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UNITED STATES NUCLEAR REGULATORY COMMISSION

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

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WEDNESDAY
FEBRUARY 8, 2006

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The Commission convened at 1:30 p.m., Nils J. Diaz, Chairman,
presiding.

- NUCLEAR REGULATORY COMMISSION:
- NILS J. DIAZ, CHAIRMAN
- EDWARD MCGAFFIGAN, JR., COMMISSIONER
- JEFFREY S. MERRIFIELD, COMMISSIONER
- GREGORY B. JACZKO, COMMISSIONER
- PETER B. LYONS, COMMISSIONER

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3 PRESENT:

4 MR. LUIS REYES, EDO

5 CARL PAPERIELLO: DIR, RES

6 MARK CUNNINGHAM: DIR, ENGIN, RES

7 FAROUK ELTAWILA: DIR, SYS. ANALYSIS & REG. EFFECT

8 CHARLES ADER, DIR., RISK ANALYSIS 7 APPL.

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PROCEEDINGS

CHAIRMAN DIAZ: Good afternoon. We gather here again in this very, very nice room to be briefed by the Office of Research, an office that I value not only because of what they do, but because I know what it could mean to this agency.

But let me just stop right there a minute and really take this on a personal note. I believe Carl Paperiello thinks this is his last meeting in front of the Commission and in one way or another, that might be true.

But I do want to recognize his outstanding service to this agency to the things he has done.

I know that in a personal way, many times when I had issues that I didn't know how to handle, I picked up the phone and Carl was there. He has meant to me a lot of things throughout the years, somebody I can rely on, somebody that I trusted and somebody to this agency has meant a lot. Carl, we are going to find a way of keeping a hook on you. But I'm sure my fellow Commissioners have some comments. But from my point, I want thank you.

MR. PAPERIELLO: Thank you.

COMMISSIONER McGAFFIGAN: Thank you, Mr. Chairman. I join you. And I warned Carl at a previous meeting that he would get roasted at this final appearance before the Commission. I also appreciate you. You have always given me very straight advice. I particularly enjoy your weekend homework assignments. I'm not sure your staff always enjoy it.

And you must be a very challenging person to work for because you can do almost any calculation your staff does faster yourself. So it's –

1 MR. REYES: He has the equipment to prove it.

2 COMMISSIONER McGAFFIGAN: To the first order, Carl has a
3 slide rule. All of us, educated of a certain age --

4 MR. PAPERIELLO: Forty-five or younger.

5 COMMISSIONER McGAFFIGAN: Greater than 39 used to get
6 first order of calculations. We were not digitized like the current generation of
7 students. I want to join in expressing deep appreciation for your service.
8 You've been a unique asset to the Commission for a very long period of time
9 and in a very wide variety of jobs. And the thing I always appreciated the
10 most was your honesty and your ability to give me first order answers to
11 questions very rapidly.

12 COMMISSIONER MERRIFIELD: Well, it's hard to layer on top
13 of the very warm comments already made. But, you know, in my role, Carl, I
14 was thinking back on it, we been meeting at least once a month for the last 7
15 and a half years. And I can't count the number of times where we would be
16 talking about an issue and Carl would say, well, I was home working on the
17 calculations over the weekend.

18 I think that the assumptions that X Y and Z have made were
19 wrong. Or I spent the weekend going through the NIST manual on FISMA,
20 and I think there are some -- I think Carl would say at this point that I know
21 more about FISMA than anyone else at this agency. I never had a doubt.

22 COMMISSIONER McGAFFIGAN: Which I am sure is terrifying
23 for Jackie Silber and Ed Baker.

24 COMMISSIONER MERRIFIELD: Carl, we will I'm certain have
25 another opportunity to give you yet another for us to say warm things about
26 you. But you have served this agency in a number of different roles not just

1 in headquarters, but in the regions and stepped up to the plate on a lot of
2 hard tasks and took them with a great fervor. I would add my congratulations
3 and appreciation to those of the other members of the Commission.

4 COMMISSIONER JACZKO: Well, I certainly echo the
5 comments of my fellow Commissioners.

6 I been here slightly over a year and in that short time have
7 come to appreciate Carl's contributions to this agency and his almost infinite
8 wisdom and knowledge of these subject matters.

9 I can't think of too many questions that I have ever had that I
10 didn't think Carl would know the answer to. And perhaps today, we will find
11 some that you don't.

12 This will be a chance to disprove that.

13 But as I said, I certainly have appreciated all the advise and
14 suggestions and information that you provided to me and my office. I think it
15 has been an invaluable service to me in the work that I perform here and
16 certainly, that your contributions to the agency I think are also equally
17 impressive and I think we will be in the process of replacing you soon but
18 finding another person to head your office and replacing you will be very
19 difficult.

20 COMMISSIONER LYONS: Carl, you and I had interacted a little
21 bit before I came here, so I wasn't starting quite from square zero in
22 interaction with you. But I've really appreciated over the last year the ability
23 to know that you are right close by, available to answer all kinds of questions,
24 provide suggestions and your wisdom on any number of subjects has really
25 been appreciated. So thank you for your service and I wish you well in all
26 future endeavors, and I hope we stay in touch.

1 CHAIRMAN DIAZ: Having said that, let's all forget about that
2 and go on and give him some heck ---

3 COMMISSIONER McGAFFIGAN: Don't expect us to treat you
4 that kindly later.

5 CHAIRMAN DIAZ: Mr. Reyes?

6 MR. REYES: Mr. Chairman, Commissioners, the staff is ready
7 to brief the Commission on the Office of Nuclear Regulatory Research,
8 programs, performance and plans.

9 Earlier this year, we briefed the Commission on the international
10 cooperative research. The staff had requested that particular briefing
11 because we wanted to have enough time to cover the key activities of the
12 office.

13 It is a lot of activity, a lot of issues rather diverse in terms of all
14 the activities the office does. So that's why we ended up separating into two
15 sections. Let me just turn over the meeting to Carl for the presentation.

16 MR. PAPERIELLO: Thank you.

17 Good afternoon, Chairman, Commissioners, staff. I'm pleased
18 to be here to make a presentation on the Office of Nuclear Regulatory
19 Research's programs, performance and plans. And my principal staff are
20 with me to help answer questions that I might not be able to answer.

21 We will be pleased to answer your questions today. Can I have
22 slide 2?

23 I'm proposing to give a brief overview of the office, outline its
24 programs, discuss its performance and particularly, management
25 performance, discuss our plans along with the challenges and then, give an
26 extremely short wrap up summary.

1 The Commission has been given a book of backup information
2 that provides much more detail than I can possibly present here. And I will
3 not be discussing international research because we did discuss that a month
4 ago, but that does factor into our program.

5 Could I have slide 3? We are primarily a support office. If
6 others did not license, write rules, inspect or evaluate performance, there
7 would be no need for the office.

8 Since we support the entire agency, the office is technically,
9 very diverse.

10 The ACRS in the last version of NUREG-1635 identified 15
11 disciplines in which the office does research and that did not include a
12 number of areas that primarily support NMSS or NSIR.

13 I think we are probably at about 22 different technical areas.
14 Furthermore, the level of expertise needed to do the work is very high.

15 Consequently, the Research staff has the highest average,
16 educational level in the agency. As previously discussed, we make extensive
17 use of domestic, and I emphasize, both domestic and foreign collaboration to
18 obtain the information needed to accomplish our mission.

19 The ACNW a few weeks ago in their briefing to you, noted the
20 high quality and effectiveness of our environmental and decommissioning
21 research with limited funding that was enhanced by domestic and
22 international cooperation. That is just one example.

23 I would summarize it by saying we process a volume of
24 information that is far beyond that represented by the contract budget and we
25 perform a fair amount of research internally especially with respect to
26 computer codes.

1 Could I have slide 4? Of course, we support NRR and probably
2 is the major single office that we support.

3 And the Commission has received a briefing on many of the
4 topics shown on this slide and the next slide.

5 Research in October, delivered the thermal hydraulic code set
6 needed by NRR for the analysis of the ESBWR.

7 We brought to an orderly close out our work the ACR-700
8 preserving all the work accomplished to date in case there is a chance that
9 that project or a variation on that project would be started up again.

