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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE AND MATERIALS

(ACNWM)

179th MEETING

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THURSDAY,

MAY 17, 2007

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 10:30 a.m., Dr. Michael T. Ryan, Chairman, presiding.

MEMBERS PRESENT:

MICHAEL T. RYAN Chair

ALLEN G. CROFF Vice Chair

JAMES H. CLARKE Member

WILLIAM J. HINZE Member

RUTH F. WEINER Member

NRC STAFF PRESENT:

DEREK WIDMAYER

JEAN-CLAUDE DEHMEL

TIM FREY

TINA GHOSH

CHRISTIANA LUI

BRIAN SHERON

ROB TREGONING

DON HELTON

NATHAN SIU

PHIL REED

JOHN FLACK

I-N-D-E-X

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M-O-R-N-I-N-G S-E-S-S-I-O-N

10:08 a.m.

CHAIR RYAN: On the record. The meeting will come to order. This is the second day of the 179th meeting of the Advisory Committee on Nuclear Waste. During today's meeting, the Committee will consider the following: Proposed Revisions to Standard Review Plan Chapter 11.5 for New Reactor Licensing; a Briefing on Interim Staff Guidance ISG-04 "Preclosure Safety Analysis - Human Reliability Analysis;" Briefing on Long-Term Research Activities. We concluded our ACNW Paper of Volcanism yesterday. So we will not have that session and we'll finish up with any further discussion of ACNW letter reports and white papers that we did not complete yesterday.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Derek Widmayer is the Designated Federal Official for today's session. We have received no written comments or request for time to make oral statements from members of the public regarding today's sessions. Should anyone wish to address the Committee please make your wishes known to one of the Committee staff.

It is requested that speakers use one of

the microphones, identify themselves and speak with sufficient clarity and volume so they can be readily heard. It is also requested that if you have cell phones or pagers you kindly turn them off or place them on mute. Thank you very much.

And we'll go right to our first session which is the Proposed Revisions to the Standard Review Plan Chapter 11.5 for New Reactor Licensing and our speaker is Jean-Claude Dehmel. Jean-Claude, nice to see you again.

MR. DEHMEL: Thank you.

CHAIR RYAN: Thank you for being with us.

MR. DEHMEL: My pleasure. So this is essentially the last of a series of presentations on the work that we did on the revision of chapter 11.2, 11.3, 11.4 and 11.5 of the SRP NUREG 0800. As you know, this was completed and made available March 2007.

Again, as before, I'm going to go over the purpose and scope of the SRP Chapter 11.5. Some of the approaches applied in revising that chapter to the extent of the revisions and some reports of the revisions that were implemented and reflect some of the changes and some of the reviewer responsibilities and conclusion and then we'll have an opportunity to

have questions.

So the focus of this SRP section is on instrumentation that is used for several functions, for process monitoring as well as effluent releases and process monitoring applies both to liquid and gaseous process streams and effluence involves liquid and gaseous effluence. The typical type of -- And basically there are several components to the this chapter. One involves the hardware itself meaning that the hardware that is used to extract samples from process or effluent streams and sampling systems, the instrumentation itself that is the radiation monitor be it on-line or off-line and the kind of operational programs that are mandated by that chapter and we'll go over these. So the typical type of process and effluent streams are waste, gas hold up, condensatory accretions, steam jet rejectors and so on, a whole stream of different types of airborne process streams and airborne effluence, liquid waste including liquid waste that we've processed through mobile processing systems, so those permanently installed as well as temporary mobile systems that would be installed in the rad waste building for example.

CHAIR RYAN: Jean-Claude, just I think maybe to refresh everybody's thinking.

MR. DEHMEL: Sure.

CHAIR RYAN: At some point, mobile systems come into the plant, not to the original plant assigned, but typically through a Part 50.59 sort of review. Is that correct?

MR. DEHMEL: Yes.

CHAIR RYAN: Is there a difference in how it's treated in the chapter versus how it gets started or how it becomes part of the plant?

MR. DEHMEL: Well, we're starting new grounds at this point. What's happening is that with the current applications that have been reviewed and approved by the NRC recently is that the commitments have been made that mobile rad waste processing systems will be the responsibility of the COL applicant to describe. So there is a description about the overall, very generic operational characteristics of what the system may contain. There is some discussion as to where and how it may be connected to permanently install portions of this system in the plant that are described in more detail in the DCD and then there are discussions about the overall performance of characteristics and then essentially what you have in the DCDs is a box, a pre-conceptual design that says this is going to be the

part of the mobile system that will address liquid waste, detergent waste, that will process solid waste and so on.

Then when the time comes to build the plant, the applicant at that point will have to make a determination as to which system they are going to ultimately procure and install and that's the system that's going to be reviewed as part of their inspection program or as part of an ITAAC or as part of the license condition. These things have yet to be fully defined. Then after that, the plant is operating, then any time after that they can change it based on the 50.59 process.

CHAIR RYAN: So the 50.59 really still kicks in after a license is issued.

MR. DEHMEL: Right.

CHAIR RYAN: Okay.

MR. DEHMEL: And then after that, then those changes are now subject to routine inspection, the same way we're doing it for any operating plants.

CHAIR RYAN: Okay. Thank you.

MR. DEHMEL: And then so we have liquid and solid waste systems including a mobile processing system, building vents, exhausts and plant stacks and now the tendency is to have as opposed to an older

design, the existing feed of operating reactor, now the design is essentially considering a single plant stack where all of the effluence from, for example, the rad waste building, the aux building, the turbine building, will be arrived to one single emission point. That is the plant stack.

And then obviously there are subsystems required to collect and process effluence samples. So this is for the requiring where there are some samples you cannot measure through a piece of electronic equipment and you have to extract the sample and then subject it to some laboratory analysis for chemical extraction or, for example, for tritium, process it separately. Then the key operational programs are the off-site dose calculation measure or the ODCM, the rads or the standard radiological effluent controls and the radiological environmental monitoring, the REM.

The purpose of the radiation monitoring systems relies on permanently-installed and skid-mounted equipment. Again, it's kind of in many aspects analogous to the approaches we use, that is going to be used, with mobile rad waste processing systems because there's a lot more experience that with kind of skid-mounted systems because many of the

plant systems right now for the fleet are essentially, many, many of them are skid-mounted equipment.

Essentially, looking at it from the point of where you want to extract a sample where you want to analyze the effluent, we start with sampling lines including the system or subsystems or portions of the system that would involve the conditioning of the sample and/or purging of the sampling line. Then we have the radiation monitors, either on- or off-line detectors and then there are essentially processes or equipment or valves that divert or terminate the process or effluent streams depending on how the alarm setpoint is established and what are the conditions, whether or not it's a safety system or not.

Then there are control panels located in the control rooms and this is in the plural form because, for example, the rad waste processing system typically has its own control room and then so the monitoring system that's used for rad waste processing when it alarms, it typically alarms at two, maybe three locations. So the main control room where the opertors are and also in the rad waste control room. It obviously involved local panels for alarms and system actions.

Then there are design specs and

instrumentation. For example, an instrumentation sensitivity dynamic response range, instrumentation failure, data display and data reduction. And then there are operational issues associated with electronic and radiological calibration and self-diagnosis and so on and then finally operational issues and maintenance such as on and off line repairs, etc., those kind of routine operational issues associated with the instrumentation involving both performing some of these operational checks, doing daily sources checks, making sure that the instrumentation responses both to an electronic impulse signal as well as to built-in radiation check sources, depending on the type of system.

Now focusing on the key operational programs and their requirements, the first one, the most important one, is the Offsite Dose Calculation Manual which describes the method for controlling releases and describes the method with which to estimate offsite to members of the public and those are the maximumly exposed individuals. And then this radiological environmental program, the REP, which describes the environmental samples and analysis used to assess radiological activity and radiation monitoring on risk to the areas. So basically, you

have a system where the environmental report as well as the COL application or the FSAR presents an asystemic source term of ISO methodology which you calculate those things identified to a maximally exposed individual and that information is used to set the alarm set points in the system and identify the kid of dilution factor, the chi/q and so on you're going to have for the purpose assessing these doses to this mechanical process which is the Offsite Dose Calculation Manual.

The alarm set point is out there to essentially identify limits above which some process should be terminated or the operation be notified for the purpose of taking some action as it identifying the Offsite Dose Calculation Manual. And the REP essentially is the proof in the sense that after having done all this you go out and collect samples, look at monitoring stations and so on and confirm that indeed radioactive releases have been well within the requirement of the Offsite Dose Calculation Manual and you have not exceeded the requirements of Appendix I, design objectives, the 3 millirem and 10 millirem per year, for liquid effluent and 5 and 15 for gaseous effluent, met the requirements of 40 CFR Part 190 and the effluent concentration limits of Appendix B of

Part 20 are also being met.

Regarding the development of the guidance, there are some key documents, NUREG-1301 for PWR, NUREG-1302 for BWR, type over there. I'm sorry, but that's NUREG-0133 which applies to both types of plants, PWR and BWR, Generic Letter 89-01 which is contained in NUREG-1301 and NUREG-1302 and this generic letter essentially allows the plant operator to licensee utilities to take the tech spec requirements that were essentially in the tech spec and place them all in the Offsite Dose Calculation Manual. So the requirements are still the same. What the generic letter did is it allowed one to put these requirements in a separate document which would not if they were changed require a license amendment as changes are normally required -- if such a change was normally made the tech specs. So this essentially is a sub-tier of tech specs that we translated and moved into the ODCM and do not require license amendment and that can be implemented by the utility as needed, document it for 50.59 process in order to diagnose the inspectors and the NRC-1979 Branch Technical Position of Radiological Assessment which is also contained in NUREG-1301 and 1302.

And in response to Part 50 requirements in

Appendix I as well NUREG-1301 and 1302 and the generic letter, there are annual reports that have to be submitted by the utility. One is the Annual Radiological Environmental Operating Report and the other one is the Annual Radioactive Effluent Release Report. And then sprinkled through all these documents as well as in the Regs., there are these notification criteria and record keeping requirements which I have summarized here.

The key acceptance criteria cited in the SRB Chapter 11.5 are Part 20 requirements which we're all familiar with and then the Part 50 requirements, the most important ones are obviously Part 50.34(a) on the equipment to control releases of radioactivity, 50.36(a) which is the genesis for the tech specs and the operating procedures to control and monitor releases of radioactivity and then there are also some associated items on the TMI-related requirements, design criteria 60.63 and 60.64 which has been implemented at a time by the COL applicant as well as also in the DCD, the Part 50 Appendix I ALARA dose objective for all effluence. This is kind of the subset of Appendix I. This is called Section 2D which requires that once a type of system that's being used to reduce liquid effluence or gaseous effluence it is

installed that a cost/benefit analysis be done such that one can demonstrate that it is ALARA and then the other requirements identified for the purpose of the licensing of the Part 52, 52-47 and 52-97, as they relate to DCD and COL applications.

Key guidance in the SRP again, Reg Guide 1.70 for the existing feeder operating reactor and Reg Guide 1.26 for the upcoming wave of applications, Reg Guide 121 on measuring, evaluating and reporting effluence, Reg Guide 1.33 on operation of QA programs, Reg Guide 1.17 on instrumentation to assess conditions during accident conditions, it means accident/post-accidents both, Reg Guide 4.1 on monitoring of radioactivity, 4.8 on around tech specs, 4.15 on quality assurance, ANSI N.13.1-1999 on sampling and monitoring from ducts and stacks, ANSI N.42.18-2004 performance of instrumentation. Of these reg guides, obviously Reg Guide 1.26 is new, Reg Guide 1.21 is in the process of being revised, 1.97 has been revised, I think it's 2006, it escapes me right now, 1.33 is in need of revision, 4.1 is being revised, 4.8 is on the books to be revised, 4.15 has been revised.

So the structure of the chapter, Chapter 11.5, essentially is still the same as before. There are secondary responsibilities. With respect again as

before to Chapters 2, 3, 4, 5 of the SRP, the Health Physics group has the responsibility as having the prime review and it's supported with other technical branches. So for Chapter 11.5, some support here or secondary responsibilities include I&C and balance of plant.

As before, we've gone over this before with the other subsection of Chapter 11 of the SRP. We identified and flagged some issues associated with compliance of 20.1406, Minimization of Contamination. So some of the things that you've seen before are virtually identical here. Again, I just wanted to remind you that why we were preparing the update of the SRP we didn't have the benefit of the Reg. Guide that has been prepared for 20.1406. That's a work in progress and we know there's a rulemaking ongoing for 20.1406 as well. The information that you see here on this slide as well as that's in the SRP right now are kind of placeholders with the understanding that whatever guidance emanates out of the new reg. guide and whatever is any of the requirements of the revised Rule 20.1406, we're going to have to go back in and update all those sections in the SRP in 11.2, 11.3, 11.4, 11.5 to reflect the new guidance.

We've provided some additional

supplemental guidance on meeting the 20.1301(e) and EPA environmental dose standards in 40 CFR Part 190. Again, the next bullet addresses the fact that this relates to all potential sources of radioactivity and radiation. The difference is because Appendix I requirements on the per plant basis, well, 40 CFR Part 190 is for the entire site regardless of how many plants there are and only involves the liquid and gaseous effluence, but radiation and radioactivity from other sources of material onsite, for example, tanks that may contain a radioactivity, in term, rad waste storage facility or staging areas during major outages and so on.

And as compared to the maximally-exposed individual under Appendix I, the requirement of 40 CFR Part 190 are for a real member of the public and all of this is essentially folded into the ODCM and the REMP and the doses for radiation is dealt with a different chapter, Chapter 12, of the SRP. Again, some of the miscellaneous changes and updates are similar to the other sections that we talked about before on 11.2 through 11.4. This is really nothing new here.

In conclusion, we've done some minor updates. The structure of the chapter remains

unchanged. We provided more detailed guidance to staff and applicant on specific updates and just to flag those, if you compare this version of the SRP with the prior one there is more elaboration discussion about the content of these operational program documents, the ODCM, the REMP and the tech specs. We also provided some further clarification and amplification on two elements, one on the calibration of the instrumentation, again the fact that the calibration response of the instrument may be different if we have a source term that involves routine operation where the radionuclide mix may be different than under abnormal conditions as well as during accident/post-accident condition. So in calibrating the instrumentation and determining the responses of the instrumentation depends on whether it's liquid or gaseous effluent, we flagged the fact that the conversion factor that may be used to convert, say, raw counts per minute to a meaning for radiological units such as microcuries per mL or microcuries per second. But the conversion factor may be different to reflect those conditions. And we also flagged the need since most of the instrumentation now comes prepackaged from the vendor where the instrument does the raw data conversion to meaningful

radiological units so that the utility or the licensee would have to be aware of making sure that they agree with the software and the conversion that the vendor is using to convert again from raw radiological units which are counts per minute, counts per second, to appropriate radiological units.

Again, we have incorporated information from recent staff studies having to do with water contamination from the Lessons Learned Task Force and some D&D lessons learned report and with respect to the long term, again as I noted earlier is that we're going to update all SRP chapters after the issuance of the reg. guide and Part 20 and the rulemaking of Part 20.1406, whatever the task force recommendations are regarding the tritium leaks and spills that were noted in the groundwater contamination Lessons Learned Task Force report. And then as we progress, that chapter will have to be obviously updated as the computer codes and reg. guides are updated to reflect whatever changes were made so that it's all internally consistent with the SRP and all the cited references including the reg. guides and the supporting computer codes.

