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BRIEFING ON OPERATOR LICENSING PROGRAM

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TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Allison M. Macfarlane, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

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APPEARANCES

External Stakeholder Panel:

Steve Johnson
Director of Accreditation, Institute of Nuclear Power Operations

Brian Snyder
Vice President, Professional Reactor Operator Society

Andy Barbee
Director, Nuclear Training, Vigil C. Summer Nuclear Station

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Chairman, Nuclear Energy Institute's Licensed Operator Focus Group and Fleet Operations Training Manager, NextEra Energy

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P R O C E E D I N G S

CHAIRMAN MACFARLANE: Good morning. Good morning, everybody. Today we're here to review the agency's practice with respect to the licensing of nuclear power plant operators, and we'll be hearing both from NRC staff and from a variety of distinguished external guests. And having quality operators is essential to safe operations at nuclear power plants, and we think that it's important that the process to select operators is rigorous to ensure that those entrusted with the safety of these plants meet high standards. Additionally, we'll also be discussing operators and their development for the new AP1000 plants with their digital control room, so that will be an interesting part of the discussion this morning.

Coming from an academic background, I am very familiar with the concept of testing students for their comprehension, so I will be very interested in the discussion this morning. But before we begin, let me see if any of my fellow Commissioners would like to make any comments. No? Okay. All right, then what we're going to do is begin with the external panel. And each panelist has 10 minutes for their presentation; I'll introduce each one before -- just before you speak, and then we'll have a period of Q-and-A from the Commissioners, okay? Okay, so I'm going to start with Steve Johnson on my left.

Steve is the director of accreditation at the Institute of Nuclear Power Operations. Mr. Johnson.

STEVE JOHNSON: Good morning, Chairman, Commissioners. I know you're well aware of what INPO's mission is in working with the nuclear industry, I just did want to highlight in a brief time here what our engagement is, specifically with the operator training programs.

As you know, INPO has four cornerstone programs: evaluations, accreditation and training, assistance, and analysis. And specifically in the area of evaluation, INPO does a comprehensive evaluation of all station performance every two years, which includes operator performance and operator training programs. Part of that evaluation is a one-week or two-week-crew performance evaluation, where we watch three crews in the simulator, as well as watch their performance in the plant and in the control room, and assess their performance both from a line standpoint and from a training standpoint. There is right now a strong focus on operator fundamentals, specifically. You know, taking a look at events in the industry and their -- and operations performances as related to that has caused INPO and the whole industry to put a strong focus on operator fundamentals. And we can talk further about that if you'd like.

In the area of accreditation, all station operator training programs are accredited. We bring those programs before an accrediting board every four years, and the process consists of the station doing a comprehensive self-assessment of themselves with external peers; then, INPO sends in a separate team to do an assessment; and then both of those reports are brought before an accrediting board, which are five board members. One of those is a person that's nominated by the NRC. And that board makes a decision every four years whether those programs will be renewed for accreditation, whether those programs will be placed on probation for some period of time, or whether accreditation for those programs is withdrawn.

I do want to highlight the NRC involvement in the accreditation process. Often, there is an NRC observer that goes out with us on accreditation team visits. As I said, one of the accrediting board members is nominated by the

NRC, so of the boards that we conduct each year, one of the five voting accrediting board members is a person nominated by the NRC. And also, frequently, the NRC has a separate observer on the accrediting boards. There's also an annual INPO/NRC meeting that's conducted once a year for us to touch base on things like operator training programs.

So, specifically, for initial license operator training, again, this is looked at as part of every accreditation visit. We monitor performance in the industry as it relates to operator training, and are focused, right now, on throughput within the reactor operator and senior reactor operator programs, because of problems in throughput recently in both of those programs. As a result of throughput issues in those programs, we've work with the industry on a -- what we call a "call to action framework," where we revised guidelines for the industry selection process, how they manage their RO and SRO initial training programs. We've provided assistance to the industry in visits to the sites, and also, we conduct an exam writers' course three times a year to help the individual stations work on the audit exam and the NRC exam, in terms of the skills they need to do that successfully. And that concludes my presentation.

CHAIRMAN MACFARLANE: Great. Thank you. In that case, we will move on to Brian Snyder. He's vice president of the Professional Reactor Operator Society. Mr. Snyder.

BRIAN SNYDER: Thank you, Madam Chairman, and Commissioners and staff. First of all, I'd like to extend my gratitude for our invitation to this very important meeting. For those who don't know -- next slide, please -- PROS is Professional Reactor Operator Society, and that's what we really embody in our membership, to be professional. We want safe nuclear

operations, and we share and communicate with others our knowledge and our professionalism to ensure that we can give constructive input to the regulatory process, and also to the industry on operator issues. Next slide, please.

I'd like to, first, talk about how we feel the operator training is impacted. And I labeled this slide NRC/INPO Reactive Impacts on Training. What that means is we react and change our training methods or processes, for that reason. In several such things as the Fukushima response, SOER 10-2 response, the change in the fundamentals, and the CPE and operator fundamental changes from INPO; INPO LER/SOER response, and regulatory violations that caused us to have some kind of response in our training methods. And I'm the end user. I live it every day when we go into training, and I believe it every day.

Operator throughput -- next slide, please. It's very important to us, because operator throughput is when we start 12 people in our license class, we finish with 12 people, and they obtain licenses; anything less than that is not a success. There are slight variations throughout the last four years, but we are getting better as an industry. The goal should be to be maintained between 80 and 90 percent, to ensure the industry licensing staffing commands are met and plant safety margins are met. Next slide, please.

Next topic I'd like to talk about would be the experience levels required to become a senior reactor operator or a reactor operator to senior reactor operator upgrade. In light of the dilution of our experience in our industry plants because of attrition, whether it be retirement or to seek an opportunity somewhere else in the industry, we have seen a lot of increased inexperience in the control rooms which have led to some input into such things as SOER 10-2

events.

The Professional Reactor Operator Society has an opinion that six months of site experience for direct SROs is not adequate, and that one year minimum requirement for upgrade to SRO is not adequate; and that education is important, but education cannot replace operating experience. The only way that you can get experience is to serve your time. The current ACAD and NUREG requirements allows an inexperienced candidate to progress from senior reactor operator to OSM in a very short period of time. What I mean by that is a model would be if an individual graduates from college with a four-year mechanical engineering degree, and is hired as an operator, within six months he would be a licensed class; within two years, he would be a senior reactor operator.

We feel that they need to go through the process of being a nuclear equipment operator and a reactor operator for several years before progressing on. That would ensure that the experience level would be sufficient that they could actually operate safely and obtain the license. Next slide, please.

The next topic I'd like to discuss would be the differences of the NUREG and ACAD documents on licensing exams. Currently, the ACAD document for initial licensing class recommends using essays, drawings, and short answers during the ILT process. And then, eventually, taking the NRC exam, which is completely objective, not subjective. And it is also used, in an ACAD document, for requalification training, or continuing training, talks about using essay questions or drawings, and so forth. And in NUREG-1021, it clearly talks about using objective questions, using plausible distracters, and allowing for an objective grading, not a subjective grading. And the NUREG clearly states that if you can't have a single correct answer, or for which credit given can vary,

or depending on who grades it or when it is graded, there is no place on an NRC examination. But having said that, PROS has been involved with going to the exam writers workshops, and trying to give input from an operator's standpoint on how we can change things. One of the things we can do is connect the K/A catalog to the NUREG and ACAD documents. Next slide please.

On the topic of initial licensing exams, many of the operators who have taken the exams since Revision 9 of NUREG-1021, describes an ILT question as a two-part question. And, when asked, many are told it's to meet the K/A requirements. I think we can, and PROS also decided that, we can focus on system interrelation and knowledge questions, and have answers to the questions that are plausible, and still meet the requirements of the K/A catalog without making a two-part question where it is difficult to read, where you have to get a proctor's explanation of a question. The question should be able to be read, understood, without any additional explanation. The initial license exams have been what's really keeping people from getting a license, because usually the simulator and the JPMs are passed pretty well. Next slide, please.

Onto requal license issues. Class exam requals, we have seen an increase of closed reference questions; open reference does not mean a direct lookup, so we should test on knowledge and not memorization of trivial items, and there should be a K/A direct link to exam questions. And I have included some examples of PWR example questions for the Commission to look at. Next slide, please.

To continue on with my presentation I'm would like to talk about the Fukushima recommendation impacts. We have seen an increase in staff required to perform walk-downs and engineering support for plant modifications.

We've also seen increased operator staffing to meet additional mitigation requirements. Next slide, please.

Fukushima recommendation impacts have also increased staffing for procedure upgrades for such things as external flood mitigation, spent fuel pool operations, and beyond design basis in SAMG events. Facilities have actually developed organizations for Fukushima response, as well as corporate response. Next slide, please.

The impacts on operator training have increased emphasis on multiple-unit event scenarios, and we have increased emphasis on time-critical actions in the classroom and simulator training. In conclusion -- next slide, please -- I've discussed that we have impacts from INPO and NRC on training, policy and regulations have large impact on training; and the ILT exam and catalog -- K/A catalog, should match each other. We need to increase operator throughput and the NRC exam pass rates. We should allow for a fair and practical evaluation of a licensed operator. Next slide, please. Plant operator experience should be earned with time, not replaced with previous education or experience. Finally, the Fukushima impact, we talked about staffing requirements and performing further analysis of design basis events. Next slide, please. Finally, the operator training has been expanded to ensure operators are prepared for mitigating multiple unit and beyond design basis events. Thank you.

CHAIRMAN MACFARLANE: Thank you. Now we have Andy Barbee, the director of nuclear training at the Summer Nuclear Station. Mr. Barbee.

ANDY BARBEE: Good morning, Madam Chairman. Thank you and thank you to the Commissioners and the NRC staff. I'm Andy Barbee, the

director of nuclear training at VC Summer Station. I want to thank the Commission for this opportunity to discuss the licensed operator training programs.

Over the last several years, much has been accomplished to improve the effectiveness of our licensed operator training programs, and the industry continues to benefit through the sharing of best practices and lessons learned with respect to the selection of licensed operator candidates, pace and content of our training programs, and the NRC examination process. I believe more improvements are possible in each of these areas, and I'm encouraged by the ongoing efforts of the NEI licensed operator focus group, INPO, and the NRC staff to improve the process for licensing operators.

The duration of a typical licensed operator class is approximately 18 months. That's a large commitment on the part of those who are selected as licensed operator candidates; it's also a large commitment on each utility. In addition to resources invested in classroom, in-plant, and simulator training for the candidates, many others at the station and the NRC are invested in the development, validation, approval, and administration of the NRC licensed operator examination. I think that you will agree that all stakeholders benefit from a licensing process that is reliably consistent. In the next few minutes, I hope to communicate a few of the more important challenges that we have collaboratively solved together, others that I believe have a clear line of sight towards success, and then ones that require our continued focus. Next slide please.

I want to share a couple of the past challenges that highlight the benefit of collaborative solutions by the industry and the NRC staff. The first is

the coordination of NRC resources to match the industry requested license exams. Sometimes, those were at odds with each other. A better flow of information was needed between the licensee and the regulator to manage NRC resources and to create realistic licensed operator training schedules. Each year, the licensees are requested to share future examination plans with the NRC, via a regulatory information summary. Forms submitted to the NRC via this process provided a four-year projection of anticipated NRC examination request, and this process has greatly improved the scheduling of licensed operator exams.

Each year, at least in Region II, an exam writer's workshop is hosted in Atlanta. This meeting between utility exam authors and regional NRC examiners is an excellent forum to share best practices and lessons learned from recent NRC examination activities. One item typically discussed at this annual workshop has been a need to revise the generic pressurized water reactor and boiling water reactor knowledge and abilities catalogs for nuclear plant operators. These K/A catalogs form the basis of items selected for inclusion on licensed operator written examinations. The K/A catalogs were systematically developed and based on a review of operator job requirements conducted over 20 years ago. They are simply outdated and require revision. A revision is planned for 2013, and the NEI-led effort will require dedicated resources from both the industry and the NRC to reach a draft submittal of that document.

One issue that requires more discussion and is also highlighted in the NEI's final report of the independent review team for the licensed operator examination process, shares NUREG-1021 inconsistencies across the various regions of the NRC. If we are to benefit from a reliably consistent operator

licensing process, then we need to understand the drivers of these inconsistencies. This is just one of the seven recommendations concluded by the independent review team. Next slide please.

To carry the discussion of collaborative success into the world of new build plants, I want to highlight the work accomplished through an NEI new plant training taskforce to identify code licensing obstacles within the current regulatory framework. The teamwork culminated in the creation of NEI O613 alpha, titled "A Template for the Industry Training Program Description." The document reflects guidance provided by the NRC and industry/NRC discussions on training-related issues; it provides a generic operator training program description for use with combined license applications.

Also, just last year two new knowledge and abilities catalogs for the AP1000, and Advanced Boiling Water Reactor, were issued by the NRC. These catalogs provide design-specific knowledge and skills, and will be used to develop the NRC exams for future license applicants. Another success, in 2012, Vogtle Units 3 and 4, and VC Summer Units 2 and 3 operator training programs received initial accreditation through the National Academy for Nuclear Training.

ANDY BARBEE: NRC personnel participated on the INPO-led accreditation teams for both sites. This milestone for the operator training programs is a culmination of much collaboration between the industry, INPO, and the NRC, to describe an acceptable method to all stakeholders to accomplish accreditation early in the construction phase of each project.

Now, issues with a clear path forward. The first operator license exams at VC Summer 2 and 3 and Vogtle 3 and 4, are currently scheduled before the main control rooms are fully constructed. This timing challenges the

NRC's ability to compare the physical fidelity of the plant referenced simulators to the actual main control room. A new NRC inspection procedure has been drafted, allowing new reactor plant simulators to be compared to the design of the main control room. The first operating exams using these plant referenced simulators are scheduled for December 2013 -- or 2014, so it's a very near-term use of that -- operating the referenced plant simulator. These operating exams are a resource challenge to both the NRC and the licensee, based on the size of the classes, 24 each at Vogtle and VC Summer. Creative examination schedules are being drafted to support simultaneous simulator evaluations across four simulators, two at Vogtle, and two at VC Summer.

Conducting the NRC operator license exams before the plant is fully constructed may also require the use of waivers and conditional licenses; they simply won't be able to access or interact with some of the equipment that may not yet be constructed. A white paper has been developed and is in review at NRC that describes proposed methods for addressing temporary license conditions within current regulations. Next slide please.

Those are some issues that we've solved together; some that I think have a clear line of sight; and some that require additional focus. One of the things that concerns me is the impact the current operator training schedules associate with the Fukushima event. I see this issue going one of two ways, or maybe a combination of the two. A rule changed at 10 CFR 55, or the issuance of NRC guidance that requires a development of related operator training using the systematic approach to training. Industry continues to assess lessons learned from the Fukushima event: initial insights focus on training and realistic challenging emergency preparedness drills to prepare operations and emergency

response personnel to fulfill their roles during an accident. Operator training will be modified as necessary based on development or revision of operating procedures to implement the extended loss of all AC power plan to extend the equipment mission times. This includes proper understanding and implementation of changes to the Severe Accident Management Guidelines, security response strategies, and other beyond-design-basis strategies.