10 We are engaged in a limited pre-application review for the
11 Pebble Bed Modular Reactor and will provide support for the limited
12 pre-application review of the IRIS Reactor.

13 We've also been contacted by representatives from Toshiba
14 with respect to the 4S metal cooled reactor and they have been informed of
15 the process for engaging in pre-application review.

16 We are piloting a knowledge management portal with HR and
17 we are focusing on HTGR, High temperature gas cooler reactor research, all
18 the areas in the area of new reactors.

19 Chemical testing has been a significant budget driver for the
20 last year. Research expects to complete all testing in April of 2006 unless
21 NRR requests additional work.

22 The testing of the Hemyc fire wrap produced important safety
23 results in the last year.

24 Working with EPRI, Research published draft NUREG-1824.
25 This NUREG provides verification and validation information for advanced fire
26 models used to implement the recent revision of 10 CFR Part 50.48 and the

1 National Fire Protection Association 805.

2 And finally, Research does licensing reviews for NRR in areas
3 requiring specialized skills of our staff. We also do licensing reviews for
4 NMSS in certain specialized areas such as seismic or instrumentation and
5 control.

6 Slide 5 please. As the Commission is aware, Research is
7 involved in developing the technical basis for rulemaking, regulatory guides
8 and other guidance documents.

9 A few of these include the 10 CFR 50.46 LOCA break size,
10 revisions in cladding performance requirements in 50.46, the revision of the
11 pressure thermal shock rule, 50.61 and we worked together with NRR to
12 revise regulatory guides.

13 Several of these will support the above rulemakings, while
14 others, notably several of the seismic guides, will support new reactor
15 licensing.

16 Work in the digital I&C area will support both new reactor
17 licensing and upgrades and replacement at existing facilities.

18 In all cases, we need to remember that regulatory guides also
19 support knowledge management, in that they both make a implicit knowledge
20 explicit and have textbook type features in that they distill our knowledge on a
21 particular topic.

22 Before it became obsolete, for quite a few years, I would cart around
23 Regulatory Guide 1.109 with me in my briefcase because it had a great table
24 of data if I ever had to respond to a radiological emergency.

25 So that is a document that we are also in the process of revising
26 based upon a lot of the research we did for the purposes of

1 decommissioning.

2 And of course, two days ago, the Commission was briefed on
3 the materials integrity programs.

4 Slide 6: NMSS is also supported in a number of areas.
5 Although in this slide, the program research support is called
6 decommissioning, I want to make it clear, the research actually deals with the
7 dispersal, the re-concentration, the path through the environment and the
8 detection and dose from radionuclides in the environment.

9 And although the initial work and the user need is to support
10 decommissioning, the work is relevant to models used to evaluate potential
11 doses and environmental impact statements, the routine accidental and
12 malevolent releases of radioactive material and low-level and high level waste
13 disposal.

14 I think it is important and I think Research serves a very
15 important role here in looking at the connectivity of certain work that we do.

16 In other words, there are applications of this work not only in the
17 NMSS arena but the NSIR arena and the NRR arena.

18 We have done dry cask storage, PRAs and we are working on
19 getting data to support fission product burn-up credit for transportation casks.
20 Again, another multi-use product.

21 This data although the intended use right now is for criticality
22 calculations for dry cask transportation and storage, this can be used
23 anywhere criticality calculations are needed for spent fuel.

24 Anywhere spent fuel is being manipulated such as disposal
25 facilities or reprocessing facilities some time in the future.

26 Again, Research provides technical support as I mentioned in

1 doing licensing casework.

2 Slide 7. The Office of Research supports NSIR. Much of this
3 effort is safeguards or classified. And much of the work, the Commission has
4 been briefed on at other times.

5 We provide staff and technical support for the Incident
6 Response Center. We supply comment on technical studies sponsored by
7 NSIR. And we are working with NSIR to back up and date the technical
8 information that is in the Incident Response Center that people who are
9 responding to an incident rely on to predict the outcomes of severe accidents
10 and other events that are ongoing.

11 Slide 8. There are other activities that fall under Research
12 responsibility. Besides the international bilateral work, we are responsible for
13 coordinating generic safety issues, the abnormal occurrence report. We
14 provide the standards executive under the National Technology Transfer Act
15 so we coordinate a lot of the work the agency does on consensus standards.

16 This is an extremely important aspect of what the agency does
17 because in fact, many of our facilities when you deal with construction
18 pressure vessels are built in accordance with consensus engineering codes
19 and these codes are important for the safety of these facilities and they are
20 referenced in our rules.

21 We support OE on safety culture and we have provided
22 guidance for internal and external risk communication.

23 Slide 9. Research chairs and provides administrative support
24 for the CRGR. We maintain the radiation exposure and reporting information
25 system for facilities that are required to report this information.

26 We provide technical support for the regions and we have

1 accompanied regional inspectors on special inspections. And as requested,
2 Research will perform advanced analysis.

3 Slide 10. Currently, in front of the Commission, is a proposal for
4 a state-of-the-art reactor consequence reanalysis and the development of a
5 faster than realtime analysis tools for incident response decision-making.

6 On the latter point, thinking about the faster than realtime
7 analysis tool, I would point out that we already do this for accidental releases
8 because computer codes that we use to project dosage from releases give us
9 information long before they are received or even before the plume reaches
10 some of the exposure points. But when I think about the project, it is a
11 challenging thing because it does rely on having very fast computers which of
12 course, years ago, didn't exist.

13 I want to mention that when I get into the --

14 CHAIRMAN DIAZ: I do have a slide rule.

15 COMMISSIONER MERRIFIELD: Have you bronzed it?

16 CHAIRMAN DIAZ: Not yet.

17 MR. PAPERIELLO: Slide 11.

18 COMMISSIONER JACZKO: I do not have a slide rule.

19 COMMISSIONER MERRIFIELD: I'm a lawyer.

20 COMMISSIONER MCGAFFIGAN: We've admitted our ages.

21 COMMISSIONER JACZKO: I would note, I think it gives a new
22 meaning to the definition of presentation slide.

23 MR. PAPERIELLO: Slide 11. I want to talk about the role of
24 Research in knowledge management. I inherited a knowledge management
25 project that was ongoing when I became director of the Office of Research
26 and I will talk a little bit about it later, but I read a fair number of books on it.

1 And I have my own views.

2 And one of them is that there are two components and being a
3 physicist, it has to be described in terms of space in time. And what do I
4 mean by space?

5 Unless Research transfers what it knows to the regulatory
6 offices or other stakeholders, including the Commission, we are not doing our
7 job. In recent years, we've used technical advisory groups to monitor major
8 research projects. And these technical advisory groups are made up of staff
9 from Research and user's offices.

10 I believe this helps maximize the transfer of relevant information
11 as well as keep the research on an application driven track.

12 For major projects, technical advisory groups are more effective
13 than user need requests from user offices. And I define this, this transfer of
14 what we know, to the clients, the users, as the space component of
15 knowledge management.

16 Books on knowledge management show similar examples but
17 may use different terminologies.

18 In addition, almost everything that we -- all our results are
19 published as NUREG and most are accessible on the NRC's website, public
20 website even or through ADAMS.

21 However, for both the staff and external stakeholders, the
22 material has to be read and I have concerns with whether or not the staff
23 reads what we put out.

24 Computer codes. Computer codes are another aspect of
25 knowledge management. Why?

26 They capture and embody a great deal of we know about given

1 phenomena.

2 For example, the MELCOR code incorporates over 20 years of
3 severe accident research into the various models used in the code.

4 Documentation of the code, the experiments, that support and
5 validate the code result and training and distribution of the code are all parts
6 of knowledge management.

7 I refer to this capture of information acquired in the past as the
8 time dimension of knowledge management. A number of our codes are the
9 result of collaborative research and development.

10 The sharing of these codes is also part of knowledge
11 management. And I should point out last year, I had some more detailed
12 numbers.

13 I didn't go back and recheck what they were but they were
14 widely used in educational institutions because our codes are not proprietary.

15 So they are being used in training, nuclear engineers -- actually,
16 the codes are used by people who are not even nuclear engineers, fire codes
17 that we are part of, part of our collaboration are used by fire professionals
18 both inside and outside of the nuclear field.

