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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

July 21, 2004

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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152ND MEETING

ADVISORY COMMITTEE ON NUCLEAR WASTE

(ACNW)

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WEDNESDAY, JULY 21, 2004

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ROCKVILLE, MARYLAND

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The Advisory Committee met at 1:00 p.m. at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, B. John Garrick, Chairman, presiding.

COMMITTEE MEMBERS:

B. JOHN GARRICK Chairman

MICHAEL T. RYAN

Vice Chairman

ALLEN G. CROFF Member

GEORGE M. HORNBERGER

Member

RUTH F. WEINER

Member

JAMES CLARKE	Consultant
BRUCE MARSH	Consultant

ACNW STAFF PRESENT:

JOHN T. LARKINS, Executive Director

NEIL COLEMAN

LATIF HAMDAN

HOWARD J. LARSON, Special Assistant

MICHAEL LEE

RICHARD K. MAJOR, Staff

SHARON STEELE

NRC STAFF PRESENT:

DONALD COOL, Senior Advisor, Health Physics Issues, Office of Nuclear Materials Safety and Safeguards

YAWAR FARAZ, Project Manager, USEC

TIM JOHNSON, NMSS

I-N-D-E-X

P R O C E E D I N G S

12:59 p.m.

CHAIRMAN GARRICK: Good afternoon, our meeting will come to order.

This afternoon, we're going to hear from Sharon Steele in spite of what it said on the program yesterday or whatever. And Sharon is going to talk to us about the integrated safety assessment business. She's going to give us a background briefing.

Sharon?

MS. STEELE: Thank you.

My name is Sharon Steel. I'm on rotation to the ACRS/ACNW, previously with Fuel Cycle and NMSS. And my introduction to integrated safety analysis and Part 70 in particular, came about through my review of the MOX Fuel Cycle facility. I've also had limited involvement in the ISC review of other fuel cycle facilities.

The presentation today is threefold. I would like to give background information, as Dr. Garrick said, on the new Subpart H requirement.

I also have an example of an ISA submittal that was made recently. And I'll share some recent developments in the ISA world for fuel

cycle.

Well, when this slide was developed, it was a new rule. Subpart H was developed in September of 2000. New staff guidance had been identified and basically they were NUREG-1520. I should say new staff guidance was developed, which was the standard review plan for the license application.

Also NUREG-1513 has guidance on integrated safety analysis methodologies. But I also want to point out that there are other applicable guidance. NUREG-6410, which tells the applicant or the licensee how to perform quantitative methods for determining consequences.

The rule requires that by October of this year, that the licensees complete their site-wide integrated safety analyses and that they correct all unacceptable performance deficiencies that they identified through the ISA. And they also need to submit their site-wide ISA Summary for the NRC approval.

And Subpart H applies specifically to nuclear fuel fabrication facilities and any new enrichment facilities that will be coming in for -- with their applications.

The Part 70, Subpart H, regulatory concept has three major elements, performance requirements, items relied on for safety, and management measures. The focus of Subpart H is the integrated safety analysis. And the applicant is required to identify accident sequences and determine their likelihoods and estimate consequences.

They do so in an integrated fashion by using or convening a group of various safety disciplines and they comply with the -- they help to assure compliance with the performance requirements which I'll get to in a second and identify the items relied on for safety to prevent or mitigate accident sequences and establish management measures that would ensure that the IROFS are available and reliable.

As I said, here are the performance requirements. This slide is really talking about accident sequences that are determined to be of high consequences.

And high consequences accidents sequences must be made highly unlikely according to the rule. And the high consequence accident is one where the worker receives greater than 100 rem or

some life-endangering chemical exposure. It also applies to the public. If the public receives greater than 25 rem or an irreversible chemical injury.

Next slide. And if the accident sequence is determined to be -- the accident consequence is determined to be of an intermediate result, then the applicant must show that that accident sequence is unlikely.

And in unlikely, the performance requirements is that there is between 25 and 100 rem for the worker, irreversible chemical injury. And for the public, it's greater than 5 rem but less than 25 rem. And there's also environmental guidance.

Next slide. And this slide is just a matrix to summarize or put it all together in one page. Basically, as I said, high consequence events must be demonstrated to be highly unlikely in order to fall into the acceptable range.

And medium -- well, this says medium but the terms is really intermediate consequence events must be demonstrated to be unlikely in order to be acceptable.

Next slide. One of the concerns is that

with this methodology that likelihood evaluation is n not quantitative. Well, in the guide -- and the rule does not require it to be quantitative. And in our guidance, we have some qualities that we look for if the applicant is going to use qualitative techniques and quantitative techniques to determine likelihood.

If the applicant's definitions for likelihood are qualitative, they would be found to be acceptable if -- well, first of all, that criteria must be reasonably clear and based on objective criteria. And you must be able to differentiate between a highly unlikely and an unlikely accident.

And basically you're looking at their reliability and availability qualities related to the IROFS that would be applied to those accident sequences. And so you want to assure that these measures or controls have a large -- provides for a large margin of safety, there are low failure rates associated with them.

You want to demonstrate a preference for engineered, passive controls over administrative controls. And insure that there's a high level of quality assurance.

The controls must be auditable and have surveillance measures that limit their downtime. They must demonstrate defense in depth, a high degree of redundancy, and a degree of independence diversity of the controls. And they must be able to protect against the vulnerabilities of common cause failures.

The rule also allows -- or the guidance -- the guides also allow to use a quantitative measure for likelihood. And that guide, in particular, in is NUREG-1520. In 1520, it talks about high consequence accident sequences where the -- it says that in order to be acceptable, that that accident must occur less frequently than 1 times 10 to the minus 5, for example. And if it's to be unlikely, it must occur 1 times 10 to the minus 4.

Next slide. This is what the staff generally expects from integrated safety analyses. And essentially we would like -- we think it will end up -- we'll end up with a streamlined process for licensing.

And that the licenses can actually make the facility -- would be able to make facility and procedural changes without prior approval from the NRC unless -- well, under certain conditions. And

they're listed there. You know, if the IROFS is not downgraded and so on.

However, the licensees must submit annually a summary of all such changes to the NRC. And as a result, we hope that the annual summary updates would significantly reduce the need for the scope of the renewals.

I'm going to move on to the example of an ISA submittal that we received. And this particular one is the NFS Blended Low Enrichment Uranium or the BLEU Project. And I highlighted this portion of the figure to just sort of -- to show where NFS would come in.

Just by the way of background, NFS will be receiving off-spec high enriched uranium materials. And then they will down blend it into low-enriched oxides, which will be sent to fuel fabrication facilities for further processing.

And NFS submitted applications for the BLEU Project under three different -- three major parts. There's the Uranyl Nitrate building, which will receive and store the materials.

Then the BLEU preparation facility, where it will -- the actual down blending will occur. And then there's an oxide conversion

facility. And the focus of this example is for the Uranyl Nitrate building. And because it's a new process, even though it's at an existing site, it's a new process, a new building. Therefore, an ISA must be conducted.

And here are the overall steps that -- I'm going to go through the steps or procedures that NFS use and then actually show some of the results that they came up with.