That concludes my presentation and if you have any questions, I'll be glad to entertain them.

CHAIR RYAN: Bill.

DR. HINZE: A few questions if I might please. What kind of input have you received from the user community in preparing this revision? Has this been passed by the users?

MR. DEHMEL: Yes, it was made available on the website as a draft and then we have gotten some comments separately from NEI and those comments were kind of tied altogether with their utilities and NEI's review of reg. guide 1.206.

DR. HINZE: So there was no overt attempt to get input from the user community on specific guidance here?

MR. DEHMEL: No, my understanding the SRPs are NRC documents and basically the Agency publishes those documents and they are implemented. The comments we have received which tie the draft reg. guide 1.206 together and also the fact that in the reg. guide we referenced the SRP so there was a vehicle or means for NEI to submit some comments.

But basically the comments were three types that I can relate to you. One is the idea that the industry recognized that some of the computer codes under the reg. guides need to be updated. This was very clear. No one disagreed there. The other

one was, the other category of comments, was that NRC is asking a lot of information and this information will not be available at a COL application stage and therefore there has to be a mechanism by which the delta, and that's addressed in reg. guide 1.206, is that as opposed to prior licensing procedure now you have a DCD in place that may or may not have been approved but essentially there is a document that essentially validates a type of reactor system that the NRC is in the process of reviewing or is being approved and then there is possibly an early site permit which banks a site as being suitable to accept one or more reactors and that once the applicant takes the information from early site permit and takes a DCD and packages it together in COL application is that utilities say that the actual construction and the final detail design is now going to occur some years down the line, anywhere from five to six years or ten years, that some of the items that are described both in the reg. guide 1.206 and also described as being needed in the SRP will not be available and therefore there should be a mechanism in the licensing process.

The way the SRP right now is written in 11.2, 11.3, 11.4 and 11.5 regardless whether or not we're dealing with liquid or gaseous effluence of

waste or solid waste or radiation in system to liquid and gaseous effluence, there is no escape clause there. The information is required and it's mandatory for the staff to be able to look at it and evaluate it in order to reach the evaluation findings that are stated at the end of each section of the SRP. So this is something that is being addressed through the upper tier of the other branch of the NRC that's dealing with infrastructure and so on as in the licensing process how this is going to be dealt with.

So the issue -- Just to make a long story short on that element was that we are requesting information both in the reg. guide and the SRP that the applicants, future applicants or near-term applicants, we won't have that by the time we supply the application to you.

DR. HINZE: I guess that kind of gets to my second question I wrote down here. How robust is this standard review plan and certainly we all know about the advances that are made in hardware and operational procedures and so forth. Is this written with sufficient flexibility and I think that was what you were really getting at, Jean-Claude, that there needs to be some flexibility in this to incorporate future instrumentation or do you look at the

instrumentation and modify this as it becomes available?

MR. DEHMEL: The flexibility -- This point you're raising also applies to mobile waste processing system.

DR. HINZE: Sure.

MR. DEHMEL: And the approach, we've had several meeting with the utilities and potential applicant on this subject alone and the idea was that, for example, they are telling us that the level of details required it cannot be provided. For example, these operational documents, they cannot be prepared, that rad waste processing system that are being designed or that will be designed in the near term, they don't have enough design specifications to include information now. So the idea of postponing these kind of major operational program or providing the technical details on different types of rad waste processing systems, that's where the utilities and the applicant is looking for flexibility.

We have the flexibility. In the context the way we described it in these meetings is that with respect to, for example, in complying with Part 20 or complying with Appendix I, we have to demonstrate to you that we can meet those requirements now. But

we're not essentially forcing the applicant that once described the hypothetical system that this is exactly the same type of system that's going to have to be installed.

And our approach in discussing this across the table was that to provide enough information in these COL application packages such that if you put the health physicist, a systems engineer and a radiochemist together in a room they'll say that we agreed that if you have that kind of system with these major elements, major features, in this kind of ionic change goes on or this kind of instrumentation that you can meet those objectives of Part 20 and Appendix I and that the applicant would only need to caveat the application by stating that it is recognized that by the way the time the plant is actually built the applicant at this point will look at whatever systems are available commercially and make a decision and thereby make a commitment that whatever they ultimately end up installing and reinspecting as part of the licensing process that it be of equal or better performance and so this issue is still in the realm of discussion with the applicants, but that's essentially the approach that the staff is using at this point.

DR. HINZE: Finally, you talked about

incorporating the tritium task force recommendations. How will that be done and does that mean that you will issue the review plan again? I'm ignorant about this. Or can you just have an addendum? Do you have to go through a lot of procedure to add those? What's the process?

MR. DEHMEL: We're going to look at the recommendation, I believe. I mean Tim can talk about this a little bit more, but there are several task forces that are essentially looking at the recommendations and the recommendations will be issued. Then management will have to make a decision as to how these things will be implemented and then depending on these recommendations we're going to go back in the SRP and see what the recommendation is, what the impact is on the SRP and we're going to supplement. We're just going to revise the SRP.

DR. HINZE: I see.

MR. DEHMEL: Tim.

MR. FREY: Yes. Tim Frey, Branch Chief for Health Physics. I think as Jean-Claude mentioned earlier in the briefing one of the key outputs that the staff is doing and it's really NRR that has the lead as revising a couple of reg. guides, Reg. Guide 1.21 and Reg. Guide 4.1 to address the Lessons Learned

Task Force and as those get revised that guidance will be reflected in the SRP.

DR. HINZE: Thank you.

CHAIR RYAN: Allen.

VICE CHAIR CROFF: I'd better lean forward. In your slide 10 in a couple of places there, you have phrases and quotes, "real member" and "total dose." When I see that, it sort of leads me to think that I'm mean that your intension is to say some document says "real member" but maybe we don't really mean that. What should I read into that? What are you trying to tell me with those?

MR. DEHMEL: The distinction between the recommendation of 40 CFR Part 190 and Appendix I is that the appendix slide calculations are the ones that are done every month or before a batch release occurs, liquid or gaseous effluent. Those calculations reflect maximally-exposed individuals as it is defined in Reg. Guide 1.109. That means something with respect to the kind of individual assumptions made as to the location of that individual, the kind of exposure pathway that individual may be exposed to and so on and again, that's based on a per plan basis as opposed to 40 CFR Part 190 which is a person outside the fence. So in this case it could be the nearest

house with a real resident in it.

The total dose meaning that when Appendix I, the way the requirements are set up, it only deals with gaseous and liquid effluence while the requirements of the EPA normally addresses liquid and gaseous effluence, but also external radiation. So, for example, if you have a turbine building from a BWR where, for example, it's Nitrogen-16 as a significant contribution to potential outside doses due to the sky shine, then in calculating the total dose as it is defined in NUREG-1301 and NUREG-1302 you would consider liquid and gaseous effluence, the contribution of those effluent releases to that real member, whoever that is as it defined just outside the fence, and that real member is defined by these PRA called these yearly land use census and the contribution of direct dose, direct shine from external radiation, takes into account, for example, the BWR from turbine building skyshine in a rad waste storage building, a rad waste warehouse that may be used, a storage warehouse that may be situated, temporary staging area where radioactive waste and material and equipment is stored during a major outage condition and so on. So the total dose is different in the context of complying with 40 CFR Part 190 than

it is with Appendix I requirements.

VICE CHAIR CROFF: I understand now what you're saying about total dose. I'm still not sure about the real member. As I understood it, depending on, well what does Chapter 11.5 say about the real member? As I heard it, there were two real members. One was a maximally-exposed and the other was a real person outside the fence. Does that mean there are two different calculations to show how two different regulations are met?

MR. DEHMEL: It could be. But in most cases to simplify the issue is that the utility combines the two. So you have maximally-exposed individual, but that person and location happens to be also the same person that's used for the purpose of doing those calculations for 40 CFR 190.

VICE CHAIR CROFF: Okay. Thanks.

CHAIR RYAN: Jean-Claude, that kind of brings me to something we just discussed at our planning and procedures meeting. We're thinking about the string here. I think we understand the standard review chapters and we dealt with the GALE code as an issue that backs up a couple of those and as I'm sure as you're probing now with Allen, there are other codes and calculations that go back. I was just

trying to quickly identify what is the data in Reg. Guide 1.109 now. Late `70s?

MR. DEHMEL: Yes. All the T reg. guides are essentially 1976 and 1977.

CHAIR RYAN: And I'm going to guess most of those are not risk informed.

MR. DEHMEL: Right.

CHAIR RYAN: I'm going to guess that most of those kind of rest on bounding assumptions and bounding calculations and overestimates of dose by a modern kind of risk informed thinking and the structure of how the chapter is revised and how it relates to the documents I think you've laid out very well in all these briefings. But we're beginning to think about pulling the string a little bit and saying what's the substance backing up this structure in terms of what are the reg. guides. What's the underpinning of the reg. guides? We touched on the GALE code, just the idea that it's a calculational tool that's probably not as well vetted as a more modern tool that we would use today for some application just because it's older and folks who wrote it are gone and retired and it's in Fortran and all the things we talked about.

So I think what we're thinking about and

I throw this idea out to you and to Tim is we'd like to study a little bit and get ourselves ready to think about what in the reg. guide arena or in the fundamental documents arena are out there that an applicant would use and can we offer the Commission any insights that there ought to be a little bit more of a systematic assessment of those that -- Let me just pick out some categories for just the sake of the discussion of need immediate attention, are okay but a couple of work-arounds might be needed or they're fine the way they are just as a rough cut. I think if that was offered to applicant, that might ultimately even though it's some work up front now, might ultimately serve the review process in a good way. Do you have any reactions or thoughts to that idea?

MR. DEHMEL: Yes, I concur with you. Since we've been at this, these reg. guides are kind of like living documents. We look at them almost every day and you could look at potential revisions of these documents in three tiers. The first one is that, for example, if we're concerned about the reg. guides being outdated with respect to the basis of radiation dosimetry, ICRP-2 19.59 vintage versus the current Part 20 or the upcoming recommendations from the ICRP, one way to deal with that would be to simply

go in there, in the reg. guides, and obviously this is the simplest revision and the most cost effective revision with respect to expenditure and time of effort would be to go in there and say, "I'm going to go in there and change all the dose conversion factors and modify the routine of the code so that when I have the new dose conversion factor I can calculate dose according to either ICRP 26 and 30. So that would be one approach.

CHAIR RYAN: Right.

MR. DEHMEL: The simplest approach. The other tier of review and modification would include the first one plus the revision of the factors that directly impact dose such as bio-accumulation, consumption rate and so on, occupancy rate and so on, shielding factor credits that are provided into the code. So that would be essentially the next level of review. So that would be at this point we were talking about mounting some mini-research project to figure out what are, for example, bio-accumulation factor for the BIV transfer factor from soil to plants and so on and update that.

The third revision would be essentially a complete revision where we're saying "This is set of reg. guides is fine for the existing feed of operating

reactors. But what we are going to do now for the new reactors is revise this thing from top to bottom.

CHAIR RYAN: So that might even be a different platform, use of inputs.

MR. DEHMEL: Exactly.

CHAIR RYAN: And it's a refresh review.

MR. DEHMEL: That's right. Fresh review, starting from scratch with no hindrance, with no tie to the existing methodology. We could look at this with such things like no ties to what has currently been done. What that would involve is major level of effort. You're talking about years of research to support information.

I realize that since then there is a lot of information available that was not available when the reg. guide 1.109 generated. For example, if you look there's a database, ISCORS. It's a large database now available on Factor that may be used for environmental dose calculations. So there's a wealth of information. ICRP has done some work. IAEA.

CHAIR RYAN: Even Larson and so forth.

MR. DEHMEL: Exactly.

CHAIR RYAN: That's all been brought forward in the new commissioning arena. So there's no reason that that same information shouldn't be brought

forward to the reactor arena.

MR. DEHMEL: Exactly. Right. And then we've heard talking to industry and other groups that should dose calculation for Appendix I be done probabilistically, the same way that it's done for compliance with the decommissioning criteria and 40 CFR Part 20.1401 and the question then is should we apply that methodology. There are some people out there who really think that we should do probabilistic dose calculation to demonstrate compliance with Appendix I. The question is should that be something to consider or should it be based on the all deterministic method? Does it warrant to be probabilistic the same we're doing for demonstrating compliance of 25 millirem per year for decommissioning? So what I'm suggesting is a third level of revision, everything is up for grabs, everything is up for review. We're starting a clean slate and we're free to go.

The other thing that we've heard is that why even bother with Appendix I. Just delete it from Appendix I. Slip it into the ALARA requirement of Part 20. So you just open your vision on this one and everything is possible so to speak as to what may be considered. What ultimately the Agency and the

Commission decides to adopt that's a different story. But you could toss a lot of option on the table and look at all of these and figure out which way they go.

CHAIR RYAN: And I think our tack is to think about the reg. guides and the codes and the underpinnnings of the structure and the requirements, maybe more towards that sort of first look of are there any showstoppers, things that are just so out-of-date they might not even be useful at this point or they're wrong or there's a hardwired parameter that really shouldn't be hardwired and isn't what's in the hardwired number or those kinds of things and I have no sense at the outset here of how much effort we've put in here to even get to level of detail. But I think you want to at least examine the question and see if there's any real criteria issues.

I mean just on the dose symmetry alone we have everything from ICRP-2 which was developed and published in 1959 as you all know all the way up to now ICRP-68 which is the newest on the street and that spans 50 years of dosimetry. I've heard Ralph Anderson talk about the fact that they're happy that the *Health Physics Journal* published ICRP-2 in that DVD compendium because that's the only place you get it. It's not available anymore and they have to teach

it to their folks to use it.

MR. DEHMEL: We have the same problem. We're hiring people and --

CHAIR RYAN: They've never been taught ICRP.

MR. DEHMEL: Yes. That's right. It's not being taught in the health physics curriculum.

CHAIR RYAN: And it's not just a simple matter of different factors. It is a completely different way of calculating critical dose.

MR. DEHMEL: Correct.

CHAIR RYAN: We won't go into the details, but it's a different method. And I know that there's a provision that if any licensee says "Hey, we want to use the modern dosimetry in a Part 20 evaluation and exposure" no problem. Please do. It's an easy request and so forth, but --

MR. DEHMEL: It's an easy request, but remember that the staff is not prepared to do those evaluations because all the tools that we have with respect to the guidance is that it's all defined in those reg. guides, all defined in the SRP. So if somebody were to submit an application based on SRP-26 or SRP-68, we would have to scramble and actually develop a tool that would be suitable to do this

analysis and we don't have it.

It's something that any of us could develop a spreadsheet to do this calculation, but the question is is this the way it should be done. I mean, that kind of supplemental tool would have to be developed with some recognition that this is the way to approach it. Here's what is going to be developed up and how is the structure, how it is going to be structured, and so on, some recognition. So it's not like every health physicist -- one health physicist reviews an application X, Y, Z and another one from A, B, C to developing their own spreadsheets. That's a disaster.

CHAIR RYAN: Yes, that's terrible.

MR. DEHMEL: This is kind of licensing by anarchy. You can't do that. So we would have to scramble and come up with a tool, a methodology, that would be consistent.

