UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

OFFICE OF THE SECRETARY

***

BRIEFING

OFFICE OF NUCLEAR REGULATORY RESEARCH

Nuclear Regulatory Commission
Commissioners' Conference Room
Building 1
One White Flint North
11555 Rockville Pike
Rockville, Maryland
Wednesday, February 9, 2000

The Commission met in open session, pursuant to notice, at 10:00 a.m., the Honorable RICHARD MESERVE, Chairman of the Commission, presiding.

COMMISSIONERS PRESENT:

RICHARD A. MESERVE, Chairman
GRETA J. DICUS, Commissioner
NILS J. DIAZ, Commissioner
EDWARD McGAFFIGAN, JR., Commissioner
JEFFREY S. MERRIFIELD, Commissioner

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

MICHAEL MAYFIELD, RES
THOMAS KING, RES
ASHOK THADANI, RES
WILLIAM TRAVERS, EDO
MARGARET FEDERLINE, RES
ERNIE ROSSI, RES
ANNETTE VIETTI-COOK, Secretary

P R O C E E D I N G S

[10:00 a.m.]

CHAIRMAN MESERUE: On behalf of the Commission, I would like to welcome you to the briefing by the Office of Nuclear Regulatory Research. That office, as I know all my colleagues realize, plays a vital role in the support of the agency's regulatory mission. It develops the technical bases that underlie the Commissions's regulatory requirements and develops the analytical tools that the NRC staff uses to assess licensee compliance.

The office provides technical assistance to NRR and NMSS, through its confirmatory research program, and, also, conducts anticipatory research to help position the NRC for the future. Decreases in the NRC's budget over the last several years have hit the office particularly hard. I know that the office has responded by seeking ways to leverage its resources, to allow it to fulfill its very important support mission. I look forward to hearing this morning about both the past accomplishments of the office and your aspirations for the future.

Let me turn to my colleagues and see if they have opening remarks. And if not, why don't we proceed.

DR. TRAVERS: Thank you, Chairman, and good morning. We are glad for the opportunity to brief the Commission today on the research program. Joining me at the

table today are the Director and Deputy Director, Ashok Thadani and Margaret Federline, and the senior management of the research team, who Ashok will introduce in just a minute. Behind me, let me quickly mention that we have a number of senior managers, who are available to respond to any questions or issues that arise. Included are Carl Paperillo, who is the Deputy Executive Director for Materials, Research, and State Programs; Frank Miraglia, who is the Deputy Executive Director for the Reactor Program; and major stakeholders, Sam Collins, from the Office of Nuclear Reactor Regulation, and Marty Virgilio from the Office of Nuclear Material Safety and Safeguard are, also, here joining us today.

And with that, let me turn it over to Ashok, who will begin the presentation by identifying his --

MR. THADANI: Thank you, Bill. Good morning. On my right is Tom King. Tom King is the Director of Division of Risk Analysis and Applications. To his right is Mike Mayfield, who is the Acting Division Director of Engineering

Technology. To my far left is Ernie Rossi. He's the Director of Division of Systems Analysis and Regulatory Effectiveness. And sitting behind me is Charlie Ader, who is the Director of Division of Project -- Program Management.

May I have view graph number two, please.

CHAIRMAN MESERUE: You forgot Margaret.

MR. THADANI: Oh, Bill introduced Margaret. Margaret -- Margaret and I are a team.

Let me first note that the fiscal year 1999 was indeed a pretty significant year for us, in terms of change and some of the challenges. We went through a major reorganization, wherein some of the AEOD functions were merged with the Office of Research. We went through significant reductions in management positions. In fact, we went from 23 SES positions to 13. We did conduct the self-assessment, with the assistance of Arthur Andersen, and we made a number of changes that you will hear about, as we go through the briefing.

While it's been a challenging year, I believe we have met our commitments. The briefing today will cover quickly the role of research, in response to the June staff requirements memorandum, and how we are leveraging our resources and some examples of past accomplishments and their value; and then get into the substance of the discussion on our recent accomplishments and plans for future, and what we see as some of our future challenges would be.

May I have the next view graph, please? Now, as -- in terms of the mission of research, there were certain key elements that led us to identify the areas that were

provided to the Commission in SECY-99-281, December 9, 1999. The elements were, first, to be sure that in the development of technical basis for regulatory decisions, that we maintain certain amount of independence. Independence clearly does not mean isolation. And, in fact, we have a number of cooperative programs you will hear about, both with the industry, as well as the international community.

It was important to recognize that we should develop sufficient technical basis to make realistic decisions and if margins are to be added, they are to be added at the end, so there's a good understanding of what the margins might be in those decisions.

The third key element in developing our role was to make sure that we were timely in providing the information. That meant planning ahead, in many cases.

The fourth key piece was to make sure that we do what we can to maintain the kind of technical expertise that would be needed by the agency.

I'm not going to go through all the areas that are identified here. I'll just maybe highlight a couple. It is important for us to make sure that our research provides the knowledge where knowledge is needed, particularly areas which might be important to safety and where there might be significant uncertainties and where agency decisions are likely to be made at some future date.

I do want to touch on the anticipatory research part. I think it is very important that we, as the office, pay close attention to what is likely to come down the road. We have had some criticism in the past and we want to make sure we're responsive to that. That means we have to get out more, interact more with organizations who are directly responsible for new technology, new designs, and so on.

I, also, would like to make a note that we're paying close attention to our new responsibility, the function that came from AEOD, making sure that we're looking at operational experience and making sure that the staff has direct access to me, if there are issues of some significance, as the Commission noted in its staff requirements memorandum.

Two key elements that I want to highlight here are making sure that we have actively engaged ourselves with the stakeholders, both internal and external, and we'll share with you later on some of the things we're doing. And I think this is an area where we do need to improve. In terms of our work, I think we've made the number of improvements. I'd like to think that we're doing much better in leveraging our resources and we're looking for additional opportunities to see if more can be done, in terms of leveraging our resources.

May I have the next view graph, please? We do

have -- as you see here, we do have a number -- a significant number of cooperative agreements, both with domestic, as well as international organizations. Our agreements cover most of the areas that we're involved in, including fuels, thermal-hydraulics, severe accidents, aging, seismic issues, health effects, structural issues, and so on. In certain areas, we receive funds from Funds or -- and/or information, where we take the lead. We have code assessment and maintenance program on thermal-hydraulic codes, 22 countries participating. We receive some funds from them. Similarly, we have severe accident research programs. We have the lead up to now. And a cooperative

program in risk analysis, a number of countries participating and provide some resources to us.

We are, also, engaged in a number of international activities where we provide resources to those countries. They have the lead in some of these efforts. We're contributing on the order of four million dollars in these efforts and the total cost of that research is about $60 million. More and more, we are going into support mode rather than in a leadership role, and this is an issue that we'll come back and touch upon later on.

May I have the next view graph, please? This is an important piece. It is something that is of some concern to us. That is, it really does take time to fully realize

value of research. In fact, if you look at some of the benefits of our past research, I'll describe some examples here, when we initiated these programs, we did not anticipate some of the benefits of this research effort. When we began our aging research program many years ago, it was to really understand what the effects of aging might be on component structures. We didn't realize that, at the time, that kind of research information could be valuable in some license renewal decisions that would have to be made, that are being made now. In fact, some of this research was used to develop the standard review plan for license renewal activities, resolution of some other generic technical issues that have been addressed, as part of our review process.

Pressurized thermal shock is another example, where some of the work in terms of understanding flaws and embrittlement effects, in terms of lifetime for reactor pressure vessel -- obviously, some of the research results are showing that we could revise our regulation and it might open up options for some additional pressurized water reactors to pursue the option of license renewal.

Risk-informed activities is another major example. March 1400 was published in 1975. It was pioneering work 25 years ago. And, of course, over the last many years, we have used this technology, in making many decisions, in

terms of safety enhancement at operating reactors. Station blackout rule, anticipated transients -- some of these rules were based on using risk information to understand relative importance, safety impact, along with Commission's policy statement on safety rules, to know how far we should be pursuing some of the safety issues. And I think you know very well some of the recent activities that were engaged in, both in terms of today's issues, oversight program, as

well as future issues, trying to risk-inform Part 50 of our regulations.

Decommissioning area, we have developed tools, in terms of screening, as well as survey techniques. And we believe these tools are not only focusing attention on what's important to safety, but, also, providing some flexibility to the industry.

Source term: most of our requirements today are based on 1968 understanding. The technical information document that was published in 1968 on the regulations are based on that. And after Three Mile Island accident, considerable severe accident research has been done over the '80s and early '90s. And, as you know, we have a much better understanding of the source term, both in terms of timing of release, as well as physical and chemical forum. And this information has been used by the Office of Research to assist NRR in rebase lining, understanding what the

impact would be on offsite releases, control room doses, as well as environmental qualification considerations.

We did four pilot studies and I think with proper focus on safety, significant savings have been achieved by these four pilot studies. One pilot plant told us that they are saving somewhere on the order of about $600,000 a year from removal of leakage control system and that they thought that the lifetime saving would be on the order of seven million dollars. We anticipate a significant number of license amendment applications over the next few years, to take advantage of current research knowledge.