Essentially, they convened a team of 50 disciplines. And this team got together and performed a process hazard analysis. But the method they selected is called a HAZOP. And basically with the HAZOP, it's a very systematic way of selecting nodes and the processes and you use guide words to determine whether you're going to be too high in a particular area, too low, and so on.

So they performed the individual and the specific analyses to identify the hazards and the accident sequences. Then those accident sequences are evaluated to see whether they meet the performance requirements or not. And so they're binned. And that part, as I may have mentioned before, is quantitative.

And then they categorized the likelihood

of each accident sequence. And they are using the risk-index method, which is one method that was demonstrated in the guidance document, NUREG-1513.

And based on the categorization of the likelihood, they identify IROFS for each accident sequence where you may have a consequence of concern.

Go ahead. So this is where they bin the accident sequences. Once they've identified the sequences from the HAZOP, they evaluate the consequences and they bin them according to the consequences. And this looks like one of the previous slides so basically they're just getting high, intermediate and low.

And like I said, it's the risk index method so they bin them and then they assign a number to that particular binning and so on. And the -- I guess I did say the evaluation of those consequences was based on quantitative methods in NUREG-6410.

To determine the initiate and frequency, NFS proposed this indexing of assignments for the initiating event frequency.

Basically they're saying for an accident to be not creditable, that you cannot have more than

one failure per 100,000 years. So if something -- and they assign a frequency index of minus five to that. They use a frequency index of minus 4 for highly unlikely. And minus 3 for unlikely.

Okay. Each IROFS is assigned an IROFS failure index as specified in this table. And this area is definitely a qualitative criteria for likelihood. Basically they assign an index of minus 4 if you have a really robust control. And lots of management measures to ensure availability. And a zero of there is no protection.

They then calculate a total risk likelihood and categorize it. And essentially they add the initiating event frequency and the IROFS failure IROFS failure frequencies that you saw in the previous slides. And using this, it can demonstrate the relative importance of IROFS. But then they eventually use these categories in here to determine acceptability of the particular control for the accident sequence.

And this is similar to another slide you seen before. But once they've come up with the likelihood index T, here, and knowing the consequence category bin, they can determine whether that accident sequence and the sequence likelihood

pair was acceptable.

Okay. And unfortunately, the reproduction is not so great on this screen. I think it might be better in your handouts. But this is a matrix of what they did for each node where there was a consequence of concern. First -- I can't even read it -- they assigned -- okay.

For the -- in Column 2 -- and Column 1 identifies the accident sequence and the node where it occurs. And I'll just talk about the first row of information. For the initiating event frequency, they determined that there was an index of minus 3 if there was a shipper error, where unsafe uranyl nitrate was received in a particular vessel. And this accident sequence from the HAZOP that was identified as one where there was a high concentration of uranium in the tank.

As a preventive measure, they do not identify the IROFS in this particular document because it's a nonproprietary version of the ISA summary. In the version that the staff would have reviewed, we'd see the IROF. But they did show that they assigned a frequency index of one -- ten to the minus -- well, of minus 1. And they added another preventive IROFS, and that had a frequency index of

minus 2.

There's no mitigation applied to this. In fact, this is going to be a possible criticality accident. And so the objective is to prevent rather than mitigate.

They also show what the likelihood indices that they would obtain if they controlled or did not control the accident.

And the last -- well, Column 9 shows the overall risk index for the particular accident. And in this case, if it's controlled, the final number is C equals 3. And that would mean that that prevents an acceptable risk.

Next slide. And this is just more of the same. And I believe they went through several -- I don't know the total number of nodes but there were many. I think it's over 30 that were identified as consequences of concern. And they did that for all of them.

And the next slide shows what they did for natural phenomenon and external event hazards. And I forgot to mention that they not only look at process risks but they look at external events.

Some of the external events that they looked at were seismic, high winds, flooding, and

lightning, and tornadoes, and pretty much determined that they had sufficient controls and mitigating factors to prevent those accidents from resulting in exceeding the performance requirements.

This is just another part of the table showing the natural phenomenon. And this document is available in ADAMS.

In the end, NFS specified the various IROFS controls. And they selected controls based on a preference for passive over administrative. And the management controls that they specified were applied to the design, construction, operations, maintenance, change controls of the IROFS.

And they planned to or they graded the management measures commensurate with the level of risk reduction.

And based on their evaluation, the staff found that the management measures and IROFS would make the credible intermediate consequence accidents unlikely and high consequence accidents highly unlikely.

Thank you. And that's it for the particular example.

And so the next area I'm going to go into is some of the recent developments that came

about based on -- well, I'm going to talk about the status of licensing -- of ISA submittals. And then, also, some outcomes of recent workshops.

There was a workshop in September of 2003 where stakeholders identified areas that were not clear to them in the regulations or the guidance. And staff came back and developed interim staff guidance for the licensees to address those issues. All those guidance documents are draft.

And then I'll talk about the recent workshop that occurred in July to address the interim guidance and issues from the previous workshop.

And this is the status of ISA summaries. These are the ISAs. We received three -- well, we've actually received three ISA summaries associated with the BLEU Project from NFS. And -- however, we've approved two. And we've approved the USEC -- the pilot plant ISA summary.

There are also several ISA summaries that are under review right now. And there are others that are still out there that we're anticipating to receive before October 18th, which is their deadline. And we know that in the fall that we should get some summaries from USEC and MOX,

the USEC being the gas centrifuge -- proposed gas centrifuge facility.

Okay. There were nine areas where interim staff guidance is being considered. The first seven are under development. They are a draft. And ISGs 8 and 9, which have to do with natural phenomenon hazard and initiating event frequency are -- have not been drafted as yet but I believe they will be drafted in the future.

And this is the last slide. Just -- these were the basic discussion areas during the July workshop. And it sort of just maps over what some of the interim staff guidance documents -- the areas that are highlighted are in orange are really areas where there were the most active discussions.

So unless you have any questions --

CHAIRMAN GARRICK: Yes --

MS. STEELE: -- that's it.

CHAIRMAN GARRICK: -- we may have a few --

MS. STEELE: Okay.

CHAIRMAN GARRICK: -- although we have looked at this in the past.

EXEC. DIRECTOR LARKINS: I --

CHAIRMAN GARRICK: Pardon?

EXEC. DIRECTOR LARKINS: -- sorry. I'm sorry I missed the beginning of Sharon's presentation. But I just wanted to give a little introduction.

The idea here was really -- for Sharon to sort of give you some background because one of the things that is on our current projected workload is to review some of these fuel cycle facilities and in discussing this with the staff, I need to get feedback from you as to when you'd like to be engaged in those discussions. And what types of topics.

In the interim, I've said basically when the staff has completed their review and are getting ready to issue a set of RAIs or whatever. But, you know, any feedback.

This was hopefully to bring you up -- to give you a status of what the staff is doing as a part of their reviews. And give you a better familiarization with the regulatory framework so you can decide what it is and when you'd like to take a look at these issues.

MR. LARSON: And it's only for those eight facilities, right?

MS. STEELE: The fuel fabrication and

the future enrichment facilities, yes. The Part 70 licensees.

