

**UNITED STATES OF AMERICA**  
**NUCLEAR REGULATORY COMMISSION**

**Title:**           **BRIEFING ON SHUTDOWN RISK PROPOSED**  
**RULE FOR NUCLEAR POWER PLANTS -- PUBLIC**  
**MEETING**

**Location:**       **Rockville, Maryland**

**Date:**           **Wednesday, August 6, 1997**

**Pages:**          **1 - 58**

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON SHUTDOWN RISK PROPOSED RULE  
5 FOR NUCLEAR POWER PLANTS

6 \*\*\*

7 PUBLIC MEETING

8 \*\*\*

9 Nuclear Regulatory Commission  
10 Commission Hearing Room  
11 11555 Rockville Pike  
12 Rockville, Maryland

13  
14 Wednesday, August 6, 1997

15  
16 The Commission met in open session, pursuant to  
17 notice, at 2:00 p.m., the Honorable SHIRLEY A. JACKSON,  
18 Chairman of the Commission, presiding.

19  
20 COMMISSIONERS PRESENT:

21 SHIRLEY A. JACKSON, Chairman of the Commission  
22 GRETA J. DICUS, Member of the Commission  
23 EDWARD McGAFFIGAN, JR., Member of the Commission  
24 NILS J. DIAZ, Member of the Commission

25

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1 STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:

2 JOHN C. HOYLE, Secretary

3 STEPHEN G. BURNS, Associate General Counsel

4 JOSEPH CALLAN, EDO

5 GARY HOLAHAN, Director, Division of Systems Safety  
6 and Analysis, NRR

7 TIM COLLINS, Team Leader, Shutdown Rulemaking  
8 Task Force

9 TIM MARTIN, Acting Associate Director for  
10 Technology

11 THOMAS KING, Deputy Director, Division of Systems  
12 Technology, RES

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## P R O C E E D I N G S

[2:00 p.m.]

CHAIRMAN JACKSON: Good afternoon, ladies and gentlemen. We are pleased to have the staff here to brief the Commission on the proposed rulemaking for shutdown and fuel storage pool operations at nuclear power plants.

In a September 12, 1994, staff requirements memorandum, the Commission approved the publication of the proposed rule for shutdown and low-power operations for public comment. The staff has expended a considerable amount of effort to address the public comments as well as the Commission guidance regarding the use of a risk informed performance-based approach for this important issue.

During your discussion of the proposed rulemaking for shutdown and fuel storage pool operation, the Commission is interested in examples which demonstrate the use of the risk-informed performance-based approach in development of this rule. In addition, the Commission is interested in hearing any lessons learned that could improve the rulemaking process in the use of risk.

An initial comment I would make is it is important, whether it is on your viewgraphs or not, that you kind of lay out or give some sense of the context in historical -- the historical context, particularly since this Commission is not the same as the Commission that

1 issued the SRM in 1994.

2 I understand that copies of the presentations are  
3 available at the entrances to the meeting room so, unless my  
4 colleagues have anything to add to begin, Mr. Callan.

5 MR. CALLAN: Thank you, Chairman. Good afternoon,  
6 Chairman, good afternoon, Commissioners.

7 With me at the table are Tim Martin, who is  
8 filling in for Sam Collins, who is not available, and Gary  
9 Holahan, the director of the Division of System Safety and  
10 Analysis in the office of NRR.

11 Gary will introduce the members of the Shutdown  
12 Rulemaking Task Force and then Tim Collins, who is the team  
13 leader of the task force and, I might add, Tim is a very  
14 recent -- very recent selectee as the new branch chief, SES  
15 branch chief for the Reactor Systems Branch --

16 CHAIRMAN JACKSON: Are you going to announce  
17 Mr. Martin?

18 MR. CALLAN: We have a yellow announcement on  
19 that.

20 And Tim Martin, it is worth saying for the record,  
21 Tim Martin is the new office director of the Office of AEOD.  
22 But for this meeting, they are going to be in their old  
23 capacities and Tim Collins will proceed with the balance of  
24 the presentation when Gary Holahan is finished with his  
25 discussion.

1           CHAIRMAN JACKSON: I have to tell you, though this  
2 has no relevance to the meeting, but someone started talking  
3 to me about a Tim Collins, in fact, Mr. Callan, earlier  
4 today. And I thought he was confusing and lending Tim  
5 Martin and Sam Collins but I see there really is a Tim  
6 Collins.

7           [Laughter.]

8           MR. HOLAHAN: I have had that problem myself.

9           Back in January of 1997, in response to a number  
10 of internal and external comments on the staff's previous  
11 efforts to develop a shutdown rule related to, Madam  
12 Chairman, as you mentioned, the 1994 SRM. We recognized  
13 that there were a substantial number of public comments and,  
14 in the time frame between the early '90s and now in the  
15 later '90s, I think we have had some additional time to  
16 think about what do risk-informed and performance-based  
17 approaches to rulemaking mean.

18           So back in the beginning of this year, we really  
19 stepped back to take a new look at how to address shutdown  
20 rulemaking activities, to take public comments and sort of a  
21 risk-informed approach in mind and we established a task  
22 force and we gave them a due date of July 31 to produce a  
23 rule and supporting data. In fact, I think they met that  
24 date by one day. That is a pretty good performance by our  
25 rulemaking standards, I'm afraid. And Mr. Collins, who is

1 the leader of that task force, will present the details of  
2 that package.

3 But I would also like to present the members of  
4 that team so that you have a feeling for the scope and, in  
5 fact, the level of effort involved in producing this sort of  
6 activity.

7 Eric Weiss is the -- sort of the associate team  
8 leader. He is section chief under the Reactor Systems  
9 Branch. Gary Mizuno, senior attorney from OGC. We felt it  
10 was important to involve the OGC throughout the process and  
11 not as an add-on at the end. Warren Lyon from the Reactor  
12 Systems Branch; Bob Tjader from the Tech Spec Branch; Bob  
13 Lata, senior operational engineer in the QA area; Kulin  
14 Desai, who is not here today, in Reactor Systems; Steve  
15 Jones from Plant Systems Branch to deal with the spent fuel  
16 pool issues; John Monninger from the Containment Systems  
17 Branch to deal with the containment issues; and last but  
18 certainly not least, Marie Pahida from the Reliability and  
19 Risk Analysis from the Probabilistic Safety Assessment  
20 Branch.

21 So I say about half of those people were dedicated  
22 to this activity and the other half were involved as needed  
23 to contribute so it is a broadly thought out rule approach.

24 CHAIRMAN JACKSON: Commissioner McGaffigan has a  
25 very deep comment I think he wishes to make.

1           COMMISSIONER MCGAFFIGAN: I just have a question  
2 as to what happened after we got the comments? The Federal  
3 Register notice was October of '94. You got the comments in  
4 by March of '95, say. It was a difficult period, a long  
5 period. And then 21 months passed. What was the  
6 action-forcing event in January where you finally decided we  
7 better do something and what were -- what happened?

8           MR. HOLAHAN: Between the time that comments were  
9 received -- and, in fact, I think Tim will mention it is  
10 something like over a thousand comments were received, we  
11 actually went back and took the version of the rule that we  
12 had developed earlier and tried to accommodate those  
13 comments and to produce a new rule.

14           There had been some criticisms of the quality of  
15 the regulatory analysis. So there was a rewrite of the rule  
16 and a regulatory analysis. In effect, a second version of  
17 the rule was produced in that intervening period.

18           When we got rather late in that period, I think we  
19 decided I think rightly but perhaps much later than we  
20 should have, that we were not really on a success path, that  
21 taking the approach that we had used and trying to build in  
22 some additional flexibility, to try to patch up some of the  
23 original regulatory analysis, simply wasn't leading us to a  
24 success path and, in effect, it wasn't until we had seen a  
25 rather fully developed second version of the rule that we

1 thought that this is not really what the Commission and what  
2 the staff and what the industry would be comfortable with.  
3 We weren't -- I don't think it represented what I would  
4 consider our more modern thinking on risk-informed  
5 performance-based approaches.

6 So at that stage, we really decided to go back to  
7 ground zero and start over again and that is what has led us  
8 to sort of a crash program over the last six months to  
9 produce what is, in effect, a third version of the rule.

10 Obviously, if we were starting over again, we  
11 would just build this version; we wouldn't have built either  
12 of the previous two. But I think the history of where we  
13 are and what we learned through sort of the middle '90s has  
14 contributed a lot to where we are now and we probably should  
15 have been smarter in the '94 time frame of sort of skipping  
16 over that middle phase. But things just didn't come  
17 together at that point.

18 CHAIRMAN JACKSON: Okay. Go on.

19 MR. HOLAHAN: Okay.

20 Tim, you take the --

21 MR. COLLINS: Okay. Could I have slide number 2,  
22 please?

23 The first thing I want to do is give you an  
24 outline of my presentation and give you a statement of our  
25 overall objective in putting together the proposed rule and

1 a little bit of history associated with it. Then I want to  
2 discuss what we perceive as the need for rulemaking, why we  
3 think there is this need. In that discussion, I will cover  
4 where we see weaknesses in the existing regulations and what  
5 we think the risk significance of those weaknesses is.

