UNITED STATES NUCLEAR REGULATORY COMMISSION

BRIEFING ON OFFICE OF NUCLEAR REGULATORY RESEARCH

-- PROGRAMS, PERFORMANCE, AND FUTURE PLANS

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THURSDAY

FEBRUARY 18, 2010

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The Commission convened at 9:30 a.m., the Honorable Gregory B. Jaczko, Chairman presiding.

NUCLEAR REGULATORY COMMISSION

GREGORY B. JACZKO, CHAIRMAN

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BRIAN SHERON, Director, Office of Nuclear Regulatory Research (RES)
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CHRISTIANA LUI, Director, Division of Risk Analysis, RES
MICHAEL CASE, Director, Division of Engineering, RES
JAMES LYONS, Deputy Director, Office of Nuclear Regulatory Research
MARY MUESSLE, Director, Program Management, Policy Development and
and Analysis, RES

P R O C E E D I N G S

CHAIRMAN JACZKO: Good morning, everyone. We are having our meeting this morning on the Program brief on the Office of Regulatory Research.

The Commission will hear a status update on the important programs in this office and some of the things that we can be looking forward to in the coming year.

Certainly the agency's research programs are very important to advancing our safety mission.

They provide extremely good advice and tools and information to the regulatory offices, really to the agency as a whole, and always provides us with nice opportunities for interesting briefings as well with the seminar series and other things.

Certainly the Commission places great importance on the work that is done and we really benefit from the high quality of the work that comes out of the office.

It's independent critical analysis that really is crucial to our ability to verify the information coming from licensees to verify our own technical

analyses and to ensure that we remain vigilant in our mission of safety, security, and environmental protection.

Our agency certainly would not be the same without this significant office. This is something that is really unique when I look and as others have seen, and I sure Dale is aware of as well when we go internationally how we are very fortunate to have this capability of our own as part of our organization, so it's a great opportunity for us to hear today all the things that are going on.

I would note this is a unique time that we are having this meeting, apparently this is National Engineers Week, so it is certainly a great opportunity to highlight the work of the engineers and of the folks that we have with us.

Personally I am not an engineer and I have never celebrated National Engineers Week in the past, nor has Steve, we have our own celebrations.

I certainly do want to applaud all the people we have here and appreciate all of the services of our engineers and I am sure we will hear

a lot of the folks from Research with an engineering background along with others who have other backgrounds and other disciplines.

With that, I would ask if any of our Commissioners would like to make a comment?

COMMISSIONER KLEIN: Engineers Week is good, as it turns out I am speaking at the National Engineers Week downtown today and also Research is good so we look forward to hearing all of the good things that you all have been doing.

COMMISSIONER SVINICKI: You bated all engineers into speaking up now, but I have been celebrating National Engineers Week. up to and including in college when I had put up a geeky sign just to make sure that everybody knew it was National Engineers Week.

Two things you said, Mr. Chairman. One is you said that it is an opportunity for interesting briefings.

I wonder sometimes given the strong technical interests of the members of the Commission if the NRC staff thinks it's a blessing or a curse to have such

strong interests from this side of the table, but I am happy to join you in expressing that.

It's great to have this capability in house, but it poses a real challenge to the NRC's staff because it has to be the right regulatory research and they are always having to strike that balance. I look forward to exploring those issues today.

Thank you.

CHAIRMAN JACZKO: Thank you for the comments. Bill, I will turn it over to you.

MR. BORCHARDT: Good morning, and thank you. The Office of Nuclear Regulatory Research is an integral part of the success of the NRC as you mentioned.

They have the difficult task to develop the technical basis and the foundation for the agency regulatory programs and the decisions that we make on a daily basis.

That challenge is made even more difficult because of the long lead times and the time frames they need to start doing this work in order to support the regulatory decisions that are made throughout the

rest of the agency.

Let me congratulate Brian and his team for fostering a very high level of cooperation and mutual support with all of the program offices.

It is probably better today than it has ever been in the past, it is more closely linked, and the results of the work that their staff does is utilized on a daily basis and is very much appreciated by the rest of the staff.

We have a very full agenda today, so I will turn it over to Brian.

DR. SHERON: Thank you. First slide, please. Good morning. I would like to acknowledge the support that the Chairman, Commissioners, and Bill, provide to our office.

As Mr. Borchardt notes, the Office of Nuclear Regulatory Research furthers the regulatory mission of the U.S. Nuclear Regulatory Commission by providing the expert technical advice, technical tools and information for identifying and resolving safety issues, for nuclear power plants and other facilities regulated by the NRC, assistance in regulatory

decisions and the development of the basis for regulations and guidance.

In all of these activities Research partners with other program offices and has accomplished many activities with the abilities of its diverse and highly technical skilled staff. I want to thank my staff and other offices for their support in these successes.

Today we will discuss key program projects and their status as well as new directions that we see for NRC in current issues such as long term spent fuel storage.

Our agenda starts with presentations from Dr. Jennifer Uhle, the Director of the Division of Systems Analysis.

Dr. Uhle will present information on the state of the art reactor consequence analysis, the analysis of cancer risk in populations living near nuclear power facilities and advanced reactor research.

This will be followed by Chris Lui, the Director of the Division of Risk Assessment who will present information on probabilistic risk assessment and

human reliability analysis.

Mike Case, Director of the Division of Engineering will present information on license renewal beyond 60 years, followed by Jim Lyons, my deputy, who will discuss our long term research program.

Mary Muessle, Director of Program Management Development and Analysis Staff will present an overview of the research results from the Office of the Inspector General Safety Culture and Climate Survey talking about the research focus areas.

I'll then conclude the staff's portion of the briefing and turn the meeting back to the Chairman and the Commissioners for additional discussion.

Next slide, please.

During the past year the NRC Research Program has addressed many key issues that support the agency's safety mission.

In October 2009, we published NUREG-1925, Research Activities 2009, which provided a collection of information sheets that summarize current research projects.

Overall, fiscal year 2009 was a very notable and productive year for research given the number and complexity of technical issues that the office addressed while also relocating to Church Street.

The Office of Administration was and continues to be very supportive in our needs regarding that move.

Although I will not be able to touch on all the research projects mentioned in NUREG-1925, generally I note that Research worked on and continues to work on numerous activities.

Two thirds of Research budgeted activities are identified by the regulatory offices through user need work requests.

Research works with its customer offices to provide technical support for licensing actions as well as consider future research needs via our long term research plan which Jim Lyons will address later.

I would like to mention some examples of the license amendment request reviews or technical information requests for which Research has unique expertise.

They include support to NRR for recent exemptions or

relief requests for the application of primary water stress corrosion cracking mitigation methods.

Support for the Regions on non-destructive examination and material degradation, the evaluation of a shoreline fault near the Diablo Canyon plant, the examination of ground water at Indian Point and Braidwood and support for the Cooper Special Inspection team and its public outreach.

Research is responsible for several other significant activities that include publication of many annual reports.

Examples are Report to Congress on Abnormal Occurrences and a Report on Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities.

Research also prepares several annual Commission papers which include the Summary of Activities Related to the Generic Issues Program, Status of the Accident Sequence Precursor and Standardized Plant Assessment of Risk Model Programs, the Periodic Assessment of the Activities of the Committee to

Review Generic Requirements and the Annual Review of the Lessons Learned Program.

In addition, Research publishes numerous technical reports which have included Evaluations of Structural Failure Probabilities and Candidate Inservice Inspection Programs and Modeling a Digital Feedwater Control System Using Traditional Probabilistic Risk Assessment Methods.

In fiscal year 2009, the staff completed resolution of Generic Issue 163, a Multiple Steam Generator Tube Leakage, and Generic Issue 191, Assessment of Debris Accumulation on PWR Sump Performance.

There will be a separate Commission briefing in April on Generic Issue 191.

In addition Research made significant progress on other generic issues such as Generic Issue 199, Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern U.S. on Existing Plants.

In November 2009, the staff issued a revision of Management Directive 6.4 on the Generic Issues Program.

This revision provides an updated process on generic issue resolution which improves timely disposition of existing generic issues and any potential new generic issues.

Research also provides technical bases for rulemaking and develops associated regulatory guides. For example, Research completed guidance for the Power Reactor Security Rule, guidance on methods for licensees to ensure compliance with 10 CFR Part 26, Subpart 1, and guidance which endorsed the American Society of Mechanical Engineers and the American Nuclear Society PRA standards.

Another prominent accomplishment includes Research's sponsorship of numerous seminars. Hopefully you have seen a few signs in the White Flint complex that announced them to the staff.

A few recent seminars include the 30th Anniversary of the Accident at Three Mile Island II, the 1975 Browns Ferry Fire and the Experimental Basis for Modification of Cladding Embrittlement.

These seminars are usually held in the auditorium and are recorded on DVD to maintain a strong knowledge

management initiative for technical areas.

In addition, Research established and initially sponsored a more theoretically and mathematically based Reactors Fundamentals course that was well received by the staff throughout the agency which will continue to be presented at the Professional Development Center.

Several technical training courses were offered including two on high temperature gas cooled reactor technology and the use of the MELCOR Code.

Further, the Lessons Learned Program also lends itself to knowledge management.

Many of these activities are communicated through The Researcher. The Researcher is our office newsletter that is popular with all the NRC staff.

