UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
- - -
BRIEFING ON PART 100 FINAL RULE
ON REACTOR SITE CRITERIA
- - -
PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Wednesday, June 12, 1996

The Commission met in open session, pursuant to notice, at 10:00 a.m., Shirley A. Jackson, Chairman, presiding.

COMMISSIONERS PRESENT:
SHIRLEY A. JACKSON, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
GRETA J. DICUS, Commissioner

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:
JOHN C. HOYLE, Secretary of the Commission
KAREN D. CYR, General Counsel
JAMES TAYLOR, EDO
THEMIS SPEIS, Deputy Director, Office of Nuclear Regulatory Research
ANDREW MURPHY, Chief, Structural and Geological Engineering Branch, RES
LEONARD SOFFER, Technical Assistant, Office of the EDO
THOMAS KING, Deputy Director, Division of Systems Technology, RES
FRANK MIRAGLIA

P R O C E E D I N G S

CHAIRMAN JACKSON: Good afternoon everyone. The purpose of this meeting is for the NRC staff to brief the Commission on a final rule to amend reactor siting requirements in 10 CFR Parts 50, 52, and 100. This includes the establishment of a new Appendix S to 10 CFR Part 50 for use by future applicants.

The Commission recognizes that much effort has been expended on these rule changes which were originally published, I understand, for public comment in 1992.

I have requested the staff to respond to several questions which I had given after a Chairman's briefing in order to clarify aspects of the proposed rule changes.

In general, the questions were related to three aspects of the proposed rule changes.

First, the application of Part 100 to operating reactors and future use of the proposed rule changes. For example, new source term applications.

Second, the difference of opinion between Research and NRR regarding the time frame for when the new source term should be applied, namely, the question of the first two-hour period or worst two-hour period.

Third, the less prescriptive aspects of the new rule. For example, population density and the changes to the operating basis earthquake.

The Commission is interested in discussing how these issues are dealt with in the proposed final rule before the Commission, and we are also interested in your

consideration of input from the Advisory Committee on Reactor Safeguards regarding these issues.

The Commission realizes the significance of the Part 100 rule. One of the briefing papers referred to this rule as the regulatory pillar for reactor safety and public health and safety, a pedigree of those features inherent in the design that prevent or mitigate consequences of accidents. That shows you that all these things are read deeply.

We look forward to discussing the aspects of these rule changes with you today. I understand that copies of your presentation are available at the entrance to the meeting.

Do my fellow Commissioners have any opening comments?

COMMISSIONER ROGERS: Nothing.

COMMISSIONER DICUS: No.

CHAIRMAN JACKSON: Mr. Taylor, please proceed..

MR. TAYLOR: Good afternoon. With me at the table are frank Miraglia, Andy Murphy, Themis Speis, Len Soffer, and Tom King.

The staff considers this to be an important rule

. 5

since it reflects not only the experience gained over more than 30 years in siting and licensing of over 100 nuclear power plants, but also because it incorporates major advances in our understanding of the earth sciences and reflects significant research insights in the area of fission product releases resulting from severe accidents.

The rule also states basic reactor site criteria and makes explicit the Commission's longstanding policy that reactors should be located away from very densely populated centers.

With that, I will ask Themis Speis to continue.

MR. SPEIS: Thank you, Mr. Taylor.

Chairman Jackson, Commissioners. I don't want to repeat what has been said, but we will be able to give you some of the salient aspects of this proposed final rule. Of course the details are described here and we will be addressing the questions that Chairman Jackson raised. We are asking for approval from the Commission about this as a final rule.

[Slide.]

MR. SPEIS: The first viewgraph shows the outline of the presentation.

I will briefly go over the chronology of the events that have brought us here today. Also, I will give you an overview of the present rule.

. 6

Then we have broken the presentation down into two parts, one covering the seismic aspects and the other one covering the radiological aspects.

As you can see, under the seismic aspects we will cover the seismic and geologic siting criteria, the use of probabilistic seismic hazards in determining the design basis ground motion, and also will address the earthquake engineering criteria.

Then we will go to the radiological part of the rule and we will discuss in some more detail some of the major developments and experience in reactor siting and explicitly address the proposed revisions and then give you the final elements of the rule that we are asking permission from the Commission to publish.

[Slide.]

MR. SPEIS: The chronology.

Some of these things will be discussed later on by Len and Dr. Murphy. I just want to give you kind of a brief capsule.

As has been said already, this may be one of the oldest. I will defer that to our general counsel if that is the oldest or one of the oldest. That was back in 1962.

Then, 11 years later, the Atomic Energy Commission put out Appendix A, which dealt with the seismic issues. Both of these rules where when the AEC was in charge.

. 7

In 1990 we came up with a plan to revise Part 100, but the first proposed revision went out in October 1992. We had grandiose ideas at that time of decoupling, siting from design, and as you will hear later on from Len, it didn't quite materialize that way because of the extensive comments that we received.

The proposed rule was withdrawn in 1994, and then the second proposed revision was issued for comment in 1994.

Here we are in front of you to discuss the final rule.

[Slide.]

MR. SPEIS: I think it is very important to provide the context of phase 1. This is viewgraph number 4. I hope you see the color copy in front of you.

For background, I would like to say that from the knowledge and the insights that we have gained from extensive research on severe accident processes and phenomena as well as the many risk studies that have been performed we have learned that risks are dominated by severe accidents, that is, core melt accidents where the containment has either failed or bypassed. Therefore, one might ask why these risk insights have not been totally taken into consideration in this proposed rulemaking but instead this rulemaking only partially addresses the insights gained from severe accident research.

. 8

When I am talking about partially, we are addressing the behavior of the release of radioactivity as a nuclear power plant undergoes a severe accident. Also, it is fair to say that the distance itself, which is addressed in the rule, which Len will talk about, takes severe accident into consideration to some extent.