19 The synthesis of up to date technical work in the regulatory
20 guides and other licensing guidance, I also consider parts of knowledge
21 management.

22 In knowledge management terminology, this is making implicit
23 knowledge explicit.

24 Slide 12.

25 During my tenure with Research, I have placed a lot of
26 emphasis on agency integration.

1 And I'm going to say more about this when I discuss the
2 challenges.

3 However, I initiated monthly research seminars, the last one
4 being on the MELCOR code.

5 We have established steering committees and technical
6 advisory groups for much of our research program.

7 And this is all done in collaboration with the offices we support.
8 We have revised our web pages. We have added foreign research results to
9 the internal web pages. We have added plain English forewords to our
10 NUREGS and as requested by the Commission, as a result of our last
11 briefing, detailed information on foreign agreements is on our internal web
12 sites.

13 To transfer information to external stakeholders, we held public
14 workshops, we support standards development and through our cooperative
15 agreements, share documents with domestic and foreign partners.

16 As I said before, most of our information is in reports that are
17 public documents and are accessible at the NRC public website.

18 Slide 13. This slide shows some of the tasks for which our
19 computer codes are used. Many times Research not only provide the codes
20 to the licensing offices, but also does the analysis.

21 Some codes take a considerable amount of time to use
22 effectively. As mentioned previously, much of what we have learned has
23 been incorporated in these codes. And the codes keep evolving as a result
24 of new empirical data and the growing power of hardware and software.

25 And one example, is the development of graphical user
26 interfaces.

1 I think very few here would be using computers in their work if it
2 wasn't for graphical user interfaces such as windows.

3 I think the use of graphical users interfaces would allow us to
4 expand the user base for these codes. There is a lot of other factors and
5 they are actually a major component of quality assurance.

6 Trying to use a code that requires you to describe a geometric
7 object in terms of analytical geometry verses being able to point to the object
8 and enter in the dimensions is a lot more difficult and a lot more prone to
9 errors.

10 A number of years ago, I took a course on NCMP and at that
11 point, there was no graphical user interface, just putting in the description of a
12 simple object was a nightmare.

13 Needless to say, I didn't teach myself at that time NCMP, but
14 I'm trying again now because it has a GUI.

15 But anyway, I consider this a knowledge management tool, a
16 QA tool. In our own thermal hydraulic codes when they described how long it
17 took to put the information in and to queue the information, we are talking
18 about a substantial part of a year because you're talking about close to 3,000
19 different components in a reactor thermal hydraulic system in the loop.

20 Slide 14. What you are looking at here is just a snapshot of an
21 output of a calculation from one of our most sophisticated code applications
22 which is computation fluid dynamics.

23 And this provides a detailed 3-dimensional flow predictions that
24 are beyond the capability of conventional thermal hydraulic tools used for
25 reactor safety analysis.

26 Currently, 3 Research staff members can run the FLUENT

1 code. And we are seeking to add staff with this capability.

2 It is a parallel processor code that runs on a system with 64
3 CPUs. It has been used in several applications; steam generator tube
4 integrity, dry cask analysis, spent fuel analysis, power uprates, and steam
5 drier issues, boron dilution and certain dry cask PRA events.

6 For reactors such as gas cooled, or liquid metal with single
7 phase fluids, thermal hydraulic analysis are or will be likely conducted with
8 CFD codes.

9 And there are domestic and international efforts to apply
10 computational fluid dynamics to two-phase flow.

11 About 40 years ago, an engineer at -- I want to say INTEL but I
12 won't -- Moore's Law formulated a theory and it was almost a throw off that
13 integrated circuit capability will double every 18 months, keeping it at the
14 same cost.

15 A few months ago, he was interviewed. He was shocked that
16 his "law "still applied after 40 years. But if this holds true, our 64 CP unit will
17 be on a desk top in five years and our 64 CPU unit will have 1024.

18 If you look at super computers these days, we will be running
19 super computers.

20 Technology is changing and I think that's a challenge to us.

21 Next slide: Let's talk about the performance of the office.

22 In order to improve performance, and a number of actions have
23 been taken.

24 As you are aware, we are in the middle of a process to
25 reorganize that the Commission has approved.

26 I expect this will improve communication by consolidating

1 several activities which have been at different branches in different divisions.

2 New reactor activities are being consolidated in one branch
3 along with closely related support research activities.

4 We are reducing the number of SES managers and have in the
5 previous year increased the number of first line supervisors.

6 We have created a special projects branch to respond more
7 effectively to new work assignments that do not fit smoothly into any existing
8 branch's area of responsibility. It will be a highly matrix organization.

9 In addition to the communications steps previously mentioned,
10 we have a suggestion web portal that has received over 40 suggestions in
11 2005.

12 We have quarterly all hands meetings, and instituted more
13 frequent meetings to implement the reorganization.

14 We have scheduled biannual meetings with the ACRS. I meet
15 frequently with the other principle office directors and our deputies now meet
16 as well. We have revised our office procedures. And this may not mean a lot
17 to you, but having run regions, NMSS, I was somewhat appalled when I took
18 over Research and started looking for things like how do we do this, and
19 finding I had procedures that were written 15 years ago and we just couldn't
20 use them.

21 So, we have developed also, beside -- we are just about
22 completely up-to-date in all our office procedures. We have developed new
23 procedures. We have procedures for compliance with data quality and
24 scientific misconduct.

25 And we now have what I can see, the first training procedure
26 that the Office of Research ever had and it covers the entire Research staff

1 including each and every new hire, not just those that are in the professional
2 development program.

3 We have established a training council and we preparing our
4 first ever annual training plan.

5 We had a management retreat to focus on critical skills and
6 hiring needs.

7 We reviewed every position in Research to identify what activity
8 the person actually performed and the skill depth that was needed to do the
9 job.

10 We looked at bench strength in each other and where we had
11 weaknesses, we made decisions on hiring or retraining existing staff.

12 I plan to repeat the process in about a month to check our
13 progress and update the staffing plan.

14 As part of the reorganization, Research will be establishing a
15 central document desk. NMSS and NRR have them because 10 CFR says
16 when you submit a license application, it goes to the director of NRR and
17 NMSS.

18 Research never had that requirement in 10 CFR and we have
19 documents coming in to different people.

20 And I'm not always aware of what comes in. If I want to
21 maintain the quality of reports that we get from our contractors, I minimally
22 need to know when preliminary and draft reports come in.

23 This will ensure that that happens because as soon as they
24 come in, everybody in the office will be aware of what has arrived.

25 And, of course, we are copying what the other two offices have
26 so I'm not reinventing a wheel or anything. And we also have changed the

1 boiler plate in our contract language to direct all of the reports to the central
2 document desk.

3 Slide 16. We have implemented other steps to improve
4 management and oversight in planning. As I previously mentioned, we are a
5 support office. And I have insisted that managers focus on the application of
6 research regulatory product. What does this mean?

7 It means what is this thing going to be used for? It is not a
8 question of -- and I'm challenged at times for letting other offices tell you what
9 to do. No, it's not that.

10 It's not enough to say, I want to know something about. We're a
11 regulatory agency.

12 If I run a licensing office, there are certain criteria the applicant
13 has to meet. I need information from Research in a form that a licensed
14 reviewer can use or if I want to write a rule, I need to know what the rule is
15 going to look like ahead of times.

16 How do I know I have done all the critical research needed?
17 What's it going to be used for?

18 We are a full partner in the PBPM process with the offices we
19 support and our budget is actually part of theirs.

20 We have upgraded the Research operating plan and
21 management information systems consistent with those used by the offices
22 we support and the EDO's Office.

23 We have developed a first of its kind quality metric. And this
24 metric integrates the results of the ACRS annual review of Research projects,
25 the results of peer review programs initiated in the office, and a feedback
26 survey from our customers. And we will report performance against this

1 metric this year.

2 Next slide.

3 We have improved contract management. And we have 3 new
4 Office instructions that address this area, reviews made by all levels of
5 management to ensure better review by Research, but also, include frequent
6 meetings with managers and staff from supported offices.

7 Regulatory need is explicitly captured in a statement of work,
8 the budget and the Operating Plan.

9 As I mentioned earlier, we have added plain English forewords
10 to all NUREG reports. Timeliness has been improved as demonstrated by
11 the Research operating plan timeliness measures over the past 15 months.

