tested periodically, beyond which the instrument channel is considered inoperable and corrective action must be taken in accordance with the technical specifications.
- The allowable value relationship to the setpoint methodology and testing requirements in the technical specifications must be documented.

RIS 2006-17

- Issued to clarify 50.36 with respect to limiting safety system settings (LSSSs) assessed during periodic testing and calibration.
- Presents an approach, found acceptable to the NRC staff, for addressing these issues for use in licensing actions that require prior NRC staff approval.
- Concerns the use of Allowable Values for instrument channel performance monitoring to meet Tech Spec requirements for maintaining LSSSs.

RIS 2006-17 (cont'd)

Clarified Terms:

- Limiting trip setpoint

  The LTSP is the limiting setting for the channel trip setpoint (TSP) considering all credible instrument errors associated with the instrument channel. The LTSP is the limiting value to which the channel must be reset at the conclusion of periodic testing to ensure the safety limit (SL) will not be exceeded if a design basis event occurs before the next periodic surveillance or calibration.

- Nominal Trip Setpoint
  - The NTSP is the TSP value selected by the licensee for plant operations. The NTSP must be equal to or more conservative than the LTSP.

RIS 2006-17 (cont'd)

Clarified Term:

- Allowable Value (AV)
  - An AV is a limiting value of an instrument's "as-found trip setting" used during surveillances.

Position:

- Don't use AV as "as-found" LSSSs.
- Instead, use a double-sided tolerance limit for a performance measure during surveillances, based on licensee methodology to determine whether the channel is "functioning as expected" and can be reset to within the setting tolerance band.
- If the as-found value exceeds the double sided tolerance limit it shall be evaluated for operability. If it cannot be shown to e "functioning as required" it shall be declared inoperable and appropriate Tech Spec actions apply.

TSTF-493, Options A and B

Option A--Addition of Footnotes within TS Tables containing LSSSs

- (1) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.
- (2) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in [named facility document].

Option B—Setpoint Control Program in Section 5.0 Administrative TS

- Submittal of Setpoint Determination Methodology for Staff Evaluation
- Submittal of Setpoint Control Program for Incorporation by Reference into TS.

New Staff Positions in DG-1141

In 2014, the staff noted that RG 1.105 Rev 3 needed updating for several reasons:

1. Rev 3 endorsed the 1994 version of ISA Std 67.04, which had since been updated by the ISA Committee in 2006 (Reaffirmed in 2011) to address the revised staff position on Allowable Values
2. There was still no ISA acceptance criterion (like 95/95) for estimating the width of the tolerance interval used to determine the magnitude of uncertainty terms
3. The staff proposed guidance to clarify that a **97.5% probability** of the instrument channel tripping is needed for conservatism, before the Analytical Limit is reached, rather than a 95% probability

New Staff Positions in DG-1141 (cont'd)

4. The figure illustrating relationships of key terms in ISA Std 67.04.01-2011 had not been updated sufficiently to show how the As-Left and the As-Found Tolerances should be used during TS surveillances to determine whether a channel was "functioning as required."
5. The criteria regarding determination of the magnitude of the As-Found Tolerance should include consideration of anticipated error in the actual trip point over the entire period between measurements.
6. The staff proposed that estimates of **drift** during a surveillance interval **should be based on linear extrapolation, via algebraic addition of the vendor-specified drift over the specified interval, and not based on SRSS of drift over multiple intervals**

Topic VII
ISA Committee Work to Revise ANSI/ISA 67.04.01

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

NRC Staff Presentation

October 7, 2020

Update to ANSI/ISA 67.04.01

Beginning in 2016, the ISA S67.04 Committee initiated work to update ANSI/ISA Std. 67.04.01 and associated areas within ISA Recommended Practice ISA RP 67.04.02 as shown below:

- Definitions – Improved definitions based on TSTF-493, Rev 4, RIS-2006-17, and NRC updated Regulatory Guide 1.105/DG-1141
- 95/95 – Improved guidance on the development of component uncertainty data and analysis techniques for applying tolerance intervals at 95% probability/95% confidence within total channel uncertainty calculations
- Improved guidance for addressing Technical Specification requirements reflecting changes based on criteria within TSTF-493 and RIS 2006-17
- NRC input from updates in the proposed revision to RG 1.105 (DG-1141) and Branch Technical Position BTP-7-12 revision process.
- Improved guidance based on methods and conclusions within several Electric Power Research Institute (EPRI) reports on instrument calibration surveillance interval extensions, instrument drift studies.