Lastly, another active area in our office includes international activities to ensure that the NRC's programs both leverage and incorporate the results of international research and analyses.

This helps NRC identify emerging technologies and issues and support NRC's efforts to verify and validate computer codes used to model nuclear reactor

power plant behavior.

Access to the foreign test facilities expands our knowledge base and contributes to the effective and efficient use of NRC's resources in conducting research on high priority safety issues.

Through bilateral agreements NRC obtains valuable technical information on seismic issues, fuel behavior and material science, fire modeling, thermal hydraulic experiments, aircraft impact test assessments, radionuclide sorption data and more recently advanced reactors.

Next slide, please.

In the upcoming year, Research will continue to face several challenges and I have broken them in problematic and technical challenges.

Although some of these challenges will also be faced by other offices, it becomes more difficult when overlaid with RES challenge of being at a remote location.

In addition to staying connected we now recognize that getting connected will become another focus point as we hire new employees who have not

previously worked with the other program offices.

More discussion on this will be presented later in the briefing during the discussion on the RES results from the OIG's safety culture and climate survey.

I would now like to mention some future technical activities that will challenge the agency.

Two technical activities, SOARCA and PRA, will be covered more in depth by my division directors, so I will leave the specific discussions on those for later.

I would like to briefly discuss the future research needed for the long term storage of spent fuel.

Presently, NMSS and Research are working together on a draft user needs work requests. The research focus will be on the development of technical bases for the key aging issues associated with the fuel and with the storage casks.

Recently we met with Dr. Miller of DOE and have agreed to engage DOE in cooperative research in this area.

Thank you again for your support and I will turn the briefing over now to Dr. Jennifer Uhle my Director

for the Division of Systems Analysis who will begin with SOARCA.

DR. UHLE: Good morning, and thanks, Brian. I will start off as Brian indicated talking about the SOARCA program and I will start with a bit of background.

Over the years to develop information to support its regulatory mission the NRC has performed several research studies to understand the probabilities and the consequences of severe accidents at nuclear power plants.

One such study is entitled "The Technical Guidance for Citing Criteria Development," which was published in 1982 and is referred to as the so called Sandia Citing Study.

All of these studies were based on information existing at the time and over the years as we have learned more they have proved to be conservative and when used to inform public policy even misleading.

The staff is now engaging in a project called the State of the Art Reactor Consequence Analysis, or SOARCA, to develop best estimates of the off site radiological consequences for severe accidents at

U.S. operating reactors as well as to communicate those results to achieve an informed public understanding of those consequences.

SOARCA benefits from hundreds of millions of dollars of national and international research on reactor safety and health effects and reflects improved plant design, operation, accident management strategies and emergency preparedness measures implemented over the last 25 years.

The staff used state of the art computer models as well as current information to develop best estimates of accident progression and off site radiological source term for those scenarios that were predicted to lead to core damage as well as the associated public consequences from those scenarios.

At this stage as you know we have completed two analyses. One is the Peach Bottom Atomic Power Station and the second is the Surry Power Station.

Peach Bottom is a General Electric BWR with a Mark I containment and Surry is a Westinghouse PWR, with a large dry containment. These designs represent two major classes of reactors that are

operating in the United States today.

We have completed the analysis for these two pilot plants and we provided the Commission the preliminary results in March 2009. The preliminary results indicate that for the sequences analyzed potential radiation releases would occur several hours later than previously predicted and those releases would be substantially smaller.

As a result the best estimate of early fatalities from the severe accidents would be far fewer than previously estimated.

In fact, the analyses indicate that essentially no early fatalities will occur and the average individual latent cancer fatality risks are very low for the unmitigated sequences examined, in fact, significantly below the agency's quantitative health objectives.

The staff has prepared a draft NUREG that documents the study method and the results. It is being currently reviewed by an independent peer review panel comprised of national and international subject matter experts from academia, the government, and the

private sector.

In response to their comments we have completed additional analyses and have revised the NUREG to address their comments. The peer review is expected to be completed in a couple of months. Once the comments are fully addressed we will continue with the further review internal to the agency including review by the ACRS which will be an open public meeting.

We will then proceed with a public review of the NUREG and we will host several public meetings to help foster an effective public comment period.

The staff will then revise the report to address the ACRS and public comments and we will provide a proposed final NUREG to the Commission in October 2010.

Next slide, please.

So the SOARCA project is very complicated technically that covers several technical disciplines in great detail in fact.

We have been challenged already in our communication internal to the agency and therefore as we look to

the future we expect to be challenged as we communicate with the public especially during the public comment period.

We will attempt to facilitate this public communication process by holding several public meetings which we will give a chance for the staff and the public to exchange ideas interactively.

We have developed a brochure that we hope will be the main vehicle to communicate the findings to the portions of the public that do not want to read the very technically focused NUREG.

We have also provided this brochure to staff in the NSPDP or the Nuclear Safety Professional Development Program participants in reaching forward to message test it and we have received favorable feedback.

This brochure was written by a risk communication expert who has no formal nuclear power background and she has been instrumental in describing the study and its conclusions in plain English which we hope to help the communication.

The roll out of SOARCA results to all the stakeholders require communication of numerical risk to a diverse

audience and we will continue to work with the Office of Public Affairs to craft and deliver a message that strives to address the stakeholder's perception of risk, people's relative tolerance of technological dangers and their acceptance of risk analysis. That is our challenge here in the future.

As you're aware the original SOARCA program called for analyzing eight different reactor containment design classes which represent the entire commercial fleet in the U.S..

We believed it was prudent to conduct the peer review and obtain comments from the public and the ACRS on the pilot plants before we continue to analyze the other six plants so that we could adjust the methodology as we needed to based on what we learned.

Upon providing the results of the pilot plants to the Commission, the staff will then develop a Commission paper with recommendations for the Commission's consideration concerning the next steps in the SOARCA project and whether the remaining six design classes or a subset of those six should be analyzed.

This recommendation will likely consider the staff's proposed work on level 3 probabilistic risk assessment which will be discussed by Christiana Lui here shortly as well as the regulatory insights that can be gained from the SOARCA results and how they could be used by the agency.

Next slide, please.

I would now like to change topics to another study that we are conducting in the Office of Research, the analysis of cancer risk in populations living near nuclear power facilities and again let me start with a bit of background.

In 1990, the National Cancer Institute published a report entitled, "Cancer in Populations Living Near Nuclear Facilities," and that report concluded that cancer mortality rates are generally not elevated for people living in the 107 U.S. counties containing or that are closely adjacent to the 62 nuclear facilities that were in operation at the time.

NCI Study, the National Cancer Institute study is a primary resource that the agency uses when addressing questions from stakeholders on cancer risk.

Today there continues to persist perceived or a belief by the public of a perceived elevated cancer rate in populations near the facilities, so there's still is a lot of questioning of the NRC's staff in public meetings about this perceived elevated cancer rate.

Since the study is 20 years old we are now attempting to update that study and we are taking advantage of the advances in graphical information systems technology and the precision of demographic data.

The Office of Research, based on that will be focused on providing the NRC with the latest cancer incidence and mortality data for populations near past and present facilities and the study will give the agency the latest scientific information for responding to the stakeholders' concerns related to this topic.

The staff began work in October 2008, with the Center for Epidemiological Research at the Oak Ridge Associated Universities' Oak Ridge Institute for Science and Education or ORAU.

So the contractor ORAU has developed a draft methodology for the study on assessing cancer mortality risk and what we are trying to do in this study is to help to answer other questions from the public is developing a methodology for determining the feasibility of assessing cancer incidents risk which we have not done before.

Because of the technically complex nature of the work, the staff has established an external peer review committee with national and international subject matter experts, again, from academia, government and the private sector to review the study methodology, and to help ensure that the study will be of high quality and will be technically robust.

Similar to the SORACA study the staff is again anticipating challenges associated with communication of the study's approach and the results.

Consequently, we have established an agency wide communication team to help develop a communications strategy and ultimately a plan.

The staff has recently issued a sources sought notification to openly solicit for commercial

entities that may be able to conduct the study because when we originally placed the study at ORAU, we did a sole source placement based on our known understanding of their expertise.

The sources sought is not an indication of any deficiencies in ORAU's work, but rather to ensure that other commercial research organizations are aware of the project and are offered the chance to compete if they are skilled and capable.

The staff is now in the process of reviewing the sources and will decide whether to post the contract as a new solicitation or to continue with our current contractor.

Next slide, please.

We hope to complete this study by the end of 2011, but the date depends on the outcome of the sources sought process and as we go forward we realize that we will be challenged with communicating to our stakeholders.

Our aim is to share a common understanding with all stakeholders, and as I indicated before, we developed a communication team to develop appropriate

communication tools to facilitate this outreach.

Next slide, please.

I would now like to switch to the Advanced Reactors and the work that the Office of Research is doing to develop the infrastructure that will be used by the agency to perform licensing reviews.

Of these designs the NRC has received letters from potential design certification applicants outlining proposed application submittal dates and if these plans materialize the NRC could receive an application for a small modular reactor design certification as early as fiscal year 2011, and even multiple designs in 2012.

In addition, the next generation nuclear power plant program established by the Energy Policy Act of 2005 is expected to provide a design certification application in fiscal year 2013 for high temperature gas cooled reactor.