My point here simply is that many of these programs were started a long time ago. They took a long time, a lot of resources. They have not only related to safety improvements, but they, also, relate to much better decisions, in terms of what the resources should be focused.

May I have the next chart, please? I want to -- this is a complicated chart, I know, but all the research work really focuses on safety, recognition, what's more important safety and what's less important safety, so decisions can be made. In the process for reassessment, we developed these planned accomplishments early on. In development of these planned accomplishments, we are, of course, were focusing on what the agency's performance goals were. For example, in terms of technical basis to address

safety issues, include things like tracking -- crack growth rates, repairs that need to be made, and generic safety issues, and things of that sort. Improving program process efficiency considers things like adopting consensus standards or consolidating some of our computer codes, to

make sure we're being more efficient and so on. Preparing ourselves for future, things like mox fuel and so on, is included under that category.

Developing technical basis to allow reductions to unnecessary license burden: here, what we have are -- there are two regulations that we have identified -- well, we know they are conservatisms. I touched on pressurized thermo shock and the emergency core cooling system requirements in the 5046 is the other piece there. I think all of these, if we do our job right, will influence public confidence. In addition to that, we, also, have the water reactor safety meeting, where we share results from the work we're doing.

I believe that these goals -- performance goals are not mutually exclusive and that it's -- what we believe what we're doing is, in relative terms, it influences each of the goals, to a certain degree or other, but output from what we're doing influences, by and large, all of these goals. And as I said, we started with the performance goals, developed these plan accomplishments. Under that, we identified activities that would really influence these

accomplishments and we used the analytical hierarchy approach to try and prioritize the work we do, and then go back and see how it might impact the performance goal, in terms of the work we do.

May I have the next chart, please? Chairman, as you noted in your introduction, there's been a significant long-term trend of declining resources for research. What I have here are resources shown, in terms of on this chart, program support dollars and the next chart, FTE staff resources. These resources include both the research function, as well as the AEOD function that was transferred to the Office of Research. As you can see, there has been significant reduction in program support from 1990 to fiscal year 2000, approximately eight million dollars, going from $50 million to about $42 million. And then it shows you relative impact on various research programs, the reactors, materials, and waste.

May I have the next chart, please. This is, again, the same information. We are -- the FTE allocation was reduce from '99, where it was about 200 FTEs to 180 FTEs fiscal year 2000. And we have -- of course these reductions have led -- lies our prioritization scheme, to see what functions, activities we would not conduct, as a result of these reductions.

With that as background, we'll start with Mike

Mayfield and try to go through some of the major examples or

accomplishments and what the future challenges are. Mike.

MR. MAYFIELD: Thank you. Can I have slide nine, please?

The Division of Engineering and Technology is responsible for a broad range of the traditional engineering disciplines: mechanical; electrical; electronics, which picks up the instrumentation and control function; structural; civil engineering; earth sciences activities; and the materials sciences, which bring in the embrittlement, environmentally assisted cracking, non-destructive examination. Because of this range of disciplines, we find ourselves often involved in cross-cutting issues that, also, pick up involvement with the thermal-hydraulics activities and the probabilistic risk assessment. The two issues I want to brief you on this morning are, indeed, examples of such cross-cutting issues.

The first is assuring the integrity of the reactor pressure vessel. The staff, both in research and NRR, has and continues to focus considerable attention on assuring the integrity of the reactor pressure vessel. The vessel houses and supports the reactor core, channels flow through the core, and it's the only pressure boundary component whose design -- or whose failure was not accommodated in the design of the engineer and safety features. Its failure has

always been treated as an incredible event and the staff's efforts have been designed to make sure that that assumption is, in fact, a valid one.

Our research over the last several years have led to improvements and understanding of key factors that affect reactor pressure vessel failure. This has permitted us to make some improvements in operational flexibility, particularly in the pressure temperature, when its for reactor start up and shut down.

Maintaining a high level of safety for the reactor pressure vessel continues to be our primary focus in this program. However, owing to better understanding of some of the issues and quantification of uncertainties, we've been able to reduce some of the unnecessary burden in the earlier regulation. In 1999, we initiated a program that's a very thorough reevaluation of the technical basis for the pressurized thermo shock rule, which is 10 CFR 50.61. This program involves the thermal-hydraulics efforts, probabilistic risk assessment, fracture mechanics, and the materials behavior, particularly embrittlement. The pressure thermo shock rule places effective limits on the embrittlement imposed -- or embrittlement levels permitted for the reactor pressure vessel and this has affected both pressure vessel life and then facility life has, also,

affected some licensees license renewal decision.

We have been drawing on research results that have made -- I think I have an echo here -- that have made major improvements in some of the key areas, understanding the flaw distributions, the fabrication flaw distributions from the original vessel fabrication. We've looked and have made major strives forward in the pressure vessel and embrittlement estimates and in some of the fracture analysis methods, as well.

Our program is drawing heavily on both the thermal-hydraulics and probabilistic risk assessment efforts. The thermal-hydraulics were not considered all that seriously in the original formulation of the rule, simply because the uncertainties in the other technical areas, principally the flows and the embrittlement estimates, were so large that the uncertainties in the thermal-hydraulics calculations didn't figure in. As we have reduced the level of uncertainty in those other areas, the thermal-hydraulics efforts have taken on increased significance.

The PTS rule is one of the agency's early attempts at a risk inform performance based regulation and we're revisiting the risk considerations down to the level of what would be an acceptable level of risk for the reactor pressure vessel failure. This project has been coordinated extensively with NRR and with the industry, and we have a

very active industry participation through a parallel effort, where they are investing resources and doing many similar things and complementary activity. Our continuing work in this area is expected to lead to the PTS reevaluation and publication of a revised regulatory guide on embrittlement estimates by the completion of calendar year 2001.

The next slide, please. The second area I wanted to describe is the long-term storage of spent fuel. Several licensees have installed dry cask storage systems to permit on-site storage of spent fuel. The original 20-year license terms are nearing expiration for some of the early systems and the first application for renewal is expected in the 2001 time frame. MSF has requested RES support in developing the technical basis to support timely evaluation of the renewal submittals.

We initiated a cooperative program with EPRI and DOE in 1999, to evaluate the condition of casks and fuels that were in a demonstration program at the Idaho National Engineering Laboratory. We have examined the interior and

exterior of one of the cask designs and we've made some visual examinations of fuel assemblies in that cask. We are anticipating doing destructive evaluation of the fuel rods, to look at the condition of the fuel, and we'll -- this program will be providing the staff valuable data on the

continuing long-term integrity of the casks and the fuel stored in them.

We plan to examine a second cask of a different design, as part of this program. In that sense, we will, also, be developing models for the nuclide inventories and the source characteristics that are used in the overall safety evaluations for the cask. We have had some significant expressions of interest from the international community in this program and we'll looking to expand the program to capitalize on that interest.

With that, I turn to Tom King.

MR. KING: Thanks, Mike. I'm going to discuss the next three slides, which, for the most part, cover the scope of activities in my division. My division is primarily associated with developing and applying risk insights and covers support to NMSS and NRR. The three slides are pretty much broken down according to the work in the three branches, which are in the division.

If I can have slide 11, please? Slide 11 highlights activities associated with radio nuclide transport in the environment, which includes development of models and analytical codes. It can be used to assess some clients with a license termination rule. It includes activities associated with radiation protection, which involves improvement of models and codes to analyze health

effects. And it involves developing the technical basis for various regulatory activities; for example, the rulemaking on clearance and assessing the feasibility of entombment as a decommissioning option.

Work is primarily associated with the goals of maintaining safety and ensuring realism in regulatory decisions. Although it's possible, some reduction and unnecessary burden could, also, result from this work. Some of the significant accomplishments in FY99 have been publishing a revision eight of NUREG 1307, which is really an estimate -- updated estimate of waste disposal costs that licensees can use, in estimating what they need for the decommission funding. We intend to update that again this fiscal year.

Participating with other federal agencies in funding a study at the National Academy of Sciences, looking at the effects of low level radiation. This is directed

toward assessing the realism of the linear no threshold hypothesis, which is used in today's models that assess the health effects from low level radiation.

And we completed a study on the feasibility of entombment as a decommissioning option, provided a paper to the Commission. We conducted a public workshop in December on this and we're planning to come back to the Commission in June with a recommendation as to whether we should proceed

with rulemaking in this area.

Future activities, we continue to support development at the technical basis for the clearance rule. We've issued a draft report that put the individual doses for recycling metals. We're continuing to work on assessing collective doses and costs, not only for recycling metals, but, also, concrete and soils.

We've issued a draft report that reassessed materials exempt from licensing. We plan to finalize that report in this fiscal year. It basically went back and looked at where exemptions have been given in the past, using updated information on the quantities and the life cycle of those materials, assessed individual and collective doses. We've provided that report. It's out for public comment now. Ultimately, it will be used by NMSS to reassess whether the exemptions are still valid or not.

And, finally, we plan to complete work on two upgrades to analytical tools that can be used for decommissioning, very simplified code, which we call DandD. It's basically a screening tool. All licensees need to have is some idea of the contamination on their site and it can be used to assess whether that site would comply with the license termination rule. And then there's a more detailed code that we're working on upgrading, called RESRAD, which -- for sites, where you need to get into modeling more site

specific parameters. It's going to allow that to take place.