Update to ANSI/ISA 67.04.01

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- Definitions – Improved definitions based on TSTF-493, Rev 4, RIS-2006-17, and NRC updated Regulatory Guide 1.105/DG-1141
- 95/95 – Improved guidance on the development of component uncertainty data and analysis techniques for applying tolerance intervals at 95% probability/95% confidence within total channel uncertainty calculations
- Improved guidance for addressing Technical Specification requirements reflecting changes based on criteria within TSTF-493 and RIS 2006-17
- NRC input from updates in the Regulatory Guide 1.105 (Reference 5) and Branch Technical Position BTP-7-12 (Reference 6) revision process.
- Improved guidance based on methods and conclusions within several Electric Power Research Institute (EPRI) reports on instrument calibration surveillance interval extensions, instrument drift studies .

Update to ANSI/ISA 67.04.01 (cont'd)

The ISA Committee members discussed concepts where the committee disagreed with the NRC staff's positions in DG-1141.

- Initially, the Committee felt the stipulation of 95/95 for tolerance interval estimation was too restrictive, plus there were many uncertainties where there is usually not enough data to support 95/95. But the committee saw the utility of standardizing, and elected to adopt 95/95 with caveats.
- The Committee did not want to specify 97.5% probability of exceeding the AL. Deemed overly and unnecessarily conservative for many reactor types. Settled on 95%, with acknowledgement that when the reactor type allows a 97.5% margin, the expectations of the standard may be exceeded. 95% probability is the bare minimum.
- The Committee disagreed with the staff's stipulating in DG-1141 that an algebraic addition of vendor specified drift per each interval is warranted. Doesn't reflect repeated observed performance.

Update to ANSI/ISA 67.04.01 (cont'd)

Ultimately, the revision to ANSI/ISA Standard67.04.01 was completed in 2018, and approved unanimously by the voting members for forwarding to the ISA Standards and Practices (S&P) Board.

- The S&P Board approved the document in November 2018, and ANSI recorded the standard in December, 2018.
- ISA made the document publicly available in January 2019.

Topic VIII
Purpose and Goals for Development of Rev. 4 to RG 1.105

Advisory Committee on Reactor Safeguards

Subcommittee Meeting

NRC Staff Presentation

October 7, 2020

Purpose

- Regulatory: To provide one acceptable way for applicants to meet current regulatory requirements and staff concerns identified in RIS 2006-17
- Organizationally: To consolidate, into one definitive document, guidance addressing the regulatory and industry standard "tweaks" that have been taking place since the last version of RG 1.105 was issued 21 years ago.

Customer/Stakeholder Focus: New applications for reactors and possible voluntary adoption by licensees of currently operating reactors.

Goals

- To produce guidance that achieves alignment among stakeholders in the nuclear industry, including plant operators, consultants/architect-engineers, instrument vendors, and government stakeholders, regarding NRC staff positions.
- Specifically, to provide clear NRC staff positions on acceptable ways, using appropriate science and state-of-the-art methods for establishing and maintaining safety related setpoints, to meet regulatory requirements associated with plant technical specifications and the design of safety systems.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Topic IX
Status and Next Steps for Completion of RG 1.105 Rev. 4

Advisory Committee on Reactor Safeguards
Subcommittee Meeting
NRC Staff Presentation
October 7, 2020

Status and Next Steps

RG 1.105 Revision 4 (Proposed):