Changes to operator knowledge, skills, and attitudes can be properly vetted using a systematic approach to training based on difficulty, importance, and frequency. We commonly refer to that as DIF ratings. This process helps determine the degree to which a task is covered in the initial and continuing training program based on its complexity, safety significance, and frequency of performance. The same process is used to assess procedure changes and plant modifications, and potentially, alter the operator training program. Force fit of mandatory training without proper adjudication using the systematic approach to training can potentially extend the operator training program, or displace more important items. Next slide, please.

Changes to the operator training programs have and will continue to occur as stations further assess lessons learned from Fukushima. Proper balance must be maintained to ensure that highly improbable events do not displace training for events more likely to occur, and in short, we just need to be very thoughtful on how we integrate all the Fukushima lessons learned into the current training for operators. That concludes my comments, thank you.

CHAIRMAN MACFARLANE: Thank you. Next up is Chuck Sizemore, chairman of the Nuclear Energy Institute's licensed operator focus group, and fleet operations training manager for NextEra Energy. Mr. Sizemore.

CHUCK SIZEMORE: Good morning and I appreciate the Commission giving me this opportunity for the presentation. Just real briefly, Licensed Operator Focus Group is a group sponsored by NEI that has one to two individuals out of all four regions in the industry and various utilities across the industry. And we're essentially the conduit between the industry and the NRC and the actual training organizations in the four regions associated with training. My presentation today is really to just discuss actions in progress to improve the licensed operating process, and actions going forward. Next slide.

Implementation: out of the independent review team, one of the first actions was implementation of the INPO Call to Action, which Mr. Johnson has already spoken to in that. There's a number of items in there, and they are all being evaluated via the current accreditation process. Next slide.

Revision of the current Knowledge and Abilities catalog, although not started yet, all the funding has been collected by NEI and proposals for bid has been put out to potential vendors for a project manager and will be moving forward the first of this year going with that. The actual work with the industry and the regulators is going to be crucial on that, in getting a quality product out that is actually better tied to the systematic approach to training which the accredited programs are to. Next slide.

Reinforcement of current standards for use of bank questions. The use of existing bank questions is essential in being able to establish a level of difficulty consistency throughout the examination, and that we have statistics on that those questions are valid test instruments during that. And then, obviously, the biannual meetings between the licensed operator focus group and the NRC as far as any, you know, either regional consistencies, industry issues, that we

need to fix or address. That's a vital conduit from there. Next slide.

As far as working on consistency in that, there's already been some discussion on the regional workshops, which are excellent workshops. I have attended three of the various regions and their workshops. The establishment of a national examination workshop, we believe will be critical to build that consistency, not only in the industry, but also to help align the regions and any kind of what I'll call grey areas that aren't specifically called out in the NUREG-1021. Next slide.

Additional recommendations on actions going forward. Revision of the examiner standard NUREG-1021 operator licensing standard; that's going to be critical working in conjunction with the revision of the K and A catalog as far as the integrated test improvement plan, which would still include, you know, all three areas as far as the operational walkthrough, the simulator, and the written exam from that, and actually add a little bit more detail in various areas as far as use of references on the exam, validation of the written exam and how we use those validation statistics. And actually a timeline where some of the exams are developed by the utility, there are exams developed by the NRC and an actual structured timeline for the NRC developed exam so the utility can do a proper validation on that. Next slide.

The use of bank questions, we need to establish a process or at least improve the process for approval of exam bank questions so that they can be used similar to what's in the generic fundamentals exam bank and how that's used in development of the generic fundamentals exam which is developed by a contractor for the Nuclear Regulatory Commission and the industry. Next slide.

Improve the current process to communicate changes in

interpretation, actually the implementation of the NUREG-1021. That's really something between the Licensed Operator Focus Group, the group that I chair and working with the regulator so we can get it out across all four regions so that we submit consistently on exam that meets the requirements and the expectations of the regulator.

My last two slides are really on the what I'll call the white paper, the SECY-12-0151 and what I really want to just touch base on here. Over the last 10 to 15 years the training programs have changed significantly using a systematic approach to training as the exam has developed over the last 10 to 15 years. So although the exam averages have been between 85 and 89, both the level of difficulty of the exam has progressed from when I took, you know, my internal exam in '96 to, you know, the current day. But the programs have changed. So both processes have evolved over last 10 to 15 years. Next slide.

And there's some examples of it there, where actually the program I went through at the time was approximately 14 months and common programs now are anywhere from 18 to 24 months. And that's taken lessons learned and things from the industry and improve that process. And that completes my presentation.

CHAIRMAN MACFARLANE: Thank you. And finally we have Dr. Audeen Fentiman who is the associate dean of engineering for Graduate Education in Interdisciplinary Programs and professor of nuclear engineering at Purdue University. Dr. Fentiman.

AUDEEN FENTIMAN: Good morning, and thank you. I was the academic member of this independent review team that's been mentioned so today I'll look at the educational framework for training and assessment; I'll

illustrate the link between that framework and recommendations of the independent review team. And then compare the NRC licensing process with some that are used in a couple of other disciplines, particularly nursing and aviation. Next slide please.

Our charge included looking at the current educational theory and in particular we were asked to look at the relevance framework. And also looking at advances in simulator technology and training programs, of course, that's the systematic approach to training. Next slide please. Just an illustration of the rigor/relevance framework. This can be used to develop both instructional programs and assessment tools, right. If you look at the y axis it's difficult to see there just 1 through 6. And that's your knowledge taxonomy. It's increasingly sophisticated use of knowledge. If you look at the x axis, that's the application model, that's increasingly complex situations in which that knowledge would be used. And then you have the quadrants, A through D, which represent increasingly complex tasks. And these quadrants also help to suggest ways that we might test how well people perform in each of those types of tasks. Next slide please.

This just shows the y axis, this is the Bloom's taxonomy, we start at the bottom with knowledge which is just recall, you look at comprehension, in other words understanding well enough that you could explain it to someone, applying it to a particular situation, doing an analysis of a problem which would then allow you to decide which of the knowledge you have you should apply to solve that problem. Moving up to synthesis, you take knowledge from many different sources and put it in a framework, organize it so you can help solve a problem. And the top one, evaluation, is where you have enough knowledge that

you're able to propose several solutions and then be able to evaluate that and pick the best one. Next slide please.

The x axis then is the application model, starts with just basic knowledge in one discipline then being able to apply it in that discipline, being able to apply it across disciplines and this is of course in the academic setting, then you can move into the real world, predictable or familiar setting and finally at the end or at the top of that is the application of the information that you have to a real-world situation that you're not familiar with, one that may be unpredictable. Next slide please.

This is just back to this framework again and now we're going to focus on the four quadrants, A, B, C, and D. Next slide. A called acquisition is just gathering information, being able to repeat it, being able to apply it in a very well-defined situation. These are the kinds of skills that can best be tested in a written exam, multiple choice questions, all right? Move to B, that's along the x axis, you're getting to the place where you use your knowledge to solve more and more complex problems. These are the kinds of things that can be tested in job performance tests or tasks. Can you change the valve? Go show me, show me that you know how to do that. If we move to C, that's up the y axis, we're into simulation. And this is where you have the knowledge that's part of you. You know it so well you can automatically use it. And you begin to apply it to a wide variety of situations and maybe even provide several possible solutions to problems and be able to pick the best one. This is -- these are the kinds of tasks, the kinds of skills that might be best tested in a simulator where you have a lot of information coming at you and you're finding potential ways to solve the problem and then can evaluate which one is the best. The last one, D, in the upper right-

hand corner is adaptation. This is for solving very complex problems where you know that you don't know everything that you need to solve that problem. But you're able to identify what knowledge you do need and to know where to go get it. These are the kinds of things you would expect senior technical people to know and for the most part that wouldn't be on an initial license operator's exam. Next slide please.

So if I had to summarize the independent review team's recommendations in one slide, which is what I've done here, you know there are many of them and you've already heard about those. I'd have to say that what we're recommending is an integrated exam plan that is well-aligned with the system training program. And the first step in that systematic training program, of course, is to have a good, clear definition of exactly what it is that you want people to learn. Second step is obviously conducting a training program and then the third step is testing for those skills and abilities. And it's important that they be tested in a proper setting. Otherwise the examiner doesn't -- the examiner isn't in the best position to determine whether or not the person can do the task that's being asked.

And then finally, it's really important that the examiner have valid questions. You know, you can be testing the right skills, you can be testing them in the right format, but if the question isn't valid, you are still not able to determine whether or not the person is well-qualified to do the job. So it's really important that you have valid questions and typically those come from a validated exam bank. When we talked with folks across the industry, we found that there was a lot of variation from one region to the other as to how many exam bank questions were allowed. And in some cases every question had to be new. And there are

at least three things that I'm concerned about when every question is new. First of all, some of those questions may not be valid and we just don't know. Secondly, people make a really strong effort to validate all those questions. That takes a lot of time and a lot of resources, and those might be better used someplace else. And then thirdly, if you don't have validated questions, you are not sure of the difficulty of those questions and you end up with some wide variation in difficulty from exam to exam.

So let me close -- my next slide please -- yes, let me close with some information on a couple of other fields and how they handle their training and examination. And the first one is nursing, there the training is formal, you have a degree or a diploma from an accredited program and part of that accredited program will be a requirement for practices and practical experience and what skills you must be able to demonstrate in order to get the degree or diploma. So that's taken care of.

Then you have an examination and it is a nationally standardized examination and it's a computer adaptive exam. And this is for registered nurses. I had no idea that there were so many different kinds of nurses with so many different types of qualifications. But for a registered nurse we have this nationality standardized, adaptive exam, 75 to 265 questions. We say how can it be that different? Well, you start and there are several areas in which the nurse needs to be competent and you start first area, you take a medium difficulty of question, if the person gets that question right then you go to a more difficult question. And then that continues until it's clear that person understands that topic and you move to the next topic. If they didn't pass or they did not answer that first question correctly, then you go to a less difficult question until you find

one that they can answer and then you move up that ladder of difficulty. And when you go through all the areas then you can make the final determination, is this person qualified to be a nurse. You notice this -- every exam, every exam has on it 15 questions that don't count toward the score. Those are 15 questions that are simply there for validation purposes. And then they can be adjusted and checked again. All right. Next slide please.

If we turn then to airline pilots there are five levels of licensing for airline pilots. And each of those requires first of all some training, a college degree, military training or a private instructor. And a certain number of hours of flight experience, each of those prescribed. Then an examination process, and the exam is, again, from examination bank validated by people at the FAA. There are no validation questions on the exam; they are simply validated by FAA staff. The oral test is given by an FAA -certified trainer and a flight test is given by that certified examiner as well. And they tell me they're moving more and more now to flight simulators because simulators have become so faithful to the actual plane, it's safer to do simulator testing than to have them in flights.

So I guess to sum up and say that it's really from the observation that we've had of the NRC process and the comparison with similar process, it's really important to have an integrated exam aligned with the systematic approach to training and the exam is conducted in the appropriate setting and with valid questions. Thank you.

CHAIRMAN MACFARLANE: Thank you. Thank you all very much. We will have a period of questions and answers and I will start off with questions. So my first question is to Steve and to Brian. I know that you both discussed throughput a bit, throughput of candidates and I know, Brian, that you said, you

know, success is if you start off with a class of 12 and you -- all 12 pass. And I'm curious as to why that's success; it's never a measure of success in academia. Not necessarily. It seems that maybe the problem might be with candidate selection, so I'd like you both to comment on that. And I'd like to hear from you, Steve, on INPO's attitude towards that and if INPO's addressing -- you've mentioned something about INPO's addressing that. I don't know who wants to start, why don't you start, Brian?

BRIAN SNYDER: Well, my comment was just basically that everyone who starts a class, they're dedicated to the process and it's a very important process and you dedicate a lot of your personal time away from your family to do a job and do it correctly. And one of the things you have to do is give yourself time and you're right. If we are not selecting the right people then maybe that's part of the process. But if the process is working, if the exam is the reason why people are not passing, maybe it's because the process is not preparing them to take the exam. Or the exam itself is faulted. As I was saying, as far as success, I know from my point of view if I start a license class and I have to go back and take another license exam because I did not pass the first time, I see that as a failure. But overall, the reason why we need to get licensees throughput up, and exam pass rates up, it's because the attrition rate of the industry through retirement and other causes. And to meet the fatigue rule and to ensure that we are getting safe plant operations, we need more licenses. And the only way we can do that is make a new license class. So someone starts at the beginning of the license class, individuals that are there to support him or her to get through that. And at the end he or she should have a fair exam, practical and written, to make that success. Thank you.

STEVE JOHNSON: When INPO and the industry did the root cause analysis on the throughput issue a couple years ago, selection was one of the key causes of low throughput in the industry. And so the call to action, a few of us have talked about here, changes were made in guidelines and assessment criteria so that stations learned from the benefit of stations that had good throughput numbers how people addressed that in terms of the selection process and that was shared throughout the industry. INPO doesn't really have a role to play in the examination, the NRC examination, we focus on "Is there a breakdown in the training that the individuals were provided, was there a breakdown in the management oversight of the process that led to people not being successful?" If all those things are correct, if the training is good, it was good management focus and this individual just didn't put forth the effort, whatever, that's really not the concern of INPO as long as the training programs and the management team did their job.

CHAIRMAN MACFARLANE: Okay, thanks. Just a question for any of you: Have any of you noticed any trends in candidates' abilities over time? I mean, as an academic, I've noticed trends in students' abilities and I'm just wondering if you had similar observations.

ANDY BARBEE: None that come to mind right now, Madam Chairman. Obviously, you know, the makeup of the class has changed considerably. Years past I think the large majority of the folks would have been folks that had a Navy nuclear career. That mix now is changing.

CHAIRMAN MACFARLANE: Okay.

ANDY BARBEE: We've got non-licensed operators that may not have had a previous nuclear Navy experience combined with those that do.

Folks are moving from station to station now, more so than probably in years past. So the makeup of our classes is a little different, so it's kind of hard to compare, you know, draw a trend from that.

CHAIRMAN MACFARLANE: [affirmative]

STEVE JOHNSON: I think the way people learn is much different now than what it was, you know, 30 years ago and what we're finding is that what worked before in terms of PowerPoint slide presentation after PowerPoint slide presentation with the younger generation just isn't the way they pick up material. And so you see the stations have migrated towards glass-top simulators in which individuals who are very savvy in the graphics and the iPods and iPads of today learn that very quickly through that technique and we see the utilities responding to that changing some of those learning methods.

CHAIRMAN MACFARLANE: [affirmative]

BRIAN SNYDER: We'll see much more -- everybody's saying that we have less Navy nuclear trained people. A lot of that's due to the fact of the downsizing of the military, there's less input from that, so then you have to go outside and look at other industries or other methods of getting personnel. We see two-year and four-year college degree persons, we see people from other industries such as automobile industry and other parts of the military, and they do have a vast background. And you do have to change how you teach. And there's many more -- in the last nine years I've had a license, I've seen how we've become a lot more hands-on, more simulator-based. People seem to respond better to that than just giving an exam after you've regurgitated a lesson plan. Thank you.

CHAIRMAN MACFARLANE: Dr. Fentiman. So first, just a really

quick question, I didn't quite catch it on the chart --

AUDEEN FENTIMAN: [unintelligible]

CHAIRMAN MACFARLANE: Yeah. How do you test for D?