The answer is that the final rule which we will be discussing today is the first step in our overall plan to address this issue. That is the upper part of the drawing.

The middle part shows the insights, the technology that went into the final rule that we will be talking about today.

The later part, step 2, is something else that will be coming in the future. This is taken completely into consideration, the severe accident challenges. As all of us know, a severe accident has two attributes, the radioactive part and the energy part, the pressures and temperatures. So right now we are only taking into account the radioactive part.

Those other attributes of a severe accident already have been considered in the staff's review of GE advanced boiling water reactor and the Combustion Engineering System 80+ design. Those things now are going through the certification process.

We already have put out an advanced notice of

. 9

proposed rulemaking to codify generically the severe accident challenges into our regulations, but the Commission told us back in 1993 in an SRM to wait for the outcome of the certifications where severe accident considerations are considered on a plant-specific basis instead of generically, and then we will come back and see how and to what extent we can address the totality of severe accident challenges, that is, the radioactive part and the loads part, generically in Part 50 or Part 100.

I know that when you people discussed this issue with the ACRS they raised this question. Also, when this rule was reviewed by the CRGR in their letter to Mr. Taylor they raised this question. But I want to make sure that you have the complete picture in front of you now.

[Slide.]

MR. SPEIS: With that, I will summarize the current rule.

Basically, the current rule requires that a determination be made of an exclusion area which is immediately around the reactor. No residents are allowed in it.

Also a determination has to be made of the low population zone which is outside the exclusion area. Even though it may contain some residents, no densely populated centers are allowed.

. 10

There is, of course, the population center distance, which may be no closer than one and one-third times the low population zone radius.

The way the exclusion area and the LPZ are determined is a postulated source term is assumed to go into the containment, to exist in the containment instantaneously. It is constant; it's flat; it does not have the time behavior that the new source term has. Then, by using that source term and the criteria of 25 rem to the body and 300 rem to the thyroid, one determines the exclusion area size and the LPZ radius.

There are no numeric criteria in the rule itself, but there is guidance in reg. guides 1.3, 1.4, 1.145, and

4.7, and 4.7 are the reg. guides that contain the .4 miles as the distance between the reactor and the exclusion area.

The present Appendix A specifies seismic and geologic site criteria.

With those brief remarks, I would like to turn it over to Dr. Murphy, who will go forward and discuss the seismic aspects of the rule.

MR. MURPHY: I will start on page 7.

[Slide.]

MR. MURPHY: My presentation will include a description of the reasons why we got involved in the revision to Appendix A, the objectives to that revision, and

. 11

then I will touch on the highlights both in the earth sciences and in earthquake engineering aspects of it.

As noted already, Appendix A has been around since 1973 and since that time there have been significant advances in both the earth sciences and seismic engineering.

Within the earth sciences the two items that are of particular note in my mind are the advances in the use of probabilistic techniques to keep track of the uncertainties that are involved in the parameters in setting out a safe shutdown earthquake ground motion, which is the parameter that we are looking for here, and also in the occurrence of ground motions in excess of one G that have been observed principally in the last five to ten years.

Under the seismic engineering we are looking at advances in well studied after shock studies, I will call them, where we have had an opportunity to go in and see what damage has occurred to industrial facilities and then to factor that into use for critical facilities such as nuclear power plants.

A second item would be that the current regulation contains requirements as well as regulatory guidance. Part of the difficulty with the guidance actually is that it is in the rule and in a number of cases it has been treated as if it were actually requirements, and that has led to some difficulties within the licensing arena.

. 12

The third item is the conflicting interpretations that are given to some of the terminology that is used within the current rule. This would be terms like tectonic province or capable fault or understanding what micro and macro seismicity was all about. Here we have ended up with an extremely time-consuming and protracted licensing process.

Another item of specific note are the difficulties that have been associated with the operating basis earthquake definition and requirements. The current regulation has in effect three definitions of the operating basis earthquake, and these have been in a number of cases conflicting definitions.

Another note here is that we have both the operating basis earthquake and the safe shutdown earthquake ground motions that are used for design. It has occurred in a number of cases where the operating basis earthquake has controlled factors in the design process. We found that that is not appropriate.

Another requirement associated with the operating basis earthquake is that if the operating basis earthquake is exceeded, if the ground motion is exceeded at the power plant, the plant is required to shut down. It had been the staff interpretation for a long time that this was a decision that was made by the licensee, but there had been a

. 13

legal determination that this was not actually the case and that if an operating basis earthquake happens today it is incumbent upon the staff to require the utility to shut down. There is no guidance at this stage on exactly what exceedance means, and this has led to difficulty in a number of cases with small nearby earthquakes producing apparently large accelerations that in fact were non-damaging accelerations.

[Slide.]

MR. MURPHY: On viewgraph 8 we look at the objectives of the proposed revision. To a large extent these mirror the reasons why we undertook the revision.

The first one was the decoupling of the siting requirements from the design and engineering requirements. This was initially undertaken to facilitate Part 52 applications. For the seismic case we have been able to decouple the siting from the engineering requirements. The siting requirements are contained within the new section

100.23 and the engineering requirements are in Appendix S of Part 50.

We have also moved the detailed guidance from the regulation to a series of reg. guides so that this guidance would be available and it would actually be guidance rather than additional requirements.

We have updated the technical requirements in the

. 14

regulation to reflect the knowledge gained in the last 20 year or 25 years or better. Again, for the earth sciences this has principally been the introduction of the option to use probabilistic seismic hazard analysis techniques.

We have redefined the operating basis earthquake and are providing guidance on restart after an OBE triggered shutdown. We are also providing guidance on what is an OBE and when exceedance has occurred.