- Issued for public comment on 8/14/20
- 30-day comment period ended 9/14/20
- 24 comment submissions received
  - 28 total comments
  - Minor editorial changes; No significant changes to DG
- Final RG package ready for review by 12/2020
- ACRS FC meeting RG 1.105 Rev 4 in 02/2021

RG Management

- RES/DE/RGGIB Manages all NRC RGs
  – Meraj Rahimi BC for RGGIB
- 343 RGs active and in use across 10 Divisions
  – 176 in Power Reactors
  – Research & Test Reactors, Fuels & Material Facilities, Materials & Plant Protection, Transportation, Occupational Health, etc.
- Average of 25 RGs issued per year
  – Mostly revision with 1-3 new RGs
- Periodic reviews within 10 years for all RGs
  – Published reviews are unique to agency
    - Knowledge Management, Planning, Transparency
  – Average of 20 reviews issued per year
    - As-is, Revise, Issues for Consideration, Withdraw

Questions

Acronyms

ACRS	Advisory Committee on Reactor Safeguards
AL	Analytical Limit
ANSI	American National Standards Institute
ANS	American Nuclear Society
AV	Allowable Value
CFR	Code of Federal Regulations
DE	Office of Research, Division of Engineering
DG	Draft Guide
EPRI	Electric Power Research Institute
GDC	General Design Criteria (Appendix A of 10 CFR Part 50)
I&C	Instrumentation & Controls
IEEE	Institute of Electrical and Electronics Engineers

Acronyms

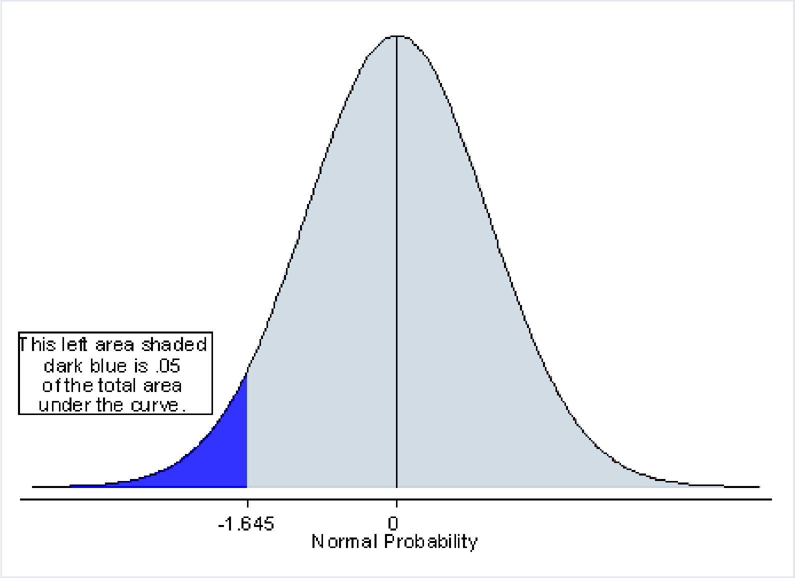
ISA	International Society of Automation
LER	Licensee Event Report
LTSP	Limiting Trip Setpoint
LSD	Least Significant Digit
LSSS	Limiting Safety System Settings
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NTSP	Nominal Trip Setpoint
RES	Office of Nuclear Regulatory Research
RIS	Regulatory Issue Summary
RG	Regulatory Guide
RGGIB	Regulatory Guidance and Generic Issues Branch