6 Then I will go through a structure of the proposed  
7 rule and try to describe how it remedies the weaknesses that  
8 we believe are present. I will also summarize the  
9 regulatory analysis results and then I have a slide which  
10 discusses how we have tried to use risk-informed principles  
11 in the development of this rule. We tried to make a very  
12 deliberate effort to use the risk-informed principles in the  
13 task force phase of the rule development.

14 I also have a slide which gives a summary of the  
15 changes to the rule relative to the 1994 version that was  
16 last published. And my last slide is a schedule of what we  
17 hope to accomplish in the next year with regard to final  
18 rulemaking.

19 Can I have slide number 3, please?

20 The objective of the proposed rule is to define  
21 requirements for cold shutdown, refueling and fuel storage  
22 pool operations that are risk informed, clear, coherent and  
23 enforceable. This is not to say that there aren't any  
24 regulations out there right now which covered different  
25 parts, different phases of this operation. But I think as

1 you will see, as the presentation goes on, there are some  
2 weaknesses and what we have tried to do is to fill in the  
3 important gaps in a risk-informed way.

4 CHAIRMAN JACKSON: Let me ask you this question,  
5 is the rule also performance-based or is it primarily risk  
6 informed?

7 MR. COLLINS: I would say it is primarily risk  
8 informed. It does have a performance element in, a specific  
9 performance monitoring element that we have included.

10 Slide number 4?

11 This slide discusses the background, some of which  
12 Gary has already touched on. As was mentioned, this is not  
13 the first time we have gone out for public comment on a  
14 proposed rule for shutdown operations. The previous rule  
15 was published in October of 1994 and it attracted quite a  
16 bit of interest from the public. We received over a  
17 thousand comments on the rule. Many of these focused on the  
18 regulatory analysis, inadequacies in the regulatory  
19 analysis.

20 The industry indicated that the rule was much too  
21 restrictive and that it would severely impact outages, in  
22 some cases up to as much as nine days' lengthening of  
23 outages. And the industry said that the rule was really  
24 unnecessary because of voluntary actions that the utilities  
25 have already put in place.

1           In the course of working on the resolution of  
2 those comments, the Commission's policy statement on PRA was  
3 also issued. That was in August of 1995. So between  
4 comment resolution and incorporating the philosophy of the  
5 PRA policy statement, that drove us toward the revision to  
6 the rule. And along the way we met with the ACRS for a  
7 status briefing. That was in May of 1996.

8           The ACRS wrote a letter following that meeting,  
9 indicating that they agreed there was a significant or  
10 important risk associated with shutdown operations. They  
11 thought that the rule that we proposed to them at that time  
12 would probably lessen risk. It was rather a lukewarm  
13 response in that regard. And they also suggested at that  
14 time that maybe we ought to consider a broader base lining  
15 of shutdown risks.

16           COMMISSIONER DIAZ: Excuse me, just out of  
17 curiosity and history of the 1,023 public comments, how many  
18 were in favor of the rule or how many were in disfavor of  
19 the rule?

20           MR. COLLINS: I think it was like 1,022 to 1.

21           COMMISSIONER DIAZ: That is what I was wondering.  
22 All right.

23           [Laughter.]

24           CHAIRMAN JACKSON: Commissioner McGaffigan?

25           COMMISSIONER MCGAFFIGAN: What is your prediction

1 about public comments on the new rule if it goes out? Will  
2 it be 1,022 to 1 again? I mean, because -- what?

3 MR. COLLINS: I believe that this rule is far more  
4 flexible than the previous rule and clearly more risk  
5 informed so I would expect we may still get 1,022 to 1 but I  
6 think that we have addressed many of the comments in the  
7 previous --

8 MR. HOLAHAN: It's clear to me I have to send in  
9 more comments next time.

10 [Laughter.]

11 CHAIRMAN JACKSON: That's very good. Very good.

12 MR. COLLINS: During 1996, we also had meetings  
13 with NEI to try to understand industry's positions with  
14 regard to rulemaking and we understood the industry position  
15 to be that they didn't believe there was a need for  
16 rulemaking primarily because of the voluntary actions that  
17 were already in place or commitments that licensees had  
18 made. But they were willing to work toward the development  
19 of a performance-based rule.

20 Late in the summer of '96, the staff made a  
21 decision to expand the scope of the rule to include fuel  
22 storage pool operations and to consider external events.  
23 And following the staff decision, the interactions with NEI  
24 were terminated at that point. NEI felt that they couldn't  
25 support a rule which included fuel storage pool and external

1 events, is our understanding.

2 COMMISSIONER DIAZ: Why? What was the reason to  
3 include fuel storage at the time? Why did we include fuel  
4 storage with the low power and shutdown?

5 MR. COLLINS: Well, it was included with low power  
6 because the fundamental concern is heat removal. It is just  
7 more distant from the time of shutdown when you are in the  
8 fuel storage pool. So we thought that, rather than a  
9 separate rulemaking effort on fuel storage pool operations,  
10 we could just attach it to the shutdown rule since shutdown  
11 is primarily concerned with decay heat removal as well.

12 MR. HOLAHAN: I would say there were two things.  
13 One is the commonality of the technical issues. Many  
14 periods during the refueling, some of the fuel is in the  
15 vessel, some of it is in the spent fuel pool and so we are  
16 sort of a continuity of the treatment of the issues. The  
17 other was following the experience with Millstone and other  
18 plants it was clear that the staff and the licensees didn't  
19 have a common, clear understanding of what was expected of  
20 the licensees with respect to their requirements in the  
21 spent fuel pool area and we felt that something needed to be  
22 done to clarify what was required, not necessarily that  
23 there were more requirements but that there was sort of an  
24 unacceptable lack of clarity as to what was expected of  
25 licensees. And in last year's study on spent fuel pools,

1 there was a Commission meeting and a Commission paper. We  
2 had studied a number of plants, we had identified 10  
3 followup areas and in addition we had said that something  
4 needed to be done generically to bring closure to the  
5 understanding of what was expected. So this is our  
6 mechanism for doing it, although it may have been done in  
7 some other way, this we thought was an efficient way to do  
8 that.

9 CHAIRMAN JACKSON: Because of the continuity of  
10 the issue?

11 MR. HOLAHAN: Yes.

12 CHAIRMAN JACKSON: I note that the ACRS had  
13 recommended a benchmark study on risk during low power and  
14 shutdown operations. How did this play into this rule or  
15 your schedule for it or how are you intending to address the  
16 ACRS comments?

17 MR. COLLINS: We read that letter very carefully  
18 and we had responded to the ACRS indicating that we were in  
19 agreement with many of their recommendations. That letter  
20 that they sent to us, the April letter, was not drafted in  
21 the context of the review of the shutdown rule. That was  
22 drafted in the context of the review of risk-based  
23 regulation as a whole.

24 You could read it to mean that well, maybe we  
25 ought to hold up shutdown rulemaking but it was not drafted

1 in response to a review of shutdown rulemaking.

2 CHAIRMAN JACKSON: And they plan, I understand, to  
3 comment on this proposed rule again?

4 MR. COLLINS: They asked to comment after the  
5 resolution of public comments.

6 CHAIRMAN JACKSON: Okay.

7 Mr. King?

8 MR. KING: Yes, we are proceeding to gather  
9 information and lay out our plans for doing these additional  
10 risk studies as suggested by ACRS. Currently, we would  
11 expect to begin those in about a year and there is a lot of  
12 information that has been developed since the previous risk  
13 studies that we did back in 1992 so both domestically and  
14 overseas and we want to build upon that.

15 CHAIRMAN JACKSON: Okay.

16 COMMISSIONER DIAZ: Just a comment. As you  
17 progress in your presentation, I want to make sure that I  
18 get a very distinct idea of why do you think the spent fuel  
19 pools should be considered with the low power and the  
20 shutdown operations, where there is a tremendous difference  
21 in the configuration and lineup.

22 In one case, the reactor vessel is closed. You  
23 know, we can only access the reactor vessel through a series  
24 of very well set systems and mechanisms. In the other case,  
25 the reactor vessel head is not there, it is sitting on the

1 side and you have a fuel transfer canal and there are very,  
2 very, very distinctive issues.

3 We have decay heat all the time when we are at 100  
4 percent power or whether we are at zero power. So decay  
5 heat is a common denominator for all operations in reactors  
6 and I think there is a very, to me, clear, distinct  
7 difference between low-power operation, shutdown and fuel  
8 storage pool and I hope they will actually --

9 CHAIRMAN JACKSON: Why don't we let them go on  
10 with their presentation?

11 COMMISSIONER DIAZ: For sure.

12 MR. COLLINS: Well, we already discussed the ACRS  
13 letter of April 18 and then in July of this year, we  
14 forwarded the rule to the Commission.

15 Slide number 5, please.

16 In the next few slides, I plan to address why we  
17 think there is a need for a rulemaking. The first step in  
18 assessing the need for rule was a qualitative assessment.  
19 We looked at the traditional safety functions that are  
20 associated with reactor operation and we looked at how these  
21 functions are protected by current requirements, both at  
22 power and during shutdown operations. I have listed on my  
23 slide the six functions we focused our study on.

24 When we reviewed the requirements at power, we  
25 found that such things that the general design criteria, the

1 technical specifications, Part 50, Appendix B, very  
2 comprehensively protect these functions. When we took the  
3 same look -- I'm going to slide number 6.