CHAIR RYAN: And more importantly, it's better for the licensee to see a transparent tool so they could understand what the expectation is.

MR. DEHMEL: Correct.

CHAIR RYAN: I guess what I'm thinking is that we're going to begin to probe this a little bit more formally in more detail so that we can at least

-- You know, way back, I don't know, a year and a half or so ago, I remember Dr. Paperiello gave a presentation on the age of reg. guides and it was very interesting that a lot of them are 30 years plus old.

MR. DEHMEL: Right.

CHAIR RYAN: And like I said, there may be some. That's fine. They don't need to change. But I think it would behoove us as a committee to maybe help with your help, of course, identify maybe some critical issues that need to be brought forward so that other parts of the organization or research or contractors or whoever can be identified to help maybe with some of these kinds of questions and get the tools up-to-date because I'm personally -- It makes me a little bit nervous as a former applicant to find out that some of the things I'm using to apply for an activity may be basically out-of-date.

That doesn't mean they're wrong or bad or can't be used. It's just maybe there's the refreshing process needs to be a little bit more formal and again more transparent so everybody understands, yes, we're using an old code that we've refreshed it in these ways. We've examined it, determined it was workable and these are the working constraints and then everybody is on the same page. That's sort of start

over and let's get a real modern whiz-bang special graphics computer code which would take time and effort. Does this kind of make sense to you?

MR. DEHMEL: Yes. The technical staff, my level, we've been striving, pushing for this for awhile.

CHAIR RYAN: Yes.

MR. FREY: It makes a lot of sense and we have been working with the Office of Research for the last several months to establish a working which really started when we came with the update to Reg. Guide 112 in the GALE code and we recognized that code needed a review and update and the reg. guides and NUREGs that support it need a review and update. So we have been working with the Office of Research to do just what you're suggesting to establish a working group and review all these reg. guides and codes that do provide the underpinning for the SRP and figure out which ones need to be updated.

CHAIR RYAN: Great. I don't want to take up all the time. Ruth, do you have any questions?

DR. WEINER: As long as you have that slide up, thank you, Jean-Claude, what is meant exactly by "integration of all exposures and pathways in total dose"? What do you do, add them altogether?

How do you integrate them?

MR. DEHMEL: I think maybe I should have said a "summation of all exposures."

DR. WEINER: Okay.

MR. DEHMEL: Sorry. I think the idea was to make sure that again as I stated earlier on our Appendix I, compliance to Appendix I only addresses itself to liquid and gaseous effluent releases and not external radiation. So the integration of summation of all exposure meaning the summation of all different sources of radiation, of source of radiation exposure, that include liquid and gaseous effluence and external from facilities and buildings and temporary rad waste storage areas and so on such that once the doses from each of those respective pathways and different types of effluence are summed or integrated that one can demonstrate compliance with the EPA's environmental standard of 40 CFR 190.

DR. WEINER: Yes, the thing that disturbs me and maybe it's not a question here is that if you integrate the inhalation dose with the ingestion dose, the people who receive the ingestion dose is a different group. I mean it isn't necessarily that everybody who lives within a certain number of miles of the --

CHAIR RYAN: This is an individual dose though.

DR. WEINER: Oh, this is the individual dose. Well, still the -- You're assuming that it's the same individual who receives all these doses. That's what I'm trying to get at.

MR. DEHMEL: In the structure of the offsite dose calculation manual as well as the result of the land use census, the data or the approach you demonstrate compliance both on the dose side and the EPA standard would recognize the fact that, for example, if you have somebody that lives near the fence, the EAV, you would be exposed to external radiation and gaseous effluent releases but the discharge point, the liquid waste could be such that the dose receptor is like miles down the road and in that context, the structure and the calculational methods in the ODCM in demonstration of, in demonstrating compliance with 40 CFR Part 190, would recognize that it's impossible to have one person exposed to both pathways.

DR. WEINER: Thank you. That was exactly what I was getting at.

MR. DEHMEL: Yes. Absolutely. That's recognized.

DR. WEINER: And you are looking only at individual doses. You're not looking at collective doses here. Is that correct?

MR. DEHMEL: There is a calculation in looking at collective dose, but it's not -- The NRC uses it or they have used it for the purpose of, for example, comparing what the ER of the application package may have said. So for a plant where it's newly constructed and it has a number of years of operational history the original inspectors may want to look at the doses that were reported, both individual and collective doses in the environmental report as well as the staff's final environmental impact statement and compare that to what the doses are currently for the purpose of determining whether or not some actions should be done. There are provisions in Part 20 and Part 50 that says that the NRC shall look at these doses, compare them to what was submitted and take appropriate action to reduce and I think Part 20 the language says to reduce collective doses. So there are dose provisions, yes.

DR. WEINER: Thank you.

CHAIR RYAN: That's on the edge of where it's technically justified and not. I mean to me and I think the Committee is on record in the letters

saying that in relative of comparisons, particularly let's say an ALARA setting. Process A gives you 10 REM to work as Process B gives you 5. Process B is probably better if it's about the same cost. Makes a lot of sense, but very often collective doses that have microdoses to mega people are misinterpreted in terms of their ultimate risk.

MR. DEHMEL: You see, this is another thing if we had to reconsider Appendix I from top to bottom, we would revisit that as well and say --

CHAIR RYAN: Right. Then it should be a dose criteria.

MR. DEHMEL: Yes.

CHAIR RYAN: Or some other criteria, but that's one where I think there's an opportunity to improve understanding because it is just flat out wrong to apply those probability kinds of estimators to an individual. It's just wrong. They don't make sense. You cannot apply the population probability to any one individual or small group. It's just bad statistics.

MR. DEHMEL: Yes, in this case you could say that if you can show that the doses to a single individual is low enough that it becomes a surrogate and you can say therefore the entire population is

protected. That could be a conclusion.

CHAIR RYAN: And again, if that presents, even if it's probabilistic and you say this is the geometric mean or this mean or that kind of an average, you can arrive at that kind of assessment in a number of really good ways compared to just relying on a arrived --

DR. WEINER: Thanks.

CHAIR RYAN: Jim.

DR. CLARKE: Thanks, Mike. Just a couple of questions. Could we go to Slide 12? And I guess what I'm interested in is how some relatively new information is being brought back to the reg. guide. For example, I'm looking at your acceptance criteria, Part 2, and you do have 10 CFR 20.1406 incorporated by reference and it's No. 5 under that acceptance criteria based on meeting the relevant requirements and if we go up to the fourth bullet, ground water contamination Lessons Learned Task Force report, D&D lessons learned report, is the intent to incorporate those by reference or are you taking specific items that would be appropriate to this reg. guide and putting that language into the reg. guide or just how do you do that? How do you take what we've learned relatively recently and bring into the reg. guide? Is

it by reference or do you have specific guidance, I guess, is the question. If you could just point me to it, I can find it and read it.

MR. DEHMEL: Yes.

DR. CLARKE: But I was kind of wondering in general how you intend to do that.

MR. DEHMEL: What we intend to do depending ultimately how the recommendation is structured and what ultimately management decides what should be implemented, we're going to look at these and essentially incorporate the ones that essentially relate to the objective of the SRP. For example, there will be recommendations addressing, for example, design features of plants that would minimize the amount of radioactivity and contamination of the soil and ground that really are targeted in the context of decommissioning.

11.2, 11.3, 11.4 and 11.5 are really not focusing on decommissioning. It's impact on operating components and routine effluence releases, liquid and gaseous. Now there are some -- There will be some recommendations we're going to look at. It's going to be clear that from the way they are objective, the way they are targeted, the way they are identified, that their intention is really to target decommissioning of

facilitated commissioning facility or minimize in a sense spills and so on. So we're going to look at these critically and say, all right, if this feature that's proposed is a recommendation in one of these reports focuses, for example, on minimizing unmonitored and uncontrolled releases, we're going to say that falls in the context of the SRP because we want to minimize, we want to avoid essentially, all unmonitored and uncontrolled releases because that essentially is contrary to Appendix I and that's contrary to Part 20 requirements for effluent releases on their Appendix B.

If they are recommendations from those task forces that, for example, focus on instrumentation techniques or monitoring techniques that would provide better characterization of the effluence or provide the means to intercept a release such that you may have, for example, a early telltale indicator or something like that, we're going to import that into the SRP because again that is a feature that is salient to Chapter 11.5 and again on being able to control and monitor all effluent releases. That will be a requirement or there will be topics of discussion and recommendations that will have to do with other aspects of the life cycle of the

facility which are not relevant to those to that chapter at this point.

DR. CLARKE: I understand.

MR. DEHMEL: So we're going to look at these and then essentially make sure that whatever we're importing from those recommendations fit the purpose and intent of those sections of the SRP.

DR. CLARKE: Sure. And with 1406 all you can do right now is incorporate it by reference.

MR. DEHMEL: That's all we can do.

DR. CLARKE: Because you don't have the rulemaking yet.

MR. DEHMEL: Yes, but keep in mind that for all the sections, 11.2, 11.3, 11.4 and 11.5, for the purpose of the SRP it's that we flagged 20.1406 as a requirement and then, for example, in this SRP section, let me quickly go -- I think it's on page 17 in the context of what 20.1406 is all about not having the benefit of a reg. guide and not having the benefit of further recommendations from those task forces is that we said we identify a number of information notices, NUREGs, reg. guides, information circular and so on that typify the kind of issues we're concerned about. It's clear that once the reg. guide is issued that the reg. guide is going to be that long laundry

list of engineering fixes, operational procedures, design features and so on. Then when we look at this, we'll be able to say "This particular type of feature addresses the concern, for example, that was identified in the information circular 77-14."

So we have identified this point. This is not a long laundry list, but enough of an example for the upcoming wave of reactor application to give ideas to the kind of issues where the staff is concerned about without having the benefit of a reg. guide. So those information notices and bulletins and circulars are going to be ultimately lifted out and then we'll simply refer to the reg. guide and provide some simple verbiage to essentially give the readers some general direction where the issues are and that's it.

DR. CLARKE: That's good. Thanks. That's what I was asking. And then another quick question following up on what Dr. Hinze if I understood your response. The next updates (long-term), I was going to ask you what you mean by long-term. But understanding that this information is going to be available at different times, will you continuously update this as that information becomes available?

MR. DEHMEL: My understanding is that, and I guess Steve Koenike is not here to talk about this,

maybe Tim can say something, it's going to be more of a living document than it was in the past. That's my understanding.

DR. CLARKE: So if one of these took five years, you wouldn't hold everything up until you had that.

MR. DEHMEL: No.

DR. CLARKE: I mean is the recommendation --

MR. FREY: We'll have to work with our infrastructure group in new reactors. You know, certain SRP sections might be good to go and go for the foreseeable future, but we need to make sure that they understand that all SRP sections do need to continuous update and we need to work out a schedule.

DR. CLARKE: The point of my questions is we've been asked by the Commission under the context of decommissioning to assist as we can in making sure that information is learned through decommissioning and is factoring into up-front planning for new facilities and so that's the motivation for my question.

MR. DEHMEL: Right.

DR. CLARKE: How is that link being made? As information becomes available, how is it translated

in the guidance, regulations, whatever is appropriate for examining and planning in facilities?

MR. FREY: I was just going to say as you said there will be different schedules. You know, one of the -- We already mentioned this, but the Lessons Learned Task Force recommendations, the main way we're getting those incorporated is the updates to reg. guides 1.21 and reg. guide 4.1 and as those get updated by NRR we'll work that guidance into the SRP 11.5 and the other SRP sections. That's how we're going to get the Lessons Learned Task Force recommendations into the SRP eventually.

DR. CLARKE: Thank you.

MR. FREY: And the schedule for that could be and is likely on a different schedule than the reg. guide for 20.1406 and we'll have to work out schedules for routine updates so we're not waiting.

DR. CLARKE: And keep them up. As your information becomes available, you will plug it in.

MR. FREY: Yes. Right.

MR. WIDMAYER: And, Jim, the first iteration of the reg. guide on 1406, we have a presentation next month.

DR. CLARKE: I understand.

MR. WIDMAYER: Okay.

DR. CLARKE: Thank you.

CHAIR RYAN: Jean-Claude, thank you very much. Tim, thank you as well. We'll, I'm sure, be talking as we move along. I would like to invite our next presenter up, Dr. Tina Ghosh, who is with us to talk about ISG-04, "Preclosure Safety Analysis Human Reliability Analysis." She was here a minute ago.

(Off the record comments.)

MR. WIDMAYER: Hello. Is anybody on the bridge? Hello.

MS. GHOSH: Susan, is that you?

PARTICIPANT: The Center is here.

(Off the record comments.)

CHAIR RYAN: Okay.

MS. GHOSH: Sorry about that confusion. We've been working with an NHRA expert from the Office of Research. Her name is Susan Cooper and she is supposed to call in on the phone bridge.

CHAIR RYAN: Well, you'll just have to wing it.

MS. GHOSH: Sorry?

CHAIR RYAN: You'll just have to wing it.

MS. GHOSH: Yes, it's not problem. If she's there, she's there. If not, I just wanted to let you all know that we've been working closely with

Susan Cooper.

CHAIR RYAN: Okay.

MS. GHOSH: The topic of this presentation is "The Draft Interim Staff Guidance from the Division of High Level Waste Repository Safety on Preclosure Safety Analysis" and more specifically, on staff review of the human reliability analysis that would be part of the preclosure safety analysis.

And if we go to the next slide, this is just a quick outline of what I'll talk about. I'll go over the purpose of the ISG, the motivation for why we wanted to write this ISG, the regulatory requirements that the guidance is tied to and I'll give you a very high level overview of the technical staff guidance that's contained in this ISG and again just a quick summary of the recommended changes to the YMRP and I'll touch on the hypothetical example that we included in the appendix and this is just an example. It's not meant to be a comprehensive list of everything that we would look at and then I'll summarize and, of course, I'll be happy to take any of your questions at the end of this talk.

So the purpose of the interim staff guidance like all interim staff guidance, it's to update a existing review plan. In this case, it's the

staff review plan for a potential license application for Yucca Mountain. That's the Yucca Mountain Review Plan, NUREG 1804 and this ISG is targeted to updating the staff review guidance for human reliability analysis specifically.

So more specifically, the reasons we wanted to do this were that there were two references that were published on HRA review guidance in general that came out after the YMRP was published. So these are newer guidance documents that are available now that weren't available at the time of the YMRP and we wanted to make sure that those were explicitly included as references in the YMRP. And then because these review guidance documents are targeted to nuclear power plant applications, we also wanted to provide some additional considerations that would be relevant for a license application for Yucca Mountain in particular.

So we go to the next slide. Why did we write this ISG? As I said, there were these new guidance documents out there and the reason that we were interested specifically in the area of HRA to provide length to these guidance documents is that if you look at the operating experience that's available it shows that human errors do contribute to the

majority of operational events for spent fuel handling. Now there haven't been any accidents in spent fuel handling in the U.S. in the commercial industry. But if you look at the kinds of operational events that do occur such as the occasional load drop or fuel assembly or fuel element misloads, you can see that human performance figures into those events that are quite common. And if you look at some things such as load drops from cranes, it seems that human actions may dominate the failure modes for some equipment and systems and again crane load drops is one example of that.

