

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BRIEFING ON OFFICE OF NUCLEAR REGULATORY RESEARCH (RES)
PROGRAMS, PERFORMANCE, AND PLANS

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PUBLIC MEETING

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Nuclear Regulatory Commission

One White Flint North

Rockville, Maryland

TUESDAY

April 13, 2004

The Commission met in open session, pursuant to notice, Chairman
Nils J. Diaz, presiding.

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COMMISSIONERS PRESENT:

NILS J. DIAZ, Chairman of the Commission

EDWARD McGAFFIGAN, JR., Member of the Commission

JEFFREY MERRIFIELD, Member of the Commission

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE

Secretary

General Counsel

MICHAEL MAYFIELD

MARK CUNNINGHAM

JACK STROSNIDER

CARL PAPERIELLO

ASHOK THADANI

FAROUK ELTAWILA

MABEL LEE

PATRICK BARANOWSKY

P R O C E E D I N G S

CHAIRMAN DIAZ: Good morning.

The Commission is being briefed today by the Office of Nuclear Regulatory Research on the status of their programs, performance, and plans. You know I do believe an effective research program is indispensable for this agency to be able to conduct the very technical work analysis, all of the things that sometimes are buried between rulemakings and inspections, and all of that technical mass of work that is in there and supports everything that we do.

We, the Commission, of course, is interested in knowing how research is supporting our organization, what are the things that we are doing that resolve our present problems, and how we're looking at the future.

Last year a significant amount of discussion in homeland security, materials degradation, advance reactors, spent fuel transportation, I'm sure some of those items are still on your plate. During the year, the office participated in many other activities, such as supporting the battle over risk-informed decision making, performance, pre-application of uses of advanced reactors. And all of those activities form a part of this network of technical and legal issues that we handle day in and day out in the agency.

I'm sure your agenda covers many interesting topics. I'm sure the Commission will have a very interesting meeting.

Before I go any further, I would like to stop for a minute and recognize Ashok Thadani for his 30 years of work to the Commission in

many, many different ways and all of them with tremendous amount of dedication and commitment. We thank you. We know that after this meeting you're going to be handling and taking on a different hat. I appreciate your willingness to come and support the efforts of the agency and the Chairman in the area of international development programs. We believe that now you can look at some of your achievements in the past, and we're going to make sure that you put them to work in many different arenas.

We also will welcome shortly Dr. Paperiello in his new hat. We look forward to you two gentlemen working closely together because we need you both. With that and before we get started, do my fellow Commissioners have any comments?

COMMISSIONER MERRIFIELD: No, Mr. Chairman. I would just like to associate myself with your comments regarding Ashok Thadani. He's done a terrific job, and we appreciate his service and his future service.

MR. THADANI: Thank you.

CHAIRMAN DIAZ: Thank you. Now I turn the meeting to the EDO -- I'm sorry, the acting EDO.

MR. PAPERIELLO: Okay. Thank you, Mr. Chairman. Good morning, Chairman and Commissioners. And we're here today, as you said, to update the Commission on the status of the research program, and highlight some of the significant activities, and to answer your questions on matters you'd like to discuss. You know, as other briefings, this is only going to touch on the surface of a number of issues. You've provided with

background materials, and you can see it's fairly extensive that Research has had its activities in essentially areas that are covered by the other program offices, both NMSS and NRR, and NSIR.

Joining me at the table, of course, are Ashok Thadani, and Jack Strosnider, the Director and Deputy Director of Research; Farouk Eltawila, who is the Director of the Division of Systems Analysis & Regulatory Effectiveness; Mike Mayfield, the Director of the Division of Engineering --

MR. MAYFIELD: Technology.

MR. PAPERIELLO: -- and Mark Cunningham, who's the Deputy Director of the Division of Risk Analysis & Applications; and Mabel Lee, the Director of the Program Management & Policy Development.

I would like to join you in thanking Ashok and Jack for their dedication and leadership in successfully guiding the Office of Research for the last few years. And with that I'm going to turn the presentation over to Mr. Thadani.

MR. THADANI: Thank you very much. Thank you, Mr. Chairman, Commissioners, and thank you, Carl.

As you have noted, this will be my last briefing of the Commission as Director of the Office of Research.

I am indeed very proud of the Research staff and the talent that they have and the many accomplishments that they have achieved during my stay with the office. I know that none of this would have been possible without strong Commission support. And I very much want to thank you for

that support I know that the office has received over the years.

If I may go to viewgraph Number 2, that's right, the outline.

What this outline reflects is the topics that I'm going to cover. I'll spend a few minutes discussing the mission that Research's activities are designed to fulfill. I then provide highlights of some of our significant accomplishments over the year, and they do cover the full range of programs. And then look ahead to major products that we expect to complete in the 2004-2005 time frame. I'll then proceed to discuss some of the challenges that we face and the steps we are taking to deal with these challenges. And then, of course, end with a brief summary.

May I have viewgraph Number 3, please?

Now, let me begin by discussing the mission of the Office of Research. In SECY-99-281, we provided to the Commission a discussion of Research's role in helping the NRC fulfill its responsibilities. The main elements of Research's programs are captured on this slide, and they're really driven by Commission directed research and conducting confirmatory user need driven research performed at the request of NRR, NMSS, NSIR, and sometimes the regional offices to provide a sound technical basis in support of licensing, inspection, and rulemaking activities, as the Chairman noted in his introduction.

We also conduct anticipatory or sometimes exploratory research to help prepare the NRC for issues that we believe will likely arise in the future. These programs are identified through a number of mechanisms,

through information provided by the program offices and the regions, suggestions from the NRC Advisory Committees on Reactor Safeguards and Nuclear Waste, and through input from external stakeholders, including the industry, which is solicited by an annual call for anticipatory research. And that is published in the Federal Register.

Next, to manage and implement our programs, we maintain technical expertise within the Office of Research with a highly competent staff, including in many cases world class experts and a wide range of nuclear related technologies to ensure that the NRC's regulatory programs are founded on high quality, state-of-the-art technical information.

And last, our projects present technical assessments that are independent of those of the industry to ensure that the agency's regulatory judgments are made in a realistic and risk-informed manner but that they also count for uncertainties and the need to ensure adequate safety margins. I want to emphasize that many of our programs, both confirmatory and anticipatory, are carried out in cooperation with organizations inside and outside the United States by means of bilateral and multilateral arrangements.

These programs are extremely important to the NRC. International programs allow us to draw on a range of experimental facilities, data, and other capabilities that would be far too expensive to develop and maintain on our own. And they also contribute to the development of our own staff in terms of technical expertise.

My presentation this morning will give some specifics about some of the programs that we have in place to meet the challenges that the NRC is likely to face and is facing today. Because the time is limited, I'll only be covering some examples of what we're doing.

Can I have slide number four, please.

Now let me go through a few examples covering these four areas in terms of our accomplishments over the last year. The vast majority of Research's work on the order of four fifths involves studies that we undertake at the request of the program offices, and as I said, sometimes from the regions. And they address issues of licensing inspection and rulemaking. Let me go through just a few examples.

Now, to support NRR, we've been working to investigate the issue of clogging of emergency core cooling system strainers and pressurized water reactor containment sumps, which will contribute to the resolution of Generic Safety Issue 191. Debris in the sumps, including that created during loss of coolant accident could potentially interfere with pumps drawing recirculatory coolant from the sumps. Our work has involved a series of experiments and associated computational and engineering assessments, which support a conclusion that some plants may need to upgrade to connect pump suction head capability.

Based on our evaluations, NRR issued a bulletin last June and plans a generic letter. Research will continue with follow-up tests to support realistic characterization of the issues and sound basis for ultimate resolution.

In thermal hydraulics area, for example, we have supported NRR's design certification review of AP1000 advanced PWR and have conducted confirmatory tests at Oregon State University's APEX Test Facility and confirmatory analysis with our thermal hydraulics code TRACE, as well as severe accident analysis, using our MELCOR code.

In addition, we conducted a confirmatory scaling analysis to ensure data from APEX, which was designed originally to support AP600 effort, was indeed applicable to the larger AP1000 plant. Some of the specific issues that we investigated I do want to briefly indicate, issues that related to vessel inventory and passive safety system performance. There were issues of potential for any entrainment of fluid and carryover. And that's potentially uncovering the core and certainly the capability of the containment to deal with much higher power level.

Now, our experimental work, as well as our analytical evaluations, really were very instrumental in satisfactorily closing a number of issues. As you know, we've certainly used our MELCOR severe accident code in several places. A couple examples certainly would be security area. We've done extensive evaluations and trying very hard to be realistic in terms of these evaluations and other areas, such as the Generic Safety Issue 189 on the potential impact of hydrogen generation from severe accident to ice condenser containments from the MARK-III containment designs.

You well know the many evaluations in the area of risk assessment. I just want to point out that we recently issued Reg. Guide

1.200 for trial use. This is really a groundbreaking document in incorporating the effort of the past few years, in developing standards for licensee PRA technical endorsement. The regulatory guide is one element of the staff's activities to move in the direction of improved quality of PRAs.

After the trial period, we expect to issue the final Reg. Guide next year. The staff is also developing an action plan for phased approach to achieve the appropriate quality of PRAs for the NRCs risk-informed decision-making. This plan will be provided to the Commission in June. And this approach, I believe, allows for the activities to be phased in as the necessary standards and guidance are developed and implemented.