AUDEEN FENTIMAN: That one is a tough one.

CHAIRMAN MACFARLANE: Yeah.

AUDEEN FENTIMAN: If I were doing it, I would do some combination of simulator and essay test.

CHAIRMAN MACFARLANE: Right, which is what the industry does.

AUDEEN FENTIMAN: Yeah, it's also very difficult to bring objectively --

CHAIRMAN MACFARLANE: Right.

AUDEEN FENTIMAN: It's one of the concerns.

CHAIRMAN MACFARLANE: And then -- that was the quick question. The longer question is I'm interested to hear about these comparisons. I wondered if you looked into any other fields, like you know, doctors come to mind. And then what lessons can the nuclear industry take away from these other fields?

AUDEEN FENTIMAN: The nursing and aviation were two of them that we looked at, we also talked with the folks from the educational testing service who do the SATs.

CHAIRMAN MACFARLANE: [affirmative]

AUDEEN FENTIMAN: Maybe it was the groups that we chose, but every one of them had validated exam banks that they chose from. Their questions came from those validated banks with difficulty -- degree of difficulty as

associated with those questions to try to standardize the questions.

CHAIRMAN MACFARLANE: And so that's one takeaway.

AUDEEN FENTIMAN: Yeah.

CHAIRMAN MACFARLANE: And then what about the, sort of, the actual simulator or performance testing?

AUDEEN FENTIMAN: They all have a requirement that you prove that you can do the job, not that you can just talk about it but that you can do it.

CHAIRMAN MACFARLANE: Right.

AUDEEN FENTIMAN: And so simulator testing particularly as the simulators get to be more and more sophisticated and more closely modeling the plant or the airplane. Even the people, the nurses now, a lot of the work that they do is with human dummies.

CHAIRMAN MACFARLANE: Yeah.

AUDEEN FENTIMAN: And as those get closer and closer to the real thing the use of those simulators becomes more attractive.

CHAIRMAN MACFARLANE: Right. Okay, okay. Those are my questions. I will now turn to Commissioner Svinicki.

COMMISSIONER SVINICKI: Thank you all for being here this morning, I think that this is a really interesting topic and I think there's a lot of dimensions to what we're talking about today. I'm sure that each of my colleagues here will have different questions for you. It's interesting to me when we're talking about what throughput rates are going to be influenced by the pool that you're drawing from. And Dr. Fentiman, I don't mean to leave you out of this, but we do have biographies for each of you and I know that all four of the gentlemen here came from the U.S. Navy nuclear programs, so you are

representative proof of the fact that historically that has been the large percentage of the -- and I know a number of you either are now or have been licensed operators, so you're very knowledgeable in speaking to these topics directly and also because of your day-to-day responsibilities. And I know that manning requirements have changed in the Navy, so that will be changing, so I appreciate your acknowledgment that the diversity in the candidates is going to change, we need adaptive training for that, and Brian, I think that you spoke to that very, very directly.

Brian, I did want to turn to a comment you made in your presentation because I really want to be sure I understand this. You talked about a progression where an individual with a four-year degree, I think you used mechanical engineering as your example, you said that individual could come out and work for six months onsite, they could enter a training program and in two years approximately they could be not just an operator but an SRO, they could have an SRO license --

BRIAN SNYDER: That's right.

COMMISSIONER SVINICKI: -- and obviously that would be kind of a fast track that would be the quickest that could happen. But your PowerPoint presentation, the slide said it used the term “not adequate” and I think you also repeated that verbally. So I want to understand that because that's a very important point. There's two ways for me to understand what you're communicating there. The first would be that someone going through that very fast track -- the first understanding would be that they would lack and I think just logically would not have the same amount of experience, perhaps they haven't had other functions and responsibilities at the site, they've had that minimal six-

month period and then they've gone into this program to become a licensed operator. The other way to understand “not adequate” is that you feel that it's unsafe for them to go through this. So I wanted to give you a chance to clarify or to communicate is there some data that, you know, people that go through a track that fast are somehow more prone to mistakes or things like that. Or was it more the first understanding which is that on that fast of a track they lack the depth of understanding and experience that other operators might have.

BRIAN SNYDER: The comment was generic and as a matter of fact, that does not apply to everyone. What I mean by that is if someone graduates from a four-year college with a mechanical engineering degree, has a 4.0 G.P.A., very intelligent, can take a written exam and pass it, comes in to the industry and if he's hired directly into operations, he'll spend six months going through and meeting the minimum requirements of being onsite. Then he would attend license class which would be from 12 to 24 months. And in that period he may not have served as a nuclear equipment operator, been in a plant, other than to get tasks done, doing a task to get qualified doesn't mean you can do the task. If you have practice on task and in being in the plant with other people, and gaining the experience of the other operators, that enriches your ability. Then, if you go on once you get out of license classes and you obtain the license that you're trying to get as a senior reactor operator, then maybe you should spend a year as a reactor operator in that experience and gain that experience, gain the possibility of a transient, gain the possibility of dealing with, mitigating a situation as a reactor operator before you step back into the role of supervisor and maybe not fully understanding what's going on. Not that it's unsafe but that experience is very important --

COMMISSIONER SVINICKI: And I know, as I have had the privilege and opportunity to talk to operators when I visited plants, I know that a number of them bring tremendous wealth of experience. Some of them have really come to their desire to be licensed as operators in the middle of their career, not everyone right at the beginning of their career goes in the kind of fast track that you described. I don't know if any of the other panelists would like to speak to this kind of, you know, that it can be done so quickly, is that represent – it seems to me that's not the preponderance of the operators I've met have gone through this really quick fast track out of college.

ANDY BARBEE: I would like to make one comment on that and the program itself is structured so that the candidate would have to demonstrate competencies and throughout their written exam, their in-plant time where they're trained on job performance measures or in-plant tasks right up to the operating exam that we conduct as part of an audit exam. So no one will be able to bypass any of those hurtles of performance before they would sit and take an NRC exam. Not to disagree, but I think the word I would choose to use for that is they may lack proficiency at that particular task whereas they have demonstrated mastery for a particular task, but maybe they have not performed it 20 or 30 times as another colleague. So that is something that we manage at each of our stations if that's part of the error reduction method where we would pre-job brief that task, maybe partner that individual with someone else if they were not proficient with that task. But not to be disagreeable, but I just sense that more a proficiency issue rather than a competency issue.

COMMISSIONER SVINICKI: And I would not represent my observation as being comprehensive but it seem to me when I've looked and

interacted with not just individual operators but with the crew and spoken to multiple members of one crew, it does seem to me that there is at least some consideration of balancing out people of greater and lesser experience so at least that's what I've observed is that there's usually a general diversity even just going by kind of my observation of the ages of the various people on a crew, it seems there's some attempt at balancing the experience levels.

ANDY BARBEE: I agree. I was a shift manager and one of the first questions that we would ask before a task was performed is “Who's done this task before?” And if no one raised their hand, we spent a lot of time discussing that task.

COMMISSIONER SVINICKI: Okay, thank you. And I would note, also, I've had the opportunity to visit the AP1000 simulator at Westinghouse in Pennsylvania, a really different operating environment and I think that the man-machine interface and just the operator to operator the crew interface is -- I had some discussion with Westinghouse, also at Vogtle and Summer that that's going to be a different feeling there because people are able to do more from their station and if there is an event going on, it won't be as clear that they're walking to a panel and they're adjusting something or they're making some modification. So I appreciate in the number of your presentations today you discussed how, you know, we're thinking forward to that and just different ways of learning and so I -- my sense in some of the discussion I had is that we do realize how different that is and we're taking it into account and preparing operators for the future.

Dr. Fentiman, I really appreciated your presentation as well and I wanted to ask the question, would you then observe that in general, are we in the nuclear industry testing too many things in written form that it really would be

better to test in a simulator environment? Have we not taken that as far as we could and do we kind of cling to old ways of written testing for things that with the simulators we have now we should be thinking more and more about reliance on the simulators?

AUDEEN FENTIMAN: I think we need to be testing knowledge and skills where we have the best opportunity to see how well a person can perform them. And some cases you need a written exam but in many cases, showing, demonstrating that you know how to do the job is the best way. Well --

COMMISSIONER SVINICKI: Well, I mean --

AUDEEN FENTIMAN: -- simulators are much better now.

COMMISSIONER SVINICKI: And some of your points, I think, that reinforce that is looking at, you know, the fact that we -- in the written tests if we are not reusing questions, we are not getting the benefit of that validation that is done in other exams in certain instances as you said, there are questions that aren't even graded, they're simply in there to improve the questions as kind of instruments through which we're testing knowledge. That concerns me a little bit, I'll be questioning the NRC staff panel a little bit about our philosophy on that, also our insistence that all answers in a multiple choice question be plausible. I'm concerned that that leads you, given that you are always developing new questions as well, that that's going to lead you to make the discriminators between those choices then might be little trivial bits of information and I'm worried it would cause us to have a reliance on because they all have to be plausible but one has to be one right answer.

AUDEEN FENTIMAN: [affirmative]

COMMISSIONER SVINICKI: You know, the way to get them

different enough might be something trivial, and so that would concern me if we were relying on that. So, again, thank you for the work that you've done on this I think that it's a really helpful perspective to those who were only looking at the nuclear industry. I appreciate that.

And I had one last question for Brian and it may seem a little off-topic but you do represent professional operators across the United States and as we reflect on Fukushima, we think about those very courageous individuals in Japan who were there, the plant personnel, the actions that they did or didn't take. And there, you know, still is much to be learned about what happened there about venting that may be should have been effectuated that was not I'm not asking you to speak to any of what they did, but I would ask you, from your experience, and your responsibilities, and operator and all of those that you're representing here today, should I be confident as an NRC Commissioner that if we were in an accident scenario at a plant the United States and your procedures in a control room told you to effectuate a series of actions like venting, should I be confident that a U.S. operator would carry out those actions?

BRIAN SNYDER: Yes, ma'am, you should. And the reason why that is because venting, when I received my license letter from the NRC, it specifically told me to operate the plant with all approved procedures and policies and follow the management above me to take safe actions to protect the health and safety of the public. And me personally, I live four miles from my plant. I'm in a 10-mile EPZ so my family is right down the road from me. So if I'm on that unit, you are guaranteed that I would take those actions as they're written. And if the managers and supervisors won't let me do that, I will advocate it as much as I can before I take them but I will take them to protect the health and safety of the

public. And so would everybody else with a license. Thank you.

COMMISSIONER SVINICKI: Thank you very much. Thank you, Madam Chairman.

CHAIRMAN MACFARLANE: Okay. Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you Madam Chairman. Thank you all for being here. A couple of thoughts came to me as you were speaking, especially Dr. Fentiman. You looked at what other fields are doing like nurses and pilots. And it occurred to me, wouldn't it be more useful to look at what other countries are doing in the nuclear business, especially the French? I was, I remember at the conference several years ago when the French speakers were claiming, I don't know how true that is, that in the United States we were too compliance-oriented whereas their training program was different, the operator who faces a new situation first is trained to develop a strategy for dealing with it and then to execute the strategy -- I don't know any more details than that. But my question is would it be useful to do that, and not just you, but the other panelists here. Have we benefited from what other countries are doing in the nuclear business?

AUDEEN FENTIMAN: And I do not have an answer to that, we did not look at other countries and I would suspect that particularly INPO has looked at some other countries because they have -- they are working with other nations.

STEVE JOHNSON: The U.K. has an accreditation process that's modeled after us. There's one international station, the Koeberg station that's in South Africa has their programs accredited to the National Academy of Nuclear Training Standards. And there's other countries that have spent a lot of time with

us over the last few years that are learning from us and our accreditation processes, going with us on visits, Spain in particular and EDF as of late who are also moving towards having an accreditation process that's, you know, built after the United States' process.

COMMISSIONER APOSTOLAKIS: So EDF is moving toward our model?

STEVE JOHNSON: Yeah, they had just came out with us on a visit that two weeks ago from EDF, again trying to gather information on the accreditation process and learn from that and move, you know, more like what the U.K. is doing and the United States is doing in terms of accreditation of the training programs.

COMMISSIONER APOSTOLAKIS: That's interesting. Thank you. Another thought that occurred to me as you were speaking, and you mentioned a Bloom model which I'm not familiar with, but I am very familiar with what our Office of Research has been doing the last maybe 15, 20 years in the area of operator performance. And in the beginning, we were interested in what the operator does and what's the probability of doing something wrong then people realized that it was not enough, that we had to go deeply -- deeper into maybe what would make the operator take certain actions and so on. And there were models especially coming from Europe, from James Reason and Dennis Rasmussen that have been adopted here. And models have been developed, you know Athena and other things.

We spent a lot of resources over these years. And on top of that, our Office of Research has also sponsored research in Norway at Halden where they take groups of operators. At the beginning it was Swedish operators but I

believe they brought American operators too. And they took detailed data, how long did it take them to recognize something, how long did it take them to take action, and so on, and it was good statistical analysis. And I didn't hear any of that here. I mean, are we in different worlds, I mean, I would think that what the Office of Research has done could be useful, very useful in fact, in training operators in the Halden results and other things. Is there a gap there that we need to bridge?

ANDY BARBEE: I'll let my colleagues answer this too but just to share one perspective on that, the plants are designed and built and we train operators to operate those plants. Many of the technologies that the Swedish were doing research on is the human factors, how can I interpret information from the main control board, what's very human factored well for that man-machine interface? Now the reason I took this question is on the AP1000, that's one of the hurdles that we will go through is the integrated system validation which is part of the human factors engineering test on the AP1000. So we, to a great degree, look at how is that information presented to the operators and any changes to that will be reflected in the operator training programs. Any modifications to the existing plants that may alter the reading on a meter, the digital interfacing, we have many of our plants to put digital systems in place that completely change the man-machine interface. So we train on those and I see more of what the Swedish is doing as an innovation of man-machine interface rather than here's what we have built, how do we train operators to operate this design?

COMMISSIONER APOSTOLAKIS: The experiments at Halden did exactly that, I mean, you know, I appreciate that the Swedes are doing other

things as well and we are doing other things too. But they actually -- and there was a case, I remember, where they tested four or five groups of operators and all except one diagnosed the problem within two, three minutes and one took 11 minutes. And that's an outlier and they tried to find out why and all that. But my question really is not about the detail, it seems to me that the training programs would benefit by talking to some of our guys in Research and bringing the experiences they have and the models they are using. I don't see why they should use Jim Reason's model, you come here and you tell us the Bloom model and I don't know I mean, I'm sure there's a reason why you did that. So just establish some communication, I think would be beneficial and see what they have learned from the experiments and theoretical studies whether that would be useful to you, that's all. I mean, I'm not saying that everything they do is useful. It is -- it is useful. I have now specific questions. Well, I don't know, do the operators have any idea what the PRAs produce, I mean, the sequences, and the accident sequences --

BRIAN SNYDER: Yes, we do.

COMMISSIONER APOSTOLAKIS: Good.

BRIAN SNYDER: We spoke to operator fundamentals and how the evaluation process with INPO really has re-emphasized what we should study and what we're taught. I actually have a card on my badge at Oconee Nuclear Station with our top five.