[Slide.]

MR. MURPHY: This viewgraph highlights the requirements that are proposed to be in the regulation for geological siting criteria. The current regulation amounts to approximately eight pages in the Code of Federal Regulations. The new streamlined section 100.23 is now about a column or a half a page in that document.

We have maintained the four items that we felt were specifically critical to the requirements. That is the requirement for investigation of the geological, seismological and geotechnical characteristics of the site, guidance on how these investigations to be carried out are included within the reg. guide 1.165.

We have provided guidance on determining the safe shutdown earthquake ground motion. Another significant point there is that we have provided guidance on carrying out the required uncertainty analysis with making this

. 15

determination.

We have maintained a requirement to investigate the potential for surface deformation and for the occurrence of seismically induced floods or water waves. So indeed we have taken a fairly cumbersome and detailed document and reduced the requirements in the regulation itself to a very streamlined document.

[Slide.]

MR. MURPHY: The next viewgraph touches on the earthquake engineering aspects of this revision. Very definitely, the most important thing that we have done in this revision is to redefine the operating basis earthquake. In redefining this one we have provided an option to any applicant.

The first is that if the applicant chooses to have the OBE equal to or less than 1/3 of the SSE, there is no explicit requirement for design or response analysis. This alleviates a considerable burden on the applicant.

If the applicant chooses to have an operating basis earthquake larger than 1/3 of the SSE, they are required to in effect go through the same analysis that is on the books today. An applicant might choose to have an operating basis earthquake larger than 1/3 for economic reasons, to balance the cost of potentially having to shut down if an operating basis earthquake occurs versus the

. 16

up-front costs of carrying out the OBE analysis according to the various codes.

The next item within the earthquake engineering aspects is that we have now taken care of the lack of guidance that has been out there for determining whether or not an OBE has been exceeded and what the plant operator has to do in shutting down the facility, and then providing guidance on what has to be done after the facility has been shut down to bring it back on line.

The two documents that provide this guidance are endorsements of documents prepared by the Electric Power Research Institute.

[Slide.]

MR. MURPHY: The last page in my viewgraphs, number 11, is a list of the regulatory guidance that we are providing to go along with this new regulation.

The first one is a fairly comprehensive document that tells how to carry out the required geological and seismological investigations and then how to proceed with the determination of the safe shutdown earthquake and how, if the applicant selects to go this route, to use the probabilistic techniques to track the uncertainty that has been involved in determining the safe shutdown earthquake

ground motion.

The next document is a revision of the Standard

. 17

Review Plan Section 2.5.2, which outlines, as it says here, the staff duties in carrying out a review, including use of the probabilistic procedures.

The next two standard review plan sections, as it says here, have conformable changes.

The next regulatory guide is a revision of an existing guide that tells the applicant about what kind of seismic instrumentation we expect to be at the plant.

The next two reg. guides are the ones I referred to just a while ago about the plant shutdown procedures for exceeding the OBE and then the plant restart facilities.

If there are no questions, I will turn it back.

CHAIRMAN JACKSON: There are questions. I want to be sure that the Commission understands what is to be in the reg. guides versus in revisions to the regulation. I am going to ask you about some areas that I am interested in.

The definitions of very densely populated and low population density, where are they? Are they in the rule or are they in the reg. guides?

MR. MURPHY: I would defer that question to Len Soffer. We do not address them in the seismic portions.

MR. SOFFER: We are getting into the radiological aspects, Madam Chairman.

CHAIRMAN JACKSON: If you want me to wait, then I'll wait.

. 18

Let's talk about the safe shutdown earthquake. You kind of talked about the guidance is primarily probabilistic. Can you be a little more explicit?

MR. MURPHY: Yes, I can. What we have suggested through the regulatory guide is that the applicant carry out probabilistic seismic hazard analysis. What this in effect means to start with is that the applicant has a choice of using the EPRI or the Livermore techniques for carrying out an analysis. Those techniques are acceptable at this stage because the staff has already examined the databases and the computer codes that are used for those techniques.

If the applicant chooses, they can go and use in effect their own probabilistic analysis techniques. The only requirement would be that they would have to be reviewed by the staff before the results would be accepted.

CHAIRMAN JACKSON: How do they migrate from the use of EPRI and Livermore techniques to the actual selection of a safe shutdown earthquake?

MR. MURPHY: Let's step through the Livermore process, and it would be very similar to the EPRI process. Basically, they make the calculations and then carry out a thing we call de-aggregation, which is to find out what rings or annuli around a site with different magnitude for each ring, how much contribution they make to the ground motion at the site or to the seismic hazard at the site.

. 19

The applicant may carry out a set of calculations looking at the contribution from an annulus that is from 25 to 30 kilometers from the site with magnitudes from 5 to 5-1/2 and then from 5-1/2 to 6 and look at the contributions that these would then make to the ground motion at the site, hazard at the site.

On this basis the applicant will in effect graph or plot this information, some of it in a computer format, so that they are able to tell what earthquake would control the ground motion at the site. This would then be equivalent to the magnitude and distance pairs that we in effect use currently. The significant contribution, the ground motion for a particular site may come from a magnitude 5.3 earthquake at about 25 kilometers from the site.

The applicant then would use this information to develop and scale a spectra that would describe the ground motion, and this spectra would be the spectra that would be used to judge whether or not the design spectra for the facility was enveloped by this probabilistically determined spectra. In effect, if it passes, the design spectra that went along with the plant would be acceptable.

CHAIRMAN JACKSON: I'm not particularly familiar with these techniques, but the techniques to which you refer, they have included in them some kind of uncertainty

. 20

analysis that helps to provide the envelope that then propagates back into the design criteria?