Then the next thing is that human performance tends to be highly dependent on a lot of specific factors of whatever facility that you're looking at. It's a little bit more complicated than looking at hardware reliability that, for example, might be modeling hardware just fails randomly at a constant rate. People don't tend to act randomly and just fail randomly and usually performance is dependent on activity and site-specific, facility-specific factors. So it's a little bit more complicated to model and understand human reliability. Because human reliability does figure prominently into safety for fuel handling activities and there were

these new guidance documents available, we wanted to update the YMRP because we think it's an important thing to do.

Now the key regulatory requirements that form the basis for this ISG, most of them are basically the same as those for the overall PCSA and I just included the two very high level ones here. The PCSA which is the pre-closure safety analysis must include an identification and systematic analysis of naturally occurring and human induced hazards at the GROA which is the geologic repository operations area and include a comprehensive identification of potential event sequences. And, second, this analysis of the performance of the structures, systems and components to identify, there has to be an analysis at the performance of SSCs to identify those that are important to safety and this analysis should also identify controls that are important to safety that would either limit or prevent potential event sequences or mitigate their consequences and I just want to point out that some of these controls might actually be human actions, for example, maintenance that you need to do in order to ensure that event sequences either don't happen or that the effects would be mitigated if they do start to happen.

And then in addition to the overall regulatory requirements for the pre-closure safety analysis, there are a couple of more that are important to human performance in particular and that includes, I just included two of them here, that the safety analysis report in the license application must include information about personal qualifications and training requirements. And I'll talk a little bit more about why these programmatic issues are important for human reliability analysis. In addition, the safety analysis report has to include an identification and justification for the selection of those variables, conditions or other items that are determined to be probable subjects of license specifications and this is another aspect that I'll talk about later. It provides an important link between the safety analysis and the programmatic review that we expect to take on.

Just to give you a kind of overall 50,000 feet perspective on what the technical guidance said, the first thing is that HRA isn't just about quantifying probabilities. You actually also have to understand how your system is going to work overall and so the first thing that we say is that qualitative analysis are going to be important as part of the HRA

and the overall PCSA and by "qualitative HRA," we basically mean the conceptual understanding of how humans are going to work with the overall system and what human performance will look like in the planned operations. And we want to make sure that staff sees that the license application contains sufficient information to review this qualitative part of the HRA analysis.

The second thing we wanted to stress is that the HRA in different parts of the license application and the PSCA we expect to be commensurate with the associated risk significance because the risk significance of different activities and different analyses are not going to be equal. There are probably a lot of mistakes that people can make in operations that don't actually result in any safety consequences and the ones that we want to see information on, the ones that we're going to think about, are the ones that might result in safety consequences. We wanted to be clear about that in the ISG.

Then the third thing is that the HRA should be integrated with the overall PCSA. HRA is not really -- shouldn't be a standalone analysis, but rather should be part of the overall safety analysis

and we just wanted to call this out as an important aspect.

If we go to the next slide, slide eight, then as I mentioned, there have been two NUREGs that have been established recently, NUREG-1792 in 2005 which is Good Practices for Implementing Human Reliability Analysis and NUREG-1842 which was published in 2006 which is the Evaluation of Human Reliability Analysis Methods Against Good Practices and these two NUREGs came out as the Agency's efforts in improving the guidance for reviewing the quality of safety analyses that support license applications in general.

Now these are targeted to nuclear power plant applications. However, the guidance that's contained in these NUREGs, the generic guidance, would be useful for pretty much any kind of application that the NRC deals with. So what we said in the ISG is that basically we point to these guidance documents and say that the generic parts of this are likely to also be useful for our review of the license application for the GROA and we want to make sure that staff look for this, basically that the HRA is actually consistent with what's recommended and what's recognized as good practices in the industry for HRA.

The next slide, slide 9 -- And just one more thing on that, one of the other things we do say in the ISG is because the operations of the GROA are likely to be different -- are going to be different from nuclear power plant operations, we expect in the license application that the guidance from these NUREGs would be considered along with the operating experience from facilities that are more similar to the GROA in order to basically adopt the good practices and shape them to what's specifically applicable for the GROA.

So if we go to slide nine, now one of the things that we kind of have to live with is that HRA as a practice and as methods, there has been a lot of development for nuclear power plants not as much for fuel cycle facilities or materials handling facilities. There have been some applications. But really most of the actual HRAs that have been done have been done for commercial nuclear power plants.

What we point out is that if in their license application, NRA methods that were developed for power plants or HRA data that were developed from power plants are applied to the GROA, we just want to make sure that there is a technical basis provided in the license application for why it's relevant for the

GROA. So we point that out in the ISG.

And then as I mentioned before when I talked about the regulatory requirements, HRA, human reliability is one of those areas where programmatic elements are likely to be very important for verifying the assumptions that you put in the safety analysis because things like human reliability and human performance depend a lot on what training programs you have, what kind of administrative controls you have and so on and you want to make sure that programmatic aspects of the DoE's operations are going to support the assumptions that were made in the human reliability analysis for the PCSA and also vice versa. If there are important risk significant assumptions that are made in the PCSA with respect to human reliability analysis, we want to see that that's supported by the appropriate programmatic elements when the time comes down the line. So that's the point of that.

If we go to the next slide, again just a very high level overview of what the recommended changes were to the YMRP. We've explicitly added references to NUREG-1792 and NUREG-1842 which are these key regulatory guidance documents for HRA review. We deleted reference to NUREG-1278 mostly

because that was in there because there weren't a lot of other guidance documents available at the time. So it was just one place to point staff for some knowledge base.

Then we added some human factors references, specifically 0700 and 0711 and 0711 in case you're not familiar is the human factors engineering program review model guidance and 0700 is the human system interface design review guidelines and again these are designed for reactor applications. But if you look at these guidance documents, most of the elements, the review elements, are very generic and can be almost adopted wholesale for other NRC applications. So they are very useful references and we expect them to be useful for the GROA license application as well.

Then we just added some words here and there to make sure that the consideration of how people kind of fit into the overall operations is considered in the review of the pre-closure safety analysis. In terms of -- There are some lists of different disciplines that we expect, for example, the design team of the DoE and the design review teams to have and we added human factors engineering as an expected area of expertise for these design and review

teams.

If we go to the next slide, now one of the things we did want to do because the ISG is written at a fairly high level, I mean it's generic, it's kind of general guidance, we wanted to provide just one example to show some more concrete details of what the staff might be looking for in a license application and what kind of questions we might expect to ask. So this particular example, it's just one example. Again, it's not the universe's considerations that we might have, but it actually just gives you a flavor for what are the questions we might ask and the example builds on the example from Appendix A in ISG-02 which Robert mentioned yesterday. That ISG was on the PCSA level of information and reliability estimation.

In that appendix, there was an example of a crane load drop being a potential event sequence initiator and what kinds of things the staff might be looking for in the license application to support an evaluation of that event sequence. So we build on this example and basically we say that we suppose that, yes, load drop from a crane is an initiating event for a risk significant event sequence in the PCAS and that the license applicant uses empirical

data to establish the -- to estimate the reliability of the crane and here "crane reliability" means with respect to load drops from the crane.

And we provide an example of a set of questions the staff may ask if this hypothetical situation were to come about. And just some examples of the questions are "Did human actions contribute significantly to the load drop rate in the empirical data" which in this case is yes and "If so, does the license application provide a justification for use of the data source commensurate with the risk and based on qualitative considerations in terms of how similar the situation is from the database from where the empirical data comes versus the GROA" and then "Does the license application discuss general risk insights from crane operating experience and insights into human actions and reasons for past unsafe actions" and "Does the license application the similarities and differences" and "What might be the implications of any differences" and "Has the application identified the key administrative controls for establishing reliability" and so on. So again, this is one example of a set of considerations that the staff would be looking for if this were a hypothetically important event sequence.

Just to summarize, the draft ISG-04 updates and supplements the YMRP, providing guidance to the staff in the area of reviewing human reliability analysis which is part of the PCSA or pre-closure safety analysis. We also are soliciting public comments through June 4th and I've just provided a web link to the *Federal Register* notice and you can also get to the draft ISG if anybody is interested. With that, I'll be happy to take any of your questions.

CHAIR RYAN: Thanks, Dr. Ghosh. Jim.

DR. CLARKE: Thank, Tina. Just a couple questions to make sure I understand how all this fits together if I could. As part of the pre-closure safety analysis, the doee will have to address human factors, human reliability, I guess, within the context of event sequences. Is that the way it's framed? As they look at things that can happen, they need to not only talk about system hardware reliability but people factors as well.

MS. GHOSH: Right.

DR. CLARKE: You've prepared a draft interim staff guidance document that addresses this and from that draft you will recommend changes to the review plan. That's where you are right now.

MS. GHOSH: Yes.

DR. CLARKE: And I guess the thing that really made this necessary is that since the review plan was prepared two documents, two very pertinent documents, have come out. The NUREGs that you mentioned, they supersede really the one that you're deleting and so really what a lot of this is about is taking what was learned in this NUREGs and getting them into the review. Is that correct?

MS. GHOSH: Yes. Right.

DR. CLARKE: Okay. Thank you.

CHAIR RYAN: Ruth.

DR. WEINER: My questions and comments are fairly general. There are a number of industries not the nuclear industry which provide examples for mitigating and minimizing the effects of human error. The fuel handling facilities and spent fuel handling facilities isn't big. You're handling large, heavy objects with cranes basically.

MS. GHOSH: Yes.

DR. WEINER: Are you taking into account some of the lessons learned from these other industries? Are you incorporating that?

MS. GHOSH: Yes. I agree completely. There is actually a large wealth of information out

there. As Dr. Ryan mentioned yesterday, he calculated 3,000 years of spent fuel operating experience. Similarly if you look at most of the activities that are going to go on at Yucca Mountain, there is a lot of experience out there to draw from and the Department of Energy has the flexibility to develop their license application and decide what they're going to rely on in order to demonstrate compliance with the safety objectives and we expect that whatever path they choose in terms of what they're relying on, they will go to the operating experience that's available and draw on the insights and provide a very clear basis for why they think their chosen path to demonstrating safety is going to work.

We definitely expect that and from the NRC staff side, I think Robert mentioned yesterday we are in the middle of an operating experience review test to help us get ready to review the license application and we're certainly looking at a lot of that experience as well for our own purposes.

DR. WEINER: I'm impressed that you have on your slide 10 that you want to address the relationship between human actions and design features and it seems to me that the direction -- Let me ask it as a question. Is the direction that you're going to

look at the design features from the point of view of how can you design to mitigate the effects of human error because you know human errors are going to happen? You can't eliminate. It would be nice if you could.

MS. GHOSH: Right. And again that's another area that we certainly hope the Department of Energy is going to consider in their license application. Based on preliminary interactions with them, our tech exchange last year where we did talk about human reliability analysis, our understanding is that their PCSA team and their design team are working very closely together so that the design team has an understanding of what needs to be achieved in terms of maintaining safety and certainly if there are risk significant aspects of the design or event sequences that have to be mitigated we do expect that the license application will show what are the risk insights from industry experience, maybe even international experience, with respect to the system and how have those insights been incorporated into the design process.

Now the NUREGs I referenced were the human factors engineering, 0711 and 0700, those actually outline in great detail how one might go about doing

such a thing and also how the staff might review such a thing. So we do expect that to happen.

DR. WEINER: Thank you.

CHAIR RYAN: Allen.

VICE CHAIR CROFF: Yes, I'm trying to get a little bit more of a, I'm going to call it, physical feel on this human reliability thing. I'd like to focus on the load drop that seems to be of concern and what I'm trying to do is understand what human behaviors or actions lead to load drops. I mean, are we talking about a crane operator pushing the wrong button at the wrong time or riggers not hooking it up properly, not suspending the load properly or what are the important human behaviors in that particular case?

MS. GHOSH: I can give you some examples. Actually, if you look at the database that's out there, NUREG-1774 tries to capture a lot of the crane experience from 1968 to 2002 and if you look at the events that are there, a lot of the load drops have to do with what they call below the hook incidents, rigging errors. The cranes in general especially the single failure proof cranes tend to be fairly reliable. But if there is rigging involved such as putting a sling around a load or hooking something to a load, that tends to be a more vulnerable phase in

terms of human performance. So just one of the things that I'm trying to remember off the top of my head is I remember there was one incident where the slings weren't plugged in in the right direction. So when they started to try to move the load, the load dropped. But that gives you some kind of idea.

Now the reasons for why these unsafe actions might occur, there are a variety of reasons. For some of the older data, it's not completely clear because if it's something that happened in 1970 and they didn't capture all the information at the time we're not completely sure why. But one of the things is that sometimes there may be procedures in place, but when people actually go to perform a certain activity, they may end up circumventing some steps in the procedure for whatever reason. Maybe it's impractical to carry out the procedure as it is. Maybe you're under time pressure, whatever it could be and sometimes something like that could lead to connecting the cables in the wrong place because they skipped a procedural step or something of that nature.

But we can have a much longer discussion about all the different things that goes wrong. But I hope that gives you a flavor for what kinds of things may go wrong.

VICE CHAIR CROFF: That helps. Thanks.

CHAIR RYAN: Bill.

DR. HINZE: Thank you. Yesterday Robert Johnson very appropriately pointed to us in his presentation that this is a first of a kind and I'm wondering in what way have you captured the fact that this is a first of a kind facility. For example, the construction license certainly will include the mining of the drifts and I think we all are cognizant of the fact that mining is one of the most deadly of the jobs that a person can have. What way have you taken into account the mining, the transportation, etc. into this document?

MS. GHOSH: Okay. So let me -- There are a number of things in there that I would like to address. First, you started with mentioning that Robert pointed out this will be a first of a kind review in many ways. I think it's true that it will be a first of a kind review in many ways. In terms of the actual operations, the vast majority of those operations I think as we've discussed, there's a lot of operating experience out there for those operations. I think that one of the reasons we say first of a kind is that our rule is risk-informed and performance-based. So we have a slightly different

basis for our review versus, for example, the ISFSIs, the Independent Spent Fuel Storage Installations, that are out there, nuclear power plants spent fuel operations and so on. The NRC has a lot of experience in licensing and inspecting and overseeing operations that are very similar to what is going to happen at the GROA.

The first of a kind aspect comes from the rule Part 63 which is more risk-informed and performance-based. But there is a lot of information out there already for the majority of the operations.

Now in terms of the mining operations, I think it's definitely true that historically mining is tough. Mining can be challenging, but from the NRC's regulatory standpoint our rule basically has to do with meeting radiological dose objectives and a lot of the mining before you ever put any waste in there might be challenging but those are more kind of occupational safety issues rather than radiological issues.

If you look at once waste starts being in place what the potential might be for radiological consequences, I think we're certainly also prepared to review that aspect of it because there is information out there on mining and human reliability during

underground operations and so on. But how much we look at that will really depend on whether there's any event sequence possible underground where you might get a radiological consequence and as Robert mentioned yesterday, there are different levels for the expected event sequences which are called “category one" versus the "category two" event sequences where in that case you only look at the dose consequences to members of the public outside the site boundary.

So we're prepared to -- There may be event sequences that end up having radiological consequences. There may not be. We're prepared to review it either way, but there's a lot of defense-in-depth or layers of protection that are built in for the underground operations once the waste implacement is actually happening.

DR. HINZE: Will the license application include human reliability concern with mining?

MS. GHOSH: I think that we expect that.

DR. HINZE: What you're requesting.

MS. GHOSH: Sorry.