We can have slide 12, please. Slide 12 deals with operational data assessment. Work in this area, which really represents work that was transferred in from -- to research from AEOD back in January of 1999. The work involves assessing reactor operating experience for generic, as well as plant specific insights and contributes to the agency goals of maintaining safety and ensuring public confidence. Specific activities that we include -- do in this area are: we assess operating events for the risk significance, what we traditionally call the accident sequence precursor program; we assess the reliability and

availability of selected components and safety systems; we assess selected inspection findings for their risk significance; and we do specific component or system studies, where there appears to be problems occurring. To do this work, we, also, need to develop tools and maintain databases, which are, also, done in this work area.

Significant things we did in FY99 included: we assessed the risk significance of the inspection findings from D.C. Cook, for example; we issued seven reliability studies on reactor safety systems and two reliability studies on components; and we supported the plant oversight process in areas such as helping to develop a guidance on

how you determine the risk significance from inspection findings.

In addition to continuing the operating event and the reliability study work, in the future, we are working on developing a more comprehensive set of what we call risk-based performance indicators that potentially could be used in the plant oversight process, if they are shown to be valid and useful. We are, also, working on expanding the accident sequence precursor analytical tools to cover shut down and external events.

Why do we do this work? What have we learned? Basically, we've gotten insights as to what is causing reliability and availability problems on systems and components that we provided NRR and they are available for licensees to use, to help focus their attention. We generally found the system and component reliability are improving with time. And the DRA results are generally conservative, with respect to the system and component reliabilities that they use, as well as initiating event frequencies.

Reporting of this information, we have various schedules today that this information is reported on. There is an annual report on the accident sequence precursor program. The reliability studies are issued, updated every couple of years, although we're trying to get that on to an

annual basis. Other reports, like inspection findings, are issued on an as needed or as requested basis. However, we have stepped back and taken a look at maybe we should try and -- or how can we try and better integrate these reports, so that we have a more comprehensive look at what operating experience is telling us, that would be issued on a more periodic basis. So, that is something we've got under assessment right now.

If you go t slide 13, risk-informing NRC regulations and activities. This is certainly an activity

that has received a lot of visibility. It includes to risk inform -- assess risk informing the technical requirements of 10 CFR Part 50, as well as our work in maintaining and improving the guidance for a risk-inform licensing actions. This work is directed towards the agency's goals in maintaining safety, while, at the same time, reducing unnecessary burden. As you know, we've undertaken a study of the technical requirements in 10 CFR Part 50, as described in our SECY paper 99-264, recently approved by the Commission in their February 3rd SRM.

The plan and approach described in that SECY were developed with quite a bit of stakeholder input. We had a number of public meetings. We had a public workshop before that paper came to the Commission. We're planning another public workshop later this month, to describe our progress

and the approach that's been developed and some of the applications of that approach, on a trial basis, to a couple of regulations. There will be a lot of -- we expect a lot of stakeholder involvement in that workshop. We plan to give the Commission a status report in March and the results of the workshop and where we stand and that status report will include any policy issues that we need to bring before the Commission that we need their attention on before we proceed and complete the study.

Key future activities: in addition to completing the study of the technical requirements in Part 50, which our schedules calls for completing in December of this year, we plan to update the regulatory guides that are associated with risk-inform licensing actions. That will begin later this year. We expect to have Reg Guide 1174 hopefully updated by the end of the year and the application specific ones later on.

We're, also, developing what we call the agency risk-inform regulation implementation plan, which was described in the January 13th memo to you. This will be the replacement for the PRA implementation plan. Hopefully, it will be more comprehensive, in terms of laying out where the agency wants to go and how it intends to get there in the risk-informed activities.

We're, also, providing support to NMSS in selected

areas, such as performing a risk assessment on dry cask storage.

Finally, I should note that the thermal-hydraulic program provides valuable support to our risk-informed activities. The thermal-hydraulic codes are essential for analyzing various accident scenarios, assessing the degree

of realism, and the current requirements and the implications of proposed changes, including the effect on safety margins. In effect, the thermal-hydraulic codes provide information on accident consequences, which basically are 50 percent of the risk equation, since risk equals probability times consequences.

With that, I'll turn it over to Ernie.

MR. ROSSI: My division is the Division of Systems Analysis and Regulatory Effectiveness, and the division has the program for generic safety issues, regulatory effectiveness. It has some work in the area of operational experience review. It has the work on human performance. The division, also, has the thermal-hydraulics program, the program for experimental work in analysis on fuels, and it has the severe accident program.

Slide 14 will talk about managing and resolving generic safety issues. About two years ago, there was a concern from both the ACRS and Congress on the number and age of generic safety issues. And since that time, the

office has performed a self-assessment, improved the process, and there has been considerable management emphasis on resolving issues.

The generic safety issue program is the agency's program for feeding in new problems that arise into the regulatory process. So, we look at those problems and see if anything needs to be put into the regulatory process. The program, also, takes potential generic safety issues and analyzes them and, in a number of cases, determines that no further generic actions are warranted, and it does a good analysis and documentation of that.

In fiscal year '99, one generic safety issue was reprioritized based on updated information, and five were resolved with no new or revised requirements for licensees. As a result of the self-assessment that we did, we developed a new management directive that focuses the up-front work on generic safety issues much better, to determine whether they should or should not be worked on and it, also, streamlines the process. What we have done in a generic safety issue in the past year or year-and-a-half is primarily focused considerably more attention on resolution of generic safety issues. This process is one where we get new items, from time to time, as we close out the old one. So, we do have three new generic safety issues that have been identified for prioritization next year. And we, also, have three

generic safety issues that are scheduled to be completed between now and the end of the calendar year.

In resolving the generic safety issues, one of the

things that we have done is we've tried to make considerable use of a number of other research products that have been completed since these generic issues were originally identified. We've taken a hard look at information from probabilistic risk assessment studies, information from individual plant examinations, and, also, we've looked at operating experience. I'd like to further note that prioritization of generic issues is an area where we will use NRC staff to perform considerable amount of the work that's been performed by contractors in the past.

If you go to slide 15, now, slide 15 talks about our work in providing support for burnup credit to reduce regulatory burden in areas that involve spent fuel. Until recently, the NRC has required criticality analyses for spent fuel in transport and storage casks to be based on the assumption of fresh fuel without burnable poison. Burnup credit refers to performing criticality analyses using more realistic assumptions, based on the fact that the reactivity of the fuel has been reduced, as a result of the fuel having been used to produce power.

There are a number of uncertainties in looking at burnup credit. I'll mention a few of those. Uncertainties

include things like the actual isotopic content of the spent fuel. Axial and horizontal burnup profiles are important in providing burnup credit, and end effects and burnable absorbers.

The outcome of this effort is there's both a safety benefit and a cost benefit of this work, because fewer casks will be used for shipment and storage of spent fuel. The safety benefit is if you're casks have to be transported, the personnels are reduced and, obviously, the fewer casks that are needed will reduce the cost for the industry.

In fiscal year '99, research supported NMSS in issuing interim staff guidance for assessment of residual burnup credit margins for actinides. We have recently finalized an agreement with Belgonucleaire for collaboration to do interval criticality tests on burnup credit. And our future activities include assessment of residual burnup credit margins for fission products and for looking at fuel burnups altitudes of 62 gigawatt days per metric ton. We are, also, going to look hard at the -- or look at the credit that can be given for fission products, over and above what we've already provided, interim step guidance on for the actinides. And so, we are obtaining fission product test data to validate codes that are used for burnup credit. This is an area where we know we are very conservative and

what we are trying to do is to do the research, to set the technical basis in a rigorous way, for being able to provide the burnup credit and still ensure that we have maintained appropriate safety.

The next four view graphs will discuss the research activities in areas of thermal-hydraulics, fuel behavior, and severe accidents. These research areas are designed to establish and maintain the agency capability to assess the behavior of the fuel cladding, reactor pressure boundary, and the containment, the three fundamental barriers to the release of fission products to the environment. And we will do this by looking at -- being able to look at a variety of accident and transient conditions that may challenge the fission product boundaries.

In the 1970s, the NRC maintained an extensive research activities in fuel behavior and thermo-hydraulic areas. In the 1980s, our support for these areas declined significantly. The reasons were that fuel vendors were not pursuing changes to the fuel or cladding, and the belief was that the data available at that time would be sufficient to addressing the issues in the fuel area. The thermo-hydraulic codes were believed to be adequate for predicting plant behavior for design basis accidents.

Resources were, also, shifted to address severe

accident uncertainties after the Three Mile Island accident. Other countries, particularly France and Japan, continued to conduct thermo-hydraulics and fuel research. And in the early 1990s, the AP600 certification work and some results from the Capri facility in France indicated the need for more emphasis on thermo-hydraulics and fuel research in the U.S.

Slide 16, please. The thermo-hydraulic codes are essential for calculating temperatures, pressures, flows, and reactor core parameters during postulated transients and accidents. And this information is fundamental in the analyses of the fuel and its cladding, and for a number of the phenomena, one of them being pressured thermo shock that you heard discussed previously, involving the reactor coolant system boundary. This program will support an independent capability within the NRC, to assess and audit vendor licensee analyses.