EXEC. DIRECTOR LARKINS: But we have three of them which are coming up shortly. So that was sort of the idea.

CHAIRMAN GARRICK: Well, as you know, when we looked at the ISAs, integrated safety analysis process before, one of the things we kept observing was that we'd like to see one. We'd like to see how new models are actually put together and executed. And how they handle the information and the data and what have you.

We're very familiar with process because this is basically the process hazards analysis approach used by the chemical industry. And it's used extensively by other industries, including DOE. And maybe they have refined it as much as anybody in support of the safety analysis work that's done on nuclear explosives.

So it clearly is an approach that has a lot of experience and support. We have always had a few problems with it because we preferred it moving more in the direction of a quantitative approach. And you have to do almost as much work here as you do for a QRA, quantitative risk assessment.

And so the position of both the ACRS and the ACNW, in the past, has kind of been we hope that what this does do is -- that it is structured in such a way that the option for moving towards a more PRA format is not excluded.

And I would hope that that continues to be the case because I think this is not risk oriented as it could be if we were to do that.

I think that it would be useful for the Committee to hear from an applicant, for example, a presentation on how they have implemented the ISA methodology. That's usually where you learn the greatest amount just as you would if you were listening to somebody presenting to you their PRA.

And as to timing, you know, that's -- the sooner the better.

There are a couple of issues here that caught my eye. And I think one is just a matter of words.

You said in the opening remarks that this was for fuel fabrication and enrichment facilities. But you weren't saying it to mean that it was -- you included in that mix, I assume, process facilities.

For example, what about conversion

facilities like facilities that convert U-02 to UF-6. I would assume the same methodology could be applied there and would be. Is that not correct?

MS. STEELE: The conversion facility you're referring to is the one we have in Metropolis?

CHAIRMAN GARRICK: Yes.

MS. STEELE: That one falls under Part 40 --

CHAIRMAN GARRICK: Yes.

MS. STEELE: -- license. And I don't know -- I suppose they could do --

CHAIRMAN GARRICK: Well, what --

MS. STEELE: -- an integrated --

CHAIRMAN GARRICK: -- if the Allied facility --

MS. STEELE: -- safety analysis --

CHAIRMAN GARRICK: -- and the --

MS. STEELE: -- but they're not required to.

CHAIRMAN GARRICK: -- yes, if the Allied facility and the Sequoia Fuels facility were still operating, would they fall under this?

MS. STEELE: I believe there are Part 40 licenses -- they would have been Part 40 licenses

and they would not fall under this requirement.

CHAIRMAN GARRICK: Yes. And is there a similar methodology?

MS. STEELE: Under Part 40?

CHAIRMAN GARRICK: Yes, under Part 40.

MS. STEELE: No.

CHAIRMAN GARRICK: I see. Okay.

I don't think I want to get into it very much but there's some terms here that are kind of bothersome.

MS. STEELE: Can I --

CHAIRMAN GARRICK: Yes?

MS. STEELE: -- can I address some of the things that you talked about earlier? Before you --

CHAIRMAN GARRICK: Right.

MS. STEELE: -- continue with the next question?

Just for the benefit of others, the guidance document, 1520, does not preclude the use of a PRA-type --

CHAIRMAN GARRICK: Yes.

MS. STEELE: -- method. And, in fact, if there are complex processes, it would guide one to use perhaps event trees or something more

sophisticated or complicated than a HAZOP methodology.

CHAIRMAN GARRICK: Yes.

MS. STEELE: And I don't know in terms of hearing from a future applicant, I know right now we have in the room project managers for the LES and the USEC facilities. And I don't know what the status is of those ISA summaries are but would the Project Managers care to comment?

MR. JOHNSON: I'm Tim Johnson. I'm a Project Manager for Louisiana Energy Services. As part of the application, LES did submit an ISA summary, which is under review. We haven't completed the review yet. But they used a semi-quantitative method using the risk index method that was suggested in the standard review plan.

CHAIRMAN GARRICK: Thank you. Thank you.

MS. STEELE: And Yawar was going to -- the Project Manager for USEC is going to --

MR. FARAZ: I'm Yawar Faraz. I'm the Project Manager for USEC.

We did review their lead cascade application, which was submitted a year and a half ago. And we approved it last February, issued a

license. And they also had submitted an ISA summary for that facility using a risk index method.

We're expecting an application from USEC for their commercial plant next month.

CHAIRMAN GARRICK: Okay.

I just am reminding myself that I don't know how much interaction there is between the NRC and other agencies and organizations that employ this basic methodology but I think there would be a real advantage in taking full advantage of other people's experience.

I know in the nuclear explosive field, they have developed this general PHA approach to a pretty fine level. And it goes through exhaustive review in the review process. And that's something you may way to look into because they do a very similar kind of modeling.

Is there any comments? George, have you got any comments?

MEMBER HORNBERGER: No, I don't.

CHAIRMAN GARRICK: Ruth?

MEMBER WEINER: Only that like you, Mr. Chairman, I'd like to see one done. I think it would be very instructive.

CHAIRMAN GARRICK: Yes.

Allen?

MEMBER CROFF: Nothing additional.

CHAIRMAN GARRICK: Okay. Okay. I guess --

EXEC. DIRECTOR LARKINS: Well, one of the things I think we need to do and in terms of planning and as we request the staff briefings on these particular facilities to see if the applicant would be willing to come in and discuss their submittal. I don't know right now. We'd have to ask and see.

CHAIRMAN GARRICK: Well, I think that's -- that would be the most revealing would be to hear from the modelers. And see how they are inputting the information, where they're getting their information from.

The likelihood calculations are particularly important, are of particular interest. Because that is the important stepping stone towards any quantitative or semi-quantitative approach. And how they structure their accident sequences, their basic scenarios.

So that's the thought there is that if we really want to -- and we felt this way a couple, three years ago. And at one time were going to get

somebody, I think it was from Lynchburg, was going to come in and give us a briefing on how they put their model together. So I think that interest still is there.

And I think it would be the single event that would bring the Committee closer to appreciating and gaining confidence in the methods.

MR. LARSON: This would be one of the things the Committee would look at, I guess, in its retreat. And try to prioritize it along with the other things --

CHAIRMAN GARRICK: Sure.

MR. LARSON: -- that it's going to look at over the next year.

CHAIRMAN GARRICK: Sure.

EXEC. DIRECTOR LARKINS: Well, I think we're scheduled in October to have a briefing of LES or USEC -- one of them.

MR. LARSON: I think it's USEC.

EXEC. DIRECTOR LARKINS: Yes. So --

MS. STEELE: Is that right? Yawar, do you know?

MR. FARAZ: Pardon?

MR. LARSON: October is USEC licensing steps. They didn't say they'd go beyond that like

bringing in the --

EXEC. DIRECTOR LARKINS: Okay.

MR. LARSON: -- applicant. But we can ask.

CHAIRMAN GARRICK: Any questions from staff?

(No response.)

CHAIRMAN GARRICK: Okay. Thank you very much, Sharon.

MS. STEELE: Thank you.

CHAIRMAN GARRICK: We're a little ahead of schedule, which is good, because we've got a lot of report work we want to do a little later.