COMMISSIONER APOSTOLAKIS: The dominant facts and sequences?

BRIAN SNYDER: That's correct,

COMMISSIONER APOSTOLAKIS: Pretty good, yeah.

BRIAN SNYDER: And we're trained on them, and it's going to be a re-emphasis and refocus for us to know those as a licensed operator.

COMMISSIONER APOSTOLAKIS: I'm glad to hear that. And Mr. Snyder, since you spoke up I have a question for you.

BRIAN SNYDER: Thank you sir.

COMMISSIONER APOSTOLAKIS: On slide 12, you say something that --

BRIAN SNYDER: Okay.

COMMISSIONER APOSTOLAKIS: -- I don't quite understand. Operator training has been expanded to ensure operators are prepared for mitigating multiple unit or beyond-design-basis events. What do you mean "has been expanded?" Is this only recent? I -- the multiple units, I understand --

BRIAN SNYDER: Okay.

COMMISSIONER APOSTOLAKIS: -- but the beyond-design-basis events? You were not trained on those before?

BRIAN SNYDER: We are trained annually with SAMG or design-basis events on an annual basis. We have increased that to twice a year, and sometimes even -- we let our simulator scenarios go to the point where they are getting into SAMG space. So my point being, we never went that far before except for certain times of the year, and now our simulator sessions, instead of being an hour-and-a-half and being very difficult, have grown into a approximately two to three hours and being more difficult to the point where we have a loss of power event and we're having difficulty getting power back. Have to think outside of our procedures in a lab scenario which we had not done as much before, and that's a response to Fukushima and Robinson and other

events. So we do emphasize on beyond-design basis --

COMMISSIONER APOSTOLAKIS: So that's recent?

BRIAN SNYDER: Yes, recent. Yes, very recent. In fact, the multiple unit event training that I received was only about a month and a half ago, but had been in the process of being developed --

COMMISSIONER APOSTOLAKIS: Multiple unit, I agree. Now, Mr. Barbee on a related issue. You said on your very last slide that there are -- there may be unintended consequences among which is displacement of important training content. Then you said that some of these events are highly improbable, therefore the implication is maybe we shouldn't really pay too much attention to them. But at the same time, if you look at operating experience, it's those highly improbable events that unfortunately have very high consequences that are called accidents. So I don't know what you meant there. I mean, should we not spend enough time on these beyond-design-basis-events that are considered highly improbable and yet, they happen?

ANDY BARBEE: Well, let me explain what I meant by that comment. There are many, many lessons learned from Fukushima that we can benefit by integrating that into the operator training programs. So I don't discount that at all. My comment there is to be very thoughtful on how we integrate and to what degree we integrate that. As an example, I think Brian just shared that what we would not want to see is a total focus on the simulator environments of beyond-design-basis events at the exclusion of steam generator tube ruptures, main steam line breaks, those things that have a higher probability to occur. Again, we want to maintain the proficiency of those operators to deal with what, in PRA space, we believe is more likely to occur. So the integration of that just

has to be very thoughtful. Obviously, we could extend operator training programs if we don't do it the right way. We can divert attention in our continuing training in the wrong direction if we're not thoughtful in doing it properly.

COMMISSIONER APOSTOLAKIS: Sure, sure. Yeah.

ANDY BARBEE: So that's what I'm trying --

COMMISSIONER APOSTOLAKIS: A balance is needed, yeah. Thank you very much. Thank you, Madam Chairman.

CHAIRMAN MACFARLANE: Thank you. Commissioner Magwood?

COMMISSIONER MAGWOOD: Thank you, Chairman -- [coughs] excuse me. First, let me thank all of you for appearing today, it's good to see you again. The -- you know, often we have these policy -- what we call policy-level discussions in the Commission and we approve some rule that goes out and it gets implemented and, you know, we go off to the next rule to consider. And it's -- I think it's easy in that context, we think about these big-picture issues to forget that the people that actually have to carry these things out are, in large part, the operators. And so one of the things I was anxious to do today was to first, you know, on behalf of all the operators, you know, thank you for the very, very important work that you do. Because it is clear, especially after we've looked at what happened at Fukushima, it is so important to understand that operators are really the first and last lines of defense when it comes to the safety of nuclear power plants. So the work you do is extraordinarily important.

And in that respect, I appreciate a lot -- I think what my colleagues have gone through a lot of the material I was thinking about, but I wanted to follow up on a couple of things. One is we talked a little bit about this issue about

fundamentals. And as you know, INPO in particular had pointed out some perceived deficiencies in how operators responded to, you know, plant transients and the activity excursions and some maintenance evolution, there were some issues that showed up at certain plants. Give me a sense of what's happened over the last, I guess I would say two years or so since this issue seemed to surface. Have we -- has it been two years? Or is it more like a one year, I guess, because it kind of happened around the same time as Fukushima it seems to me. Have we made changes to try to deal with the fundamentals? Are we doing things now that -- to try to deal with those deficiencies, I'll start with Mr. Snyder?

BRIAN SNYDER: As an operator, we come into the simulator sessions. We actually cover the five fundamentals and we tie our objectives to those fundamentals at the end as well. And we reinforce them. We actually -- if we have an issue on the fundamentals, we carry a card around and we work on that ourselves. Mine's been teamwork for some time, And it's communications. So not only do we talk about it, we've actually engrained it in our operations. Every time we do a debriefing on any kind of job, we cover the fundamentals of the job. We cover why we're doing it, how we're doing it, not just the process. So yes, we have worked on that.

COMMISSIONER MAGWOOD: So how -- and that's new? That's new since the last year or so?

BRIAN SNYDER: That's correct.

COMMISSIONER MAGWOOD: How much more time has that required you to do in training? Has that expanded the training time, or is that just displaced some of the training?

BRIAN SNYDER: We've had additional training on the SOER itself from the supervisor and from an individual contributor standpoint, at least at Oconee Nuclear Station. And it has expanded it somewhat, but it has also been a very valuable tool to get people to realize that the whole basics of being an operator is operator fundamentals. Thank you.

COMMISSIONER MAGWOOD: I appreciate that. And lets sort of shift to Mr. Barbee for a moment because I want to pick up a little bit where you left off with Commissioner Apostolakis because I think that the issue that you were discussing is an extremely important one. You know as -- it does seem to me that it was very much around the time that Fukushima occurred that we were focused on this issue of fundamentals. And one of my concerns has been, over the last year and a half, that just as we recognize that was an issue that we need to deal with, we were suddenly thrust into this other regime of the beyond design basis. And obviously as you know, one of the things that we are in the process of doing is integrating a lot of the severe accident emergency procedures. So there's a lot of things that you're training on within design basis that are going to behind to connect with things that are beyond design basis.

So the training regime is expanding, it's not shrinking. You know, unlike I think -- I guess I shouldn't talk with complete ignorance, but I would think with airline pilots, you're flying a plane doesn't change that much between, you know, 1999 and 2009. In the nuclear business things can change. You expand the horizon; you expand the things that you have to train to. What's -- I want to give you a little bit more how to -- sort of philosophize with us about this. What is your -- can you -- you said, I think that you don't want to see the training for within design basis accidents displaced by beyond design basis. But you know, sort of

answer Commissioner Apostolakis' question a little further. What -- where do you see the boundary lines? How much training do you think is necessary on beyond design basis?

ANDY BARBEE: The training has to be enough to ensure that operators are competent to answer that final question. But to go back into the details a little more, the operator fundamentals, when we started learning more about how we may have drifted our training programs without a focus on operator fundamentals, we took steps to even train instructors. So we modified the training program for instructors. Here's how you need to develop materials so that we can emphasize the importance of this particular task or this particular knowledge back to one of your fundamentals. Next is the development of the materials and the delivery of those, and then observing to make sure that we reinforce that and then can examine that through whether it be a written exam or on the simulator.

So there are a lot of moving parts to just making sure that we do that consistently, you know, whether it's me teaching that or whether it's Chuck teaching that material, we do that consistently and we properly focus on those operator fundamentals. Certainly not a distraction, and I wouldn't say that that is adding any additional time; we're just emphasizing its relevance to operator fundamentals. To try and be efficient with that, we are looking at different teaching techniques, or we can use video or visual learning. We try and integrate that in because it is true that, you know, a picture is worth a thousand words. If we can illustrate something and get that point across in the area of operator fundamentals, then we both improve efficiency and improve the learning process.

All of those things are done systematically, so as we design the programs, where's what we contain within the program based on the difficulty, importance, and frequency of that particular task. Then we build our initial and continuing training programs around that numerical value of how that particular task is weighted. All I was trying to share with the Fukushima events, it needs to follow -- or, I would suggest that it follow that same process so that it is on a level playing field with all the other tasks that we expect operators to be able to perform. That way it competes on a level playing field with content that's in the program, what's covered in the classroom environment, what's covered in the field on our job performance measures or in-plant time, and lastly, what's evaluated on the simulator.

COMMISSIONER MAGWOOD: Appreciate that. Let me sort of go a little step further with this, because one thing that also has come up in conversations I've had with people as I visited the plants is that most operators don't have training to deal with, well I guess I would say, adverse physical conditions. You know, you look at the Fukushima situation, and you have a situation where the lights are off, there's smoke in the air, there's radiation, there may be fires. We don't normally train operators to deal with those environments, so is that something that -- maybe I'll go back to -- to -- is that, Brian, is that something that you talk about in your community?

BRIAN SNYDER: We have, in fact, because we're all former Navy nuclear operators, you get that kind of stress or emphasis somehow. Whether through simulations, smoke generators, whatever. So that stress level and the thinking at the same time is actually tested.

COMMISSIONER MAGWOOD: And I think in the past

Commissioner Ostendorff has talked about that, but as you mentioned, a lot of new operators don't have that background.

BRIAN SNYDER: Right, they're not as experienced. I served four years as a nuclear equipment operator, and we actually had two plant fires at Oconee. One being a paint locker and another being a switch gear breaker. And both times I responded. I felt the heat, I knew the intensity of it, I knew what actions I needed to take. There was some fear in my body, but it was real. And if we have more experiences like that in a simulator situation, it may also elevate someone's ability in a real situation. If we turn off the air in the simulator to simulate loss of power because that's what happens in a plant, and things start heating up. That would definitely test the individuals physically and mentally.

COMMISSIONER MAGWOOD: I really appreciate that comment because we have been stressing realistic scenarios and offsite emergency planning, and I wonder if we ought to be stressing onsite realistic scenarios even though they're beyond design basis. There are things that, if you have some experience with, even if you do it once it probably makes you more proficient. Just one last thing as Commissioner Svinicki pointedly indicated, the four gentlemen here with the operator background, I visited more than, probably more than a couple dozen nuclear power plants since being a Commissioner. I haven't counted, so don't hold me to that. But I think I've seen one woman in the control room. Is that changing, or is that --

BRIAN SNYDER: It's changing drastically, sir. Currently we have a female shift manager at Oconee Nuclear Station. She is the second female shift manager in the history of Oconee Nuclear Station. We have three senior reactor operators who are still actively licensed and two reactor operators still licensed at

Oconee, and we have three or four females in training at this time.

COMMISSIONER MAGWOOD: Well, sounds like I'll make an Oconee visit very soon.

BRIAN SNYDER: Thank you.

COMMISSIONER MAGWOOD: Thank you very much. Thank you, chairman.

CHAIRMAN MACFARLANE: Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Chairman. Thank you all for being here today, I think this is a very interesting topic, and I appreciate my colleagues' questions. You hit some really important areas there, and I learned a lot from those responses. We're all creatures of our experience and I share a common background with you. I spent 26 years in the Naval Reactors Program, and served in six submarines. And I wanted to maybe make a couple comments and I'm going to get to the operator piece of some of this -- I was trying to count up how many people I'd been responsible for qualifying over the years. About 40 engineering officers of the watch when I was an Engineer XO or CO of attack submarines, 30 engineer watch supervisors and 25 ROs. So I was trying to get a data point, though I have no commercial experience at all. I think some of the principles you talk about today, and from your own backgrounds are -- do inform some of the discussion.

I guess my first point would be, I think throughput. In my experience, a college degree does not equal a good operator, and I saw a lot of people who were very smart, could pass all kinds of examinations and can draw a CRDM or, you know, deal with the coordinative PH phosphate control regimen for a steam generator chemistry control, but just because they could do that does

not mean they are a good operator. And I think education does not -- it is necessary, but it is not a sufficient condition in order to be competent. But I did want to comment on -- Brian, your slide put it out. I would say the throughput piece, maybe some history here. I look at Glenn Tracy back there. Glenn's brother Mike and I, from 1990 to 1992, his brother was at Naval Reactors and I was at Bureau of Naval Personnel. I was in charge of all the accessions, I was a nuclear enlisted community manager, so all the accessions for the nuclear field, for the EM, ET, and EMM ratings and all the planning for how many people go to nuclear power school, A school prototype. And this is a data point.

So 22 years ago in June of 1990 when I took -- got that job from my XO and commanding officer tours, the attrition rate for ETs, electronic technicians, those who go on to be a reactor operator, the attrition rate was 50 percent. So if 10 people walked into A school, after going through a recruit training pipeline, five graduated with a 33-53 submarine ET NEC from prototype 18 months later. And so I just would comment that, you know, you all four experienced that, and as Commissioner Magwood and Commissioner Svinicki were highlighting this, that the Navy's program had a significant screening aspect to it. You all made it through successfully and went on to complete the pipeline, but a lot of people you went to school with didn't.

And so, you know, if I was trying to solve -- if I was industry side trying to look at the throughput issue, because I think your pass rate's actually very high. I don't think we're talking about exam pass rate. Actually, it's almost a little too high. And I'd worry about that. I think anything above 90 percent, I'd say well, you know, that's kind of causing me some concern. But if I were an industry or INPO or NEI looking at this I'd want to go back and see what are some of the

aspects of the Navy nuclear propulsion training pipeline that have weeded out people? And so I just made a quick list here on my piece of paper. I was thinking, you know, hard work because you're routinely doing shift work for a routine 12 hours a day, in shift -- prototype at least. You're dealing with not just written examinations, but also oral checkouts. You have to be able to talk to and verbalize on the spot and answer somebody, which most college students don't have to do. Most of it is all written exams. You have to be able to draw systems which may or may not be present in some kind of a college curriculum. I was an engineering student and didn't really have to draw any systems in the Naval Academy, but I sure as heck did when I got to USS George Bancroft to qualify as engineering officer watch.

There's a sense of resilience and sense of some rejection. People say that, no second-class or -- I guess a third-class petty officer or ensign. That's not good enough. You've failed this checkout. Some people don't do well with that, so I go back and look at those things from your own experience and say what were those factors, the attributes of the experience that the Navy nuclear pipeline had A school, power school, prototype and your first qualification, and see how might you use that to help screen candidates. Because I think many people today are not really good at dealing with rejection, and there's a social dynamic, a psychology there that's not fit for everybody. So that's the comment I'd offer to you. Let me shift over to the operator proficiency item that Brian hit on in your presentation. In the six-month piece --

BRIAN SNYDER: Yes sir.