In addition to these studies, another important issue is really the communication of this. We recently published risk communication guidelines, along with the technical basis document for those guidelines. I want to personally thank the Commission for participating in that survey. I'm sure you all are well aware of it. I believe these guidelines will facilitate NRC communications regarding risk with external stakeholders and support the NRC's strategic goal of improving openness. Work continues on companion guidelines for internal risk communication, which will also include training guidance with planned publication of these reports by the end of this calendar year.

I might note that we have already heard back from some regions in terms of their interest to get this training. I have been contacted by the RAs in some cases. We have also updated NRC guidance related to

human factors engineering to counter advances in technology, such as digital upgrades to nuclear power plant control rooms, and the conceptual designs for advanced control rooms.

The updates also include new guidance for a risk-informed approach for evaluations of changes to human actions. The new guidance, which comprises of a revision of Chapter 18 of the Standard Review Plan, along with three supporting NUREG Reports, and these were published just early this year.

Now, our programs in engineering and materials cover a broad range of applications related to material aging, instrumentation control structures. One major program that is in its final stages is the development of the technical basis for risk-informed regulation of reactor pressure vessel embrittlement from neutron effluents and that is the pressurized thermal shock. This technical work is important for license renewal at some plants and will support, we believe, revisions and the relaxations in 10 CFR 50.61. Our work related to spent fuel behavior and waste bands, a wide range of technical issues, from the thermal hydraulics of accidents involving spent fuel pools to the behavioral spent fuel storage and transportation casks. Along with that are the fuel inside them.

Examples of products in this area include the development of the technical basis to support license renewal for dry cask storage installations and analyses of the behavior of spent fuel pools as a result of postulated terrorist attacks to facilitate identification of practical measures to

mitigate consequences.

May I have viewgraph Number 5, please?

As I said in my opening remarks, we conduct anticipatory research to help prepare the NRC for potential regulatory issues and challenges that are likely to arise in the future. These include understanding advances in technologies, assessing possible emerging safety issues, and preparing the technical and regulatory infrastructure to support more efficient and effective regulatory framework. Although it comprises a relatively small percentage of our budget, it is still a substantial amount.

Anticipatory research is a crucial element, and I really do want to emphasize a very important element of our program for a lot of reasons. First, it does give us the ability to look ahead and get ready for issues that as I said are likely to come our way, so that we're prepared to deal with them in a timely fashion. Anticipatory work has paid off by allowing timely and realistic assessments of important regulatory and safety issues.

A second key aspect of this research is its ability to move from being somewhat exploratory in nature to being an integral part of our regulatory infrastructure. In order to minimize our cost, significant amounts of experimental data comes from international facilities under bilateral or multilateral arrangements.

And on this slide, I've listed just a few of the applications resulting from the work done under anticipatory research.

May I have the next viewgraph, please.

Our efforts to make Research the center of technical expertise is not separate from our confirmatory and anticipatory research programs but uses those programs as basis for building and maintaining a top-notch technical staff, using state-of-the-art experimental facilities and analytical tools. Our people, the tools they use, and the products they develop to support the NRC's on-going regulatory activities across the entire spectrum, the agency's responsibilities.

And on this slide I have identified major areas where we are engaged. In thermal hydraulics, as I said, our facilities include the APEX facility at Oregon State, which was used for AP1000 confirmatory testing, and PUMA, which is the Perdue University multidimensional facility, which was originally built for the early GE SBWR design. It's now going to help us address many of the issues on ESBWR, as we go through our reviews. And, of course, we have a rod bundled heat transfer facility at Penn State, which is providing data on two-phase flow models for our consolidated advanced thermal hydraulic code called TRACE.

We maintain analytical capability obviously with the range of computer codes, including, I must note what is becoming and will become the real driver, the computational fluid dynamics codes. And of course, the TRACE and MELCOR codes. We also use not just our own codes. We utilize codes from other places but particularly in the CFBWR computational fluid dynamics. We use sometimes codes developed by others in this country and on occasion work with other countries.

I do want to highlight as part of this course that really we also direct the code application and maintenance program or CAMP, comprising international partners who use NRC developed codes, such as TRACE as I indicated. And we also have cooperative agreement on the severe accident research program. And the benefit to this program is that with several users, we learn of potential limitations of the codes or need for enhancements. So the data that we receive through our participation in these programs is really of substantial value and verification and validation of our own codes.

And this access to data and expertise all around, I would say, really helps us understand better what the margins might be. It really allows us to be more realistic in terms of our evaluations.

And as you know, this agency was certainly at the forefront of developing the science and technology of quantitative risk assessment. And we currently are in one of the leading roles in the development of a risk-informed approach to regulation. Our expertise in PRA supports a long list of on-going activities, including the continuing development and enhancement of SPAR models for reactor oversight programs, the risk informing reactor regulations, such as 10 CFR 50.44 or 50.46.

We also participate in an international partnership in the area of PRA. The program is called COOPRA. And once again, this allows us to benefit from what's going on in other countries. Outside the realm of reactors, we're also applying PRA analyses to try to better understand risks associated with dry cask storage of spent fuel to support NMSS.

Our engineering and materials expertise builds on a solid base of experiments related to the behavior of the reactor and plant components, including the reactor vessel, steam generator and containment, and the development of analytical techniques and tools that are supported by those programs.

Our facilities have included steam generator tube tests at Argonne National Laboratory and containment testing at Sandia National Laboratory. We also participate in the international cooperative program on steam generator tube integrity. And, as I said, this really allows us to have an enhanced oversight of many of these important areas that we as an agency are engaged in.

So in summary, I believe we at the NRC should be proud of the high quality of our staff and the access that we have to what I would call really top-notch facilities around the world.

May I have viewgraph Number 7?

One of our primary missions is to provide technical assessments, as I said independent of those of the industry, to facilitate regulatory decisions. I really want to emphasize that it comes from our principles of good regulations. And we firmly believe that. Independence does not mean isolation. We may conduct our own tests and develop our own data, or we may conduct cooperative research or take information from a common pool with our licensees or applicants. In either case, however, we conduct our own independent analyses, using our own tools and according to

our own processes and criteria.

This independent work provides us with greater technical understanding and insights so that we can ask the right questions, understand uncertainties, confirm margins, and perform realistic assessments. Our independent assessments can take several forms, including confirmatory analyses of licensee or vendor testing, evaluation and analysis of operating experience, and elicitation of information from experts to help determine and rank the importance of possible phenomena that could occur during reactor accidents or to come to a consensus as to the potential for occurrence of certain events.

I would like to take just a little time and talk about an approach, and it's called phenomena identification and ranking techniques, PIRT. This consists of expert elicitation to determine both the potential of phenomena occurred during reactor accidents and their importance in determining component and system responses.

This information is then used to help design experiments, to investigate key phenomena and system behavior, and to develop computer models to predict that behavior. This so-called PIRT, it really serves as a flag, if you will, those high importance phenomena that must be modeled properly and for which data are essential.

The NRC was a leader in the development of the concept of PIRT, and PIRT is now widely recognized as an integral part of nuclear engineering research all around the world and is a fundamental initial step in

the development of the state of art testing and analysis programs. The examples of our products in this area include PIRTs that we have done for AC-700 design, AC-700 advanced CANDU design, and for the Advanced Gas Cooled Reactors.

We have also conducted an expert elicitation on the frequency of lost of coolant accidents as part of our efforts to risk-inform 10 CFR 50.46, and this has been sent to the Commission recently. In another area, we conducted a study on grid reliability as a potential consequence of deregulation. This is a particularly timely issue given last August's station blackout. I would really call them loss of offsite power, but some people call them station blackout.

In addition we have completed preliminary accident sequence precursor analyses for the nuclear power plants that lost their power during this event. Also, as you know, we have conducted a broad based, independent vulnerability assessment and looked for opportunities to enhance safety and security. And again, I will not go into it, but I believe that the Commission is well aware of some of the recent work that we've done both in terms of testing and analysis to understand the Davis-Basse vessel head structural integrity.

May I have viewgraph Number 8, please?

Now, how do we disseminate the work that we do? How does it really get out. I'd like to spend a couple minutes going through that. Our products ultimately include information, include experimental and experiential

data analyses and interpretation of data, assessments of analyses, and finally, the reporting on the results so that they can be used to develop appropriate regulatory decisions. And these products come in various forms. We issued NUREG Reports, including those developed by the NRC staff, as well as by our contractors, which discuss the details, progress, and results of our research programs.

Over the past year, we have issued more than 60 of these reports. Now, I want to emphasize this is something I instituted at Research. In each of the reports, the foreword is written by NRC staff, generally Division Directors sitting at this table. And it describes the purpose and the value and the use of the research that is documented in that report. I'd like to think we're 100 percent successful on that one.

We also issue Regulatory Guides with uses resulting from our programs to help formulate acceptable approaches that our licensees may employ to resolve regulatory issues. In the last year, we issued about ten guides representing either new guidance or updated guidance on existing issues.

We issue Research Information Letters to other program officers that generally summarize our findings and generally would relate to acceptance limits. Generally, I would say.

And last year we issued a few RILs covering some of the insights from international programs on lower vessel head fragment, which really related to how one might deal with accident management strategies

and how this information could be used in reviews of advanced reactors and their ability for the vessel to maintain potential of severe accident core in this case.

We've also issued the characterization of pressurized water reactors, spent fuel rods, after 15 years of storage and dry cask. These are some examples of things we would do to Research Information Letters or RILs.