4 We took the same look at the protection provided  
5 by current regulations and tech specs during shutdown. We  
6 found that there were some issues which were not covered and  
7 I have some of these listed on slide number 6. The  
8 availability of such things as injection capability is not  
9 covered for PWRs during cold shutdown and refueling. That  
10 is, there are no technical specifications for ECCS in mode  
11 five and mode six.

12 COMMISSIONER DIAZ: This is specific technical  
13 specifications?

14 MR. COLLINS: Yes, technical specifications.

15 COMMISSIONER DIAZ: They are clearly covered by  
16 Appendix A and therefore by Appendix B.

17 MR. COLLINS: Yes, the ECCS systems.

18 COMMISSIONER DIAZ: Requirements during any normal  
19 conditions which includes, of course, the shutdown.

20 MR. COLLINS: The GDC certainly applied.

21 COMMISSIONER DIAZ: Okay.

22 MR. COLLINS: These are -- I have specifically  
23 listed this as availability to differentiate that from  
24 design requirements. Typically, availability is controlled  
25 by the technical specifications and we reviewed the standard

1 technical specifications to see whether or not these  
2 functions were covered during shutdown.

3 CHAIRMAN JACKSON: So that is where the crux is,  
4 having to do with availability?

5 MR. COLLINS: It's availability. We don't have  
6 any concerns with the capability of the systems to perform  
7 their function if they are available.

8 CHAIRMAN JACKSON: So that is what brings them  
9 away from the general design criteria?

10 MR. COLLINS: Right, the general design criteria  
11 do not address availability.

12 CHAIRMAN JACKSON: Okay. And the only question I  
13 would ask is did you consider revisions to Appendix B or  
14 some other existing regulations? I guess it really has to  
15 do with your deciding it was better to treat all these  
16 issues in a comprehensive way as opposed to trying to go  
17 back and revise Appendix B?

18 MR. COLLINS: That's correct.

19 MR. HOLAHAN: In our previous versions of a  
20 proposed rule, for example, we proposed to have individual  
21 technical specifications to control the availability of  
22 equipment. But what we found is that normal operation is  
23 much simpler than shutdown activities. During normal  
24 operation, most all systems are available and perhaps only  
25 one at a time is taken out of service. And so it is

1 relatively straightforward to write requirements calling for  
2 all the equipment to be available and then giving outage  
3 times if one piece is.

4 A more complicated situation, I think, exists in  
5 shutdown when there are numerous pieces of equipment taken  
6 out of service and the combinations of those, I think, got  
7 too complicated or overly conservative in trying to write  
8 those into specific specifications.

9 COMMISSIONER DIAZ: I just was trying to get a  
10 nomenclature. I don't know whether I have to change but  
11 since I was a kid when I started in this business, you know,  
12 I don't want to say how long ago, but it was a long time  
13 ago, normal operations including shutdown and low power so  
14 you can't call shutdown, you know, a different type of  
15 normal operations.

16 MR. HOLAHAN: Yes.

17 COMMISSIONER DIAZ: Normal operations includes  
18 shutdown and that is part of normal operations and they are  
19 clearly addressed by Appendix B. It says operating  
20 conditions and all operating conditions are covered. So  
21 whether they are low power or shutdown, those are all normal  
22 operating conditions. So we cover them in different ways  
23 but now if we want to specifically address them in a better  
24 fashion, I understand that. But they have always been  
25 normal operating conditions, including shutdown.

1           MR. CALLAN: Commissioner, if I might add, the  
2 point that you are making is a point that OGC has made  
3 repeatedly in the discussions and during the pre-brief I  
4 had, OGC made that very point, that there are regulations  
5 that apply and your clarification is correct, that we are  
6 improving or enhancing our ability.

7           COMMISSIONER McGAFFIGAN: Could I follow up on  
8 that? One of the things you all do in this new rule,  
9 though, is somebody must see some vulnerability there  
10 because you add a definition in 50.2 of shutdown operation  
11 and the last sentence of which, shutdown operation is part  
12 of normal operations. So somebody felt constrained in this  
13 rulemaking package to make that crystal clear in regulation.  
14 Is that because it may have been less than crystal clear  
15 previously?

16           CHAIRMAN JACKSON: We just wanted to be sure it  
17 was perfectly clear.

18           MR. HOLAHAN: Perfectly clear.

19           CHAIRMAN JACKSON: This just came out of OGC's  
20 comments.

21           COMMISSIONER DIAZ: If I may comment on that, I  
22 don't think there is anybody in the industry that has a  
23 question that shutdown is part of normal operation. If you  
24 want to add clarity for some additional purpose, that's  
25 fine. But the NRC and the industry, correct me if I am

1 wrong, we all call shutdown power normal operations,  
2 correct?

3 MR. CALLAN: Yes.

4 CHAIRMAN JACKSON: But I think the point is not so  
5 much to get hung up as to whether or not some existing  
6 regulations include shutdown operations within the scope.  
7 But if there are specific issues that you mentioned,  
8 availability number one, that this rule specifically allows  
9 us to deal with. And, secondly, a sentence that maybe  
10 states the obvious, if it really is obvious, and if it is  
11 not obvious, either way, it doesn't hurt to have it.

12 COMMISSIONER DIAZ: It doesn't hurt, but it is  
13 obvious.

14 CHAIRMAN JACKSON: This makes it obvious to all.  
15 Okay, let's go on.

16 MR. COLLINS: Some other functions that we found  
17 were lacking in the current requirements, the availability  
18 of BWR venting. That is the ADS system we are referring to  
19 there. In BWRs, ECCS is required during cold shutdown.  
20 However, the ADS is not required and the ECCS required is  
21 low-pressure systems. And should you have a pressurization  
22 event, you wouldn't be able to use the ECCS anyway.

23 Containment is required under very limited  
24 conditions right now in the standard technical  
25 specifications. There are other areas where the current

1 requirements are what we would describe as maybe partial,  
2 they don't fully address some functions. Fire protection  
3 for cold shutdown equipment is an important area. 50.48,  
4 Appendix R and GDC-3 all treat fire protection. When we  
5 looked carefully at them, it was clear that they focused on  
6 a fire that started during power operations. It requires  
7 protection of equipment to a safe shutdown condition which  
8 has been interpreted as hot shutdown.

9 If you have a fire that starts at cold shutdown,  
10 that hot shutdown equipment would not be available. You  
11 typically need the reactor coolant system to be closed. If  
12 you are in refueling, the cooling system is not closed.

13 The only requirement for cold shutdown equipment  
14 in the existing regulations is that it be recoverable  
15 following a fire within 72 hours. Well, should a fire begin  
16 in cold shutdown, 72 hours is far too long to wait to  
17 recover that equipment.

18 There are other requirements with regard to fire  
19 protection that are tied to inerting. BWR Mark I and Mark  
20 II containments operate in an inerted condition when they  
21 are at power and, because of that, there has been a  
22 relaxation in the equipment protection requirements relative  
23 to fire. When you are shut down, these containments would  
24 not be inerted.

25 Finally, Appendix B, which addresses things like

1 procedures, corrective actions and QA, Appendix B applies to  
2 safety-related functions and the cold shutdown equipment is  
3 not always classified as safety-related equipment. Many  
4 plants, the cold shutdown equipment is not classified as  
5 safety related. So the applicability of Appendix B is kind  
6 of tenuous there.

7 COMMISSIONER DIAZ: I'm sorry, I have to argue  
8 with that.

9 Appendix B clearly says that QA will be  
10 commensurate with the degree of safety. So even if they are  
11 not in the Q list, now, you might be right they are not in  
12 the Q list, but they still have been QA to whatever degree  
13 or measure of safety is. So that doesn't mean they're  
14 not --

15 MR. CALLAN: Let me give you a specific example  
16 that I have been involved with over the years. At even  
17 newly licensed plants, the pressurized or the pneumatic seal  
18 that provides a pressure fit around the gate on a refueling  
19 canal is not -- frequently not captured by a licensee's QA  
20 program. When those seals fail, it causes a fairly dramatic  
21 drop in water level. It is failsafe, in a sense, that it  
22 won't go below a certain level that provides adequate  
23 protection but, nevertheless, it is a fairly dramatic event  
24 when it happens and results in a lot of water in the  
25 containment building during refueling outages.

1           That has happened a number of times around the  
2 country. Relatively recently, there has been I think at  
3 least two generic communications out on that. Just one  
4 example of a fairly important component that is not captured  
5 by an Appendix B program, it is not considered safety  
6 related. And I think there are arguments why it shouldn't  
7 be.

8           And there are several other examples of that  
9 nature.

10           COMMISSIONER DIAZ: Well, it was not because if it  
11 fails, it would have no consequences. It is just messy and  
12 transfers a lot of water --

13           MR. CALLAN: Right, but you do get elevated  
14 radiation levels depending on what's going on at the time  
15 and that sort of thing.

16           CHAIRMAN JACKSON: Mr. Holahan, you wanted to make  
17 a comment?

18           MR. HOLAHAN: Well, I think that although Appendix  
19 B could be read in some respect to apply to some of this  
20 equipment, that is not the standard interpretation used in  
21 the industry and since our objective was to reach some clear  
22 understanding as to what was expected, I think we want to be  
23 clear on how Appendix B ought to apply to such --

24           COMMISSIONER DIAZ: But we already have, you know,  
25 a guidance, I will say, in that we are going to go using

1 risk assessment and everything we have available to do  
2 graded QA and I am sure that that graded QA will eventually  
3 involve all of these systems. So we are ready to do actions  
4 in that respect.