One of the accomplishments of this program was that during the AP600 review, the NRC identified a problem with the automatic depressurization system sizing by performing our own analysis. That was a very important result, because the safety systems for AP600 are passive and

dependant on gravity feed, and, therefore, the depressurization system was essential for mitigation of accidents.

We are, also, using our codes to identify the problem with licensee analysis of Electro-sleeves or steam generator tubes, under severe accident conditions, and that was with respect to what I think you know was the Calloway Amendment. The codes are used for a number of other things that I've listed here: assessing operating events. Tom King mentioned the need for all of this work to support risk-inform regulatory activities. Risk-informing the regulatory activities will require parametrics analyses to get realistic results, identify the uncertainties in those results, and to reduce excess margins.

There's a number of other areas here, where we intend to use the thermo-hydraulic codes, and I will mention one of them that we're undertaking and that is that we're going to undertake work to look at the decay heat assumptions that are used in transients and analyses where we believe there is a lot of conservatism. And, again, this will be looked at to provide a technical basis for using a more realistic decay heat curve.

Slide 17 talks about analysis infrastructure in the area of thermo-hydraulics, fuel behavior, and severe accidents. I'd like to point out that the infrastructure that's talked about includes computer codes, which are user friendly and can be used by the staff; maintaining NRC staff expertise to use these codes; and, also, having appropriate

experimental facilities for assessing the models in the codes; and, also, for looking at specific issues.

And the outcomes are listed here as more accurate codes to be used by the agency. And, again, I will stress the need for this work in development of a risk-informed Part 50. We have been doing considerable work in code consolidation, which I'll talk about on the last two slides, which will both improve our computer code capability, make them more user friendly, and, also, reduce costs. And the accomplishments for fiscal year '99 are listed here and they have to do with the consolidation of the code effort and developing more user friendly codes that can be used for parametric studies.

Slide 18 talks about the recent -- key future activities and recent activities in the thermo-hydraulic code area. Actually, this one covers recent ones -- or the future ones. In fiscal year 2001, we will be supporting two thermo-hydraulic codes, TRAC-M and RELAP-5. By fiscal year

2003, the original four codes that we had in the thermo-hydraulics area will be replaced by one single consolidated code. And, also, we are carrying on a number of experimental programs in this area, to assess and improve the codes and considerable -- most of that major work will be done by fiscal year 2003.

In the fuel behavior area, in fiscal year 2001, we

will complete a peer review and release an improved FRAPTRAN code, which will be used for analysis of high burnup fuel and we'll, also, include information on material properties of cladding that we have obtained from various experimental programs.

The last slide, slide 19, indicates similar information on the activities that we have planned for consolidating codes in the severe accident area. I would like to point out that we intend to do in-house analyses for alternative source term applications, as well as the other work that's listed there on severe accidents.

I, also, want to make a point that the consolidated codes that we are finishing will be continually maintained; to ensure maintaining the expertise; to run the code within the NRC; to ensure that the codes are made compatible with involving computer technology; and to improve and correct code models, where necessary, to address new issues or correct problems that we find.

And that completes my discussion. Margaret.

MR. THADANI: Margaret?

MS. FEDERLINE: Good morning. One of the most difficult challenges that we face in the Research Office is balancing short-term and long-term needs. Environmental factors, as well as the need for -- the need for additional information underlying phenomonalogical understanding sort

of drives us to look to the future and understand what our needs will be. As you are all well aware, the industry's look for opportunities for efficiencies has raised the importance of understanding the margins in our regulations. So, many of our future needs are driven by these perspectives. Because of the time, I'll talk about just a few of these and then I can answer any questions that you might have on others.

Industry has indicated a move to high burnup fuel. One of the challenges that we deal with is that our regulatory criteria were developed much earlier and were based on a time when high burnup was thought to occur at 40 gigawatt days per metric ton. International data have raised some questions about the rate of cladding corrosion, as well as reactivity initiated events. We need to confirm

the adequacy of our regulatory criteria in these areas, up to the 62 gigawatt per metric ton limit that we're currently using.

It's, also, important to prepare the agency for the future, as obsolescence of components occurs in the nuclear industry, as well as the introduction of new digital technology. It's important for us to convey to the industry exactly what information we'll need to review and what the acceptance criteria in many of these areas will be. Industry has indicated the desire to use more off-the-shelf

software and we need to be prepared to understand what the implications of introduction of this technology will be for the operating reactor.

We, also, need to be prepared to support projects that are in the national interest, as well aware the decisions related to non-proliferation and the use of MOX in commercial reactors has posed some challenges. We developed a Commission paper, which identified the technical issues that we face in this regard and we've recently put together a research plan to address these.

A number of other issues, one of them on the horizon, industry is looking at different decommissioning approaches, looking at rubblization and perhaps more reliance on entombment. There will be additional work that needs to be done in this area, to understand the contaminant pathways, as these are brought to bear.

Also, DOE is looking at future waste technologies. Accelerated transmutation, they have a five-year feasibility study, which assesses regulatory implications, as well as their Generation IV program for new designs, and it would be really desirable if NRC could follow those programs, to try and understand what the new and novel challenges are in these areas.

Turning to slide 21, as Ashok mentioned, we've been involved in a self-assessment effort now for about a

year-and-a-half and we're going to continue that through 2000. And one of the key findings from that self-assessment was the need for enhanced interaction with both internal and external stakeholders. We have several objectives with our internal stakeholders. We want to improve our coordination during the planning and conduct of our work and we're working hard, on an arena basis, with NRR and NMSS to define goals and metrics. We're, also, having regular counterpart meetings at all levels within the office and working very closely on products, such as GALL, which affect regulatory outcomes. We want to urge the program offices to seek our

input on licensing decisions, where complex issues or our work can be brought to bear, and we've worked closely with NRR, in that regard, on the Electro-sleeve issue.

We, also, -- one of our key objective is ensuring the quality and timeliness of our work, as well as the tie to agency goals. We have a research effectiveness review board, that you're aware of, and we're working hard in an interactive way with the office directors, to ensure the effectiveness of our program. We, also, have a pilot program going on, where we actually link our operating plans with NMSS and NRR, putting reciprocal milestones in each other's operating plan, so that we can track from a management perspective. As Ernie said, we've improved the focus of a generic safety issue process and we're, also,

trying to improve the communications with regions, to make sure that we understand more directly the needs of their programs for information.

We, also, want to involve the research staff in a two-way dialogue, to facilitate cultural change within the office. The staff has been actively involved in the self-assessment process in the prioritization, as well as in the development of the vision statement. And one true benefit that we've seen in going to an outcome-based budget has been the improved integration among the disciplines. As both Mike and Tom touched on, we need to bring various disciplines to bear and they need to understand the relationship of the disciplines and how the schedules will impact the outcomes of our work.

Turning to slide 22, we we've conducted our self-assessment, our dialogue with external stakeholders has indicated that some people don't understand the value of our research program. And we want to make sure that we're looking for opportunities for meaningful direct interaction with our stakeholders, to ensure a better understanding of our program. For example, during the last year, we've had 29 workshops, expert panels, dialogues on the work that we have going on, and we think this is extremely important for shaping our work. We, also, have regular office level meetings with DOE and EPRI.

Now, a couple of objectives that we want to achieve in interacting with our external stakeholders, we want to be more proactive in defining our research needs and our MOUs with the Department of Energy and EPRI will help us in that regard. We, also, want to work more closely with universities and our foreign colleagues and industries, to identify not only the emerging safety issues, but, also, the emerging technologies and how industry plans to use them and

on what time frame. I participated in a meeting in November at Penn State, where brought together utility executives and DOE and EPRI, to focus on future research needs. It was amazing to me what a good agreement there was on the topics of future research needs.

We, also, want to communicate and optimize coordination and minimize duplication. We're initiating regular program coordination meetings with EPRI. We believe that, although the two organizations have different roles, it will be very helpful for us to understand their programs and how they impact on ours.

Mike Mayfield is our agency codes and standards executive, following John Craig in that position, and they've both been working hard to see how codes and standards can help our efficiency and effectiveness in the agency.

We, also, want to more clearly communicate our

research results to our external stakeholders. Our water reactor safety meeting was redirected to focus on issue and outcomes and to bring together different perspectives, so that we could identify what the differing needs were for research. We've, also, made significant improvements to our Web page. We've documented all of our activities on the Web page, in terms of outcomes, so that anyone who goes to the Web page can understand the context in which our work is being performed.

Let me turn on page 23, slide 23, to challenges for the future. There will be many challenges that have to do with the aging of plants, the economic pressures, and the storage of waste. We'll, also, face challenges that have to do with implementing new technology and the need for more realistic regulatory approaches. On this slide, I've attempted to highlight a couple of the challenges that we feel are going to be of great concern to us.

Current plants are operating with a mix of technologies, some that's over 25 years old. And as I alluded to in my previous remarks, we've got to be prepared for obsolescence, to approve alternative components, to allow utilities to use off-the-shelf software. And we can learn a lot from our foreign partners; the French, with their advanced control rooms. We need to learn what lessons we can from our foreign partners.