We have already been working in the advanced reactor area to help develop this infrastructure and we have developed and we are executing the needed research programs to develop the analytical tools to provide

an independent analysis capability and regulatory guidance for both the staff as well as the industry to support this anticipated work.

We established a very strong collaborative working relationship with the Department of Energy at this point primarily focused on the NGNP design.

We have regular meetings and conference calls to keep abreast of both agencies' research programs and in cases where there is mutual interest we do our best to collaborate to make sure that we are not duplicating the effort and this collaboration of course is encouraged by the Energy Policy Act of 2005.

For instance, I gave you an example, training staff is a common concern because these designs have not been licensed in quite a while.

We have held several successful joint training sessions on high temperature gas reactors and they have occurred in a variety of locations.

They have also provided another forum for discussion of technical ideas and we find that having these joint sessions allows the NRC staff and DOE staff to

develop a good collaborative working relationship that has really allowed us to have an open communication with DOE and we think it has facilitated our progress and has enhanced the effectiveness of our research program.

The majority of the research that is underway is dedicated to the development of infrastructure for the NGNP Program including thermal fluid, neutronics and fuel behavior analysis tools as well as graphite and high temperature metallic materials characteristics.

At this point we are trying to focus on areas and issues that are common to both designs that DOE is considering for the NGNP program which are pebble bed and the prismatic core design and the DOE has been delayed in down selecting to either the pebble bed or the prismatic core design and that results ultimately for us in a bit of a challenge as I will discuss in a bit.

Some of the potential vendors that have been discussing applications with NRO are pursuing small modular reactors of other designs than high

temperature gas cooled reactors such as integral light water reactors or liquid metal reactors and we have initiated some low resource level work such as knowledge management activities for sodium fast reactors and the scoping study to determine the need for thermal hydraulic code development to support the integral light water designs.

We feel that we are in a flexible position where we can increase or decrease the level of effort as circumstances may dictate and we look to the Office of New Reactors to provide this guidance to us.

Next slide, please.

Nevertheless, as I indicated, up to this point the advanced reactor arena has been very fluid and it has been challenging to identify a plant and execute the exact necessary research to prepare the agency to review a small modular reactor when there is obviously uncertainty in the design type that will be submitted to us. This applies to those vendors who are pursuing integral light water designs and liquid metal designs and also to the NGNP program because we are not sure if they

will be submitting a pebble bed core or a prismatic core design.

The challenge here is that the analytical tools that we are developing must be capable of simulating the important phenomena over the range of conditions that the reactors will experience and that is obviously very design dependent and code applicability to those designs cannot be established until the design is fixed.

We are also challenged in the amount of time that's available to prepare for these submittals. Since sibmittals may be received as early as 2011, the time horizon is pretty short, but we are doing our best to get the agency in a place where it can ultimately handle these licensing design reviews.

As we go forward we will continue with our efforts to develop the infrastructure to support the licensing reviews of advanced reactors and we will continue to work collaterally with DOE to do so in the most efficient manner.

We will coordinate very closely with the Office of New Reactors to help us adjust as is necessary to any

changing priorities and schedules that arise and hopefully by the time these designs are submitted we will have the necessary infrastructure developed, that is our intent.

I will now turn the presentation over to Christiana Lui who will discuss PRA and HRA.

MS. LUI: Thank you and good morning. I am Christiana Lui and today I will discuss our work in probabilistic risk assessment or PRA and human reliability analysis or HRA.

Since the completion of NUREG 1150, NRC's last detailed plant specific PRA study for five plants about 20 years ago, there have been many substantial developments that affect plant risk and our understanding and assessment of that risk.

In addition to the risk informed regulations such as the station blackout rule and the maintenance rule there had been plant modifications such as the addition or improvement of plant safety systems, changes to technical specifications, power uprates and the development of improved accident management strategies.

In conjunction with advances in PRA methods, models, data, and tools, most recently as you have heard, the SOARCA project has significantly updated our understanding of severe accidents.

The methods, results and insights from NUREG 1150 have been used in many risk informed regulatory applications.

For example, NUREG-1150 has been used in part to help establish the numerical risk acceptance guidelines for risk informed changes to plant licensing bases contained in Regulatory Guide 1.174 which we now have considerable experience implementing.

We believe that the time is right to capture our advances in PRA technology and risk understanding and add to them to create a comprehensive risk analysis tool box so that we can continue to effectively support the implementation of risk informed regulation.

Today, we have identified two goals for such a project. First, to improve our knowledge of nuclear power plant site wide risks so the agency can effectively use more comprehensive updated risk insights in

focusing our safety mission.

Second, to upgrade and disseminate information about our methods, models, data and tools which will enhance our ability to address current and future risk informed regulatory decisions.

Next slide, please.

Many existing level 3 PRAs have focused on the risk of single unit reactor accidents at full power.

The planned new level 3 PRA will focus on overall site risks. This particular slide provides a visual depiction of a complete site risk analysis.

The inclusion of accidents other than reactor accidents will be assessed during the scoping study which I will discuss shortly.

The approximate scope of NUREG 1150 is shown by the gray shaded region which was limited to the risk assessment of single unit reactor accidents that were initiated by internal events occurring during full power operations.

Since only Surry and Peach Bottom had results from external initiating events such as fires and earthquakes the shaded box does not extend to cover the

whole external events bullet in the shaded region.

Focusing on reactor accident risks as illustrated in the diagram, the planned project's scope is much broader than the NUREG 1150 scope.

We would like to improve our understanding of reactor accident risks by evaluating accidents that might occur during any plant operating state, full power, low power, and shutdown that were initiated by the occurrence of internal events as well as external events that may simultaneously affect multiple units.

While performing these probabilistic risk assessments it is important that we use a common set of assumptions, level of detail, methods, models and information. This will help to ensure that the risks associated with individual accident sequences regardless of how and when they are initiated or what radioactive sources they involve can be meaningfully combined into an estimate of overall site risk.

Next slide, please.

We plan to conduct this project in several stages and we are performing a scoping study to establish

the project scope, select candidate sites for further analyses, select PRA methods, models, tools, and data to be used and identify any new work that may be needed to accomplish the project's objectives.

We will also use the scoping study to estimate resources and information needs to better understand and address the potential challenges.

After completion of the scoping study we plan to initiate a pilot site study. Additional site studies will be implemented based on the results, findings, and any lessons learned from the pilot study.

We intend to fully utilize the results from recently completed and ongoing PRA and HRA research activities as well as the SOARCA study recognizing that resources, expertise, and information availability could be potential challenges.

Our goal is to piece together the best approach that will allow us to pursue these updates without sacrificing the quality and the timeliness of the ongoing risk informed regulatory support that the Office of Research provides.

We will also pursue industry cooperation to obtain the most up to date plant information for this planned project.

Although resources, especially the availability of risk analysis expertise, present a challenge to these new initiatives, we also see these projects as a great opportunity to develop new risk analysts who will gain state of the art knowledge and experience in PRA. We welcome any Commission guidance on our current plan.

Next slide please.

I would now like to discuss our work in the area of human reliability liability analysis. The importance of the human contribution to both the occurrence and the mitigation of accidents is widely recognized.

For example, we have learned many lessons from the Three Mile Island accident and changed the way we regulate.

A prediction of human performance even in the probabilistic sense is technically challenging and continues to be the subject of research at NRC and worldwide.

However, our ability to predict human performance improves as the situation becomes more constrained or better defined, for example, through consideration of procedures and training.

Our ongoing research efforts hold the prospect of improved methods, tools, and data to systematically identify potential human failure events and estimate their probability.

Past NRC research has supported the development of many of the HRA methods currently in use. We published HRA Best Practice Guidance a few years ago which has received international attention.

Our recent and current HRA work is focused on making best use of available tools and of developing improved more realistic tools to support regulatory licensing reviews and other staff analyses.

We are collaborating with international and domestic partners to improve HRA methods and tools, develop consensus HRA models and build a comprehensive empirical human performance database.

At the same time we are providing improved HRA methods for specific applications such as fire, low

power and shutdown reactor operations and byproduct material uses.

Next slide, please.

The key to HRA prediction is to understand the context in which the human behavior of interest occurs such as plant conditions, scenario evolution, individual characteristics as well as crew and organizational factors.

Fortunately data from the most realistic contexts or in other words the actual accident conditions are rare.

Advanced control room and concepts of operation also present HRA challenges. In order to model the context to predict human liability it is necessary to understand, for example, what and how information is provided to the operators, how operators can interact with the plan, how many operators are present and their roles and the extent of automation.

Performing human liability analyses for these contexts become rather challenging when design details are still being developed.

Because real life data is rare to meet our HRA data needs we are continuing to identify and access data from a variety of sources and to collect new data.

These efforts include collaborative research and data sharing with a number of international and domestic groups, non nuclear industrial organizations and other governmental agencies.

Our current work on advanced control rooms and the associated new concepts of operation is focused on understanding the human system interface.

The data we obtain from these activities we all support the enhancement or development as appropriate of regulatory HRA tools that will serve our agency's needs now and into the future.

This concludes my presentation and I will now turn the presentation to Mike Case.

MR. CASE: Thank you, Chris. Could I have the first Life Beyond 60 slide.

In accordance with the Atomic Energy Act, nuclear power plants are licensed for a 40 year period with the possibility of extending the license for an additional 20 year period.

Our regulations in 10 CFR Part 54 do not preclude subsequent license renewals beyond the initial term.