VICE CHAIRMAN RYAN: Dr. Cool is here.

CHAIRMAN GARRICK: Okay.

So the next item on our agenda is Health Physics issues. And the Committee lead person on those issues is Dr. Michael Ryan. And I'll let Mike lead the discussion.

VICE CHAIRMAN RYAN: Thank you very much, Mr. Chairman.

Good afternoon.

Good afternoon, Dr. Cool, how are you?

DR. COOL: Just wonderful. Thank you.

VICE CHAIRMAN RYAN: Well, that's great.

We're going to hear from Dr. Cool on Health Physics related issues. And I think, in particular, we're going to focus on the consultation papers of the ICRP that are hot off the press. Welcome.

DR. COOL: Thank you and good afternoon. We'll see if we can get this -- I know the light concept there on the screen. In all due course, something should magically appear via the electronics.

I'm Dr. Donald Cool. I'm the Senior Advisor for Health Physics Issues in the Office of Nuclear Materials Safety and Safeguards.

After talking with Mike several times over the last few months, we agree that it would be useful at this stage in the process to provide you with an information briefing on some of the things that are going on, in particular, the activities of the International Commission on Radiological Protection, ICRP.

What I'm in hopes to do very briefly for you today is give you just a bit of background on where NRC currently is in its radiation protection standards, a very brief, very high level overview of the draft ICRP recommendations that have come out,

and then some of the next steps that we envision over the next few months as we begin this examination.

So we're already on the background slide. Let's leave it there. Thank you.

Just to reacquaint you with where we are in the process, NRC revised 10 CFR Part 20, the basic standards for radiation protection, finally getting it published in 1991. That rulemaking took 12 years to go through the process. It actually was implemented in 1994. So that had a fairly long gestation cycle as we went through the process.

During that intervening period, not surprisingly, other things continued to proceed forward. ICRP published a revised set of recommendations, Report 60, in 1991. Now obviously the staff did not have that report available to it at the time that we actually promulgated Part 20.

So the NRC regulations are based on the older set of ICRP recommendations that were Publication 26 and the metabolic models that were in ICRP Publication 30.

We did have the advantage of knowing a few things about what were coming out. So, for example, the public dose limit that is contained in

Part 20 was what actually came out for the first time formally from ICRP in Publication 60.

There were a number of other things that we didn't have accounted for within that process. So, as a result, we are a step behind the international recommendations as we've proceeded forward.

I say that with all due caution because we have taken on a case-by-case basis a look at proposals by various licensees to use updated models, to use effective dose from external exposure, and some of the other things that have come about over the last 15 years of so and, in fact, approved them on case-by-case basis.

We went to the Commission specifically for their approval to move forward and do that on a case-by-case basis. It's particularly useful for some of the folks who are dealing with uranium or thorium and some of those isotopes where the more recent metabolic models actually indicate a lower risk per unit of intake activity than had previously been modeled.

The more you know about the model -- the body, things move up and down. Some things move down and licensees, not surprisingly, wanted to take

some advantage of that in their modeling approach. So that's where we are on that part.

Go ahead and have the next slide. Thank you.

In 2001, the staff went to the Commission because we knew things were coming along. It seemed like more than enough things had transpired. There were some scientific issues that we were aware of to proceed with the next steps.

Included in that approach was a no action alternative, to go ahead and begin rulemaking at that time, and try to work in parallel with ICRP or to sit, monitor closely, but wait for the ICRP recommendations to come out before firmly engaging in a process. The staff actually recommended that third option and that is what the Commission approved.

So that is what we have been doing over the last several years.

More recently -- next slide -- there we go -- two papers have gone up from the Office of Research, close coordination between Research and NMSS and others. The first was responding to the Commissions's request that we have some proposals for a more robust materials program.

When I say materials in this context, I do not mean the properties of metal, as you are often used to look at in the reactor forum, but byproduct and source material and all of the other things that we also have regulatory jurisdiction over.

And then a month or so after that, we also provided a paper outlining some recommendations for how to evaluate scientific recommendations relating to health effects in radiation biology and the ISCRP recommendations.

The Commission has given us SRMs just in the last couple months which approved both of those plans, told us to go ahead and move forward with a more aggressive and proactive approach in looking at some of the science and activities.

They warned us to stay away from too much in terms of protection of the environment. I will talk briefly about that in a few minutes so let's return to that topic.

And so we are now engaged actively in the process of looking at the ICRP recommendations. And in an ongoing process, in looking at the variety of other things, the BEIR 7 work that is ongoing, looking at the radiation risk relationship, DOE's

low dose study efforts, the new results that have been coming out of Hiroshima and Nagasaki and the updated dosimetry.

There's a lot of different activities that are going on at this particular junction in time.

Let's go ahead with the next slide. In keeping with that, we have been aggressive in trying to pursue opportunities to interact with ICRP. We have provided comments directly back to the ICRP both on a draft proposal that they had on protection of the environment and on an early white paper of concepts which they had on the general recommendations.

We've availed ourselves of almost every opportunity we could to go to various forums and discuss them internationally and nationally. And tried to provide a variety of places where we could input and influence the direction that things were proceedings.

Let's go ahead to the next slide. ICRP has been engaged in this development cycle for probably five years or more, starting with some early ideas that were floated by ICRP Chairman Roger Clarke, discussed in two consecutive now IRPA,

International Radiological Protection Association meetings in Hiroshima and more recently in Madrid, a variety of different activities.

Some of the ideas initially floated were very interesting and certainly got our attention because they would have caused just a bit of concern and heartburn were they to have gone all the way potentially to fruition. And we have attempted to move those. As I will describe in a few minutes, I think we've been successful in those.

ICRP has formally placed the draft of its recommendations on their website, www.icrp.org. Download the file. It's about a two megabyte file. Give yourself plenty of time on the printer because it prints very slowly, 80-something pages long.

They will be accepting comments through the end of this year, through December. So we have now the next six months or so in which to examine and provide feedback to ICRP.

Let's go ahead and move to the next slide. These next few slides are a very quick overview of some of the key items that are in the draft ICRP recommendations.

At this point, I'm not going to give you any staff views. We're only beginning the process

of trying to assemble those. I'll talk about how we're going to be doing that when I finish giving you that overview.

First and foremost, ICRP is placing yet more focus upon the individual in the context of their recommendations. So, in fact, first they talk about protecting the individual from a particular source of radiation, that via what they call the dose constraint, the differences between constraint and the limit. A limit, in ICRP language, is that which would apply to all of the exposure that I could receive, as an individual, from any of the variety of sources that might be around me.

A constraint would be the value that you would ideally place on that particular source with respect to how much exposure that I could get from it. So there is an all-source approach and there is a specific approach limits and constraints.

ICRP has moved forward to try and simplify the number of constraints they had. If you go sorting through the various documents that have been published over the last 15 years, you can come up with some 30-plus different constraint recommendations for different specific situations that are contained in those ICRP publications.

I'll talk about specifically what those values are in a minute. One of the places that they had initially made a proposal was to eliminate entirely limits from the recommendations. There was a great deal of push back from, interestingly, both the industry and the regulators, saying that there was a place for limits.