Infrastructure is a major concern for us. U.S. experimental facilities, over the last three years, have been increasingly closing. This presents a problem, not only from the perspective of obtaining important data, but,

also, as training facilities for the talent that we need for the future. And that dovetails with the next bullet that I've listed: competitive market exists for replacement of nuclear skills knowledge, and this is not only for the NRC, but for the industry as a whole. There was a study that was conducted by the American Society for Engineering and Education and supported by DOE, that indicated over the next several years, there are only going to be -- five times more nuclear engineers were going to be needed than were planning to be graduated from universities. So, this is a severe problem.

One thing that we are trying to do to address this problem is directing our developmental resources more towards the universities, because a key for universities is having interesting work that attracts key talent to come into the program. And we're trying to structure our program, so that we can be a help in that effort.

Also, the U.S. influence in the world nuclear research agenda has declined in key areas. Tom King has been participating in a NEA and CSIS study, that tries to identify where the declining infrastructure and talent is

going to impact the world agenda and trying to put together some recommendations, like international centers of expertise, as well as shared databases, so that information exchanges is easier.

But, influence is not just for influence sake. It's very important that we maintain this influence, because people participate with us in our research programs, because we have something to contribute, that we have meaningful contributions. It's, also, important for us that we be able to leverage our resources and that we actually are able to influence the world agenda, to make sure that the work that we need is the work that's being worked on; and, also, emphasizing the role of public confidence. If there's a general agreement worldwide on what's important, it can be very important to the public in reenforcing their confidence.

So, in summary, I just wanted to reenforce that we are very aware of the Commission's interest of our need to tie our research activities to goals and become outcome oriented. We've taken some initial steps, but there's more to do in that regard. We, also, believe that we have an important role in maintaining a center of technical expertise in many areas. The important role here is leveraging expertise from our domestic and international partners. We feel that this is really a vital connection to

the world. And as Ashok emphasized, it's more important

than ever to remember that it takes a long time to conduct the research and we're currently reaping benefits from past research that we've conducted. But, if we don't invest in the future now, that information will not be available when we need it in the future. And one thing we can be sure of is that additional challenges remain.

MR. THADANI: Thank you, very much. We are ready for questions.

CHAIRMAN MESERUE: I'd like to thank you all for a very informative and helpful briefing. I'd like to ask a question about the very last subject area, that Margaret had mentioned and as Ashok had said at the beginning, that there are a large number of areas where past NRC research has proven to be enormously important in our current activities and I think no doubt in ways that were not anticipated at the time that the research was conducted. And it seems to me that one of the great challenges for you is -- as you've indicated, is to try to sort out what things you should be doing now that are over the horizon and to determine how to allocate, prioritize among the variety of things on the menu.

You've listed a number things on slide 20 that you see as important issues for the future. And I'd be interested as to your thoughts about how you would

internally prioritize among those various elements; whether you think you're putting enough effort into them; what kind of a process you go through to try to determine the menu of things that you should be doing now, to lay the foundations for the future.

MR. THADANI: Let me give you my thoughts and encourage others, as well, to join in. We've briefly touched on the process we use for prioritization. We've gone to what I would call a more top-down approach last year, than we had done in the past. I think this will allow us an opportunity to better focus on what sort of these longer term challenges would be.

The prioritization scheme that we have today, I think, is somewhat limited, in that it looks at what the overall impact on safety might be from an issue. It looks at potential number of licensees or plants that could be impacted. It looks at timeliness. It looks at -- and emphasizes areas where we have requests from either NRR or NMSS and so on.

What I believe we need to do is to take it a step further, which we haven't done as yet. In order to take this a step further, we have to get together with the industry and other stakeholders first. This is an area, as

I said, we, as an office, need to improve upon. We have not done as well.

Industry, by and large, is the most knowledgeable organization about its future needs and demands. We recognize that with deregulation, there's going to be a desire to use new technology, smart sensors, things of that sort. We need to do more with the industry, to identify those areas, so we can fold them into our scheme to prioritize, to say where should we be focusing our resources. Similarly, we need to do more with the Department of Energy. Bill Magrit has offered us an opportunity to make sure that -- he's certainly supportive -- we are working with him, to see what the Department of Energy is looking at, in terms of future role of nuclear power, types of designs that may be pursued.

It's an area where we need to do more and we -- the best way it seems to me would be for us to get an understanding of what the expectations are. There's a little bit of a constraint in the way we -- we do have a bit of a constraint, in that it's hard for us to take our resources and say we will spend any of those resources on things like new generation designs, for example, because we have a lot on our plates right now. And so, there is some boundaries that are sometimes difficult to penetrate for us.

On the other hand, if one were to take a step back look, it may be appropriate to put some resources in these areas, because, as we've said, sometimes you don't

anticipate what the benefits are going to be for some involvement. Clearly, if there are issues like that, we have to be sensitive in terms of how much resources we'll put into those areas. But, I'd certainly like for others to chime in. Margaret?

MS. FEDERLINE: No, I have nothing.

CHAIRMAN MESERUE: We've indicated that this is an area where you need to do some more, to think about how you look at these future areas. Is there anything that the Commission can do that would help in that?

MR. THADANI: I think -- yes, indeed, I think the Commission could in some areas. It would be -- it would be very helpful, certainly for the office, if the Commission were to indicate its views, in terms of whether the agency should be getting involved in activities of the nature I described. We -- I am somewhat resistant -- resistant is not the right word -- sensitive, because we are a hundred percent peer recovery agency, we do need to be careful about where we spend our resources. So, there's a tendency on my part to not support areas that I think are not going to

directly benefit the -- in terms of safety or costs, the industry. And there are some areas like that, which I personally believe we should be involved in, but it's difficult for me to support. It seems to me it would be helpful if the Commission were to indicate its views in

areas of that nature.

CHAIRMAN MESERUE: Good. Commissioner Dicus?

COMMISSIONER DICUS: Okay. Thank you, Mr. Chairman. I'm going to follow a bit on the Chairman's questions regarding prioritization of research, etc. And taking it in the direction that you do get feedback from ACNW, as well as ACRS, they provide their point of view on prioritization and their insights on what -- where they think research should go, let me ask the general question -- and this may be somewhat unfair, because this a brand new document. It's dated two days ago, which you may not have had the opportunity to review very much. But, do you find that input from advisory committees to be useful, to be helpful?

MR. THADANI: The plain and simple answer is yes. I really commend -- I commend the ACRS. Grant Wallace and other staff -- other ACRS members, I think, have done considerable thinking of the role and value of research, and I don't know of any other organization that has looked at us as thoroughly as the advisory committee -- the two advisory committees have. I have read the report -- the draft. By and large, I think it's an exceptional document. It seems to highlight areas and issues of significance, brings to -- brings those issues to the attention of the Commission, as well as the AEOD and others.

I agree with much of what they say in that report. Their fundamental message, it seems to me, is not much different than the message from Center for Strategic and International Studies. There's deep reservation about the direction. And I think it's important that they provide that perspective.

In terms of the areas that they have identified, I don't disagree with them. We have some -- maybe in detail, we might disagree on an issue here and there; but, in terms of direction of areas and so on, it seems to me that the report is very well focused.

COMMISSIONER DICUS: Okay. If I could, I'd like to go into a second area very quickly. And I recognize it's somewhat sensitive, but some concerns have been raised about the staff's PRA understandings and capabilities, relative to the industry's, and I know that's one of the areas of

research that you're involved in. And I wonder if you would like to comment on that.

MR. THADANI: Let me ask Tom. He's closest. And then, I'd be happy to jump in.

MR. KING: I'm aware of the concerns you're talking about. I think, clearly, there are truly world class PRA experts on the staff, both in NRR and in research, and I think they can pretty much address any difficult PRA questions or issues that come down the road.

I think the real issue is getting the day-to-day activities risk informed and the day-to-day staff to start thinking in a risk-informed mentality, and I think we've got some additional training, some education, some buy-in to accomplish. One of the things we want to put together is a -- call it a communications plan, but it will have an element of training and discussion and so forth in there, to try to bring the bulk of the staff along. That will be, you know, the research staff, the NRR staff. It will probably involve maybe regional folks, as well. That's one of the things we're going to be talking about in this risk-informed implementation plan document that we hope to get you a first version of the end of this month.

So, I think there is some -- you know, some work to be done to deal with the issue that was raised by ACRS, but I think, you know, we do have the right people that can deal with any issue. If we do get into a situation where we need to call upon experts, we've got them on the staff.

COMMISSIONER MERRIFIELD: Just a refinement, I think the quote was that we were outgunned; this agency was outgunned. Would you disagree with that conclusion, that we're outgunned by industry?

MR. KING: Yeah, I would disagree with that.

MR. THADANI: I do think -- if I may just add, I think in a broader sense, if you look down the road and if

this infrastructure is going to be changed in a very significant way to make it risk-informed, I do think it's a very big issue, as a country, do we have enough of the right resources, not just for us as are regulatory agency, but for others, as well. I think that's -- that deserves attention from all quarters.

COMMISSIONER DICUS: Thank you.

CHAIRMAN MESERUE: Commissioner Diaz?