We obviously, as you well know, assess and prioritize generic safety issues, and these generally would be transmitted through memoranda to the program offices when technical resolution has been developed. And we, of course, have a wide range of analytical tools that are used to confirm, in many cases, for operating reactors, changes that the licensees may be making.

And so our analyses, I'd say again, really do contribute to the entire range of the activities of the agency. And as I said earlier, this rulemaking inspection licensing issues, both for current reactors and for future reactors and the generic safety issue program, which really the focus for which is to look for opportunities to improve safety. But only with vigorous cost benefit considerations. And, of course, we assess operating experience, including risk significance of that experience. And I will not say more than that certainly we're actively involved in vulnerability assessments for many potential terrorist attacks.

May I have viewgraph Number 9, please?

Now let me turn to a short discussion of those projects that we expect to be forthcoming over the next year or two.

Our programs will, of course, continue to build upon our past accomplishments and push forward to support existing and any new agency initiatives. A major issue as we move forward is the phased use of risk analysis, and there is the characterization of uncertainties. Understanding the nature and magnitude of uncertainties is important to achieving realistically conservative approaches for dealing with issues, such as safety margins in defense-in-depth. We plan to develop further guidance on the treatment of uncertainties.

In the area of risk-informed regulation, we continue to develop the technical bases that will underpin the revision of the ECCS rule to make it more risk-informed. And, we believe it can be made more performance based as well.

As I indicated earlier, we've been working on the issue of LOCA frequency. We're also helping to develop performance-based approaches for ECCS performance and fuel responses to allow the user various fuel and planning materials without the need to specify each one in the regulation itself. Within the next few months, we are also expected to provide an evaluation related to a broad change to the single failure criterion. This was, of course, the phased approach to dealing with the ECCS.

We continue to pursue a broad-based effort in support of advanced reactor reviews, both those on-going and those expected to

commence in the next few years to our experimental and co-development program for building the technical infrastructure, which will be needed to conduct these reviews in an efficient and timely manner. We also continue to plan how we will conduct the package performance study, and we've recently provided options to the Commission. We will follow the Commission's direction.

May I have the next slide, please.

As a result of when we prepared these charts, we thought we would maybe have some discussion. But as a result of the last meeting we had in March, in the SRM the Commission directed Research to identify options for developing more robust materials program. We provided that information to the Commission. This chart identifies the areas that were identified or discussed in that paper. And we've just received the Commission's SRM on that paper. We will, of course, implement the guidance given in this SRM that just came out.

Next chart, please.

Now, in addition to the projects that we're expected to develop over the next couple of years, we'll continue to bring policy issues related to our programs to the Commission for information, consideration, and direction. A few of these areas in which we'll continuing to address policy issues or in which we expect policy issues to arise are shown on this slide. This is certainly not a full list.

The issue of plant security and vulnerability has been a top

priority since the events of September 11, 2001. And it seems that it would remain that way. We would expect that we would be continuing to assess and provide information to the Commission on real-time basis for whatever action the Commission deems appropriate.

In the non-light water reactors, we provided the Commission a paper last year with seven policy issues. Many of these issues certainly would also apply to light water reactors—advanced light water reactors. They relate to areas such as the advanced reactor policy statement, the increasingly international nature of the development of nuclear power technology, and the fact that our regulations were largely written well over 30 years ago and are based on our operating fleet of light water reactors. And as you well know, that some of the advanced reactors' features are far different than those in the current fleet of reactors.

Now the Commission provided guidance on several of the issues but requested further information on two related to expectation of enhanced safety for advanced reactors and the design of containment of confinement structures. We will provide a paper to the Commission at the end of this month, discussing the status of our work on these topics and on the advanced reactor framework as a whole.

Also, related to the advanced plant reviews, we're currently participating in the pre-application review of the ACR-700. This is an issue here that I want to bring to the Commission's attention. This is a reactor design that has not been licensed in the U.S. And in fact, it's considerably

different from existing CANDU reactors in that it uses light water as a coolant and heavy water as a moderator, rather than heavy water as both coolant and moderator.

A number of significant technical issues relating to the thermal hydraulic and severe accident behavior have been identified to what I called earlier our PIRT process. Though we are considering the need for confirmatory testing for this design and how such testing would be carried out since the availability of the facilities representing CANDU designs is somewhat limited. This is an issue that we would bring to the Commission also.

May I have viewgraph Number 12, please?

Now, let me move from the technical aspects of our work to discuss some of the process related issues that challenge us and the initiatives that we've taken to address them.

We must always pay close attention to our resources. And in that respect the first two items on this slide are really closely related. While we do our work, we do our best to anticipate and allocate for high priority emergent work that develops over the course of the year, the magnitude of this work can have a significant impact on budget. Areas in which major efforts have developed include our security related activities, testing associated with the resolution of the Generic Safety Issue 191 on sump blocking and, of course, many of the actions coming out of the Davis-Besse lessons learned, as well as additional tasks that we had undertaken.

Now as this work develops, resource constraints require us to determine what work we must defer or drop. And a coherent, consistent add/shed process is really essential to facilitate these new challenges.

We also must have a rationale process for determining when it is appropriate to bring a research project or program systematically to conclusion. We continue to focus on this issue. Actually, we sent this report up to the Commission. This is a recent collective statement by the Committee for Safety Nuclear Installation at the Nuclear Energy Agency on good practices and closure criteria. And I believe this is a useful document.

We are also assisted in such considerations by the annual review of our programs that is performed by the Advisory Committee on Reactor Safeguards. The committee's recommendations for closure of programs provide a valuable independent assessment against which we can measure our own considerations. As a result of these factors, we have sunset several activities.

May I go to viewgraph Number 13, please.

We recognize that a focus on safety is not only essential for our licensees but for our own staff as well. And in that regard, the Inspector General's survey on NRC safety culture provides us with a valuable snapshot of the thoughts and attitudes of our staff. We have reviewed the report and have conducted a self-assessment and identified issues in areas in which we can take actions to improve our communication and interaction between staff and supervisors.

As a result, we have revised our organization to improve interactions between management and staff, particularly the need for staff and first line supervisor interactions. We're also taking a number of initiatives to improve communication. I will come back to this topic.

Human capital is another area on which we continue to focus. We are investing in our human capital to ensure that research maintains the technical competencies necessary to accomplish NRC's mission. For instance, we are implementing improved approaches that include updating and expanding our human resources staffing and management systems, HRSMS. Specifically, the system will incorporate the staffing plan, the staff training requirements and schedules, and the research operating plan human capital resource needs, as well as projections from retirements and critical capability shortfalls to ensure that the highest quality scientists and engineers are recruited in a timely manner.

This revised system will provide for a more timely identification of needs, will ensure that the status of every vacancy is highlighted for appropriated management attention from the time the need is identified until the new staff member is on board. And it will ensure that Research managers have the necessary information that will allow them to be successful in forecasting their organization's staffing needs.

We're also making effective use of human capital tools at the agency and at office, including double encumbering, dual compensation waivers, recruitment bonuses, and expanding the use of the coop program,

the graduate fellowship program, and also the summer intern program. We are aggressively seeking mid-level employees and have increased our participation in our recruiting events. All of us at this table and many others participate in these recruiting events.

And so it's not surprising, therefore, that about 12 percent of Research staff is really new. That is, we've hired within the last year about 12 percent. Seventeen of 24 new employees and four of six new managers are women or minorities. Over 60 to under 30 staff ratio is now at 2.1 to 1. The ratio was, of course, much higher. And it was indeed important to look ahead to make sure we were getting new staff in, and they would have enough of an opportunity to develop and take over positions as senior staff retired.

As I said, the new staff includes both interns and recent graduates, as well as some mid-level people with hands-on experience. All of them are making significant contributions to our activities, and they're fully engaged in terms of their work assignments, their training, and developmental assignments as well. But we're still understaffed, and I must say that we are experiencing an attrition rate which is somewhat higher than we had anticipated. It is, therefore, essential that we maintain our focus on this very important need and be mindful of the value of diversity.

While we're continuing to staff up, we have had to recognize that one of our communication challenges is ensuring that we're managing the transfer of knowledge from our senior staff to our newer ones. To help retain this, our corporate memory, we have initiated a pilot program that we

expect to complete this summer in which I hope will become the model for the agency in knowledge management at next year's briefing. And I fully expect Carl will be able to announce considerable success with this initiative.

Now in addition to risk communication, we're also improving our internal communications and have recently developed a web-based feedback portal that allows for a more open dialogue between staff and management. Additionally, we're upgrading and restructuring the Research operating plan to ensure that visibility of full ranges of research activities is achieved.

Can I have the next slide, please.

We're keenly aware of the Commission's desire to improve overall agency effectiveness and efficiency. Implementing improvement measures ultimately allows us to do more as we use our limited resources in more cost effective manner. We're undertaking a number of initiatives designed to enhance both the effectiveness and the value of Research's contribution to NRC's mission.

Let me give just a couple of examples. We've been working with the ACRS and Mike Mayfield has taken the leadership role from Research to develop a metric by which to assess the quality of Research's programs and products. The ACRS would use this metric as it develops its annual report to the Commission on our programs.

Another example is that we're working more closely with standards development organizations to help develop consensus standards in a wide range of areas, such as our recent efforts that you well know in the

area of PRA, a variety of standards are being developed there. The development of standards that we can endorse in our regulations and regulatory guidance helps to ensure NRC's expectations for products from our licensees and applicants and contributes to the effective and efficient regulatory process in minimizing our few resources.

Let me go to the next chart please, viewgraph Number 15.