12 In this, more intermediate milestones have been added to direct
13 timeliness and quality checks.

14 We feel established standard boiler plate for future contracts,
15 and we believe this is going to ensure all reports get good scrutiny.

16 Slide 18.

17 I think as are you aware, contractor availability is being affected
18 by conflict of interest issues and by limited expertise in the technical
19 community. And this decreases the pool of available contractors.

20 And we are working at addressing both of these issues. We are
21 continuing to move to greater in-house research capabilities. And the
22 examples are most obvious in the computer calculation area and modeling,
23 including verification and validation and advance reactor analysis and review
24 in support of NRR.

25 The ability to use, develop, modify and program complex
26 computer models is a consideration in hiring new staff. This enhances our

1 review of contractor quality by having experts who can challenge the results
2 of contractors by engaging in high level technical exchanges.

3 Slide 19.

4 Challenges in response: This slide shows what I believe to be
5 NRC as well as Research challenges and possible responses.

6 Realism will be driven by outside forces, not only by our own
7 desire to have risk-informed regulation. And many of these forces will be
8 economic.

9 The use of bounding and very conservative assumptions involve
10 tradeoffs between cost resulting from margin that you use by using these
11 assumptions, and the cost and technical complexity of analytical methods
12 that go beyond the bounding assumptions.

13 Let me give you an example, Let's talk about burnup credit for
14 spent fuel.

15 Storage of spent fuel must be designed to be subcritical under
16 all conditions. This is routinely based on fairly sophisticated computer
17 modeling validated against certain benchmarks.

18 The bounding assumption traditionally has been that the
19 isotopic composition is that of fresh fuel. Criticality controls limit the amount
20 of fuel in a given volume.

21 Actually, there are other issues on shielding and heat. Let's talk
22 about criticality.

23 Cost could be reduced if more fuel could be placed in the same
24 volume.

25 And this might be achieved if we can accurately factor in the
26 fact that the fuel has less reactivity because a great deal of the fissile

1 material, U-235, is depleted and some of the fission products poison the
2 chain reactions by capturing neutrons. Particularly some fission products
3 have extremely high neutron cross sections.

4 However, this is complicated by the fact that some plutonium,
5 239 is produced along with other transuranic elements that are either fissile
6 or poison the reaction.

7 And then, further complications are caused by the decay of both
8 the transuranic and the fission product elements with time and thereby
9 changing the reactivity to fuel with time.

10 Furthermore, there are uncertainties in both the cross sections
11 of these various elements and the yields of transuranic and fission products.

12 And I can give you similar examples in all the various areas we
13 work in, thermal hydraulics, severe accidents, structural design, materials
14 properties when you talk about realism. So the bounding assumption is much
15 easier to calculate but results in throwing in a lot of margin which involves
16 cost.

17 Cost drives the use of realism, but the realism drives a lot of
18 calculational and knowledge that is needed that you don't need if are you just
19 doing bounding. And our job, the challenge to this agency and the challenge
20 to Research is to get the information to assure you that if we agree to this, we
21 are safe.

22 That the first major challenge. I raised in January, the
23 expanded information sources.

24 And the more I look at this, the more I see a need to sort the
25 information.

26 There is just an enormous volume of material out there.

1 And work is needed to identify critical sources and a
2 mechanism to intelligently sort the information economically.

3 Actually, the management literature refers to technical
4 gatekeepers in research and development organizations for a role like this.

5 I think there is a need to capture in ADAMS, important
6 information developed in previous years.

7 One of the things I can't find in ADAMS is WASH-1400.

8 And if are you going to teach people PRA, and you want a
9 history, NUREG-1150 is in ADAMS but WASH-1400 isn't.

10 A small matter but, we need to think about all the information
11 that this agency has acquired over the years that ought to be available
12 electronically.

13 Now, while I really like the information potential of electronic IT
14 systems, we can't overlook the value of existing paper libraries and journal
15 collection.

16 While electronic libraries may some day place the more
17 traditional library, that day has not arrived. There is a tremendous amount of
18 information in the agency library.

19 New technology: New technology will both drive the way we
20 work, computer for example, and the issues we must respond to.

21 And if I look back on my 30 years with the NRC, the technology
22 that has changed the most in this period is the medical use of radiation and
23 radioactive material. And this is in part why we had to change Part 35.

24 Between 1975 and 1995, the radioisotopes in use changed, the
25 way they were used changed, and the infrastructure that used them changed.

26 And I believe that if expected growth occurs in the power

1 reactor sector, we may see similar changes and this will likely feed back into
2 the realism challenge that we face and I will refer to the slide rule.

3 I don't know how many people have used one of these, but
4 when I started as an inspector, a reactor inspector in 1975 and 1976, the
5 plants that I inspected were designed in part with this type of computing
6 engine.

7 Most of those plants are still operating today. We need to
8 realize that we are actually regulating devices that were built many, many
9 years ago. We are looking right now at certifying, licensing and perhaps even
10 inspecting plants that are going to be built using completely different design
11 principles.

12 I don't know how many materials will be identical to what's been
13 used in the past. So I expect we will have a lot of challenges ahead of us.
14 And that's why I say, new technology will bring us a lot of challenges and we
15 have to have the people who can respond to them. Another challenge is
16 agency integration. It is essential for Research.

17 Although we are support office, we have to be supported by the
18 rest of the agency.

19 As NMSS Director, I believe that I had a responsibility to ensure
20 that the proper research was being performed to meet my present and future
21 office needs and I still believe this. This may be even more essential under
22 the PBPM common prioritization.

23 We done a lot in the past two years to reach out to the rest of
24 the agency but Research can't function properly without feedback.

25 Its products are not very useful if they are not read or used.
26 And if we are producing things that are not usable or very useful, we need to

1 know that.

2 I think a lot of progress is being made in this area but it is not
3 complete. I think the movement of staff between Research and other offices
4 helps the process.

5 Human capital: And I subordinate knowledge management to
6 human capital. Human capital is prior. And is our most critical challenge not
7 only in the NRC but Research. Our business is processing knowledge.

8 People and their knowledge skills and abilities is just about our
9 only resource. The demands for greater realism, the incorporation of new
10 technology and the expansion of information sources require not only the
11 replacement of the knowledge skills and abilities as staff retires but growth in
12 these areas.

13 Research has focused on critical skill hiring and we have piloted
14 a knowledge management portal, but much more needs to be done. I think
15 we need to build relationships with university graduate science, engineering
16 and applied mathematic programs both to perform the work for us and attract
17 students with advance research degrees to the NRC.

18 I think this can help us tap into expanded information sources
19 and keep abreast of some new technologies. That's why I gave this list with
20 human capital at the bottom. I think it is the challenge that integrates
21 everything together.

22 The tools that we had or the tools that I had when I got out of
23 school in 1970 are inadequate for today. You need better tools, because
24 again, I was raised in a slide rule environment.

25 Computers have come along. When I think back at courses
26 that I didn't have that I would expect somebody to have, I think of numerical

1 analysis. I have an eclectic knowledge of numerical analysis, never
2 systematic, things like that.

3 Slide 20. I hope I have shown the Commission and our
4 stakeholders today that we are focusing our limited resources on the NRC's
5 mission. We are working to enhance agency integration. We are
6 implementing plans to strengthen human capital and knowledge
7 management. And we continue to make significant progress in improving
8 management.

9 My staff and I would be pleased to answer Commission
10 questions.

11 MR. REYES: Chairman, Commissioners, that concludes our
12 prepared remarks. We finish in the green and would like to be open for
13 questions now.

14 CHAIRMAN DIAZ: Thank you Mr. Reyes and Carl. If I can
15 make one comment, it is that in your presentation, it is obvious the
16 enthusiasm and the dedication you brought to this job. I think I will remember
17 and probably cherish the times that I called you to my office and said would
18 you consider going to Research.

19 He said would I consider it? And we appreciate it.
20 Commissioner McGaffigan?

21 COMMISSIONER MCGAFFIGAN: Thank you Mr. Chairman. I'll
22 start by noting my usual annual comment about Cheryl Trottier not being at
23 the table is no longer applicable because I think she retired since last year
24 and we miss her.