Staff has an ongoing successful program to review licensee applications for the initial license renewal period and has reviewed and approved to date 59 units for an additional 20 years of operation beyond the initial licensed period.

The staff expects that essentially all licensees with operating reactors will request an initial license renewal.

With several plants now entering the initial license renewal period in accordance with the NRC regulations, these licensees could apply for a subsequent 20 year license renewal period at any time.

Based on public meetings with industry some licensees are considering submitting applications for a subsequent license renewal period possibly as early as 2013.

Although the burden is on the industry to demonstrate through their research in engineering activities that an applicant for a subsequent license

renewal can safely manage the aging effects on structures, systems, and components within the scope of the license renewal, the agency must be prepared to review these applications in a timely manner.

The Office of Research in collaboration with the Division of License Renewal in the Office of Nuclear Reactor Regulation began working on the Life Beyond 60 area several years ago as a long term research item.

In February 2008, Research had laid the ground work for our current activities by holding a joint public workshop with the Department of Energy.

This workshop engaged a range of domestic and international stakeholders in discussions on issues, technologies and future needs for long term operations.

The staff continued its initial scoping activities with focused followup with major domestic and international participants with interest in aging management issues for long term operation.

These follow up activities included engaging the Nuclear Energy Institute and the Electric Power

Research Institute on the industry's long term operations research program, participating in the steering committee for the development of the Department of Energy's Research Program on light water reactor sustainability, sponsoring an international collaboration with potential partners in Asia in October 2009 on collaborative research efforts relating to aging degradation management activities, and finally planning a similar workshop in May of this year for potential European partners.

As a result of the staff's initial scoping activities several areas of technical focus have emerged for subsequent license renewal periods such as aging of cable insulation, concrete exposed to high temperature and radiation, and aging management of the reactor pressure vessel as well as its internals in piping.

We believe that research activities in these areas will help provide important information to support the staff in effectively evaluating these topics for the period of extended operation and developing appropriate

modifications to the regulatory framework.

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The overall goal of our work in the Life Beyond 60 Program is to develop the information necessary to answer the longer range technical and policy issues on whether there is reasonable assurance that licensees can assess and manage the aging of components during the period of operation beyond 60 years.

Since this program is just beginning the transition from the scoping phase to the implementation phase no Commission policy issues are expected in the next year.

In partnership with the Office of Nuclear Reactor Regulation, a user need request has been developed to guide our future implementation activities.

The user need will begin the assessment of potential modifications to the regulatory framework by focusing our future activities in four key areas: The first is holding periodic NRC and industry workshops focusing on the operating experience in the initial renewal period and the related industry research activities;

developing an expanded materials degradation assessment for the subsequent license renewal period that extends our previous assessment to cover the beyond the 60 year period and expands it to cover the identified areas of technical focus; we wan to develop a library of results of the licensees' implementation of aging management programs in order to determine if the present requirements are sufficient for the subsequent license renewal term; and finally, we want to continue to leverage domestic and international partnerships on aging management research.

We believe that the successful completion of these items in combination with the ongoing license renewal work such as updates to the Generic Aging Lessons Learned report will provide a solid technical basis to address the issues associated with the licensed operations of plants beyond 60 years.

I will now turn the presentation over to Jim Lyons who will speak on the long term research program.

MR. LYONS: Good morning, I will discuss the long term research activities that we do.

Long term research is defined as research that is scoping in nature and is not already funded or already being worked on in some other area.

We try to look five years down the road to determine the fundamental insights and the technical information that will be needed to address potential fundamental insights and to identify gaps in our knowledge.

We ask ourselves, "Are there safety issues out there? Who needs to address them? Should it be the industry or should it be the NRC? When do we need that information in order to for us to be effective regulators?"

The first long term research plan was developed in 2007. Plans for succeeding years have been sent to the Commission on a yearly basis to support their budget development process.

We also currently identify as a matter routine many forward looking research projects that are in the next five years that still need to be worked on.

These forward looking activities such as the work we are doing in probabilistic seismic hazards analysis, digital instrumentation and control issues and advanced reactor code development are identified and pursued during the normal planning and budgeting process.

The process for identifying candidate long term research projects starts by our requesting from the research staff and from the regulatory office staff any suggestions they have on future work that they can see.

These suggestions are reviewed by a committee of senior level technical advisors from the research and the regulatory offices.

The review committee uses five criterion scoring the candidate projects.

First of all, will the candidate project address gaps created by technology advancements? Would it advance the state of the art? Will it provide an independent tool to the NRC? Will it apply to more than one program area? Can we leverage our resources through cooperative agreements working on those

projects?

The results of the scoring process are provided to Brian and to the other program office directors to be used in the planning and budgeting process.

The projects that were identified in fiscal year 2009, and are continuing in 2010, are the Advanced Level 2 and 3 PRA modeling techniques which support the work that Chris Lui described and then we did some exploratory work that identified facility design and data needs for an integral effects test facility at Oregon State University.

The construction of that scale model of a high temperature gas reactor at OSU will be funded by the Department of Energy through an existing memorandum of understanding between the Department of Energy and the NRC.

This fiscal year we are planning on two projects that were deferred from 2009 and two new projects.

First is a demonstration project to get additional data on the storage and transportation of high burnup fuel; a scoping study to identify viable extended in-situ

real time monitoring sensors and techniques; a review of past digital I&C testing related to the effects of heat and smoke to determine if future testing is needed; and finally, . the review of advanced fabrication techniques for structures and components to determine if any safety or regulatory concerns exist.

There are seven candidate programs in fiscal year 2011 that were identified in SECY-09-0021. Resources are included in the fiscal year 2011 budget for those items, and as always, we will revisit those candidate projects when we finalize the work that we will be doing in 2011 to determine which one of those we will proceed with.

The process for identifying candidate projects for fiscal year 2012 has been completed and the Commission was informed of that recently in SECY-10-0013.

There were four projects there that were given high priority ranking. The first was assessing the feasibility of quantitative methods for ensuring that the protective coatings inside containment continue

to meet their design basis requirements; developing insights on the types of regulatory issues that might confront the NRC if advance reprocessing methods are included in the policy decisions regarding the disposition of spent fuel; staying abreast of the development of smart grids and any impacts they may have on the safety of nuclear power plants; and finally, exploring safety and regulatory issues of the thorium cycle which has been proposed by some stakeholders and certainly is something down the road.

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Let me address the second bullet first. The staff believes that the process for funding long term research that was described in our recent SECY-09-0176 will maintain the funding for long term research since the projects will be assigned a high priority in the planning and budgeting process by the Office Director for the Office of Research in consultation with the other office directors.

So we think that that's going to be a very effective

message.

Finally, our challenge is not to get too far ahead of the policy makers and the industry. We don't know exactly what challenges the NRC will face in the future, but we do know that in some areas we need to start that research well in advance of the implementation of new policies and technologies in order for the NRC to effectively carry out its mission to protect people and the environment.

With that I will turn it over to Mary Muessle.

MS. MUESSLE: Good morning. I would like to discuss our safety culture safety and climate survey results and how we will use our research focused areas to address them.

We are very proud in Research of our results from the OIG's NRC safety culture and climate survey that was administered last May.

We had double digit improvement in every one of the 17 categories from the 2005 survey and similar research results from the 2002 survey.

This increase brought us in line with the rest of the NRC and higher than the U.S. national in high

performance norms in most categories.

In November we formed a staff level working group to complete our initial analysis of the results and to formulate our next steps.

Through these efforts we have identified areas that we see as the foundation of our success and want to continue to maintain.

These strengths include the work life balance of the staff, the physical work environment, and our staff actually really likes the offices at Church Street.

Our staff is team oriented and our employees are treated with respect. The staff received fair performance evaluations and there is effective communication by supervisors.

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The analysis of our results also indicated specific areas that might require further attention. One of the key ones is staying connected.

Research scored lower in this area and while the staff likes the offices at Church Street they also feel somewhat disconnected from our colleagues at White Flint and the other interim buildings.

This finding was not a surprise and it supports the Chairman's and the Commission's goals to have all of our NRC offices in a single complex and we appreciate all of those efforts.

We are actively addressing staying connected and are currently participating on the agency committee and we have also formed an internal research committee to maximize communications within the NRC.

We have also been working with other offices on interim solutions and would like to particularly thank the Office of Administration for many improvements to the Church Street building including on site support and shuttle services and to the Office of Information Services for providing on-site IT support and also services loner laptop distribution at Church Street.

We have also heard that we can do a better job communicating and empowering our staff by promoting awareness of the openness of NRC's management to hearing differing views through open door policies and through the differing professional opinion process.

We can also communicate more information on our efforts for capturing staff knowledge as people retire or otherwise leave the office and we will work with the Office of Human Resources to ensure training courses are available and that the staff has time to take the training, particularly career advancement training outside of the Nuclear Safety Professional Development Program.

As always we will continue to address staff concerns around the idea that quality may be unduly sacrificed to meet performance metrics.

We initially reached out to research staff through the working group and at office and division "all hands" meetings to gather more information on the research culture and climate and we will continue to solicit staff input through other means such as focus groups in areas that need further investigation. All of this input will form the basis for our action plan which we will submit to the EDO in March.

In implementing our action plans we will incorporate the new activities into our existing research areas of focus.