There were certain places where you had to have legal requirements and otherwise. And they have retained that recommendation within this draft proposal.

Numerically, the values for limits are exactly the same as they were in ICRP's Publication 60, that is for occupational exposure, 10 rem over five years, in other words roughly two rem per year, with a maximum of 5 rem in any year. Five rem is the value that we currently have in Part 20 for occupational exposure.

For public exposure, the limit is set at 100 millirem per year, which is exactly the same as we currently have in Part 20.

Let's go ahead to the next slide. ICRP does not use background to justify it's recommendations for various dose levels however they have used it as a benchmark and to try and establish

the various levels of concerns which people would typically tend to have for varying degrees of exposure so as to try and rationalize an entire framework of various kinds of exposures.

This graphic is taken from the ICRP Draft, fairly readable actually. In the middle, natural background, roughly one millisievert per year that is excluding all of the radon contributions so this is the natural terrestrial gamma radiation, the cosmic radiation, those sorts of things, the potassium 40 in our body, one millisievert, 100 millirem, all of these slides are in the SI units. I'll try to do the conversions for you if you need.

Moving below that, there tends to be a lower degree of concern down to the point where basically no one does much of anything to actually influence it if they have choice in the matter. Above that, you get increasing levels of concern up to the point where you almost always do something one way or another.

If we can go to the next slide, that translates for ICRP then into four maximum constraint values, 100 millisievert, that's 10 rem, for emergency-type situations as in what you would

normally want to try and hold workers to in an emergency situation responding expect for, perhaps, lifesaving-type measures where you're almost always assured of doing evacuation or a variety of things of things if you are in emergency response, where people will almost always try to do something to control ongoing exposures that they might find in the environment.

The second maximum constraint, 20 millisieverts, that's two rem, each of these are annual values, by the way -- that's typical for a direct or indirect benefit of the exposed individual, most usually occupational exposure.

It assumes that there is some measure of training and understanding and ability to influence the degree of exposure you're getting, minimize you exposure when possible.

And in the public side, places where you would apply simpler countermeasures, some of the things like perhaps iodine prophylaxis, the place there you would usually try to shelter people in an emergency situation, so of those sorts of things.

The third maximum constraint, one millisievert per year, that's 100 millirem, that's for situations where the practice or situation

probably has some societal benefit. But there's no expectation of training or monitoring or other values, in other words, public exposure.

That is a maximum value assuming a single source although not in ICRP's table, in the text of the draft recommendations, they have an additional little caveat that if there are multiple sources of significant contribution, then the constraint should probably be beyond the order of .3 millisieverts, 30 millirem. That's the international rounding version of what we usually do at 25.

Margin of error is essentially nonexistent between those two.

The final number, the minimum constraint, the minimum number that they would ever suggest anybody attempt to use as a constraint for a single source. I will not use the old famous acronym but it has had its various lingoes in NCRP at the negligible individual risk level.

People talk about trying to have clearance or controlling materials, exclusion exemption, a variety of other sorts of things that go on at that level.

That does not mean that an effort to

reduce exposures under the ALARA principle couldn't take it or perhaps shouldn't take an exposure below that level. This would just be the lowest value that they would ever suggest someone selecting to start that process.

Because that is, in fact, the way they see a constraint, the maximum value source to an individual, within which you then provide additional protection -- next slide -- to compliment that constraint with the requirement to optimize protection.

This is ALARA. This is the second cornerstone of radiation protection. This has not changed in any significant extent from that which we have seen before, which is currently part of Part 20 in other activities.

The third leg, which everyone is typically familiar with in the radiation protection scheme is called justification, as in when should you even allow such a source to be in existence.

ICRP's draft recommendations this time back away from many of the statements that they said with regards to justification. This is a clear acknowledgment that in most all cases, radiation protection decisions, the amount of radiation

exposure, the efforts that you can pursue, are actually only one of many components that go into deciding whether or not to have a particular source in use.

And so justification, in the sense of deciding that you're going to introduce a source, goes well beyond the radiation protection recommendations. They still suggest that it is important to have that benefit, where appropriate, that radiation protection considerations be a very strong component.

But they have backed away from some of the language which could have been interpreted as you must only focus on the radiation protection without considering all of the other things that would go on in the process.

Let's go ahead and move on to the next slide. There are a number of other things that are happening in these drafts. Some of these are actually perhaps more significant, the changes that we might wish to make.

Some of the most significant ones, there are proposals that change both the radiation weighting factors and the tissue weighting factors in the calculation of the effective dose. In the

radiation weighting factors, protons and electrons continue to be one. That's not surprising.

Protons are a two. That's just a little bit of a change there.

Alpha particles are 20. That's what we've expected.

And you have a curve -- I haven't tried to reproduce all of this data for you -- for neutrons. Amongst other things, this revised curve has the effect of lowering the weighting factor for low-energy neutrons to a lower level.

So that would have some effect where you are calculating neutron doses. We don't do a whole lot of that here but for some folks, that gets to be more important.

The tissue weighting factors have also undergone a rather substantial revision. They have lumped them into four categories. Interestingly, breast has moved up to .12, so an increased risk associated with irradiation of the breast. Lung has remained the same. Bone marrow and others at .12.

The gonads have moved down to .05. Recall that they used to be .25. There was a much greater concern about exposure of the gonads being driven by a lot of the concerns of genetic

susceptibility and genetic risk.

The material that's now available indicates that that risk is not nearly as significant as it was previously believed. And so that has resulted in a rather substantial reduction in the contribution for the gonads. Hence the weighting factor comes down.

There are a few other little changes that go on. There are a set of remainder tissues, a fairly long list of them, which would be lumped together and averaged in order to complete the calculation.

So there are a number of things that have happened in the scientific underpinnings of the calculation that we would want to look at. Any time you play with the equation and you play with factors, obviously you have people very nervous about what dose they now calculate for what they thought was the same exposure that they were doing before.

And, in fact, some of this means that depending on your favorite radio nuclide, the exact same amount of material under the new calculations may be a lower effective dose or it may be a higher effective dose. And it will move around both ways.

I don't have anything like a complete list. There's 800 and something radio nuclides out there to look at.

Some other interesting factors. The fatal cancer risk coefficient itself increases just slightly. But the overall detriment coefficient actually comes down some in this calculation.

Neither one of them are substantial enough to cause any significant change in the way we've been doing business. When you round up the one significant figure, you're still in the same place but there are small changes in each direction looking at how they would do that calculation.

They've spent a fair bit of time in the draft talking about patient dose, the justification and optimization of patient doses, something that the NRC doesn't directly get involved with other than to make sure that the physicians prescription is required but very, very important in other forums and activities.

And they have included for the first time a policy on protection of nonhuman species as in the protection of the environment.

Let's go on to the next slide. This is an area that ICRP is devoting a great deal of

additional attention to. There was a separate publication, Publication 91, that came out not quite a year ago, which laid out this framework.

So in the draft recommendations that were just published, there's nothing new that you can't find in ICRP Publication 91 that came out last October. ICRP plans to have a new Committee 5 dealing particularly with this issue when it starts its next term, its 2005 to 2009.