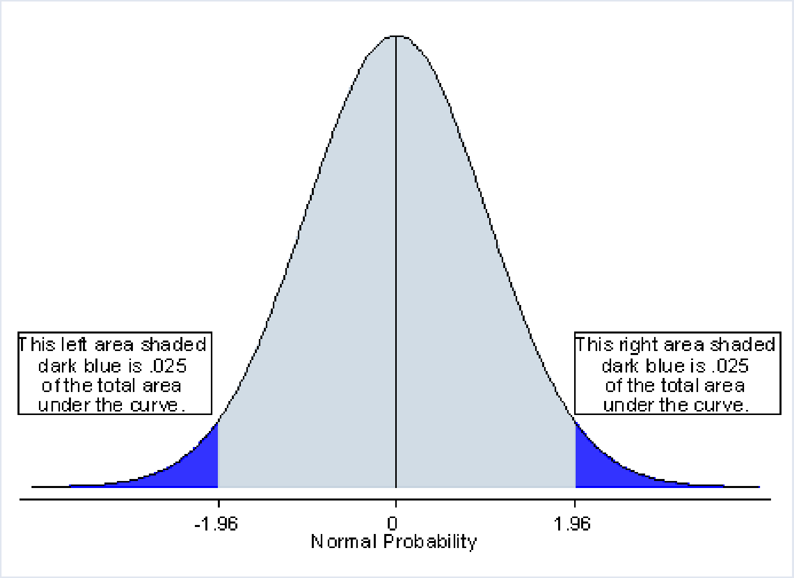
Acronyms

RP	Recommended Practice
RTD	Resistance Temperature Detector
SL	Safety Limit
SRSS	Square Root of Sum of Squares
SBICI	System-Based Instrumentation and Control Inspections
TR	Technical Report
TS	Technical Specification
TSP	Trip Setpoint
TSTF	Technical Specifications Task Force

Backup Slides

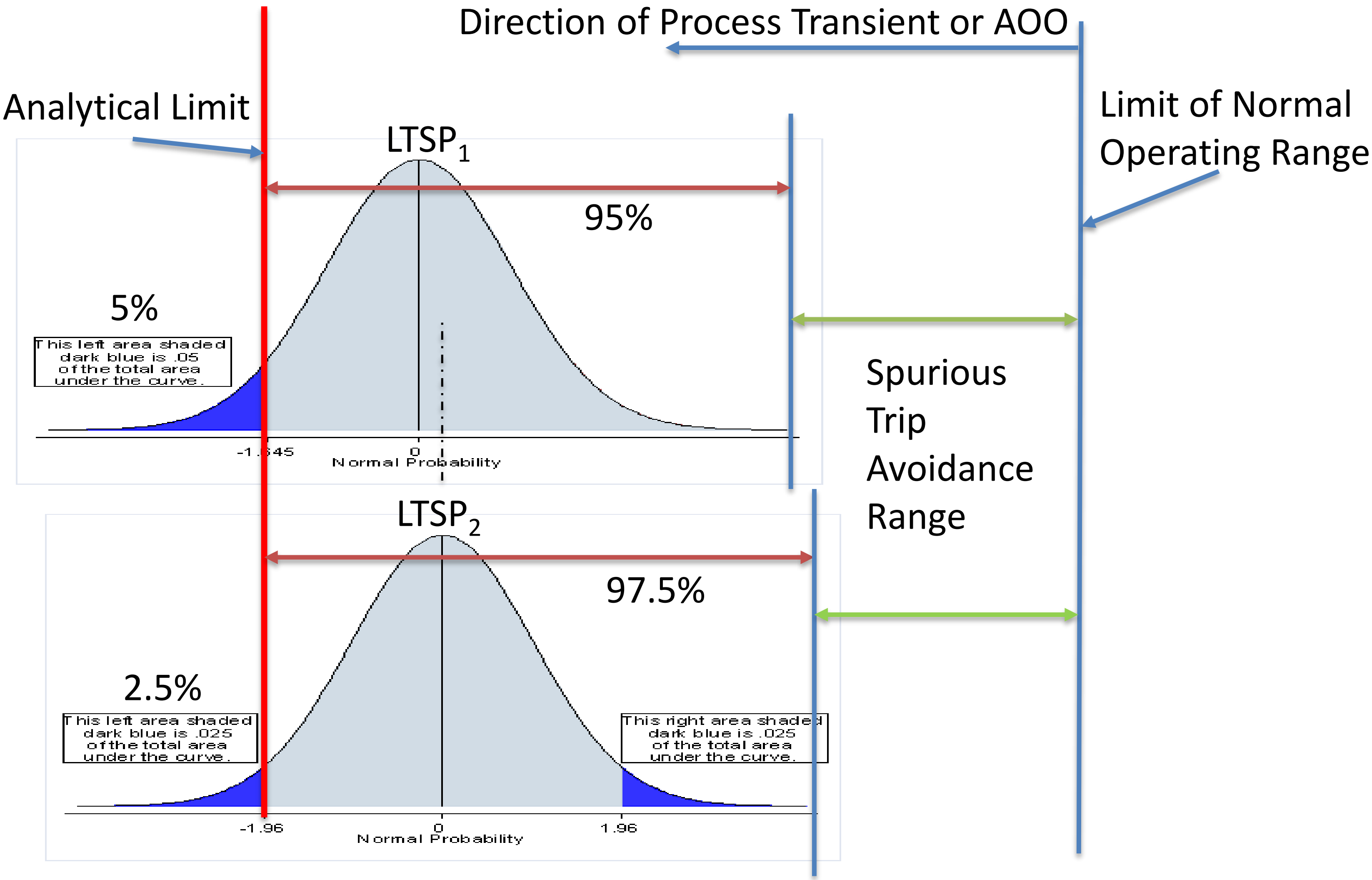
One-tailed vs. Two-Tailed Probability Tests