COMMISSIONER DIAZ: Let's see, let me just start with a couple of comments, since I just spent a little bit of time in doing research. And I think we all know that research is always between hard and rock place -- a rock and a hard place. And, you know, it's almost like doing a tight

rope, high-wire balancing act, because everybody that is producing something that is on the line always can justify what they do. Well, research has that extra responsibility of justifying what is the usefulness of what they are going to do, that will result in years afterwards. And we appreciate the fact that this needs to be balanced and it has to be a balance between present day and day after tomorrow and next year, and that is something that is very important to do. And I know that you are in the processes or realigning, you know, your resources, to take care of both areas, which both needs to be taken care of.

Having said that, I am going to say back to you

some of the things you just say; I'm just going to say it in my own words. It is obvious that research has specific responsibilities for making sure that realistic technical scenarios are used for the analysis of safety and for establishing regulatory requirements, to make sure that that safety is taking place. That essentially puts almost a shall, not a should, but a shall, that research must have state-of-the-art know how, okay, that maybe transcends what the normal staff should have. You have a -- shall have or should have a repository of technical competence that exceeds the day-to-day issues, and that's part of your main contribution to this agency, is the ability to address something that just came out or the ability to foresee what is going to come out. That's a major issue.

But, I want to emphasize, and it was used by you, the word "realistic," and that's something that keeps comments about. This demand for technical competence, okay, is an everyday issue; but, it's more important for research than anybody else and it transcends everything you do. I am pleased to hear that we now are going to allow spent fuel to be a spent fuel and not be new fuel, and that's certainly nice. However, you know, I am concerned that it took so long for us to recognize that it was spent fuel. And in that sense, I think you have a responsibility to identify any other issues where super conservatism has been

established and just being carried out year and after year just because it's there. And it is time that you use your technical expertise to sort out these issues, in a manner that serves this country, serves this Commission, serves the issue of safety.

Now, let me focus on the area of thermo-hydraulics, and I know you made an attempt to cover some of these areas in here, especially page, I think, 16 and 17. However, I'd like to say that, you know, when we

specifically asked to have thermo-hydraulics covered, I had a different view of what really, you know, would be the emphasis.

In 1996, research proposed a five-year thermo-hydraulic plan; that it was approved in, I think, it was June of 1997. It was a major resource undertaking, okay, which have very clear, you know, specification from the Commission. And it just requires that we come up with a new architecture, you know, that will actually do away with, you know, the -- they say that it's very time consuming. It requires that we have a very competent staff in-house that will be able to do with these issues. It will be able to address and merge issues. It will be able to look at things that are in the future.

And I'm still not satisfied that we are not seeing, you know, what the Commission asked, put in terms of

where we are. If I read this, it looks like now we're going to be a year late in getting these codes where they should be. That's the way I read it. So, my question on thermo-hydraulics is: there is an SRM, there are requirements for the Commission, and many times we forget what those are. I want to emphasize that I can see the thermo-hydraulics the most important single, you know, technical area of -- that impacts on everything that we do on safety. There will be radiological consequences if the thermo-hydraulics are right in 90 percent of the cases. So, it is a prime area, okay, in which the agency needs to have updated, you know, stuff. And I am concerned that we are not hearing where exactly we are.

Have we met our requirements in this area? Have everything that needs to be done has been done? Have the two-phase flows been taken -- each has been taken care of or will be taken care of in the year 2002, not 2003? Where are we? Are we now satisfied that those elements of that plan have progressed according to the Commission requirements?

MR. ROSSI: Let me address that. With respect to the code consolidation portion of this, we believe we are on track, according to the plan. And as you indicated, it started in June of 1997. As part of the code consolidation effort, the TRAC-P has been modernized and the coding language has been updated and it's been made into a more

modular design. In fiscal year 2000, we will have completed the consolidation of TRAC-B -- TRAC-B and the three-D neutronics capability of the Ramona code. And by the end of fiscal year 2000, the assessment of TRAC-M -- that's the one that we're consolidating TRAC-P, Ramona, and TRAC-B into -- that assessment of TRAC-M will be completed.

COMMISSIONER DIAZ: When will it be useful -- I'm sorry, when will you be able to put it to use? When will it be used? Not when it be consolidated, not when you change things, when will it be used?

MR. ROSSI: I believe as we're going along, and we do have Faruq El Tavala here, if you want to get into the details of exactly the use of them, my understanding is that as we're consolidating them, we are maintaining either the ones we're consolidating into the other one for use or we can use portions of the new one. It's now year 2000, so we're approaching three years out of the five-year plan.

COMMISSIONER DIAZ: Four years, sir; four years.

MR. ROSSI: FY97 --

COMMISSIONER DIAZ: It's June of '97.

MR. ROSSI: June of '97, '98 --

COMMISSIONER DIAZ: It is four years.

MR. ROSSI: -- '99 -- it's '97 -- June of '97 -- '98 --

COMMISSIONER DIAZ: I'm sorry.

MR. ROSSI: -- '99 and 2000, so it's three years.

COMMISSIONER DIAZ: It's three years.

MR. ROSSI: Yes, 60 percent are through. And so, we do believe that in the code area, we're on track. The degree to which we can use something that's consolidated, I don't have that information here right now.

COMMISSIONER DIAZ: Will you be able to use it at the end of the five years?

MR. ROSSI: We believe we will be able to use the consolidated code at the end of the five years.

Now, in the area of some of the tests information that we wanted to collect and improve the models, there, we, indeed, are somewhat behind, because of the resources that we had to do the work on the five-year plan were not the ones that we originally said that we needed. And we've, also, had some staff leave and we have recently hired two new thermo-hydraulics people to replace those staff. So, with respect to the model improvements, we had hoped to complete the tests and start using the data to improve the models during the five years. But, because of the resource limitations, the program is being stretched to cover a longer period and we expect to finish some of the tests by the end of FY2000 and all the separate effect tests by 2003.

So, your concern is right in the area of some of tests to support the model development; but, in terms of

where we are in consoliding the codes, we believe we're on track --

COMMISSIONER DIAZ: I don't --

MR. ROSSI: -- at this time.

COMMISSIONER DIAZ: I don't remember that we cut resources. It was a contract issue of -- my memory might fail me, it was $5.7 million to consolidate the codes. We allocated a series of resources. And, again, I'm concerned, you know, that we might not be providing the checks on a Commission-established requirement that says this is going to be done. The -- I mean, one of the key issues -- one of the key underlying issues in the thermo-hydraulics was the fact that we were going to have the capabilities, in the staff, to determine which way to go. I hear now that there is some problems with the staff. I don't --

MR. ROSSI: Well, we did have some problems with the staff members and we have recently hired two people that do have experience in the area to offset losses.

COMMISSIONER DIAZ: Let me tell you where I'm going now. Research every place always have, you know, an issue of credibility. That credibility always comes on extending the time to complete something and always is addressing the issue of whether resources were right or not. I do believe that we established a series of resources. We established a plan. And in this most important area

regarding, you know, safety, especially of reactors, you know, that the accountability for this is basic to the credibility of research, from my perspective. There is a series of requirements. There is money allocated. There has to be a plan and there has to be, you know, a schedule, and we need to be able to live up to that.

MR. THADANI: Commissioner, first of all, I completely agree with you, that thermo-hydraulics is the core of safety and we need -- we need to recognize that, and we do. Second, I would say this is a well managed program, as a matter of fact. We have had some challenges, Ernie talked about them; two in particular. One, there's been some adjustment on resources for a variety of reasons. There's been some adjustment. Probably the more important challenge we faced was when we lost two very key people. These people are in great demand. They have tremendous talent. They both left for, I'm sure, a variety of reasons, but one of which was higher salary. I talked to each one of the two before they left, to try and understand. And by and large, that was one of the factors that caused them to leave. In one case, there was some personal issues.

Now, we are monitoring this program, as you well know, and we identify, when we go to our budget process, if there is going to be an impact, what that impact would be for reductions. And there have been some reductions in

resources. On the positive side, we said we're catching up; we're making up for some of the impacts. As Ernie said, we've now got, I think, enough in-house resource to make sure we don't lose too much ground.

But, I will tell you, I believe this is a well managed program. It really is.

COMMISSIONER DIAZ: I am not arguing about how well managed it is. Is it - is it managed to Commission requirements is what my -- is my question.

MR. THADANI: It's managed to the schedules that we've identified; and if there is an adjustment to be made, we will identify that.

COMMISSIONER DIAZ: Okay, thank you.

CHAIRMAN MESERUE: Commissioner McGaffigan?

COMMISSIONER MCGAFFIGAN: Let me try to put in some perspective the big issue you started with, which is resources, and ask a question or two. Clearly, we've been a resource constrain agency, as a whole, recently, and research has been constrained, as well, and probably more so. But, the EC and the Commission faces these choices between additional research and making sure license renewal goes well. We handle license transfers, as well; that we're on top of waste issue, etc. And we, perhaps, artificially constrain ourselves, but we constrain ourselves to some sort of top line. This year it was about 3.7 percent increase,

which was basically salary. So, there was no growth in the agency in the budget we just submitted.

And then, we face these tradeoffs about research, and research, as you say, tends to lose. You know, compared to -- we don't get questions when we go up to Capitol Hill about how well we're doing on research. We hear the questions about license renewal, license transfers, the new oversight process, etc., etc., to which you contribute and have contributed in the past.