DR. HINZE: Is that what is requested here?

MS. GHOSH: I think that depends on what the Department of Energy's safety case is based on.

So, for example, we expect that their application and different parts of their application will be commensurate with the risk significance in different activities and parts of the operation. If it turns out that it's virtually impossible to get any kind of radiological dose from a subsurface operation, we may not expect the same kind of treatment that we would, for example, perhaps in the wet handling facility where you may have some consequences.

DR. HINZE: So, for example, the possibility of health and safety with relationship to the operation of the tunnel boring machine will not be considered as part of the license application?

MS. GHOSH: I believe the NRC's regulatory purview has to do with the radiological consequences and have a memorandum of understanding with OSHA for the occupational safety aspects of it. So again, if there's a radiological hazard, I think we would do that review. If it's an occupational hazard, that's kind of outside of Part 63. There are other requirements for that.

CHAIR RYAN: I think the key point here is it doesn't relieve DoE from any obligations they might have under other regulations for mine safety and so forth.

DR. HINZE: That's right and I'm wondering if OSHA has been brought into this in terms of --

CHAIR RYAN: Well, she has a -- of understanding.

DR. WEINER: Yes.

DR. HINZE: Yes, in terms of updating this ISG. Are there any updates from OSHA memoranda?

MS. GHOSH: I think OSHA has their own approach to reviewing with mining operations. They certainly regulate other mining operations. I'm not familiar with them.

DR. HINZE: Let me ask you another question then. We know that we don't have the final design considerations of the pre-closure facility and the pre-closure operations. In what way are you building in a sufficient amount of flexibility comprehensiveness to handle the final designs in this ISG?

MS. GHOSH: I don't know if you had a chance to read the ISG, but if you do read it, you'll see that it's very general and exactly for that reason because we wanted to make it general enough to accommodate any specific situations that might arise. So it's based on our current level of understanding and leaving us the flexibility to use it regardless of

what final design and operations look like.

DR. HINZE: Thank you.

CHAIR RYAN: Thanks, Bill. Just looking ahead a little bit, we had a briefing yesterday. We have your briefing today and another one next month. So rather than write three individual letters, we're probably going to consolidate our thoughts on those three items in one letter. So don't expect an individual letter here, but we might make comment on the overall letter which will probably a couple months down the line just to give you a preview.

MS. GHOSH: Okay.

CHAIR RYAN: I think that will close our morning --

DR. CLARKE: Can I ask another quick follow-up question?

CHAIR RYAN: Yes. We're already behind schedule.

DR. CLARKE: Okay. Tina, just a quick one. Did your research, your information base for pulling all this together focus exclusively on the nuclear industry or was it broader than that? Is there merit to looking at chemistry process industries?

MS. GHOSH: You know we're initially

focusing on the nuclear industry for I think one big reason which is that the regulatory regime in the nuclear industry is quite different than that in the chemical industry. I'm familiar with a lot of the accidents that have happened in the chemical industry and the cultural issues and some human reliability aspects, but I don't want to generalize too much, but I think if you speak to people from the nuclear industry and I tend to agree they're under a more tight regulatory framework than the chemical industry.

DR. CLARKE: A lot of this is basic to any industry I think.

MS. GHOSH: Sorry? Yes.

DR. CLARKE: Okay. Thank you.

CHAIR RYAN: Tina, I can second that from firsthand experience in a facility that dealt with both radioactive material requirements and chemical because it was a mixed waste processing facility with a thermal destruction unit. So I would tend to agree with you that the nuclear requirements were often complimentary to but very often were more robust than some of the chemical requirements on particularly some of the process hazards analysis aspects including human reliability. So I think your general sense there probably seems right to me. I wouldn't want to

generalize too much either, but it seems like the right track.

DR. CLARKE: Thank you.

CHAIR RYAN: Okay. With that, we will adjourn our morning session and return promptly at 1:00 p.m. for our afternoon briefing. Thank you very much. Off the record.

(Whereupon, at 11:45 a.m., the above-entitled matter recessed to reconvene at 12:58 p.m. the same day.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

12:58 p.m.

CHAIR RYAN: On the record. Okay. It is the appointed hour of 1:00 p.m. and we have a briefing this afternoon from a team of folks from the Research it looks like and we're going to lead off with Christiana Lui. Christiana, maybe I'd ask you to introduce your teammates and go ahead and jump right on in.

MS. LUI: Okay. The biggest teammate I would like to introduce is our Office Director Brian Sheron.

CHAIR RYAN: Thank you.

MS. LUI: And I also have with my team right up in front here is Rob Tregoning on my left inside. He's the Senior Advisor for Materials and then right next to Brian is Don Helton. He's the Reactor Systems Engineer and to the right of Don Helton is Dr. Nathan Siu. He is the Senior Advisor for PRA. So Brian.

CHAIR RYAN: We really appreciate your getting our new name right up there on your slide.

(Laughter.)

MR. SHERON: I want to thank you for the opportunity for first the staff to come down here and

I think this is probably the first time I've been down here in front of the Committee.

CHAIR RYAN: Welcome.

MR. SHERON: So I'm looking forward to a few more meetings I hope. I've been in the office now just about a year. I think May 1st was my one year anniversary and just so you know my background, I've been with the Agency since `76 and with the Federal Government since `73. So I've been around here awhile and mostly on the reactor side in NRR, although I did work in Research from 1987 until 1994. So I have a fairly good feel for both offices.

But what I'd like to talk to you about a little bit is just the background for the long-term research plan that we put together. As I talked to DCRS, I think, a few weeks ago when I told them the same thing and that was I was up in the Chairman's office during a periodic meeting with him and he asked me what the long range plan was in Research and as usual, I said we're starting to get ready to look at the `09 budget and go through that process and he went "No, no. I'm talking like five, ten, fifteen years from now. What are you doing to make sure the Agency is ready to meet the challenges it will have then?" And I said, "We normally don't plan out that far."

But I could tell that's really the, I think -- The Chairman is a strategic thinker and I could tell that he felt that this is something that was an implicit part of our responsibilities is to look beyond the immediate future and I kind of like that and I took it as a challenge. And I said, "Let us go and see what we can do."

So I talked with Luis Reyes as the EDO and he agreed and we decided to put together a long-range research plan and we figured looking at the schedule, the Chairman I think wanted something in a couple weeks which I can't get anything through concurrence in a couple weeks. But I thought that for the time which was right around the beginning of December of 2006 I figured maybe in around three months we could pull something together. So we embarked on that.

First off, I wanted somebody that could devote almost full-time to developing this report and I asked Chris if she would do that and she actually stepped out of her line management job and took this on as a full-time task and as you heard, the rest of the team here, Don, Rob, Nathan, all participated with her as well as the rest of the Research staff. This was not just a small group. We actually went out and solicited input from the entire Research staff.

But the intent was to say what kind of challenge is this Agency going to face down the road. What can we think of in five, ten, fifteen years? I realize there's a lot of uncertainty. I mean if somebody told me six years ago to plan research in the future I'd probably say I'm going to work on decommissioning because that's where we were heading back then. But as you can see, things turned around and I certainly wouldn't be surprised if other factors come into play in the coming years and we have to readjust.

But right now, we're looking at an expanding industry which means that there will be not only new reactors being licensed and built, but we're seeing an increase in fuel fabrication facilities. We're seeing proposals by DoE to better utilize the existing fuel, the waste fuel that's come out through GNEP and the like. And so what we're doing is we're trying to anticipate and say what kind of regulatory challenges will this Agency be faced with down the road and is there work that we need to do now, that we need to start now, in order to be prepared so that when these challenges do come in that we'll have the tools, we'll have the technology available. That's really what our starting point was.

We were not trying to include all of the current research that we have going on. We said those programs are in place. They're documented and the like and even for some of the near term like on some of the advanced reactor work and the like we did not want to look at that.

We're thinking down the road like, for example, on the reactor side. Plants right now can be relicensed for an additional 20 years. But we have gotten indication from a lot of utilities that the investments they are making in those plants are so tremendous that they envision they'll want to go beyond 60 years. And so one question is what are the technical challenges, what are the technical obstacles, if any, to operating a nuclear plant beyond 60 years and do we need to start looking at those now and identifying what they are not so that we're going to solve them, but at least we can identify them to the industry and let the industry start to think about what they may need to do. Are they going to annelle vessels for example? Are they going to replace vessels? Questions like that.

We see digital I&C as a technology that just keeps changing. Fiber optics, a lot of questions about, for example, under fire situations. We do a

lot of work right now looking at cable behavior under fires, but what about fiber optic cables? Is the industry going to move to that? Nanotechnology is another one. We don't even know how it might be used, but there's a potential. So what we tried to do is to solicit not only from the Research staff, but also from our user offices to kind of pick their brain and ask them what kind of work do they think they're going to see coming in down the road that we should start planning for now.

That was the first phase of the program. We were trying to finish that up by the end of February. We actually got it done by the end of March. We got a commission paper up to our Commission. We told them this finished up first phase.

Phase two is when we would engage external stakeholders and that includes both the ACRS, ACNW, National Laboratories, other foreign governments, our counterparts that we cooperate in research in, industry, other Federal agencies, some other stakeholders like the Union of Concerned Scientists. But we want to get their input and say what do they see as something that might be needed.

What we'd like to do is sort of get this consensus and see if there is a consensus on the areas

that need to be focused on.

We see the plan as a living plan. This is not something that's a one-time static thing where we write it and issue it and then we put it on the shelf. The plan is is that it will serve as the basis for budget planning. Our budget planning right now, we're in the `09. We're trying -- We're in 2007 and right now, we're putting together the budget for 2009. One of the things the Chairman wanted to do was if we were going to put planning money or a planning which money to do this long-term research we would need to be putting it in now to get it in the `09 budget and he really didn't want to go forward and I agree with him 100 percent. You don't want to go in and just say "I'm going to put $5 million in the budget for long-term research and trust me. I don't know what it is but trust me." This report hopefully will provide some technical basis for the amount of money that we want to put in the budget for 2009.

I would expect every year we will revisit the report because as we go through the budgeting process, next year it will 2010 budget. We'll need to see do we need to add things. Have we learned anything in the year that says that maybe we should drop things out or give them a lower priority? Are

there other things that need to go in? So we see it as a living document.

I very much would appreciate the Advisory Committee's input on this. I think you all bring a very unique perspective to the Agency and to the Research program and so the more that you can provide to us, I think, the better the report will be.

The Commission had asked the ACRS actually to identify long-term research at their last meeting with them and I would presume that that request implicitly carried over to this Committee. So any input, any guidance you can provide us would be very useful.

The plan right now, Chris can go through it in more detail, but I think we want to get the second phase and this report finished up by the end of July. So with that, I'm going to -- If you have any questions of me -- I apologize. I'm going to have to run. I'm going let these guys go over the details. I have another meeting.

CHAIR RYAN: Okay. We'll go over the details and we'll get back to you.

MR. SHERON: Yes.

CHAIR RYAN: Any questions at this point or do you want to just dive into the details?

DR. WEINER: No. We just want to thank Brian for coming and giving a good introduction.

CHAIR RYAN: Thank you, Brian. Okay.

MS. LUI: Good afternoon. My name is Chris Lui and I'm the Director for New Reactors and Computational Analysis and I'm the lead for the development of the Long-Term Research Plan and I'm just going to give this presentation by providing a little bit more detail regarding the context whereby Brian has actually already given you a lot of the information. And Don, Rob and Nathan will go through a number of technical topics identifying the current version of long-term research plan that we would like to discuss with you today. And the purpose today is that we would like to solicit your comments on this set of topics and any other topics that you believe that we should consider for incorporation into a long-term research plan.

As Brian has indicated, we set out to develop an Agency-wide long-term regulatory research plan that will focus on new program areas and emerging technologies and we did that by engaging the other program offices and also engaging the Office of Nuclear Regulatory Research staff to help us to really focus on that particular task and there will be more

regarding the scope on the next slide later on.

And the current version again is a relatively high level document that's for a planning purpose and provides the technical basis for our budget request. We also intend to use this particular version to develop communication tools that will help us to communicate what we intend to do and what will be the focus of the technical program and what we intend to get out from this set of activities. And again, this is the initial version and it's a work in progress and as new information becomes available we will be updating the long-term research plan on an annual basis.

Scope. We actually had a fair amount of existing planning documents in many or not all the program areas and technical areas. A few of them actually focused on forward-looking activities such as a proactive material research program plan. And some also contained long-running activities. One of the things I can point my finger to is one point we have actually a PRA research plan that contains a lot of long-running activities. But again, this planning document as Brian has indicated generally focus on current and near-term needs and they're not really geared towards long-term needs for the Agency.

So given that we already have certain activities identified in these other planning documents, our goal is not to duplicate where there already documents elsewhere. It's really to go through a process to really get people to focus on thinking other long-term research activities and we also started by looking in the various technical areas such radiation protection, environmental assessments, GRA human factors, security, just to name a few and because we carved out what's the scope of these particular documents not to duplicate others, we only include those that have not been discussed elsewhere in other documents.

As Brian has indicated, we developed these documents really to develop a planning wedge for the FY `09 budget formulation. So the time line was somewhat dictated by how the Agency budget development process is and also because this is our initial effort, we were mapping out a process where we're doing the development of the plan. At the end of this particular initial effort, we also expect that we will be able to come up with a more systematic process for the future updates.

With that, we recognized that the environment that we are in is not stagnant and we

fully expect that things will change and we will need to be responsive to those changes. Therefore, we intend to keep this as a living document. And based on our observations so far, there are people who want to participate, but they are also watching how this whole effort will evolve to see whether the agencies truly want to focus on long-term efforts. So the success of this initial effort will pretty much help us, will pretty much determine the future participation regarding whether people will really look forward to come forward with good ideas or this is going to be one of those activities that kind of is a one-shot deal. So the success of our efforts is going to help to set a tone for future participation.

Slides five and six provide the summary of these proposed activities that's identified in the current version and your slide package contains materials for all the topics included on slides five and six. And those that we don't plan to discuss for the rest of this hour are included as the backup slides to the package. So it's for your information and at the same time during the next 40 minutes or so, materials come up and topics come up that will bring us to those backup slides, we do have that available.

So the four topics that we would like to

discuss with you today are the DoE Global Nuclear Energy Partnership program or GNEP, the Advanced Offsite Consequence code as on the bottom of slide no. 5 and on slide no. 6, to identify Extended in-Situ and Real-time Inspection & Monitoring Techniques and also the Advanced Quantitative Risk Assessment Methods. With that, if there are any questions for me, I have the time. Otherwise, we will proceed with the discussion of these four topic areas.

DR. HINZE: I'm sorry. What are you asking from us at this point?

MS. LUI: Okay. We would like to get your feedback regarding whether the focus of these topics are the right ones in terms of long-term research and also if there are any additional topics that you feel that we should start in FY `09 or beyond. We also would like to hear those.

CHAIR RYAN: That's a big question.

DR. HINZE: Can I kick off one? One I don't see here and when I went on this committee originally back in `88 or `89, I think that one of the major interests that I had and one of the major interests that I was told to have was on information and data and I still believe that the Commission, all of us, are not giving sufficient due to information

and data storage, transfer and presentation and that leaves us to artificial intelligence and if we're thinking down the pike with a mass of information that's coming into us and that we have to absorb and we're right here at the firing line of this massive information, readily accessing and presentation and use of artificial intelligence to help us is going to be a major contributors to the success in regulation in the next decade.