5 MR. HOLAHAN: Yes. But I think where a licensee  
6 chooses to do the risk-informed graded QA, this would be  
7 taken care of. But we are approaching that as a voluntary  
8 program so if a licensee doesn't choose to do this, I think  
9 it would be different at that plant.

10 COMMISSIONER DIAZ: Thank you.

11 MR. COLLINS: All right, moving to slide number 7,  
12 please.

13 The second step of our analysis was to make a  
14 quantitative assessment of the significance of the  
15 weaknesses that we found in our qualitative assessment. And  
16 the first step we took in this was to try to make an  
17 estimate of risk of plants that are operating, in normal  
18 operation today. The way we did that was we took NUMARC  
19 91.06, which is an industry-sponsored guidance document for  
20 shutdown operations management and we said, if we were  
21 implementing this guidance, what equipment would we make  
22 available during different phases of shutdown operation.  
23 And then we did a risk estimate based on the availability of  
24 that equipment.

25 That is the first line that you see on slide

1 number 7 where it says, estimate of industry practice. I  
2 just want to make it clear that this is not a number that  
3 the industry has provided to us, this is a number that we  
4 have estimated ourselves. You see that it comes up with  
5 numbers that are in the vicinity of the Commission's safety  
6 goal guidelines, quantitative guidelines.

7 Then the next step in our analysis was, what  
8 happens if we remove from that things which are voluntary,  
9 things which are not strictly required by the regulations,  
10 and we remove things that are not included in technical  
11 specifications, anything that was not specifically called  
12 out in the regulations, and we also removed commitments made  
13 in response to generic letters. So it is really a stripped  
14 down analysis.

15 If you took the tech spec requirements which were  
16 our minimum during these modes of operation and only what  
17 the strict regulations require, what happens then? And that  
18 gives us numbers which are well removed from the safety goal  
19 guidelines. Which was not surprising to us when you looked  
20 at the safety functions involved.

21 I think the primary message from this, this  
22 viewgraph here, is that the existing level of safety is very  
23 heavily dependent on voluntary measures. That is the  
24 message we got from this analysis.

25 CHAIRMAN JACKSON: What would the numbers look

1 like with the requirements of the rule?

2 MR. COLLINS: They come a lot closer to where the  
3 industry is right now. That is on a slide a couple slides  
4 down.

5 COMMISSIONER DIAZ: But again, let me see if I can  
6 try to understand these numbers. What you have, and let me  
7 see if I understand what numbers apply, the numbers will be  
8 different for, say, mid-loop operations in a BWR?

9 MR. HOLAHAN: Yes, yes.

10 COMMISSIONER DIAZ: Than they will be when we are  
11 refueling. So, in a certain way, the table, it is too much  
12 of an average and we conclude --

13 MR. COLLINS: These numbers are driven --

14 MR. HOLAHAN: It's not an average. It is an  
15 integral. It takes each of those situations but obviously  
16 the dominant contributor is just the mid-loop operations.

17 COMMISSIONER DIAZ: Right, it is an integral. And  
18 therefore, you know, it gives us a very, to me, I mean, I  
19 look at it, I almost fell out of my chair, look at it,  
20 flip-flop, had to be given salts and all of that.

21 [Laughter.]

22 COMMISSIONER DIAZ: As you know, it is a kind of  
23 very, very distinct difference. I think it is important to  
24 realize that, and that is what I was talking about,  
25 refueling operations and separating it from mid-loop in a

1 BWR, that these numbers probably only apply to a very narrow  
2 range of normal operations that were called mid-loop, going  
3 from mode five to mode six.

4 MR. COLLINS: To a degree, yes.

5 COMMISSIONER DIAZ: And that really, you know, it  
6 represents the risk in that area. While the risk, when the  
7 fuel transfer canal is open and everything is at atmospheric  
8 pressure, you know, a hose from the sanitary sewer can  
9 provide enough cooling, you know, if we get into extreme  
10 cases.

11 MR. COLLINS: Yes.

12 COMMISSIONER DIAZ: So I think it is important  
13 that we come out and separate them. And now, having said  
14 that, let me try to understand how we arrive at the, let's  
15 call it the first column, the mid-loop operations of BWRs  
16 and probability of core damage frequency of two to 10 to the  
17 minus two per reactor year. Is this the worst, worst, worst  
18 case scenario? Meaning, you have taken the fact that the  
19 system is sitting there and also you take the receivable  
20 heat removal system out completely?

21 MR. HOLAHAN: No.

22 COMMISSIONER DIAZ: No?

23 MR. COLLINS: No, we have used initiating event  
24 frequencies that are historical data or are best estimates  
25 at initiating event frequencies. What happens is mitigation

1 equipment is gone and --

2 COMMISSIONER DIAZ: So the receivable heat removal  
3 system is gone?

4 MR. COLLINS: No, not necessarily. Things like  
5 the CVCS would not be present, okay? The ECCS is not  
6 present. Containment does not affect the core damage  
7 frequency but it is not present either, okay?

8 And if you take a simple example, you have a loss  
9 of level control in a PWR, which is not infrequent from our  
10 perspective, and you don't have a makeup capability, you  
11 can't recover even if you have two-hour HR systems  
12 available, neither one of them can recover without first  
13 having some water makeup, okay? So something like a  
14 loss-of-level control event occurring during mid-loop, you  
15 can't recover from it. All you need is the initiating event  
16 frequency to get you these types of numbers.

17 CHAIRMAN JACKSON: Why don't we go on. We  
18 can't --

19 COMMISSIONER McGAFFIGAN: Could I ask just one  
20 question?

21 CHAIRMAN JACKSON: Sure.

22 COMMISSIONER McGAFFIGAN: NUMARC 91.06, is that  
23 mandatory within NEI framework for its members or is that  
24 voluntary? Was that a voluntary guideline?

25 MR. HOLAHAN: Yes, it met their definition of an

1 industry initiative which I think is comparable to mandatory  
2 within the NEI framework.

3 COMMISSIONER DIAZ: So that means that 80  
4 percent --

5 MR. HOLAHAN: Exactly, yes.

6 COMMISSIONER DIAZ: Okay.

7 CHAIRMAN JACKSON: Okay.

8 MR. COLLINS: Moving on to slide number 8, this  
9 slide is an outline of the rule as we are proposing it. We  
10 are trying to address each of the weaknesses that we have  
11 identified in our analysis of current requirements.

12 The first element in the rule is a procedural  
13 element that would require administrative tech specs be  
14 added for all plants which would require that procedures in  
15 quality assurance, training and corrective action be  
16 included for activities that can affect decay heat removal,  
17 for safety function performance monitoring and for  
18 activities associated with maintaining mitigation capability  
19 available. This is basically to account for the potential  
20 Appendix B weakness.

21 The second element is the performance monitoring  
22 element that we made reference to earlier. Here, we have  
23 defined safety function limits associated with water  
24 temperature, reactor coolant system pressure and reactor  
25 coolant system level.

1           And we have defined limits. We have left it to  
2 the licensees to decide how they would monitor those  
3 parameters, what instrumentation they want to use, what  
4 frequency they want to monitor it. We would review the  
5 methods and criteria used for determining what  
6 instrumentation they were going to use and what frequency  
7 they were going to use. Should they violate any of the  
8 safety function limits, it would be a reportable event.

9           The third element in the rule is an administrative  
10 tech spec requirement relating to mitigation capability. We  
11 have written the rule in very high-level language. The rule  
12 itself says that the licensees must maintain equipment  
13 available to assure adequate core cooling and protection  
14 against the uncontrolled release of fission products. In  
15 this statement of considerations and the reg guide, we  
16 discussed that we expect that to mean backup RHR and  
17 injection capability and containment being intact, a  
18 definition of which we provide in the statement of  
19 considerations, or an alternative to the intact containment.

20           I think it is important to understand that in the  
21 containment alternative, we have made it clear that the  
22 containment provides a defense in depth function. It is a  
23 diverse type of protection. And that if a licensee chooses  
24 to use the alternate to containment, they need to recognize  
25 the defense in depth attribute that containment carries with

1 it and they can't simply put a second pump in place and say,  
2 well, I don't need a containment now. They have to be able  
3 to handle a wide range of initiating events just as  
4 containment would be able to handle it.

5 We also allow the licensee to choose whatever  
6 equipment they want to use. They must keep it, keep  
7 documentation in a licensee-controlled document, the  
8 document that will need to be identified in the tech specs  
9 for the purposes of inspection and enforcement. We don't  
10 want to have the requirements spread out in a bunch of  
11 different licensee documents. We have asked them to put it  
12 in one place so that an inspector can go and understand what  
13 is being relied upon at any given time in a shutdown.

14 We again would control the criteria and methods.  
15 We would review the criteria and methods used for the  
16 selection of equipment but the licensee would be free to  
17 change out different types of equipment at different points  
18 in the outage as long as they followed the methods and  
19 criteria that were approved by the staff.