My question goes back to history. Maybe somebody in the audience -- maybe Ashok will know. Part of our new budget we've just submitted is that 10 percent of the budget, for fairness and equity reasons, will, over the next five years, if Congress approves, get off the fee base. But when we did the original report back in '93, I believe, under Chairman Selin, to the Congress, we did not identify research as a fairness and an equity category. We had agreements states and we had international programs and we had -- you know, the six -- the big six or whatever programs that we identify each year to Congress that really do clearly raise fairness and equity issues. But, research is

sort of a public good and, you know, you can say the group -- the industry benefits from your program and perhaps it's fair. But, has any thought ever been given or was there any internal argument in the agency back in the '93-94 time

frame, as to whether this, also, should have been identified as a fairness and equity category, where the public, because this is a public good, should be paying for it out of the general fund, rather than taxing licensees?

MR. THADANI: I don't know the answer.?

COMMISSIONER MCGAFFIGAN: Well, if Jesse is going to comment, this came up out in the CSIS report. John Ahearne did berate us, publicly and privately, about the research program. But, he said, why the heck isn't this stuff off the fee base, and I didn't have an answer. And so, it will be interesting to hear.

MR. FUNCHES: I think if you go back just before the hundred percent, we were hard to get like 33 and 45 percent of the budget from fees and during those times, research -- most of the research was not being collected as part of the fees. And when they increased it to hundred percent, what they did was the concept was to look at everything you were doing to carry out a program for, say, reactors, whatever. When we looked at the fairness and equity issues back in the -- I guess the early '90s, we were looking at the question of whether -- for what purpose was the work being performed and whether or not those people are then required to pay fees for the purpose for which the work was done. We did not address the issue of public good.

The question of public good, I think, came up

during the first fee rule, in terms of -- one of the comments came back relative to the question of whether the public good here for the nuclear industry was any different than it was for the coal industry, in terms of the regulatory oversight. But, the intent of that study was not to look at the question of whether the activity that the agency would perform was a public good, say, similar to defense or some other public good, in an economic sense. We did look at the issue in a narrow way, when we looked at the non-profit education; but, we did not address that issue.

COMMISSIONER MCGAFFIGAN: We may well be constrained by definitions and statute and whatever. But, I think this was big idea that's been out there. The ACRS has talked to me about it. John Ahearne has talked to me about it. And it may sound to Congress that -- they may gag at our 10 percent of the fee base, may not; that putting another 10 percent off the fee base someday, because research really should be not funded that way. We may sound

like, you know, we're two-timing them or whatever.

But, I think, at some point, the only way research, given the pressures I see -- when you look forward, the operational pressures on this agency are not going to let up. We're going to have more license renewals. We're going to have license transfers. There's going to be more industry restructuring. Yes, we may get more effective

and efficient and save some resources in NMSS or NRR. I don't want to bank on that; we might. But, the pressure will be there on research eternally, unless the top line gets changed or unless research somehow gets treated differently in the process.

That said, let me just mention the Chairman's -- you know, the question to Ashok about priorities on anticipatory research or longer term research. On the page 20 chart, I see real differences between some of those, you know, like, you know, digital instrumentation and control is shorter term; mixed oxide fuel, we're going to have an application from DOE shortly. Those are things that are anticipatory, but not very far anticipatory, and I imagine significant resources need to go into dealing with them. The new designs, and Margaret mentioned accelerated transportation of waste. I think the DOE plan is a 100-year plan there, and so we might get an application in the 22nd century. But, I would think that that would not be a place where, at least in terms of short-term resources, we'd be spending very much.

But, my final question -- I thank Commissioner Dicus, I had not seen this ACRS draft report. I'm going to sort of put the EDO on the spot a bit, because it suggests, on page seven of this draft report, that perhaps the EDO needs to be more involved in at least two of these tasks.

It says, "NRC needs effective agency-wide methods for identifying, formulating, and expressing its needs for additional information methods," etc., and the third one is "evaluating the effectiveness of its research; redirecting efforts, if appropriate, and determining whether the resulting products adequately satisfy." And it says in here that we recommend the EDO be more actively involved.

From talking to Dr. Wallace, he's raised the issue, at least informally, as to whether you or somebody on your staff should chair the Research Effectiveness Review Board, as opposed to Ashok, given that it involves competing views of different offices and whatever. If you haven't looked at it, I won't ask you about --

DR. TRAVERS: I haven't read the report, but I was

privy to some of the discussions that indicated that this recommendation may come out of it. So, I think it's a fair one. In fact, I think some of what we've already done in the rearrangement of the deputies and their involvement has -- is speaking to that today. But, it's something we're actively looking at and pursuing and I think you're going to see quite a lot more involvement from our shop. We think not only research and NRR and NMSS need to be the starting point to these things, but we clearly play a role, particularly when we're trying to make judgments between competing priorities, as the offices see them in the various

arenas, that are primarily managed out of the offices.

COMMISSIONER MCGAFFIGAN: My sense is, and the Chairman hasn't gone through one of these detailed budget processes, we need better sense, when we're cutting our research program, as to what the impact is somewhere else. You know, if cutting sort of almost below the Commission level funding for thermo-hydraulics is going to have an impact on time lines or if cutting funding for high burnout fuel is going to have an impact on something that's going to need to be done in the quite foreseeable future, we need to understand those impacts. I think we understand better the impacts at the moment.

Sam can tell us, and he has since the NRR meeting with me, if -- you know, here's where we stand on licensing actions and here's how we're going to fix licensing actions and here, if you cut resources, what the effect might be on licensing actions or license transfers or license renewals. And he can quantify that in a way that helps us relate to it.

And at the moment, I've seen a lot of our comments from research, SSDC, over the years, and they don't sing. So, maybe you need a better writer; but, you, also, need to somehow connect it to a program that -- you know, an outcome that we're trying to get in one of our regulatory programs.

CHAIRMAN MESERUE: Do you want to comment?

MR. THADANI: Just a quick comment. The way we work the budget process, we don't -- we don't allocate in the Office of Research. We don't allocate any resources or contingencies. And by very nature, when issues develop, whether they're from NMSS or NRR, we do get requests and we do recognize sometimes that those issues need quicker attention.

What we have to do, then, is a number of things. One option, of course, is to see what it is we're working on; can we deobligate some resources -- if we have to do that, that's not an efficient process; or can we delay some

work. I think this is an issue that is not well recognized, I don't think, of the challenges we face because of these lack of any contingency resources. We need to highlight this a little bit better. And I think in the end, it may address some of the concerns that have been raised here today.

DR. TRAVERS: I think that's a common problem. I agree that's a problem in research. But, that's true throughout the agency and one of the things that PBPM model is trying to -- at least I think it will be effective in doing is establishing a process that gives us some insight into making those decisions. We've been awfully good over the years, in sort of slicing a little off of this program, a little off of that program. We're getting very, very

close, in my view, to making hard decisions about programs, perhaps some major programs, that may need to be cut, as we face continuing fiscal constraints. But, I think PBPM puts us in a good position to have a better insight against agency outcomes that we're trying to achieve and I think that's one of the major benefits for resource strategy.

COMMISSIONER MCGAFFIGAN: And my only comment would be I think just as we, I think, said to Sam on -- you know, he said he could adjust his schedules and he could -- it's the transparency of what gets dropped, in order to accommodate a contingent need, that, you know, we -- I think it may be transparent to the EC; it isn't always transparent to the Commission and understanding that finding a mechanism without inviting -- I don't want to be second guessing every $10,000 decision you make. But, significant changes in schedule affecting outcomes, whether it's an NRR, an NMSS, or research, would probably be useful for us to just understand. We had to do this, because x, y, z, is clearly more --

DR. TRAVERS: I think we ought to keep you apprised. If we're not doing that well enough, we ought to. But, the place for that sort of demonstration is in the operating plan, investments that take place after the decisions are made. But, we'll certainly strive to keep the Commission informed.

CHAIRMAN MESERUE: Mr. Merrifield?

COMMISSIONER MERRIFIELD: Thank you, very much, Mr. Chairman. A couple of comments I want to start off with and then go into some questions, which follow along the line of questions my fellow Commissions have already.

The first couple of comments: I want to say, you know, I've had some very pleasant walk-arounds with Ashok,

particularly over in White Flint II, and I would say that I had an opportunity to meet a number of employees in research, who, I think, are very committed folks, who have really demonstrated record of achievement, and I just want to recognize that I think we've got a very good staff in research. I didn't want to let that one go by.

Recently, I had the opportunity to speak at the Water Reactor Safety meeting, and I -- the speech that I gave there, I've gotten a lot of criticism -- I've gotten some criticism for it. Some of the public -- from former chairman, John Ahearne, in which I think many misunderstood what I meant. In that speech, I focused on a notion that one of the things that research needs to do better -- a better job of is explaining why it is conducting various levels of research and why that fits into the overall agency goals and where we need to go. And I think part of the PBPM process will help bring that out.