Source: UCLA Institute for Digital Research & Education
https://stats.idre.ucla.edu/other/mult-pkg/faq/general/faq-what-are-the-differences-between-one-tailed-and-two-tailed-tests/

One-Tailed vs. Two-Tailed Probability of Trip Illustration



Regulatory Guide 1.105
draft revision 4
DG-1141 DG-1363

Bases for Nonconcurrence

Presentation to the ACRS Subcommittee on Digital I&C Systems

October 7, 2020

Paul Rebstock
RES/DE/ICEEB

Background

- DG-1141
  - References the 2006 version of ISA 67.04.01 (reaffirmed in 2011)
  - Includes extensive technical detail (33 pages)
    - Adequate treatment of the concerns raised in the nonconcurrence
  - Concurred by all parties, released for public comment
  - Comments received, responses developed, draft modified accordingly
    - All efforts terminated with draft and responses mostly through concurrence
- DG-1363
  - References the 2018 version of ISA 67.04.01
    - 2018 version incorporates many but not all of the technical details in DG-1141
  - Endorses the standard without clarification or exception

Specific Areas of Concern

- **Interpretation of the 95/95 criterion**
  – Tacit acceptance of the long-debated “Single-Sided Setpoints”
  – *Increases the probability of operation in an unanalyzed condition*

- **Temporal extrapolation of time-related uncertainties**
  – Inadequate guidance in the determination of the allowance for drift
  – *Affects the adequacy of the channel uncertainty estimate*