MS. LUI: Thank you for your input. We do have other related programs. We may not touch upon your point exactly, but the Agency is actually --

DR. HINZE: I guess I'm having a hard time hearing you, Chris.

MS. LUI: The Agency is actually undertaking knowledge related program and I think certain aspects of that will touch up the data or the information of data storage and research issue, although that's not the focus of the knowledge management program. On the other hand, we have identified certain topics here that is kind of looking at the acquisition of data and also use of better methods to do our work. So there are aspects of what you have brought up that we will probably touch upon but not in a concerted effort as what you have

identified here.

DR. HINZE: Nothing is moving faster than information technology today and I don't see any slowdown in that. I think that what we have to do is we have to think out of the box as they say and think about what kinds of technologies will be available in two, five, ten years and how we can capitalize on that for the Agency.

MS. LUI: Right. We definitely have thought about that and some of the topics that we have identified here are really looking at the information technology advancement to help us do our work a little bit more efficiently and effectively.

DR. HINZE: I really find that the information transfer in this agency is highly deficient. I could use even stronger terms and I think that it's incumbent upon the Research group to show the way here.

MS. LUI: Okay. Thank you for your feedback.

CHAIR RYAN: Just a small second on Professor Hinze's comment. ADAMS is an example of something that's very hard to use on information management and I'm still not qualified to use it.

But in a broader sense, I think you need

to do something on time frame. You talk about `09. `09 is tomorrow as far as research goes. It's not future research. 2010, that's tomorrow. They're creating that plan now and once it's a plan, that's what you're going to do. You can tweak it and that. So I want to understand better. When you say "long-range research" what do you really mean?

I think about now as now to the next six years. I think intermediate time frame you talk about a decade or more. Long-range is, I think, we heard earlier the Chairman's idea was 15 years plus. So let me finish.

MS. LUI: Right.

CHAIR RYAN: I think you very carefully need to communicate to people what you mean by the time frames of "short-term," "intermediate-term" and "long-term" research goals so that everybody is on the same page because what's long-term to me or long-term to somebody who had been here five years is not long-term to somebody that's been here 32 and looking at retirement. So I think you need to create a time scale that's common for everybody to think about. That's one.

And then I think you need to sort out -- I'm just looking on the list that's on the screen

behind you. Offsite mitigation strategies, well, that's going to be probably something you can talk about in any one of my three time frames. Fire effects on fiber optic cables, I'm going to guess there could be a technical solution or replacement for fiber optics in 15 years. Maybe it will all be radio transmitted at some point.

So every one of your projects, you need to think about where will technology be and what will be the issues in short, intermediate, long range and where do you want to put it. So I can't think about long-range research without thinking about what's the time scale there.

MS. LUI: Yes, actually we -- At the beginning when we tried to put together this we had a lot of discussion of within the core group that you're seeing up front there and also discussion with the other program offices and also with our staff. So for this initial effort, we are pretty much looking at anything that we don't have a program plan already that will become -- I mean that we expect the Agency will need a product about five years and beyond.

CHAIR RYAN: Five years is tomorrow. That's not very long range.

MS. LUI: And most of our current

regulatory work we focused on today really, meaning today and/or two or three years out. So even five years sometimes we have a little bit of trouble getting people to come forward with what we see five years from today. And like Brian has indicated that five years ago he would think that the bulk of the business would be in decommissioning, but how quickly things change. So we also need to be aware of the dynamic environment that we are in.

CHAIR RYAN: That's a good example. Pardon me, Ruth. I'm sorry.

DR. WEINER: Sure.

CHAIR RYAN: But that's a good example. What caused that change?

MS. LUI: A lot of that, I would guess, is the cost, the economy.

CHAIR RYAN: That's economy. New reactor license applications and now covered by insurance.

MS. LUI: Correct.

CHAIR RYAN: That's it. That's what made the change. So in any long-range planning, you have to understand what the force majeure could be to actually take your plan and just chunk it in the trash can and start over because something big has changed. Well, the fact that the licensing for new plants

became much more doable because of that insurance requirement, that changed the game.

MR. TREGONING: But I would argue it's more complex than that because the economics associated with operating a current reactor also has had a big impact in terms of sites looking at decommissioning as well as plants making larger capital investments that at one time would not have been deemed feasible.

CHAIR RYAN: But the key thing is that investment is protected now.

MR. TREGONING: For a specific subset of new reactors it's protected.

CHAIR RYAN: Right.

MR. TREGONING: Not --

CHAIR RYAN: But that's -- Of course, that thing snowballed. So there are lots of variables and I'm not trying to -- Please do accept me as oversimplifying it. But I'm just trying to understand a little bit about your time frame and what are these bigger issues in the drivers of research? What are you thinking about? If you're thinking about your normal planning for budget cycles, that's not a real driver of research. That's responding to what's already on the table. I'll stop. I'll let you guys

go ahead. Sorry.

DR. WEINER: I had a question that you may be going to answer. So just me if I'm anticipating. I was just interested in what your thinking was that picked out these four particular areas from the whole list and if you're going to go into that just say so.

MS. LUI: We looked at the extent of the topic that we had identified in the report and we thought that this would fit with the ACNW&M much better than the other topics because some of the other topical areas really focus on the actual work.

DR. WEINER: I see.

MS. LUI: And the overlap with the material waste side is even none or minimal and also in the interest of time we thought that we wanted to provide -- we wanted to offer these up and at the same time, if you have a different selection, we are ready to discuss them today, too.

DR. WEINER: So you really looked at these and said these are the ones that seem to fit ACNW best and the rest of them are more suited to ACRS. But this is still a negotiable thing.

MS. LUI: Correct.

DR. WEINER: Thank you. That's all I wanted. Why don't you go ahead?

DR. HINZE: Mike, could I add something?

CHAIR RYAN: Well, Ruth is in charge of this session.

DR. WEINER: Yes. Go ahead.

DR. HINZE: I don't know if you're aware but the ACNW held a research working group meeting I think in 2002. The only people that are at the table or in the room or at least at the table that were involved were Mike and I. In fact, that's the first time I met Mike and that looked at both short and long-term and there was some really good interchange of ideas and there are reports on that and there's a transcript which is even more interesting to mind and there were some really excellent ideas by a number of individuals representing both the agency and those outside the agency and it also included Commissioner Rogers who by that time had retired from the Commission, but as you know, was an extremely strong supporter of research in the agency and had some excellent ideas and I really encourage you to look at that. It's a resource of some pretty knowledgeable people.

MS. LUI: Yes. Thank you. And I would like to guess that the findings from your 2002 working group, some of the work and your suggestions that you

have already made into our planning documents.

DR. HINZE: You know, they are in the report. I don't recall. I was a consultant to the Committee at that time. So I don't know who -- I didn't follow it exactly, but I don't know who wrote the report up, but there was a report that came out.

CHAIR RYAN: I don't remember. I would have to go back and look.

DR. HINZE: But I remember, Mike, you gave a presentation on health physics that covered a lot of really interesting areas.

CHAIR RYAN: Wow. That was good. Thank you, Bill.

MS. LUI: Proceed?

DR. WEINER: Yes, go ahead.

MS. LUI: Don.

MR. HELTON: Don Helton, Office of Nuclear Regulatory Research. The first topic that we wanted to bring in front of you is one that you are intimately familiar with. It's DoE's Global Nuclear Energy Partnership. There is some work going on in `07 and `08 dealing with some of the higher level infrastructure issues associated with GNEP and the idea is that in fiscal year 2009 work would start in earnest to develop the regulatory infrastructure that

we would need to license both the consolidated field treatment center and the advanced burner reactor.

The NRC is already interacting with DoE on this issue and as you likely know, the staff is also developing licensing options that they put forward in front of the Commission for the approach that would be taken for licensing those facilities. The two technologies that are currently being -- that seem to be in the forefront are chemical separation for the reprocessing side of things and a sodium cooled liquid mineral reactor for the advanced burner reactor.

The main uses for the work that we would be starting in fiscal year 2009 would be to develop the technical bases for both the CFTC and the ABR. We would also be looking at the risk strategies and the acceptance criteria that would be appropriate for licensing those facilities. As you also probably are aware, DoE has a June 2008 deadline currently for the selection of technologies for GNEP and while we have some indications as to which direction they're heading, that Secretary's decision will certainly heavily influence the specific work that we do in fiscal year 2009.

DR. WEINER: Would you like to take some questions now?

MR. HELTON: Absolutely.

DR. WEINER: Jim, do you have any?

DR. CLARKE: I was going to save mine until the end, but since you gave me this opportunity, I'm struggling with an even more basic question and that is how you're defining research. I mean, are you talking about actually developing models? Are you talking about working with people who develop models? Are you talking about bringing your staff up to speed on models that are already available?

I guess the reason I have this question is I don't see a step that usually comes before this which is the needs analysis. What do you need that you don't have and then how can you focus the research effort on that? If you want to think about that and we can talk about that afterwards, it's really not a question about GNEP. But it's a more basic question about what you're trying to get to.

MR. HELTON: Let me take a quick stab at it and some of my colleagues here may want to add onto what I say. That's something -- That's actually one of the very first questions that we asked ourselves when we started this back in December is what we are going to consider research to be and we went out trying to get some guidance on that from Brian Sheron

and others because that's going to directly influence the scope of what type of work you identify.

Here we've used research to describe the development of the methods, tools, experiments if they're needed and to build up the technical bases of the infrastructure you need to fulfill a regulatory need. An example that we cited before is that if you were developing the technical basis for a rulemaking that would be research. The actual writing of the rule and the interaction between the different NRC offices as the development of the rule would not be considered research. That would be considered part of our nonresearch function.

So it's a good point to make sure that you understand that in Brian Sheron's eyes and others what's been defined as research in this report does not encompass everything that the Office of Nuclear Regulatory Research does. It encompasses a subset of what we do, but we do a lot of things that are consultation or assisting in rulemaking or licensing or decisions that use research, but in and of themselves are not research.

DR. CLARKE: But am I correct in assuming that before you got to this list that you're showing us that has the four items that you want us to look at

in particular you did a needs analysis? In other words, there are some activities that took place before you got to where you are. That's kind of where I'm going. Basically, where did this list come from? How did you define these priorities? You're asking us if there are any omissions and I think it would be -- But again, I don't want to distract you from your presentation. You have more than you have in this meeting so far, but these are some of things that I'm kind of wrestling with right now.

MR. HELTON: Yes, if I may. Some of the activities that you mentioned certainly like, for example, coming up to speed on what's available. One might say that's a necessary part of a research program. One might say that's the end of research. But we're pretty broad in our definition of what could be included in the research program. So you'll see a mixture of these different activities.

There was a need analysis done. I would say it was done less formally than maybe you would see in a later incarnation of the plan. Certainly when we went out to the different subject matter experts in the areas and said, "What do you think we should be looking at," already in some ways that needs analysis has been performed and what you see is a reflection of

that. But we didn't go back from scratch and say, "Okay, here is the environment." We thought about the environment. We thought about scenarios. We thought about the different disciplines and we were rapidly bogged down in the time frame that would permit formal analysis. So I would say informally there is that aspect. I don't think you will find that in the document itself to say here's the full analysis that leads to the conclusion.

DR. CLARKE: Yes, that might be helpful in understanding how you got there.

MR. DEHMEL: Sure.

DR. CLARKE: That's fine and that's very helpful and let me stop and --

MR. TREGONING: The other thing, I guess, the point I would make, Tregoning from Research, if you look at many of the individual activities and what's specifically proposed for our plan in many cases within that specific area it's essentially a needs analysis being conducted within that given technology area where we're doing scoping analysis to see where the industry might be heading, to see what regulatory and technical hurdles we would have in that area and looking at potential applicability for nuclear applications on down the line. So the scoping

analysis that are again a fundamental part of many of activities at least within those narrow areas will serve exactly the purpose that you're describing.

DR. CLARKE: Okay. Fine, and I guess I just offer the suggestion that you write this up. There may be merit to helping the reader understand how you got to where you are.

MS. LUI: Thank you.

DR. WEINER: Mike? Allen?

VICE CHAIR CROFF: Yes. A couple of things. First, you say "develop regulatory infrastructure." What are regulatory infrastructure needs? What is regulatory infrastructure?

MR. HELTON: Again, I'll take a stab at this and let my colleagues jump in. What we're going for here is the idea that if we're going to license the AVR and the CFTC several years from now there's a certain -- What we're referring to is infrastructure but there are needs that we'll have to make those licensing decisions, to support those licensing decisions, to point to a technical basis for why the regulatory decision that we're making is the appropriate one and being able to identify those needs and assess those needs and make that regulatory decision will require individual expertise, models,

analyses, experiments. It will require all of those to be able to in the end make the licensing decision. So is that more vague than what you're looking for?

VICE CHAIR CROFF: Yes, but --

MS. LUI: Let me try to jump in. It is our responsibility to develop the regulations and also regulatory guides and standard review plans in order to license these facilities related with GNEP, I mean, if DoE comes over to us to basically ask us to review any applications. Our understanding is that it's up to DoE to decide whether they want to seek an NRC license and at the same time through all the communications that we've had with DoE so far, even DoE does not formally seek NRC license. They want all the facilities to be licensable. Therefore, when we say "regulatory infrastructure" from the research perspective it's really to develop the technical basis and the analytical tools to allow us to provide the potential applicants all the regulatory guidance and the regulations so that they can submit a quality application and at the same time, develop the necessary tools to allow our own staff to review the application.

VICE CHAIR CROFF: Okay. That helps some. I'm not going to try to offer any specific suggestions

until your thinking and DoE's thinking may be more important until we get a bit further along. I'll offer a very general comment. We've had multiple briefings on fuel reprocessing, on GNEP, in this committee, the latest one being yesterday and there are two key aspects to getting fuel recycle, let me call it, licensed.

One that I think you focus on here is licensing a couple of big facilities, but the other comes under the sort of collateral damage thing. If you start recycle, you process a lot of different waste and you raise a lot of different effluent issues that have to be dealt with there sort of outside the facility itself. In other words, what do you do with recovered cesium and strontium? There's a whole other set of issues there that this recycle raises. So I would urge you not to focus only on the facilities. There are other things that have to come along with it that are maybe going to be, well, in my view, will be more difficult than the facility itself which is just another facility handling nuclear materials. Let me leave that as a comment.

MR. HELTON: Okay. And I'd actually like to respond to that. It's a very good point and what you're seeing on these slides it does focus quite a

bit on the facilities, but the staff that is working on is aware of the waste disposal issue. They did even as recently as yesterday remind me of the fact that that's something that's very near and dear to the heart of the ACNW and it's something that they are keyed in on. So I'm glad you brought it up. It's a very good point.

VICE CHAIR CROFF: Thanks.

DR. WEINER: Bill.

DR. HINZE: Well, let me bounce back to facilities for one moment. I recently have been looking at the history and evolution of the characterization of nuclear facility sites and I've been amazed at the change that we've seen in that evolution and I think there might be some parallels of what might be happening in the future. I think as we look at GNEP and we look at the facilities to be used in GNEP as well as new reactors that there certainly is a long-range view here as to how characterization regulations will change in the future.