25 But at some point, we did have Jennifer Uhle at the table last
26 week and I know there are some rising female members of the Research
27 staff but hopefully some day, they will get to the table. But that's just the

1 annual tweak.

2 MR. PAPERIELLO: I would note that a substantial portion of
3 my SES core is female.

4 COMMISSIONER McGAFFIGAN: Good.

5 You sent a letter recently to the head of Argonne National
6 Laboratory about their hot cell facility that supports our work in a variety of
7 areas particular fuel cladding.

8 Can you update us as to where that stands.

9 MR. PAPERIELLO: Yes, I can. I spoke to him late yesterday.
10 They are concerned about supporting us.

11 What I would hope to get to the Commission because I need it
12 in my own mind, everybody's mind within the next two weeks is where we are
13 going.

14 The problem with the Argonne hot cells is they don't meet
15 today's DOE safety criteria. And probably to refurbish them would take a lot
16 of money. He told me that DOE made a decision that they would put their
17 money in maintaining the hot cells at Idaho, not at Argonne.

18 As you may be aware, because of agreements between DOE
19 and the Governor of Idaho, it is just about impossible to get spent fuel into the
20 state of Idaho. A lot of what we want to accomplish can be accomplished
21 without the hot cells. Some work involves cladding, just unirradiated cladding
22 and some involve irradiated cladding.

23 We need hot cells to remove fuel from cladding. We think that
24 could be done elsewhere. The problem right now is integral testing. And
25 what I have to do with my staff is to take a look at what our options are. Can
26 we get it done somewhere else?

27 Can we appeal to DOE and make a one time exemption to

1 allow us to use the hot cell for one project? These are a number of options.

2 COMMISSIONER McGAFFIGAN: The latter option is, all the
3 other options, I'm starting to hold my wallet. So I know we are a safety
4 agency and it may sound a little strange for a safety agency to ask DOE to
5 waive its current safety standard for a period of time for us to complete our
6 work. But that is exactly what exemptions are for. And we do them
7 occasionally appropriately after thinking about it. And there are ways you can
8 put additional procedures in place to get the equivalent standard.

9 But I urge you to keep us informed.

10 MR. PAPERIELLO: Certainly.

11 COMMISSIONER McGAFFIGAN: If there is something that we
12 can help you with, the higher levels in DOE possibly. They are asking for a
13 lot from us these days.

14 I heard something over lunch, I'll just say it very briefly. We
15 were talking about reprocessing and recycling this morning. And we had
16 recently heard, since I had written a paper on the subject, I recently heard
17 there was an NMSS paper. Now, I hear there is a Research paper and you
18 are going to integrate those very promptly, right? Is that the answer?

19 MR. REYES: Yes, sir.

20 COMMISSIONER MCGAFFIGAN: And you will get their stuff to
21 us so we can consider all this stuff fairly quickly?

22 Mr. REYES: Yes, sir.

23 COMMISSIONER McGAFFIGAN: In this case, I commend the
24 EDO's office -- the general EDO office is the one place that realized the stove
25 pipes were doing their usual thing. You also mentioned the importance of
26 integration. We're being integrated here.

27 MR. PAPERIELLO: It is worse today. I didn't know about it

1 until I was interviewing people and it was sort of popped -- but the people
2 who did it, did a very good job.

3 MR. REYES: Before the recent announcement, there were
4 reasons why we were doing things we were doing. Scenarios have changed.
5 It will be all one product and it will be coming to you very soon.

6 COMMISSIONER McGAFFIGAN: I do have my paper before
7 the Commission at the current time. Maybe I should just join the staff for a
8 day and see if I can integrate mine with theirs. There's hesitancy. Hesitancy
9 noted.

10 CHAIRMAN DIAZ: The staff was in anticipation mode. Now
11 they are in integration mode.

12 COMMISSIONER McGAFFIGAN: I just urge you to get that to
13 us soon because I envision this playing in the mid-year money circuit and I
14 think people disadvantage themselves in getting mid-year funds if the paper
15 isn't before us.

16 I brought this place to a grinding halt a couple of days ago
17 when I asked about the implications of this paper here, "Seismic
18 Considerations for Transition Break Size."

19 And what that said about our ISI programs and all that. And we
20 have a letter in today from Congresswoman Kelly that -- do I have the name
21 right -- who among other things says that her concerns which she has
22 elaborated above are exacerbated by recent revelations that NRC has
23 discontinued reviewing the in-service inspection summary reports that plant
24 owners are required to provide to the Commission -- I hope that isn't
25 accurate -- but given the importance of ISI, given the importance of -- if the
26 Chairman ever wanted 50.46 to work, and have a transition break size less
27 than 42 inches -- we presumably have to have a decent ISI program.

1 My understanding is you guys had a meeting yesterday
2 afternoon where first order answers to my questions were developed.

3 Does anybody want to either at the table or not at it give me a
4 short answer?

5 MR. PAPERIELLO: I'm going to start, I'm going to turn it over
6 to a specialist, but --

7 COMMISSIONER McGAFFIGAN: I used my 7 minutes precisely
8 here.

9 MR. PAPERIELLO: It is an example of realism, some from my
10 physicist's perspective, some pieces of pipe under current technology don't
11 ISI very well. Having said that...

12 MR. CUNNINGHAM: Having said that, there are a couple of
13 ways you can go. One is, the ethnology of in-service inspection has been
14 evolving over the last ten or 15 years considerably and it will continue to
15 evolve. So this is an opportunity where the technology could, if you will,
16 come to the rescue and permit us to get past this particular hurdle.

17 Another way to deal with it is to treat the areas that are of
18 concern, the piping that might be of concern as under special, if you will,
19 category of leak before break, that we can manage the piping in a certain way
20 under that technology.

21 That requires that certain -- that in effect, the pressurized -- the
22 primary water stress corrosion cracking, and I will come to Jennifer in a
23 second, primary water stress corrosion cracking is managed.

24 And again, that's something that is evolving as we speak as
25 well. So with that.

26 CHAIRMAN DIAZ: Short comment Jennifer?

27 MS. UHLE: I'll be short and that is just to follow up. There are

1 data out there that we have access to, industry data, that indicates that there
2 are techniques in cases very, very effective. There are some particular
3 specific materials under specific locations that the NDE techniques are not as
4 effective.

5 This isn't new news to the industry or the staff. And that is
6 because ISI programs are looked as an added defense in depth and they are
7 not the only things relied on to ensure plant safety.

8 With respect to the 50.46 issue, we recognize the impact on the
9 rulemaking because the cracks that we are trying to indicate are impossible
10 to be there, are those that would perhaps fail under beyond design basis,
11 seismic loading and that is the big key, that it was a much higher seismic
12 loading.

13 So what we are doing is we are working with the industry
14 collaboratively to develop or we should say, determine the effectiveness of
15 techniques that are being developed by the industry to manage these
16 particular locations where we can't effectively inspect. And part of that is of
17 course, mitigating the PWSCC, the primary water stress corrosion cracking.

18 CHAIRMAN DIAZ: This might be an area where we might want
19 staff to provide us with a summary of where we are.

20 COMMISSIONER MCGAFFIGAN: The document as I
21 understand it is out for public comment at this time, simultaneous with the
22 rulemaking. When does that comment period end? Presumably only
23 technical experts are likely to comment on it.

24 MS. UHLE: The comment period had been extended -- based
25 on --

26 COMMISSIONER MCGAFFIGAN: Both comment periods, both
27 on the rule and on this document.

1 MS. UHLE: Yes, and I believe it's another 3 weeks or so before
2 the comment period is over.

3 Once we get the comments, then we will take a look to see what
4 path forward is appropriate.

5 COMMISSIONER MCGAFFIGAN: The part of my question that
6 Luis was looking like he wanted to answer; is Congresswoman Kelly right that
7 NRR no longer reviews the summary documents submitted –

8 MR. REYES: I need to get NRR to answer that. You have to be
9 careful with what you ask because if are you talking about on-site inspection
10 of the welds that were of interest which is bimetal, et cetera, we do that in the
11 field.