From my standpoint, it certainly only reflects my

views as a Commissioner, I think as we look at research issues and as I evaluate decisions and budgetary issues, I sort of look at what I would call a four-factor test. Does the research make sense? Is it something that we ought to be engaging in? Is it a value added product, not just a make work project? Is it adequately justified? Can we really go down on paper and explain what we're doing? And as a related issue, is it defendable? And I think those are the things that we all ought to think about, as we're going through the program and understanding what's important for us to be working on and things that are not as important for us to be working on.

As far as questions, Chairman -- Commissioner Dicus has already opened the door, relative to the ACRS draft report. One of the things that they talked about was the integration in communication with internal stakeholders. Now, on page of that report -- I'm going to read just a brief excerpt. The report states that the "line organizations of NRC must have more stake in, appreciation for, and confidence in research efforts. They must understand and play a role in defining the return on investment from products of research. Research in isolation cannot realistically anticipate, justify, evaluate, and prioritize its activities."

I think the implication from this is that the

integration between research and the other offices isn't where it should be. I think that was along the lines of what Commissioner McGaffigan, also, focused in on. What are your further thoughts on that, as it relates to this

particular quote?

MR. THADANI: I think, first of all, we need to do better, there's no question about it, in terms of integration, and we're working on that. Margaret actually touched on some of the things we're doing. I want to assure you that when we are starting research programs, we work very hard, in the last year-and-a-half, to make sure we are outcome oriented and not output oriented. We are not interested in research for the sake of research. We want to make sure that we are able to identify, not necessary to everyone's satisfaction, the value of conducting certain research. I mentioned earlier, we have a tool. We've used a prioritization tool, which factors in a number of elements. The tool needs -- it ought to be better. It's perhaps a little bit narrow and focused, and we're going to -- we're working on that and I hope we will come up with a better way to go about it.

It is essential to -- for us to be well integrated with NRR and NMSS and, to a certain extent, I think with the field and the regions, as well. I -- as you know, I went to the Office of Research after many years in NRR. One of the

things I pushed very hard was to make sure that the office works on not just issues that have many years of effort involved, but rather we should be involved in more day-to-day efforts, as well. We initiated a number of activities to do that and I think you're well familiar with the plant oversight process, the various regulatory guides to support license amendment reviews, and so on, developing criteria.

We need to know what's happening, to be able to plan well for the future, and that means we've got to be integrated. And I do admit we have some work to do in that area.

COMMISSIONER MERRIFIELD: I appreciate that and I know you're working very hard on that. I didn't want to -- I didn't want to let that one slip.

The EDO mentioned the issue of PBPM. When I reviewed your revised slides, I was somewhat disappointed. You had originally, in an earlier version, had a slide on issues associated with the research self-assessment associated with the implementation of the PBPM process. And, obviously, there are time constraints and that may have been one that fell off the table. But, one of the challenges that surfaced during the most recent budget process was how research goes about implementing PBPM and, specifically, an ability to clearly link its research initiatives with those strategic and performance goals,

getting that integrated as we follow up on. That, also, was touched on in the ACRS draft report. And so, through that PBPM process, how are you further enhancing those particular goals?

MR. THADANI: Well, again, and I'll say a little bit; but, then, I'd like for Margaret, also, to comment on that. She's been very active in this area, personally.

We started out from, as I said, more of a top-down approach last year, which had not been done in the past. But, we laid out what are the agency -- what's called for under strategic plan; what's called for under the performance goals for the agency; and looking at those performance goals, how can we most influence those goals. We identified, as I said, the planned accomplishments and then we said, okay, even within those accomplishment major issues areas, what is go in to have the most impact. And that's when you get down to the activity level. And we used the kind of criteria that I talked about, to make sure that these efforts, in fact, lead to either improvement in safety or making sure they lead to maintaining safety, making better decisions, that the technical basis is developed for that.

Now, where it's harder to show, I think, is in quantitative terms, as to how much will safety really improve by. When Tom talked about we do reliability

studies, we look at operational experience, we need to integrate that information and we need to not just do it for ourselves. I think the public ought to know what we're doing and they need to understand how this work helps the agency understand the safety out there.

Now, I saw that -- when I read the draft report, I saw that comment as an area where we need to talk some more to the ACRS and, perhaps, directed more towards our inability today to quantify. That's my view, but Margaret, you have --

MS. FEDERLINE: Yes. Just let me add, having been involved in the strategic planning process, one thing that occurred to me after we had gone through it, and I think ACRS recognized it in their report, the goals are at a very high level. And I think the more transparency we can introduce in this strategic plan, in terms of strategies and metrics, to really key in on what is the contribution that research makes to each of these goals, I think that will help us be more definitive. I think, right now, we have high-level goals and the strategies are somewhat rolled up, so it's difficult to see, you know, exactly what the research contribution is. But once there is more transparency, I think we can more directly relate our goals

against -- our activities against those.

COMMISSIONER MERRIFIELD: I think that's a very

good point. I think transparency is very important. Ultimately, in the end, the Chairman and the other Commissioners are the ones who are going to have to defend this budget in front of Congress. In an age of diminishing resources, we've got to be able to do that, clearly and articulately. And if we don't have the background from you all to make that happen, we're not going to be successful in formulating our agenda for pushing the collective view of the Commission forward.

A quick comment and then one final question. The comment is on burnup credit. You know, I personally think this is an important issue, certainly would hope that you would notify the Commission promptly if there are any problems that you run into that are going to delay any key future milestones.

On a separate issues, we haven't touched on this today, is the issue of the competitive market for the replacement of nuclear skills. And you mentioned how the fact is that it is -- that market has changed dramatically over the last few years. We have some key managers right now handling some very high priority issues in this agency. Do you have a development -- well, I presume you have a development effort underway and if you could just touch on it briefly, as to how you're going to deal with a successful transition in the future, at the point where these key

managers leave us.

MR. THADANI: There are some things that we can do. There others, as I said earlier, that it's a national issue for future, in terms of having the right type of capability. Some of the things we're doing are within the constraints of FTE and so on, which we, of course, have to be careful about, but what we're doing is to make sure that in key technical areas where there are critical needs, that we go out and try to get people today. We stay fairly close with universities. We -- Margaret mentioned she was at Penn State. I keep in touch with various people at the universities, to see which of the people may be graduating, their capabilities, and so on, and what our needs would be, so we can maybe get ahead of the line, so to speak, ourselves.

We, also, are doing our part in engaging universities in some of the research that we do. A lot of the model development work, our separated effects testing, and so on, by and large, we try to go to universities,

because that's probably the most effective way to get results, as well as that trains a lot of people. In the long run, that would help us. We are currently -- we have an activity underway, we're hoping by the end of March, to have laid out a very explicit plan on what are strength is, in some areas, and what sort of losses we might anticipate

in the Office of Research, and to target those people in those areas, universities.

I have mentioned to you before about my concern. It's a very serious concern about what's happening. As we're losing declining resources, we've been forced to not support a number of facilities -- experiment facilities. Some of them have been shut down. I think there are some that are at risk of being shut down in the near future. I'll mention some: we have a group at University of Maryland; we effort at Purdue University; we have effort underway at Oregon State. I think some of these facilities we may have difficulty maintaining, unless others come to the table and share costs and so on. We're working on that. We're trying -- as you heard, Tom is actively engaged with other organizations, to see if they can't come and support us.

But, it is -- it is a much broader issue, in my view, for the nature, and Office of Research is a piece of that here.

COMMISSIONER MERRIFIELD: Do you -- I'm sorry, do you feel confident in your succession plans, at this point?

MR. THADANI: Do I have what?

COMMISSIONER MERRIFIELD: Do you feel confident in your succession plan, at this point?

MR. THADANI: I would be more comfortable

answering that in April than today. We have a plan, but I've asked for more information.

COMMISSIONER MERRIFIELD: Okay. We'll ask it again in April.

MS. FEDERLINE: Commissioner, could I just add one key point? One key point that I wanted to mention, in tightly constrained times of FTEs, I think we need to look, as an agency, how in critical areas, we can use over-hire strategies, to bring people in at a lower level and give them the necessary training that they need, so that when the people leave the agency, there is that transition plan.

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman.

CHAIRMAN MESERUE: Well, we've come to the end of our allotted time. I'd like to thank all of you for a very informative and helpful briefing. The research component of the agency really is a fundamental part. It's essential to

our long-term success, as well as of enormous help in the short term. And, again, I'd like to appreciate -- express my appreciation, on behalf of my colleagues, for the work that you're doing.

Any other comments? If not --

COMMISSIONER DIAZ: I'm sorry, Mr. Chairman, it's just something occurs to me that we never realized. There is a fundamental difference between research in a regulatory agency and research in a non-regulatory agency, and that

distinction, sometimes, is not clearly understood. The clear difference is that research in a regulatory agency is watched carefully by the industry and it could have impacts on the industry long before the research is completed.

There is a very strong coupling. People realize what's going on, just like when we start rulemaking. And that -- this distinction is not clearly recognized and I think it is a factor in what we select to do research, a factor on what -- how credible it is. Because, it is different in the Department of Defense, when it actually looks at, say, anti-missile and there is no budget for it. Here, there is somebody that is watching over you and is feeling the impact of that research. This is a very important concern.

Thank you, Mr. Chairman.

CHAIRMAN MESERUE: Good. With that, we stand adjourned. Thank you.

[Whereupon, at 12:00 p.m., the briefing was concluded.]