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For the past several years Research has identified areas of focus for the office and updated them annually.

The current areas which were last updated in January 2009, are: maintain high technical quality, optimize performance of corporate support measures, emphasize project management and physical awareness, stay connected and maintain relationships with stakeholders and promote self development and well being.

Within each area we have targeted efforts to address during the year. This strategy has helped us to keep our finger on the pulse of the research organization and to be proactive in determining areas of strength and of risk in the office.

We believe the strategy contributed to our success on the culture survey and many of the items identified on the survey are already being addressed under this initiative.

For instance as previously mentioned we have planned activities for staying connected.

We are also developing knowledge transfer plans

which match the junior and senior staff together to create training plans in specific technical areas for new or developing employees.

Another group is building project manager notebooks for knowledge management and has formed the Church Street Information Living and Learning, or the CHILL committee to provide an NRC community at an interim building.

Research will meet in March to update the focus areas and will incorporate recommendations and action items for the safety culture survey at that time.

Brian will now conclude the presentation for Research.

DR. SHERON: Today you have heard a discussion of the major programs and projects in Research that are expected to continue in the next year.

As with most offices Research experiences the balancing act of securing the expertise needed to meet the current workload.

We have also been working very hard to assure adequate contract support to keep up with the

critical projects that are scheduled to provide deliverables to customer offices in the coming year.

Our key focus is to provide the tools and information needed to resolve safety issues and we strongly support the collaborative efforts among the offices and we will continue that strong coordination.

During the briefing we have identified many of the policy issues that are expected to come before the Commission this coming year.

Additional key research activities for this coming year will also include maintaining the focus on aging related materials issues such as dissimilar metal butt weld inspections and mitigation; support the program offices on cyber security and Digital I&C issues; severe accident knowledge management and maintenance; and supporting the agency's fire protection stabilization plan including the transition to NFPA 805.

Again, I would like to express my appreciation for your support and this completes the staff's presentation.

CHAIRMAN JACZKO: Thank you, Brian and

Bill, and everyone for a very informative presentation. There certainly is a lot of interesting work going on in the Office of Research. We will begin our questions with Dr. Klein.

COMMISSIONER KLEIN: Thank you for a good presentation. I noticed that the staff likes their offices at Church Street. The question is, Brian, are they going to want to come back when White Flint 3 is finished?

DR. SHERON: We will have to check out the offices first.

COMMISSIONER KLEIN: Good answer. One of the challenges you have in the research area, there are a lot of really interesting and needed projects to work on.

Jim mentioned it in terms of you don't get ahead of industry and their needs. So how do you balance those issues, knowing that you have to do something, but not getting ahead of industry.

DR. SHERON: I will let the others talk too, but my perception is that we do rely on our senior level review committee which, as I said, involves senior

level employees from all of the offices and they perform a screening and I think we went through the screening criteria that we use, but that tempers what is recommended.

We did identify, for example, some areas in the past where we actually wrote a letter to the industry and suggested that if they were going to be pursuing a certain area we gave them some additional areas that they needed to look into that they would have to pursue and be prepared to address when they did come in.

We don't necessarily say, "We're going to go out and do this research," and actually do it before the industry does.

What we may conclude is that it's a valid area to work on, but it may not be necessary at this time, we could wait and see what the industry does or we may need to go to the industry asking them, "If you're going to pursue this we have to start doing something now so we need a better commitment."

We try to put out the feelers, if you want to call it that, and see how far the industry or how serious

the industry is before we actually go off and really commit to anything major, but I will let anybody else go ahead if they want to say anything.

MR. CASE: Just a quick addition. Brian does it really well in that we focus on the program offices and we focus on the regulatory need.

When you focus on those two activities, it sort of keeps you out of trouble with getting ahead of the industry.

It helps us to keep focused on the product we're trying to make and focused on the customer we are trying to serve and then we really don't have a problem with getting out too far in front because the customer will not do it and the regulatory product typically doesn't get out in front. It's part of the focus on the customer and the product.

DR. UHLE: I would like to add just to compliment what Mike just said is that we also do a great deal of communication with the industry. As the Office of Research as it is our role to anticipate what the needs are going to be.

We are very involved in the standards development

organizations so we see what are the topics that people are concerned about.

We participate in conferences to get out amongst the industry to find this information.

In addition we have yearly meetings with the Electric Power Research Institute, the research arm, as well as the owners groups to determine where they are heading and that allows us to stay not ahead, but to stay, I would say, at pace with the industry.

COMMISSIONER KLEIN: What do you do to keep from getting behind? That is also a challenge that you stay ahead and we're not the long pole in the tent.

DR. SHERON: One of the things I know we do, and Jennifer alluded to it, is we constantly try to keep in touch with the various players you might say.

For example, we periodically meet with EPRI and one of the things that I continually ask EPRI is, "What are you working on down the road? What are you looking for?"

You will notice at the RIC we have a breakout session now which is "International Perspectives on

Long term Research," and one of the things I wanted to accomplish with that session is to find out what other countries, for example, France, Japan, even Korea, are doing in terms of long term planning?

We talked with DOE to find out where they are heading with things. The way we do it is we continually pulse and interact with these organizations that are going to be providing the funding and the impetus to improve technologies and try to keep our pulse on where they are going and use that as a gauge on how fast and how much we should put in that area.

COMMISSOIONER KLEIN: Jennifer, you talked about SOARCA and you said it looks like on the two pilots you have completed, "That the time constant is different and the source term is different than initially planned." Does that look like the EPZ might be modified based on the preliminary results?

DR. UHLE: At this point, in fact, there was an SRM from the Commission early on as you are aware that said, "Don't talk about how SOARCA is going to be used. Keep your head down and focused on the

technical work."

That's what we have done.

However, in going forward as I indicated one of the policy issues that we will be facing will be, "How is this information going to be used?" and we will provide in the SECY paper after we provide the results of the pilot plants some recommendations for the Commission's consideration.

Before I would say anything, we definitely need to communicate with the regulatory offices and consider what options there are.

Now the regulatory offices are involved in the SOARCA process. We have a steering committee with all the regulatory offices involved and so they are kept abreast of the results that we are finding, but at this point we have these results for these two plants and we will see if that is something that we can say for all plants at all sites or whether there is something different about the different design types or even if there would be something that could be very site specific. At this point we have only focused on these first two plants.

COMMISSIONER KLEIN: Chris, in your presentation you said, "If we proceed to Level 3 PRA." Why would you not proceed to Level 3 PRA?

MS. LUI: As I have highlighted in my presentation, though we do realize that our potential challenges such as resource needs, expertise needs, and the information needs, we have to gauge to take on these new initiatives how that may impact our current work that we are doing to support the regulatory offices.

It's going to be a balancing act there that we want to look at, how we will be able to accommodate both pieces in such a way and also if we're going to go forward with the new initiative the information will come on a timely basis.

That's the only reason where we kind come out of not fully committed to doing that. We would be conducting a scoping analysis to help us to better understand what might be the potential limitations and challenges so that we can make a good decision about the path going forward.

COMMISSIONER KLEIN: At this point it is not a funding issue.

It's just a whether you want to do it issue?"

MS. LUI: I would like to say that it's not clear right now. Well, it could become a funding issue if after the scoping analysis we look at the resource needs we think the time line that we would like to have the result is going to be in such a way that it is going to require a fair amount additional resources.

By this point in time I would like to say, and this is my personal view, I am very optimistic that we will be able to pursue this project because of all the groundwork that we have laid in the past 20 years.

COMMISSIONER KLEIN: Thank you. Mike, you talked about "Life Beyond 60" and I noticed that you were not talking about Bill's age or anything when you talked about that.

One of the things I was impressed with when I went to the Callaway plant is that they are looking at some of their piping which is polymer based rather than metal based.

Do you have any kind of a research program to look

at the long term aging impacts of these new piping materials?

MR. CASE: Yes, we have a couple of activities. It is high density polyethylene piping and there's actually a code case going through the American Society of Mechanical Engineers, ASME, so we are involved in that.

Some of the areas that we're looking at for the plastic piping as we call it is the way they're fused, they are sort of melted together and that's how they fuse them so we want to look at that fusing process and see that that is actually done safely.

We are looking at NDE methods that can be used on plastic piping because it is a little bit different so we want to understand how they examined the fusions they make.

Then the third thing we're working on, in the plastic pipe area is, well, let me see, no, I can't recall that one, but we do have some research going on in the plastic pipe area and we are engaged with the program office on helping them with the code case.

COMMISSIONER KLEIN: Are there any techniques you can use to sort of advance the aging issues when you look at those?

MR. CASE: No, I'm not aware of that and I don't know if we have looked into the aging issues associated with this piping. We can look at that.

Once again that might be something we can add on. Right now we are in the getting it out in the plant and making sure it is being done safely.

COMMISSIONER KLEIN: Obviously, the issue we are all familiar with are leaking underground pipes. As we look at these new reactors, are there some new materials that might be applied that would make life easier for everyone sitting at the table 60 years from now?

MR. CASE: Actually, plastic piping is one of the preferred solutions for some of the underground piping issues.

COMMISSIONER KLEIN: One of the things, Jim, on long term research activities is the possibility of recycle. Could you talk a little bit about any events that you are looking for in that regard if we go down the recycle path what research do we need to do as a

regulator to be ready?