12 So, I think you have to be careful.

13 COMMISSIONER MCGAFFIGAN: She is analogizing this to the
14 steam generator issue.

15 MR. REYES: My point is we do field work doing the outages
16 and we monitor all that's going on, but the report itself that gets submitted, I
17 don't –

18 MR. SULLIVAN: My name is Ted Sullivan. Just to follow-up on
19 those comments. Those reports are not reviewed in NRR but they are
20 reviewed in the regions as part of their preparation for inspections that the
21 regions do under our core inspection procedure.

22 MR. REYES: We specifically, if you look at the inspection
23 procedure, specifically, it ranks where you go to look first. I mean, it is a
24 smart way to go and inspect. So I think the implication and that statement is
25 not quite right.

26 CHAIRMAN DIAZ: Thank you. Commissioner Merrifield?

27 COMMISSIONER MERRIFIELD: Carl, in your backup slides on

1 the dry cask storage area, you mentioned and I think that you alluded to this
2 in your oral presentation, that are you developing a methodology for
3 performing a PRA on dry cask storage systems at plant sites. And I'm
4 wondering if you can provide a little bit more fulsome explanation how we
5 intend to use this and what kind of benefit do we see from this?

6 MR. ADER: We are nearing the end of completing it. It's a
7 demonstration dry cast PRA unless it is for a BWR site. But it was trying to
8 go through one of the techniques looking at the cask, looking at challenges,
9 whether there would be potential flooding, vent blockage, local fire involved,
10 materials involved, PRA, involved thermal hydraulics looking at the heat load
11 rises.

12 We have handed out to NMSS for comment. We're working
13 with them now no try to finalize the comments. We will be going to ACNW
14 later this year and hope to have it final by the end of this year. This is kind of
15 a demonstration methodology that NMSS would then use potentially to inform
16 their decisions if they have risk-informed applications or also deciding where
17 they want to apply resources.

18 Commissioners MERRIFIELD: As a general matter, I'm quite
19 supportive of efforts to risk-inform our regulations and use PRAs where
20 appropriate. When I saw this, I was a bit struck of wondering a bit whether
21 this is something we really need, or whether the tools we currently have
22 would be appropriate for what we need for --

23 MR. PAPERIELLO: This project was practically done. We are
24 not making much of any investment in it, to risk-inform, my understanding
25 from NMSS, the technical specifications for dry cask.

26 MR. REYES: It will give us some insight. We are very
27 conservative when we give a certificate to a cask. If you see what the staff

1 goes through, if you see the robust structure.

2 COMMISSIONER MERRIFIELD: Oh, no, no, I have no doubt
3 about that.

4 MR. REYES: This will give us some insight.

5 COMMISSIONER MERRIFIELD: That's fine, I don't have a
6 problem with that. What concerns me is going down the road requiring plant
7 specific PRAs for every ISFSI, that I just -- I didn't know where you all were
8 going.

9 MR. REYES: It was for our insight.

10 COMMISSIONER MERRIFIELD: On slide four, you noted that
11 we've got some limited pre-application reviews for the Pebble Bed Modular
12 Reactor, the Westinghouse IRIS reactor and also the Toshiba 4S. How
13 extensive is that?

14 I know there has been some tension about with all the
15 multiplicity of reactor orders we may receive, how much money ought we to
16 be spending on these efforts?

17 MR. PAPERIELLO: Not much. Farouk.

18 MR. ELTAWILA: For PBMR, for example, we have less than
19 \$200,000 to spend on pre-application review. That's not sufficient to meet all
20 the requirements for pre-application review that is requested by PBMR
21 Limited. On IRIS, we are just using internal resources to meet with the
22 applicant when they come here, but we don't have resources, same thing with
23 4S, it's just interaction by email.

24 COMMISSIONER MERRIFIELD: I have a couple hundred
25 thousand dollars to keep your skills up, I'm not going to quibble with that.

26 MR. PAPERIELLO: If resources grow, the Commission will be
27 informed.

1 COMMISSIONER MERRIFIELD: This is my personal view.

2 MR. REYES: The short answer is it is limited by the budget we
3 put together. This was discussed extensively. Now, the applicants are
4 interested in engaging on a higher level and we'll have to come to the
5 Commission as part of the budget and explain the increases.

6 COMMISSIONER MERRIFIELD: Which gets to my personal
7 view, if you got somebody who wants to buy one, arm in arm with a vendor,
8 fine. But if it is just a science project.

9 MR. REYES: You will see that in our proposal for FY 08.

10 COMMISSIONER MERRIFIELD: On the issue of human
11 reliability, this went to slide 5. ACRS has focused on human reliability as an
12 area they think we need to put a little bit more time and money into.

13 I'm wondering if you can talk a little bit to sort of your views on
14 that issue and whether our current human reliability models are lacking or do
15 we need to put more attention to this issue in a risk-informed regulatory
16 framework?

17 MR. ADER: Human reliability is an area that is probably not as
18 robust as some of the other level one PRA. It is an area we are working to try
19 to advance the -- I won't say state of the knowledge -- but the application of
20 HRA.

21 We have completed a good practices guide for HRA. One of
22 problems with the different techniques is how -- when in the process and how
23 HRA, the different methods might get applied. Like experience has shown,
24 the HRA analyst needs to be involved really from the beginning. The good
25 practices guide helps put out that concept, some of the things they need to
26 look at.

27 We are going to ACRS's full committee tomorrow morning. We

1 have a companion document that's an evaluation of the various methods out
2 there, pros and cons, our methods, industry's methods. That will go out for
3 comment later this Spring.

4 We will get comments and we will finalize that and that will help
5 guide us a little bit more where we think we need to put additional emphasis
6 in this area.

7 COMMISSIONER MERRIFIELD: That will be useful and
8 certainly as we start thinking about -- I know it's early on, but the next budget
9 cycle, that is something the Commission needs to consider going forward.
10 Thank you.

11 CHAIRMAN DIAZ: Commissioner Jaczko?

12 COMMISSIONER JACZKO: I want to ask a question on where
13 do we stand with some of the ECCS research, the chemical effects testing.
14 When we had the ACRS meeting, recently, I asked the question of them if
15 they had a chance to take a look at some of the research and they said it was
16 not in a format for them to do that.

17 I'm wondering maybe if you can briefly update where we are at
18 with that testing and then what your plans are to share some of that with
19 ACRS or have documents in a form they can take a look at?

20 MR. PAPERIELLO: The quality document?

21 COMMISSIONER JACZKO: The chemical effects testing.

22 MR. PAPERIELLO: Sump.

23 MR. CUNNINGHAM: I think Carl mentioned this in his
24 presentation. The testing that we are doing to support the resolution of all of
25 the issues related to sumps is due to be completed by April.

26 There is a public meeting tomorrow to talk about some aspects
27 of that.

1 We have next week, two and a half days of subcommittee
2 meeting with ACRS, a full day with NRR on the work they are doing in terms
3 of the implementation of the changes and a day and half on the research that
4 supports or provides the technical basis.

5 COMMISSIONER JACZKO: The research will be completed --
6 is there additional work that you think will come out of this that needs to be
7 done that is not yet?

8 MR. CUNNINGHAM: We don't know of any at this point. We
9 work very closely with NRR and they understand what they are getting from
10 us now. We fully understand that the meetings tomorrow and meetings with
11 ACRS may lead to new things. But at this point, we are not aware of
12 anything that's not budgeted and due to be done here in the next few months.

13 MR. PAPERIELLO: I chose my words carefully, that unless we
14 are requested to do additional work. You may be aware that Palisades has
15 proposed to remove trisodium phosphate from their sprays to avoid the
16 problem. They are going to be relying on potassium iodine and I believe
17 respirators to protect the control room crew. It is not beyond the realm of
18 possibility that we may be doing work. And of course we would have to
19 re-program, the Commission would be informed. If it is to do more realistic, I
20 believe that if you look hard at the source term, that may not be needed. And
21 this may be a driver.

22 As I said, I chose my words very carefully. I don't think really
23 think, personally, that April will truly be the end of the story. I think there will
24 be ways of addressing the issue that we have to do work on that.