CHAIR RYAN: Just to take your conversation with Allen a step further, I think there's a bigger question that's a research question. This would be the only country in the world that doesn't have an intermediate waste category that

recycles. Regulatory structure of having high and low level waste only support a recycle facility. In other words, can you fit all these waste that Allen alluded somehow into the system that we have? My own view is that you could say yes or no based on your point of view. So that's a research question that's completely apart from the facility itself.

The other part that is more related to the facility is this is a -- And again, I'm going by what I've heard in briefings and some of the trade press I've read. The current plan is to build what would be the largest reprocessing plant or one of the largest in the world, yet they're going to skip the detailed engineering design step and go right to construction. How do you all feel about that?

So I guess my point is that very much of the GNEP research needs are going to be a little bit hard for you to nail down and I mean that honestly. You just can't guess what some of the research needs will be because it's not real clear what the directions and the decision points are that would shape what you need to know and focus on. To that end, do you have any if/then kind of thinking in your document? Do you know what I mean? I mean if you have any optional thinking if it goes in this

direction we'd have to focus research here. If it went in this direction, we would have to focus research here. I'd suggest particularly in the longer range view that's very typically what you see is kind of a one-off analysis. If it goes in one of these three directions, the research needs would shift from A to B to C and you'd have a profile. You might want to think about using that approach for some of these programs that are longer range like GNEP and maybe some of the others that you could think of three plausible paths and what would the research profile be? Would it be the same or would it change?

One other thing that I guess I have mentioned yet is manpower. We're already in a manpower crisis in terms of technical skills, capabilities, across a broad spectrum of nuclear engineering, health physics and others and programs are coming back a little bit. But if you think to `09, I don't know the exact number, but it's dozen of people that leave the Agency every month or so. What's the experienced man/horse power going to be of folks who are here and is that an ongoing issue for research to think about? How are we going to keep the place filled up with talented people? Just a thought. Thank you, Ruth.

DR. WEINER: I have been focusing on one question. If you could go back one slide, you mentioned in the technical background and you do allow yourself wiggle room by saying technology selection which will likely involve technologies such as chemical separation. Well, the techniques that you have mentioned here are those which we have been doing in the United States. We've been doing chemical separation for decades. Have you looked at or are you looking in your plan at other techniques that would apply to GNEP? In other words, there have been some -- The shutdown of the EBR-2 reactor handling that waste was a very unique and clever system that I'm very slightly familiar with and I'm sure there have been others.

In other words, my question is to what extent are you thinking outside of the current GNEP box. Everything here says GNEP as it is currently conceived is where it's going to go and since you are looking ahead long-range, have you considered alternatives or would you like suggestions about alternatives?

MR. HELTON: I'm actually not at all qualified to answer that question. So I'm going to see if any, either the folks from NMSS or one of the

folks from research wants to jump in and talk about to what extent other things other than the UREX plus 1A process are being considered.

DR. WEINER: Anyone?

MR. HELTON: Yes.

MR. REED: Maybe I can help answer the question. My name is Phil Reed and I'm in the Office of Research. Right now, we've only evaluated essentially what the DoE has presented. We're not in the position at this point to look at other technologies since as a license evaluator we can only evaluate what the licensee sends to us.

With regard to EBR-2, yes, we're very familiar with the pyrochemical processes of EBR-2. We have actually toured their facilities and we have asked a number of questions related on the specific areas of about separating uranium from the transuranics, from the fission products, and things like that.

We are also well aware of the General Electric, the presentation that's been made to us in March. They talked about another approach using the EBR-2 which is totally different than aqueous reprocessing. So we are familiar with those techniques and we do plan to do work in those areas.

DR. WEINER: So I can take it that you would plan to look at some other things than what DoE is presenting or are you constrained in some way to the DoE --

MR. REED: We're pretty constrained in what DoE will send to us. We did not originally plan to look outside the box and look at other methods and technologies. That's essentially a DoE type of research effort. At least that's the way we've been considering now.

DR. WEINER: Thank you. Do you want to go ahead or does somebody else want to jump in on this?

MS. LUI: Ideally, maybe we can come back to answer some of the questions.

DR. WEINER: So move right along.

MR. HELTON: I'll also be covering the Advanced Offsite Consequence Code slide here. The objective here is to look and see if starting in fiscal year 2009 it's warranted to start development of a next generation offsite consequence code. The two codes that I list here under the technical background are traditionally reactor codes. We certainly are interested in that issue, but we're also open to issues that would be of interest for other licensing activities such as transportation, dry cask

storage, GNEP, fuel cycle facilities.

But the codes that we currently have we're evolving to meet changing needs to increase realism as we move towards best estimate plus uncertainty and risk informed regulation. But they do have fundamental code architecture constraints that limit to some extent the ability to revolutionize them and for that reason, in 2009 we're proposing a scoping study that would look at whether or not the time is right to step back away from those codes and develop a code from scratch that would not share some of those historical constraints.

I've already talked about the uses and I've pretty much covered the FY `09 activities. If we get to the point where we think that the improvement in realism that could be realized by undertaking this effort is warranted, then in fiscal year 2009 we would prepare a code development plan.

DR. WEINER: Questions? I would only make the comment that there is considerable chatter in various blogs associated with code development on the web on the question of developing a brand new code as distinct from improving an existing code and I encourage you before you undertake a brand new one to look into that, remembering that existing codes can be

modified, but you're working on a base that has already been QA'ed, had the bugs worked out and so on.

MR. HELTON: Right, and that's hopefully along with the great things of these committees as we engage external stakeholders as part of step two as well, we're hoping that some of that activity will come to the forefront so that we'll be aware of them when the time comes.

DR. WEINER: Okay. Moving right along to the next topic.

MR. TREGONING: I have the next one. Rob Tregoning from the Office of Research. This topic is on extended in-situ and real-time inspection & monitoring capabilities, simply referred to sensors by and large and as it's written and was envisioned in the research plan, this is a very broad area. It incorporates sensors that would be evaluating things such as real-time material degradation, reactor states even in normal and accident conditions, but as well as issues related to issues that this committee would have concern about such as environmental monitoring of groundwater and groundwater conditions, real time and in-situ and I look at this one as really the first step. You mentioned information technologies. Well, this is the first step in that, getting more robust,

more precise data so that you can evaluate the conditions and assess performance in a more meaningful way as time marches along.

DR. HINZE: Also you have the opportunity to assess a lot more data which gives you the statistical robustness that you need.

MR. TREGONING: Right. So I think a lot of staff -- the environmental staff was very passionate about this issue and this need and I think it dovetails nicely with opinions that this committee has had and gone on record as saying that we're particularly deficient in these area, again, especially in monitoring effluence from waste containers and the like and I think some recent National Academy of Science-National Research Council studies also back up that this is an area that we really need to put some additional thinking and effort in in terms of evaluating what sensors are out there and then what sensors can we possibly employ to really improve our knowledge so that again we can do more. We can make better regulatory decisions. We can assess in terms of monitoring and performance assessment, how we should be evaluating these capabilities.

So I just really wanted to focus on that

one particular use on slide 12 which was again assessing radionuclides and chemical species in groundwater and soil. This is one of those activities in FY `09 that we're really proposing a scoping study to begin in `09 where we'll be -- What I don't show here is activities that we will be doing in `07 and `08 which is essentially canvassing the industry.

We're already a part of the NERI initiative at NIST which is an advanced sensor initiative. So we'll certainly maintain our activity in that area, but we'll also be planning to canvas industry in a variety of these areas and see what applications they actually propose. We think in terms of groundwater monitoring as Tom Nicholson and others always have been briefing me on incessantly, this is one area where industry is actually pretty well ahead of us and we need to make sure that we have the ability to ensure what they're doing is technically feasible and acceptable.

So `09 again, we'll be evaluating promising sensor candidates. We'll be evaluating regulatory safety considerations and then as appropriate, we'll be developing research plans for viable sensor candidates.

DR. WEINER: We have a committee member

who is also passionate on this issue, Dr. Clarke.

DR. CLARKE: Yes, I want to identify --

MR. TREGONING: I hope I didn't offend you.

DR. CLARKE: Not in any way. I'm glad that you're looking at this. I want to join that passion and a couple of things. I would encourage you to think beyond groundwater monitoring. My view of groundwater monitoring is it gives us the flat line response. In other words, it tells us that we've had a release. So again, I would temper that by saying that I think monitoring needs to be risk-informed. So as you go into a monitoring strategy, I think we need to think about consequences as well as likelihoods and then if there are significant consequences, we may want to do more monitoring and different kinds of monitoring the way we would otherwise do.

So as you would monitor the real-time for facilities, we might want to monitor environmental containment systems in a similar way again depending on the consequences and even in addition to that, just to get some data. I mean we've done a lot of groundwater monitoring. We've done very little what I would call system monitoring. They're doing some at Fernald on the disposal of cells there. There are

some other limited applications. It's a good way to generate a lot of data in a short time. What do you do with it and a lot of questions, I think, still need to be answered.

We work closely with some folks in this room on a two-day modeling and monitoring workshop. I think there is a lot that came out of that that you would want to take a look at. But again, I encourage you to do this and think beyond traditional ways of monitoring when consequences are significant and risks are potentially high.

MR. TREGONING: Thank you and I know our staff is familiar with the workshop and the recommendations that came out of that. So I know that, not me personally, but we do have staff that follows that very closely.

DR. CLARKE: Other key words as I think Dr. Hinze will agree are "noninvasive," if possible, "risk-informed, noninvasive."

DR. HINZE: And I would add one more word. My two words are "precursory" and --

DR. CLARKE: Yes. I was getting to that. Thank you.

DR. HINZE: -- "noninvasive." Precursory is really very important.

DR. CLARKE: We've been monitoring for failure. Our monitoring right now demonstrates that the system failed. Obviously, we want to know before the system fails that things are not going according to plan in those cases where we need to know that and again, I don't think we want to do this on everything. I don't think we can afford to do this on everything, but in those special situations where the consequences are particularly significant, it would merit that.

DR. WEINER: Mike Ryan.

CHAIR RYAN: I would add one thing to this particular topic which I think is a very good one. I want to put on my former licensee's hat. What do I get for all this if I do it? You need to figure out what is the value to the stakeholder and I think we've mentioned possibilities like lower decommissioning costs. If my reliability goes up in terms of understanding a facility through all this monitoring, there should be a benefit to the licensee. Whether that's a lower license cost or a lower inspection rate or a lower decommissioning trust fund obligation or all of the above, somehow this expense has to be tied to a benefit and to me the benefit is quite clearly the potential for a much higher regulatory confidence reliability factor. You need to tie that to something

to gain the interest, I think, you're seeking from the regulated community.

MR. TREGONING: Yes, I think that's a great point and I can say in other areas, not environmental sensoring, but when we've developed sensors in the past that's been in my opinion the prime impediment for actually implementing those in a plan or in another industrial application has been being able to make the case and have the flexibility as an agency to make the case that there is some true benefit for the licensee to actually installing more advanced technology.

CHAIR RYAN: And that boat will leave the dock if you don't include it in your research plan.

MR. TREGONING: I think that's an excellent point and again it's one historically that we struggled with.

CHAIR RYAN: And the winning example to me is all the efforts in water quality and reactor cooling waters 20 years ago. Nobody wants dirty water anymore because they get lower doses, they get shorter outages and we all know outages are very expensive things. If you can shave an hour out an outage, that's a win.

So there's many examples where once people

realize that the investment pays off ultimately, that's like you say, when you get everybody to come on board with this. So I would try and find those elements right here at the beginning.

MR. TREGONING: And that's the challenge. Sometimes it's not clear or apparent in the beginning what those advantages will necessarily be.

CHAIR RYAN: Another element of this which is also well within NRC's wheelhouse is decommissioning, not just reactors but other facilities. If I could -- And this is a favorite topic of Commissioner Merrifield. What can I do to avoid creating headaches down the line in decommissioning? All the major earth movements at some of the reactors so far have been very slow and long-term kind of leaks from a fuel pool or wherever it might be that created very dilute, large volumes of soil or concrete or rubble or all of the above that had to be managed. So if I do facility monitoring, I'm thinking more of bigger structures like new reactors and others where again if the reliability goes up, what's the benefit to that licensee for avoiding headaches? You can monitor an existing situation, but if you can monitor to demonstrate you have successfully avoided a headache, now we're

talking.

So there are two aspects there. There is dealing with ongoing recognized problems so you can effectively demonstrate compliance and then there is newer facilities or new systems where you can avoid ever getting to a compliance question. Enough said.

DR. WEINER: Allen. Dr. Hinze?

(No response.)

DR. WEINER: Moving right along to the last topic, Quantitative Risk Assessment.

MR. SIU: Okay. This one is mine. Nathan Siu, Office of Research. I think as you're all aware we've been performing risk assessments for facilities for a long time. The technology for performing those risk assessment hasn't changed much over the years. It's basically logic-based models quantified using certain algorithms and as time has gone by, the staff has been aware of various efforts to improve approaches both to the numerical solution of existing content to improve ways to model systems, cause-effect relationships between the key parameters and, let's say, the failure parameters that go into the risk models. But we haven't really done much work in that area and we're starting to become aware of applications to current systems and we see potential

advantages as we look at advanced systems and thinking of passive systems in the case of advanced reactors' systems where the phenomenal logical response of the plant, let's say, or the facility to an upset condition very much changes the likelihood of successful performance of defenses, defense-in-depth.

So the notion behind this is to look at a number of specific techniques that have been proposed and aren't necessarily industrial strength yet in terms of applications but can be anticipated to be developed along the way partly because of the advances in computing technology available. So in some sense, we've done the what if. We're thinking about looking ahead. Applications may come in that exercise these technologies.

A binary decision diagrams is a particular technique used to quantify risk models without some of the standard approximations used in current PRAs. Bayesian belief nets, a way to represent relationships between causal factors in a nondeterministic fashion and the relationships are influenced by available data. And near and dear to my heart at least, more simulation-based risk assessment approaches where we're starting to integrate the key phenomena associated with the system and behavior into the risk

models. Now I know that's done in other arenas looking at, for example, groundwater transport, but this is an application now to facilities where again in the past we have typically used the event tree/fault tree methodology to represent accident sequences and the likelihood of those sequences.

So this is an initial effort. If we learn from our scoping assessment that there's work that needs to be pursued more seriously, that would be the outcome of this activity. So in a way, it's the needs analysis that you mentioned earlier and that's what we would be doing in `09.

DR. WEINER: Since we're almost to the end of the program, why don't you wrap up, Christiana, and then we can --

MS. LUI: Okay.

DR. WEINER: Anyone can ask any other questions.

MS. LUI: Okay. I just want to wrap up the session that we have discussed. An example that key piece has been incorporated into the current version of the long-term research plan that we plan to start in FY 2009 and as Brian has mentioned in his opening remark that we are committed to provide the draft final to the Commission by July 2007. So any

recommendations that you have based on today's exchange if you plan to send us a letter we will take that into consideration when we update the current version and when we provide the final to the Commission in July 2007.

And I just want to come back and answer Dr. Ryan's question about the events scenarial type of approach. We actually thought about doing that and we were trying to identify and define the purpose of this particular version of the plan as we developed the plan. We were focusing on the level of detail that we should go into and at that particular point, we decided that we were not going to pursue the event scenario and with that said, it does not mean that that's not what we intend to do. Given that we want to keep this as a living document, whatever new information comes up, we will incorporate that and update our plan.