As I mentioned earlier, communication is a key for us. It is imperative that our staff members know how they work, fits into the big picture in terms of meeting NRC's mission. This sort of information improves staff morale and facilitates interactions between—within--Research, between Research and other NRC staff, NRC offices and regions, and between our staff and our external stakeholders.

To meet the challenges in this regard, we have developed a strategic communication plan to facilitate improvement in communication at all levels. This chart lists some of the strategies that we have already implemented so far.

Okay. Go to the next chart, please, Number 16. Just to summarize, let me make the following brief comments. Research's activities flow from and support NRC's strategic plan. Our programs provide part of the essential technical backbone that allows the agency to achieve its strategic goals, as the Chairman noted in his opening remarks. Our programs are designed to develop a sound technical basis for making timely, realistic decisions concerning the full range of regulatory issues that the NRC must

face.

Our anticipatory research programs are essential to prepare the NRC to meet future challenges and contributes substantially to the development and maintenance of a high degree of technical competence and capability among research staff.

I want to once again thank the Commission for not only your support for the Office of Research but also patiently listening to me go over certain views on these programs. Once again, thank you very much, and we're ready to take any questions.

CHAIRMAN DIAZ: Thank you very much, Ashok.

Commissioner McGaffigan?

COMMISSIONER McGAFFIGAN: Thank you, Mr. Chairman. I clearly associate myself with your remarks earlier. I think Ashok has done an excellent job during his tenure here. He has a lot of accomplishments to point toward. He was lucky enough to preside over a research program that was growing, as opposed to I think his predecessor's for quite a few years, which presided over research programs that his resources were constantly declining.

And indeed, I think your total resources now, contractor and in-house, are in the \$80 million range, aren't they? And a few years ago, it was more like \$50 million. So a lot of that is security, but a lot of that is just a recognition that we have to do, you know, in advanced reactors and in other areas, we have to make investments to be ready for the future. That doesn't

mean that everything has gone up, and we appreciate the rigor with which programs that really have reached their end point have been with your sometimes assistance of ACRS or whatever put to bed.

There's one line of questioning that I'm going to ask you about, and I wish I had brought it with me. But I was interviewed last week for what may someday be a TV program. And I got a lot of questions about NUREGs and NUREG-CRs. And the folks who were asking me the questions clearly were not technical experts, but, as usual, somebody had gone in and excerpted, you know, parts of sentences and were sort of tossing them back at me.

And at your Research conference last fall, I gave a whole talk on the fact that we have to desperately try to do better in communicating. And when we do bounding engineering analyses, that they are indeed bounding engineering analyses. I think I suggested at the time we say it in the introduction, that introduction written by your Division Directors. We say it in the body of the text. We say it in the conclusion. We say it in anyway that we can if indeed it is a bounding analysis.

In talking to this person, I tried to point out that, you know, I recalled the ACNW letter, which I know the staff doesn't entirely agree with, but the ACNW letter of about a year ago, with regard to a NUREG-CR from Sandia that I think one of the members of current ACNW actually worked on. But it basically said that I think there were three to five different conservatism that led to many orders of magnitudes, conservatism in the result. And the

staff's view, I think appropriate, was this was a bounding analysis to get the degree of rigor, you know, get those orders of magnitude of conservatism convincingly demonstrated would cost a lot of money. And the staff didn't believe that it was worth that amount of money to get to that point.

I think that's a fair engineering judgment. I absolutely think that's a fair engineering judgment. The trouble is how these things then get used by people who want to excerpt the one little nugget without any of the caveats and claim that's reality and get people worried about it. It may meet our regulatory criterion, and we may want to dismiss it, but the public would feel a lot better if it met our regulatory criterion by five orders of magnitude.

I tried to explain to this person how that could happen. What I did was I said, well if we have seven parameters, seven different numbers, were trying to guess at in making an overall calculation, and we're pretty sure the numbers are between zero and ten, non-zero, they're positive, but between zero and ten, but we conservatively guess ten for all of them, and the real factor is two. So instead of getting two to the seventh, 128, I get ten to the seventh, 10 million. And I have a five-order magnitude difference. But if the 10 million meets the regulatory criterion, the engineer is going say, "Great! I'm finished. Good job. I'm in great shape." So we have to think about how we communicate, and I urge you to think about that all the time. It doesn't just happen on one side of the equation.

There was in a Science Magazine, a letter to the editor, a year plus ago written by a bunch of folks who were extracting from a Sandia

report. And Sandia fairly quickly, probably more quickly than we could said, "Wait a second. That's misusing this particular study where a plane was run into a wall. And so sometimes the folks, you know, they're misusing research on both sides. But it's more typically somebody who's excerpting. And now I'll turn to GSI 191. In GSI 191.....

COMMISSIONER MERRIFIELD: Can I interrupt, I'm going to agree with you, so hopefully it's not a problem. The one thing I would, the additional layer of caveat that I would put on that and agree with Commissioner McGaffigan, we need to be quite clear about what the report is being used for. It even goes to the issue of fair and -- that's plain English. We bounce around the idea of bounding analysis. And even if you put on the bottom of the report that this is a bounding analysis, a typical reporter or member of the public who's not familiar with what we do is going to see bounding analysis and not draw any conclusions from that one either.

So we need to, in a plain English way, effectuate the outcomes that Commissioner McGaffigan has spoken about, in terms of presenting research information in a way, not dumbing it down, but at least providing an introduction to it so that someone who's not familiar with what do and how we work, and what we're working on, will at least have a vague clue as to what we're intending with a particular research report.

COMMISSIONER McGAFFIGAN: Well, in GSI-191, it's a sort of tangible example. You all did some very good work with Los Alamos. Los Alamos wrote an initial bounding analysis. It is followed up with more recent

analyses that make clear that an alarmist interpretation of their first report is mistaken. You all in the Research office never made the alarmist interpretation of the initial report. If you look at your memo from September 2001 you were exactly on the mark that what we're talking about here is for about half of the PWRs, the possibility of something on the order of a ten to the minus four, a ten to the minus five reduction in core damage frequency.

But extrapolating from that report, members of the public have been convinced that the New York Times editorial page, and various other folks, members of Congress, that we're sitting around tolerating core damage frequencies in the order of ten to the minus two per year, which is an absolute falsehood and is not a reasonable result of that report.

So I toss that out to you just to sort of ask, as you leave this office, do you have any ideas other than what I've tossed out. You know, having your Division Directors write plain English introductions to these reports, try to explain what a bounding analysis is, try to explain in plain English why getting precise estimates of each of these parameters would cost a lot of money, and so we do bounding analyses. But if you have any ideas as to how to solve this problem of our research reports. Sometimes memos -- Jack Strosnider and Brian Sheron wrote a memo some time ago about the ability to detect leakage and whether there are technologies available. A member of the public sort of took the report in one sentence, left out all the other sentences around it, and I didn't think that was very fair. But it's going to happen. So part of it may be how to have a faster turn around

like Sandia did when the Science Magazine article turned out, a faster turn around when our reports are being abused in some way. Being able to say, our report is being abused in some way.

MR. THADANI: A very valid point, obviously. I think historically we probably haven't paid enough attention to the communication issue that we probably should have. And we've learned a number of lessons, I think, in the last few years. Some years ago, I asked our staff to address a set of seven questions as products come through. We have not systematically done that. It was really -- that's what led me to, over the last two year, have the Division Directors personally look at these documents and articulate in the foreword, I would like to think, in reasonably clear language. And I think we're making improvements. We're not there. We're really not there. We're making improvements.

The intention of the foreword is really to address the issues that we're talking about here, trying to be more clear about where the bounding assumptions might be, how the information is going to be used. Always be asking from the perspective of who's going to use it, how they going to use it. That's frankly why I keep saying Research staff should be engaged even during the implementation phases because you need to really understand what you have. You need to know where the strengths and the weaknesses are in terms of the work that's done.

I would like to say, going forward, certainly I think, I believe that we're going to be successful if we consistently follow that line. But we still

have some mortgage out there. There's a number --

COMMISSIONER McGAFFIGAN: There's a huge mortgage out there. There's two and a half decades of mortgage out there, going back to a Sandia report that . . .

MR. THADANI: 1982.

COMMISSIONER McGAFFIGAN: 1982 that we desperately tried at the time to say, this is a ridiculously binding analysis. And that report, to this day, gets misused as if it were reflecting a realistically conservative view of the world, which it absolutely, completely, and totally does not.

But it was an interesting assignment given at the time that people--sometimes these reports--like that particular NUREG, and the Chairman has gone back, and he may want to talk about it later, but looked at the history of that time. People sort of recognized this report is about to be abused. Even at the time, it's sort of like more recently, NUREG 1748 our spent fuel pool study of a few years?

CHAIRMAN DIAZ: 1738.

COMMISSIONER McGAFFIGAN: 1738? That we knew--the Chairman knew--we knew that that one was, you know, probably didn't reflect reality very well, wasn't realistically conservative. But it was also prime material for someone who wants to come in and misuse it. So sometimes we do these things to ourselves. It's almost like turning in a homework assignment knowing that this is -- the teacher may like it, the teacher, you know, she understands all this technical gobbly gook that we speak around

here, but, if it gets leaked to somebody else at the school, they may not like it at all.

I urge you to keep thinking about it. I urge your successor to think about how to do better here and how to maybe have faster turn around when that legacy, which we're never going to burn off--unless we're going to give you \$800 million a year, which you might accept, but the Congress will never let us do it. We're not going to go back and re-do the entire legacy.