25 COMMISSIONER JACZKO: I want to switch topics slightly to
26 another area, I think the Office of Research has done a lot of very important
27 work and certainly there has been a lot of success with the fire testing with

1 Hemyc. But an area I want to focus a little more on is the state of the art for
2 the fire modeling. In the short year I have been here, we've gone from a few
3 sites interested in piloting the new risk-informed performance based fire
4 protection standards to now, the latest number is something on the order of
5 30 some sites.

6 So I'm wondering if you can comment on where we stand with
7 fire modeling, if the research is there right now to support an increase for that
8 large expected increase in people interested in moving to --

9 MR. PAPERIELLO: Charlie, you want to take that.

10 MR. ADER: The models are there, the research is there. There
11 are areas of fire modeling that the models will perform well. There are other
12 areas where there's uncertainty.

13 COMMISSIONER JACZKO: What are some of those areas?

14 MR. ADER: When you get into multiple compartments, when
15 you get into some of the temperatures, plume areas. We put out a recent
16 NUREG, draft NUREG, validation of verification, out for public comment, just
17 went out.

18 It is 7 volume document that looked at the two national institute
19 standards codes, the CFAS and FDS, looked at two of the industry and one
20 of the industry codes MAGIC and two more of a spread sheet type of fire
21 modeling. One of them developed in-house and the other, the 5
22 methodology. It identified some of the areas where the codes worked well.

23 And plume height, if I remember, we have somebody that can
24 speak more specifically. I think Mark Salley is back there.

25 But in general, the feeling is the codes – knowledgeable users
26 using the codes, knowing the limitations, can clearly use them for their 805
27 implementation. I don't know. Mark is our team leader for the fire.

1 MR. SALLEY: Did that answer your question?

2 COMMISSIONER JACZKO: Yes, but if there is anything you
3 want to add specific.

4 MR. SALLEY: With the fire model codes, the NRC is taking a
5 leadership role in the industry. A lot of industry talks about risk-informed
6 performance based. The AE firms want to get into that, different industries
7 want to do that.

8 We are actually taking a lot of the steps. What Charlie was
9 talking about NUREG-1824 is a joint project with EPRI and the NRC, the
10 Office of Research, working with our partners at NIST who developed
11 models. And again, when we started the project, who did this in the industry?
12 Did petro chemical people do this, the hospital people or the AE firms?
13 There really was no one. So we have taken a leadership role as far as doing
14 a good solid V&V with these.

15 COMMISSIONER JACZKO: You said that a knowledgeable
16 user with the skills. Are those knowledgeable users out there yet from the
17 licensee side? Are they going to have the expertise to be able to use these
18 models in the way they need to?

19 MR. ADER: I believe so. Mark has more experience in the area
20 and while he is there, I will refer to the expert.

21 MR. SALLEY: Yes, industry saw this a few years ago through
22 EPRI who does a lot of their educational work.

23 They put a program in place where once or twice a year, they
24 hold workshops out in the field. We send our regional inspectors, for
25 example, and the licensees will attend. We go through fire modeling
26 seminars. They will bring in professors from Maryland. The staff, we've
27 always supported them. We've been through this training. This year, it's

1 going to be in California, I believe San Onofre is the plant. This is an
2 ongoing program.

3 COMMISSIONER MERRIFIELD: And this is one that I been
4 following for a while. There is an issue out there. In the number of utilities
5 that want to get into pursuing a FP-805, a lot of those folks will rely on
6 contractors to assist them who have expertise in that area and there will be a
7 limited number of contractors who can deal with that.

8 So, I think what you are really are going to see even though
9 there are 37 people that want to sign up at this point, it's going to sort of pace
10 itself out over a series of years because only so many people will be able to
11 get through the pipe at any one time.

12 CHAIRMAN DIAZ: All right, thank you. Commissioner Lyons.

13 COMMISSIONER LYONS: Let me start with a comment that
14 will give a slightly different view than perhaps Commissioner Merrifield and
15 his question on Slide 4, where advanced reactors where you were interested
16 in being sure that the amount spent on things like Pebble Bed or HTGR was
17 not too high.

18 I probably would come at it from a different perspective of
19 making sure it is not too low.

20 At the same time, I'm not suggesting that it needs to be
21 astronomical. But at least in my mind on something like the Pebble Bed or
22 an HTGR, where I think even though there may be a question whether it is
23 applied in this country, I think you can be quite sure it's going to be applied in
24 other countries. And I think we need to at least be ready to participate in an
25 international forum relative to the safety of what's going on in other countries.
26 So, I would take a slightly different view and we have differed before on this.

27 By way of a question, in the area of digital I&C, that is an area

1 that continues to worry me as to whether we are going to be ready with the
2 standards, the technical basis that are going to be required as we get into
3 advanced reactors.

4 Do you think we have strong enough research program in that
5 area?

6 MR. PAPERIELLO: Right now, we are dealing with a moving
7 target. We have existing standards and they are endorsed by the agency. If
8 they use those standards, we're in good shape.

9 However, what I'm being told right now is that the I&C control
10 and safety system design details are being deferred to the design acceptance
11 criteria approach due to the unavailability of certain portions of designs at the
12 time of the safety review.

13 I'm reading, I don't know exactly. This is an area that I have put
14 a lot work on.

15 We have a digital I&C Research Program that was prepared, it
16 is focused on regulatory product.

17 It has been endorsed by the ACRS and the program offices that
18 we support.

19 I'm not knowledgeable on digital I&C – again I've got a lot of
20 eclectic knowledge. I would summarize it as this:

21 I don't think we are behind the power curve but it's something
22 we've got to keep working on. And we have tried to get a digital I&C, SLS in
23 and have not been able to do it because we can't pay the market wages. We
24 have a good staff and it's an area I'm still concerned about.

25 I know that is not a clean answer but we don't have a problem --

26 MR. REYES: If I can add, we are aware of what Finland require
27 of the EPR. And they basically require hardwire backup to all the digital

1 controls for safety and all that stuff.

2 We are trying to understand the level of detail of the design
3 because we're not sure that is exactly the way to do it in terms of what the
4 Finland Regulatory Agency requires. But a part of our program is we don't
5 have the detailed design to review yet.

6 I think the EPR specifically, that effort is going to drive the
7 resolution of the issue.

8 We have dealt with pieces of it in some of the existing fleet
9 where they are replacing areas but we have not seen the design of the EPR
10 level of detail on the digital I&C to know if we are going to have a lot of
11 difficulty. We do have standards.

12 COMMISSIONER LYONS: Well, I appreciate the answer. I do
13 view it as a real challenge. Let me try to get one more quick comment or
14 question.

15 MR. PAPERIELLO: The Office of Research is supporting
16 NRR's review of the Oconee Amendment, I think its's Oconee, to deal with
17 digital I&C.

18 COMMISSIONER LYONS: My observation and then, question,
19 relative to 50.46, you make the observation in some of your supplemental
20 materials that in the expert elicitation process, it was a very wide divergence
21 of opinion which made it very hard to decide how to average the divergence.
22 I would come at it slightly differently, the fact that it is a wide divergence is to
23 me a source of great, great concern.

24 And maybe I have asked you this before Carl, but are we really
25 sure that we can't come up with a reasonably first principles based estimate
26 to supplement or guide instead of that expert elicitation?

27 MR. PAPERIELLO: I want to fall back on previous history. And

1 that is direct containment heating for PWRs. That was an issue that came up
2 in the 80's and an expert elicitation was done and it was decided that it would
3 not occur. But we do not have proof that it wouldn't occur.

4 It took about a decade of research, international research, not
5 just the United States, but overseas. But by the mid 90's, we had decided
6 that through much more experimental work and modeling and the like, that
7 direct containment heating would not occur.

8 I'm not giving you a yes, no, answer, I know that. My belief is
9 this is an issue where we need to continue to do research to understand
10 more and more about how the pipes would crack, and how they would fail.
11 And my guess is that sometime in the future and maybe not too far in the
12 future, we will have a much more precise answer, and it won't depend on
13 expert elicitation.

14 MS. UHLE: Yes, that's something that when the original 50.46
15 expert, or I should say the expert elicitation because the expert elicitation
16 data will also be used for other areas, risk-informing activities where you have
17 to have the probabilities of LOCAs.