MR. MURPHY: That's correct. The probabilistic techniques provide a vehicle for carrying the uncertainties about the various parameters on through the process so that we can put bounds on the magnitude and distance pairs that we achieve and also the bounds on the spectra that are used to check the design spectra.

CHAIRMAN JACKSON: In doing that bounding, are there confidence intervals that we specify or that would be specified?

MR. MURPHY: There would be confidence bounds that would come out of the analysis, that would go along as part of the analysis.

CHAIRMAN JACKSON: But we don't have any that we say are required?

MR. MURPHY: No, we do not.

CHAIRMAN JACKSON: Given whatever those confidence intervals are, the design in the end has to accommodate that; is that the point?

MR. MURPHY: That's correct.

MR. SPEIS: Chairman Jackson, on the SECY paper we briefly summarize the seven steps that we go through. If you and the Commissioners want to hear more about it, we can go through these.

. 21

CHAIRMAN JACKSON: Dr. Murphy has answered my questioned.

MR. SPEIS: We knew that was an important part of this and we tried to highlight it in pages 8 and 9 of the SECY paper.

CHAIRMAN JACKSON: Thank you. Why don't you go on. I'm probably going to come back to you on some of this later, but I want to hear the full story.

MR. SOFFER: Thank you.

Viewgraph 13, please.

[Slide.]

MR. SOFFER: I would like to briefly describe the experience that we have in reactor siting in this country and the role of reactor siting.

Virtually every power reactor in the United States has been sited using Part 100. The construction permit for Big Rock Point was granted before Part 100 was promulgated. However, the operating license was issued after Part 100.

At the present time there are 110 operating reactors in the United States on 69 sites. There are about 2,000 reactor years of U.S. operating experience. However, this doesn't constitute the entire base of our experience on reactor siting.

It's important to recognize there have been about an additional 20 reactor sites approved but where there are

. 22

presently no operating reactors, where operating reactors have been decommissioned or shut down. There are about ten sites that were reviewed but were not approved for a variety of reasons, some of them seismic, some of them population considerations, a number of other considerations. Even this does not represent the entire base, because there are a number of sites that I haven't quantified here where the review process was ongoing when the review terminated and consequently there was no decision.

Consequently, we have to recognize that there is very substantial basic siting experience that exists in the United States and numerous risk studies that have taken place since Part 100 was issued. These all indicate to us that the primary factors that influence public health and safety are reactor design, construction and operation.

Nevertheless, the siting factors are important for assuring, along with reactor design, that radiological doses from normal operation as well as postulated accidents would be acceptably low, that natural phenomena and potential man-related hazards in the site vicinity are described and are appropriately accounted for in the plant design, that the site characteristics are amenable to developing emergency plans and adequate security plans, and finally, to maintain the Commission's policy of siting reactors away from densely populated centers.

. 23

If I can go on the next viewgraph.

[Slide.]

MR. SOFFER: Part 100 has a number of important aspects, and it is important to recognize those.

First of all, it functions as a siting rule. It determines the important site parameters that are in the rule itself: The distance to the exclusion area boundary,

the low population zone outer radius and the population center distance that provide acceptable separation distances between the plant and various members of the public.

In addition to its acting as a siting rule, it is important to recognize that it also serves as an important performance measure of the accident mitigation capability of the plant. It sets the requirements for things like containment leak rate, for the performance measure of fission product systems; it serves in a way as the radiological challenge for control room habitability for the operators, and a number of other important areas.

It also serves as one test of adequate protection of the public for a postulated degraded core accident and fission product release into containment as long as containment remains intact. It is important to recognize that before the Commission's safety goal Part 100 in a sense was one of the measures of adequate protection of the public by virtue of the fact that a postulated accident was

. 24

postulated and evaluated considering the site as well as the plant design.

It is also important to recognize those things that Part 100 doesn't do. It does not determine the containment design. This is done by the pressure and temperature conditions of either the loss of coolant accident or the steam line break accident, whichever one is more limiting. So the pressure and temperature conditions associated with a severe accident, as was mentioned by Dr. Speis, are not considered in determining the containment design.

It does not control severe accident risk. That risk is dominated by core melt accidents where containment fails or is bypassed, but neither does Part 100 totally deal with design basis accidents. It does reflect consideration of severe accidents by virtue of the population center distance criteria.

It has been very clear from the statement of considerations going back over 30 years that the population center distance criteria was added as a reflection of accidents that could occur beyond the design basis accidents that were contemplated at the time. This has been one of the reasons why the staff has continued to issue population guidance in the form of regulatory guides and kept this aspect in the forefront.

. 25

It also reflects consideration of severe accidents in the nature of the postulated fission product release. It is intended, as the regulation says, to represent a substantial core meltdown with appreciable release of fission products. Originally this was given in an accompanying document, TID 14844, that was issued along with the rule, and as our knowledge of severe accidents has improved over the years we are supplementing this with a revised accident source term formulation as well.

CHAIRMAN JACKSON: Before you go on, let me ask you this question and clarify something. You say that Part 100 does not determine containment design and the fact that pressure/temperature conditions of a LOCA or steam line break determine that, but your second bullet says that it de facto determines containment performance, because you are saying it does set requirements for containment leak rate; is that correct?

MR. SOFFER: That's right. It does set requirements for allowable containment leak rate. That is correct.

CHAIRMAN JACKSON: So while it does not specify containment design, it de facto specifies containment parameters?

MR. SOFFER: Yes.

CHAIRMAN JACKSON: I will come back to this with

. 26

another question. Thank you.

MR. SOFFER: Let's go on to viewgraph 15.

[Slide.]

MR. SOFFER: The reasons for revising part 100 are, first, to facilitate along with the issuance of Part 52 its use of standardized design and early site permits, as we mentioned earlier.