COMMISSIONER OSTENDORFF: We used to call it time on the pond, and six months is not a very long period of time, and I'm not suggesting

that your licensing program time period of 18 months is a long time. I'm not suggesting that you should do anything to lengthen that, but I think you have to realize that the aggregate experience of showing up for work and for seeing different things in the workplace whether your plant is operating or in an outage, that there's an aggregate -- used to, you know, call it wiping the salt spray off our shoulders at sea, but there's an aggregate experiment gained by just being there and seeing things.

And so I would worry -- I'm not saying that six months is not appropriate or is appropriate, I have no judgment on that, but I do think there is a significant value, and it's been demonstrated over the years, of just seeing, being exposed to other things. And some things can't replace experience. And I think you hit on a key -- a very key point there about the experience being so important.

Now, one of the things that -- I was always a little anxious as engineer and as a commanding officer certifying the watch stand, especially as CO, because you're the final person to certify engineer officer watch, but I would never put a brand new engineer officer watch on watch in a section without a strong reactor operator and a strong engineering watch supervisor. And so you're balancing the watch sections to help -- I'm not going to say carry somebody, but recognizing that you don't want to have a qualification process that's so rigorous that you have to have perfect knowledge in everything before you get qualified. Then people will never go through it. And so there's a how-safe-is-safe-enough approach to operator certification in the Navy. I'm not going to say that's your approach, I'm just using from my own experience. But I would suggest that there are ways to balance the experience in -- on a person-by-

person basis in a plant to ensure that that person, he or she can gain the maximum experience possible by who he or she is working with.

Dr. Fentiman, I wanted to comment on your -- I think Chairman Macfarlane asked you a question, about how do you test the number D? That was a great question, and one thing I'll tell you -- I don't think you have to be able to test on everything. I think there's some elements that you can't really ask a written question on, but you can expose operators to different scenarios. And I know when Admiral McKee took over from Admiral Rickover who was head of Naval Reactors back in the early 1980s, there was a concept that he originated called the small-group seminar approach, where you'd have small groups of watch standers that would sit back and go through a very complex scenario, one not covered by operating procedures or casualty procedures. And would just talk through how they'd deal with something using their plant knowledge. And so though we did not test on some of these, there was a training session where people became exposed to the principles and so I don't' think you can test on everything. And there are some things that are so complex that you want people to develop the ability to talk through, use their plant knowledge, and then talk to other operators that will -- what would we do here if we had a fire on this breaker and you couldn't operate this pump that's required for cooling purposes? And there's a lot of opportunity to engage people in that area.

So I thank the Chairman for her questions, I think it really hit on a very important point. Commissioner Magwood and Commissioner Apostolakis I think hit on this point, but I just want to make sure I understand. As far as post-Fukushima action items in training on integration of procedures and so forth, I'm assuming industry is fully capable of sorting out how to balance this training. You

don't need any NRC guidance here. But I could be wrong. Or do you need guidance for how to balance your training time?

ANDY BARBEE: Since you're looking at me, let me respond to that question.

COMMISSIONER OSTENDORFF: [laughs]

ANDY BARBEE: And you've also made me feel a little better, because I was a navy nuke electronics technician. I didn't realize I was so close to the cut line of 50 percent attrition, so I appreciate you sharing that data point. I think what you just shared about something being in the initial training program, but not necessarily evaluating it or, maybe it showing up the continuing training program is an excellent example of we might apply a DIF score -- difficulty importance frequency again -- only Fukushima-type learning. We expose the operator to it, we want to make sure they're familiar with the strategies that maybe are beyond the design of the station, but we may not cover that again in their continuing training program. Or we may cover it in the continuing training, but it will solely be driven by the difficulty, importance, and frequency. So I won't presume that we can't benefit from the collegial guidance from the Nuclear Regulatory Commission, so I know that there's a benefit in helping all of us providing a clear standard to which all of us march. So I'd certainly encourage that. But I do agree with you that through the systematic approach to training I think we've demonstrated that we're able to sift through, prioritize knowledges and abilities for the operators, embed that and evaluate that into the training program. So to the last part, I think we can assess that, yes.

COMMISSIONER OSTENDORFF: Thank you. Thank you Chairman.

CHAIRMAN MACFARLANE: Okay, let me see if there are additional questions. We'll start with -- yes.

COMMISSIONER APOSTOLAKIS: I do.

CHAIRMAN MACFARLANE: Yeah. Okay, and you do. Well, let's start with George.

COMMISSIONER APOSTOLAKIS: I'm wondering, has any of you gentlemen dealt with a training program for operators of BWRs?

ANDY BARBEE: I have not.

COMMISSIONER APOSTOLAKIS: No?

BRIAN SNYDER: Yes.

COMMISSIONER APOSTOLAKIS: You have?

STEVE JOHNSON: Obviously INPO accredits both PWR and --

COMMISSIONER APOSTOLAKIS: So in particular, PWRs with Mark I or II container? You think they're going to be anything different if filtered vents were installed on those machines? Would you train them differently?

STEVE JOHNSON: If it's a new piece of equipment, it will go through the systematic approach to the training process and it will probably -- most likely there'll be training required procedure changes. And people will be trained on those procedure changes, so I would expect that it would.

COMMISSIONER APOSTOLAKIS: Well, that's the mechanics of doing it. Do you think the operators will be helped or impeded in their work?

STEVE JOHNSON: By...

COMMISSIONER APOSTOLAKIS: By having the filters.

STEVE JOHNSON: I'm not sure I understand the question.

COMMISSIONER APOSTOLAKIS: Right now there are no filters in

some of these machines, so you train them in a certain way. Then, maybe, they put the filters on. Would it make the life of the operator easier?

STEVE JOHNSON: I don't think it would make it harder or easier. I think the procedures would be revised based on the scenario to either put in place the filtered vents or, you know, to use the filtered vents or not, and the operators will be trained to use those procedures.

COMMISSIONER APOSTOLAKIS: Okay, thank you.

CHAIRMAN MACFARLANE: Mr. Magwood.

COMMISSIONER MAGWOOD: Thank you, Chairman. Just a question to follow up with something that Mr. Barbee mentioned. You mentioned that there was some inconsistencies among the regions and some of the programs. Could you expand that a little bit? We have a staff panel coming up next, and perhaps I might ask them to respond a little bit to what you --

ANDY BARBEE: Yeah, I'd be happy to. In fact, you've heard us talk at length about the recommendations of the independent review team, and their report -- one of the pages, an entire page is devoted to regional differences. And I'll just cite a couple of those which may be addressed in future conversations. The NRC in Region II provides the licensee with the K/As to be sampled on the evaluation. The other regions, that's done by the licensee. NRC II is more restrictive, allowing few questions that have been used before as compared to the rest of the industry. So the rule there, or the standard, is 75 percent on the exam. And again, that's just a difference that the independent review team identified. They do cite in here all regions restrict the number of open reference questions. So that would be a question where I'm required to pull from maybe a technical specification information or some related document to be

able to respond to that question. Those are called open reference questions. Region II is the most restrictive for the use of those questions. And again, all we're looking for is a reliably consistent exam process. And anyway, that just highlights a couple of the inconsistencies that the team pointed out.

COMMISSIONER MAGWOOD: Thank you very much.

ANDY BARBEE: Thank you Commissioner.

CHAIRMAN MACFARLANE: Okay, great. We will now take a five minute break before we have the staff panel.

[break]

CHAIRMAN MACFARLANE: Okay, okay, let's keep going. Pushing on here, now we're going to hear our staff's views on this issue, and I will turn it over to Bill.

BILL BORCHARDT: Thank you, Chairman. There are no individuals that work at the nuclear power plants in this country that are more important than those that are at the controls and in the control rooms of the 104 operating reactors. It's for that reason that they receive special treatment, and are the only individuals onsite that receive a license from the NRC. I think that license reflects both the trust and the responsibility that the NRC as the regulator and, in fact, the American public, place on those individuals to do the right thing. And I think the issues discussed, and Brian in the earlier panel very clearly reflected how personally they feel that responsibility. We place such high importance on this program for that very same reason, that in the middle of the night when the event is likely to happen, that's the first line of defense. We rely on it and place great importance on that. The program that we have, I believe, is thorough, it's proven, and it's constantly being improved. And some issues were

raised this morning that we certainly are in the process of responding to, and this will never be a stagnant program. The events of 9/11 and the events at Fukushima have both caused plant changes which have in fact, then resulted in changes to plant training and plant operations. The briefing you'll hear from us today is the result of work from the Office of Nuclear Reactor Regulation, the Office of New Reactors and the Regions. They all work very closely together on a continuous basis to put together the best program that we possibly can. So with that, I'm going to turn it over to Ho Nieh.

HO NIEH: Thanks, Bill. Good morning, Chairman, Commissioners. The NRC's Operator Licensing Program is indeed a vital part of the agency's safety mission. We have a mature and reliable program in place. We will brief you this morning today on the staff's activities in that area that support existing and new reactors with headquarters and regional perspectives.

In this overview, I'd like to provide you with some highlights about the staff that carry out the program. We have approximately 80 staff located in headquarters and the regions dedicated to the operator licensing. We have about 50 certified license examiners, about half of which have held either a senior reactor operator, SRO, or reactor operator license. In fact, my colleagues, Mike and Jack here at the table, were both formally licensed SROs. Having staff that have had license control room operating experience adds valuable insights to the work we do in this area.

The talent and skills of the operator licensing staff were also called upon to support other agency programs such as reactive inspections like augmented inspection teams, and fire protection, emergency preparedness, and component design basis inspections within the reactor oversight process. Our

staff's also called upon to support other important agency activities such as responding to significant events like Fukushima, the flooding at Fort Calhoun, and the SONGS steam generators.

A very positive aspect is the high level of interaction among the regions, headquarters, and the technical training center. For example our headquarters' staff get out in the field. They participate on examinations that are administered by the regions, as well as other collaborative efforts such as the development of the new Knowledge and Abilities Catalogues for the AP1000 and advanced boiling water reactor designs.

Our staff is also actively engaged with the industry, as you heard from the external panel this morning. We observe accreditation team visits conducted by the Institute of Nuclear Power Operations, as well as many nuclear accreditation board meetings held each year. We also support the various regional exam writer workshops and licensed operator focus group meetings that are held throughout the year as well.

More broadly, we are working with the industry to strengthen onsite emergency response procedures and capabilities, and that's pursuant to the Near Term Task Force Recommendation 8, and with that overview I'd like to turn it over to Jack McHale for further detail of the program. Thank you.

JACK MCHALE: Thank you, Ho. Good morning, Chairman and Commissioners. Before covering some of the program specifics, I'd like to just briefly go over the high level goals. First as has been stated, we only want to license safe, competent operators, and all of our staff work hard to achieve that goal. To that end, a major part of this is that we have reliable, valid examinations so that the licensing decisions that we make can be made with confidence.

Also as was mentioned, the program is not static and cannot be static. We need to be responsive to operating experience. As an example following the 2003 Northeast U.S. blackouts, electrical grid disturbances ended up in the knowledge-ability catalogues for licensed operators. So things like that, and you'll hear more about new reactors, and also the Fukushima event response as well. Next slide, please.

As I mentioned, a major focus of the program is on the examination process, and during fiscal year 2012, the NRC administered 42 exams, and that resulted in almost 350 new reactor operator, or senior reactor operator licenses. The initial exam consists of a three part format, a written exam, job performance measures, and a simulator operating test, and I'll talk about each of those individually.

The written test has a multiple choice format and it's based on a random and systematic sampling of the Knowledge and Abilities that are defined in the NUREG-Series catalogue for the specific reactor technology. Randomness allows us to make an inference on an applicant's knowledge of the broader base of knowledge, even though we're not able to test everything in one setting and systematic weights us towards the most safety significant issues for operators. The exams are constructed to be valid, and by valid they have content validity meaning they are related to the job duties, and that's insured by the use of Knowledge and Ability catalogues outlining those duties. They are operationally valid, meaning that they test actual mental or psychomotor processes that you have to go through on the job, and that they have discrimination validity, meaning that they distinguish between someone who has mastered the subject matter and someone who has not. It's not a logic puzzle

that you could pass an exam without knowing anything about the topic.

Also, the exam has to be reliable, and to do that it needs to be consistent and repeatable, and we ensure that through our examination standards that are contained in NUREG-1021.

Also, I would like to point out that most exams, the vast majority are prepared by the facilities themselves. The NRC approves and administers each exam; however facilities prepare them and submit them for NRC approval. However, the NRC does prepare one to two exams per region, per year, to qualify our new examiners and also to maintain our proficiency in the exam writing area. Next slide, please.

The next portion of the exam is referred to as the walkthrough portion of the operating test, and that's the job performance measure. And it's a limited scope task evaluation, and it's conducted in a one-on-one setting as shown in the picture with the examiner and the applicant, and the applicant is graded against performance and success criteria. These activities can be control room manipulations, administrative topics, or plant walkthrough. Next slide, please.

The most performance based aspect of the operating test is the simulator test, and this evaluates the applicant's ability to safely operate the plant systems in dynamic integrated conditions. So, this is again practically oriented. This exam in contract to job performance measure is administered in a team format, and there are typically three applicants filling the reactor operator and senior reactor operator crew positions. Scenarios lasting one and a half to two hours in length examine response to normal/abnormal and emergency conditions, and it includes an assessment of the candidate's ability to interpret

and diagnose conditions, manipulate the controls, communicate within the crew, and for senior reactor operators specifically to direct the operations of others, and implement the plant's technical specifications. Next slide, please.

Another key aspect of the program is the requalification program, and this is designed to maintain the knowledge and proficiency level of our licensed operators. You could think of it as continuing education for licensed operators. Requalification programs are accredited by INPO's National Nuclear Accrediting Board, and the NRC regulations require operators to pass an annual operating test, and a biannual written examination.

While the NRC does not develop or administer requalifications exams, we do have an inspection program that checks on the health of this at each site. Part of the inspection does include observation of that annual operating test and our resident inspectors have time set aside each quarter to observe requalification training activities.

The requalification inspection was recently changed to account for some of the challenging reactivity events and plant transients that were mentioned earlier. Specifically, we added additional reactor, or resident inspector observation time in the actual plant control room, as opposed to the training setting each quarter, and they're usually to focus on either infrequently preformed or higher risk evolutions. And also, we've added a section to assess problem identification and resolution, to look at a licensee's ability to improve operator's performance based on how they're performing in the actual plant. So, that's a new component of our requalification inspection. Next slide, please.

As we discussed earlier, several of the Near Term Task Force actions in response to Fukushima are going to impact licensed operators. Some

of these elements would include new equipment, whether it be the use of filtered vents, additional instrumentation, or special equipment to cope with an extended station blackout. All of these represent resource demands in the training area, and also just in routine maintenance and surveillance activities, as well as to use during an actual event. Also important will be the strengthening and integration of procedures such as emergency operating procedures, severe accident management guidelines, and extensive damage mitigation guidelines. The goal is to ensure that the technical basis for those procedures is strong and that there are appropriate transition points, so that the operators are never left in a procedural dead end, if faced with a situation.

Also command and control strategies are essential as well as training qualification and exercises for the implementers, which certainly include licensed operators. In defining requirements, or developing requirements in these areas, had several considerations. First is to leverage the current training and expertise gained through years of operating with our current system of emergency operating procedures. Our currently licensed operators are very proficient, so we want to maintain that proficiency and build upon it for responding to severe accident conditions.