MR. LYONS: One of the topics that we have identified in the fiscal year 2012 paper is that we want to start scoping out what are the issues that need to be addressed?

What are the regulatory issues?

What are the technical issues do we need to address in order to be ready for advanced reprocessing techniques if they come up and even the work that Jennifer is doing in getting ready for advanced reactors start looking at if we end up getting into liquid metal reactors, the fast breeder, that type of reactor, what types areas do we need to look there?

Yes, so we are kind of continuing to look where we have to, and again, not get too far ahead of the policy makers on this, but at least to be thinking about what we want to do and what can we and what should we do if that is where we head.

COMMISSIONER KLEIN: Thank you.

COMMISSIONER SVINICKI: I will start with a couple of comments, Dr. Sharon. I am glad you mentioned the

Office of Research's role in seminars.

I had been interested in a lot of them that I have read in the agency wide announcements and I have managed to go to one or two. They tend to be a packed house which is really a compliment to your staff in putting them together.

I want to highlight that your staff had the lead as I understand it for the anniversary of the Three Mile Island event and I thought that that was really an outstanding event and I know that your staff was supported by staff from other offices, but they did have the lead on the TMI anniversary event and I thought it was particularly well done so I wanted to compliment your folks on that.

Also, I wanted to make a comment because we have heard a couple of you mention a research priority that is emergent now which is to know more about long term storage of spent nuclear fuel.

I know the couple of times it was mentioned, I think it was in the context of high burnup fuel, I personally have spent time over the last year understanding better the agency's basis for confidence in the long term dry

storage, in particular spent fuel, and certainly now it is appropriate for us to look at emergent research needs there for looking at longer durations of dry fuel storage.

Of course that also needs to be done in concert with DOE, and others, but at least in looking at the historical research is when dry storage was more of a novel concept that the EPRI and others did some of the very seminal work on that.

I believe it is timely to turn to our research basis on the long term dry storage and do more work there.

Maybe you could tell me, Brian. Is it timely if I wanted a more detailed presentation or a briefing on what it is that you propose there or are you still kind of formulating that and would it be timely for me if I wanted additional information because it seems to me you are still in the kind of discussion stage on it.

DR. SHERON: Yes, we are still in the discussion stage with NMSS. I believe they also have a briefing scheduled later in the spring, NMSS does on that topic, and I imagine that we would be able to

provide a lot more detail then on what the proposed go forward approach would be on research at that time.

COMMISSIONER SVINICKI: Yes, I just want to understand the scope better as we move forward and so I know that feedback is more useful if it is early rather than late, so I look forward to continuing to work with you and NMSS on that.

Dr. Uhle, I want to turn to your presentation on maybe small modular reactors really more than advanced reactors, although maybe advanced reactors is kind of the umbrella, but within small modular you have concepts that are more or less exotic, I think, some of the proposers are trying to stay closer to things that are familiar and the obvious reason they are doing that is that we have such a tremendous amount of data.

If you kind of think of the reactors that we have operating, the power reactors today, I sometimes think it was a multi decadal process, it's like the pyramid, the licensing of a reactor design is the top of that pyramid and there is so much underlying understanding and work that needs to go on to build

that foundation.

So for a new reactor design, the more they can utilize this, and I think you might have mentioned this, a thing like the applicability of codes to the types of regimes of performance that the reactor would experience with the fuel, what it experiences, so I sat back thinking to myself, "We are still doing research on the fuel we use now."

Maybe what I am looking from you is if you can tell me whether I am overwhelming myself with the complexity of things or if I am appropriately concerned about the amount of work that really needs to be done for some of these small modular or more unique more small modular designs.

Since I came to the NRC, I have now had the chance to the go to Idaho National Lab in this NRC capacity and Sandia as well.

In Idaho I had an opportunity to go through a research facility where a couple of researchers were in the room and they were studying one alloy for one specific NGNP application and they were basically looking at the very high temperature regime so they

basically had ovens where they were cooking these little samples and they talked to me and spent some time talking at great length. It will take them two years, the best case estimate there, to get an accepted code case for that alloy for that specific temperature regime.

It is easy to look at that and step back, and say, are we appropriately communicating the amount of work that it might take for some of the materials that we have not licensed before for design concepts that are new and different?

We structured our research portfolio around the user needs basis, so I am very familiar with that working with the military services and the commanders who go to DARPO or to a Science and Technology Office, and say I have a user need, so I think that's a great construct for us and in the two years that I have been at NRC that works really well.

I'm not suggesting that we monkey with that at all, but I am a little worried, we had at least one opportunity before a Congressional committee to have the agency and Mike Johnston went and talked to the

Senate Energy Committee about what will it take to bring the regulator along and we testified alongside DOE which is appropriate.

It's important that we calibrate the external community on the fact that the reason that we are able to review light water reactor designs and turn around new concepts there is that going all the way back to the Atomic Energy Commission we have built up a body of knowledge about these things that we are familiar with.

Am I making too much of this or is there really a lot of work to be done?

DR. UHLE: What you're saying is exactly correct. When we take a look at a new technology it's going to be more difficult for us to license it. It will be clunkier along the way and there will be perhaps different road blocks and detours that take place and will not be as streamlined as the light water reviews.

However, if you take a look at some of the designs that are being proposed aside from the integral light water designs, but say the sodium fast reactor we

have experience with the sodium fast reactors, in fact, Super Phenix in France and the Phenix reactor actually just shut down a year ago.

There is a reactor in Japan, so both Japan and France have quite a bit of experience in sodium.

We also have DOE experience with sodium fast reactors and therefore there is information out there.

We began a licensing review in the mid 1980's on the Clinch River. It subsequently retracted, that application, but we do have expertise.

It is not perhaps at our fingertips so that's why we have taken a look at knowledge management activities to try to dust off some of the technical basis that we had developed previously and refresh it and all the training sessions.

The challenge really is going to be getting the reviewers and the agency back up to speed on these designs.

If I point to HTGRs, again, Fort St. Vrain was a reactor that we licensed and it operated. Do we have the regulatory guidance to the degree? Do we

have 400 regulatory guides focused on gas cooled reactors or liquid metal? No.

COMMISSIONER SVINICKI: That's interesting. That is actually the second part of this since I am talking to Research I wasn't even focused on that.

It is a little bit like your Q and A with Dr. Klein on SOARCA where you said you do your analysis and your research and then the second step is how is that reflected in the regulatory framework, which is the whole other piece that we may or we may not have. Fort St. Vrain was licensed.

Obviously a reactor in another country is not something that we necessarily licensed. So that's a whole other component of kind of just bringing the regulator along on these new technologies and that is a significant step all in and of itself.

DR. UHLE: We have done some work take a look at that with the technology neutral framework.

There are basic principles that you would be concerned about when you have a nuclear reactor.

Criticality control is one thing and pressure boundary control for the release of radioactive materials is another.

There are big principles that are common to all of these designs. They are a little bit different in terms of the gas cooled reactor where you worry about air ingress when you have a loss of coolant accident or essentially a breach of the primary pressure boundary and the helium releases.

You have different concerns, but in general the principals, cool to core, shut the core down, and keep it shut down, keep removing the heat and prevent radiological release.

Because of that, I think the ultimate framework is easy to sit down to list, "Here are the concerns," then you look at the particular design and you understand how it operates and then you take a look at the regulations to determine if they are applicable.

Principles are applicable whether or not the exact limit that is specified may not be or the exact

design basis, a Chapter 15 transients will not be. That is where we have to scratch our heads.

COMMISSIONER SVINICKI: That's a good way to approach the problem. What is the work that needs to be done? What do we need to know? The second element is, Who does it? I know you all are really performing that coordinating function and working with others.

We look at the AP1000 and we are exploring with the designer their issues related to basically concrete and rebar and that is not an exotic alloy and something we don't know, but I am sounding negative so I will stop here.

CHAIRMAN JACZKO: Following up on Commissioner Svinick's point. You didn't touch necessarily on the integral light water reactors. Obviously that is a technology that is used in a larger scale with current fleet of reactors, so is that an area where you think that we have as much of a need to develop a framework or is that in better shape?

DR. UHLE: Certainly integral light water reactors will be easier for us to review. By easier I should say it will require less effort for us to prepare ourselves

to do a review. It doesn't mean that technical issues will be any less challenging.

We have a lot of experience with light water and our codes are focused on light water, but with any new design there are new features. For the EPR, they rely more on reflex condensation to cool the core at the higher pressures.

We never really had that before to worry about because we had high pressure injection so there are new phenomena that we have to take a look and make sure that we can analyze appropriately and we look to see is test data in the appropriate ranges of conditions and we assess the code thereafter.

I would say that with the integral light waters they are potentially thinking about a helical steam generator, an helical coil, well we have never done that before.

We can connect all the pipes and we have the water materials and properties, but are we going to be able to simulate how that steam generator drains down in the case of a loss of coolant accident then we are

going to have to have a test program where the licensee will have a test program and we will validate our code against it and do model development as is necessary.

That is for every new design. EPR, USAPWR, ABWR, ESBWR, we go through an applicability report and it takes a year.

CHAIRMAN JACZKO: Specifically on the integral light water reactors then, if you look at the issues that need to be addressed, what would you say are the top three things that need to be addressed and are those things being addressed right now by Research or do you have to do more work?

DR. UHLE: At this point we are not in a preapplication stage and so what we are looking at would be things in common.