And they currently have a task group that is moving a step beyond the Publication 91 work and actually trying to develop a set of reference flora and fauna. And yes, you interpret that correctly.

It's the reference pine tree, frog, there's about a dozen. I'm not going to try and quote them all off to you but there are a variety of different plants and animals to represent not the most sensitive but something which could be a benchmark for helping to understand how various modeling and benchmarks and evaluations take place.

At this point in the process -- you can go ahead on to the next slide, thank you -- the second tick is their statement with regards to protection of the environment. They have attempted

to construct a sort of parallel approach so that it would be safeguarding the environment by reducing frequency of the effects likely to cause early mortality, reduced reproductive success.

Note that this is a different kind of endpoint than you look at with humans. In humans, you're trying to prevent any deterministic effects and you're trying to minimize the stochastic doses.

In the protection of the environment, you're looking at a different set of endpoints, a higher level set where you're trying to reduce early mortality or reproductive success.

So that's the goal that they have laid out. There's still quite a bit that will need to be evaluated to try and move farther.

We can have the next slide. As I think was in the SRM that the Commission gave the Committee not that long ago, the Commission has also given us a very clear message and transmitted this message to both the ICRP and the IAEA.

To quote the Chairman, this is a quote out of our SRM, "The Commission continues to have deep misgivings about the need to go forward with standards."

So we are watching this very closely to

try and influence it in the correct direction. Quite frankly, there is a huge amount of work that needs to be done simply to understand the underlying science, to understand the modeling methodologies that are currently available, to try and have some benchmarking consistency with the way different people do it across the United States, Europe, and other places before there could be any sort of consideration of whether a standard is necessary, what that might look like, and otherwise.

And that's a great part of what the Commission is concerned about is it doesn't appear that it is necessary. Certainly there is a conceptual gap that needs to be filled. But let's not go running off to try and write a new standard.

We've taken and are continuing to take the position that the framework in process should allow flexibility, let people look at it and move forward carefully.

That is the very, very quick summary of the ICRP recommendations. If we can go to the next slide -- I have been having conversations with Roger Clarke, who is the Chairman of ICRP and Lars-Erik Holm, who is the Vice Chairman, for literally months now, trying to find a mutual date by which they

could come over and visit us in the United States for a day or two and talk about this.

I think perhaps we're actually going to make it in September, roughly the middle of the month. The plans and details are not all completely laid out yet but it appears that they will be in town the 14th and 15th of September. Now all of this, of course, is still subject to change but I think they've bought some tickets so it's becoming a little more firm.

I believe they plan to have meetings with each of the Commissioners.

We are trying to arrange an opportunity for the various federal agencies through ISCORS, the International Steering Committee on Radiation Standards, to have a time of interaction.

And to see if we can arrange an opportunity for them to spend a few hours in a public forum because certainly there are lots of people in the area as well as NEI and a variety of other industry groups who are also in the D.C. area who would very much like that interaction.

Those details are not worked out so I can't tell you anything more than I'm pretty sure they are coming. I expect it to be -- the 15th

would be the day in which we might be able to arrange those but no other arrangements have been made yet.

If we can have the last slide. There are a variety of reviews that have now been started. Certainly within the NRC staff, we have begun that process. Our office-level steering committee on radiation protection will be meeting next week to try and lay out the details of how we're going to pull that together and assemble a coherent set of comments within the NRC staff.

In addition to that, they ISCORS, Interagency Steering Committee on Radiation Standards, Federal Guidance Subcommittee, will be coordinating an interagency federal review. We have a meeting tomorrow to kick that process off to try to lay out some of the framework and ideas.

We also will have an opportunity to interact, as well as EPA and DOE, as members of the Nuclear Energy Agencies' expert group that will be providing comments. That will be an international set of comments that will be assembled.

So there will be a whole series of forums in which we attempt to try and put forward comments and ideas. The staff plans, at this point

very tentative, are to try and have a coherent set of comments within the NRC for Commission consideration by early in October, roughly the first of October, to allow plenty of time for interactions and for the Commission to be able to agree and provide a set of comments to ICRP.

That will also enable us to have a Commission-agreed position as we interact with some of these other organizations a little bit later in the year.

We are in hopes that we can interact with you during that process. Things will come together fairly nicely in the mid-September time frame to see where the staff reviews are, get some interaction with ICRP itself, and be able to pull together some ideas.

And that completes the very quick overview. And I would be glad to entertain your questions. Thank you.

VICE CHAIRMAN RYAN: Thanks. That was, I think, a good, thorough, yet top-level briefing but gives us a picture of where things are.

I guess I'll wait and see if other Committee members have questions first. And then maybe we can have a little bit more detailed

discussion.

I'll start with Allen.

MEMBER CROFF: I think only my congratulations on a very lucid presentations. I don't have any further questions.

VICE CHAIRMAN RYAN: Ruth, any questions?

MEMBER WEINER: I'd like to add my thanks. I thought that was a very interesting presentation.

I do have a couple questions. One of them refers to the change -- I'm trying to find -- desperately to try to find the slide that I want to talk about -- on your Slide 11?

DR. COOL: Yes?

MEMBER WEINER: You said the fatal cancer risk coefficient increases and the total detriment risk decreases. As we're uncomfortably aware, that fatal cancer risk coefficient is simply used as a linear conversion factor. And everybody says oh, my goodness, here is the dose in person rem. Now you're going to get so many cancers.

Is there -- this is really more a comment than a question but is there some way that you can convey to the public -- we sit here and make

sensible statements.

Is there some way you can convey to the public that this is the sense of this particular bullet, that you aren't then going to have, you know, radiation isn't worse than we thought or whatever? That this is not even a totally appropriate use of this coefficient? Is there some way that that can be conveyed and sort of disseminated generally?

DR. COOL: I think there is. There's probably several ways to do it. And we could brainstorm about them. That would make a wonderful conversation or multiple conversations.

You're quite right. There are several things in this. ICRP does, for pragmatic purposes in making its recommendations, assume that there is a linear relationship between the dose and the risk that is associated with it.

When you start to tease into that just a little bit, one of the first things -- Abel Gonzalez's graphics are some of the best, where he immediately points out to you first and foremost, I'm starting at 100 millirem because that's where background is --

MEMBER WEINER: Yes.

DR. COOL: -- and above that, we assume that there is this proportionality. There is a high degree of sensitivity to the fact that there is simply no absolute information that is available about what happens at very small increments of dose.

We are living in an environment which has radiation in it. It's always changing.

These materials that are here imply a great deal of precision, which, of course, isn't really warranted when we actually start talking about what might happen to me or what might happen to you if you got a particular exposure because simply the variability that each of us have is an enormous factor compared to some of these.

What I've given you today is sort of the scientific, of course, view in this sort of discussion. When you start to interact with the public, you need to say it in a number of different ways to try and represent it in a way that they can understand it.

MEMBER WEINER: I thank you for the starting at 100 millirem comment.

My other question has to do with Slide 13 which is -- yes, this second bullet. Our experience at the DOE sites, like Hanford, Savannah

River, Sandia where I work, is that the environment flourishes in the absence of human activity --

DR. COOL: Yes.