COMMISSIONER MERRIFIELD: Nor is it anywhere near what we have under postulation either.

COMMISSIONER McGAFFIGAN: You know, I'm just -- but to fix all the NUREGs that are out there that routinely get abused would not be the best use of our money. But we do have to have a fairly clear communication strategy as to why there were bounding analyses. Maybe all those forewords that should have been written for some of these things, you go back and write them so that they are readily available to the communications folks when something gets taken out of context.

That wasn't my only line of questioning. Let me just try to find maybe one or two others. One place that I do want to ask you. Recently we had a briefing here, I guess it was NRR and/or -- I forget. But Sam Collins threw out the notion that we should think about whether the SPAR models are really worth it or whether we should just work directly with the licensees PRAs, the simplified probabilistic review assessment models. And any thoughts you have, I mean, we have spent a lot of money getting the SPAR

models to be better. Part of that was in the context of mitigating systems performance indicator effort, which has a real positive affect on our SPAR models for the pilot plants and would have a positive effect if we went forward more broadly.

But the issue comes up, should we be using the SPAR models, which now come in many cases into pretty good fidelity with the licensee model? Or should we be just dealing with the licensee model?

MR. THADANI: Let me ask Mark if he will address that.

MR. CUNNINGHAM: Just by way of history, we thought about that question when we engaged in the development of the SPAR models a number of years ago. The trade-off really was and still is the cost of developing consistent models here and having the models available for a number of people to use versus developing a staff capability to understand all of the licensees' models. And all of the licensees' models are not standardized. They're not here in headquarters or at the regions necessarily. So our conclusion at that time was that the staff effort that would be required to develop a working knowledge of each of the licensees' models and to maintain that expertise was greater, substantially greater, than what it would take to develop the model themselves, a more standardized set of models that a wide variety of people could use.

By way of history, we considered it. I think honestly that's still the case. I think our capability to go out to really understand what's in each of the licensees' PRA models would be substantial --

COMMISSIONER McGAFFIGAN: That's because there's so much variation across -- the industry did not have any codes when they developed these models. So there's just such a tremendous variation across them. Whereas your SPAR model starts with the common--it is more standardized.

MR. CUNNINGHAM: Correct. There were three or four different codes out there, but there were no -- we've talked a lot about development of standards for PRAs. The standards were -- well, there were standards of sorts at times, but they were much more loose. So that while each of the PRAs may be perfectly fine, what's in them, how things have been modeled, what systems have been modeled, could vary a good bit across the set of licensees' models. We thought it would be a big investment.

CHAIRMAN DIAZ: Have we done a sensitivity analysis that looks at, you know, taking up a series - I'll say a few plants, and look at what the SPAR model does, what the licensee model does? Is the results or the errors factor of two, you know, something that we believe still might be functional in regulatory space?

MR. CUNNINGHAM: Yes. Each of the SPAR models is part of the QA process. It's kind of benchmarked with the licensee's model. So we have a sense of -- at one point we get a sense of what's difference. And then we make a judgment of whether or not it's important to resolve the differences. Pat's going to answer the question in more detail. But yes we've done that.

PAT BARANOWSKY: Chief of the Operating Experience Risk Analysis Branch. I'm responsible for the development of SPAR models. And we've done exactly what you indicated, Chairman, and found that there are some differences in the total core damage frequency that are on the order of factors of two to three typically and that the dominate action sequences, while approximately the same, sometimes have some different ordering. And this has to do with a number of technical issues that typically get disputed, if you will, during either regulatory applications when a licensee will come in and ask for some relief or an amendment or -- or whatever, or else a significance determination process analysis.

And what we're trying to do is to identify the largest ones that contribute to the differences that would cause the outcomes from risk analyses using SPAR or licensees' models to be different and, therefore, an apparently different regulatory implication and try to address those as part of the SPAR upgrade. And that's our future activity for the next year or two. We learned a lot of that from the mitigating system performance index work that Commissioner McGaffigan mentioned.

CHAIRMAN DIAZ: Alright. Thank you. Commissioner McGaffigan.

COMMISSIONER McGAFFIGAN: Which brings me to the mitigating systems performance index. I think one of the good things about the Research office is that you can have a different point of view on some matters. And since we heard from NRR a few weeks ago and the

Commission has already given some guidance that we'd like them to take another try, but could you outline why your office, despite some of the issues that NRR talked to us about, felt, and the regions apparently felt strongly about, nevertheless felt the MSPI might go forward? And also let me ask do you have any problem with removing front stops and things like that if that will improve the indicator and make it more useful?

MR. THADANI: Right. Right. I have no problem. Our goal basically is to make sure we are truly being risk-informed and that we're really focusing on things that are more important. I believe MSPI does help us achieve that.

Now, there are other issues, cost issues, and other factors that one has to clearly consider. And let me ask Pat. He can briefly tell you why really we believe MSPI does give you better insights in terms of relative importance. And then he can also give you a sense of what we think the cost might well be.

COMMISSIONER McGAFFIGAN: Okay.

MR. BARANOWSKY: I'm not so sure I can speak too much about the cost, but I can tell you that the indicator was designed to address specific issues that were raised by NRR in the regions in their request for us to develop the indicator. And we've recently produced a draft report, which evaluates the capability of the indicator. And that's the basis for our conclusion that it produces a valid and a good indication.

There are some differences between what one gets using the

MSPI and say the current safety system unavailability indicator or the significance determination process. We've evaluated some of those, and we're looking at a few more modifications to the MSPI to address those differences. In some cases, we think the MSPI is just a more valid indication. And we're going to cover that to some extent at the ACRS subcommittee meeting that we have tomorrow.

But the report has been put together for internal review and now released for external stakeholder comments also. And we're following the process, and we will address these issues.

COMMISSIONER McGAFFIGAN: Do you have a view about the front stop at the current time? It seemed to be a major issue with the staff because you could get a bad first indicator, probably not highly probable, but you could get a bad safety system unavailability that would be colored, perhaps yellow or white or something. And it would get a pass under the original design. If you got rid of that feature, it struck me that a lot of the concerns about getting different results on the current process versus the new process would likely go away.

I know your judgment probabilistically is that the chance of that happening, of the first one being the bad one, the one to get the pass on being the bad one is not a high probability event, but it seemed to bother much of the staff.

MR. BARANOWSKY: Yeah. The way that the significance determination process looks at, say, a single failure, is different than the way

that the mitigating system performance index handles it. In one case, you looked at it as a reliability issue. In another case, you convert it into unavailability over a short period of time, which gives a fairly high short-term risk. And what we need to do is resolve what our philosophy and policy is on those things, which could then produce some adjustment.

But I wouldn't just drop the front stop because there's a high chance of false positive indications, which you'd may or may not want to see embedded in the program and a significant or at least a notable increase in the number of white and higher findings could come out. So we need to study it a little bit.

COMMISSIONER McGAFFIGAN: Okay. Mr. Chairman, I'm just going to mention one last thing. I don't want to overstay my time here. But I noticed that Cheryl didn't quite make it to the table this year. She's sitting directly behind the Director. Next year I hope, in light of the guidance given in the recent SRM with regard to an enhanced materials program within the Research program, that she can join all these reactor types at the table and have something to talk about.

I think there's a vision. There's a vision, and I do think that her office provides great support, both in terms of the long-term work they do, you know, NUREG-1640 for the clearance rulemaking, etc. But recently we had an incident that I can't go into in public because it's pre-decisional in another agency, but basically we had a very short turn around response to OMB on something. And Vince Holahan and Don Cool, the two offices linked arms

and came up with a very sound comment document on very short notice.

And that's because they're engaged. I mean that's because Vince and Cheryl and her group are engaged and thinking about these things. And they can have a point of view very rapidly.

So I think there's a future there. I don't know if there's a division there. That'll be up to the new director of the office, but we're looking forward to the material side of the house being emphasized more robustly in the future.

CHAIRMAN DIAZ: Thank you, Commissioner McGaffigan.
Commissioner Merrifield.

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman. I'd like to start just briefly by saying, obviously, the Office of Research has a tremendous number of issues that it's grappling with on behalf of the agency. And I know the staff works very hard on those and it is to be complimented for a lot of very good products, one of which you mentioned. We talked about another venue is the grid reliability issue, which I think is an important product that came out this year.

I want to turn first to a couple of reactor issues, notably the ACR-700. In your presentation, you mention that the issue of thermal hydraulics and severe accident research is more difficult for us because of our lack of facilities here in the U.S. that can deal with some of those issues. I wanted you to go into a little bit more detail about our action plan to resolve that to the extent that you can. And also, you have in the materials, not

provided to the public, but to the Commission, you provided some level of detail about the various tasks that need to be accomplished and focus areas, and status. All of which is very useful.

But I want to get a sense, given the recent announcement by Dominion that it is focusing on this reactor design, which seems to me to raise its profile, are we being clear with the applicant, notably AECL, about our expectations, our concerns, our requests. Are we being fully transparent with them so that they can be prepared to meet in a timely way our needs to meet our regulatory and research programs?

MR. THADANI: I believe we're being very transparent. And, as a matter of fact the PIRT process I sort of talked about included people from Canada as members. And let me ask Dr. Eltawila to tell you the program plan and the interactions that we're having with AECL.

MR. ELTAWILA: As Ashok indicated, we have the PIRT process and toward that PIRT, we identified the most important technology. It goes hand in hand with the PIRT process of this scaling analysis. And what the staff right now is doing is looking at this scaling analysis of the RD-14M facility in Canada.