Second, there was a recognition that the dose calculation was in effect regulating plant design in some ways more than siting in terms of regulating allowable containment leak rate, as we just mentioned, fission product cleanup system performance such as sprays and filters,

isolation valve timing, drawdown time on a secondary containment annulus. All of these things were being influenced and strongly determined by the nature of the Part 100 calculation.

We also wanted to revise Part 100 to incorporate some of the changes in siting practice and to allow for updated accident source terms, to make explicit the Commission's policy of requiring plants to be away from densely populated centers; to make explicit the fact that the staff has evaluated man-related hazards in the site vicinity, and yet this is not explicitly mentioned in Part 100; to require that sites be amenable to the development of adequate security plans and emergency plans; and to update

. 27

the dose criterion to be more in accord with modern radiation protection practices and to be amendable with the development of a revised accident source term.

In addition, as Dr. Murphy mentioned, there were significant advances made in seismic analysis and earthquake engineering. Basically this effort was initiated about 1990 with a staff recommendation to decouple siting from design.

[Slide.]

MR. SOFFER: This brought us to this first proposed revision that was issued in 1992. In this revision there was a genuine effort at decoupling. There were no dose calculations proposed for siting. There were numerical criteria for the exclusionary boundary size and there were numerical criteria on population density that were included and specified in the rule itself.

Subpart A would apply to current plants and Subpart B would apply to future plants. There were no proposed changes made for current plants.

This proposed revision elicited some very, very strong comments from a number of people, the major comment of which was that almost everyone -- in fact, I should say everyone did not favor the idea of eliminating dose calculations for siting purposes.

Generally speaking, industry felt that this provided a flexible performance-based measure and they

. 28

wanted to see it retained.

The public interest groups felt that it provided a valuable piece of insight and risk knowledge and felt that this should be retained by the Commission in its criteria.

In addition, a number of people felt that the rule itself was too prescriptive, that it was highly conservative, and that the incorporation of fixed numerical criteria in the rule was incompatible with the concerns of many in the international community. As a result, with consultation with the Commission at that time, the rule was withdrawn in March of 1994.

The second proposed revision was issued in October of 1994, and source term and dose criteria were relocated to Part 50.34 and retained for siting.

We proposed a new section 100.21, which would contain basic non-seismic criteria but without numeric values.

Numerical values for population density are in proposed Regulatory Guide 4.7.

And the dose criterion was changed from 25 rem whole body and 300 rem thyroid to 25 rem total effective dose equivalent, TEDE, and evaluated over any two-hour period.

[Slide.]

MR. SOFFER: Going on to the next viewgraph, I

. 29

want to give you some of the highlights of the public comments. The more detailed discussion of the highlights was provided to the Commission in a memorandum from Mr. Taylor sometime ago.

The industry comments were generally favorable but there were significant concerns in a number of areas. All of the industry felt that the use of TEDE was an appropriate measure but there was concern that the dose criterion of 25 rem was more restrictive than the current criteria, although there was one comment that it was appropriate.

In the industry comments, there was no need felt for an organ capping dose or a separate organ dose.

And there was also a belief that the use of any two-hour period to evaluate the dose was confusing and illogical and introduced some inconsistencies.

The one public interest group that did comment found the rule generally unfavorable, believed that it was a

significant retreat from decoupling, considered the use of TEDE acceptable and 25 rem appropriate, but believed that there should be a dose to any single organ, but no comment on the dose evaluation period itself.

CHAIRMAN JACKSON: Let me stop you there. I note that you are moving the dose criteria to Part 50 for future applicants, but it has been stated that the dose criteria are used not only for reactor siting but to assess whether

. 30

the plant continues to meet its design basis. How do you handle that dichotomy in terms of the use of the criteria and whether or not it should be highlighted at least in some descriptive way in regulations for operating reactors?

MR. MIRAGLIA: The intent of the final rule is to apply for only future designs.

CHAIRMAN JACKSON: I appreciate that. What I am saying is, if it is currently being used to assess whether currently operating reactors continue to meet their design bases, then de facto are you not using them for operating reactors?

MR. MIRAGLIA: Our current plan with respect to the application of the new source term insights for operating reactors is that we are working with the industry. The industry has proposed a framework for examining how this new source term would be used for operating reactors.

As a way of background, the siting rule in Part 100 and our evaluation of plants that are currently operating are based upon design-basis accidents that go back long term into the regulations in our regulatory history. That requires a very stylized analysis of these kinds of accidents.

Because there were large uncertainties at the time, the application of these stylized analyses had lots of conservatisms in terms of release of material into

. 31

containment and how they were evaluated.

What we have done, consistent with the two phases that Dr. Speis indicated, is to do an integrated review of these changes of source term for the new designs. We have done that substantially and it is completed for the ABWR and the System 80+ in that we have examined that design against required design-basis accidents.

We have analyzed the severe accident considerations and insights against that design, which is a robust design because of the conservatisms in that process and superimposed those to say that the margins that we are providing by the design-basis accidents are also sufficient to consider severe accident considerations and accident management. So it has been an integrated package for those two designs.

That is an ongoing effort with respect to the AP-600, the passive design, and the application of these same kinds of concepts to operating reactors needs that kind of integegrated approach: if we back off from certain conservatism margins, what impact does it have in terms of measuring the overall effectiveness of the design?

CHAIRMAN JACKSON: Apparently you already have some applications from licensees who want to utilize the new source term.

MR. MIRAGLIA: What we have done with those, Madam

. 32

Chairman, is we have expressed this concern of doing an integrated review to fully understand it. As a result, NEI has proposed a framework for piloting certain of these potential uses so that we could take a look at what pieces can we deal with, what is important for them on a priority basis from an industry perspective, what pieces of those source term changes the staff feels are firmly based on science that we understand what the impact would be that we could move at perhaps a faster pace, to evaluate that, come to the Commission in the fall and say here is our plan for implementing these changes for current reactors in an integrated kind of sense. That's the current plan.