18 And along the lines of the expert elicitation, was also this idea
19 that if we could develop a mechanistic modeling of pipe fracture, then, that
20 would also help to not only -- I would say confirm the expert elicitation results,
21 but also, be able to be using that particular computer code to then revisit the
22 frequencies, the LOCA frequencies every ten years as was directed by the
23 Commission. So underway, we have a probabilistic fracture mechanics code
24 that is being developed and also part of a cooperative program. Four
25 different countries are also involved. It's called the pro-LOCA code and it is
26 incorporating all of the degradation mechanisms that are known that would be
27 impacting the LOCA frequencies and that would be hopefully when it gets

1 benchmarked and fully developed that it, in part, replace the idea of an expert
2 elicitation. We don't want to be doing that every ten years.

3 CHAIRMAN DIAZ: Thank you, Commissioner Lyons. You just
4 entered into an area that is dear to my heart and I don't want to start going
5 into it. But I will. The reality is that from the very beginning, the agency
6 needs to be guided not by just one tool or one data point.

7 The fundamental issue is that we have 3 tools and they are
8 called, if I remember my time, you map potential results and you map
9 probabilistic fracture mechanics. And you map the history, and then you map
10 the predictions from expert elicitation. And then, if there are areas of very,
11 very significant difference, then, you focus on those areas. And eventually,
12 what you are trying to do is not to come up with one answer but to come up
13 with areas where you can converge to provide sufficient assurance that the
14 decisions that are made are right.

15 I think we are going in the right direction. I still think there are 3
16 tools and the three tools are different. They provide different answers, which
17 to me, actually is very reassuring because it is an area in which we don't
18 know everything.

19 Probabilistic fracture mechanics is not an exact science.
20 History sometimes doesn't give us all that we need because it is only in a
21 certain area. And expert elicitation has its variabilities and therefore it is the
22 combination of these 3 things that I think the staff should continue to use to
23 be able to give us a mapping of where the answers are.

24 Is that relatively where we should be?

25 MR. PAPERIELLO: I would use a different example I gave with
26 the pressure vessel. I think that is about right.

27 COMMISSIONER McGAFFIGAN: For those of us skeptics, I

1 would only note there are historical counters to the direct containment heating
2 story.

3 MR. PAPERIELLO: If you look at the history of trying to come
4 up to where the large pipe break numbers came in from WASH-1400 and
5 NUREG-1150, the analogy they used is not as good as expert elicitation.
6 Numbers in 1400 came out of oil pipelines and water --

7 CHAIRMAN DIAZ: Enough, we can discuss this for a long
8 period of time. Let me go to another one of my favorite subjects, realistic
9 analysis or realistic conservatism. What is it?

10 And the reality is that it is a tool. It is a tool to take a step back
11 and say, is what I'm doing sufficient to provide me an answer in which I can
12 make regulatory decisions? And that's what it boils down to. And I get
13 concerned at times that people are not taking that hard step of stopping and
14 saying, hey, let me forget what I have in the computer or the boiler plate. And
15 let me just go back to some basics.

16 Am I doing the right thing? Am I taking the right conservatism?
17 You use an example that to me, I spend a significant fraction of my life doing
18 fuel calculations, or at least, I had a lot of students doing fuel calculations,
19 and let me rephrase that.

20 And the reality is that, you know, a realistically conservative
21 approach would take into consideration, over any period of time, what are the
22 different contributions of the fissile materials and the vulnerable poisons and
23 you always come out negative once you take that from the reactor. Never
24 seen a fuel that has more reactivity than years.

25 MR. PAPERIELLO: I'm not disagreeing with you. When you
26 practically apply it, engineers -- I am a physicist, that is an exact science --
27 engineers taught me margin.

1 MR. REYES: We're still teaching you that.

2 CHAIRMAN DIAZ: And that is actually right.

3 The issue is, what is the margin and how do you use the
4 margin?

5 MR. PAPERIELLO: That's exactly right.

6 CHAIRMAN DIAZ: And I think we need to make very serious
7 decisions on those two issues. Beside that, there is no question. The
8 physics is there. Reality is there. And what we have not come down to is the
9 difference between NMSS and NRR is how we use it in regulatory decision-
10 making.

11 MR. PAPERIELLO: That is exactly right.

12 CHAIRMAN DIAZ: You want to add anything?

13 MR. PAPERIELLO: All I was going to say is, when you remove
14 the margin, you need to know more, that's all, you just need to know more,
15 and sometimes it is not nice and linear. You need to know a lot more.

16 CHAIRMAN DIAZ: Well, I think we have had a wonderful
17 afternoon. I fixed my watch which was 2 minutes ahead of time this morning.
18 But now, we are past two minutes from there.

19 Any of my fellow Commissioners want to make a final comment:

20 COMMISSIONER McGAFFIGAN: Could I just ask a question.
21 One of the things you didn't mention today and I want to stress how important
22 it is, is the group of people who look at precursors and score precursor
23 events, go over operational data.

24 And I think that's a very important function that your office
25 received from AEOD years ago. And the importance of it was stressed again
26 in the Davis-Besse lessons learned and making sure that you are doing
27 alliance with NRR and all that, that scenario where alignment is needed. But

1 it didn't come up today, at least in the summary charts and I thought I would
2 make that remark.

3 CHAIRMAN DIAZ: Commissioner Merrifield?

4 COMMISSIONER MERRIFIELD: I didn't want to interrupt his
5 time when he was using it, but not to create a further debate but to go on and
6 perhaps underscore my comments on the Pebble Bed, IRIS and the System
7 4S. I don't disagree that we need to make sure that we have research skills
8 that can keep us up with the technology. That was not at all my comment.
9 And the Office of Research is the house for that. And they should be doing
10 that work.

11 My sense, however, is to go the next step toward design
12 certification which would take larger amount of resources.

13 We had a luxury for that in the mid-90's. With what we have
14 ahead of us, we have to focus on real people with real projects and I would
15 not want to discourage any of that.

16 The other additional thing which I think is no small issue, is
17 those small reactors raise a whole host of policy issues this Commission
18 would have to grapple with and I would be concerned as a Commissioner
19 about getting ourselves distracted on that when we have, again, real issues
20 ahead of us that we will have to grapple with.

21 MR. PAPERIELLO: I would like to address a point that you
22 made and the point that came up in this morning's briefing on things that
23 might happen.

24 I don't know what's going to come in, for sure, I made a point
25 about our use of computational fluid dynamics.

26 My major concern is to make sure I have capabilities in that
27 area and the people capability, because I don't know whether it's going to be

1 gas, I don't know whether it will be liquid metal. I don't know what fluid will be
2 employed.

3 All I know is that's the kind of technology that I want to use to
4 model. And it takes a lot of work to get a skill to run those codes.

5 The fire code, the advanced fire codes are computational fluid
6 dynamic codes. So the fact that we have the equipment and the people, the
7 skills to do that is more important than any other thing -- you know what I'm
8 saying -- it is that capability that I'm after.

9 That's what I'm concerned about. That's why I talked about
10 human capital as our biggest issue.

11 COMMISSIONER JACZKO: I thought it was a very good
12 briefing I don't think I had any questions that stumped you.

13 CHAIRMAN DIAZ: Anything else?

14 COMMISSIONER LYONS: Other than Commissioner Merrifield
15 and I are not as far apart as I thought we were. Thank you for an excellent
16 briefing.

17 CHAIRMAN DIAZ: Let me make one final comment because I
18 think looking at the past few weeks at the scores of issues that are going to
19 be potentially presented where we are. Among all of those, the capability to
20 make decisions on instrumentation and control, become to be very, very
21 important.

22 So I know that we used to do a lot of things but eventually this
23 agency will have to make a decision on a package.

24 The package could have certain changes, technological
25 innovations that people will be able to do under 50.59. But fundamentally at
26 one point or another, we need to be able to make decisions on an I&C
27 package that includes reactor control systems, reactor protective systems.

1 And so, I do believe that we need and I think the Commission
2 would like to know how far are we in being able to make that decision
3 because that is coming down the pipeline. And are we capable of assessing
4 a package that might be technologically innovative, but still within the state of
5 the art and is that capability in place? Do we have the framework? Do we
6 have the regulatory framework to be able to make those decisions? I think it
7 is an important issue.

8 And with that, we are adjourned.

9 (Whereupon the proceedings were concluded)