They will be integral. They are not have piping on the exterior. So we are really going to be forcing the code to do three dimensional low behavior internal to this vessel.

We have a three dimensional capability in the code. Have we used it for this type of geometry? No. So

we're taking a look at it and we are saying to ourselves, "How would we model this using the capabilities we have," and then we take a look at data.

Is there data out there that has more three dimensional behavior they we can compare it to and how did we do?

The steam generator, the helical design of the steam generator, helical coils in the steam generators is another example.

There are certain things like that, but we do have a code that is very well documented for heat transfer in the flow path over the fuel rods which we don't have for a gas cooled reactor at this point because we have never done a pebble bed here in the U.S.

That's where it's easier, but there still will be particular issues that we need to take a look at.

CHAIRMAN JACZKO: Certainly, as we go forward it is important in particular in the integral light water reactors that we are prepared. Right now our plans are to begin with perhaps more significance and substantial preapplication review

work in 2011 and then in 2012.

If there are areas right now where you Brian don't feel you're able to respond to the user needs from NRR, Jennifer, if there are things that you see let us know and keep us informed so we can make sure that you get the resources to do that because we do want to be prepared to be able to respond and to deal with the applications, and as you said, if there are some unknowns right now we will not know more until we see more detailed designs beyond some of the PowerPoints.

Now I would like to turn to a subject that Dr. Klein had raised. Sometimes we ask questions and maybe hidden in them sometimes there are statements. I don't want to put words in his mouth, but I may try to say what he said perhaps without asking a question.

I would be supportive of your proceeding with a Level 3 PRA work. Perhaps I heard that in the phrase of his question with the caveats that you rightfully talked about that this is in many ways not necessarily directly applicable to any regulatory

needs or anything right now.

It is in many ways a knowledge enhancement activity and a skills enhancement and a personal development opportunity right now for a lot of staff which all are valid, but may not necessarily be the highest priorities.

I would certainly be supportive in that regard of continuing in what seems to be the path you are on right now of in making this somewhat of a medium to low priority activity, but one in which you are continuing activity and development on.

So if I have captured that right, and if I have not, feel free to clarify.

MS. LUI: Yes, if I could offer one comment. I know that a lot of our work in terms of what are the established risk metrics are really looking at Level 1 type of measure, sometimes at Level 2 and Level 3 or all the way extending to probably health effects and the consequences are now being looked at frequently.

At the same time we do have lots of different places where we need to look at regulatory analyses and

that's where Level 3, a good solid Level 3 PRA, really provides a lot of defensibility.

In terms of our generic issue program, if we actually go through the entire evaluation we do have to perform regulatory analyses at the end so sometimes we do have to struggle a little bit in order to find that information.

Yes, even though there may not be an immediate need, but ultimately that you will provide the agency the best tools to allow us to do all the different types of regulatory decision-making.

CHAIRMAN JACZKO: And with that, that perhaps even strengthens my support. I don't see this as a high priority item necessarily, but a medium to low priority activity I think is something where this is well founded.

On that topic, are there any licensees out there that have a full Level 3 PRA right now?

MS. LUI: I can't really speak about the vintage of the information, but I am pretty sure that there would be at least one or two out there where they do have a full Level 3 PRA.

CHAIRMAN JACZKO: Does that include then where they look at low power and shutdown operations or would it simply be full power?

MS. LUI: A lot of the information actually exists in piecemeal fashion in a sense that the licensees do perform certain scope of low power and shutdown analysis to support their shutdown operations and many plants have come in for license renewal they pretty much have to do a pseudo Level 3 PRA because of the requirement in that area so it may not be as detailed but certainly scoping analysis do exist.

CHAIRMAN JACZKO: One of the issues that has been an ongoing concern as I look out over the years, and the changes that are happening internationally and as well as domestically is the availability of facilities for research.

I know this has been an issue that we have talked about in the past with these kinds of meetings.

Perhaps, Brian, if you want to comment on that or if there is anybody who wants to make a comment where you see the state of facilities right now.

Do we have domestically the capabilities we need to

conduct the research we need to, and if not, does it exist internationally or are there just simply some things that do not exist anymore that will hamper our ability to do the kind of confirmatory research we need?

DR. SHERON: Right now I think domestically we don't obviously have the facilities that we had back in the 1970s and the 1980s like LOFT semi scale and the MIST facility. I could go on and name tons of them, but as Jennifer said, we now have a proposal to work with DOE and they will fund, for example, a scale model of the NGNP gas cooled.

Obviously one of the questions is that unless DOE does a down select fairly quick we will be faced with the potential of two different core designs which could involve the need to do more experimental work to have a scale facility of both kind of cores.

We don't have that planned right now. We will probably look to DOE if that was the case to provide that.

Internationally, we are looking and as a matter of fact one of my initiatives over at the NEA through my

membership or in the CSNI Committee we established a tariff group in which Jennifer, and now, Kathy Gibson is a member of, the intent of that was to kind of force the NEA to get out in front, or in other words historically the work they do has always been sort of catch up after things have been decided. The idea was to look at the available facilities worldwide for some of these advanced reactors, the gas cooled as well as the sodium.

The U.S. took the lead for the tariff group on the gas cooled and Jennifer provided that leadership and the French are providing the leadership to look at the sodium cooled.

I will turn it over to Jennifer because you can talk a little bit about what your group came up with in terms of looking at facilities available.

DR. UHLE: The tariff program, again, was specifically focused on two different designs, sodium fast reactor which is underway and Kathy Gibson is involved in that activity and I was the chairman of the gas cooled reactor.

So this is just for these two particular designs,

and we concluded, and the purpose of the tariff was to ask what facilities are out there that are available to develop the data that would be necessary and the first thing we did was, what phenomena are important and what ranges of conditions do we need to have this data set that we are ultimately going to need to extend over.

So NRC and DOE collaborated to develop a phenomena identification and ranking table 4, the NGNP program, the gas cooled reactor, so we used that and we selected those high ranked phenomena from those reports and then that worked.

Then, we said, "What facilities are out there?" and we have about 40 different facilities and the conclusion was that there is more than enough coverage.

If we are looking at would we have to potentially add extra instrumentation to a facility to look at a particular phenomenon? Yes, maybe we have to do something like that, but we found that there were a lot of overlap in the facilities that were out there and we did make a recommendation that

the HTTR, the high temperature test reactor in Japan, which is actually a 5 megawatt prismatic design gas cooled reactor, we said that that would be a great place to do a collaborative work because we could get some kinetic information because it is actually a neutronic core.

We are doing the same thing with the sodium fast reactor. We didn't have a phenomenon identification ranking table for the sodium fast reactor, so this is more of an ad hoc identification of the high ranked phenomenon.

But, again, asking the same question. What facilities are out there," and based on what I have been hearing from Kathy is that there are a lot of facilities out there.

The real benefit of participation in CSNI and CNRA on the regulatory side is just that. It is you develop these collaborative relationships and you have access to the facilities.

Typically if we think especially with light waters, if we think there is a technical issue that needs to be looked at the other countries are usually

agreeing and we band together, so I don't think that we have to have a facility in the U.S.

Also there was another report that was written by CSNI a couple years ago that looked at light water facilities and had the same conclusion, there are plenty out there, but we highlighted the need for the international community to band together, and if there was the potential for one of the most flexible and better instrumented is for the facilities to be shut down, then please alert the international community and then we will cross that bridge when we come to it, but we haven't had that happen.

So I think the participation in the international activities through CSNI is a great way to maintain our access to these facilities.

CHAIRMAN JACZKO: It sounds at this point there are no major gaps and that is always good news. Dr. Klein do you have any additional questions?

COMMISSIONER KLEIN: Just a couple quick questions. As with Commissioner Svinicki, I have concerns with do we really have a good research program now identified for long term storage and then the follow up of

transportation?

So one thing I would like to see as a follow up is your research plan both for long term storage and then some of the issues we should start looking at as that fuel might be transported to another location after long term storage. Those are two issues that would be good to look at.

Then another question that I have for you Jim,. do you ever travel internationally?

MR. LYONS: Once in a while.

COMMISSIONER KLEIN: Do you ever take a laptop with you?

DR. SHERON: No, I don't usually take a laptop. I usually take my BlackBerry and use it to communicate.

COMMISSIONER KLEIN: One of the things I noticed in Bill's EDO message that came out recently is the fact that we are all sort of homebound with this snow that came in the last few days, the importance of telecommuting and being able to work while we travel.

One of the things that I have learned is that with a lot of the hotels in foreign countries you only have Wi-Fi.

For those who have laptops, I would just encourage

the EDO to continue to push IT processes so that we can travel and have Wi-Fi access both domestically and internationally because it really does make us be able to perform. At least BlackBerries is a good step in that direction.

MR. LYONS: You can at least connect it, especially when your flight gets canceled from Frankfurt to Dulles because of snow.

COMMISSIONER KLEIN: This is a final question for Brian. One thing where I was really surprised at is when I was at Kashiwazaki recently is the complexity of seismic analysis.

Obviously the geology characteristics at that site was very complex, but then it sort of brings in the question, "How well prepared are we for a seismic analysis for complex geological issues?"

I assume you're getting a lot of information from the research that the Japanese are doing?

Then the second part is, "How are we doing with what we need to do to stay ahead of that potential issue in the U.S?"