20 The fourth element of the rule is the fire  
21 protection element. I think the simplest way to think of  
22 this is that we have tried to bring the protection afforded  
23 at power operation into the cold shutdown regime. The rule  
24 would require that licensees either protect their cold  
25 shutdown equipment from the effects of fire or if they can't

1 do that, they need to provide suppression and detection  
2 equipment and to have contingency plans in place such that  
3 if both trains of cold shutdown should be lost by a fire  
4 that they can maintain core cooling by another mechanism.

5 CHAIRMAN JACKSON: Let me ask you a question.

6 How do you assess the inspectability and  
7 enforceability of the performance monitoring aspects?

8 MR. COLLINS: The inspectability, to a large  
9 extent, is very straightforward once we have approved the  
10 methods in the criteria because the licensee will have to  
11 document what instrumentation is being used, what frequency  
12 it is being used. An inspector can simply go to that  
13 document and say, show me that you have done this, and they  
14 can review the records over the past year or at any moment  
15 in time go in and say, show me.

16 CHAIRMAN JACKSON: So that is how you both have  
17 the inspectability and enforceability and consistency in  
18 inspection and enforcement?

19 MR. COLLINS: Yes. It does put some burden on the  
20 headquarters staff in that we will have to review the  
21 methods and criteria in advance. It should facilitate  
22 inspection and enforcement.

23 MR. HOLAHAN: And the office of enforcement has  
24 reviewed the package?

25 MR. COLLINS: Yes, they have.

1 CHAIRMAN JACKSON: Commissioner McGaffigan.

2 COMMISSIONER MCGAFFIGAN: On the fire protection  
3 side, is there anything we are doing here that plays back  
4 into when and if we ever get around to doing Appendix R and  
5 getting rid of words like combustible and whatever, that  
6 have you protected yourself against having to come back and  
7 review this rule when we finally get around to doing that  
8 rule?

9 MR. COLLINS: Yes, we have worked with the Office  
10 of Research in the development of this rule and as far as we  
11 know, we are not doing anything contrary to what they plan  
12 to do and as a matter of fact, they plan to incorporate what  
13 we have done in shutdown into their own requirements as well  
14 as they see it fits. You know, they don't intend to redo  
15 shutdown.

16 MR. HOLAHAN: There were a number of discussions.  
17 I think it was recognized that fire protection for shutdown  
18 was not fully covered in the regulations and there were a  
19 number of discussions about how to address that. We could  
20 have just taken the 50.48 fire protection regulation and  
21 written shutdown into it or it could have been done here or  
22 it could be done in both. Through the discussions as to  
23 what looked like a reasonable way to do it and how that  
24 could be referenced in a future change to 50.48 results were  
25 sort of worked out before these words were developed.

1                   CHAIRMAN JACKSON: Let's go on.

2                   MR. COLLINS: Okay, the last element in the  
3 proposed rule is the one that addresses the fuel storage  
4 pool. The requirements here would be simply to update the  
5 FSAR to incorporate the assumptions which are essential for  
6 the design and safety functions of the pool and to be sure  
7 that those assumptions were incorporated in the plant  
8 operating procedures.

9                   I believe the thrust here is that there is the  
10 perception of misunderstanding of what the expectations were  
11 with regard to fuel storage pool operations, as evidenced by  
12 the problems we have had in the past few years. And risk  
13 studies didn't indicate a compelling reason to have a rule  
14 for fuel storage pool. We didn't do any quantitative  
15 assessment which says there is a heavy-duty risk here. But  
16 it is almost a matter of housekeeping to make it clear not  
17 only to the licensees but also to the NRC staff what is  
18 expected with regard to fuel storage pool operations and we  
19 see this as cleaning the slate and making it clear from here  
20 on out this is what is expected.

21                  MR. HOLAHAN: I would say that, because of the  
22 decision we have come to, that in fact there are no  
23 technical requirements, there is no real backfitting of  
24 requirements here, this piece, this objective could be  
25 accommodated in other ways. The FSAR update rule could have

1 some specific language with respect to spent fuel pools or  
2 the Commission could just express to the industry that its  
3 expectation that 50.71(e) covers spent fuel pools but -- so  
4 I think it is written in such a way that it is not an  
5 essential element of this rule. That piece could be taken  
6 out and that issue could be dealt with separately.

7 CHAIRMAN JACKSON: But is it written in a way that  
8 is consistent with what is already going on vis-a-vis  
9 50.71(e)?

10 MR. HOLAHAN: Well --

11 CHAIRMAN JACKSON: It's hard to say?

12 MR. HOLAHAN: It's hard to say because I am not  
13 sure exactly where we are going with 50.71(e). I think it  
14 is not very prescriptive at all. I think what it really  
15 says is whatever the current licensing basis is for spent  
16 fuel pools, write that into your FSAR. To the extent  
17 50.71(e) is being pushed in that direction of saying get  
18 that sort of stuff in your FSAR, I think that is consistent.

19 CHAIRMAN JACKSON: Okay.

20 MR. COLLINS: There are a couple other conforming  
21 changes that go along with the rule which are not listed on  
22 the slide. Equipment which licensees wish to credit for the  
23 shutdown rule would need to be included in the maintenance  
24 rule program and for license renewal, any equipment which a  
25 licensee wishes to credit for shutdown rule would also need

1 to be covered in the license renewal.

2 Slide number 9.

3 Slide number 9 is the regulatory analysis results.  
4 We have already seen the first two lines, the estimate of  
5 industry practice and what is the base case in the  
6 regulatory analysis.

7 The bottom line is where we would be -- an  
8 estimate of where we would be if this rule was in place,  
9 okay? And, again, the rule basically raises the floor from  
10 several orders of magnitude away from the safety goal to  
11 right in the vicinity of the safety goal guidelines.

12 COMMISSIONER DIAZ: Subsidiary guidelines.

13 MR. COLLINS: Subsidiary guidelines, yes.  
14 Subsidiary objectives, sorry.

15 There is just one -- we have used the frequency of  
16 unmitigated release as if it was a large early release. In  
17 fact, shutdown is slightly different because the short-term  
18 products would all be decayed away before you would get to a  
19 release in a shutdown accident. Typically it takes a couple  
20 days to get to cold shutdown.

21 CHAIRMAN JACKSON: Does the rule accommodate  
22 having NUMARC 91.06 being an acceptable methodology for  
23 meeting the requirements of the rule?

24 MR. HOLAHAN: Not directly, although I think the  
25 way the rule is structured, a licensee could propose the

1 program that they have under --

2 CHAIRMAN JACKSON: 91.06?

3 MR. HOLAHAN: NUMARC 91.06 as their approach and I  
4 think that could be reviewed and approved separately. I  
5 think 91.06 is not really a program, it is really a test of  
6 how good is your program. It is not really a definition  
7 itself. But I would think a program developed and  
8 consistent with 91.06 --

9 CHAIRMAN JACKSON: Would most likely meet the  
10 requirements of this rule?

11 MR. HOLAHAN: I think if you look at the risk  
12 numbers --

13 CHAIRMAN JACKSON: The risk numbers are very  
14 similar?

15 MR. HOLAHAN: Yes. I think what it would do is it  
16 would move that from a voluntary program into a more  
17 structured regulatory approach.

18 MR. COLLINS: Yes, NUMARC 91.06 is very high  
19 level. It is hard to answer the question directly, I mean  
20 depending on how you implemented it.

21 CHAIRMAN JACKSON: Okay.

22 MR. HOLAHAN: I think it is fair to say the same  
23 program and the same general use of equipment and its  
24 availability would apply to both cases.

25 CHAIRMAN JACKSON: Okay.

1           What do you mean by intact containment and does  
2 the reg guide include definitions of these kinds of less  
3 prescriptive areas?

4           MR. COLLINS: We include a definition of the  
5 intact containment. It allows certain penetrations to be  
6 open, provided that they can be closed automatically from  
7 the control room. It requires, though, that the closure be  
8 able to withstand full design pressure. We have given an  
9 explicit definition in the statement of considerations and  
10 in the reg.

11          MR. HOLAHAN: And correct me if I am wrong but I  
12 believe it calls for one barrier as opposed to two?

13          MR. COLLINS: Yes, one barrier, right.

14          CHAIRMAN JACKSON: Okay. Let's go on.

15          MR. COLLINS: Just one more comment, though, while  
16 we are on this slide. That is the ACRS letter talking about  
17 the need for a benchmarking study. If we look at the  
18 results and the insights to be gained from the studies we  
19 have done, I think it tells us that we really don't need to  
20 have a big, comprehensive benchmarking study of low power  
21 and shutdown to see that there is some weaknesses in our  
22 existing regulations and we can address those weaknesses  
23 very directly with the proposed rule we have.

24           The base case I don't think would change one iota,  
25 regardless of how much of a comprehensive benchmarking study

1 you have done. Once you take away important safety  
2 functions, it becomes a very simple problem. And the rule  
3 case would be fine tuned. But we are talking about a  
4 thousand-to-one value impact ratio in this cost/benefit  
5 analysis. We can't see how the overall insight is going to  
6 be changed.