The cumulative effect of all requirements and operators, and their workload needs to be considered and assessed by the staffing studies that are part of the Near Term Task Force Recommendations. Also as was touched on earlier, training will be important for new systems and trying to balance the appropriate level of training for the low probability but yet high consequence events with the more routine operations, or more likely scenarios. Also, consideration to expanding what is in Part 55 for required licensed operator

knowledge to include the severe accident management guidelines and extensive damage mitigation guidelines.

And lastly, the staff feels that exercise will be an important component of this because there really needs to be a means to demonstrate competency in handling severe accidents, and also to monitor our performance in that area so that improvements can be made. Work is ongoing in developing requirements and the staff is soliciting input on all of these considerations via the rulemaking process. With that, I'll turn it over to Mike Junge from the Office of New Reactors.

MIKE JUNGE: Thanks, [inaudible]. Good afternoon, Chairman and Commissioners. I'm here this morning wanted to update you on the new reactor approach to operator licensing. So far, we've been working through -- we've been progressing and no major issues to date. We have resources in place and we're preparing to execute the examination process for the AP1000 design. When we're done, the new reactors will have licensed nuclear power plant operators that have completed a high quality training and qualification program, which has been accredited by INPO. They will be examined by qualified NRC operator license examiners, and will be qualified, and fully prepared to operate the new reactors.

Technical training for inspectors and operator license examiners has been developed for the AP1000, and several classroom sessions have been administered by our colleagues at the technical training center. The NCR simulator is under development and we'll use that to finalize the AP1000 training. At this time 30 examiners have gone through the classroom training and we're scheduled to complete the simulator training in the end of calendar year '13.

The Office of New Reactors has ensured the right resources are in place to allow the regions to effectively and efficiently execute the operator licensing program. FTE has been assigned to each region as well as to the technical training center to qualify license examiners in the AP1000 technology. It takes about two years to qualify as an examiner and our colleagues in the regions have started cross training the current qualified examiners in AP1000 technology, as well as have hired additional staff to support new reactor operator licensing activities. In addition to the qualified examiners in all the regions, we'll have qualified examiners available at the technical training center, as well as in the offices of NRO and NRR, to supplement regional staff as needed for these new reactor exams. Next slide, please.

Approximately six years ago, the NRC staff began holding public meetings with the Nuclear Energy Institute New Reactor Operator Licensing Focus Group, to discuss operator licensing process and new control room designs. We offered to start with a clean slate for operator licensing and we wanted to encourage challenges or discussion on the new process. After many discussions a determination was made by both NRC staff and industry representatives to use the same process that was in place for the current reactor operating fleet. The decision was based on several items, but the most significant item was that the industry has recognized it's a robust process and that they are very familiar with it. So modifications to the process would be evaluated to accommodate the highly integrated control rooms.

One area identified for improvement was in the Knowledge and Abilities catalogues. The industry reviewed the current catalogues and determined that modifications would be needed based on the digital environment

for the new designs. Modifications to the catalogues were a significant undertaking and after two years of outstanding work by both the industry and NRC staff, the catalogues were published last year. There are now AP1000 design specific and ABWR design specific Knowledge and Abilities catalogues available for the staff and industry to use for the creation of operator licensing exams.

To operate the new reactors when construction is complete, approximately 45 operators per unit are necessary. To certify that number of operators, we recognized some adjustment to our process would be necessary. So the staff worked with the industry to determine what changes were necessary in the process, and additionally the staff worked with the industry to develop mock exams, mock operating exams which are held at the Vogtle simulator. The training staffs of both Vogtle and Summer were evaluated by operator examiners from the region, the technical training center, and headquarters. Based on the reviews of these mock exams, changes will be made to the operator examination process.

We've also worked with Region II, as well as the Vogtle and Summer staff, to schedule examinations of operators on the same dates. This allows the administration of one written exam to approximately 100 operators, at the same time, in two different locations. Since there are two simulators at each Vogtle and Summer sites, we can limit the number of operating examination scenarios needed to five, and we'll run one scenario on all four simulators at the same time. Both these efforts will result in a significant reduction of resources required by both the NRC and the industry, to create the examinations while maintaining the effectiveness of the program. And coordination will be key to the

success of the exam. Next slide, please.

As Jack described, the job performance measures are the walkthrough portion of the operating exam, and they are individual versus crew, and these activities usually are administrative such as shift turnovers, staffing, emergency action levels, things like that, control room systems where you would go into a control room and you would start a diesel. You'd align boration, emergency boration, and then there's implant systems where you would go out in the plant and locally reset a breaker, line up an aux feed water pump, and things like that.

For initial operator examinations for new reactors, the in plant job performance measures may not be completed at the time of the operating examination. If construction isn't far enough along, these JPMs will have to be completed at a later time, based on the availability of plant equipment. Operator licenses won't be issued until all portions of the examination are complete, and this is one issue we are working through with the industry to resolve at this time.

Secondly, plant reference simulators are required both for reactivity manipulations and operating examinations. To certify the simulators, detailed design for the instrument and control platform must be completed for the AP1000 simulators. If the simulators are delayed, the applicants will require a scheduled compression for their examinations, and this will affect the operating plant examination schedule, and will be a resource challenge for the agency. Although we hope this is not an issue, contingency plans have been developed to mitigate this challenge. Next slide, please.

So, some of the changes to the operator examination process are required because the designs have changed from this picture. In this

environment it was much easier for an NRC examiner to observe the operator walk to a panel, turn a switch, and get credit for an action. Next slide, please.

Now, it's gone to this. The operators are at a computer monitor and thus it's far more difficult to observe the same action. Either operator can manipulate the controls, and these pictures display the need for the examination process improvements we've discussed. So based on the staff's actions and plans, we will be ready to execute the examination process for applicants, for operating licenses, and ensure they are fully prepared to operate these new reactor designs. Now, I'll turn it over to Mark Haire from Region IV.

MARK HAIRE: Good morning Chairman and Commissioners. I'm going to give a bit of regional perspective -- turn my mic on -- a bit of regional perspective and what I'd really like to do is highlight three specific areas where I think the regional examiners, as well as the headquarters examiners, and the TTC examiners make a significant contribution to the overall safety mission. And the first example I want to focus on is in the quality of the written exam.

Obviously, we've already stated that our key goal is to distinguish in the exam between competent and non-competent operators, written exam is a key cog in that process. And what examiners bring to that effort is skill in what I would call the science of knowledge measurement, how to write and validate a quality question that gets at the knowledge you want to test, and doesn't have flaws in it that allow folks to get around it without having the knowledge you want to test.

So, if I could turn to the next slide, this is a particular, specific example of a written exam question that was submitted to the NRC a few years ago on a draft exam. So, the NRC examiners had to review it. I've eliminated

some of the details in the stem of the question just so it'll fit on the slide. It's not really relevant to our discussion, but essentially it's a classic kind of question format. It has a stem which sets up some conditions in the plant. In this case there's an event in the plant in progress. That's included in the technical plant conditions that I referred to, and then the question asks what should you do. There's a lot of ways to ask/phrase that question, but essentially what should you do now, and you can tell by looking at the options, that this question is focused on the ability to prioritize and utilize the EOPs and AOPs in event response. So, that's a valid bit of knowledge to be asking an operator to demonstrate knowledge on.

And so there's several good points about this question. It asks valid knowledge. It has four options, because that's our standard format. It has one correct answer. It happens to be option D on this question, but it's not really relevant to our discussion, and it has three distracters that are incorrect, but what an examiner would identify in this question is that it has a flaw. What an examiner wants to make sure happens is that a candidate can't eliminate one of the distracters or get to the right answer without the knowledge being tested. If you can use logic, or cues in the stem, or other tricks in test taking to throw out any of the distracters, or get to the right answer, then the question is flawed and examiners would want to correct that, identify that.

And so in this particular question, I want to draw your attention to the options A and B on the question. So, the question was what should you do, and option A poses that you should exit EOP-20 and immediately enter AOP-17. So, that's one possible answer to the question to the question. Option B says the same thing, exit EOP-20, enter AOP-17, and then it has additional information.

Now, if I don't know because I was trained and I remember that the correct answer is option D, then I'm trying to probably find ways to eliminate some of the distracters, and get closer to the right answer, and increase my chances with guessing. So, if I'm tempted to look at bravo as a possible answer and I think that the correct answer to what should you do is exit EOP-20, and enter AOP-17, and then do some other stuff, if I'm tempted to think that, then logic dictates that A is also a correct answer, because it says that you should exit EOP-20 and enter AOP-17. So, if I think B is an answer, that tells me A would have to be also an answer. So, that means I can logically, not with knowledge, but logically eliminate B. So, that's a flaw in the question and that's the kind of thing that examiners look for, just one example of the kinds of flaws that examiners would look for and correct before this question made it onto the exam. So next slide, please.

I want to next highlight another area where examiners bring value, and I think it's not talked about much, but when an examiner is involved in an exam review or authoring an exam as we do once or twice a year, we get a deeper look into licensee's procedures than any other standard baseline inspection procedure that the NRC implements, and so because of that deep look we can identify in procedures that aren't commonly used and aren't commonly reviewed by the NRC, we can identify flaws that need to be corrected. Sometimes those flaws are minor. Sometimes they rise to a more than minor significance. As an example in the 2012 exam, we identified 16 non-sighted violations for procedure quality issues, and that's abnormally high, but it just illustrates that when we get that kind of deep look, we can identify those kinds of issues.

And you may be asking, “What would a procedure quality issue look like?” So, I included an example that on a particular procedure that we looked at, it dealt with what you do when you lose auxiliary feedwater to the generators, and the procedure says, well, “Start one of the main feed pumps.” Now, if you’ve been trained, you know that there’s an inner-lock between the main feed pump and its associated aux lube oil pump. You can’t physically start the main feed pump unless you first start the aux lube oil pump to get lube oil to that feed pump, but the procedure did not say that. The procedure just assumed that operators would know that and implement their knowledge, and so the procedure didn’t provide the kind of Defense-in-Depth that we expect procedures to provide in addition to operator knowledge. And so, what we identified in this particular exam was that eight out of the ten applicants, even though they’ve been trained, didn’t remember in the heat of battle that they needed to start that aux lube oil pump first. The procedure didn’t give them the backup, and so they weren’t able to complete the task. They had to take some very complicated recovery paths because of that. And so that’s an example of where examiners using the exam process and procedure review were able to improve plant procedures by including that kind of information, so that we had the Defense in Depth operator knowledge and quality procedures.

And then on the last slide if you go there for me, I’d like to just highlight the fact that we think that the effective operator licensing program does result in competent operators, operators that are capable of responding to normal and abnormal events, and I’d just like to highlight a 2009 event where there was a fire in switch gear at the Columbia Generating Station, and in this particular event it was in the morning, 7:50 in the morning. The shift manager was out at a

meeting, as shift managers often do at 8:00 in the morning, and so there was just the one CRS SRO license in the control room to direct activities, and then the board operators. And the fire broke out in the switch gear, and obviously it was a fire so that demanded attention, created toxic gas which demanded a notice of unusual event emergency declaration, which is additional load on the control room staff, the one control room supervisor. That fire in the switch gear caused the turbine to trip, which caused the reactor to trip, and that would be something that operators have practiced and they've been trained on, but in addition to those events they had a secondary fault which caused the turbine bypass valves to fail open, and what that does is it causes basically an uncontrolled cool-down event, which further complicates the event.

So in a nutshell, this control room supervisor had to use his training, use his procedures, direct his operators to diagnose and correctly prioritize their actions to get the plant in a safe shutdown mode. And it was a very complicated event, but operators are trained for that, but why I think this is significant that this control room crew was able to accomplish that, to get to safe shutdown is that that control room supervisor, the guy directing all of that was only a couple of months out of license class, and so that's just one example of why we believe that the training program culminated and the license exam produces competent operators, and I will turn it back over to Ho, to finish up.

HO NIEH: Thank you, Mark. I'd like to just leave the Commission with some closing conclusion. The NRC has a robust and effective program that's aimed at licensing safe and competent operators. We have a really talented staff that's very experienced, and their contributions are not only in the operator licensing program, but elsewhere in the agency, and the program while

mature as Bill mentioned, it's not a stagnant program. There are various mechanisms and opportunities in place for us to receive feedback and be responsive to adapt the program as needed, as things affect the operator licensing area. So with that thank you, and we look forward to your questions.

CHAIRMAN MACFARLANE: Great, thank you. All right, I will start off again. First of all let me just invite any of you to answer a number of these questions. In the previous panel we had a number of discussions about throughput of candidates and I wanted to get your views on throughput. Is there a problem, you know. Should 12 people start off and 12 people finish up, or not?

JACK MCHALE: Actually, that's a very interesting question, Chairman, because I think there are many dimensions to it. I guess just to start out, I don't think that it's probably natural to expect that if 12 start a program that 12 will necessarily finish, because there are a lot of things that happen along the way. I'll save the academic part for last, but there are a lot of factors that go into it and really deals with candidate selection. A lot of them are tied to just the personal will and desire to -- once you get into it, that family demands shift work don't look as attractive as maybe the different opportunity did a while back. So, there's some losses from that source.

Also, just there's sometimes some collective bargaining agreement union factors that come into a class selection, in other words it's a seniority based thing. So, if someone's turn to go next, so you know, that sometimes may hamper who would necessarily be the most successful, and also the fact that the training program is rigorous, and this gets more to the academic side of things. Selecting a good candidate is the first step, but there is a pretty extensive program to go through, and some people will have more difficulty with some of

the practical aspects than they may have had with written exams, and vice versa, and it does take work to get through all that. So, it's probably natural to assume that somewhere along the way, you may lose a few. I think the comment was made that the passing rates are maybe if anything seem a little high.

Actually, I think that the passing rates are probably reasonable because of the intensity of the program. Again, if we're talking about -- if the utility does a good job in screening, a good job in training, mentoring people along the way, spending 18 to 24 months in this process, if that's done correctly I think you can be successful with the people that you have. So that resource investment I think is what bears out in the pass rate. However, I think it also contributes to the throughput being naturally lower.

MARK HAIRE: Can I speak to this? I can tell you from the regional examiner perspective, we give zero thought to throughput. If 12 applicants demonstrate knowledge and ability in past exams, we give those guys licenses, and if none of them do, we don't give any of them licenses, and we feel like we've done our job either way.

CHAIRMAN MACFARLANE: Well, that's sort of my attitude as a teacher, and that you find -- I found that different years, some years you have a bunch of smart people and some years you have a bunch of people who struggle. It really just varies, but and you know, reflecting on Commissioner Ostendorff's comment about the 50 percent pass rate in the Navy, you know, there is some value. I know this is a big investment for the industry, but there is some value in terms of keeping standards high and keeping everybody's confidence that the people that you're producing on the other end are really competent in having a weed out aspect to it. So, just my views from the

academy.

So let me ask a couple of different questions then. The previous panel -- this should be a brief one, but the previous panel talked about how the younger generation has different learning styles than us old hearts, and I'm interested in your views on that. You know, should we alter training and examination to meet their learning needs, or and if we do that, how do we ensure that those folks are as adequately prepared as the previous generations? You know, this is something I think that all educators struggle with. I personally don't -- would never let students use their computers in my classroom, because I knew they would always be surfing the Internet, and I actually find great value in writing things down, because I think it commits stuff to memory. But it's true that there are aspects that, you know, especially now with the new plants, they're very different.