Terminology

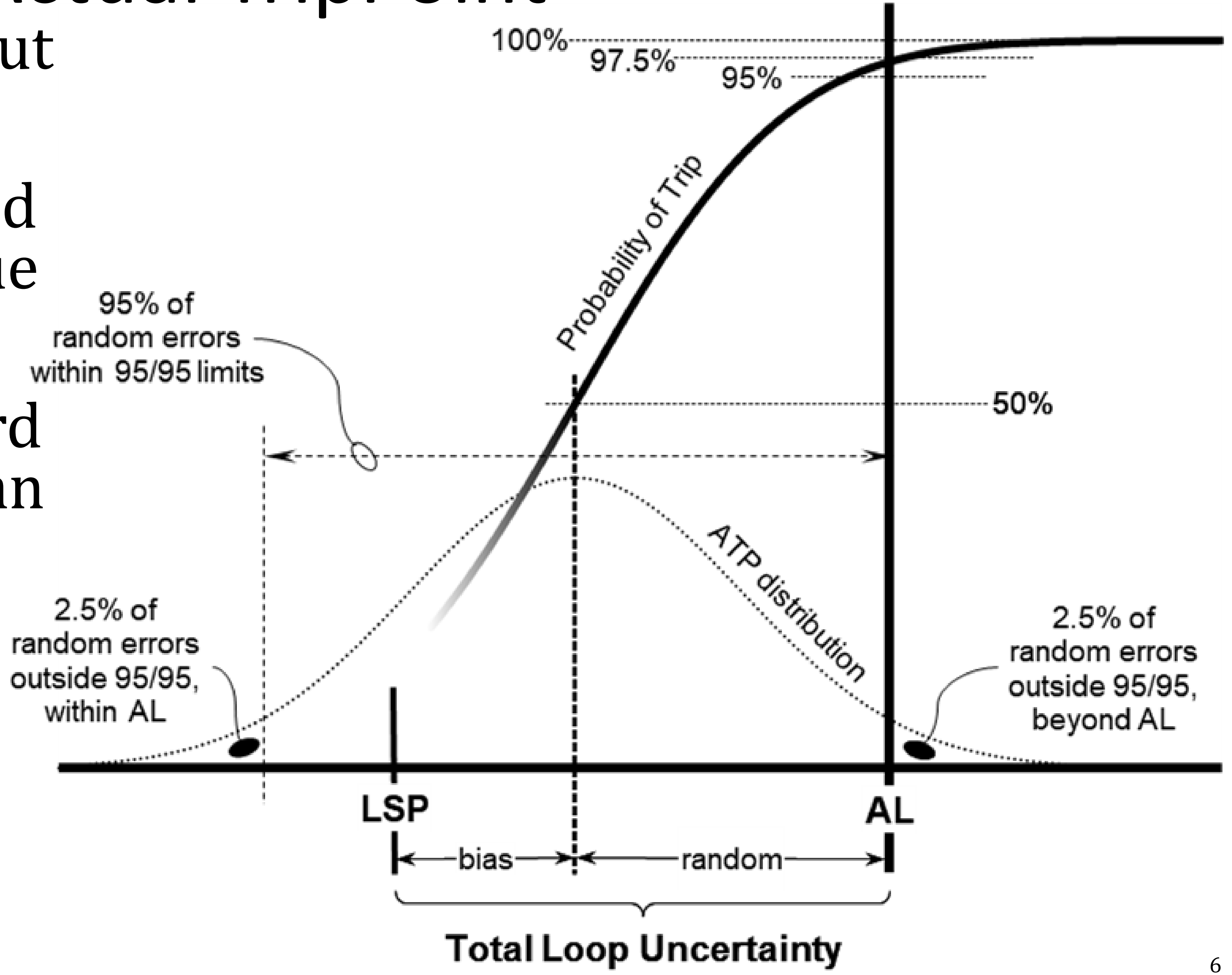
			fixed	***random***
Setpoint	StPt	where the channel is believed to trip	✓	
Actual Trippoint	ATP	where the channel actually does trip		✓
Error		The difference between StPt and ATP		✓
AsFound	AsF	Setpoint as measured at the start calibration	✓	
AsLeft	AsL	Setpoint as measured at the end of calibration	✓	
Deviation		Amount by which the measured setpoint has changed since the previous calibration	✓	
Drift		Amount by which calibration changes over time without consideration of any other influence	n/a	n/a
Limiting Setpoint	LSP	Limiting Value for AsL, to be incorporated into Technical Specifications	✓	
Nominal Setpoint	NSP	Target value for AsL	✓	