7 MR. HOLAHAN: The one area that might be somewhat  
8 different is I think that there hasn't been much research on  
9 core melt in an oxygen environment for a shut down reactor.  
10 I think in most cases, you know, we think of an at-power  
11 case and core melt in a superheated steam environment. So I  
12 think some of the chemistry and some of the release  
13 mechanism might be somewhat different and I think that  
14 deserves a comprehensive thought. In this case, I don't  
15 think it changes the answers but I think it would bring a  
16 better understanding of what sort of real risks are  
17 associated with these shutdown conditions.

18 MR. COLLINS: In addition to that, the way we have  
19 written the rule, you know, it requires things like  
20 adequate -- equipment for adequate core cooling and  
21 uncontrolled release of fission products, protection against  
22 that. We wouldn't necessarily need to have a rule change to  
23 implement insights from such a study and research anyway.  
24 They would be plant-specific implementation if it is found  
25 that certain equipment is particularly beneficial or certain

1 equipment is particularly vulnerable, those could be --  
2 those insights could be incorporated without any change to  
3 the rule.

4 CHAIRMAN JACKSON: Okay.

5 MR. COLLINS: Slide number 10.

6 The regulatory analysis numbers do not include  
7 fire. We didn't believe that we had the capability to do a  
8 generic fire PRA for the purposes of the regulatory  
9 analysis. So, instead, we performed what I will describe as  
10 a qualitative risk assessment and I have listed five factors  
11 we believe are important in an assessment of risk from fire  
12 during shutdown operations.

13 What we did is we looked at how these factors are  
14 protected by regulations at power, how they are protected by  
15 regulations at shutdown and how the conditions associated  
16 with these risk factors are different during shutdown as  
17 opposed to power. Our objective was, let's try to bring the  
18 shutdown protection into the same regime as the power  
19 operation protection.

20 We found the first factor is frequency of fires  
21 during shutdown, there was an AEOD study. We used the data  
22 from that study that showed that the frequency of fires was  
23 rather high during shutdown, on the order of 10 to the minus  
24 two per reactor year. So initiating event frequency is  
25 relatively high, comparable to power operation.

1 All the other factors, we found that the  
2 conditions were either the same as at power or worse and the  
3 protection afforded by the regulation was the same or less.

4 COMMISSIONER DIAZ: Excuse me.

5 Could you be a little more specific? Fires where,  
6 in any --

7 MR. COLLINS: Oh, right. It was fires in areas  
8 that could affect the safe shutdown equipment or the cold  
9 shutdown equipment, I'm sorry. That's right.

10 For example, if you look at the probability of  
11 combustible loadings to allow fire to propagate, during  
12 shutdown that is the time when you've got a lot more welding  
13 equipment on site, you are doing combustible fluid changes,  
14 you've got a lot of wood around to help with projects. It  
15 is just -- the conditions on all these factors were either  
16 the same or worse from a risk perspective, which led us to  
17 the conclusion that we could use some additional  
18 requirements to bring these, the protection, more up to the  
19 standard at current power operation.

20 Slide number 11.

21 This is where we have assessed what the cost to  
22 the industry would be from implementation of the rule.  
23 These costs are from today to the end of plant life. For  
24 the shutdown portion of the rule, we estimate it will be a  
25 little under \$2 million per plant. These are primarily

1 paper costs. It is just a matter of bringing something  
2 which is currently in the voluntary regime into the  
3 regulatory arena just costs some money. We have included  
4 some costs for instrumentation upgrade which some plants  
5 could possibly need to do the performance monitoring portion  
6 of the rule.

7 The fire protection, again, it is a largely paper  
8 cost. There is some equipment, we have included a cost for  
9 some equipment which may be needed to enhance fire  
10 suppression and detection equipment for cold shutdown  
11 equipment.

12 A fuel storage pool operation is strictly a paper  
13 exercise and it is about \$50,000 a plant to update the FSAR  
14 and modify procedures so the total cost for the entire rule  
15 we would estimate to be less than \$3 million per plant for  
16 the lifetime of the plant.

17 CHAIRMAN JACKSON: Is this above and beyond what  
18 the licensees may already be doing to update their FSARs?  
19 So this is kind of as if they have done nothing to this  
20 point?

21 MR. HOLAHAN: Yes, I think that's correct.

22 COMMISSIONER DIAZ: Have you had some feedback on  
23 this number from industry? Has anybody said it's low?

24 MR. COLLINS: No, they haven't seen these numbers.  
25 They have not seen these numbers.

1 CHAIRMAN JACKSON: That is what the new comment  
2 period will do.

3 Yes?

4 COMMISSIONER MCGAFFIGAN: Could I ask, are these  
5 numbers front loaded? I mean, if you use paper exercise, in  
6 the year after the rule goes into effect would most of this  
7 cost be incurred?

8 MR. COLLINS: Yes, it would. Yes.

9 MR. HOLAHAN: In some cases, all of it is just a  
10 one-time cost.

11 MR. CALLAN: Just anticipating some comments from  
12 the industry, there is a hidden cost here that is not  
13 reflected and that is, I guess, what you could call the  
14 regulatory impact or the regulatory cost. Now that what was  
15 voluntary is now enforceable, that means that from time to  
16 time, probably every outage, there will be issues that will  
17 be raised by the inspection staff that will have to be dealt  
18 with and at no small cost in some cases in terms of staff  
19 time and paper. So there is that expense that is not  
20 reflected here that would be ongoing.

21 CHAIRMAN JACKSON: Okay.

22 MR. COLLINS: Slide number 12.

23 Slide number 12 discusses how we tried to take  
24 into account the risk-informed principles in the development  
25 of the rule. There was a very deliberate effort to use risk

1 insights throughout the development of the rule. We used  
2 PRA technology where we thought we had the capability. We  
3 did the quantitative assessment for the shutdown portion.  
4 We didn't think we had the capability to do a meaningful,  
5 generic fire PRA and for the spent fuel pool there was no  
6 need to do a PRA at all. There were some previous studies  
7 which showed that the risk of fuel damage was very low to  
8 start with.

9 We tried to maintain defense in depth philosophy  
10 in dealing with containment. Obviously, the containment  
11 can't always be closed during refueling operations.  
12 However, we didn't want to give up totally on defense in  
13 depth so we wrote into the rule that the defense in depth  
14 attribute had to be considered when a containment alternate  
15 was being used. In the analysis, we tried not to use any  
16 DBA assumptions at all. We tried to be as realistic using  
17 information that was available to us in all our analyses.

18 Treatment of uncertainties, we did a qualitative  
19 assessment of the uncertainties. We used point estimates  
20 for all the risk values and when we looked at the value  
21 impact ratio being a thousand to one, we concluded that a  
22 detailed uncertainty analysis is very unlikely to make any  
23 changes to that conclusion so we didn't do anything further  
24 after we did our qualitative assessment.

25 Finally, the safety goal subsidiary objectives

1 were used throughout. We used that to assess where the  
2 current regulations put us, where the new regulations would  
3 put us and where we thought the industry was today.

4 CHAIRMAN JACKSON: Okay.

5 MR. COLLINS: Slide number 13 is a summary of what  
6 has changed since the rule last went out for public comment  
7 in 1994. The hot shutdown and low power modes are no longer  
8 within the scope of the rule.

9 We did a more rigorous regulatory analysis where  
10 we broke out the early phases in hot shutdown and low power,  
11 looked at the regulatory requirements applicable to them and  
12 concluded that, in fact, the safety functions were pretty  
13 well protected by existing requirements. So we withdrew hot  
14 shutdown and low power from the scope of the rule.

15 The previous rule also had a requirement for the  
16 containment closure was always required, containment closure  
17 capability. In this rule, we try to be more flexible by  
18 allowing alternatives to containment, provided that the  
19 defense in depth consideration was maintained.

20 The previous rule also made broad use of the  
21 single failure criterion. It was very reminiscent of  
22 traditional design basis accident analysis type approach and  
23 we have tried to use risk insights to limit the scope of the  
24 single failure criterion and basically it now is a  
25 requirement for a backup RHR.

1           The licensee is allowed to set performance  
2 monitoring limits in this rule. We simply define safety  
3 function limits related to water temperature, level and  
4 pressure. The licensee is free to decide how they want to  
5 monitor those. If they want to correlate some other  
6 parameter to those particular parameters, they are free to  
7 do that provided that we have approved the methods and  
8 criteria they are using.

9           The fuel storage pool was not addressed in the  
10 previous version of the rule at all and the regulatory  
11 analysis which supports this rule, we think, is much more  
12 rigorous than supported the 1994 rule. In summary, we think  
13 that it is much more flexible and risk informed than the  
14 1994 version.

15           Slide 14 is the schedule that we are hoping to  
16 accomplish for rule implementation. We would love to have  
17 Commission approval by the end of the month to go out for  
18 public comment.

19           CHAIRMAN JACKSON: We will work on that.

20           MR. COLLINS: Given that, it will take us a few  
21 days to get the rule actually published.

22           CHAIRMAN JACKSON: I've got the fast commissioner  
23 over here anyway. It shouldn't be a problem on that side.

24           MR. COLLINS: We have allowed a 75-day comment  
25 period which traditionally manages to get extended to 90

1 days so we have shown 90 days on the schedule. We plan to  
2 meet with the ACRS then in next April following resolution  
3 of public comments and we would have to go back to CRGR  
4 again. We would anticipate doing that in May and then  
5 bringing the final rule to the Commission in August of next  
6 year.