If we find that the facility can capture all the important phenomena that are identified in the PIRT, we are going to be in a much better situation than we are right now. So we're still waiting for the closure or the completion of the scaling analysis.

As far as our long-term plan right now is that we have PIRT,

which is based on information presented by AECL to a group of experts, which included but actually did not participate, members of the CNSC, the regulatory body in Canada. What we are planning to do right now is to review the PIRT, see if we agree with the information, see if there are more information available by interacting with AECL that was not presented. And at that time, we will rank the phenomena. Go back to PIRT panel, and start interacting with AECL about the test program.

One important facet of that is that we need to review the test plan of AECL. We are currently doing that. So the combination of the PIRT, the scaling analysis, the review of the test analysis program of AECL will identify if there are any deficiencies in their test program. Once the deficiencies are identified, our first responsibility is to go to the applicant. Of course, we're doing all of that with NRR. So our first responsibility to go to the applicant and identify some deficiencies and test the program. And it is their responsibility to provide us with information why it's important, not important, or they are going to do this information.

Now to answer your first question about not having a facility in this country, I think Ashok and I visited Canada, and we heard from AECL some encouraging news. They said that if NRC would like to perform its own tests at the facility, they are more than willing to give us the facility. And we can conduct extra tests, more than what we would normally require.

COMMISSIONER McGAFFIGAN: This is the facility in what, in Winnipeg?

MR. ELTAWILA: In Winnipeg, yes. It's a very impressive facility. So the issue right now the scaling analysis and if it is really representative of ACR-700 and that's on-going right now.

MR. THADANI: Let me just add to what Dr. Eltawila said. There is also another -- cold pressure integral facility in another country. And if push comes to shove and there are some issues, we would have to look at those options there.

MR. ELTAWILA: But what we are working right now--we're working with NRR, and based on the their recent announcement, for example, we are going to completed the certification by certain date. And we're working backward to try to identify when information is going to be available and when we need to do our confirmatory analysis, develop the tool and data, and all this stuff. So we are working on a schedule based on the recent announcement right now.

COMMISSIONER MERRIFIELD: Well I think obviously it will be a challenge in meeting our needs here. But, on the other hand, it does present opportunities. There are about a half dozen countries out there, which do operate CANDU reactors and which have a variety of programs and a range of programs and capabilities. And we certainly should take the opportunity, particularly with our Canadian counterparts at CNSC, also with the folks at most in KINS in Korea, to try to focus on areas where we can make use of work that they've already done. But make sure that we meet our own needs.

Flipping to the next issue is the issue of the Pebble Bed Modular Reactor. Now this is an area that I think is in a different place. A few years ago, three or four years ago, there was significant interest exhibited by Exelon in this particular project. I was among those in the Commission who urged that we appropriately designate research resources to be able to be responsive and anticipatory of an application for that coming in. Obviously things have changed during in the intermediate time period. Exelon no longer appears to -- they have taken a new role in that particular development and have stepped down to a certain extent.

There appears at least in terms of the information I've received, no other utilities out there currently, actively considering this kind of design. Now I know in the slides, you talked about continuing interest on the part of that entity to come in and perhaps conduct a pre-application review. I think the only thing that I would want to note, we are in a period where we have limited resources. And I think we have to recognize that we can't do everything.

I've said it in other venues, and I'll say it again, I think we need to focus on those designs in which there's the greatest likelihood that we'll actually have an application. And I think PBMR, although it's an interesting design, is one that frankly at this point does not rise to that very same level. And I think as you plan going forward, we need to be very remindful of that.

MR. THADANI: Commissioner, I would like to comment on that because I think fully agree with you that resources are limited and we have to

put them where we have a high likelihood of value coming out of that. I can tell you that because of the change in the environment, we do not -- we're not proposing any resources in the attempt at the gas cooled reactor -- the Pebble Bed Modular Reactor. We're not proposing any resources.

MR. PAPERIELLO: Could I add something to that? In my role as Deputy with oversight of Research, I've had a series of briefings over the past month and a half by both NRR and the Office of Research on new reactors. And I've pretty well satisfied myself at least for the first quarter that our investments are where they ought to be.

In other words, there's intensive cooperation between NRR and Research. In fact, there is a steering committee made up of both NRR and Research managers overseeing the processes. The resources are going to those designs of which we have the more intense interactions with the vendors. And there are very few resources going into anything other than what is, you know, in the reasonable foreseeable future, like two to three years. Or what we're actually having in front of us, like the AP1000.

MR. THADANI: I just have one point.

COMMISSIONER MERRIFIELD: I want to keep moving on, but

--

MR. THADANI: The only point that I want to make is we are monitoring what's going on in high temperature gas cooled reactor technology, but we're not spending, you know, dollars and so on.

COMMISSIONER McGAFFIGAN: Mr. Chairman --

Commissioner Merrifield, I'm going to do the same with you. I agree entirely with the point that you made. The only additional point I'd make is that I don't think we ever as an agency got caught up in the Pebble Bed Modular Reactor bandwagon to the extent that the proponents would have desired.

I think we recognized that Dana Powers did a very nice trip report at one point from the ACRS. The staff had very similar judgments about a lot of problems that were faced with that technology, and I think the proof is in the pudding at this point.

The designs that are being cited and as these folks from the industry go into the Department of Energy and seek costs here for a potential combined operating and construction license that technology is not being mentioned. It's the ESBWR. It's the AP1000. It's the ACR-700 that clearly we now have to have as our focus because that's the focus that the marketplace has determined. But we never got caught up in that hysteria.

COMMISSIONER MERRIFIELD: I wouldn't say that it was hysteria or bandwagon. We did direct monies, and we did spend monies in terms of lot of our capabilities on graphite and other technical areas. We can sort of go through chapter and verse. It's a non-insignificant amount of money that we spent, but I think my issue goes beyond merely just Research. And that is we may get a desire to bring in a pre-certification and I think we've got some internal questions we're going to have to ask. How do we deal with that given the absence of a desire of a U.S. utility that actually wants to order one? So I think that's at least a policy issue that we're going to face on our

side of the table.

Switching to the issue of safety culture on page 13, you noted here that you have your internalized attempt to respond to the IG safety culture survey. Without going into too great of detail in the back-up slides, you identify some activities that are not simply inward focus but the potential for development and some metrics on safety cultural that would be outward performance, vis-à-vis our licensees.

I don't have a significant question here. I may wish to seek a briefing on this at some point. The Commission has been quite clear, I think, in terms of our focus as an agency on a safety conscious work environment. The issue of monitoring safety culture or developing metrics for safety culture or regulating safety culture in a more intrusive way goes down a regulatory road that so far the Commission has not gone very far down.

And so I guess that what struck me by these slides is the notion that perhaps you all might be getting a bit ahead of the Commission from a policy perspective. And I think that before you start doing that, you need to get the appropriate Commission buy-in on where you're going.

MR. ELTAWILA: Commissioner Merrifield, I agree with you 100 percent. Maybe the viewgraphs are misleading, or what we are doing right now is following the Commission direction. We are watching what's happening in the international community. We are just putting all the lessons learned from the Davis-Besse and the challenge of lessons learned about safety culture. And we are trying to put a Commission paper together and to

bring it to your attention to seek guidance if you want us to pursue this issue further. But what we're focusing on right now nothing but monitoring what's happening in the international community.

COMMISSIONER MERRIFIELD: Okay. I will say that the slide, as I read it in plain English, would lead one to feel different --

MR. THADANI: It is misleading. I think it is.

COMMISSIONER MERRIFIELD: Okay. Okay. I'll leave it at that. In terms of -- let's see where are we.

MR. THADANI: That's what happens when you have 160 or 70 pages.

COMMISSIONER MERRIFIELD: Yeah. On slide 12, you mentioned briefly you are going to be responding to the ACRS research report that Dana Powers put together. We'll have an opportunity to discuss that in more detail when we talk to ACRS. I think it's a good piece of work that Dana did for us.

You talked about sunseting of activities, but then you moved on. Can go into a little bit more detail about the rigor with which you are using the ACRS report to conduct that review?

MR. THADANI: First, once again I want to say that the ACRS has done a very good job of reviewing our programs. I know it was a lot of work on their part, and I think it's a pretty good objective picture they've put together. The number of areas they have identified where they believe we should be sunseting now or in the near future some areas.

They've also identified areas where they believe we ought to be doing more than what we're doing or initiate some programs that we don't have on-going. I'd say by and large we agree with what the committee is saying. There are some places we disagree, and we would, of course, have an opportunity to carry on that dialogue, to provide the committee our reasons for disagreeing.

Just let me give you a few examples of where -- we're going to stop the work in the area of degraded containments. That was a recommendation that the committee made, and we agree with that. They asked that we quickly bring to resolution the issue dealing with cable aging. And we agree with that.

But there are others where we agree with them, and there are some facets where we don't agree with them in terms of sunseting. They've asked us to do more in some areas, and we don't agree to do more. An example there has to do with the vessel embrittlement nuclear effluents. The program that we had in Michigan, the Ford reactor -- I mean, it would be nice to be able to have data that would provide us additional information and to maybe change the correlation that we use today. But that would be an enhancement.

And for us to try to continue that effort, we would have to find another university. We think it's going to cost us more than \$2 million to get started. And so we don't think that's cost beneficial.

So there would be issues like that. And we've got the report.