MIKE JUNGE: We've had discussions on new types of learning, new styles of learning, but we're on the back end giving the exams, and we have to provide an examination based on the training that the operators have been given. If the industry changes the style of training that they provide, whether it's iPods, electronic exams, things like that, I think we would adjust to that.

CHAIRMAN MACFARLANE: Okay. Then let's talk about the new AP1000 operators, and how they're being trained, and whether you guys think that we'll meet that challenge of having those folks ready when they need to be. I was really impressed when I went to the technical training center, you know, the real extreme difference in the control rooms for the existing reactors and the new ones. I mean they are just completely different, and so it requires, as you noted, it requires completely different ways of determining whether they pass or fail. It

seems to me your job actually may be easier because you can set the computer to score them, you know, based on what they do on the particular computer. In fact, it might be a lot easier.

But one question I -- so, you're welcome to speak to that too, but a question that I have that occurred to me was, you know, we're not the only ones building new plants, and so there's for instance, the EPR is being built in Finland and France. What are their control rooms like? What are their training programs like? What are their examinations of their operators like?

MIKE JUNGE: Since China's building AP1000, we've been communicating with the AP1000 owners group. China is modeling the training programs that the U.S. has. They've been sending people over and modeling our training programs to train their operators. It is a little bit different. As a matter of fact, Commissioner Apostolakis talked about Halden and they do send operators, Swedish operators. The U.S. has sent some as well, and it doesn't take long for an operator to go from an analog system to a digital system. As a matter of fact it might be easier, because the way an operator trains, it's on piping and instrument diagrams. So, it lays out the flow path of all the equipment, and when you look at the screens for an AP1000, that's the way it's laid out, and you can move the mouse and click on a pump. Then you can start it, stop it, or a valve, whereas in the power plants you saw the picture where all the switches were. Well, the operators have to know where all that is. Alarms come in a legacy plant, and it comes up on the screen. Now, they can click on the screen and see everything that can cause that alarm. So, it's a little bit easier, but the training is very similar to what we do for the United States as well as Taiwan. We went to watch their ABWR operator licensing, and they have

copied similar training from the U.S.

CHAIRMAN MACFARLANE: So in terms of the regional offices, I'm interested in how you guys achieve consistency in terms of decision making about exams and et cetera across the offices, because we've heard previously that there was some discrepancies.

BILL BORCHARDT: Yeah, let me just -- I'll let Mark answer this in a second, but the program offices in headquarters own the programs, and have responsibility for providing oversight of the implementation. So I mean that's one layer. Let's say a second layer on this is I think you've heard quite a bit about, you know, a number of workshops, a lot of meetings. The new reactor licensing process has been the result of many, many meetings over many years. So there's a lot of interaction between the industry and the staff to help drive towards some level of reasonable consistency. Clearly, you could centralize the function, and all at the headquarters, and it'd be perfectly consistent, but we tried that years ago, and it didn't work as well as the current model in my view. So, I think we're striving through these kinds of workshops and different meetings to have a reasonable amount of consistency, and the other response that I would have to the discussion from the earlier panel is that we really encourage in this area especially, but in all areas of our regulatory responsibility, that a licensee can call a regional manager, or call a headquarters manager at the moment that there's a problem or, you know, potential inconsistency, to try to get it resolved on a non-confrontational manner. So, you know, we would like to have, again, a reasonable degree of consistency, but so -- Mark.

MARK HAIRE: Sure, I'll just say that I've only operated from Region IV, but we do have a number of things that we do on a regular basis to try

to cross-pollinate and make sure that we're being consistent. We have a program review. The headquarters' office goes out to each of the regional offices once a year to do a program review and make sure that we're implementing the program as required. We have biweekly phone calls with all of our counterparts from all of the regions and headquarters, to talk about issues for consistency. We share examiner resources across regional boundaries for cross-pollination, and knowledge sharing, and then we have a counterpart meeting every couple of years to refresh our knowledge, and restore/reset some of those standards.

And I can tell you that the NUREG, the exam standards has some flexibility, some range of abilities that allow for the number of bank questions on an exam, and the level of difficulty on the exam, and things like that. We've not given any exams that didn't meet those exam standards in any of the regions. So from that perspective, there is a measure of consistency, but there is also an allowed variability in it. Sometimes it depends on the particular exam submittal is whether a chief examiner would review that and go, "Look, you've got bank questions on here that are too easy," or that are, "too many," or -- I know that a question came up a few years ago in Region IV, the exam standard allows 75 percent bank selection, up to, but that 75 percent is based on an assumption that you'll have a robust, large exam bank to draw from. Most of the -- there's not a national exam bank, at least not for the site specific exams, there is for the generic fundamentals exams. That's a lot more standardized, but for the site specific exams, it's up to each facility to maintain its own bank, and the facilities don't have as large a bank as that 75 percent assumption is really based on. And so when we typically see exams that have 25, 30 percent bank questions based on the random and systematic sampling, then when we see an exam that

comes in that has 50, or 60, or 70 percent bank, we ask questions. Then we say, "How did you get this?" "How did you get random and systematic, and still achieve this many banks?" and so it's not that there's a requirement, but that there is a reason to question.

CHAIRMAN MACFARLANE: Thank you, thank you all very much. Commissioner Svinicki.

COMMISSIONER SVINICKI: Thank you all for your presentations. I might just follow up on what the Chairman was pursuing there. I can't find the page now. I have the independent review team report that I think the earlier presenter, I almost asked him what page he was reading from, but he had these regional differences, and Mark, if I understand your answer, you're talking about, you know, our standard template provides some -- allows for some variability, so the regions can choose within a range. But there was one example that had to do with Region II I think was the outlier, and if I'm remembering the example that was given, it was that Region II specifies the knowledge areas, or maybe the things from the catalogue that have to be tested on, and all the other regions allow that to be proposed by the licensees. So, that seems to me something that almost is representative of some philosophical difference about the better way to do that. Do you know why Region II does that and why do the other regions feel that the way that they do it is the preferable way?

MARK HAIRE: I can tell you that Region II is not the only region that does that.

COMMISSIONER SVINICKI: Okay.

MARK HAIRE: Region IV adopted that practice a year ago.

COMMISSIONER SVINICKI: And so, what's the motivator behind

it?

MARK HAIRE: Well, let me explain what actually we're talking about here. The first step in a written exam is to develop an outline, and that outline is essentially a random and systematic sampling of knowledge elements out of the Knowledge and Abilities catalogue. So, there's 5-, 6-, 7,000 Knowledge and Ability elements in the catalogue. We systematically sample those, put them in a list of a hundred, 75 for ROs, 25 for SROs, and then we say, okay, let's write or find bank questions, or modify bank questions to fit that list of knowledge and abilities.

So, the first step is randomly and systematically selecting those KAs. So, it's not a matter of me cherry picking them; it's a matter of random and systematic to develop the outline. So the NUREG -- the exam standard allows either the facility licensee or the NRC to generate that outline.

The problem that we found I think in Region II and both, in Region IV is that we are challenged with when we see an outline come in that has, for instance, 70 percent bank questions, and we ask, Well, how did you get that many bank questions with a random and systematic outline, given the bank size that you have, and there's no way for us to effectively inspect and validate how that random and systematic outline was developed. And so what we decided was rather than spend inspection hours and man hours trying to answer a question that we can't answer, why don't we just develop those outlines in house, and hand those to the licensee, and say, start from here. There's no -- as long as everyone's following the exam standard, there's no fundamental difference in the outcome whether we do the work or whether they do the work, to generate that random and systematic sample plan. In fact, we save them time by doing

that.

COMMISSIONER SVINICKI: Well, I actually think that's very informative, and sometimes -- and that was why I asked you about one specific example. It was not to pick on that, the relative significance or importance of the example that was given by the earlier panel, but I think in hearing that response, I don't know if I'm overinvesting too much in the motivator that you describe, but it seems to me that it almost by your response, you're indicating that there may be lessons learned for us kind of about our process in terms of these variations, that these variations across regions to the extent that they exist, or the regions approach. The flexibility given to them by having different preferences, that there may be value in examining those and saying, do those arise from something that is deeper, and more systematic about -- as you just said, it points out why the region would not want to invest a lot of labor hours in trying to validate something that, you know, the preferred path. And the simpler way to do it is simply to generate it yourself.

So I don't know. Perhaps you already do this, but it seems to me that whatever is the list that I can't find in this report of the regional differences, they may themselves have some really genuine learning in there for us, and it sounds like -- I know you described for the Chairman how generally people talk to people, and they have phone calls, and things like that, but sometimes it's getting down to these specific examples of why do you do it that way, and we do it a different way. You might find out that really there is a smarter way, and again, what I heard from the previous panel is not necessarily a complaint about the variation, but it certainly would simply if they operate plants in multiple regions to have a consistent approach to it. So I think to the extent that we

provide flexibility to the regions, but upon further examination there really is one smart and preferred way to do it. I think that what I heard from the first panel is just a plea for us maybe to narrow that range of differences, and even if it became less flexible, at least they would have a consistent approach across the regions. So I just offer that suggestion as that you are all talking to each other, but maybe again -- and you said it started with Region II, and then Region IV maybe looked at it, and said, “Hey, that does make a lot of sense.” So, I don’t know why the other two regions -- they may yet be yet to come onboard with us, and then it will become the national approach. So I appreciate you giving me a sense.

Can I ask you have you looked at the independent review team report, which again was done for industry, was provided I think not this past summer, but the summer before to NRC, it says, “For our information and use.” You know, there are things in there that I just at my level thought were interesting for maybe some further contemplation. Did you all react the same way? Are there any things you’re taking form that report?

JACK MCHALE: Yes, actually, COMMISSIONER, there are several things. First off, the general conclusion about the robustness of the program and that we are, you know, compare favorably with other industries, was certainly a takeaway from this, but also that there are things that we can work on. And as mentioned, we have a very collaborative working relationship with the NEI Operator Licensing Focus Group, to focus on changing some of these things that were recommended in a matter that makes the process more efficient, namely the Knowledge and Ability catalogue updates. I think those were the chief recommendations that have come out of that, and the staff would support

working with the industry to update those catalogues much using the same processes that were used in developing the new Knowledge and Ability catalogues for AP1000 and the Advanced Boiling Water Reactors. So, we've, you know, used that process and certainly worked on those.

COMMISSIONER SVINICKI: Do we have a procedure or directive that would tell us on a certain frequency to look at the K and A catalogues for updating, or is it like much guidance, just updated as needed?

JACK MCHALE: That's correct. There's not a specific frequency. There have been minor revisions over time. I mentioned we added the electrical grid disturbances. We also -- there's a generic plant-wide Knowledge and Abilities section that was revised at the same time, but it was more or less on an as needed type thing.

Again, we think that the Knowledge and Ability catalogues work now for our exam. We think that they're still -- because the basic plant and the safety functions that operators perform are the same. What we can do a better job of is again, giving that a scrub to make sure that it's up to date, and also look at some of the issues that were brought up as far as seeing if we can define a better examination plan to look at what's the best exam, and in a written setting versus what might be better evaluated using the simulators, or the job performance measures.

Also, you know, we take the comments about the regional consistency, you know, very seriously. We do spend a lot of time looking at those types of issues, and reflecting, you know, amongst ourselves on how we can be consistent. We have our informal interactions. We also have a record interaction process, where if a question comes up in a region, we will write a

formal written response, and give it to everyone, and there's a record of those going back for years. So we have documented our positions to try to force us all to be as consistent as we can, and again, if there are specific issues that come up that we're aware of, we can address those directly, and as quickly as this biweekly phone call where we get the word out. Or if it takes process changes, or changes to our examination standard, we'll do that as well to make sure that we're all operating as consistently as possible.

COMMISSIONER SVINICKI: Okay, thank you for that, and I just had one last question. On slide eight, Ho, I think that was one of yours. You have a statement about looking at post-Fukushima activities and their impacts. I think, yes, it's slide number 8, post-Fukushima impacts. It said that one of the considerations is cumulative effect on operators. I think that your example there was in a proposed -- for proposed rules we solicit for comment on cumulative effects. Is there any other mechanism through which other than kind of asking people, "Hey, does this have a cumulative effect on you?" Do we go out and try to do any assessments or, perhaps, resident inspectors engaging, you know, on this question as they go about and conduct their other activities at plants?

HO NIEH: Thank you, Commissioner. We don't have a formal tool in place that goes to seek input on the cumulative effects for a particular focus group, like the licensed operators. I think the activities we have underway right now are looking more broadly at the rules that were put in place, and how the impacts are across the industry. I do think the mechanism you mentioned, such as the comment periods for rulemaking do provide an opportunity for licensed operators to communicate to the NRC what the impacts are. We have received a number of comments from the industry with respect to the advanced notice of

proposed rulemaking that we issued for strengthening emergency procedures from the NTTF recommendation. But right now we don't have a specific tool in place to gauge what the impact would be, actually, on the operators. We're relying on more surrogate measures such as comments on rules and things like that.

COMMISSIONER SVINICKI: Okay, thank you. Thank you, Chairman.

CHAIRMAN MACFARLANE: Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you, Madam Chairman. Mike and Jack, why are there titles of your branches different?

MIKE JUNGE: I have operator licensing as well as human performance, which is reviewing the human factors that control design for new reactors. So I have a little bit more than Jack.

JACK MCHALE: During the last reorganization, commissioner, in NRR, the human performance aspect was moved to a different branch, so some of the fatigue rule considerations and some of that was moved to a different branch, so for the new reactors area, it's in one location and in NRR it's just a little different.

COMMISSIONER APOSTOLAKIS: I'll repeat what I said to the earlier panel, that the Office of Research has done a lot of work and maybe there's something there that you can use. I don't know. Do you talk to them at all?

JACK MCHALE: Actually, Commissioner, yes, we do. One of my examiners actually accompanied them on a plant visit. I think it was to H.B. Robinson to get a sense of what control room operations were like. Another one

of my staff worked with Research up at Church Street with their tabletop simulator, where they had brought in, I think, college students on summer break to run them through some exercises. And, again, he provided that previously, senior reactor operator license experience to guide them through that exercise.

Also, Region IV has been in touch with Research because there's an ongoing data collection exercise at South Texas plant that we went through a memorandum of agreement with the licensee that we would collect data from their requalification training scenarios and be able to, you know, input it to the research study, without penalizing them too much. So that was the memorandum agreement, but Region IV was tied in with that, so, yes, I think we have been --

COMMISSIONER APOSTOLAKIS: Good. Now one final thing: I remember -- oh, I'm sorry -- Mike.

MIKE JUNGE: I was going to also say that one of the projects you mentioned was determine the best HRA method, and I was involved with that. I've had my staff involved with that. And Jack has had members of his staff involved with that, you know, determining which event and which operators did it right. And also I've been to the TTC and taught a training session to the human factors people, both NRR, NRO and Research. So we bring them down there and I try to make operators out of them. And I think I was successful.

COMMISSIONER APOSTOLAKIS: So we do have the best HRA method now.

MIKE JUNGE: I believe the one I was on was the correct method. Yes, sir.