Increased Likelihood of Unanalyzed Operation

- ATP cannot be known
  - ATP can only be characterized statistically
  - The probability of ATP in excess of AL can never be zero
- LSP affects the probability of ATP in excess of Analytical Limit (AL)
  - Effectiveness of LSP depends upon adherence to 95/95 (among other things)
  - Failure to meet 95/95 increases likelihood of nonconservative ATP
  - Nonconservative ATP means ATP in excess of the Analytical Limit
- If ATP is beyond AL, the plant could be in an unanalyzed condition

Actual TripPoint

- Presumed Gaussian about AsLeft setting + bias
- AsLeft setting is assumed to be at the limiting value
- 95/95 says 5% of ATP are beyond 1.96 standard deviations from the mean
  - Half are conservative
  - Only 2½% of ATP are nonconservative
- Success probability is therefore 97½%
- DG-1363 accepts 95%



Increased Probability of Failure to Operate

- Successful operation:
  - The safety function is successfully initiated, and
  - the actual value of the process variable does not exceed AL.
  - ➔ *Therefore*: Analyzed conditions are not exceeded.
- Nearly 8× increase in failure rate
  if nonconservative ATP probability is 5% rather than 2½%
  - for two out of four voting in the actuation system
  - assuming accurate estimate of all standard deviations
  - Ignoring hardware failures
    - 7× increase if I&C and equipment unavailability is 10^{-3}
    - 1.7× increase if I&C and equipment unavailability is 10^{-2}

(*From informal 95/95 and SSS analysis, ML19239a261*)

Assessing Setpoint Deviation

- AsF is measured at the beginning of calibration.
- Deviation from the previous calibration is assessed
  – For assessing channel health, deviation in the conservative direction is just as important as deviation in the nonconservative direction
  – Reference value for deviation assessment: NSP or pAsL
    - If NSP, the difference between NSP and pAsL could partly mask deviation
  – Chronic vs acute deviation:
    - AsF "slightly" in excess of the limit is to be expected occasionally
    - AsF "significantly" in excess of the limit should be rare
    - Excessive deviation more often than expected would be cause for concern

NOTE: Deviation includes drift, but is also affected by other factors.

Temporal Extrapolation of the Allowance for Drift

- Drift is sometimes confused with deviation
  - Deviation includes drift and other effects
  - Drift can be measured only under laboratory conditions
- Drift is typically specified for an arbitrary time period that is shorter than the actual period between instrument checks
    - Drift allowance is x% per y months
    - Expected operation is z months, z>y
    - *Drift allowance for z months =???*

Temporal Extrapolation

- DG-1363 defers to the standard
- The standard endorses an “As Found As Left “analysis (AFAL) described in a “Recommended Practice” document that is not endorsed by the NRC
  - The Recommended Practice recognizes that AFAL addresses deviation rather than drift
- DG-1363 explicitly cites the section in the standard that cites the AFAL analysis
  - Tacit endorsement of part of the recommended practice?

Temporal Extrapolation (continued)

- DG-1363 mentions but does not preclude the use of Square-Root of the Sum of the Squares (SRSS) to extrapolate drift over multiple specification intervals
  - SRSS result would be affected by the length of the specification interval
    - The length of the specification interval is arbitrary
    - More or fewer specification intervals per surveillance interval – it depends…
  - For example:
    - Specification interval = ½ surveillance interval: SRSS(½, ½)=0.707
    - Specification interval = ¼ surveillance interval: SRSS(¼, ¼, ¼, ¼)=0.5

Conclusions

- Acceptance of “Single-Sided Setpoints” (95% probability of trip at AL)
  - results in a significant increase in the probability of operation in an unanalyzed condition
- The provisions for temporal extrapolation
  - can produce arbitrary results, and
  - defer in part to a portion of an unendorsed “recommended practice”

References

DG-1141 as released for public comments	ML081630179
Response to public comments on DG-1141 (not issued)	ML15335a085
DG-1141 as modified as a result of public comment responses (not issued)	ML15135a255
95/95 and SSS informal analysis (no concurrence or public release)	ML19239a261
DG-1363 as released for concurrence	ML20055g823
Nonconcurrence on DG-1363	ML20181a524