We've, you know, we've read it, and we have some views. But we will systematically -- and what I'm here to tell you is that we're taking each of the recommendations of the committee seriously, objectively, and in fact I have already made some decisions in budget space on some that we're just not going to oppose this work to go on. But you will see that as we go forward.

COMMISSIONER MERRIFIELD: Okay. Well, I appreciate that. I trust it will be in -- that communication will be in a transparent way in such the Commission will have some written materials that we will take a look at in terms of making its own judgment. We're starting to get into the budget time of the year, and these kinds of interactions are helpful in informing us in how we ought to be spending our limited monies.

MR. THADANI: Absolutely. I mean the committee has given you their independent views, and we owe it to the committee and you to make sure the feedback is transparent in documented form.

COMMISSIONER MERRIFIELD: Okay. My time is running short. So let me close out with a couple of -- well, one point, one question. You did go into some detail earlier on in the efforts you've made to enhance and consolidate the codes, like the work on TRACE and MELCOR. I think it's important, as you have said many times privately to me, the importance of having capability in the Office of Research to update and maintain these codes as technology improves and as time goes on.

I guess one of the things I'd like you to perhaps think about, and you can provide this information separately, I'd like to have a better

understanding of how we're getting these tools into the hands of licensing reviewers in other offices and the kind of training that we're using with those folks so that we're getting the biggest bang for the buck out of these codes.

We put a lot of money into the development and the maintenance of these codes. They provide very useful tools, but if the tools are only really utilized by a limited group of folks in the agency, how can we make sure that we get those out to as many people who could really make them as useful as possible? So that's something that at a later point you or Carl can give me in greater detail.

The last thing I want to ask you about is we've had a number of discussions most recently in our meeting with the CFO about how the Commission is informed on reprogramming and changes in the budget. Now the Commission during the summertime period pines on what it thinks you ought to do to spend money. We do an awful lot of work on that, very detailed work by the Commission.

And then a long period of time goes on and when reflecting on what happens the following year, there are a significant number of changes made by the staff, many of which currently are not transparent to the Commission.

Sometimes when the Commission says, "Gee, we want you to go take a look at something. Don't go into too great of detail." But we postulate perhaps we're going to spend a dollar on a given issue, and come to find out later on it's \$7 on a given issue. So there's a significant increase

in the original cost. I'm interested in know how are you going to improve the way you inform the Commission of how you spend money and how you reprogram?

MR. THADANI: I think as all the offices probably owe you a clearer articulation of how we go about doing what we call add/shed process. Fundamental to that process is early prioritization of what work is done. And I think in any organization--and Research in particular has to be very careful because sometimes there's lots of money we're talking about--we prioritize each activity up front that we engage in. And sometimes there's a downside to that because that means we have very good understanding of each issue. And that's when we get in difficulty when new issues come up because we haven't really thought about those.

So we go through and we had and we still do have a prioritization approach that I think is very systematic. It focuses first on safety and then on other performance goals. Attempts to assess value of whatever activity we engage in. Looks at where would the result be helpful for 103 operating reactors or one operating reactor because a value judgment is different in terms of what cost goes into the program.

So we go through that initial prioritization of everything we -- and naturally, our budget can only support so much. So some of the bottom stuff just gets off the table. And then what we end up with is relative ranking the activities in terms of their priority. If a new issue comes up and they do, I personally have asked that we do a better job on generic safety issues. We

had to spend a lot of resources that we didn't anticipate. Certainly the sump issue is a good example I think of that.

So what we do basically is we go back and look at the priorities, look at the bottom priorities, relative. They're all probably important but relatively speaking. And we look at that bottom and say, "What should we do?" We go in and identify what the impact would be from either delaying that work or not doing that work. And that impact is assessed by the PRC to say, "Okay, should we support additional resources because we now understand there are new challenges." First step we do is to look within the office. We try to rearrange some things to try to deal with those challenges.

We can't always do that, particularly if the new challenges are pretty significant in terms of resource demands. So then we'll go to PRC, and PRC will make its judgments on mid-year funding to support those activities.

It's a process we go through. I wish it were a little faster than it is because it is a little less efficient than I wish it were because starting/stopping programs is not very efficient. And sometimes that does happen because of new challenges.

That's a process that we go through. I think it's a very disciplined process, myself, that we go through.

COMMISSIONER MERRIFIELD: Well, I think that -- I want to commend you. I think that the Office of Research has made a lot of progress in terms of how it explains and provides information to the Commission during the budgetary process about the specific research item you're working on.

So I want to leave you with a compliment on that.

What I'm looking for and I'll stop, but what I'm looking forward to is how do we bring that same quality and level of information to the Commission in a mid-year time or in a time period when you're moving that money around so that there's appropriate alignment between the Commission and the staff so that we are using money in the right way to help us make regulatory decisions. Because at the end of the day, setting aside the anticipatory research, which is very important, the effectuation of what you're doing as a research body is making sure that the staff and the Commission has the information necessary to make regulatory decisions.

COMMISSIONER McGAFFIGAN: Mr. Chairman, I might just comment on Ashok's answer. It sounds like from your answer -- if I were the Research director, which I'm not, and I had this stacking of my programs, and if I had new starts toward the bottom of that list, I would not let those programs get started in the first six months of the year. That would be my wedge. And if you're really, if you have a good prioritization list, and these are low priority but they're just above the line, and they want to do a new start here, I think I wouldn't let them start until April or something and when I was clear that I actually had the money to spend.

And then you start the important ones. I mean anything that's at the top of the list, you'd go through and just do it. And you're not worrying about timing. But for the lower priority ones, otherwise you have these starts/stops. "Gosh boss, I just started in October. It will now cost, you know,

\$250,000 to cancel, and I'll get no real value." And you set yourself up for that.

MR. THADANI: Under continuing resolution, we, of course, do not start new projects until, I would say, it gets into January, February time frame.

COMMISSIONER McGAFFIGAN: So Congress does it for you.

MR. THADANI: They do it for us. But I accept the comment certainly, and we need to do better. But I would just note that sometimes the programs are on-going, and it can be disruptive sometimes, but --

COMMISSIONER McGAFFIGAN: I wasn't saying ongoing. If it's ongoing, low priority, you let it go along. But if it's a new start, low priority, then you have to think about the timing of the year in which you start it.

MR. THADANI: Yes.

COMMISSIONER McGAFFIGAN: We have a former Research director whose about to ask questions. So I'll just shut up.

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman.

CHAIRMAN DIAZ: Thank you, Commissioner Merrifield. Let me just -- sometimes it's good to have clean up. And I was usually sitting and looking at the interactions between the different people. And I realize there's a lot of people that are jumping from the fire into the frying pan around this area. I think some of them are jumping from the frying pan to the fire, especially Jack Strosnider, which I want to acknowledge that you know there is a synergistic movement toward the direction that Commissioner

McGaffigan was talking about from research and materials.

And, of course, back there is Marty Virgilio, who is now playing some type of Chinese chairs in here. And I think when we get to next year, we're going to find some different emphasis. It's not that Yucca Mountain is really that a terrifically important project, but it does rise up in the horizon. And so we do appreciate you taking your new responsibilities, and we look forward, Jack, to working with you, and, of course, with you, Marty. We know that you all are working hard in achieving this transition, which is important to us.

Making another comment, the age of communications came up. You know this is dear to my heart. You know, it's not, of course, Research. I think since last year I have been stressing the fact that we have the obligation, not only to do the work but to communicate the work. And that means to communicate it to the public, especially to those cases that have impact on public health and safety or the environment, in a manner that people can understand what the significant is.

I'm pleased to tell you that it would only be hopefully if the wheels of the government turns a little faster, beginning of May, there will be a new organization set up in the agency to deal with communications at each one of the deputy directors and the office directors of the technical communications assistance. We are assembling this new organization to be able to work with you, through you, and with you in a manner that both the Commission and the needs of the agency are served.

However, it starts with each one of you and the people that work with you. It has to be a commitment from the beginning when you look at a product to make sure that the essence of the product is communicated factually. And that cannot be legislated, mandated. It has to be something that everyone believes is the obligation of the agency. And I am looking seriously to your leadership, all of the leadership to senior managers in this area.

Having said that, I may go on now and focus on some of the issues on research. As you know, I believe that priority that we started last year for the agency is to take a proactive approach to prevention, detection, preservation, mitigation, and repair of reactor material degradation. I think it is not one issue. It is a comprehensive sets of issues that actually goes to the very core of what we can consider providing assurance of adequate protection.

I understand there is a joint project between NRR and Research in this area. And I'd like to ask what would be the product of this program? What do you expect that will be the central product of this program? When are you expecting some timely completion of this initiative that the Commission will know what the products and the schedules are?

MR. THADANI: Let me just say one thing, and then Mike will give you -- I just wanted to add that this is an area where industry has also taken an initiative to integrate many of their various activities related to material degradation issues. And the industry has also developed what they

call an integrated plan. And we are also in addition to internal dialogue, of course, we are talking to the industry as well. EPRI, in this case, I'm sorry is the key organization that's involved. Mike?

MR. MAYFIELD: Chairman, in terms of what we're starting now with a PIRT like process to look at degradation types and different mechanisms that could show up in different systems, different components. So there's a set of international experts that we're bringing together to serve on this PIRT panel. We've got a facilitator that actually Farouk Eltawila and his folks have used with their extensive experience with the PIRT.

So we're using that process to identify mechanisms, components, systems, that could be susceptible to either the kinds of degradation we've been seeing or new types that might emerge, based on expert opinion. We're then also looking at the types of mitigation strategies, inspection strategies that could be used. So it's very much an integrated approach to look at what could be degrading next in what time frame. What you do about that in terms of inspecting for it, and mitigating strategies to come to grips with it?