CHAIRMAN JACKSON: Would this be in any sense taking you down a path of granting exemptions relative to operating reactors whose licensees want to make use of the new source term?

MR. MIRAGLIA: Since we haven't completed all of that review, I think one of the products that we would like to produce is what kind of changes would that be. Would it be change in guidance only? It may have to be changes in rules as well.

That is one of the things that we would try to

look at and propose to the Commission in this integrated set of how we are going to look at the pilots, what do they suggest in terms of what is the appropriate regulatory
. 33
vehicles to move forward.

We didn't want to do it on a piecemeal basis for an individual plant because of what are the implications, the full plethora of regulatory implications such as exemptions, change in guidance, generic letters, or whatever the case may be.

CHAIRMAN JACKSON: With the plan that you have in mind or that you are going to be proposing, other than the pilots, you would not be contemplating changes for existing operating reactors until you have worked out the whole plethora of the implications; is that correct?

MR. MIRAGLIA: That's correct. I think there have been some instances where we have done some changes in terms of timing which are clearly consistent with previous Commission guidance that any changes we make need to be well founded on the technology and the research that supports the source term pieces, but to make major modifications and changes to that, we would come forward with a plan to say here's how we are going to work with the industry.

CHAIRMAN JACKSON: When you say changes, do you mean exemptions or do you mean changes in framework?

MR. MIRAGLIA: I think what we are looking at is modifications to the regulatory framework.

CHAIRMAN JACKSON: Let me go back to Mr. Soffer. Has there been resolution of this difference of opinion
. 34
between NRR and Research with respect to the "any" versus the first two-hour time frame?

MR. SOFFER: I will defer to Dr. Speis.

MR. SPEIS: I would say yes. The staff position as presented in the SECY paper is that we will go forward and recommend to the Commission any two hours.

I think the views were very clear. They were expressed and clarified. Both of them lead to a safe design. Our position dealt mostly with the issue of risk versus design basis.

CHAIRMAN JACKSON: And "any" addresses risk?

MR. SPEIS: Yes. I think it was helpful to all of us to put some of those things on the table. The Commission has all the information. We will be happy whichever direction the Commission decides to go.

MR. TAYLOR: Although we recommend "any."

[Laughter.]

MR. MIRAGLIA: I think Dr. Speis has accurately characterized it. One is a risk; the other is design basis. Since there is this design basis attribute left in the rule in terms of the efficacy of the design, the worst would be conservative.

CHAIRMAN JACKSON: So your unified position is any; is that what you are telling us?

MR. TAYLOR: Yes.
. 35
MR. SPEIS: Yes.

CHAIRMAN JACKSON: It's important that you come to some overall concurrence that makes sense as reflected in the SECY paper, because you are asking the Commission to make a decision based on that particular recommendation, and it has implications relative to things such as emergency planning, et cetera, and so it is very important that you have clarified any issues here. This is your opportunity if there is any additional clarification that needs to be made.

MR. MIRAGLIA: No.

CHAIRMAN JACKSON: Let me ask you about the 25 rem total effective dose equivalent. There was an ACRS letter that recommended that a careful definition of the TEDE limits that are mindful of organ dose weighting factors should be -- and some of this was referred to in some of the public comments -- included in the final rule. The question would be, is it clear that you recommend this particular dose limit based on latent cancer fatality risk?

MR. SOFFER: Yes. We are recommending this based on latent cancer fatality risk. We believe that this is consistent with other Commission regulations in this regard.

The industry raised a point of apparent contradiction in the sense of a conversion of 25 rem whole body and 300 rem thyroid to a latent cancer fatality risk. The staff computed that that would be approximately
. 36
equivalent to 27 rem, which we then rounded down,

admittedly, and said that was pretty near equivalent to 25 rem.

However, there are organ weighting factors in Part 20 which would make the 25 rem whole body and 300 rem thyroid equivalent to 34, that is, the thyroid weighting factor is 0.03. So 25 times one plus 300 times .03 would give you 34. And the industry felt that there was a certain amount of unfairness in this where one equivalency came to 27 and yet they were being asked to hold to 34.

There is a certain amount of inconsistency in this. The organ weighting factors in Part 20, we have discovered, are not entirely due to latent cancer fatality; they include additional factors as well.

However, we do not feel that this is a more restrictive criterion because the thyroid criterion has always been the limiting criterion in licensing. The highest dose that I can recall to which we have licensed a plant was approximately 10 rem whole body and very close to 300 rem thyroid. When one equates this in a TEDE dose, this comes out to approximately 19 rem. So the use of 25 rem TEDE and converting the thyroid dose to a TEDE equivalent is, practically speaking, a slight relaxation.

CHAIRMAN JACKSON: In effect it is a slight relaxation relative to the potential thyroid dose; is that

correct?

MR. SOFFER: Yes, it is.

MR. MIRAGLIA: That's the rate for plants we have examined to date.

MR. SOFFER: Although in theory it can be argued that it is a restriction, in fact the thyroid dose has been the more limiting and it acts practically as a slight relaxation. Nonetheless, we feel that 25 rem is the appropriate dose criterion, and that is what the staff is recommending.

CHAIRMAN JACKSON: Thank you.

MR. SOFFER: If we can go on to number 18.

[Slide.]

MR. SOFFER: I would like to discuss some of the elements of the draft final rule. We are proposing to incorporate basic reactor site criteria in a new section, 100.21. I will just go over these very briefly.