[laughter]

COMMISSIONER APOSTOLAKIS: I'll make sure I find out which one that was.

MIKE JUNGE: It was Athena.

COMMISSIONER APOSTOLAKIS: Athena. One last question. I was working on human stuff some time ago, and I learned that the pilots, they have those checklists. And most of them are experienced pilots, of course, so they skip steps. And there's a high correlation between accidents and skipping steps. Then through anecdotal evidence, I also learned that a lot of our own operators believe that -- and that may be wrong, but -- believe that the procedures are written for so-called "idiots," and if you are experienced you really don't have to follow every step. You know what you can do by skipping a few steps. And I'm wondering whether that's an issue. Is it true or, you know --

JACK MCHALE: If I can speak to that. When I was a licensed operator and there was no way I would have looked at those procedures as being optional or guidance. In fact, it got to be the -- if you had a step that you could not perform for some reason, there was a step deletion process that you went through and got that changed, reviewed on the spot. So as far as looking at it as a guideline or anything less than a step-by-step process, I don't think that's true. And if anything, I would think in more recent times, the emphasis on a procedural compliance has improved within the industry. My experience is a little dated but based on the engaged thinking organization report that INPO put out, and also the operator fundamentals, that's something that's, I think, being stressed more and more, and I think if anything I think operators would say that the procedural compliance aspect is stressed more than ever, you know, in the past, or more than it was in the past. And certainly, you know, flying by the seat

of your pants or whatever would never be acceptable.

HO NIEH: The analogy I would use is that procedural steps are like the direction in Commission SRMs.

COMMISSIONER APOSTOLAKIS: Oh, there must be a cleaver line there, which doesn't come to my mind.

[laughter]

So the whole thing is anecdotal, but it's false. That's what you're saying. I mean, it's not that they don't think that a step is important, but if you're experiencing that, you can go down a few steps. And I don't know whether that's important or not.

JACK MCHALE: Again, I don't think that experience -- in fact, if anything, as someone progresses to the shift manager level, their job is to reinforce expectations within a crew, and part of that is the procedural compliance. And it was mentioned earlier about the pre-job briefs and especially for this is a first-time evolution, that is a, you know, before the evolution takes place, it's a step through and discussion of exactly what's going to happen. So I would be very surprised to find that during one of those part way through, it would -- well, then we'll just -- we don't really need to do this. We'll go here because I know better than what's written. I just don't see that as a likely scenario.

HO NIEH: And one thing I would add is our inspectors look for procedural adherence. And part of when we go on site and after an event, or during the routine resident inspection, part of what we'll do is we'll look at how the operators at the facility or the maintenance workers are following procedures and the particular steps. So I think we don't look favorably upon situations where we

find, you know, a licensee hasn't followed specific steps in a procedure.

COMMISSIONER APOSTOLAKIS: Okay. Thank you.

CHAIRMAN MACFARLANE: Commissioner Magwood.

COMMISSIONER MAGWOOD: Thank you, Chairman. Just following up on that point. I think that from what I've understood that a larger concern isn't so much that operators skip procedures. It's that they adhere to procedures. I don't want to overstate this, but in a sort of a cookbook fashion. That's a bigger concern, that they've become a bit detached from -- as we discussed in the previous panel -- fundamentals so that they follow procedures. They think that takes care of the problem. And, of course, if the procedures aren't comprehensive, you might run into a problem if the operators aren't watching those, understanding exactly what's going on. That's when things can happen. So I know that's the reason that the industry has gone back to -- the fundamentals -- been stressing that to highlight that point. I don't think that this is something that's, you know, an epidemic, but certainly it's something that was – there were concerns there were some instances that we mentioned earlier.

In that respect, one of the things that, like Commissioner Svinicki -- I also visited the simulator with the AP1000, and, you know, certainly impressed with the technology and, as we sat going over the control systems, it was interesting to see how easy it was to bring procedures up and to actually have contextual screens come up so that, depending on what was going on, the right screen would come up, and it would sort of give you the right options and you almost sort of saw yourself mouse-clicking your way along.

I would think that this issue of the checklist mentality that the industry has been concerned about. I would think with the new plants that this

would be an even larger concern. Is this something that's been discussed?

MIKE JUNGE: Yes, we talked about it many times -- is that we don't want the computer making the decisions for the operator when there's a decision point. And we've talked about it several times as part of the exam taking that away, so that they would have to use paper and make decisions. Because, like you said, when it comes in there'll be a green check or the color will be green on the number that they're supposed to look at. Well, if they do go look at that actual indication, it may be correct, but we don't want them relying on that computer-based procedure to make the decision in all cases. We still want them thinking. So, yes, it has come up many times. As a matter of fact, we've gotten to the point where we're actually saying, "Somewhere during your exam, you're going to lose this, at least on one of the scenarios." And I don't think the industry is pushing back hard on that. But that is an issue that we are watching. We're trying to make sure that the operators are constantly thinking about the indications that they have.

COMMISSIONER MAGWOOD: I appreciate hearing that. This is quite interesting. I know, going and sitting back there -- one thing that -- and we haven't seen the applications yet for the small modular reactors, but we are hearing from the sidelines, so to speak, that they're hoping to have more automation, not less automation in these systems. So it will be interesting to see the interplay between the kind of work that you're doing and these new systems, because there may be some conflicts there that we haven't had a chance to sort out yet. So I guess we'll see when we get the first applications, assuming those actually come in.

I think the Chairman and Commissioner Svinicki discussed the

issue of consistency. I wanted to highlight one aspect of that, and that is I was interested in hearing -- I forgot which of the previous panel members mentioned this, but that Region II holds, I think it was an annual workshop of exam writers. And that there were some aspiration, perhaps, you can go national with that and have a national level exam writers or exam givers. That sounds like the sort of thing where you would be able to work out those kinds of inconsistencies, and to the degree we wanted them to go away would be vetted. Is that something you're trying to move towards?

JACK MCHALE: Yes, Commissioner, we are working with the focus group to set up the National Examiner, Exam Writers Workshop, hopefully in 2013. As far as the regional events, we find those to be valuable and, in fact, usually myself or one of my staff attends the regional -- I've been to exam writers workshops in Region II and Region III this year. So we try to inject ourselves in the process so we can also pick up directly from the licensees talking with the regional operator licensing folks what issues they may be having and seeing if any of these types of inconsistencies that bubble up and get to our attention. So, yes, we would support the national, bring everyone together workshop, and also we'll continue to attend the regional ones because there's benefits there as well.

COMMISSIONER MAGWOOD: Just to make sure the Commission is aware of the national event when it comes together, it'd be worthwhile to have the meeting record reflect, perhaps, a CA note or something to the Commission just to keep us abreast of what's going on with that. I find that interesting. Like to stay in tune with that.

We also, in the previous panel, had a brief discussion about adverse conditions the operators could face under extraordinary circumstances:

fire or smoke, lack of lighting, that sort of thing. Is this something the staff has talked about as well, particularly in the aftermath of Fukushima?

JACK MCHALE: I don't believe we've looked at that directly as far as maybe to the extremes. Most simulators are set up that the lights will go out at the appropriate time based on the electrical bus losses, so that's something that's already built in as far as making the air conditioner go off and become uncomfortable that way. I don't think we've gone there yet.

For fire, I would point out that most responders to fires are fire brigade qualified, and utilities will typically -- at least, again, my experience years ago was went to one of the Maryland national fire academies and put on the air pack and went into the trailer full of smoke and pulled out the cadaver or whatever it was. And so there was some practical training for specifically for the fire one -- that was the smoke and heat.

As far as control room and longer term, maybe scenarios that go on for days, and how you relieve crews on site and feed them and all. I don't think we've really fleshed out what that, you know, what level of training --

COMMISSIONER MAGWOOD: Well, it really goes beyond a control room, doesn't it?

JACK MCHALE: Right.

COMMISSIONER MAGWOOD: Because the operators, under a certain circumstance, can be expected to go into the plant and turn valves or perhaps even move pipes under the right conditions.

HO NIEH: If I can just add to that discussion. What we're doing with Recommendation 8 in the advanced notice of proposed rulemaking. One of the elements we're looking at right now is the training and qualification

requirements, so I think that does provide an avenue for us to ask ourselves that question as far as how do we introduce realism into the training for these events that would have more extreme environmental conditions?

COMMISSIONER MAGWOOD: I think it's worth at least exploring because it does seem to me that certainly when you go through the training, you know what to do but do you know what to do if there is a fire right there and the smoke's in the air and you're wearing a mask and alarms are going off and there's a high radiation environment. And are you going to be able to calmly go through your checklist? That's something I think that, again, as Commissioner Ostendorff was the one that sort of highlight this from his naval experience. You know, if you don't actually go through that experience, you don't know, you know, how you're going to react. So I do think it's something that's worth exploring.

Commissioner Apostolakis talked about the work at Halden. I'm less familiar with it than he is. And one question I have about it is has Research looked into what the limits are for human training. Can we simply keep loading procedure after procedure, requirement after requirement and not expect to see a fall-off in proficiency? Is there an infinite well that we can go to? Has that ever been examined?

MIKE JUNGE: Not that I know of. I know that they've done a lot of work on, say, a screen. They can put a ton of information on a screen and make it visual. But I haven't seen anything or heard any work on how much an operator can take as far as procedures.

COMMISSIONER MAGWOOD: I just hope we haven't reached the limit yet. [laughs] All right, well, thank you again. Thank you, Chairman.

CHAIRMAN MACFARLANE: Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Chairman. Thank you all for being here today. I also want to thank Commissioner Magwood for having proposed this meeting a while back. I think, you know, there's not any direct policy issues that we were aware of at the time. I think that this has been very informative. So thank you for proposing this meeting.

Ho, Commissioner Apostolakis may not have appreciated the analogy, but I liked your Commission SRM analogy, so thank you for offering that to us. [laughs]

The first panel discussed a bit about the six month time period for experience and maybe suggested that that may not be sufficient. I'd be interested in any thoughts anybody here may have on that topic.

JACK MCHALE: If I could, Commissioner, I would like to address that. There's more to the story than six months. The typical way that the experience requirements are laid out in the nuclear -- Academy for Nuclear Training Accreditation and the ACAD series documents. And, you know, there's one for initial licensing that talks about basic eligibility requirements, education, experience, and for an instant senior reactor operator, as they're called, this would be the person with a college degree that would go directly to the senior reactor operator level as opposed to going through the reactor operator first. There's a six months onsite experience but there's also 18 months of what's called "responsible nuclear plant experience." And that is something like a staff engineer at the plant. And actually, if it's at that plant, it counts one for one. But if you're doing it at -- let's say if you came from additional site, there's a 1.5 multiplier on it, so it would go to 27 months at a different type of facility. So you have at least that amount of experience, which could overlap the six months, and

then there's the training program, which is another 18 months to 2 years. And typically as part of that training program, you're going to get some experience. It won't just be control room simulator. You'll start walking around with the auxiliary operators and making the rounds. It's not the same as being qualified and serving in that position for a number of years, but certainly there's a degree of familiarity with that. It's about the same level of experience, but it certainly is significant experience.

So, again, I don't look at that as being inadequate or whatever, but rather it's a very basic requirement that you're at that site as opposed to trying -- you mentioned movement within the industry. It's meant to address that but allow the flexibility to bring the people into the pipeline that you wish. And, again, there's more to it than just a bare six months, so.

COMMISSIONER OSTENDORFF: Okay, thank you. That's very helpful.

Let me turn to another question. I know that Commissioner Svinicki and Commissioner Magwood have already touched on this. Let me just add one question. This is the area of operator training. Do you all have any concerns or are you flagging any potential concerns in the area of training required as a result of any of the near-term task force Recommendation 8 actions?

JACK MCHALE: As far as concerns for --

COMMISSIONER OSTENDORFF: As far as balancing training, prioritization -- Commissioner Magwood, you know -- overload issues and --

JACK MCHALE: I think the issues are, you know, still being worked out as far as what the final requirement for training is, but, again, I think it has to be an informed decision to balance between the low probability, high

consequence events and, again, the more routine operations. So that is definitely a factor that we would consider in coming up with a training requirement.

Also, I think the fact that if we move to having a systems approach to training being the way that the new training requirements would be approached, that lends itself to doing that job task analysis, finding out what those duties are and incorporating them in the training programs as appropriate. The plants, when they were built, they've all been modified, basically, continuously over their lifetime. And I would almost venture to say that perhaps something like an extended power uprate might be more of a change for the operators than maybe some of the incremental changes to look at different procedures and transitions. So I think, you know, anyone involved with nuclear power plant training has continuously been adapting to what's coming, because these plants are not the same as they were 20, or 30, or 40 years ago when they were licensed.

COMMISSIONER OSTENDORFF: Okay, thank you.

BILL BORCHARDT: Yeah, Commissioner, I just -- you know, from a high level, we're sensitive to the issue. We don't want to displace important training. There will be requirements to be trained on flex equipment and on various provisions coming out of Fukushima lessons learned, that's obvious. We are approaching it in a much more holistic so that we're taking a broad view of the current requirements so that we have a well-qualified, well-trained operators throughout the plant. Because this impacts not just licensed operators that we're talking about today, but the AOs have training programs that everybody in the plant has, you know, variety of different training programs. So we're sensitive to

this.

COMMISSIONER OSTENDORFF: Okay, thank you. Mike, a question for you on your slide 10, and, on the -- you talk about design-centered approach and how that might change the philosophical orientation for how you develop questions, or at least that's how I understood. Maybe I didn't get that right, but --

MIKE JUNGE: For the Knowledge and Ability catalog, for design specific --

COMMISSIONER OSTENDORFF: Yeah, yeah.

MIKE JUNGE: What that did is if we were to try and create new Knowledge and Ability catalogs for the operating plants, we'd have a hundred Knowledge and Ability catalogs, because they're all different. We took advantage of the design, the AP1000 design, and we created a design specific catalog in which it's not as generic when -- each catalog would have a reference to a system. That system would discuss every interface with the other systems in the plant, so what that does is it provides design-specific systems associated with each Knowledge and Ability. So that was one of the big benefits that we gained from that. We adjusted the stem statements a little bit to make sure that we wouldn't duplicate questions. Right now, I believe with the older catalogs duplication of questions could come out based on the interface. So the interface has really changed. Each system is described versus a generic system. So those are the big, the major changes to the Knowledge and Ability catalog.

COMMISSIONER OSTENDORFF: Thank you. Finally, Mark, I don't have a question for you but I just want to tell you -- I think your examples you provided at Columbia Generating Station -- the event there and your other

examples of test questions, those are very helpful. So thanks for those. The context is very helpful. Thank you, CHAIRMAN.

CHAIRMAN MACFARLANE: Do any of my fellow Commissioners have any further comments, questions? Yeah.

COMMISSIONER MAGWOOD: Just more a process question. Do we have an internal procedure against having people wear Dallas Cowboy at the Commission?

[laughter]

COMMISSIONER OSTENDORFF: I think we highly encourage that.

[laughter]

COMMISSIONER MAGWOOD: We'll have to look into that.

CHAIRMAN MACFARLANE: Excellent point. [laughs] All right, well on that note, I will thank all of you very much for your excellent presentations and the previous panel as well. I think it was a very fruitful morning, and at this point, we are now adjourned.

[whereupon, the proceedings were concluded]