DR. SHERON: We have been very actively involved with the Kashiwazaki event and Annie Kammerer of Mike's

staff has been over there I would say, I don't know how many times, but many, yes, working with them understanding what was learned, what the lessons learned were as well as, for example, in the tsunami in the southeast region that occurred.

We are learning all about where we are trying to constantly take this information and apply it and see what the lessons learned are and whether there are any changes needed in the U.S. I will ask Mike if you want to elaborate any on that.

MR. CASE: Yes, I will add on a little bit. We are in the process of what I would call thoroughly modernizing our seismic regulatory guidance.

We have a seismic research plan that we have coordinated a lot with the New Reactors Office. It is mostly focused in the central and eastern United States right now, but we are thoroughly modernizing our seismic approach, so at the end of this we will have a world class regulatory framework that has sort of shifted from a deterministic type view to a more probabilistic type of view and we have been doing this in collaboration with EPRI, DOE, USGS and so it

is really a consensus process that we are working on.

COMMISSIONER KLEIN: Nothing further. Thank you.

COMMISSIONER SVINICKI: Ms. Lui, I will turn to a couple of areas that you talked about. First, I solicited for some feedback on the Level 3 PRA and I have some notes here about the scoping study and it seems to me to be complete, but there is something that I would ask you to think about, though, maybe as a precursor step. I don't want to suggest it if it is not of value and you would know better than me, but is there any potential that a workshop or something that would get stakeholder input and I am talking kind of academic expertise industry input, just other interested stakeholders an opportunity to get early input into what you're scoping because, again, with research, my bias is always having issues raised earlier rather than later is helpful.

My other perspective is that for Level 3 PRA you talked about building a kind of tool kit. My sense is that different elements of the tool kit are at different levels of maturity, so you could calibrate maybe our internal assessment of what the level of

maturity is of things versus some external perspectives.

I don't want to suggest an action if you have really done it in bits and pieces. It's not a useful step right now, so if you want to give some feedback?

MS. LUI: Yes, absolutely, we are only at the beginning stage of the scoping study so we have not really gone that far yet.

What we have done is that we have been discussing the ideas of doing a Level 3 PRA with the internal NRC offices, so we have talked with NRR and we have talked with NRO, and we are in the process of engaging NSIR, NMSS, and FSME just to make sure that everybody is on the same page there.

The next step, clearly, is we are hoping that by the end of the calendar year we will be able pull our plan together in terms of what we really intend to do and what will be the actual scope.

If we were not going to do any type of assessments that are laid out on that particular slide, or in other words, there are the reactor accidents and there are the other types of accidents where we can

document reasons why those would not be included.

We definitely want to engage external stakeholders and at this point in time we want to at least involve a strawman so that the stakeholder would have something they can digest and look at to promote that very productive interaction.

COMMISSIONER SVINICKI: Yes, because today I think my feedback to you would be that I would feel much better able to give you more specific feedback on what could potentially be very resource intensive if I had a better perspective on some alternatives and maybe some modularity to what you were proposing and what different options might cost out on that and certainly these perspectives on what use we would make of it and how we might feed it back into things and then also to test those theories against some other stakeholder perspectives.

MS. LUI: Yes, and in terms of the tool kit, absolutely, I mean in talking about Level 1, Level 2, and Level 3 PRAs, the Level 1 PRA is definitely the most mature.

In fact our planning starting point is to start with

the SPAR models which is the standardized planned analysis risk models. We actually have those models updated periodically so that they are in very good working condition.

In terms of the consequences analysis it is just like the SOARCA study that we have the MAX Code that can actually do a calculation.

Where we really need to bridge the gap is in the Level 2 analysis because NUREG 1150 allows you to rely on expert elicitation to actually generate the probability and frequencies in order for us to propagate the computation to that particular stage.

With the advancement in our understanding in severe accident and also MELCOR has matured over the years where we're hoping that we would be able to really capitalize on all of this groundwork that has been laid in the past 20 years.

As Jim Lyons had mentioned, we also have a piece of work that is ongoing specifically targeting the improved methods to handle Level 2 and Level 3, including the interface with Level 1.

We want to really pull these different pieces

together in order to do this particular project and that is the reason I am optimistic about the path going forward.

COMMISSIONER SVINICKI: I appreciate your mentioning that. I think it was in the Commission's meeting on fire protection that we had an EPRI participant, maybe even the NRC staff talked about certainly the value of expert elicitation, but it also has its limits.

I appreciate your mentioning this goes kind of back to this issue of the level of maturity of the various component pieces that we are talking about here.

The other issue that you had briefed on today was the HR, the human reliability analysis and at a prior Commission meeting with NRR, I talked a little bit about operator licensing and now I find myself in a circumstance where as I have gathered more information about it, I am not even sure exactly what I would like NRR to provide me more of.

It's tough for them because as they give me more information about operator licensing, they are finding that I have additional questions, so I am still

trying to scope what I think might be meaningful in terms of the staff looking at some operator licensing issues, but an issue going forward is something you talked about which is the advanced control rooms.

This certainly I think has to shadow back into anything we might need to prepare for an operator licensing as far as the way control rooms are going to have a different interface with operators.

Can you talk a little bit from Research's perspective on how far we are from having kind of actionable results out of our HRA work that we could feed into our regulatory process on operator licensing?

MS. LUI: Yes, absolutely. We are working extremely closely with NRO in terms of the events and control room designs.

In fact the staff has gone to visit a couple simulators out there that the current group of potential applicants have built to better understand what it is they are thinking about and what kind of training strategies they are going through.

Right now we are at a stage of understanding the

system. The way that we are doing this is that we look at the human factors aspects first and then the human factors aspect will get propagated and converted into something we call performance shaping factors in the HRA analysis and given that these are the applicants intent of how they are going to run their operation, what kind of time scale they will be on, what will be the crew size, what kind of technology will be involved and propagate that through the HRA model.

We are definitely not there yet because right now we are in a new human system interface understanding stage and recently we have put a couple of small contracts in place so that we will be able to have the best thoughts and the best support to help us in going forward.

Clearly, that's again one of those situations where you have a push and pull type of situation. So that's the reason why we are staying very close with the licensing office just to make sure that we are staying on top of the game, not so much ahead, and definitely not falling behind.

COMMISSIONER SVINICKI: I appreciate that kind of context. I

certainly don't want to ask the staff to have to formulate any recommendations on something if it is premature, but it sounds like you are definitely monitoring and you are plugged in with the licensing folks and so I do appreciate that.

Quickly, and this is a last item. I'm not sure who could address this because Dr. Sheron just mentioned it in his introductory remarks. It has to do with smart grid initiatives and any kind of nexus they may have on reliability/cyber security issues.

How plugged in are we with government wide initiatives with NIST, with DOE, and with others who are looking at kind of a global interest in smart grid initiatives? Is there someone here who could answer that.

MR. WIGGINS: Good morning, this is Jim Wiggins, Nuclear Security and Incident Response. We have the lead for cyber.

We also assumed the lead for smart grid because of the connection, but I appreciate your view. We share the same view. It is more than a cyber, it is an overall reliability.

As you said, NIST is the lead for, I guess it's the Federal Energy Regulatory Commission in developing the standards.

Pardon me, my voice escaped me this week much to my staff's benefit as it turns out, we are getting a lot less questions this week.

COMMISSIONER SVINICKI: Mr. Burns is so nice, he said much to your staff's delight.

MR. WIGGINS: Yes. NIST set up a structure to provide governance and oversight and it is a smart grid panel of some sort, an oversight board and we have a representative from the office NSIR that sits for the NRC on the board, so he is a voting member of this activity that involves a number of sectors that are interested in smart grid.

We are the regulatory government piece of it and there is industry and vendors who are involved in that and that has just started now.

COMMISSIONER SVINICKI: I am certain this is happening, but our representative has obviously a heavy burden because he or she will need to kind of put feedback back into NRO, NRR and Research and make sure there is

good cognizance of emergent issues because there are likely to be.

MR. WIGGINS: Yes, we recognize that. The individual staff member which is kind of atypical for the board membership has a background coming to it from a prior activity before he joined the NRC which made him attractive to NIST and the people who were assembling this activity.

We had dealt with that very question about the need to stay connected.

At the start of this when we learned of the individual being voted in being somewhat interesting in the way that that happened, but we will leave that out as we don't need to discuss that, but Jack Grobe is here and Mike Johnson is here and we worked together to make sure that we're going to stay tied in.

We recognized that that was important and that this individual gets the support he needs to serve the role he is serving on this board which is beyond federal Well, it's a government regulatory role beyond even NRC, but certainly the enlightened self

interest aspect of if indicates the NRC interests are paramount in what we are asking him to do.

COMMISSIONER SVINICKI: Thank you and thank you, Mr. Chairman.

CHAIRMAN JACZKO: Thank you. I was a very interesting briefing and we probably have a certain language that we can work on the Level 3 PRA.

It sounds like there is certainly a Commission interest in that activity of varying degrees in putting some language together to work out any specifics that we would need to look at with any breaks or any stopping points or any kind of caveats as that process goes forward.

In general, this was a good discussion and we appreciate all the work that you do in this very important area, and as you can see from the questions it is of very strong interest to the Commission. So thanks for all your work and Happy Engineers Week.

(Whereupon, the proceedings were concluded)