Site atmospheric dispersion characteristics must be such that doses for normal operation would be met and the consequences of postulated accidents would meet the dose criteria that are given in section 50.34.

Second, that potential hazards associated with physical characteristics of the site as well as man-related or human-related activities nearby must be shown to pose no undue risk to any plant that would be located on that site.

The site characteristics must be such that adequate security plans and measures can be developed and adequate emergency plans can be developed.

And finally, that reactor sites should be located away from very densely populated centers, that low density areas are preferred, and that other sites may be acceptable.

CHAIRMAN JACKSON: Let me reinstate my earlier question. Where are the definitions of these terms?

MR. SOFFER: If we can go to the next viewgraph, we will get there.

[Slide.]

MR. SOFFER: The proposed population criteria are in proposed revision of Regulatory Guide 4.7. I would like to say that, first of all, these reflect some consideration of severe accidents as well as reflecting conditions that are reflective of U.S. geography and demography.

What we are saying is that sites where the population density does not exceed 500 persons per square mile out at any distance out to 20 miles, that is, circular area out to 20 miles, are preferred sites.

The guide also states that reactors should not be located where the population density is well in excess of this above value.

Population projections are to be considered for about five years from initial site approval and the

transient population is to be factored in.

Population growth after site approval is expected, but changes should be factored into the site emergency plans.

As you will see, and I hope I am answering your question, the guide does not directly address the question

of what is a densely populated site; it rather addresses the question by saying a population density below 500 people per square mile is a preferred site and that sites above this may be approved, depending upon safety or environmental considerations, but sites should not be located in areas that are well above this value.

It is interesting to recognize that the criterion of 500 people per square mile in effect does represent some kind of a standoff distance from cities of significant size.

For example, a population center of about 100,000 people in practical terms cannot be located closer than ten miles because anything significantly closer than that would get you above 500 people per square mile. Similarly, a major metropolitan center of about a half a million or more in practical terms would have to be at least 20 miles away. These are the kind of standoff distances that the regulatory guide basically sets in terms of preferred distances, but it does not directly address the question of what is a densely populated area.

. 40

In part this is due to the fact that from demographic considerations it is very difficult to define densely populated areas in terms of density. Cities vary all over the place in terms of population density.

For example, cities in the Northeast tend to be rather high in population density. The District of Columbia, for example, has a population density of almost 10,000 people per square mile. Manhattan has a population density of over 50,000 people per square mile. On the other hand, Los Angeles has a population density that is just a little over 2,000 people per square mile.

So trying to define a densely populated center in terms of density has often not worked out very well, and the guide does it in a much better way, in my opinion, by describing the total number of people within a fixed distance to the plant so that it tends to count all of the people and gets around some of the obvious difficulties of looking at political boundaries and subdivisions and suburbs. So I think this is a better way of doing it.

CHAIRMAN JACKSON: But even that is not totally disqualifying.

MR. SOFFER: Even that does not totally disqualify it. That is correct.

CHAIRMAN JACKSON: Let me ask you one other question. How is emergency planning actually to be factored

. 41

into site evaluation? In particular, I am thinking about the Commission's Seabrook decision that said that emergency planning is not site disqualifying. Is this going to overrule that decision or conflict with it?

MR. MIRAGLIA: I don't believe so. I think the emergency plans are looked at as another measure of defense in depth beyond the regulations in terms of safety. The defense in depth is the design, the siting of the facility, meeting the safety goals. The emergency plan is another aspect of defense in depth.

CHAIRMAN JACKSON: Would you provide the Commission with an explicit answer to that question.

MR. MIRAGLIA: Sure.

MR. SPEIS: Yes.

CHAIRMAN JACKSON: The other question I have is, how is the major accident for site evaluation purposes chosen?

MR. SOFFER: I'm sorry.

CHAIRMAN JACKSON: When you are doing site evaluations as opposed to design evaluations, how do you choose or decide what a major accident is?

MR. SOFFER: The major accident is essentially the same for both. It is a large fission product release into containment. The current licensing basis was essentially the source term formulation that was given in TID 14844.

. 42

For new plants we would probably propose using the revised source term, which is an amalgam of severe accident evolutions based on current plant understanding. But they are basically the same. They represent a significant degraded core accident, and the fission product release in that bounds what was released into containment from Three Mile Island, for example.

CHAIRMAN JACKSON: Okay.

MR. SOFFER: If we can go to viewgraph number 20.

[Slide.]

MR. SOFFER: There are a number of risk insights

that were developed as part of our thinking in developing of this rule. I would like to mention several of them.

The staff investigated how the size of the exclusion area would comport with meeting the Commission's safety goal. We examined this using risk insights from the NUREG-1150 plants.

It was determined that the prompt fatality quantitative health objective, the QHO of the safety goal, was met for all exclusion area boundary sizes of about 0.1 mile or greater. We did not look at any exclusion area boundary sizes smaller than 0.1 mile. So for all the sizes that we looked at from 0.1 mile or greater the prompt fatality QHO was met.

The latent cancer fatality quantitative health

. 43

objective was also very easily met.

It is important to note that this size, 0.1 mile, encompasses all of our current operating plants and all of the sites that have been reviewed and approved by the staff.

Another important insight that comes out of this is that the staff investigated the individual risk of permanent relocation as a result of land contamination.

Using the insights from NUREG-1150, a severe accident release was examined that was characteristic of our present operating plants, and it was found that the risk of permanently relocating an individual was low at all distances, that it was less than about ten to the minus six per year. This is a reflection of the low frequency of such an event. And that this risk itself declined significantly beyond about 20 miles. This is a reflection of the effect that distance and wind direction have on mitigating such a severe event.

Consequently this distance of 20 miles has been factored into and considered in our revision of Regulatory Guide 4.7, and this is why I said Reg. Guide 4.7 represents not only the demographic considerations of the United States but also represents and reflects some consideration of severe accidents as well.