7 CHAIRMAN JACKSON: Okay. Any further comments or  
8 questions?

9 Commissioner?

10 COMMISSIONER DIAZ: Should the other commissioner  
11 go first?

12 CHAIRMAN JACKSON: No, you're the senior  
13 commissioner.

14 COMMISSIONER DIAZ: Let's see if I can organize a  
15 couple of comments in here.

16 First, I think it is very important that the staff  
17 focus attention in an area where I think we have been  
18 working up and down and I think that has been going on for  
19 years. I think it is important that we realize where are  
20 the risks and that follows the philosophy that the present  
21 Commission is emphasizing in the area of risk assessment.

22 I do want to have something clear. That is that I  
23 believe that the fuel storage pool does not belong in this  
24 role. I think that that is an issue --

25 CHAIRMAN JACKSON: That is going to be something

1 that the Commission will have to decide since it is in the  
2 paper.

3 COMMISSIONER DIAZ: That's correct. That's it  
4 absolutely. And the Commission will look at it.

5 But I think we are mixing apples and grenades and  
6 I don't think we should do that.

7 In the area of the overall -- in the rest of the  
8 rule, I think we need to give a little bit more  
9 consideration, or I will give consideration to the fact that  
10 we have been trying to be less prescriptive, trying to work  
11 in developing, you know, an environment in which things are  
12 done because they are right and this might be going the  
13 wrong way, although it might be necessary. I think we need  
14 to put those two objectives and bring them together. There  
15 is a long history now of we, the NRC, and the industry  
16 providing licensees with requirements that make the plants  
17 work better. Those requirements that you have not taken  
18 into consideration, I understand the base for it, actually  
19 have made nuclear power plants safer through a long history  
20 of time now and, of course, we really never have a  
21 "accident" or release during shutdown. That is a major  
22 issue.

23 We actually have been allowing the industry to  
24 determine which systems are operable or must remain operable  
25 during certain conditions and which they can actually remove

1 from service. So we have actually been making allowance in  
2 determining can you take this system out, can you do  
3 in-service inspection. Essentially, this rule comes in and  
4 restricts that area significantly as a rule rather than as a  
5 voluntary process or as a process that might be really  
6 required through other means which could be generate letters  
7 and so forth.

8 I just want to bring up one major thing that the  
9 NRC did many years ago, which is called ALARA, and which has  
10 served this Commission and this Commission has used for many  
11 years in assuring that we have minimal impact due to -- you  
12 know, from radiation to personnel, the public and the  
13 environment and that has worked well. So I believe that we  
14 should take these things into consideration as we go into  
15 the rulemaking.

16 But I want to thank the staff for a wonderful job.

17 CHAIRMAN JACKSON: I want to thank you for  
18 outlining your vote.

19 [Laughter.]

20 CHAIRMAN JACKSON: Commissioner McGaffigan.

21 COMMISSIONER MCGAFFIGAN: I am actually going to  
22 ask a question.

23 I would comment that your earlier answer to the  
24 Chairman's question about where does this fall in  
25 prescriptive versus performance-based space, I actually

1 reading the rule find it quite far towards performance based  
2 and there are things that you have done since the last time  
3 in terms of alternatives to containment and it is very broad  
4 language. The licensee shall minimize the frequency of  
5 fires during shutdown operations. I mean, you are not  
6 telling them how to do it, you are telling them they shall  
7 do it and there may be some prescription in the reg guide  
8 but in looking at that continuum, I think they have made a  
9 larger step than perhaps the answer indicated towards  
10 performance-based rule.

11 That is in response to Commissioner Diaz. Now,  
12 let me ask my questions.

13 One thing I noticed in the package that I haven't  
14 seen earlier in previous rulemaking packages is this Table 7  
15 safety goal decision guidance that apparently comes from the  
16 safety goal and it -- does this come up in other  
17 rulemakings, just as a matter -- I am just interested  
18 whether you do this matrix every time you propose a rule in  
19 reactor space?

20 MR. HOLAHAN: This, the regulatory analysis  
21 guideline, core damage frequency, additional containment  
22 failure probability?

23 COMMISSIONER McGAFFIGAN: Right.

24 MR. HOLAHAN: That is a screening criteria that is  
25 used for all -- actually for all generic issue screening,

1 both for generic letters as well as for things like  
2 rulemaking, and it is built into the regulatory analysis  
3 guidelines. It is a screening step to identify which are  
4 issues that ought to move forward and then a risk analysis  
5 with a, you know, cost/benefit analysis done sort of as a  
6 second stage, so what Tim was showing was the second stage  
7 results.

8 COMMISSIONER MCGAFFIGAN: So I should look forward  
9 to seeing this in every -- in almost every package that  
10 comes forward?

11 MR. HOLAHAN: Usually, you don't see that  
12 particular piece but that is the screening level. Usually,  
13 you see the second level results.

14 MR. KING: Yes, right.

15 That piece goes to CRGR when they review rules.  
16 It doesn't always show up in the statement of  
17 considerations.

18 COMMISSIONER MCGAFFIGAN: Right.

19 MR. HOLAHAN: But it has always been considered at  
20 some stage in the process.

21 COMMISSIONER MCGAFFIGAN: And then we have been  
22 exploring through the afternoon some of the interactions  
23 between this rule and other rules. There is a separate  
24 package up to us at the moment on the famous maintenance  
25 rule, Section A(3) and Alternative 3 that is offered in that

1 package is something that would not just change the "should"  
2 to "shall" --

3 MR. HOLAHAN: Right.

4 COMMISSIONER McGAFFIGAN: -- but address other  
5 issues and it doesn't sound unreasonable if we are going to  
6 move in the direction of risk-informed regulation that says  
7 that one of the advantages would be to provide a foundation  
8 on which other risk-informed regulation could build. But  
9 among the disadvantages, it says such a rule would have  
10 broad impact on other current and proposed rules including  
11 the proposed shutdown rule and should thus be part of a  
12 separate rulemaking that would be used for risk-informed  
13 regulation in general.

14 Can you explain that, what the impact of the  
15 possible Alternative 3 for the shutdown rule would be?

16 MR. HOLAHAN: Well, I think there is clearly an  
17 interrelationship. I am not sure I would describe it  
18 entirely as negative. From what Tim has said, you can see  
19 the most important aspects of this rule have to do with  
20 controlling the availability of equipment that is used to  
21 mitigate events and to the extent that the maintenance rule,  
22 the A(3) part of the maintenance rule also addresses  
23 availability of equipment, I think a strong A(3) which  
24 addressed both power operation and shutdown I think could  
25 accomplish that same function as the shutdown rule.

1           Now, I think the implications are in order to do  
2 that as part of the maintenance rule, you would have to  
3 build some infrastructure in the sense of, well, how would  
4 you use A(3), what sort of analysis would be done, does it  
5 require that there would be a PRA that was reviewed and  
6 approved? There are a lot of ancillary questions that we  
7 are not quite ready to answer.

8           But I think that functionally there is this  
9 overlap in terms of control of the availability of  
10 equipment. Likewise, I think technical specifications  
11 control the availability of equipment and so there would be  
12 a considerable overlap between an A(3) and the current  
13 technical specifications. So I think it is a powerful  
14 thought but it has a lot of implications to be sorted out.

15           CHAIRMAN JACKSON: Thank you.

16           MR. HOLAHAN: Thank you.

17           MR. CALLAN: Chairman, I would like to just make  
18 one comment at the end.

19           You know, a common theme in this presentation is  
20 the Staff's view that there is a problem with our  
21 regulations that needs to be addressed and that the safety  
22 net that our regulations provide for shutdown operations is  
23 not sufficient. That is the baseline. What the staff is  
24 not saying is there is a compelling need in terms of  
25 licensing performance for a rulemaking. You know, my view,

1 and somewhat anecdotally, is that the performance of the  
2 industry is actually better than the NUMARC 91.06  
3 guidelines. I mean, the region I just left, I would say at  
4 least half of the licensees in that region have something  
5 equivalent to a shutdown risk meter concept with a very  
6 sophisticated war room during outages where risk is tracked  
7 almost hour by hour, without exaggerating. As equipment is  
8 taken out of commission, the range of options are reviewed  
9 and adjustments are made daily. Quite sophisticated control  
10 of risks during outages.

11 So in terms of licensee performance, there isn't a  
12 compelling argument. But none of that -- I shouldn't say  
13 none of that -- very little of that falls within the  
14 regulatory framework and that is the issue here.

15 MR. HOLAHAN: Absolutely. I agree. And one of  
16 the things we have done in these last six months is  
17 recognized that I think in the past we were in danger of  
18 writing a rule that would have been at odds with even the  
19 better licensee programs. It would have required them to  
20 keep some set of books on technical specifications and maybe  
21 even distract them from their risk management approach. So  
22 I think what we have constructed here is a rule which could,  
23 in effect, adopt and bless a program that Mr. Callan has  
24 described. They wouldn't necessarily have to change that  
25 program. It would simply draw it through the reference from

1 an administrative technical specification. It would become  
2 the licensee's commitment to continue to carry out that  
3 program. I think that is a way of taking advantage of the  
4 best features of an existing program.