The product will be, actually, a series of outputs from the PIRT panel as we go in time, rather than waiting for the end result. So it will be assessments as the panel goes along of different systems, components that could be susceptible to different types of degradation mechanisms and inspection strategies. So this begins to cascade into several different programs.

The time frame for the first bit of output is in the six to eight-month time frame from when we first get this panel going. We're struggling now with getting all the consulting agreements lined up. We've had some interaction with EPRI and NEI in terms of looking for their support for the panel and in terms of logistic support as opposed to cash. And we've had some dialogue with them to address that issue.

So it's starting soon, measured in, I would have hoped to have been able to tell you we already had our first report. But that just didn't come to pass. So in the six to eight-month time frame is when I'm looking for the first bit of output from the panel, and then continuing over the next year or so to have this comprehensive look.

CHAIRMAN DIAZ: It needs to be done well, but timeliness is an issue.

MR. MAYFIELD: Exactly. And one of the things we have looked at is what NEI and the industries, new materials initiatives did, and their strategic plan, and their ranking. And that was a good starting point. And so we're looking at how to go beyond that and look at what may have been missed, if anything, and to make sure that it's handled comprehensively.

It has been the proverbial pushing a noodle uphill to get going.

MR. THADANI: Could I add to what Mike said? Just Mike's staff actually, just last month, issued a report which summarizes the cracking experience of nickel based alloys around the world and what programs

various countries have in place to try to deal with them. So this has to also take advantage of what's going on in other countries, both in terms of what they're experiencing, as well as some of the programs that they have in place. It's a worldwide issue. And so I think integration would be internal and external to the country.

MR. MAYFIELD: And we did see very strong support for an international conference we held last fall on the nickel alloys. We've seen very strong support from both the national and international technical communities to participate in the panel. In fact, we've had to screen back from the number of people that want to participate.

CHAIRMAN DIAZ: I look forward to keeping being informed of this. This is one of those issues that we don't want to be surprised with like --

MR. MAYFIELD: Yes, sir.

CHAIRMAN DIAZ: I noticed that ASME recently wrote to Dr. Travers, expressing support on their involvement on the development of standards of the PRA quality. I was caught by a phrase in here that I think should have elicited a smile from Commissioner McGaffigan who, you know, when we were dealing with this issue, thought that this program was not developing fast enough.

And if I may quote in here: "While a face approach is prudent and correct, the schedule defining the SRM seems rather ambitious."

Do you expect to meet the schedule set up for developing the standards?

MR. THADANI: We certainly expect to, and this will be laid out in the plan that's going to come to the Commission in June. And this is specifically looking through as . . . I think it reflects the vision well in my mind. I mean where do we want to be x specified years from now as an agency. Given that vision, how can we move up to that point? And that's what's going to be in it.

CHAIRMAN DIAZ: So even with their concern, you still believe that we are taking a very serious and systematic approach to achieve what the Commission laid out on the SRM regarding the --

MR. THADANI: Absolutely. Yes, we are.

COMMISSIONER MERRIFIELD: We're always concerned about over-conservatism. Perhaps ASME is overly conservatism about the capabilities of our staff. We've been doing better recently.

COMMISSIONER McGAFFIGAN: I can't quite let it go.

CHAIRMAN DIAZ: I knew it.

COMMISSIONER McGAFFIGAN: The problem I raised was not how quickly the code organizations could come up with PRAs. It was that for the later phases other than phase 2, I did not know what the regulatory mechanism was, especially with the backfit rule looming that would actually get the PRAs to phase 3 or phase 4 quality. And I'm still confused as to what the regulatory -- if we don't take advantage of the 50.46 rulemaking to require the prospective 50.46 rulemaking; I'm not sure what will ever be done later.

And I think that some of the public comments from some of the

industry have only reaffirmed my concern that they see, like I, no regulatory mechanism that will ever get them to phase 3. And I think they're sort of happy about it.

CHAIRMAN DIAZ: Excellent. I knew that was coming. Let's see.

Now that we mentioned realistic conservatism as a term I started to use last year, which I think my fellow Commissioners have, you know, endorsed the fact that both our regulatory decisions and the analysis need to be realistically. And, of course, we always want to have a measure of conservatism.

You talked a little bit about MELCOR and the severe accident. How are we actually using realistic conservatism into some of these codes that are reasonably well establish but we continue to improve?

MR. THADANI: First, we're definitely making sure that they're physically based. That's fundamental. I'm going to ask Dr. Eltawila to address this, but I'd like to give you some thoughts in mind.

As I leave the Office of Research, and I really do hope that the Commission will support the office. I think that we have to do what Commissioner McGaffigan said up front. Sometimes it's easier, cheaper, quicker, to say I'm going to do some conservative analysis. And the answer doesn't impact my decision.

And then we have to make sure we document, communicate that properly so it's not misused. But then there are other sites where to

understand what is realistic conservatism, one needs to have a reasonable in the data base from which to make those conclusions.

Now I will say sometimes that requires more resources. I mean -- and I hope that the Commission will --

COMMISSIONER McGAFFIGAN: Lots more resources.

MR. THADANI: Sometimes. But as long as we're very judicious and said this does impact what decision we're likely to make, and I really do hope the Commission will support the Office of Research to develop the necessary foundation for those kinds of decisions. And that's the vision I see.

CHAIRMAN DIAZ: I see Carl.

MR. PAPERIELLO: Given a simple example, we all learn in school how to solve the differential equations in one dimension. That's fairly straightforward. When you go to three dimensions, it becomes more complicated, where you have to use a numerical analysis ten years ago, one dimension, you can easily do in a desktop computer. Three-dimension, you'd probably want a bigger machine. Today, you can run those calculations on a desktop computer. It's just one example. When you get into thermal hydraulics, you're into non-linear differential equations.

I'll give a practical example in radiation protection. A basis for much of our decommissioning modeling is NUREG, the model's in NUREG is 5512. They were developed 11, 12 years ago. They're one-dimensional models. The source term is infinite. Now to change that, it's going to take an

investment of resources to do it realistically because we're going to three-dimensional models, which obviously limits the source terms because it's more complex to solve.

And we're doing that. Now this is where we're sharing resources, and we're working with the EPA and the DOE and develop through PNL to develop more realistic models. It does cost resources to do that.

CHAIRMAN DIAZ: But it is doable.

MR. PAPERIELLO: It's doable, and the technology is changed. The things that couldn't be done ten years ago can be done today at a relatively inexpensive.

CHAIRMAN DIAZ: Okay.

MR. ELTAWILA: Very short, I think, a short answer. It's just continuous assessment of the code based on the experiment data that is available. But at the same time because MELCOR is used beyond design basis accident we have to use the PRA to see if the scenario is credible or not. We cannot just go always to the extreme, assuming that the whole core is melting and all of this stuff.

So we're using the experimental data, and the PRA to inform us about the probability of the scenario.

CHAIRMAN DIAZ: Okay. Thank you. A couple of more comments. The issue of security and vulnerability assessments, in slide 11, you maintained that there's an on-going need. And we realize there's a small

on-going need to continue it. But I didn't want to leave the impression that the bulk of that work is essentially coming to an end.

The majority of these issues are now being essentially completed. They're being analyzed. They're being -- some of them peer review, but we have done the majority of that. There could always be some need, and there'll be some work that is already programmed. But I didn't want to leave the impression that this is an open field.

MR. THADANI: You're exactly right Chairman, and I believe that the quality of work in the area of vulnerability assessment is got to be best in the world. I do not believe any of it, but it is.

CHAIRMAN DIAZ: I agree that the products that we are now seeing are comprehensive. They address the issues, and they provide the Commission with an appropriate tool to make the decisions that we need to make. And for that, we thank you.

One last pet peeve of mine because many years ago I used to look into this area; I notice that I&C keeps coming into different parts, but it's never played up because there's always something that's more urgent and more interesting.

However, I keep reading that eventually, you know, everybody is going to take attempts, whether they're phased into bringing it into nuclear power plants or everyone of the processes, real state-of-the-art digital instrumentation. And I never hear enough about this issue.

I just want to make sure -- we're running out of time -- but you

know somehow I would like to hear a little bit about it. Maybe somebody gathers what we have on it and see where we were. We used to have years ago a very vibrant engagement on this issue, but it seems like it has been reduced. A comment on that?

MR. THADANI: Just a very brief one. Your observation is obviously right on in that we have not really had any extensive discussion on digital I&C, but we are engaged. In fact, if you look at the ACRS report, it does focus on some of the work we're doing in that area.

And they suggest -- we're taking advantage of Haldon a great deal in area, particularly man/machine interface issues and so on. The bottom line is I think we're focusing, in my judgment, appropriate level of attention. Where I believe we need to be stronger in my view is the verification, validation aspects. I think that on the hardware side, we're probably in a pretty good shape. But we have efforts on-going.

And, Mike, if you want to add.

MR. MAYFIELD: Okay.

CHAIRMAN DIAZ: Alright. Well, if my fellow Commissioners have any additional comment. If not, I want to thank the staff for their efforts throughout the year in bringing to the attention of the Commission these issues. We look forward to working with you.

And, Ashok, I look forward to being with you a little closer in the months to come. I think that the issues that are being dealt with are of great importance to us.

We want to thank your staff. And with that, we are adjourned.

(Whereupon, the Commission meeting was adjourned.)