MEMBER WEINER: -- no matter what kind of radiation the environment is exposed to. I know -- and I was going to ask you -- I know of no data that shows that given all of the other influences on the natural environment that exists, that there is any correlation between ionizing radiation exposure and reproductive success, conservation of species, maintenance of biodiversity, and all of these things.

Is there any such data that you can rely on? And if there isn't, why is this going ahead?

DR. COOL: Well, let me answer the first question is I'm not aware of any. That's the first part of your question.

The second part of your question, I would go back, and I can't quote ICRP's Publication 91, but they, in fact, acknowledge that they do not believe that there is an issue where the environment is not being protected. But in the face of the increased environment awareness in a variety of activities by lots of our friends out there, it is difficult to sustain a simple statement that if you

have protected man, you have de facto and automatically protected the environment.

In fact, it appears that the set of protections that are put in place in order to provide protection of man has protected the environments at any place that we can measurement hence exactly your statement.

But you don't have a demonstrable basis or any sort of standing or correlated methodology to be able to see how much radiation is actually in a particular area to be able to provide some better demonstration than what people take as a sort of hortatorical of course because they no longer believe that these days.

So this is really more to fill that, as they put it, conceptual gap. And complete a framework and provide a benchmark demonstration set so that when someone comes up to you and says how do you know? You can say we have all these data. They have not shown these effects.

Here are some benchmark methodologies that shows you here's what the dose is in this environment. That dose is less than this. Therefore, we make the statement.

That is the place that we would hope to

get to. And why we would hope that, in the end, you wouldn't need other standards. You wouldn't need to take changes to effluent controls or otherwise.

VICE CHAIRMAN RYAN: Just so we're clear, though, when you say we, you don't mean the NRC. You mean the --

DR. COOL: I don't mean the NRC.

VICE CHAIRMAN RYAN: -- ICRP --

DR. COOL: -- I mean we in the really big sense.

VICE CHAIRMAN RYAN: I got you. Okay.

MEMBER WEINER: We, in the scientific --

DR. COOL: We in the scientific sense in keeping with the same statements here. Yes, thank you for that --

MEMBER WEINER: Well, I would suggest --

DR. COOL: -- correction.

MEMBER WEINER: -- that if you're in any way connected with any research that is going on in this area, I would suggest a good place to look for effects is, in fact, the defense facilities, the large defense facilities both in the United States and elsewhere. Because it is extremely evident there that the more you keep people out, the more the environment flourishes and that swamps

everything else.

DR. COOL: I very much agree. In fact, I believe that DOE with some of the RESRAD biota calculations and examinations are going to be participating in some of the benchmark activities that the EC and NEA are conducting. So I think that is going to be happening.

MEMBER WEINER: Thank you.

VICE CHAIRMAN RYAN: George?

MEMBER HORNBERGER: Well, actually, I also had a comment on the bugs and bunnies. It actually strikes me as quite strange because your endpoint, as you point -- as you indicate, are different. So we're not talking about individual protection.

And once we're not talking about individual protection of pine trees, how are you going to have an effect? How are you going to possibly have an effect on reproductive success of a species?

Well, the only thing I can think of is a very restricted environment where you have the Tennessee snail darter existing only in one stretch of the Clinch River. And you somehow introduce radiation there an nowhere else. Is that the

thinking?

I can't quite get my arms around that.

VICE CHAIRMAN RYAN: It sounds like deep misgivings to me.

(Laughter.)

DR. COOL: Yes, deep misgivings, which we share with you.

In fact, the thinking -- how do I put this in a somewhat politically correct manner -- is still evolving. You have pointed out some very good and appropriate problems that are faced in trying to develop this sort of framework.

And it's going to be very interesting in the Chinese proverb sense of may you live in interesting times, to see how this might proceed because there are enormous issues of how you would conduct measurements, how you would have any degree of understanding.

And you're dealing with very complex systems and --

MEMBER HORNBERGER: But even conceptually --

DR. COOL: Right.

MEMBER HORNBERGER: -- even conceptually how can I think about having an effect on the

reproductive success of pine trees?

VICE CHAIRMAN RYAN: George, if I may add, the whole framework here is to think about this in terms of manmade radiation exposure. I would challenge anybody to think about the Earth as a radiation source. And think about the increment that is manmade.

So the whole background question comes in in such a way that as you've pointed out, the framework, in my view, collapses. So just the basic question of the radiation environment as a global system and the manmade increment on top of that is another reason it collapses.

So there's -- and, again, I think there's lots of reasons in my own personal view why that's so. But we'll see how it unfolds.

And, again, it leads me to concur -- not that they really -- that I need to or not -- but I mean I believe that the deep misgivings that the Commission has is well founded at this point without significant work to the contrary.

Anything else, George?

(No response.)

VICE CHAIRMAN RYAN: Dr. Garrick?

CHAIRMAN GARRICK: Just continuing that

thought a little bit, one of the comments I've heard made is if we go in the direction of a standard for the protection of nonhuman species, somewhere along the way we have to establish something as a baseline. You have to start with something.

DR. COOL: Correct.

CHAIRMAN GARRICK: Was there any work that you are aware of that lead to this proposal that puts any illumination on what that baseline might be?

DR. COOL: In fact, that's exactly one of the things that we're trying to remind, not so much ICRP but IAEA as they've been laying out an action plan is the first thing we have to have is an understanding and a baseline. And we need to spend some time making sure that you've got that before you can even consider this other stuff.

CHAIRMAN GARRICK: Right. Right. Because it's like George is saying, you just don't know where to start. You have to have some sort of a surrogate or some sort of a starting point, whether it's the lady bug or the pine trees that somehow can be a representative for the environment or representatives.

DR. COOL: Right, right. And so in the

parallel processing that's going on right now, you've got ICRP and this task group of this main Commission that is attempting to define a set of reference organisms --

CHAIRMAN GARRICK: Right.

DR. COOL: -- with their, you know, spheroids or whatever, so you can do some calculations of their exposure.

And, in parallel, you have other organizations trying to look at the current state of radiation and the effects in the environment through UNSCARE and others.

And you have also going on several efforts to try and do some modeling, RESRAD biota, some other codes over in Europe. And the thought is that these will gradually come together to improve our understanding of our baseline of what we have.

Now you might see a couple very large capital ifs in between my lines there, so --

CHAIRMAN GARRICK: Yes, yes, okay.

DR. COOL: -- as a personal speculation.

CHAIRMAN GARRICK: Let me ask you. Do you have any indication of what the international reaction is to the idea of a separate standard for nonhuman species?

DR. COOL: It's a bit mixed. You have some countries -- and I would like to be careful in trying to characterize them -- but particularly northern Europe, Scandinavia, who are particularly concerned about protection of the environment who are pushing more strongly for this to move forward.

You have other countries that, like us, are very skeptical about the whole process.

Much of this could be attributed, in part, to the fact that you have -- particularly in the European Union now, some directive requirements coming in requiring demonstrations of impacts and effects. And people are going oh, this is a very nice directive, European Union. Now exactly how am I supposed to prove to you that I'm not impacting the environment per this directive?