And at the same time because we need to apply for resources, we were doing that based on our best information at this point in time of what we may need two years from now and also in the budget process, every year when we prepare the budget two years from now, we have an opportunity to reprioritize and restack the budget for the following fiscal year.

So we have opportunities to even though not explicitly considering the scenario planning type of approach that you have mentioned, that we can easily accommodate that.

The other issue about critical skill sets, our office is continuously looking at the critical skill areas and either for recruitment or training or development that we have identified areas that we definitely want to maintain core capability. So that is an ongoing effort and that has not been forgotten.

CHAIR RYAN: Some of these points that you're articulating, you ought to put in your report as bounding conditions, the structure and limitations and grounding conditions that you have constrained your report to provide would help the reader a lot.

MS. LUI: Okay.

CHAIR RYAN: Because when you think about -- And I guess quite frankly even the title of "long-range" I challenge. 2009 is tomorrow. It's not long-range. So I would think carefully about what you're really offering in terms of forward thinking. I'm not criticizing the thinking. I'm just saying "long-range" people are going to be looking for that what/if/then kind of analysis. 2008 November a new president is elected and may decide GNEP is off the

radar screen. Done. That's a force majeure. There's nothing you can do about that if the rules change.

MS. LUI: Right.

CHAIR RYAN: Again if you want to limit and not do those kind of things, I think it would strengthen your report to tell folks that's an intentional thing you've done.

MS. LUI: Okay.

CHAIR RYAN: And just be real explicit about what you haven't done as well as what you have done. That way you're sharing your thinking more than just saying here's a bunch of research topics which I think will help people appreciate the collaboration you've made on this document. Thank you.

DR. CLARKE: If I could just add to that. I would throw in again it would help people like me to know what you mean by "research" as well as what you mean by "long-term" and how you got to where you are. I think that kind of up front needs assessment that's typically done before you get to the end, a gap analysis, some of the other tools that are out there to help you focus your efforts. I think that would be very helpful so the reader can understand how you got to this list.

CHAIR RYAN: And if I may, Ruth. Again,

it kind of feeds off of Professor Clarke's comment. If I were in your shoes, I would try and identify each major program area in the agency that each area that you're identifying would serve. I understand the modeling stuff. We've all talked a lot about that with you all and with folks out here and we've had workshops. But we're speaking Klingon as far as most folks go when they come to try to figure out what are we talking about. So it would be nice to identify this serves the Office of something or the program of something and then each research elements could be applied maybe one, two or 20 or agency-wide and if you could just identify who it would serve a little bit, I think that would -- even if it's a new initiative like GNEP, that's a different thing. But just where would this research land and be useful? That would be a helpful way to again share your thinking and what it would serve.

MR. HELTON: Thank you for that comment. It's actually something that I think each of us is thinking in the back of our mind. In a previous incarnation of the report, there was what we called a crosswalk table that listed 20 technical areas versus seven program areas and attempted to do what you're describing and one of the issues we ran into is we

have very few empty spots. It seems like every program in some ways supported by almost every technical discipline that the Agency engages in. It's something that going forward we shouldn't forget and we should try to see if there's a better way to accomplish the --

CHAIR RYAN: What a great message that is. We've done a crosswalk of the programs and the elements and we found that these research projects basically can be in any one box. That's a great thing to put in.

MR. TREGONING: And that was the intent with all the crosscutting activities that we identified, the idea that they would support multiple, if not, most of the programs here at the Agency. We did try to parse out those elements of research that would support specific program initiatives like GNEP, like the offsite.

CHAIR RYAN: Right. And again, tell that story. Show what you did, even the fact that -- I would just put all that in there. That's great information. And again, I'm not thinking of the folks necessarily in this room that understand all that. I'm thinking of the broader audience of folks that if, for example, the Chairman decides to seek some funding

from Congress for research money. It's going to have to be something that will translate beyond the technical realm and technical people. So those things really help. They've analyzed where this would fit and how it would in the agency and who it would serve. That's a great message. And the fact that it's broad scope and broadly applicable stuff that's on your top list, what a great message.

DR. WEINER: Allen.

VICE CHAIR CROFF: Yes, a couple of comments. On the risk assessment methods, I guess maybe the most blunt way to say it is don't fall into reactor think. We do fuel cycle and PRAs are rarely or have been rarely applied in the fuel cycle. I mean things like a uranium melt just don't really require it.

But that then raises the question first for what fuel cycle facility is something like a PRA required and are there any differences in how you go about in a reactor? Secondly, for those where a PRA may not be justified, what should be done? So keep in mind the fuel cycle.

Sort of a similar conceptual thought, one of the things we didn't talk about here is test facilities. You list a couple which appear to be

reactor oriented, but especially if GNEP processes, you're going to need some test facilities. You're going to need some access to some hot cells and some other fairly specialized things that you haven't had access to and from experience, a hot cell that tears apart a fuel assembly for post irradiation examination doesn't cut it if you're handling liquids. You know there are hot cells and then there are hot cells and you need to think about what test facilities the NRC needs, test experimental facilities, and look around because they're getting fewer and fewer every day.

DR. SIU: If I may. On the risk assessment aspect, yes, we've been reminded many times that we deal with reactors, that problems on the fuel cycle are probably different, the assessments are different. There are activities underway now, arguably you would say more qualitative in nature, that are aimed at looking at the safety of the fuel cycle facilities that if you will borrow from some PRA concepts but are being applied in a new way to the other facilities. That wasn't included very much in this topic.

Obviously, the topic was labeled "quantitative risk assessment." In a way it was looking forward. It is somewhat an if/then. If we

worked towards more quantitative risk assessment methods for these kinds of facilities, what would that require? And we've explored the -- That's why it's under this particular banner and it also applies, of course, to the reactor side. So the overall heading was "advanced reactor fuel cycle facilities" but I appreciate that there are differences between the two.

DR. WEINER: Dr. Hinze.

DR. HINZE: I hate to mention the word "low-level waste" because we have the expert here. But I was struck by hearing once again yesterday from Commissioner Merrifield the concern about the Low-Level Waste Policy Act and how it has been a failure to this nation and sooner or later, we're going to have to face that problem of a proper low-level waste repository and policy.

And I think that one of the things that a research group might do is try to look down the pike and see what could be done and what encouragement could you give and support could be given to Congress to really, when it's ready, change this in a proper way.

DR. WEINER: Any staff questions?

CHAIR RYAN: There are a bunch of letters on that topic.

MS. LUI: Thank you.

DR. WEINER: John Flack.

MR. FLACK: Yes, John Flack from ACNW. You know having been on the other side of the fence for all these years in the Office of Research it's always difficult for this agency, I think, as a whole and I can say that now because I'm here with an independent body to see the real value of research. It's always a struggle to get that value out there and show that it has value in the way they do business and I think sometimes my only friends were the committees when I came down here because I think both committees always to large extent supported research more than the general agency did and saw the value of research. So I think it's great that you came down here and just laid things out for the committees in general and I think it was a great idea. That's all I wanted to say as a comment.

DR. WEINER: Thank you. Since we are somewhat over our time, I'd just like to thank you all and encourage you when you want ACNW and, it doesn't sit very well, when you want our advice on something or want to bounce something off of us, we come, all of us, from research backgrounds and we all have slightly different views of what that means. But please feel

free to contact us and if you want our input and seek it, that this is an area that we're very, very interested in and I wanted to thank you all again.

Does anyone else have any more closing thoughts?

CHAIR RYAN: Yes, I'd like to just touch on the idea of a letter before we have the folks leave.

DR. WEINER: Yes.

CHAIR RYAN: You said your report is due in July.

MS. LUI: Correct.

CHAIR RYAN: So we're a little bit behind our own power curve if we would have to draft a letter. We will deal with it next month and you probably wouldn't get it until your report is due.

MS. LUI: With that said, it doesn't mean that your input cannot be incorporated into the thinking because like we have mentioned that this is a living document and also we always have the chance next year to restack the FY `09 priority, too.

CHAIR RYAN: I wonder if what we've discussed today is enough for you to deal with our endpoint on this go-around.

MS. LUI: That was a really great starting

point.

CHAIR RYAN: And maybe -- I'm just throwing this out as an idea. I don't know that a letter would change anything that we've said or offered to you today except tell the Commission that the document you're now receiving includes some of this input. So I'm wondering if we -- I'm sure you'll recognize that you were here and presented to the Committee and we had a thorough discussion of your key issues and so forth and we gave you, I don't know, 3,000 suggestions. But I throw that open for anybody to react to. Do we need a letter or not?

VICE CHAIR CROFF: Mike, my inclination -- I agree with what you're saying. My inclination to wait until their proposed budget --

CHAIR RYAN: The draft is out.

VICE CHAIR CROFF: -- comes out in July. Then we can go through that and maybe hear a little bit more and comment on a piece of letter with some serious thought behind it.

CHAIR RYAN: How does that sound?

MS. LUI: There are -- We can work with the Committee anyway that meets your needs and your schedule.

CHAIR RYAN: You're giving the Commission

a draft. Is that correct?

MS. LUI: We have already provided the current version to the Commission in April.

CHAIR RYAN: So we're way behind the curve.

MS. LUI: And we proposed -- I mean we want to provide the Commission the final draft for FUY `09 plan in July.

MR. WIDMAYER: Are they supposed to vote on it and approve it?

MS. LUI: No, we intended to send that out as an information document.

VICE CHAIR CROFF: What's the date in July that you have to do that?

MS. LUI: July 31st. It's due to the Commission July 31st.

DR. WEINER: So we would still have two meetings before.

CHAIR RYAN: I guess I would like Allen's idea. I mean I'd like to see the more advanced draft and then comment on that.

VICE CHAIR CROFF: Yes.

CHAIR RYAN: That's probably the right way to go.

DR. WEINER: So I'm not confused. What

you are submitting in July is a paper but it will be a living document and there will more --

MS. LUI: Yes. There will be a FY `10 version the next time around.

DR. WEINER: I see and that version would follow a similar sort of schedule where you would present a draft in March or April?

MS. LUI: This time around because we operate under a very compressed schedule we got the task at the end of November. So we really started in the month of December. You can see December and January, you can condense working months into just one working month. So we're on a very compressed schedule and as I've mentioned before that as we are developing this plan, we are also mapping out a more systematic process so that when we do the next round, it will be more in line with the schedule for FY `10 budget development and give us more up-front time for interaction with others.

DR. CLARKE: Coming back to the July deliverable, that is a draft.

PARTICIPANT: Draft final.

(Several say "Final.")

VICE CHAIR CROFF: So it would be fine if you guys just want to say that it would be getting to

the Commission's hands just time their final is getting there and the Commission --

CHAIR RYAN: I just think we can look at that document and then comment to the Commission on it if we choose to do it even at that point.

DR. WEINER: Yes, I would think that since this is a continuing effort that comments we would make on that document would also have value to --

CHAIR RYAN: I mean you're going to take our input and you're going to integrate that and by the time we write a letter and work the letter out half the things that are going to be in our letter you're going to have already addressed. So let's get ahead of the power curve here. I don't want to write a letter that's out-of-date the day we stamp it and send it upstairs.

MR. TREGONING: And next year our draft for FY `10 is required in February of 2008.

CHAIR RYAN: One place I think we can address what we've talked about today is in our meeting summary notes. It does go up to the Commissioners. So what we can do is maybe write an extra paragraph in that meeting summary, Antonio, and just say we've discussed several options and ideas with the Research staff regarding their report which

we understand will be in your offices in July and we'll write a full letter and comment on that draft final plan.

MS. LUI: Yes, and at the same time I just wanted to make this point one more time. In my opening slides, I have indicated that there are a lot of people watching how these activities are evolving. If this particular committee believes that this is a worthwhile effort, any kind of support and encouragement in any way you can express to -- in particular when you write the Commission also expressing your view to the public, if you do believe that is something that the Agency should focus on, I think your endorsement will certainly help the push in this effort, too.

DR. WEINER: Antonio.

MR. DIAS: Did we share with all the members the letter that ACRS wrote on the same topic? I know that Ruth has it.

DR. WEINER: You have to speak in the microphone, Antonio.

MR. DIAS: This is Antonio Dias from ASNW staff. Did we share the letter that the ACRS just wrote on the same topic with all the members? I know Ruth has it.

DR. WEINER: Yes, I have it.

CHAIR RYAN: I don't.

DR. WEINER: I think we should.

DR. CLARKE: The answer is no.

MR. DIAS: That was the question and you gave the answer.

DR. WEINER: I think before we make a final --

MR. DIAS: It's a very interesting letter they wrote. They have --

CHAIR RYAN: Just to summarize, I think we're concluding we're not going to write a letter based on today's presentation. We're going to reflect in our meeting summary that we heard this presentation. We understand it's a very dynamic process at the moment. The staff is finalizing their report and we'll comment to the Commission after we review that final report.

Are all the members in agreement with that or not? I'm getting two nods, a third nod and a fourth nod. So that's where we are. Are there any objections to that from the staff?

MR. FLACK: I think that just even a very simple letter at this point in time supporting the research effort -- I think what Chris was mentioning

would be a good idea and then you could get into a more detailed -- I know the ACRS letter was very detailed. It got into each of these subjects and discussed. But I think even a simple message to the Commission saying that what you're doing and what you'll be following up with is a good idea and that --

CHAIR RYAN: Well, John, when did the ACRS have their briefing? I mean we're behind the curve here.

MR. FLACK: Well, they --

CHAIR RYAN: This idea that we have to write a letter every 30 days every time we heard something has to stop.

(Several comments at once.)

MS. LUI: It was a few weeks ago.

CHAIR RYAN: God bless them. That's great.

DR. WEINER: We do have at least one more meeting before.

DR. WEINER: Ruth, you're the lead. If you want to write a letter and get it going, that's fine. I'll withdraw my suggestion.

DR. WEINER: Thank you. I think John's suggestion was very good and I look forward to working with you and Antonio on a brief letter reflecting a

little bit of what we've heard. We won't go into the detail that ACRS went into.

DR. HINZE: I would hope you'd put some substance into it.

DR. WEINER: It will have substance.

DR. HINZE: Just a heading isn't going to do it.

DR. WEINER: We're not going to write a letter that says, "This was good. Thank you very much." I know that Christiana would never look at me again if we just said that.

MR. FLACK: You could put Bill's name on it. That would be --

DR. WEINER: There we go. We will come out with something and then have some --

CHAIR RYAN: Well you volunteered to write a letter overnight just like the ACRS. That's what I heard.

DR. WEINER: Yes. Well I won't be the first time.

CHAIR RYAN: That's true. Like I said, you have practice.

DR. WEINER: Thank you very much. Before we quit, there are other people here from the Research team.

CHAIR RYAN: Ruth, we have other things we need to do.

DR. WEINER: Okay.

CHAIR RYAN: So we need to -- We're a half hour over time.

DR. WEINER: Thank you.

CHAIR RYAN: If you want to have private conversations or take a last round of comments, make it quick.

DR. WEINER: Is there anybody who would like to make a comment?

CHAIR RYAN: No, good.

DR. WEINER: Thank you. Just wanted to recognize them. Thank you very much.

CHAIR RYAN: Perfect. With that we'll adjourn the record for the day and we'll concluded. Off the record.

(Whereupon, at 2:26 p.m., the above-entitled matter was concluded.)