[Slide.]

MR. SOFFER: This is just finishing up the draft

. 44

final rules. I believe most of these have been mentioned and I don't want to go into great detail.

As has been mentioned, the source term and dose criteria for future plants have been relocated to Part 50.34.

It is also important to recognize that we have left the licensing basis for current plants alone in Subpart A of Part 100. So the dose criteria really appear in two places.

Subpart A of Part 100 still contains 25 rem and 300 rem thyroid for current plants and does not change the current licensing basis for those plants

Subpart B, which is applicable for future plants, moves the dose criteria to Part 50.34 and changes it to 25 rem total effective dose equivalent, and that the dose to an individual is not to exceed that value for any two-hour period at the exclusion area boundary or for the course of the accident at the low population zone.

I would also like to mention in conclusion that both the Advisory Committee on Reactor Safeguards as well as our management review group, the Committee to Review Generic Requirements were briefed. ACRS recommended issuance of the rule and CRGR indicated that it had no objection to issuance.

The additional view by Research has been discussed

. 45

already. So unless there are any more questions, that concludes my presentation.

CHAIRMAN JACKSON: Commissioner Rogers, do you have anything?

COMMISSIONER ROGERS: Just a couple. Did you get any comments from the international community on the new version of the rule?

MR. SOFFER: Only indirectly. We received a comment from one law firm that has a number of international clients, and they were rather favorable and believe that this revision addressed most of their concerns.

COMMISSIONER ROGERS: That is good. We did hear a lot about the first version and it apparently did give some serious concerns elsewhere in the world.

You referred on slide 20 to your investigation of the safety goal versus the size of the exclusion area. How

available will those studies be?

MR. SOFFER: The study is a NUREG that is in draft form and is presently undergoing a final review by the staff. We should be issuing it fairly soon, I believe.

CHAIRMAN JACKSON: I think that also would be very interesting to the international community. The fact that you have come down to a tenth of a mile would probably give considerable comfort to some of the people that were very concerned about the earlier version of the rule.

That's all I have.

CHAIRMAN JACKSON: Commissioner Discus.

COMMISSIONER DICUS: On slide 19, I was curious about how many of the current sites would meet this population density preference.

MR. SOFFER: You mean the preferred number of 500 people per square mile?

COMMISSIONER DICUS: Yes.

MR. SOFFER: There are currently about six or seven sites that are above 500 people per square mile. These were all reviewed and approved before the current version of Reg. Guide 4.7 was issued in 1975. The three highest population density sites, of course, are Indian Point, Limerick and Zion, but there are a few others. I don't remember all of them by name, but I can get that information if you wish.

MR. SPEIS: I would like to add something to that point that is very important. These are the sites that the previous Commission ordered special restudies specific to Indian Point and Limerick and Zion.

CHAIRMAN JACKSON: If you look at the safety goal versus the exclusion area, they are bounded by that.

MR. SPEIS: Yes.

MR. SOFFER: Yes.

MR. SPEIS: In some cases changes were made to the

design to enhance it and make it more robust for severe accident challenges.

MR. MIRAGLIA: As Dr. Speis has indicated, specific PRA reviews were done on those three facilities that were mentioned.

CHAIRMAN JACKSON: This is a question I am not sure you can answer, but you did speak of your 30 years of license experience.

MR. MIRAGLIA: The Chairman is looking at me.

[Laughter.]

CHAIRMAN JACKSON: Mr. Taylor was looking down.

[Laughter.]

CHAIRMAN JACKSON: Is there any area that you think is particularly litigious?

MR. MIRAGLIA: In terms of the old plants, we just want to be cautious and make sure that we fully understand the ramification of any changes. In terms of the new plants, those processes have been open to the public and those issues have been considered in the context of the two design certifications and are ongoing for the AP-600.

CHAIRMAN JACKSON: I would like to thank you very much for briefing the Commission. You have presented to us a lot of information today that shows how much work you have done to improve these regulations and to lay the groundwork for future siting applications.

This is just a reiteration of an earlier point, but I know you have placed the dose criteria in Part 50 for future applicants, and that is appropriate, but particularly with respect to the new source term tackling this issue for operating plants remains open. As in some sense the ACRS has said, we have been using the Part 100 dose criteria as a surrogate for estimating certain of the consequences of design basis accidents.

The Commission looks forward to the work that you have outlined, Mr. Miraglia, and we would like you to come back to the Commission for guidance as you proceed, also to not proceed down a path where you are doing de facto exemptions. I think the pilots will help you address a lot of the issues.

Having said that, I think we would just urge you to continue to work on the open issues so that the rule is clear in how we apply it. I think the various reg. guides should be ready and promulgated as close to the rule, assuming we approve it, as possible, and that the rule can accommodate future applications where appropriate.

I do believe that the improvements in the seismic

area are comprehensive and allow a clearer assessment of the issues. Very important and something that all of us are concerned about is that our regulations stay abreast of advances in the science, but it is also important that the

clarifications of the type presented today, for instance, clearly differentiating between safe shutdown earthquakes and operating basis earthquakes, are addressed in a timely manner.

I think we understand the rationale for moving to the use of the TEDE, but I think we should continue to study the issue of the organ dose weighting factors as used in Part 20 and evaluate whether their use may be warranted across the board for consistency.

Other than asking you for the specific answer to the question with respect to how emergency planning is treated and the fact that it is not site disqualifying a la the Commission's earlier Seabrook decision is an important answer you should provide to the Commission.

Are there any further comments from fellow Commissioners?

[No response.]

CHAIRMAN JACKSON: We are adjourned.

[Whereupon, at 4:15 p.m., the briefing was adjourned.]