So some of this, in fact, you can actually trace back not through the scientific so much but through the legal concern of being able to provide a proper defense in the face of these directives.

VICE CHAIRMAN RYAN: Okay. Thank you.

John?

MR. CLARKE: I just wanted to join the others and say that I, too, will be very interested

to see where the ecological piece goes.

(Laughter.)

MR. CLARKE: If you haven't already, I think you would find it very interesting to go back and look at the non-rad side and how ecological risk assessment has been evolving for stabilized organics and toxic chemicals. And, you know, just try and get your arms around it.

As George and John said, where do you start? What are your implants? Which species are you interested in?

But I would think all of this could have a big impact on the environmental restoration activities that are going on now where these kinds of non-rad ecological risk assessments are already being done as well.

DR. COOL: Yes, I think we would very much agree. We have attempted to comment a couple times that surely we just haven't suddenly gotten smart and we can go off and create something all on our own on the rad side because there has been a lot of work on the other side.

It's not entirely clear how much connection there is between the great deal of work that's been done in other forms and how much

connection there is. I would hope that that happens.

MR. CLARKE: Yes, I think what would be interesting though is how they have struggled with the ultimate goal as well in trying to answer some very fundamental questions.

VICE CHAIRMAN RYAN: Don, I've got a few questions on the things that we are going to turn our attention to, hopefully --

DR. COOL: Good.

VICE CHAIRMAN RYAN: -- in responding to the ICRP's recommendations rather than what we're not really going to respond to.

It seems to me that there is kinds of a couple of categories of things. The one category of things is kind of updating the science of calculating dose, particularly internal dose.

And it's interesting, and I just kind of summarize that from the 10 CFR 20 that we have and what backs it up to where we are with these new recommendations, there's kind of a -- for any particular isotope or element, there's several steps of modeling that are not up to date.

It seems reasonable to think about bring those to some concurrent point rather than having a

case-by-case exemption for licensees would be a smoother regulatory system. So there's probably a bunch of tools, if I can call them that, that licensees want to use that are updated, that for whatever reason, they recognize as better science, that would -- it would probably be a very positive thing on how to bring that forward. That's Box 1.

The second box is how do the fundamental pieces of risk-related factors, whether they're the radiation risk factors or the weighting factors for tissues and so forth, correct me if I'm wrong but I'm just trying to help the Committee understand, all of that has come out of what you mentioned earlier, the Hiroshima/Nagasaki studies and BEIR Reports and so forth from the time frame of `91 when we updated up through the current time. Is that a pretty good general statement?

DR. COOL: That's a pretty good general statement. Recognize that the underlying science that Part 20 is based on goes back to `77 and `80.

VICE CHAIRMAN RYAN: Yes.

DR. COOL: There was, in fact, a step jump in the scientific modeling and things with ICRP 60, which we didn't adopt because of the procedural place that we were in at that time. That is

undergoing another revision at this point.

Certainly what we are looking at is the hows and whats and implications of leapfrogging directly to more update science --

VICE CHAIRMAN RYAN: Right.

DR. COOL: -- the risk factors that would go along with that, and a whole set of organizational issues that sooner or later we'll have to deal with because as long as we have all of these codified in the regulations, we have ourselves rather nicely tied together.

VICE CHAIRMAN RYAN: Right. A couple other aspects that struck me from your presentation is that -- and I wanted to highlight it for everybody's memory, that the five rem per year limit for a worker under 10 CFR 20 is different from the two rem per year that ICRP recommends.

And they have kind of a five-year window and, you know, there might even have been some age-dependency questions earlier on that have tended to not be there now. So I think that sticks out as a difference.

Now I put difference in quotes in my own mind because I'm not too sure what the differences in those two numbers means in terms of ultimate risk

to the individual. So that's something to think about.

I recall that at the time that came around in `91, the idea was that it is rare to see exposures in workers above two in the U.S. And that with the ALARM principle and the current standard, it was felt that we were meeting the obligations for radiation protection that was, in fact, not far out of step with international recommendations.

Is that also a --

DR. COOL: And that is true. And yet more so true as the years have progressed.

VICE CHAIRMAN RYAN: Right.

DR. COOL: I can't quote you exact numbers. But there are maybe a couple of hundred folks out of the entire worker population that is required to report to NRC that are over two rem --

VICE CHAIRMAN RYAN: Right, so --

DR. COOL: -- in any year, so --

VICE CHAIRMAN RYAN: -- again, I think that will be a focal point, perhaps, as the staff moves forward in considering this -- I'm sorry --

CHAIRMAN GARRICK: No, go ahead.

VICE CHAIRMAN RYAN: -- there's a number of these technical points kind of on the worker

exposure side more than any other. And the techniques or the calculation method side that might be the bulk of the considerations that you and the ISCORS Committee and other staff here are going to take up.

Is that a fair summary?

DR. COOL: That's correct.

VICE CHAIRMAN RYAN: Okay.

DR. COOL: In fact, when you look at these draft recommendations versus where we are in Part 20, there are differences, as you've highlighted. When you look at it vis-a-vis the previous set of ICRP recommendations, Publication 60, there are small evolutions --

VICE CHAIRMAN RYAN: Right.

DR. COOL: -- almost entirely in the scientific underpinnings. The concepts have matured a bit. They are expressed slightly differently. But it is, as Roger Clarke has billed it, evolutionary, not revolutionary.

VICE CHAIRMAN RYAN: I think, too, there's one part of 10 CFR, 10 CFR 61, that actually goes back to ICRP 2 because it's the only one with an organ dose limit.

DR. COOL: Don't get me started.

(Laughter.)

VICE CHAIRMAN RYAN: But that's an artifact for another day.

DR. COOL: Right because that's not the only place.

VICE CHAIRMAN RYAN: Mr. Chairman?

CHAIRMAN GARRICK: You may have answered this but where does the NCRP stand on all of this?

DR. COOL: I'm sure NCRP will be putting in some comments. NCRP's last publication more or less mirrored ICRPs'60, although I'm not recalling because I haven't looked lately what they did on the occupational piece nor have I talked with Tom Tenforde lately to know whether they may go through some sort of update on their recommendations down the line a bit.

I just haven't had a chance to talk to him on what NCRP's plans may be at this point.

CHAIRMAN GARRICK: Oh, thank you.

VICE CHAIRMAN RYAN: Thanks. Any other questions or comments?

I think in closing, Don, we're looking forward to, perhaps, a working group meeting with you and others to help in any way we can to, you know, provide input for comments or to facilitate

information gathering. And I think we would envision a letter to the Commissioners that would come out of that process in support of your investigations.

I think we've talked about working with you on schedule in a way that helps you meet your obligations to get material to the Commission and then subsequently out the door on schedule.

So we'll continue, if it is okay with the Chairman, the Committee -- I'll work with you to see if we can make that happen.

CHAIRMAN GARRICK: Excellent.

DR. COOL: Very good. We appreciate that.

VICE CHAIRMAN RYAN: Thank you very much for your time and very informative presentation today.

DR. COOL: Thank you.

CHAIRMAN GARRICK: Thank you.

(Whereupon, the above-entitled meeting was concluded at 2:27 p.m.)