5 CHAIRMAN JACKSON: Yes.

6 COMMISSIONER DIAZ: Are you convinced that none of  
7 our requirements, even if they are old, have captured this  
8 or have we actually forgotten to use them? Because, you  
9 know, there are some that actually I could pick out from the  
10 book that might address this and not very long ago we  
11 actually put out a new one.

12 CHAIRMAN JACKSON: Okay, let him answer.

13 COMMISSIONER DIAZ: I was still talking. I wasn't  
14 finished.

15 So, you know, when you look at it, okay, and you  
16 look at what we just did with PRA and you look at some of  
17 the things, my question always goes back to the definition  
18 that we use in the book of any normal operating condition  
19 and it might have been captured. I just want to be sure it  
20 was not captured someplace else.

21 MR. HOLAHAN: Okay.

22 What I am convinced of is the Atomic Energy Act  
23 covers shutdown operations. So the Agency has the power to  
24 regulate it. There are other areas where the regulation  
25 either suggests or could be interpreted to cover shutdown

1 but it is not clear and it is certainly not the current  
2 staff and industry practice to interpret the regulation that  
3 way. So part of what we would be doing here is, remember,  
4 the original objective is to become clearer on what the  
5 requirements are.

6 COMMISSIONER DIAZ: All right, thank you.

7 CHAIRMAN JACKSON: I would like to thank the staff  
8 for a very informative briefing today and it is clear from  
9 the quality of the briefing that you and the rest of the  
10 staff that have been associated with this project have spent  
11 many long hours of thought and consideration on this. And  
12 as the overall safety and reliability of nuclear power  
13 reactors does generally continue to improve but pressures to  
14 improve economic performance continue, it is imperative as  
15 you have outlined here that if, where necessary to ensure  
16 protection of public health and safety and that operating  
17 and safety margins are maintained, that we promulgate  
18 regulations that are as risk informed and performance based  
19 as they can be.

20 I think it is interesting, coming out of this  
21 discussion, for the staff to review as it is involved in  
22 resolving either other generic issues or other rulemakings,  
23 to review the extent to which voluntary licensee action is  
24 relied upon and where, if regulatory action is warranted,  
25 that it is not something that takes the licensee -- takes us

1 away from where that can satisfy what our needs are.

2 If there is nothing more, we are adjourned.

3 [Whereupon, at 3:18 p.m., the briefing was  
4 concluded.]

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CERTIFICATE

This is to certify that the attached description of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON SHUTDOWN RISK PROPOSED  
RULE FOR NUCLEAR POWER PLANTS --  
PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Wednesday, August 6, 1997

was held as herein appears, is a true and accurate record of the meeting, and that this is the original transcript thereof taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company.

Transcriber: Christopher B. Cutler

Reporter: Mark Mahoney



**DEVELOPMENT OF §50.67  
SHUTDOWN AND FUEL STORAGE  
POOL OPERATIONS  
AT NUCLEAR POWER PLANTS**

**August 6, 1997**

**Timothy Collins**

**301-415-2897**

# **OUTLINE OF PRESENTATION**

- **Objective and Background**
- **Need for Rulemaking -  
Risk Significant Issues**
- **Structure of Proposed Rule**
- **Regulatory Analysis Results**
- **Risk-Informed Principles in  
New Proposed Rule**
- **Changes in Proposed Rule  
Since 1994 When Last Published**
- **Schedule**

# **OBJECTIVE OF PROPOSED RULE**

**To define requirements for cold shutdown, refueling, and fuel storage pool operations that are risk-informed, clear, coherent and enforceable.**

# **BACKGROUND**

- **October 1994 - Proposed Rule Published**
- **1023 Public Comments on 1994 Proposed Rule**
- **August 1995 - PRA Policy Statement Published**
- **Discussion with ACRS May 21, 1996**
- **1996 - Public Meetings**
- **ACRS letter of April 18, 1997 recommended Benchmark Study on Risk During low-Power and Shutdown Operations**
- **July 1997 - Proposed Rule Forwarded to Commission**

# **RISK SIGNIFICANT ISSUES**

- **Decay Heat Removal**
- **Inventory Control**
- **Protection Against Fission Product Release**
- **Reactivity Control**
- **Pressure Control**
- **Operator Performance**

***Protected by 10 CFR Part 50 Appendix B & Technical Specifications when at Power***

# **RISK SIGNIFICANT ISSUES DURING SHUTDOWN**

## **SOME ISSUES NOT COVERED BY EXISTING REQUIREMENTS**

- **Availability of ECCS for PWRs**
- **Availability of BWR venting to permit makeup**
- **Availability of Containment**

## **SOME ISSUES NOT FULLY ADDRESSED BY EXISTING REQUIREMENTS**

- **Fire Protection for Cold Shutdown Equipment**
- **BWR fire protection for equipment in containment  
(no inerting)**
- **App B (Procedures, Corrective Actions and QA) for  
Cold Shutdown**

# ASSESSMENT OF CURRENT REGULATORY REQUIREMENTS USING PRA

(Excludes Fire)

	Core Damage Frequency events/reactor-year		Frequency of Unmitigated Release per reactor-year	
	PWR	BWR	PWR	BWR
<b>Estimate of Industry Practice per NUMARC 91-06 (Voluntary Case):</b>	<b>8E-5 to 2E-6</b>	<b>1E-5 to 6E-7</b>	<b>2E-5 to 2E-7</b>	<b>8E-6 to 6E-7</b>
<b>Potential Regulatory Minimum (Base Case):</b>	<b>2E-2</b>	<b>1E-3</b>	<b>2E-2</b>	<b>1E-3</b>

# **§50.67 SHUTDOWN AND FUEL STORAGE POOL OPERATIONS**

<b>Rule Outline</b>
<b>Procedural Element Admin Tech Specs §50.67(a)(1)</b> <ul style="list-style-type: none"><li>-Procedures</li><li>-Quality Assurance</li><li>-Training</li><li>-Corrective Action</li></ul>
<b>Performance Monitoring Tech Specs §50.67(a)(2)</b> <ul style="list-style-type: none"><li>-Safety Function Limits</li></ul>
<b>Mitigation Capability Tech Specs §50.67(a)(3)</b> <ul style="list-style-type: none"><li>-Backup RHR</li><li>-Injection</li><li>-Containment or Alternative</li></ul>
<b>Fire Protection §50.67(a)(4)</b>
<b>Fuel Storage Pool §50.67(b)</b>

# SHUTDOWN OPERATIONS

## Regulatory Analysis Results (fire not included)

		Core Damage Frequency events/reactor-year		Frequency of Unmitigated Release per reactor-year	
		PWR	BWR	PWR	BWR
Estimate of Industry Practice per NUMARC 91-06 (Voluntary Case):		8E-5 to 2E-6	1E-5 to 6E-7	2E-5 to 2E-7	8E-6 to 6E-7
Potential Regulatory Minimum (Base Case):		2E-2	1E-3	2E-2	1E-3
Proposed Requirements (Rule Case): (S/D only)	Intact Containment	8E-5	8E-6	1E-6	4E-6
	Comparable Equipment	1E-5	4E-6	1E-6	4E-6

# **FIRE PROTECTION FOR SHUTDOWN MODES OF OPERATION**

- **Risk Factors Assessed in Regulatory Analysis**
  - **Frequency of fires during shutdown operations**
  - **Probability of sufficient combustible loadings to allow fire to propagate**
  - **Probability of fire barriers being removed or degraded**
  - **Probability fire detection and/or suppression systems would be unavailable**
  - **Probability of failure to recover from a loss of decay heat removal**

# INDUSTRY COSTS

(Base Case to Rule Case)

(Present value per plant over its remaining life)

<b>SHUTDOWN OPERATION w/o FIRE PROTECTION</b>	<b>\$ 1.8 M</b>
<b>FIRE PROTECTION</b>	<b>\$ 1 M</b>
<b>FUEL STORAGE POOL OPERATION</b>	<b>\$ .05 M</b>
<b>TOTAL (per plant)</b>	<b>\$ 2.85 M</b>

# **RISK-INFORMED PRINCIPLES IN RULE DEVELOPMENT**

- **PRA technology used to the extent supported by the state-of-the art.**
- **Maintain Defense in Depth Philosophy**
- **Realistic Assumptions Used in Analysis**
- **Treatment of Uncertainties -  
Qualitative Assessment**
- **Safety Goals Subsidiary Objectives Considered**

# **CHANGES IN PROPOSED RULE SINCE 1994**

- **Hot Shutdown/Low Power Modes No Longer Included**
- **Alternatives to Containment Permitted**
- **Less Use of Single Failure Criterion**
- **Licensee to Set Performance Monitoring Parameter Limits**
- **Fuel Storage Pool Documentation Addressed**
- **Better Value/Impact Analysis**

***More Flexible and Risk Informed***

# SCHEDULE

<b>ITEM</b>	<b>DATE</b>
<b>COMMISSION APPROVAL</b>	<b>8/29/97</b>
<b>PUBLISH PROPOSED RULE</b>	<b>9/1/97</b>
<b>PUBLIC COMMENT</b>	<b>12/1/97</b>
<b>ACRS MEETING</b>	<b>4/98</b>
<b>CRGR MEETING</b>	<b>5/98</b>
<b>COMMISSION APPROVAL</b>	<b>8/98</b>
<b>PUBLISH FINAL RULE</b>	<b>8/98</b>